

VIETNAM ELECTRICITY

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

O MON III COMBINED CYCLE POWER PLANT

LOCATION: O MON DISTRICT, CAN THO CITY

(This report edited according to the comments of the assessment Council of the Ministry of Natural Resources and Environment on 17th November, 2008 in Hanoi)

CAN THO, January 2009

VIETNAM ELECTRICITY

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

O MON III COMBINED CYCLE POWER PLANT

LOCATION: O MON DISTRICT, CAN THO CITY

THE OWNER

Can Tho Thermal Power Company

CONSULTANCY

ORGANIZATION

Power Engineering Consultant J.S
Company 2 (PECC2) *JS*



Phạm Văn Chảo

Can Tho, January 2009

STRUTURE OF INVESTMENT PROJECT REPORT

EIA report of O Mon III Combined Cycle Power Plant Project (CCPP) is structured into Book 3.5 of Volume 3:

PART 1: INVESTMENT PROJECT

VOLUME 1: GENERAL DESCRIPTION

VOLUME 2: DRAWINGS

VOLUME 3: APPENDIXES

BOOK 3.1: LEGAL DOCUMENT AND APPENDIXES

BOOK 3.2: INVESTIGATION REPORT

**BOOK 3.3: PLANNING DEVELOPMENT OF SOUTH – WEST GAS
REPORT**

BOOK 3.4: REPORT OF RESIDENT PLANNING

BOOK 3.6: FIRE FIGHTING REPORT

BOOK 3.6: CONECTION REPORT

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ABBREVIATION

BQLDANĐ3	–	Thermal project management board Unit No.3
BOD	–	Biochemical Oxygen Demand
CO, CO ₂ ,NO ₂ , SO ₂	–	Chemical formula : carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide
EIA	–	Environmental Impact Assessment
EMP	–	Environmental management plan
EVN	–	Electricity of Vietnam
FGD	–	Flue gas Desulphurization
GIS	–	Geo - Information system
GOV	–	Government of Vietnam
HC	–	Hydrocarbon
HRSG	–	Heat Recovery Steam Generation
MOIT	–	Vietnam Ministry of Industry and Trade
MONRE	–	Ministry of National Resources and Environment
PM10	–	Particulate matter 10 micros
PECC2	–	Power Engineering Consulting Company
VOC	–	Volatile Organic Matter
STG+GTG	–	Gas turbine generation + Steam turbine generation
TSP	–	Total suspended Particles
TCVN	–	Vietnam Standard
UXO	–	Unexploded Ordnances
RAP	–	Resettlement Action Plan
WHO	–	World Health Organization
WB	–	World bank

INTRODUCTION

0.1. ORIGATION OF THE PROJECT

In recent years the high economic growth in combination with economic restructuring leads to the high increase of industrial production in the GDP of Vietnam. The increasing speed of electricity demand of the nation is estimated at 15% per year. The high economic growth contributed leads to the high increase of power. The Vietnamese government has targeted at maintaining the economic growth rate so as to cut down the rate of poverty to 19% in 2010. Nevertheless, shortage of electricity is the biggest hindrance to the growth as well as the target of poverty reduction.

Due to high demand for economic growth, Vietnam has faced with limited supply of energy, particularly in the dry season. In a bid to overcome that difficulty as well as to improve the quality and stability of electricity supply to industrial, agricultural, commercial and popular consumers, Vietnam Electricity Corporation (EVN) has planned on development of new generating sources with additional capacities of 12.000 MW in the period from 2005 to 2010

Out of the total capacity mentioned above, O Mon Power Complex with the capacity of 2910 MW will be a key one in the master plan for electricity development of Vietnam. O Mon III power plant project is one of four plants in the O Mon Power Complex. Q Mon III power plant project with capacity of 750 MW has input to master plan for electricity development of Vietnam in the period from 2001 to 2010.

In order to meet power consumption phase of 2006-2010 and after 2010, Prime Minister has signed decision No 1195/QĐ-TTg on mechanism regulation, specific policy for construction urgent power projects period 2006-2010, in which O Mon III power plant is one of these project.

The development of O Mon III power plant is urgent because:

- The center will supply electricity for the national economy from 2011 onwards so as to secure the national energy and at the same time it is gas consumption unit of B&52 O Mon gas pipeline project.
- It will energize the Southern Focal Economic Zone, provinces in the South of Vietnam. The demand for transmitting electrical power from other Power centers and loss due to such transmission will be thereby reduced.

According to Decree 80/2006/ND-CP dated 09.8.2006 by the government on details and guidelines on implementation of some articles of the Law on Environmental Protection, EIA report of O Mon III power project with the capacity of 750 MW has to made and submitted to MONRE for approval.

EIA report will supply fully basis on environmental feasibility of the project for consideration of Owner. EIA report is basis for implementation mitigation, control

and environmental management method in construction and operation phase of the project.

Approved agency of investment project: EVN

Approved agency of EIA report: Ministry of Natural Resources and Environment.

0.2. LEGAL AND TECHNICAL BACKGROUNDS FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

0.2.1. Legal Background for EIA

At present, Vietnam environmental policies that should be complied with in the EIA include:

- *The Law on Environmental Protection*

The Law on Environmental Protection was passed by the National Assembly of the Socialist Republic of Vietnam, Session XI, and Plenum 8 on 29.11.2005, promulgated on 12.12.2005 under the President's Ordinance 29/2005/L/CTN. The Law on Environmental Protection is valid as of 01.7.2006.

- *Decree 80/2006/ND-CP* dated 09.8.2006 by the government "on details and guidelines on implementation of some articles of the Law on Environmental Protection". Decree is consisting of 3 chapters and 25 articles, of which Section 2, Chapter I includes 12 articles with detailed regulations on SEA, EIA and undertaking to protect the environment. Annex I to Decree 80/2006/ND-CP provides the list of projects, on which EIA reports should be established and Annex II thereto provides the list of inter-sector and inter-province projects, the EIA reports of which should be appraised and approved by the Ministry of Resources and Environment (MRE). According to regulations provided in the two annexes, the project for O Mon III with the capacity of 750 MW should establish an EIA report, which should be appraised and approved by the Ministry of Resources and Environment.

- *Decree 21/2008/ND-CP* dated 28.2.2008 by the government on revision and addition of some articles of the Decree 80/2006/ND-CP dated 09.8.2006 by the government "on details and guidelines on implementation of some articles of the Law on Environmental Protection".

- *Decree 81/2006/ND-CP* dated 09.08.2006 by the Government on administrative penalty in the field of environmental protection. The Decree is consisting of 5 chapters, 44 articles, of which Article 9 stipulates on penalties applicable to breaches of regulations on SEA and EIA.

- *Circular 08/2006/TT-BTNMT* dated 08.09. 2006 by the Ministry of Resources and Environment with "guidance for SEA, EIA and undertaking to protect the environment". Section III of the circular provides details for establishment, appraisal and approval of EIA reports; checkup and certification on implementation of contents of EIA reports. Annex 4 to the circular provides structure and requirements of contents of EIA reports.

- **Circular 59/2007/NĐ-CP** dated 09.04. 2007 by the Government on management of solid waste.

- **Circular 39/2008/TT-BTC** to guide to perform Decree 174/2007/NĐ-CP dated 29.11. 2007 by the Government on environmental protection fee for solid waste.

The EIA report on O Mon III power plant is established in compliance with the Law on Environmental Protection, Decree 80/2006/ND-CP by the government and Circular 08/2006/TT-BTNMT by the MRE. In addition, the following legal documents are observed in the EIA study into the project:

- **The Water Resources Law:** passed by the National Assembly of the Socialist Republic of Vietnam Session X, Plenum 3 on 20.05.1998.

- **The Land Law:** passed by the National Assembly of the Socialist Republic of Vietnam, Session X, Plenum 4 on 26.11.2003.

Letter No 22/2006/QĐ-BTNMT dated 18.12. 2006 by the Ministry of Resources and Environment to force application Vietnamese standard on environment.

The Vietnamese environmental standards applied in this EIA report include:

- Standard on ambient atmosphere (TCVN 5937: 2005)
- Standard on emissions of electricity industry (TCVN 7440: 2005).
- Maximal limit on emissions – land vehicles (TCVN 6438: 2001).
- Noise in public and residential areas – Maximum allowable noise (TCVN 5949: 1998).
- Standard on surface water quality (TCVN 5942: 1995).
- Standard on sea water quality (TCVN 5943: 1995).
- Standard on underground water quality (TCVN 5944: 1995).
- Industrial effluent – discharge standard (TCVN 5945: 2005).
- Sanitary wastewater – allowable limits on pollutants (TCVN 6772: 2000).
- Vibration and shaking – Allowable maxima for the environment in industrial and residential areas (TCVN 6962: 2001).

0.2.2. Technical documents

In the EIA study of this project, the following technical documents have been used:

- i. Feasibility Study of O Mon III power plant Project by Power Engineering Consulting Company 2 (PECC - 2), March 2008.
- ii. Report on topography-geology investigation of O Mon III area by PECC 2, March 2008.
- iii. Data of the environment in the region of the project, investigation by PECC 2, 2005-2006 April, 2008.

- iv. Guidelines on safety and environment policy of World Bank, 1991, 1998.
- v. EIA Report of energy projects in Vietnam, implemented by PECC 2 during period from 1994-2005.
- vi. Report on air quality, noise and vibration of the region of O Mon district by PECC 2, March 2008.
- vii. Report on socio-economic investigation of Phuoc Thoi and Thoi An commune, O Mon district by VESDEC, January 2007.
- viii. Heat dispersion Reports along the river due to discharge cooling water from O Mon III by Institute of applied mechanics, March 2008.

The list of scientific-technical documents used in this EIA study is given in *Chapter Nine*.

0.3. IMPLEMENTATION OF THE EIA

The EIA study (feasibility phase) into O Mon III power plant is carried out by the investor (Electricity of Vietnam - EVN).

The entity that supports the investor to establish the EIA report in compliance with the Law on Environmental Protection is PECC 2. The basic information for PECC2 is listed below:

- **Electricity Construction Consultancy JS Company 2**
 - General Director: Truong Khac Len
 - Address: 32, Ngo Thoi Nhiem Str., Dist. 3, Ho Chi Minh City
 - Tel: (08) 22210252
 - Fax: (08) 22210408
- **List of specialists directly participating in this EIA study is given as follows.**

Thermal power engineering Division (TPED) – Power Engineering Consulting JS Company 2

1. Nguyen Viet Dung, MBA, Director of TPED.
2. Nguyen Hai Phu, Deputy Manager of thermal Dpt., Project Manager.
3. Nguyen Thuy Ha, Environmental Engineer, EIA Team Leader.
4. Nguyen Hai Bang, Thermal Engineer, thermal researcher.
5. Dau Thi Thuy An, Environmental Engineer, Air quality researcher
6. Le Thi Tham, Civil Engineer, climate-hydrographic Air quality researcher
7. Le Phi Khu, Dr. Sc, Environmental Modeler.
8. Vu Viet Dung, Thermal Engineer, air environmental Modeler.
9. Hoang Tin, Environmental Engineer, soil, water and air analysis.

Can Tho thermal power company (Owner)

1. Phan Duc Hon, vice director of Can Tho thermal power company.
2. Le Quoc Vu, head of construction management Department.

And assistance of:

1. Technology Ciency and environment Board – EVN.
2. Can Tho thermal power company
3. Department of Natural resource and environment of Can Tho city.
4. O Mon district People committee and Fatherland front committee of Phuoc Thoi, Thoi An ward.

1

SUMARY DISCRIBLE OF THE PROJECT

1.1. NAME OF THE PROJECT

O MON III COMBINED CYCLE POWER PLANT-CAPACITY OF 750MW

1.2. THE OWER

Can Tho Power Company – Vietnam electricity (EVN).

Main office: 1 Le Hong Phong Street, Tra Noc Ward, Binh Thuy District, Can Tho City.

The representative according to the law: Mr. Nguyen Huu A, Director of Can Tho Power Company.

Phone: 0710.2221218

Fax: 0710 2221 220

1.3. LOCATION OF THE PROJECT

O Mon III Combined cycled power plant (CCPP) Project, which belong to the Master Plan of O Mon Power Complex, It's located at Thoi Loi Hamlet, Phuoc Thoi Commune, O Mon District, Can Tho City, Vietnam. The distance from O Mon III CCPP to Can Tho city central is about 18km on the West – South side. The O Mon site is located in planed Industrial zone of Can Tho city, The North side is Hau River, Nation Road No. 91 at the West – South, O Mon Canal at the West side. Project site with good Topography and Geology condition, near the big river, Advantage in transportation by water way and work way, thinly resident, the land mainly used for agriculture.

The planned Area for O Mon III CCPP is about 42ha. It's located between O Mon III and O Mon IV, distance about 2km. (The existing drawing of project land –refer to Appendix of chapter 1)

Co-ordinates of O Mon III Power plant: (Refer to drawing No. NĐ.0253.10.C.G.002 in the appendix of chapter 1)

Co-ordinates of main benchmarks of O Mon III power plant and O Mon Power complex as the following.

Location	HN-72Co-ordinates , L=106'		Assume co-ordinates	
	X	Y	Xp	Yp
G1	1,120,161.1379	463,861.1609	-142,2466	-1,2460
G2	1,120,473.6628	463,397.6858	-142,2466	557,7540
G3	1,120,650.3316	463,135.6855	-142,2466	873,7540
G4	1,120,804.0782	462,907.6790	-142,2466	1148,7540
G5	1,120,954.4704	462,684.6471	-142,2466	1417,7540
G6	1,121,653.1070	463,155.7433	700,3830	1417,7540
G7	1,121,502.7148	463,378.7752	700,3830	1417,7540
G8	1,121,348.9682	463,606.7817	700,3830	873,7540
G9	1,120,313.5059	465,142.3744	700,3830	-978,3332

Location	HN-72Co-ordinates , L=106'		Assume co-ordinates	
	X	Y	Xp	Yp
A'	1,121,171.7610	463,869.5820	700,3830	556,7900
D'	1,120,859.7750	464,332.2560	700,3830	-1,2460
A''	1,121,192.0612	463,839,1360	700,3830	593.0766
G2''	1,120,714.8030	463,517.5386	124,8830	593.0766

1.4 MAIN CONTENT OF PROJECT

O Mon III combined cycled power plant is planned to construction on the area about 42ha with the capacity about 750 MW. Investment project of this project including the following scope of work:

- Compensate and Land clearance
- Equipment: Procurement cost, installation cost, performance test cost, training cost...
- Construction works: Including the construction work for main equipment and BOP system.
- Project management cost and others cost.

The main item of O Mon III combined cycled power plant including:

- Main items power plant
- Switchyard
- Cooling water supply system
- Cooling water discharge system
- Cooling water pump and cooling water intake
- Fresh cooling water system
- Demineral water system
- Fuel oil receive and fuel oil supply system
- Fire fighting system
- Wasted water system
- Ventilation and air conditional system
- Workshop
- Storage house
- Administration building
- Auxiliary system
- Others.

1.4.1. General layout arrangement

O Mon III Combined cycle Power Plant is the plant where all main equipment are standardized, fabricated and installed in modules to minimize the cost of construction and installation at the construction site. Therefore, the arrangement of main components of power plant is also based on sample design and module type. Equipment arrangement method will be more or less different from manufacturer to manufacturer. By the actual experience and taking into account the tropical meteorological and hydrological conditions of Vietnam, the following arrangement method is proposed:

- Gas turbine units can be arranged outdoor or indoor. However, in the climatic conditions of Vietnam, it is recommended to install gas turbine units indoor. In addition, gas turbines should be equipped with enclosures to shield noise.
- Steam turbine unit will be arranged wholly indoor with the auxiliary components related such as water pump, circulating pump, dosing system of chemicals and make-up water, etc.
- HRSGs are arranged outdoor.
- Generator transformers are arranged outdoor.
- Auxiliary transformers <2000 kVA should be of dry and indoor type, transformers >2000 kVA can be arranged outdoor.
- The central control room of the whole power plant, medium and low voltage cubicle room is arranged in the premises near to machinery hall, for the ease of management and operation.
- The other auxiliary components related to unit as unit fuel supply system, cooling system for generator cooling air, lubricating oil system, will be arranged optimal and suitable for their functions.
- Between units there will be corridors and stairs to facilitate the traveling.

General layout arrangement for O Mon Power complex refer to attached drawing No. NĐ.0253.10.C.G.002.

General layout arrangement for O Mon III CCPP refer to attached drawing No. NĐ.0253.10.C.M.004.

1.4.2. Eco-technical specifications of main equipment

1.4.2.1. Main mechanical equipment

O Mon III power plant will consist of one combined cycle power plant with capacity of 750MW in 2-2-1 configuration (2 gas turbine of 250MW, 2 HRSGs and 1 steam turbine of 250MW). The main equipment selections shall be as the followings.

1. Gas turbine

Gas turbine is equipment to transfer the chemical energy to work energy to turn the generator.

The main items of gas turbine including: Compressor, combustion and turbine. The auxiliary including: Fuel oil system, Air inlet system, composed of filter compartment (filter boxes), noise damper; wind duct; expansion joint; inlet wind shutter...

The general parameters of gas turbine planned to be installed for power plant is shown in the following table.

Table 1.1. General characteristics of gas turbine

Capacity, MW (Gas fired – ISO conditions)	Efficiency	Heat rate, kJ/kWh	Gas flowrate, T/h	Exhaust gas temp. °C
260 – 292	37.5% - 39.6%	9084-9601	549-675	577 – 641

(The parameters in table are for reference and orientation; the final parameters will depend on the specific manufacturer and equipment).

2. Heat recovery steam generator (HRSG)

Heat recovery steam generator is the technical equipment using the high temperature flue gas from gas turbine to generate steam and supply for steam turbine.

HRSG is planned to be the type of 3 pressure levels with reheat. The general parameters of HRSG are presented in the following table

Table 1.2. General parameters of HRSGs

Flue Gas side parameter (Site condition)	Steam parameters	LP	IP	HP	Cold Reheat	Hot Reheat
Inlet temperature:: 577 – 641°C Outlet temperature: 100°C Flue Gas flowrate: 549-675 (Kg/s)	Temp., °C	240	560	560	365	560
	Press., bar	5	30	128	32	30
	Flow, T/h	35	55	260	255	255

(The parameters in table are for reference and orientation; the final parameters will depend on the specific manufacturer and equipment).

3. Steam turbine

Steam turbine is equipment to transfer the thermal energy to work energy to turn the generator.

In order to operation effect and safety, the following auxiliary items is equipped for steam turbine: Condenser: Responsible for cooling and condensate steam from

steam turbine, the water to be use for cooling, Feed water system, Hydraulic and lubricating oil system, Other...

ST is planned to be condensing turbine, three pressure levels with reheat; capacity of around 250MW. The general parameters of steam turbine are presented in the following table

Table 1.3. General parameters of steam turbine

Capacity, gas fired, MW	Steam parameters	LP	IP	HP	Cold Reheat	Hot Reheat
250 – 280	Temp., °C	238	558	558	367	558
	Press., bar	4.5	29.5	124	33	29.5
	Flow, T/h	70	110	520	510	510

(The parameters in table are for reference and orientation; the final parameters will depend on the specific manufacturer and equipment).

4. By pass stack and damper and main stack

- Damper: to be installed under the bypass stack. Damper which controlled by hydraulic system will be permitted to change over quickly from single to combined cycle and inversely.
- The bypass stack: Height about 30 m. That height depends on the HRSG type, the NOx concentration reducing solutions. The by-pass stacks permits the gas turbine to single cycle operation before HRSG, ST has not been finished construction, yet or failure of ST.
- The main stack: Height about 40 m, depends on the HRSG type. With horizontal type, the stack is installed on the separated foundation in the end of exhaust gas duct. The stack was designed basing on gas velocity of 15-23m/s. The expected height of main stack is 60m, basing on the environmental calculation result

1.4.2.2. BOP system

1. Gas Fuel Supply System

Gas Fuel Supply System: Fuel supply to O Mon III Power Plant is natural gas exploited from B&48/95 and 52/97 (common call B&52 Block) which are conducted by B&52 Block- O Mon gas pipe line. Gas demand for O Mon III capacity of 750MW is approximately 972 million m³/year.

The gas fuel supply system is designed as the following requirement: Gas supply system will treat and distribute gas to meet GT requirement about temperature, pressure, and gas quality at all operation conditions. Moisture and foreign matters must be rejected by filters. Gas pressure has to control with operated requirement of gas turbines, gas flow must be measured on gas pipeline to gas turbines. This system is designed to control automatically from central control building.

Pressure, temperature, and gas quality have to maintain on requirement including emergency shutdown.

2. *Fuel oil system*

Back up fuel for O Mon III is DO, consumption of DO quantity incase without gas is around 2.600 ton/day.

Each gas turbine is furnished separated oil supply system from oil storage tanks (2 x 10600 m³) to main oil pumps. The main equipment of oil supply system for each unit includes. The DO supply system for each gas turbine is included the following system: Oil measuring system and duplex strainers, oil storage tanks and auxiliaries to meet 7 days continuous operation, transfer pumps system, forwarding pumps, duplex strainers....

3. *Main Cooling Water System*

Cooling water system for condenser of O Mon III is designed by using once-through cooling water system. Cooling water will be taken from Hau river, after cooling, will be discharged to Hau rive by general common discharge channel of O Mon III an O Mon IV.

Cooling water system is designed to ensure the demand which for 750MW power plant with 10% margin

Total cooling water demand of O Mon III CCPP : Water flow for O Mon III CCPP will be rounded up 18m³/s

Cooling water source: Hau River.

Main cooling water system is included main items as followings:

- + Inlet system: intake tower, intake chamber.
- + Pump pit and pump station: located near Hau river, pump station will be equipped two (2x50%) pumps.
- + Main cooling water pipe: conducts cooling water from pump station to condenser.
- + Cooling water discharge pipe: conducts discharge cooling water from condenser to siphon pit to Hau river.
- + Siphon pit and discharge culvert: conducts discharge cooling water from siphon pit to common culvert of O Mon III & O Mon IV, after that to open common discharge channel (O Mon III&O Mon IV).
- + open common discharge channel to Hau river.

4. *Chlorine dosing system*

Chlorine dosing system is designed to protect equipment of cooling water system avoid the developed of organism such as seaweed, lithe animal etc. It stokes the heat transfer. Chlorine should be supply under the gas form (Cl₂) or under the

liquid as hypochlorite. Hypochlorite is storage in the storage tank. These Chlorine is installed in the chlorine housed with 6 tanks, capacity of its tanks is about 1000kg.

Chlorine dosing is using for make up water/ river water or for circuit cooling water system.

Chlorine house for cooling water system is located besides cooling water pump.

Location for chlorine doing normally before the traveling screen, bar screen

Chlorine dosing system is designed ensure operation requirement and discharge meet the environmental requirement, the design basis data is base on demand/data as the following

Table 1.4. the design basis data for chlorine dosing system.

Items	Unit	Value
Dosing mode		Dosing
Concentration	ppm	4.0
Number of Chlorine tanks	set	16
Capacity of each tank	kg	1000

5. *Auxiliary cooling water system*

Besides the condenser of steam turbine, some other auxiliary systems shall also in need of cooling such as

- Generator air coolers.
- Gas turbine oil coolers
- Steam turbine oil coolers
- Air compressors
- Sampling coolers
- Blow down coolers
- Coolers for feed water pumps, stopping pumps

The above-mentioned systems are cooled by closed circuit cooling water system.

The system is designed with 03 heat exchange loops as follows:

- Loop 1: to receive the emitted heat from auxiliary equipment via heat exchange medium such as oil or hydro, etc.
- Loop 2: Heat exchange between oil and demineralized water,
- Loop 3: Heat exchange between demineralized water and outer circuit water.

Normally, to increase the safety of system, demineralized water will be used as heat exchange medium of Loop 2, design pressure of Loop 1 is higher than that of Loop 2 and pressure design of Loop 2 is higher than that of Loop 3.

Auxiliary cooling water will be extracted from main cooling water system. In order to ensure water demand for auxiliary cooling water, flow rate is designed with 10% margin.

Auxiliary cooling water is extracted from main cooling water supply pipeline for condenser, via the auxiliary heat exchanger by booster pumps; cooling water is taken back to the outlet of condenser. In the heat exchanger of the outer loop, demineralization water of intermediate loop is cooled and then it becomes active solvent of cooled equipment by heat exchanger of the inner loop.

6. *Waste water treatment system*

Chemical wastewater: Chemical wastewater includes wastewater from the system of chemical wastewater treatment and clean up condenser, wastewater from the system of water demineralization treatment and blowdown. Waste water from this system includes neutralized salt, soda, acid inorganic.

Waste water is gathered into the neutral pond to treat. In the normal condition, amount of soda and acid are the same equivalent so they can be neutralized themselves. When amount of acid or odd alkali, system of water treatment will add alkali or acid to neutralize. So that wastewater from demineralization system will be treated to satisfy Vietnam standards before discharging to environment and don't harm environment.

Oil contaminated waste water: Resources arise from main machine STG+GTG and HRSG, transformer area, distribution yard, another support area, diesel factory and oil tank area.

With low density and high mobility when in the water, oil is easy to spread to thin layer to cover the water surface, prevent oxygen infiltration into water, to reduce DO concentration in water, so lead to decrease self-cleaning capacity of water resource and harm life of aquatic creatures. Oil infiltration into respiratory organs of shrimp, fish and prevent from breathe process. Oil has stick capacity in the tree root, leaves prevent photosynthesis capacity and metabolism. Flora of Hau river bank like cypress, nipa, ... capacity stick highly by oil. Due to impact of element environment (temperature, wind, radiation, flow, microorganism ... impact of oil decrease slowly.

Some heavy oil can be sunk to the bottom, stick mud, hard to disintegrate will affect water quality and aquatic creatures long.

Thus, if it is not treated to reach permit standards, wastewater containing oil can affect on aquatic ecosystem of Hau river which receives wastewater of plant and canal, arroyo around the plant.

Wastewater standard for O Mon III CCPP obeys Vietnam standard TCVN 5945-2005, type A.

Domestic wastewater: is mainly in administrative area and bathroom, refectory, toilet ... Domestic wastewater contain organic concentrate, suspended solid, oil, high nutriment.

Amount of domestic wastewater are calculated average about 50m³/h.

7. Water Treatment System

Water treatment system is designed to supply the water demand with different quality for Power plant.

Water treatment system including:

- Raw water treatment is used to treat the river water or under ground water.
- Demineral water: supply the demineral water for demineral water f Power plant.

The capacity of Raw water treatment system is about 52m³/h, The capacity of demineral water treatment system is about 30m³/h.

1.4.3. Fuel supply

Main Fuel supply to O Mon III Power Plant is natural gas exploited from B&48/95 and 52/97 (common call B&52 Block) which are conducted by B&52 Block- O Mon gas pipe line. Gas demand for O Mon III capacity of 750MW is approximately 972 million m³/year.

Back up fuel for O Mon III is DO, consumption of DO quantity incase without gas is around 2.600 ton/day. The O Mon III Power plant will be common using the port of O Mon I Power plant.

Gas from B&52 block area: It's belong to the offshore of West South sea, the gas source of this area is estimated about 247-263 billion m³, the Discovered gas and can be recovered reserve (2P) is about 113 Billion m³.

Table 1.5. Gas fuel demand for O Mon III, capacity of 750 MW.

Capacity (MW)	LHV (MJ/m ³)	Gas supply	Gas fuel demand						
			Second (m ³ /s)	Hour (m ³ /h)	Day (million m ³ /day)	5000h (million m ³)	5500h (million m ³)	6000h (million m ³)	6500h (million m ³)
1TBK: 255.3	29.484	B&52	22.49	80974	1.94	404.87	445.36	485.84	526.33
2 TBK: 507.2	29.484	B&52	44.99	161948	3.887	809.741	890.715	971.689	1052.66

Source: Investment project of O Mon III CCPP Power plant – PECC2, September, 2008

Table 1.6. Fuel gas specification form B-52 Block

COMPONENT	Unit	Value
C ₁	(%Mol)	73.13
C ₂	(%Mol)	2.91
C ₃	(%Mol)	1.52
ⁱ C ₄	(%Mol)	0.44
ⁿ C ₄	(%Mol)	0.35
ⁱ C ₅	(%Mol)	0.17
ⁿ C ₅	(%Mol)	0.10
C ₆	(%Mol)	0.24
CO ₂	(%Mol)	18.41
N ₂	(%Mol)	2.73
H ₂ S	Vppm	0.00
Minimum GHV	Mj/m ³	29.9
Maximum GHV	Mj/m ³	33.6
Mean GHV	Mj/m ³	23.5
Max H ₂ S	mg/m ³	79
Max H _g	mg/m ³	50
Max water	mg/m ³	112

Table 1.7. Gas oil demand (D.O) for O Mon III, capacity of 750 MW.

Capacity (MW)	LHV (kJ/Kg)	Specific gravity	D.O Demand (ton)		
			Hour (T/h)	Day (T/day)	7 day (ton/7 days)
1TBK: 241.91	42600	0.85	54.37	1196.12	8372.81
2TBK: 483.81	42600	0.85	108.74	2392	16746

Source: Investment project of O Mon III CCPP Power plant – PECC2, September, 2008.

Table 1.8. The compositions and specifications of typical D.O No.2 is the following table:

Specifications	Unit	Typical	Allowed range
Component (by mass)			
Carbon	%	86,19	85.3-86.5
Hydrogen	%	13,11	12.6-13.8
Nitrogen	%	0,1	
Oxygen	%	0,1	
Sulphur	%	0,5	1.0, Max
Moisture	%	0	
Ash	%	0	0.01, Max
Total	%		
HHV	KJ/Kg	45225	44800-46050
LHV	KJ/Kg	42600	
Viscosity at 38oC	cSt		1.3-5.5
Flash point	°C		50, Min
Freeze point	°C		-6, Max
Water and sediment	%Vol		0.05, Max
Carbon sediment per 10% total sediment	%Wt		0.35
D. - 90%	°C		282-338
(V + Pb + Zn + Ni)	ppm		1, Max

1.4.4. Electrical solutions

1.4.4.1. Generator

Generators will be connected directly with turbine shaft. The technical parameters are as follows:

- Type: Rotating field, two poles, cylinder rotor, fully enclosed, synchronous.
- Rated Capacity: about 300-320MVA

- Rated voltage: Subject to the manufacturer standard
- Power factor: 0,85
- Insulation class: Class F (operation temperature increase limit in of "B" class)
- Short circuit ratio: not less than 0.5
- Rotating speed: 3000rpm corresponding to 50Hz
- Frequency: 50Hz
- Cooling system: Totally enclosed air or hydrogen cooling system
- Excitation system: Static excitation

1.4.4.2. Main Transformer

Main transformer is used to increase generator voltage up to busbar voltage of 500kV switchyard. Each unit will have 1 main transformer with the following technical parameters:

- Type: 3 phase, 2 windings, 50 Hz, immersed oil, outdoor, step up transformer
- Vector group: YNd11
- Capacity: about 320MVA
- Rated voltage: Umf/230kV
- Lightning impulse voltage: 1550kV
- Switching impulse voltage: 1175kV
- Power frequency test voltage:
- LV winding: According to IEC 60076 list 2 with one (1) step higher than the generator voltage.
- HV winding: 680kV
- On Load Tap Changer: On load automatic/manual voltage regulation with each step not greater than 1.5% and the tapping range shall be suitable with the variable range $\pm 10\%$ of the power network voltage and $\pm 5-7.5\%$ of generator.
- Cooling system: ONAN/ONAF or ONAN/ONAF/ODAF (Subject to the manufacturer standard)
- Grounding: Solidly grounding HV neutral
- The operation of overload:
 - + 10 seconds: 140%
 - + 1 minute: 125%
 - + Continuous: 110%
- Noise level: Not greater than 70dB

1.4.4.3. Switchyard

The switchyard of O Mon III power plant will be extended from O Mon 500kV common switchyard (one and a half circuit breaker scheme). The extension will consist of 3 incoming feeders, feeders for extension in future, the extension of control system, communication, protection system and other relevant parts. The new equipment and provisions shall be designed in accordance with the equipment and provisions in the Scope of O Mon 500kV common switchyard Supply.

1.4.4.4. Auxiliary power system

To produce electricity, the power plant shall consume a part of power to ensure the activities of mechanical and electric auxiliary mechanisms such as cooling water supply pumps, circulated water pumps, condensate pumps, blowing fans, lighting, control and telecommunication, etc. The capacity of auxiliary power of compound cycle gas turbine power plant makes up about 2-3% of the generation capacity of power plant. With the capacity scale of O Mon III power plant about 750MW, the ratio of auxiliary power will be about 2.5%, the capacity of auxiliary power of power plant is temporary calculated of $750\text{MW} \times 2.5\% = 18.75\text{MW}$.

Alternating auxiliary power:

- The 6.6kV auxiliary system shall be supplied from two Generator Voltage/6.6kV Station Service Transformers. They shall be supplied for common auxiliaries, motors with the capacity more than 200kW (i.e.: condenser feedwater pumps, circulating water pumps etc.).
- The 0.4kV LV auxiliary system shall be supplied from 6.6kV auxiliary system via 6.9kV/0.42kV common auxiliary transformers. They shall be supplied for the LV distribution boards, motors with capacity less than 200kW, CB motors, lighting system, sockets, etc.

DC auxiliary system:

Direct current (DC) source will be used for control, monitor and DC motors. For normal operation, DC loads are supplied by rectifiers. Battery will support high load current only in short time, or help overcome the interruption in A.C power supply, especially help unit safely shutdown when the unit is happen fault. The DC auxiliary system of power plant will selected with two voltage levels of 220VDC and 48VDC. The application range of each voltage level is as follows:

- 220VDC voltage supplies for DC motors, control power supplies, emergency lighting, and protection relay and instrumentation systems.
- 24VDC (or 48VDC) voltage system with DC/DC converters are supplied from 220VDC busbar and they supplies for communication circuits, electronic equipment, indicators, fire alarm system and computer circuits.

Emergency diesel generator:

Power plant will operate only when the switchyard has been energised, therefore, the black start diesel generator is not required. The emergency diesel generator will be supplies for the safety shutdown and the station essential loads. The total required

capacity is about 1000kVA including the jacking oil pump, exhaust fans of battery room, battery chargers, communication, emergency lighting, control and instrumentation equipment, etc.. Therefore the capacity of emergency diesel generator will selected at about 1000kVA.

1.4.4.5. Protection relay system

The protection relay system shall be designed with the electrical safety protection requirements for power plant. In the event of faults or abnormal service conditions, the system shall be promptly clear all faults may cause the equipment damage and this system shall also be including alarm indication function for the abnormal service conditions (over rating but under limited permit). The system shall be operate under the following conditions:

- All short circuit faults shall be promptly clear.
- The protection relay system shall also consisting of alarm and trip with definite time delayed of thermal overload faults, overcurrent, overvoltage, undervoltage etc.. These functions shall be subject to the protected equipment.

1.4.4.6. Instrumentation and control system

O Mon III CCPP shall be controlled by Distributed Control System (DCS). This system shall have the capability to monitor, control, display, alarm, record and trend all assigned inputs and outputs of the combined cycle power plant.

The instrumentation and control system will be modern system and will also be the widespread use of the power plants in the world.

This Section covers the plant operation and control principles as well as control and instrumentation equipment specifications including the interfacing of autonomous control equipment for the gas turbine sets and steam turbine.

1.4.4.7. SCADA and communication system

To operate the plant and communicate to outside system and within the plant etc., it's necessary to have a communication system for supporting operational activities generation of the O Mon III CCPP applying latest technology.

The communication system has to assure the following requirements:

- Communication network and data exchange inside plant.
- Communication network and data exchange between the power plant and other plants inside the power complex and related substations.
- Communication network and data exchange between the power plant and MOHC (Management and Operation Housing Compound).
- Communication network and data exchange between the power plant and PSTN, Internet etc.
- Communication network and data exchange between the power plant and the power communication system.

- Communication network and data exchange between the power plant and National Load Dispatching center (A0) and Southern Regional Load dispatching center (A2).
- Supporting the channels for teleportation of OHL and for connection to SCADA/EMS system of National Load Dispatching center (A0) and Southern Regional Load dispatching center (A2).

1.4.5. Civil solutions

1.4.5.1. Major construction items of Power Plant

1. Power house

The power house which includes of the gas turbine and steam turbine buildings is the most essential item, and central structure in scope of construction, with the function of covering turbine units and generator. The Power house is located in the area with the good geological condition including of the gas turbine & steam turbine buildings with different alternatives of configuration. The structure is the industrial house fitting 1- storey with crane, the main bearing structure is steel frame, connecting between the foundation and column or the column and girder which are all rigid connection. Gas turbine & Steam turbine hall can be selected from standard design of manufacturer. The dimension and specification of power plant are considered as follows:

Gas turbine building with size of 163x17m, 7m & 10 m column grids, 18m high

Gas turbine building with size of 70x36.3m, 10 m & 12.5m column grid, 18m high

The main hall combined with Gas & Steam turbine, the column grid is about 5~10m.

Steam turbine building with size of 17x81m, 6m&10m column grids, 18m high

Steam turbine building with size of 47x42m, 10m&12m column grids, 18.2m high

The power plant has configuration of 2 x (2-2-1), according to technological requirement in respect of arrangement layout of turbine and equipment (the standard design of manufacturer), Gas turbine & Steam turbine buildings will be arranged separately, the dimensions and specification of Gas & Steam turbine buildings are considered as follows:

Gas turbine building with size of 21x200m, four gas turbine of (2-2-1) configuration to be provide indoor comply with design manufacture requirements, 9m~11m column grids, roof spacing of 21m, maximum height of roof is 20m. Gas turbine locate indoor and covering in steel sheet structure.

Steam turbine building with size of 31x94m, two (02) steam turbine of (2-2-1) configuration to be provide indoor comply with design manufacture requirements, 7m column grid, roof spacing of 21m in turbine located area, maximum height of roof is about 22m

Roof bearing structure is steel truss combined from shape steel. The roofs are made of double metal cladding

The boundary wall of building is from the elevation of 2m to 3m in comparing to finished building base, assembled by the prefabricated reinforced concrete sheets of casted in situ, in upper it is assembled by double metal cladding with insulation.

Doors, windows, louvers are provided to meet illumination, air ventilation & get out of danger requirements

Air ventilation of plant is the combination of natural ventilation and forced ventilation. The air ventilation system is arranged on the roof as the requirements of air ventilation flow necessary in accordance with calculation and be suitable with equipment capacity. It is requested to equip with air ventilation fans on roof.

Plant lighting system is the combination of natural lighting and artificial lighting system for meeting the requirements of luminosity in grade of III.

2. Area of HRSG, Bypass Stack and Main Stack

Entire area of HRSG, by pass stack, main stack, Fin fan cooler are constructed in accordance with standard design of the manufacturers, by pass stack is about 30m in high and stack of 40m in high (the height of stacks shall be analyzed and calculated in environment impact assessment).

Support steel structure of HRSG and fin fan cooler are made and installed completely with HRSG and equipment by the manufacturer.

3. Center control building

The Center Control building which is designed and constructed for all unit group (2-2-1) is the 3-storeies in which each storey is equipped with control equipment depending to different functions, the main bearing frame is made of reinforced concrete casted in situ, the floor of four sides fixed plate casted in situ with the beams

The building wall is built by hollow brick, block cement brick or in situ casted concrete according to each requirement, outside walls are painted with emulsion paint, the floor is tiled by ceramic or electrostatic prevention slab, the roof is made of reinforced concrete with waterproof and thermal insulation treatment, all working rooms are provided with the air conditioning equipment, control or local air conditioning system.

4. Administration building

Administration building is the office and working place of staff of the plant, Administration building is three-story building with one flat roof, the main bearing frames are of monolith reinforced concrete; four-edge floor is placed in monolith with beams; building foundation is reinforced concrete pile foundation is binded in two directions by beams in combination with supporting wall, construction concrete structure of administration building shall apply M250, used steel is group CII - CIII.

The building wall is built by hollow bricks or block concrete bricks. , the floor is tiled by ceramic, the roof is made of reinforced concrete with waterproof and thermal insulation treatment

The building located near center of power plant, far from water treatment area, chemical hazard area.

1.4.5.2. Architectural solutions

Plant architectural must be designed suitably with technology sequence of combined cycle power plant, surrounding landscape as well as convenient and comfortable during operation and production process.

It is proposed to arrange the water basin, plant trees, and grass cover in boundary plant for improving the weather condition, reducing solar radiation to building surfaces and for reducing the air temperature around the plant

For the roof, draining gradient shall be guaranteed to be suitable to tropical weather condition as well as to resist the thermal ultra transmitting through the roof to indoor of building. It is propose to use insulation roof combining with air ventilation system on roof and louvers on wall.

Boundary wall of buildings: except otherwise allowed works placing outdoor or using roof for temporary cover, other buildings of the power plants shall be constructed with boundary wall in combination with doors, windows providing light, air ventilation.

For safety standard, it must ensure the spacing of hygiene and fire prevention among the buildings in accordance to the Vietnam standard

Besides, the architectural solutions must be ensured harmonious construction, with the notices of master plan of the power center, internal traffic within the power plant area, the communication with external of plant, water drainage and auxiliaries arrangement being ensured the most comfortable usage.

Besides, the architectural solutions must be ensured harmonious construction, with the notices of master plan of the power center, internal traffic within the power plant area, the communication with external of plant, water drainage and auxiliaries arrangement being ensured the most comfortable usage.

1.4.5.3. Equipments

Lighting system shall be assembled at the suitable locations, combined with natural lighting for ensuring enough luminosity during operation and application.

The lighting systems are included of:

The neon lamplights are provided at the control rooms, offices, machine halls

Tungsten lamplights are provided at the workshops and guard lighting system

At the outside of plant area, where there are many people and vehicles moving at night, on the roads inside power plant, the goods storages, the outdoor distribution station are provided with the high voltage lamplights system.

The air conditioning and ventilation are designed for all the buildings in power plant. In the power house, natural ventilation by windows, roof widows shall be combined with the forced air fans system. The air before discharged into atmosphere is filtered. In the areas with the electronic equipments (the center control room, group control room) will be provided the air conditioning

The communication system in power plant will be installed with the automatically telephone system for ensuring the communication within the power plant.

The fire fighting system will be designed for all the buildings, the equipment which are installed in the buildings include of hydrant pipelines, the fire boxes with the flexible hoses ect.

1.4.5.4. Landscaping, green trees of the Plant

According to the environment requirements, the coverage of green trees of industrial plant shall be greater or equivalent to 15% of total construction area. O Mon 1 combined cycle power plant is designed with area for green trees and grass cover satisfactorily area requirement

Flower-garden, green trees, grass cover, lake shall be designed so that they are harmonious with surrounding natural landscape and general architecture of O Mon power center, green color shall cover evenly entire area of the center, it is unallowable to scatter and divided into lots, trees and grass cover shall provide at areas of office building, public work, along traffic road more than area nearby the operating equipment.

Besides, according to the typical requirement of power plant, for the areas that do not plant green trees and out of additional construction scope shall be gravel provided.

1.4.5.5. Construction solutions

1. Land filling work

The power plant located surrounding by Hau River, Vam canal and Chanh canal.

In order to perform leveling work, above mentioned vegetation cover and organic mud layer should be cleared and arroyo system also should be leveled.

The vegetation cover shall be cleared all roots, the remaining organic mud layer and vegetation trashes on the surface shall be taken off with a layer of 0.3m thick, surface discharge is required when carrying out leveling work.

Sand shall be applied for sand filling and leveling, according to the current transportation and traffic conditions at the expected construction place of the power plant, the sand filling and leveling work shall be done mainly by waterway means of transportation, leveling materials shall be transported from the river (by barges, vessels in combination with bucket and dredging ect.,), it is the fact that current road traffic of expected construction area has not developed, the transportation of leveling materials by trucks via temporary road shall account for small amount outside of the leveling area (areas nearby the roads inside power plants of the industrial zone)

Leveling materials of sand and soil shall comply with Vietnamese standards on leveling materials. Leveling procedure shall follow Vietnamese standards with layer from 30 to 50 cm, each leveling layer shall be subject to compaction test in accordance with Vietnamese standards, and the next leveling layer shall be performed only when testing results are satisfactory.

The elevation of leveling is expected at about +2.700m HD in O Mon Power Complex. Finishing elevation is expected at about +2.8 to +3.0m Hon Dau altitude datum.

2. *Foundation works*

The foundation structures of construction items will be designed depend on superstructure, soil condition and actual conditions at site. O Mon III combined cycle Power plant project area locate in soft soil condition ($0.5\sim 1.5\text{ kg/cm}^2$) so that the foundation system shall be treated by soil improvement methods.

The Foundation solutions in soft soil area are divided into many categories depends on superstructure and load conditions.

Basing on the above factors and soil conditions in project area, economical – technical issue, the suitable foundation solutions are considered as follows:

Bored pile foundation is used for heavy load structure, stabilization, no settlement allow such as turbine foundation, generator foundation, HRSG foundation and main stack; oil tank foundation, ... diameter and length of pile are selected base on load and soil conditions. Normally, bored pile are designed reach to hard soil stratum (depth from 70~75m), suitable diameter to this depth is about 0.8m or 1.0m

Fabricated pile (or prestress pile), driving or pressing method are applied for the items near the river bank such as fuel oil berth; revetment; transportation road of superweight of equipment, pump pit foundation, etc, heavy load items, medium load items, tanks foundation, switchyard equipments foundation, ... the size and length of pile are selected base on load and soil conditions. Common sizes are used include 30x30 cm, 40x40 cm, 50x50 cm for the RC pile or circular pile with diameter of 40, 50, 60 cm; the length of pile vary from 24 – 60 m depend on each item.

Because the soil conditions at O Mon site are very soft (soft soil layer vary from 12m to 15m (layer no. 1-2)) so that almost of construction items shall be treated by concrete pile.

CDM soil improvement method to take into considered for design and using in O Mon III combined cycle power plant. This method can increase soil condition bearing capacity within improvement area to 6kg/cm^2 and can be supported the foundations with heavy load without piling.

Discharge canal, box culvert, underground tanks the CDM soil improvement method are suitable. Because this method increasing soil bearing capacity and can be supported the foundation, easy for construction and excavating and no need to provide steel sheet pile to protect the slopes with very high cost.

Beside, the sand pile, sand mat are also considered for the item with medium & light load.

Direct foundation is applied for the items with light load and very light load.

3. *Superstructure works*

Steel structure is applied for the items belong to O Mon III combined cycle power plant are include: Gas turbine building – generator, Steam turbine building –

generator, HRSG supporting, stack, Pump house, pipe rack, oil pump house, gas station, fight fighting pump house, warehouse, workshop, etc.

Reinforced concrete:

In O Mon III combined cycle power plant, beside the items designed & constructed by steel structure, the remaining items will be constructed by reinforced concrete structure such as: Administration building, center control building, water treatment control buildings, fuel oil treatment building, guardhouse, etc.

1.4.6. Construction organisation

Construction activities of project are including the main task as follows:

- Preparation of construction lay-out.
- Construction sequence.
- Soil improvement work
- Excavation work.
- Embankment work.
- Piling work
- Pile – testing at site
- Construction and concrete production.
- Constructing of steel structure.
- Constructing of brick and stone structure.
- Mixing and using works of motar.
- Finishing work.
- Road work.
- Foundation works.
- Constructing work of major items : Power house, stack, discharge system,...
- Air ventilation and air conditionning systems.
- Power and telecommunication systems.
- Transportation and erection works of supper long and supper weight equipments
- Safety and pollution protecting works.
- Auxilary works

1.4.6.1. Power supply for construction

Power supply for construction of O Mon III combined cycle power plant are estimated about 2500kVA with construction voltage is 380/220V ac, which are expected taking from 110/22kV-25MVA substation belong to Can Tho industrial

zone via connection with 22kV existing overhead line which supply power for construction of O Mon I power plant. With the scale and connection as above, two new 22/0.4kV – 1250kVA substations will be provided within O Mon III combined cycle power plant area and one 22kV transmission line from connected point to construction substations

1.4.6.2. The quantity of essential construction material

The materials for construction are used mainly from local materials. Roof materials are made of metal cladding, frames are made of steel or reinforced concrete. The essential material quantity refer to table 1.9

Table 1.9. Essential material quantity

No.	Material	Unit	Quantity
1	Structure steel	tone	3.950
2	Pile	m	62.000
3	Pile concrete	m ³	12.000
4	Other concrete	m ³	40.000
5	Reinforcement	tone	8.000
6	Excavated of soil	m ³	20.000
7	Soil filling	m ³	13.000
8	Sand	m ³	29.000
9	Gravel	m ³	54.000
10	Cement	Tone	25.000
12	Wall cladding	m ²	16.500
13	Doors, windows, louvers	m ²	3.000
14	Paint	m ²	19.000
15	B40 wire mesh	Tone	3.000
16	Roof waterproofing	m ²	2.000
17	Roof cladding	m2	16.000
18	Asphalt concrete	100m ²	580
19	Dredging	m ³	235.200
20	Steel sheet	Tone	3.000

Note: The quantity are estimated only

The quantity of mechanical equipments is refer to table 1.10

Table 1.10. Mechanical equipment quantity

No.	Items	Unit	Quantity
1	Water discharge pipe line made of PVC 300-1750mm	m	2978
2	Water supply pipe line made of PVC	m	2000
3	Mechanical equipments	tone	30.500
4	Water treatment equipments	tone	300
5	Oil unloading equipments	tone	1.500
6	Electrical equipments	tone	2.000

Note: The quantity are estimated only

1.4.6.3. Source of equipments and materials supply

In Omon – Can Tho area, almost materials used for construction of O Mon combined cycle power plant such as cement, sand, gravel, goods expecting taken from local and vicinity areas. Cement can be supplied from Ha Tien factory, sand from Tan Chua – Dong Tap quarries, gravel from Bien Hoa and transported by water way to the site. Others materials such as reinforcement, structure steel for power house will be imported because of local material do not meet requirements relate to quantity and quality, however for the auxiliary items which are not so important, the local material can be used.

In O Mon power complex area, the topographic condition is low so that the material for filling very big, material for filling is sand on Hau River near the power plant. The quantity at Tra Noc quarry is estimated about 7.000.000 m³, beside there area some quarries in Linh island far away from site about 2km. at the moment Vietnam mineral geologic company carrying out investigation some quarries near the site, the quality can be used for filling.

1.4.6.4. Equipments transportation and material

For the construction of power plant, the essential material quantity are very big, therefore suitable transportation method will be considered to meet material and time schedule requirements. Normally, this construction time schedule is very strictly and very fast. To reduce the cost and to meet the quality, time schedule requirements, almost essential materials shall be transported by water way and combined with road for bulk and light material.

In O Mon site almost essential materials are transported by water way along the Hau River to the site. Import equipments can be unloaded and stored at Can Tho Port or Ho Chi Minh City. The road is used mainly to transport light equipments and building materials if more economically

In lay-out arrangement, the temporary storage yard of equipments and material are arranged near the river bank to promote the waterway transportation ability. Materials used for concrete work such as gravel, sand, cement, etc... will be transported by barge from the ferries in Can Tho to the site, unloading by scraper machine and excavator,...

For the structure steel are fabricated at shop, packing and transporting to the site by water way, unloading by crane.

Bulk materials with small quantity, the transportation shall included by water way and road.

1.4.6.5. Construction organization method

- *CDM soil improvement method*

According to technical requirement, soil improvement method shall be applied for O Mon III combined cycle power plant besides driving pile method are used very common.

CDM work need to have the equipments such as mixing machine, compressor, drilling machine, injection machine..

- *Foundation construction procedure*

Sequence and construction of foundation method shall be combined with construction works of underground items, road work and other works.

The foundation is expected cast in situ by reinforced concrete. Foundation pit are excavated by excavator in accordance with specification to meet the depth and width. After driving pile, fresh concrete from batching plant shall be casted for foundation.

Driving pile by K35 hammer from 3-5 tone. Because the foundation can be located underground water so that the dewatering work shall be considered. Beside for the deep foundation pits the steel sheet pile shall be provided. for slope protection..

- *Earth work*

Before carrying out the filling work, the vegetational cover shall be cleared all roots, the remaining organic mud layer and vegetational trashes on the surface shall be taken off with a layer of 0.3m~0.5m thick, the bulldozers will bulldoze into layers with 0.3m thick, and 10tone roller and 15tone compactor to be used.

- *Constructing of brick and stone structure*

Constructing of brick and stone structure shall comply with current standards issued by Government such as TCVN 4459:1987, "Instruction of mixing and using construction motar"

Indoor water supply and water discharge system

Fixing of sanitary equipment and heat equipment indoor have to carried out comply with design approval.

Material and components used for fixing sanitary equipment system indoor will comply the provision and current standards.

Fixing equipments and accessories in accordance with manufacture provision.

- *Finishing works*

Constructing of finishing work shall comply with safety provisions, fire fighting provision and other relation standards issued by the Government.

For the structures fabricated at shop the finishing works are carried out during fabricating and comply with particular provisions

- *Constructing of bored pile foundation:*

According to design and construction of pile foundation, the main items such as power house, generator, oil tank,...bored pile will be applied. Construction method is use drilling machine with auger diameter equal with design pile diameter and drilling at design locations.

Construction of bored pile, construction method, testing method shall be carried out comply with Vietnam standard.

- *Constructing of steel structure work*

Structure steel shall be fabricated and erected in accordance with design drawing (shop drawing of structure steel). During fabricating and erecting the mechanism construction equipments should be applied to meet construction method and technology diagram.

Structure steel has to erect in accordance with design and construction sequence. Constructing erecting in the next step shall be carried out after fabricating, welding and bolt setting works completed

Transportation and preservation of structure steel shall comply with specification, before erecting structure steel have to checked the dimension, paint thickness

- *Constructing of concrete works*

Almost the foundation of main items of power plant are driven pile driving by machine. Frame and roof are made of steel sheet and metal cladding. Concrete work is carried out by manual and machine. The reinforcement is fabricated into the elements at shop by using cutter and welding machine 15kW. Erecting, removing of formwork and scaffolding are mainly by manual with supported by crane and electric hoist.

Frame of structure steel, steel members are erected by crane

Concrete are mixed at fresh batching plants and transport by pump truck to site for casting and compacted by vibrator compactor and spud vibrator. For the ground floor and mat foundation the plate compactor shall be added. The precast of reinforced concrete structures such as beam, girder, pile are transported to site by car or barge. These members are unloaded and erected by 25tone crane and tower crane.

For the stack, the casing concrete of foundation shall be carried out after piling work completed. Fresh concrete are transported from batching plants by pump trucks to the site for casting and compacted by vibrator compactor and spud vibrator. The upper part made of steel will be erected by crawler crane.

- *Constructing of mechanical equipments*

Complex mechanical equipments before official erecting will be temporary erected at erecting layout area and then mobilize to setting location by the form separate equipments.. Crane shall be provided for erecting and repairing the equipments. Erecting of equipments are carried out in assembling floors and put into the location by crane.

In the area without crane such as fuel oil storage, auxiliaries area, substation, the wheel crane and crawler crane with capacity of 10~20 tone will be provided for erecting the equipments.

1.4.6.6. List of construction equipments

To meet requirement relate to quality and time schedule, construction machine shall be provided. The construction equipments necessary are included as follow:

- *Earth work*
 - 108 CV bulldozer.
 - Excavator from 1.5 to 2.5 m³.
 - Heavy truck, 15 tone.
 - Roller roll, 15 tones, 10 tones, 5 tones.
- *CDM soil improvement*
 - Wheel mounted crane
 - Mobile crane
 - Cement silo, water tank 150 m³, betonies tank
 - Compressor, injection blow molding machine
 - Control equipment
- *Bored pile & driven pile construction work*
 - Drilling machine $\geq$ 45m depth
 - Wheel mounted crane
 - Mobile crane
 - Bentonite tank 75m³
 - diesel driving machine(3-5T) K35.
- *Concrete construction works*
 - Batching fresh concrete.
 - Motar mixing machine, 500liter.
 - Elevator.
 - 2,5 tone crane & 10 tone crane.

- Compactor: vibrator compaction, plate compactor, spud vibrator.
- Concrete pump truck.
- Cutter and metal bending machine.
- Welding machine 15-50 kW.
- Scaffolding system.
- Electrical hoist.
- *Construction equipments*
 - Special transport truck (turbine transport, generator transport, superheavy equipment)
 - Truck 10-20 tone.
 - Crane.
 - Tower crane 25 tone.
 - Wheel crane 10 tone.
 - Drilling machine .
 - Welding machine 15 - 50 KW.

Beside the equipments mention above, during the construction stage the personnel safety tools shall be provided.

1.4.7. Construction lay-out organization

O Mon III construction schedule is expected as follows:

O Mon III: 2011 year

In the case that more than one project constructed, the coordinate work will be considered in actual conditions. However, two road can be used are road No.1 and road No.2. In order to avoid affecting to existing power plant operating, the Contractors shall take into consider the solutions to reduce in minimum affecting. The power plant is located adjacent, the solutions to reduce vibrating will be considered during driving pile or driving pile without vibrating.

1.4.8. Implementation Schedule of Project

O Mon III combined cycle power plant with capacity about 750MW, the schedule as the following:

- 01/2009 Approval of Investment Project Report.
- 10/2009 Sign the EPC Contract

Two stages:

- 10/2013 Open-cycle operation (GT1)
- 11/2013 Open-cycle operation (GT2)
- 05/2014 Commercial operation for steam turbine

One stage:

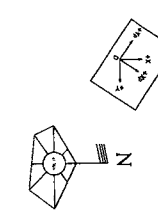
- 03/2014 Commercial operation for combine cycle power plant.

1.4.9. Total Investment Cost

Total investment cost for O Mon III Power Plant Project is estimated with project financing from ADB's Ordinary Capital Resources: (Loan 85% from ADB 85%, EVN capital 15%: 11,974,966,492,000 VNĐ (725.755.543,00 USD).

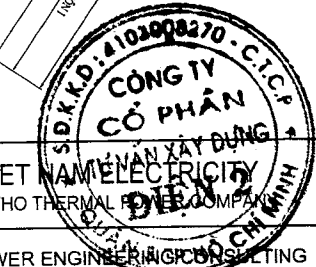
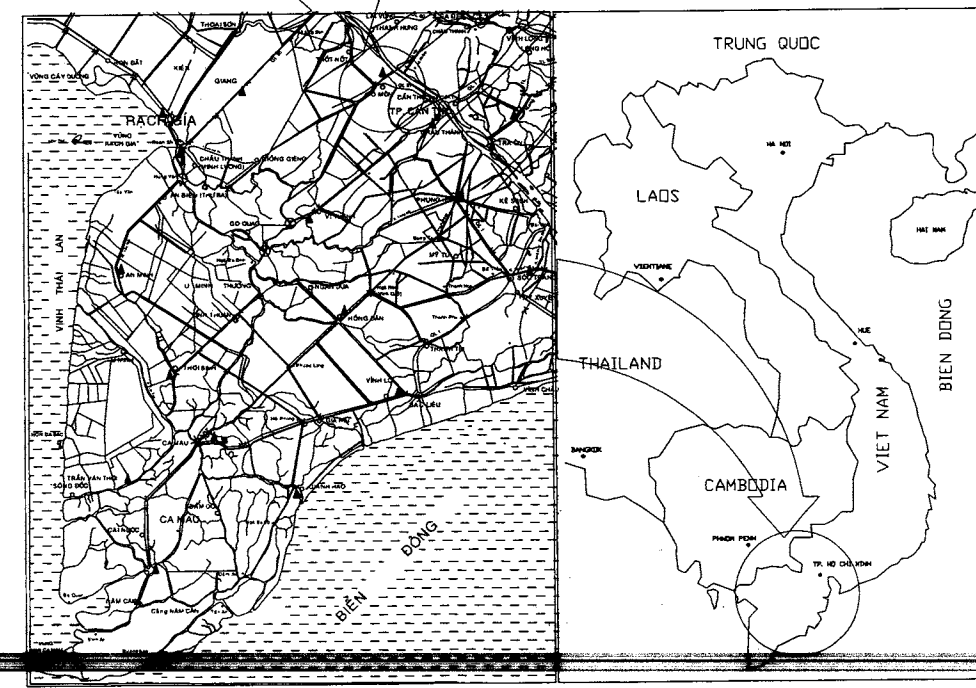
Phụ lục 3 kèm theo QĐ số 1671/QĐ-EVN ngày 15/12/2008
Tiến độ chỉ tiết năm 2009, dự án NMND 0 Mổn 3

TT	Nội dung	Bắt đầu	Kết thúc	2009												2010														
				O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	1 DỰ ÁN NHÀ MÁY NHIỆT ĐIỆN Ở MÓN III OMONIII THERMAL POWER PLANT PROJECT	Sun 3/30/08	Wed 11/13/13																											
2	1.1 Kế hoạch đấu thầu The bidding plan	Mon 12/15/08	Fri 2/27/09																											
3	1.1.1 Lập Kế hoạch đấu thầu đợt 1 The bidding plan stage 1	Mon 12/15/08	Mon 12/29/08																											
4	1.1.2 Trình duyệt kế hoạch đấu thầu Submit the bidding plan	Tue 12/30/08	Fri 2/27/09																											
5	1.2 Gói thầu San lấp mặt bằng level layout package	Sat 1/15/09	Thu 5/6/10																											
6	1.2.1 Lập và phê duyệt TKBVTC-DT Make & approval construction drawing design	Sat 1/15/09	Thu 2/12/09																											
9	1.2.2 Lập và phê duyệt HSMT Make & approval bid document	Mon 12/1/08	Wed 4/28/09																											
13	1.2.3 Đấu thầu The bidding compete	Thu 4/30/09	Sun 8/9/09																											
14	1.2.3.1 Thông báo mời thầu	Thu 4/30/09	Thu 5/14/09																											
15	1.2.3.2 Phát hành HSMT& Nhà thầu chuẩn bị	Fri 5/15/09	Sun 6/28/09																											
16	1.2.3.3 Đóng thầu	Mon 6/29/09	Mon 6/29/09																											
17	1.2.3.4 Đánh giá HSĐT	Tue 6/30/09	Sun 7/19/09																											
18	1.2.3.5 Trình duyệt KĐĐT	Mon 7/20/09	Mon 8/3/09																											
19	1.2.3.6 Thương thảo HB	Tue 8/4/09	Sat 8/8/09																											
20	1.2.3.7 Ký kết hợp đồng	Sun 8/9/09	Sun 8/9/09																											
21	1.2.4 Xây dựng Construction	Mon 8/10/09	Thu 5/6/10																											
22	1.3 Gói thầu giám sát kỹ thuật SLMB level layout technical supervision package	Sun 3/1/09	Thu 5/6/10																											
31	1.4 Gói thầu Hệ thống điện thí công Electrical system package	Sat 8/1/09	Sun 7/18/10																											
32	1.4.1 Lập và phê duyệt TKBVTC-DT Make & approval construction drawing design	Sat 8/1/09	Thu 9/24/09																											
36	1.4.2 Lập và phê duyệt HSMT Make & approval bid document	Fri 8/25/09	Tue 12/8/09																											
41	1.4.3 Đấu thầu The bidding compete	Wed 12/9/09	Sat 3/20/10																											
48	1.4.4 Xây dựng Construction	Sun 3/21/10	Sun 7/18/10																											
50	1.5 Gói thầu giám sát Hệ thống điện Electrical system supervision package	Fri 9/25/09	Fri 6/18/10																											
59	1.6 Lập dự án đầu tư make investment package	Sun 3/30/08	Mon 12/15/08																											
65	1.7 Tư vấn kỹ thuật Selection consultant	Thu 1/15/09	Tue 1/26/10																											
66	1.7.1 Tuyển chọn tư vấn	Thu 1/15/09	Sun 6/31/09																											
67	1.7.1.1 Lập TOR + Dự toán chi phí	Thu 1/15/09	Thu 1/29/09																											
68	1.7.1.2 Phê duyệt TOR+ Dự toán chi phí	Fri 1/30/09	Sat 2/28/09																											
69	1.7.1.3 Phát hành TOR	Sun 3/1/09	Mon 3/30/09																											
70	1.7.1.4 Tiếp nhận HSDX	Tue 3/31/09	Tue 3/31/09																											
71	1.7.1.5 Đánh giá HSDX	Wed 4/1/09	Wed 4/15/09																											
72	1.7.1.6 Thương thảo hợp đồng	Thu 4/16/09	Thu 4/30/09																											
73	1.7.1.7 Trình duyệt kết quả thương thảo	Fri 5/1/09	Sat 5/30/09																											
74	1.7.1.8 Hợp đồng có hiệu lực	Sun 5/31/09	Sun 5/31/09																											
75	1.7.2 Lập và phê duyệt TKKT-TDT Make & approval technical design - total cost estimate	Mon 8/1/09	Fri 11/27/09																											
76	1.7.2.1 Tư vấn lập TKKT-TDT	Mon 8/1/09	Thu 7/30/09																											
77	1.7.2.2 CTPP xem xét TKKT-TDT	Fri 7/31/09	Fri 8/14/09																											
78	1.7.2.3 Tư vấn hiệu chỉnh TKKT-TDT	Sat 8/15/09	Sun 9/13/09																											
79	1.7.2.4 CTPP xem xét TKKT-TDT lần 2	Mon 9/14/09	Mon 9/28/09																											
80	1.7.2.5 Trình EVN phê duyệt	Tue 9/28/09	Wed 10/28/09																											
81	1.7.2.6 Trình Bộ Công Thương phê duyệt	Thu 10/29/09	Fri 11/27/09																											
82	1.7.3 Lập và phê duyệt HSMT Make & approval bid document	Sat 8/15/09	Tue 1/28/10																											
83	1.7.3.1 Tư vấn lập HSMT	Sat 8/15/09	Mon 9/28/09																											
84	1.7.3.2 CTPP xem xét HSMT	Tue 9/29/09	Wed 10/28/09																											
85	1.7.3.3 Tư vấn hiệu chỉnh HSMT	Thu 10/29/09	Fri 11/27/09																											
86	1.7.3.4 CTPP xem xét HSMT lần 2	Sat 11/28/09	Sat 12/12/09																											
87	1.7.3.5 Phê duyệt HSMT (EVN, MOIT, ADB)	Sun 12/13/09	Tue 1/26/10																											
88	1.8 Gói thầu EPC EPC Package	Wed 1/27/10	Wed 11/13/13																											
89	1.8.1 Tổ chức đấu thầu Bidding organization	Wed 1/27/10	Fri 12/10/10																											
100	1.8.2 Triển khai thực hiện Implementation	Sat 12/11/10	Wed 11/13/13																											



NOTES:

- RIVER AND CANAL
- RICE-FIELD BOUNDARY
- GREEN BOUNDARY
- HOUSE
- HIGH-TENSION LINE



VIET NAME ELECTRICITY
CAN THO THERMAL POWER PLANT
POWER ENGINEERING CONSULTING

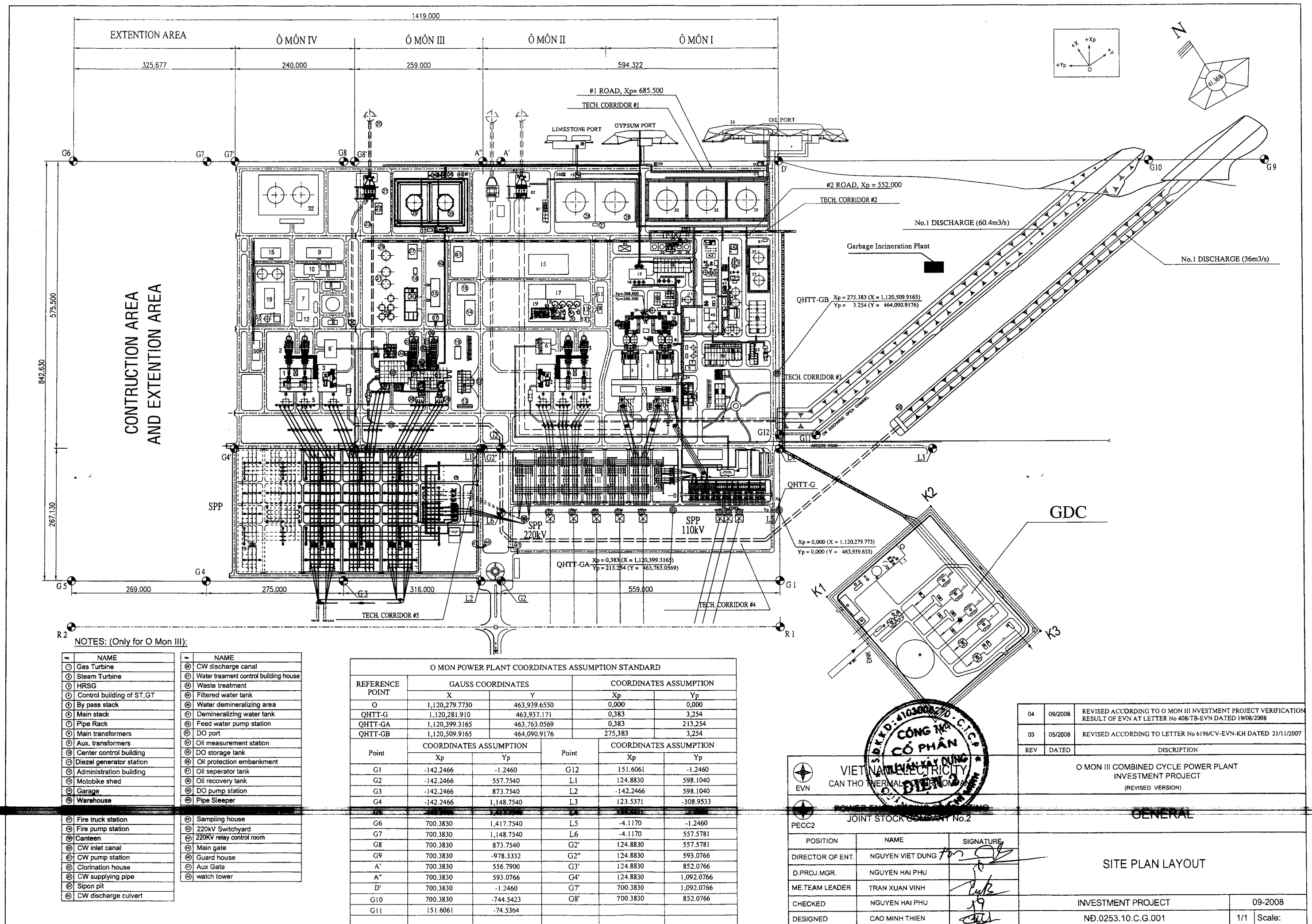
04	09/2008	REVISED ACCORDING TO O MON III INVESTMENT PROJECT VERIFICATION RESULT OF EVN AT LETTER No 408/TB-EVN DATED 19/08/2008
03	05/2008	REVISED ACCORDING TO LETTER No 6196/CV-EVN-KH DATED 21/11/2007
REV	DATED	DISCUSSION

O MON III COMBINED CYCLE POWER PLANT
INVESTMENT PROJECT
(REVISED VERSION)

GENERAL

POSITION	NAME	SIGNATURE
DIRECTOR OF ENT.	NGUYEN VIET DUNG	
D.PROJ.MGR.	NGUYEN HAI PHU	
ME.TEAM LEADER	TRAN XUAN VINH	
CHECKED	NGUYEN HAI PHU	
DESIGNED	CAO MINH THIEN	

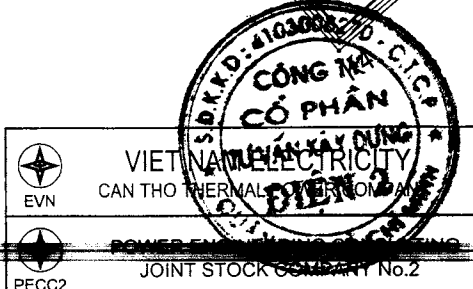
SITE PLAN LAYOUT	
INVESTMENT PROJECT	09-2008
ND.0253.10.C.G.001	1/1 Scale:



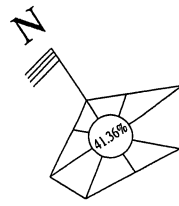
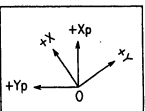
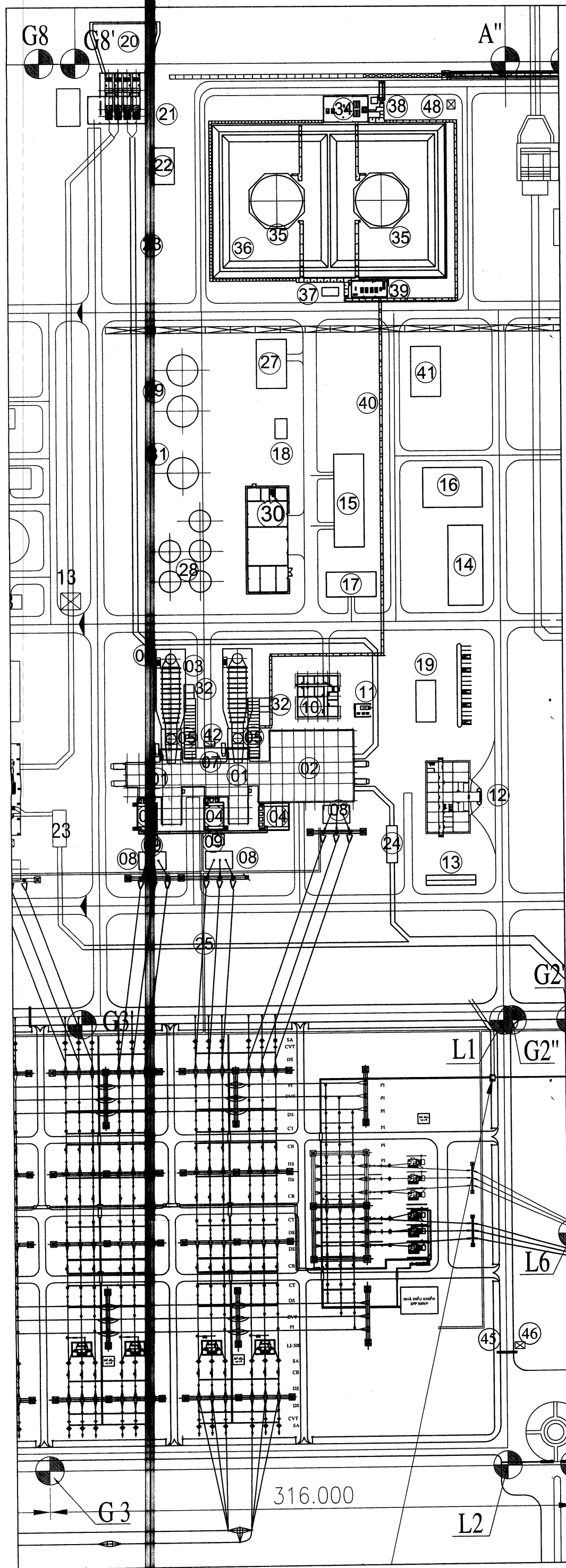
NOTES: (Only for O Mon III):

NO	NAME	NO	NAME
①	Gas Turbine	②⑥	CW discharge canal
②	Steam Turbine	②⑦	Water treatment control building house
③	HRSG	②⑧	Waste treatment
④	Control building of ST,GT	②⑨	Filtered water tank
⑤	By pass stack	②⑩	Water demineralizing area
⑥	Main stack	②⑪	Demineralizing water tank
⑦	Pipe Rack	②⑫	Feed water pump station
⑧	Main transformers	②⑬	DO port
⑨	Aux. transformers	②⑭	Oil measurement station
⑩	Center control building	②⑮	DO storage tank
⑪	Diesel generator station	②⑯	Oil protection embankment
⑫	Administration building	②⑰	Oil separator tank
⑬	Motobike shed	②⑱	Oil recovery tank
⑭	Garage	②⑲	DO pump station
⑮	Warehouse	②⑳	Pipe Sleeper
⑯	Fire truck station	②㉑	Sampling house
⑰	Fire pump station	②㉒	220kV Switchyard
⑱	Canteen	②㉓	220kV relay control room
⑲	CW inlet canal	②㉔	Main gate
⑳	CW pump station	②㉕	Guard house
㉑	Chlorination house	②㉖	Aux Gate
㉒	CW supplying pipe	②㉗	watch tower
㉓	Sipon pit		
㉔	CW discharge culvert		

O MON POWER PLANT COORDINATES ASSUMPTION STANDARD					
REFERENCE POINT	GAUSS COORDINATES		COORDINATES ASSUMPTION		
	X	Y	Xp	Yp	
O	1,120,279.7730	463,939.6550	0,000	0,000	
QHTT-G	1,120,281.910	463,937.171	0,383	3,254	
QHTT-GA	1,120,399.3165	463,763.0569	0,383	213,254	
QHTT-GB	1,120,509.9165	464,090.9176	275,383	3,254	
Point	COORDINATES ASSUMPTION		Point	COORDINATES ASSUMPTION	
	Xp	Yp		Xp	Yp
G1	-142.2466	-1.2460	G12	151.6061	-1.2460
G2	-142.2466	557.7540	L1	124.8830	598.1040
G3	-142.2466	873.7540	L2	-142.2466	598.1040
G4	-142.2466	1,148.7540	L3	123.5371	-308.9533
G6	700.3830	1,417.7540	L5	-4.1170	-1.2460
G7	700.3830	1,148.7540	L6	-4.1170	557.5781
G8	700.3830	873.7540	G2'	124.8830	557.5781
G9	700.3830	-978.3332	G2''	124.8830	593.0766
A'	700.3830	556.7900	G3'	124.8830	852.0766
A''	700.3830	593.0766	G4'	124.8830	1,092.0766
D'	700.3830	-1.2460	G7'	700.3830	1,092.0766
G10	700.3830	-744.5423	G8'	700.3830	852.0766
G11	151.6061	-74.5364			

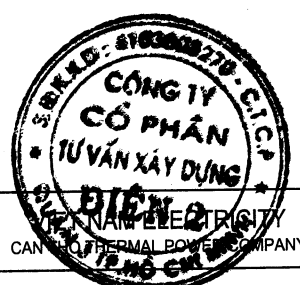


04	09/2008	REVISED ACCORDING TO O MON III INVESTMENT PROJECT VERIFICATION RESULT OF EVN AT LETTER No 408/TB-EVN DATED 19/08/2008
03	05/2008	REVISED ACCORDING TO LETTER No 6196/CV-EVN-KH DATED 21/11/2007
REV	DATED	DISCUSSION
O MON III COMBINED CYCLE POWER PLANT INVESTMENT PROJECT (REVISED VERSION)		
GENERAL		
SITE PLAN LAYOUT		
INVESTMENT PROJECT		09-2008
NĐ.0253.10.C.G.001		1/1 Scale:



NOTES:

No	NAME	No	NAME
01	Gas Turbine	26	CW discharge canal
02	Steam Turbine	27	Water treatment control building house
03	HRSG	28	Waste treatment
04	Control building of ST,GT	29	Filtered water tank
05	By pass stack	30	Water demineralizing area
06	Main stack	31	Demineralizing water tank
07	Pipe Rack	32	Feed water pump station
08	Main transformers	33	DO port
09	Aux. transformers	34	Oil measurement station
10	Center control building	35	DO storage tank
11	Diezel generator station	36	Oil protection embankment
12	Administration building	37	Oil seperator tank
13	Motobike shed	38	Oil recovery tank
14	Garage	39	DO pump station
15	Warehouse	40	Pipe Sleeper
16	Workshop	41	Fuel gas treatment and supply plant
17	Fire truck station	42	Sampling house
18	Fire pump station	43	220kV Switchyard
19	Canteen	44	220KV relay control room
20	CW inlet canal	45	Main gate
21	CW pump station	46	Guard house
22	Clorination house	47	Aux Gate
23	CW supplying pipe	48	watch tower
24	Sipon pit		
25	CW discharge culvert		



POSITION	NAME	SIGNATURE
DIRECTOR OF ENT.	NGUYEN VIET DUNG	
D.PROJ.MGR.	NGUYEN HAI PHU	
ME.TEAM LEADER	TRAN XUAN VINH	
CHECKED	NGUYEN HAI PHU	
DESIGNED	CAO MINH THIEN	

04	09/2008	REVISED ACCORDING TO O MON III NVSTMENT PROJECT VERIFICATION RESULT OF EVN AT LETTER No 408/TB-EVN DATED 19/08/2008
03	05/2008	REVISED ACCORDING TO LETTER No 6196/CV-EVN-KH DATED 21/11/2007
REV	DATED	DISCRIPTION
O MON III COMBINED CYCLE POWER PLANT INVESTMENT PROJECT (REVISED VERSION)		
GENERAL		
O MON III POWER PLANT		
INVESTMENT PROJECT		09-2008
NĐ.0253.10.C.M.004		1/1 Scale:



TOPOGRAPHIC LAYOUT OF O MON III COMBINED CYCLE POWER PLANT

BOUNDARY COORDINATES OF O MON GENERATION COMPLEX

Point	Gauss Coordinates		Supposed Coordinate	
	X	Y	Xp	Yp
G1	1,120,161.1379	463,861.1609	-142,6296	-4,5000
G2	1,120,473.6628	463,397.6858	-142,6296	554,5000
G3	1,120,636.3316	463,133.6833	-142,6296	870,5000
G4	1,120,804.0782	462,907.6790	-142,6296	1145,5000
G5	1,120,954.4704	462,684.6471	-142,6296	1414,5000
G6	1,121,653.1070	463,155.7433	700,0000	1414,5000
G7	1,121,502.7148	463,378.7752	700,0000	1145,5000
G8	1,121,348.9682	463,606.7817	700,0000	870,5000
G9	1,120,313.5059	465,142.3744	700,0000	-981.5872
A'	1,121,171.7610	463,869.5820	700,0000	553,5360
D'	1,120,859.7750	464,332.2560	700,0000	-4,5000

NOTES

	Canal
	Houses

**NATURAL ENVIRONMENT, SOCIO-ECONOMICAL
CONDITIONS**

2.1. GENERAL

O Mon III Combined Cycle Power plant (CCPP) is planned in the O Mon Power Complex with the area of 162ha, in which O Mon III CCPP area is 42ha. It is located on the right bank of Hau River, on the West – South of Nation Road No. 91, of the West of O Mon Canal. Project location belongs to Phuoc An and Phuoc Thoi wards, O Mon District, Can Tho City. This project is about 18km West – North of Can Tho City.

From April 04, 2008 to April 11, 2008, Power Engineering Consulting Joint Stock Company No.2 coordinated with Vietnam Institute for Tropical Technology & Environmental Protection for investigation, sampling and testing of air, water, soil qualities and biological environment of project area and collection of the economy social data.

2.2. NATURAL ENVIRONMENTAL CONDITIONS

2.2.1. Topography

O Mon III CCPP Project, which is in the master plan of O Mon Thermal Power Complex, is encompassed by Hau river and Chanh and Vam arroyos. In this area, Hau River is straight, flows in direction from West North to East South, 900m width, the maximum depth is 22 – 23m, river banks are stable and not landslide. O Mon District is in center of Mekong Delta, on the right bank of Hau River, smooth, average level is 1.2 – 1.4m with above sea level, and decrease toward the interior field

2.2.2. Geology

O Mon area had the geological feature of western region of Hau river. The geology is marsh deposit strip, associated with yearly sediment deposition of Hau river at high water period on the ancient deposit. This deposit is on riverbank from Thot Not to O Mon and extends to center of Can Tho City, and gets thinner and thinner in the interior field, Co Do – Hau river Farm.

O Mon III area is encompassed by Hau Rach Chanh and Rach Vam Rivers, therefore geology is effected by local rivers

Project geology is 3 layer: layer 1 is clay, layer 2 is clayed – silt, and layer 3 is speckled clay.

Layer 1: Yellowish brown gray clay. Stiffish soil, clay content is large, it can be used for brick, the thickness is 1 -2 m. This layer has the average physio mechanical characteristic, bearing capacity is about 1,2kg/cm².

Layer 2: clay loam – silt, soft soil, low dry density, bearing capacity is about 0.3kg/cm²

Layer 3: spotted clay intercalated with lens or sandy thin layer, width is over 70m. This layer have the large thickness, it can be used the project basement. Bearing capacity is about 1,5kg/cm².

2.2.3. Climate

O Mon district area of Can Tho city is located in the center of the Mekong Delta, in the typical tropical climate zone, strongly affected by two monsoon regimes: North-east monsoon and West-south monsoon, establishing 2 seasons clearly: dry & wet seasons.

Temperature

Can Tho City area is located in the tropical monsoon zone. The dry season is from November to April next year, the wet season is from May to October.

The temperature in Can Tho city changes corresponding to the seasons during the year. Temperature increases at the end of the dry season (March, April) and gets the lowest in December and January. However, the mean temperature difference between the months in the year is not high (about 2,6°C)

- Daily average temperature: 27°C
- Lowest monthly average temperature: 26.2°C (December)
- Highest monthly average temperature: 29°C (April)
- Absolute maximum temperature: 40.0°C
- Absolute minimum temperature: 14.8°C

Table 2.1 Air temperature progress for years at Can Tho city (°C)

Month	Yearly average temperature (°C)				
	2003	2004	2005	2006	2007
January	25.3	25.9	25.1	26.0	25.2
February	25.0	25.7	26.6	27.0	25.8
March	26.9	27.4	27.2	27.5	26.9
April	28.7	29.0	28.8	28.1	26.7
May	28.2	28.1	28.5	27.8	28.2
June	26.9	27.2	27.8	27.1	27.4
July	26.5	26.8	26.2	27.0	27.5
August	26.5	26.7	27.2	26.7	26.2
September	26.6	26.9	26.8	26.6	26.7
October	26.5	26.9	27.1	27.0	26.7
November	27.3	27.4	26.7	27.8	26.6
December	25.1	25.7	25.5	26.1	26.6
Average	26.6	27.0	27.0	27.1	26.7

(Source: *Can Tho City statistics year book, 2007*)

Solar radiation

Can Tho city is located in the low latitude, Sun is always high and changes a little bit through the months of the year so that the solar radiation is rather stable. In Can Tho city, the monthly average solar radiation energy is about 430.6 cal/cm², maximum is 521 cal/cm² (March), minimum is 391 cal/cm² (September). The months with maximum solar radiation energy are in dry season (March and April), the months with the minimum solar radiation energy are in wet season (September and October).

Total sunny hours in the year at Can Tho are from 2400 to 2600 hours. The total sunny hours in dry season is higher than in wet season, about 9 hours per day and 200 hours per month. The solar radiation energy in dry season is higher than in wet season, the total average radiation energy in the year is about 5.17 kcal/cm².

Table 2.2 Sunny hours & solar radiation progress at Can Tho city.

Month	Average sunny hours in the year (hours)				
	2003	2004	2005	2006	2007
January	237,6	226	218,8	206,4	257,4
February	264,4	222	248,0	208,4	240,5
March	295,3	240	257,9	238,4	276,9
April	280,1	237	241,2	204,3	269,9
May	109,7	174	217,9	195,1	202,8
June	184,7	151	187,0	144,2	148,3
July	183,7	162	139,8	135,3	175,5
August	180,8	138	182,5	149,3	111,7
September	125,6	166	142,3	147,8	132,9
October	124,3	165	167,9	156,6	167,5
November	219,2	174	164,8	227,1	179,4
December	159,7	196	122,7	230,0	238,7
Average	197	188	191	186	200
Yearly sunny hours	2365,1	2.249	2.290	2.242,9	2.401,5

(Source: *Can Tho City statistic year book, 2007*)

Air pressure

Air pressure in the area is changing a little bit between the seasons of the year. The monthly average air pressure is around 1.009,6 mb, maximum is 1.019,6 mb and minimum is 1.000 mb.

Air humidity

In Can Tho city, the relative humidity of the months of the year is always higher than 75%. The difference of air humidity is not high. The average

relative humidity in the year is about 82,3%. The minimum air humidity is about 27% (in May) and maximum is 96%. The months with maximum air humidity are from July to November and months with minimum air humidity are from February to April. The progress of air humidity in the year is showed in the table 2.3.

Table 2.3 Air humidity progress in the year (%)

Month	Average relative humidity in the year (%)				
	2003	2004	2005	2006	2007
January	80	79	80	82	83
February	79	79	79	77	81
March	80	77	77	80	81
April	80	77	76	83	79
May	86	84	81	85	83
June	92	82	85	88	87
July	88	87	89	88	88
August	91	88	86	88	89
September	90	87	88	89	88
October	89	84	87	87	85
November	89	82	86	82	81
December	86	82	84	81	85
Average	86	82,3	83,2	84	84

(Source: Can Tho City statistic year book, 2007)

Rain regime

At Can Tho, the rainfall change in a rather wide range in dry & wet seasons. The rainfall mainly concentrates from May to September (account for about 80% total rainfall of the year), the rainfall in dry season is insignificant.

- Annual average rainfall: 1.415.7 mm
- Annual maximum rainfall: 1.878 mm
- Annual minimum rainfall: 1.257 mm
- Average rainy days/year: 130 days
- Maximum rainy days/year: 172 days
- Minimum rainy days/year: 111 days
- Monthly maximum rainfall: 439 mm (August, 1988)

The observed daily maximum rainfall is 198 mm and the maximum rainfall in one hours is 79.3 mm. The distribution of monthly average rainfall at Can Tho city in the year of 2004 is showed in the table 2.4.

Table 2.4 The distribution of monthly average rainfall at Can Tho

Month	Rainfall in the years (mm)				
	2003	2004	2005	2006	2007
January	0.9	32.5	-	9.5	20.8
February	2.4	-	-	11.1	0.1
March	156.7	-	4.8	98.8	-
April	159.9	8.3	0.5	116.3	0.3
May	179.4	141.5	93.7	207.6	159.0
June	130.6	130.3	197.8	138.7	211.6
July	281.6	246.8	254.6	175.8	236.3
August	282.3	209.8	108.8	148.1	144.2
September	263.0	250.1	307.4	307.3	181.0
October	359.0	244.2	311.5	295.4	218.7
November	186.8	141.9	315.1	61.4	45.5
December	33.4	10.3	137.7	72.2	52.6
Annual rainfall	2.036	1.415	1.731	1.642	1.270

(Source: Can Tho City statistic year book, 2007)

Evaporation

The Annual average evaporation is 750 mm. In wet season, the monthly evaporation is about 50-55 mm and in dry season over 60 mm.

Wind regime

In Can Tho city, the yearly average wind speed reaches at 3.5 m/s, the maximum wind speed is 31 m/s. There are 3 main wind directions: West-West south, North-East, South-East.

The main wind direction in dry season from November to February is North-East and from March to June of South-East.

The main wind direction in wet season from July to November is South-West. The wind from the sea brings a lot of steam causing rainfall.

Table 2.5 Wind speed & directions at Can Tho station

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Main wind direction	E-EN	E-EN	E-ES	E-ES	E-ES	W-WS	W-WS	W-WS	W-WS	W-WS	E-EN	N-WN	E-WS
Secondary wind direction					W-WS							N-WN	

Source: Department of Environment and Natural Resources, 2006

Can Tho city is almost not affected by tropical typhoon, however the storm phenomena are rather common.

In the project area, topographical condition is rather flat so that the material emission can be exhausted easily and possibly cause the air pollution.

Rigidness of atmosphere

Rigidness of atmosphere affects to emission ability of the pollutants by the elevation. The rigidness of atmosphere is defined based on the wind speed and solar radiation in the daytime or cloud ratio in the night-time.

In the Mekong Delta, the rigidness of atmosphere in the sunny day with small wind speed (2-4 m/s) is A, B. In the cloudy day, it is C, D. In the night-time, it is E, F.

Under the condition of rigidness of atmosphere in groups of D, E, F, the dissipation process of the pollutants is better than in groups of A, B, C.

Table 2.6 Classification the rigidness of atmosphere by Pasquill

Wind speed	Daytime solar radiation (cal/cm ² .h)			Daytime and night-time. The thickness of cloud: 8 - 10	Night-time	
at elevation of 10 m (m/s)	>50	25 - 49	<= 24	night-time with cloud	Cloud: high 5-10 low 5-7	Cloud: 4 - 0
<2	A	A - B	B	D	-	-
2...3	A - B	B	C	D	E	F
3...4	B	B - C	C	D	D	E
4...6	C	C - D	D	D	D	D
>6	C	D	D	D	D	D

Remark on the weather and climate factors:

In general, the weather and climate factors in the project area are advantages for applying the exhaust gas emission measures.

The temperature condition is rather high so that it will make influence to the Hau River's water temperature and affect the cooling-down process by river water.

2.2.4. Hydrological regime

The ground-water layer in the project area is rather shallow of about 2.5-2.93 m

depth under the ground level. The reserves of the ground-water layer is about 55 – 84 m³/s. The details of hydrologic geology conditions are showed in Appendix 3.8.

At present, the ground-water in the project area has been exploited by the local people for domestic use. There is not any big project to exploit the ground-water in this area.

Hydrologic features of Hau River system

Hau river is one of the downstream branches of Mecong river in the territory of Vietnam. Hau river flows out the water to the East Sea by two esturaries namely Dinh An and Tran De. Hau river has the high discharge, in the Can Tho city area, the water is free from salinity (no salt intrusion), this is the fresh water source for domestic and industrial uses, etc for almost consumers in Can Tho city.

The yearly average discharge of Hau river is about 2440 m³/s. The maximum discharge reaches 18.000m³/s accounting for about 70-85% annual discharge volume. The minimum discharge occurs in May of about 800m³/s. The maximum rainfall happens in 3 months: September, October, November with the flow volume accounting for 50% of total flow volume of the year. In wet season, the flow has big discharges. Due to the flat topography, the drainage capacity of this area is rather low. The recorded flood peak flood in Can Tho city are 2.09m (25/10/1961); 2.00m (26/10/1991); 2.12m (06/10/1994).

In the wet season, the variation amplitude of semidiurnal tide is only 0.5 m, in dry season, it is reached to 2.16m.

The minimum water level at neap tide occurs in the months from March, April, May and June, maximum in the months from September, October and November. So that in the months of March, April, May and June, it is favorable for irrigation & drainage but unfavorable for dilution of waste materials. On the contrary, in the months of March, April, May and June, it is favorable for irrigation & drainage but unfavorable for dilution of waste materials.

Table 2.7 Water levels in the Hau river in 04 recent years

Station	Recording time	2003	2004	2005	2006	Remarks
Phung hiep - Cai Con river.	Maximum	120	129	134	134	In October
	Minimum	-105	-106	-114	-108	In June
	Mean	37	35	37	42	
Vi Thanh - Xa No Canal.	Maximum	55	56	69	58	In October
	Minimum	-27	-29	-31	-25	In May
	Mean	22	18	20	24	

Remark: Hon Dau national bench mark elevation

(Source: statistic year book, 2006)

Table 2.8 Discharge and average water temperature of Hau river at Can Tho

Month	Average discharge (m ³ /s)	Temperature (°C)
I	1360	30.0
II	700	28.2
III	420	30.2
IV	330	30.4
V	460	32.0
VI	1450	30.2
VII	2390	29.9
VIII	3970	28.5
IX	5290	28.6
X	5480	28.5
XI	4700	28.3
XII	2710	27.7
Yearly	2440	

Source: Department of Environment and Natural Resources, 2005

Table 2.9 The drainage basins of Hau river system in Can Tho city.

Basin	catchment area (km ²)	Length of flow (km)	flow area (km ²)	Flow coefficient (km/km ²)	Flow/basin ratio
Hau river system	86.50	131.4	26.11	1.59	32%
Sang Trang	1.75	1.4	0.03	0.80	2%
Tra Noc	18.97	20.6	0.82	1.09	4%
Binh Thuy	37.17	43.1	1.72	1.16	5%
Cai Khe	10.59	19.9	0.68	1.88	6%
Song Hau	14.31	46.4	22.86	3.24	160%

Source: Department of Environment and Natural Resources, 2005

Flow regime

Due to flat and inclined topographical condition from the North to the South, from the East to the West, so that in the wet season, the flood water flows on the one direction.

Flood flow: in wet season, the water level in the rivers, streams increases due to the heavy rainfall in the basin. it absolutely depends on the climate regime of the basin. Hau river and other canals in Mekong Delta in general and in Can Tho in particular are under influence of the South-West monsoon in the downstream of Mekong river, the wet season starts in June and ends in November of the year.

The the flood flow is characterized by high water level amplitude, high water

velocity at the large river cross-sections, the maximum water velocity of Hau river in Can Tho city is from 1.5 to 1.7 m/s. The water level amplitude in the main river is bigger than in the field canals.

Table 2.10 Statistics of water level amplitude of flood peak in 2002

Station	Can Tho	Tan Thuan	Co Do	Thanh An
River	Hau	Canal No. 1	Thot Not	Cai San
Amplitude				
- ΔH .cm/day	21	01	01	04
- H max	195	107	131	193
-Occurred day	9-x	10-x	13-x	11-x

The big and prolonged floods is resulted from the combination of upstream flood discharge (Tan Chau, Chau Doc) and influence of heavy & continuous rainfall in the large area, and at the same time with flood tides (the flood in 1978 and 2002) and the long drainage time.

Table 2.11 Statistics of tide water level amplitude in April, 2002

Station	Can Tho	Phung Hiep	Vi Thanh
River	Hau	Cai Con	Xa No
Tide amplitude (cm)	252	196	52

The climate regime in dry season: rainfall decreases quickly from the end of November, beginning of December and yearly average rainfall from December to May, June will be reduced significantly. The total rainfall volume in dry season is only occupied about 5 to 10% total rainfall of the year. There is no rainfall or rainfall of insignificant amount from January to April in some years. So that the water level in the rivers and canals reduce significantly affecting to the production and daily livies .

Water level

Can Tho city is located in the downstream of Mekong river under influence of climate conditions of Southern Vietnam. Every year, it is affected by two tropical monsoons. The North-East monsoon causes rainless or little rain so that the water levels in rivers and canals fluctuate affected by tide. The sunlight time lasts from the middle of May to the end of November or beginning of December, and the wind direction changes from North East to South West, the South-West monsoon is stable and the wet season begins. The average maximum rainfall is occurred in September, October in every years. The South-West monsoon will reduce the flood drainage capacity from Hau river through the canals to the lower area in the southwest. The water level at Can Tho station (max, mean, min) is showed in the table 2.12 (based on the national elevation system).

Table 2.12 Minimum water level of months in the year (unit: cm) at Can Tho.

Year/month		II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1993	-94	-142	-143	-142	-144	-146	-122	-92	-58	-19	-46	-80
1994	-96	-132	-131	-133	-151	-136	-108	-67	-38	-6	-25	-76
1995	-83	-115	-124	-125	-142	-137	-122	-78	-45	-2	-35	-60
1996	-101	-117	-123	-116	-135	-124	-111	-66	-38	23	4	-50
1997	-74	-92	-115	-117	-135	-129	10	-54	-19	10	-42	-76
1998	-99	-114	-117	-126	-130	-133	-110	-92	-74	-45	-63	-76
1999	-99	-106	-117	-130	-114	-104	-87	-52	-33	9	6	-44
2000	-74	-89	-105	-121	-115	-101	-49	-37	-13	1	-8	-55
2001	-91	-96	-100	-113	-131	-111	-83	-68	-26	19	-6	-62
2002	-82	-97	-127	-124	-129	-115	-84	-58	-15	17	-13	-54
2003	-79	-97	-114	-130	-130	-126	-109	-79	-54	-3	-37	-78

• Source: Can Tho hydro meteorological Center, 2004

Table 2.13 Maximum water level of months in the year (unit: cm) at Can Tho

Year/month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1993	123	117	118	114	94	90	127	136	149	164	148	136
1994	121	116	130	110	103	116	130	142	156	176	170	144
1995	140	138	122	104	103	109	127	137	164	167	153	141
1996	129	131	103	124	107	110	134	159	173	172	159	150
1997	149	134	125	111	102	94	141	155	167	179	184	145
1998	137	125	130	113	101	95	117	135	141	167	155	148
1999	135	121	114	113	129	127	123	146	175	179	175	164
2000	147	129	113	112	111	134	153	156	179	173	173	157
2001	141	147	139	120	107	117	146	168	186	190	182	156
2002	156	152	133	127	116	113	143	156	178	195	185	162
2003	151	141	131	117	113	106	123	157	183	181	167	147

• Source: Can Tho hydro meteorological Center, 2004

Table 2.14 Mean water level of months in the year (unit: cm) at Can Tho

Year/month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1977	22	18	2	-17	-28	-33	-12	6	37	58	51	32
1978	17	12	-4	-9	-10	-9	13	29	62	92	68	39

1979	19	5	2	-2	-12	-7	16	32	53	71	54	30
1980	12	11	-5	-11	-21	-13	-2	17	54	81	73	51
1981	30	13	1	-11	-11	7	39	43	59	63	69	52
1982	28	11	-3	0	-15	-20	2	16	44	73	60	43
1983	26	3	-4	-16	-23	-24	-9	20	40	61	76	56
1984	35	24	3	-13	-9	-11	12	33	69	71	73	48
1985	25	16	18	-7	-6	-10	19	28	53	76	62	49
1986	34	14	8	-4	-15	-7	5	29	52	69	65	44
1987	30	9	-1	-1	-12	-14	0	17	46	63	55	48
1988	27	18	6	1	-15	-10	1	28	40	53	65	37
1989	31	17	8	-12	-15	-8	7	29	45	72	69	43
1990	36	18	11	-4	-6	4	14	28	47	73	68	51
1991	36	22	5	0	-7	-11	11	32	63	78	75	51
1992	33	13	1	-7	-12	-13	9	25	45	69	66	37
1993	31	13	7	-4	-12	-12	17	30	46	68	60	48
1994	38	25	9	2	-3	-3	15	38	55	60	71	52
1995	39	26	10	4	-4	-7	17	39	62	79	77	55
1996	33	32	10	8	2	4	16	44	63	93	85	69
1997	47	37	19	8	-4	-6	24	48	67	82	72	50
1998	32	19	16	2	-1	-5	22	38	44	62	54	52
1999	37	28	14	6	17	21	25	50	65	88	87	70
2000	49	38	27	6	10	25	51	55	82	90	92	66
2001	45	39	26	18	1	12	38	51	79	96	90	68
2002	48	38	22	14	11	12	37	55	74	91	84	67
2003	50	36	25	5	3	3	20	38	61	84	74	52
Total	890	555	233	-44	-197	-135	407	898	1507	2016	1895	1360
Average	37	23	10	-2	-8	-6	17	37	63	84	76	54

• Source: Can Tho hydro meteorological Center, 2004

Tide regime

Hau river is affected by the semidiurnal tide regime irregular since Can Tho city is located a little far from the sea so that the sea wave is descended and flood tide time

(4,39 – 5,08 hours) is shorter than neap tide time (6,36 – 8,35 hours). Special in the neap tide, the water level between the two tidal legs varies in a wide range (170 cm).

The maximum average peak tide occurs the months of October to December (165 – 170 cm), and minimum average peak tide in the months of May to June (116 – 118 cm). At this level, the tide just cause lightly flood for a short time or no flood.

The minimum neap tide occurs in the months from March to June (-155 to -131 cm) so that the tide amplitude in these months is about 200 cm, it is an advantage condition for water drainage.

2.3. CONDITION OF EXISTING NATURAL ENVIRONMENT AT QUALITY

To carry out the EIA for O Mon III Power Plant, the study team of PECC2 has collected the samples, analyzed and assessed the environmental quality at the project area and surrounding areas. The points for collection of air, water, soil and aquiculture system samples are indicated in the figure 2.1, 2.2; 2.3; 2.4

2.3.1. Surface & ground-water quality

Surface water quality

The surface water quality in the O Mon III combined cycle power plant area has been studied by PECC2. The specialists of PECC2 have collected the samples at a lot of points in April, 2008. The location of these points is indicated in the figure 2.1. The results of analysis are showed in the table 2.16. The detail of observed locations as below:

Figure 2.1 The observed surface water quality locations.

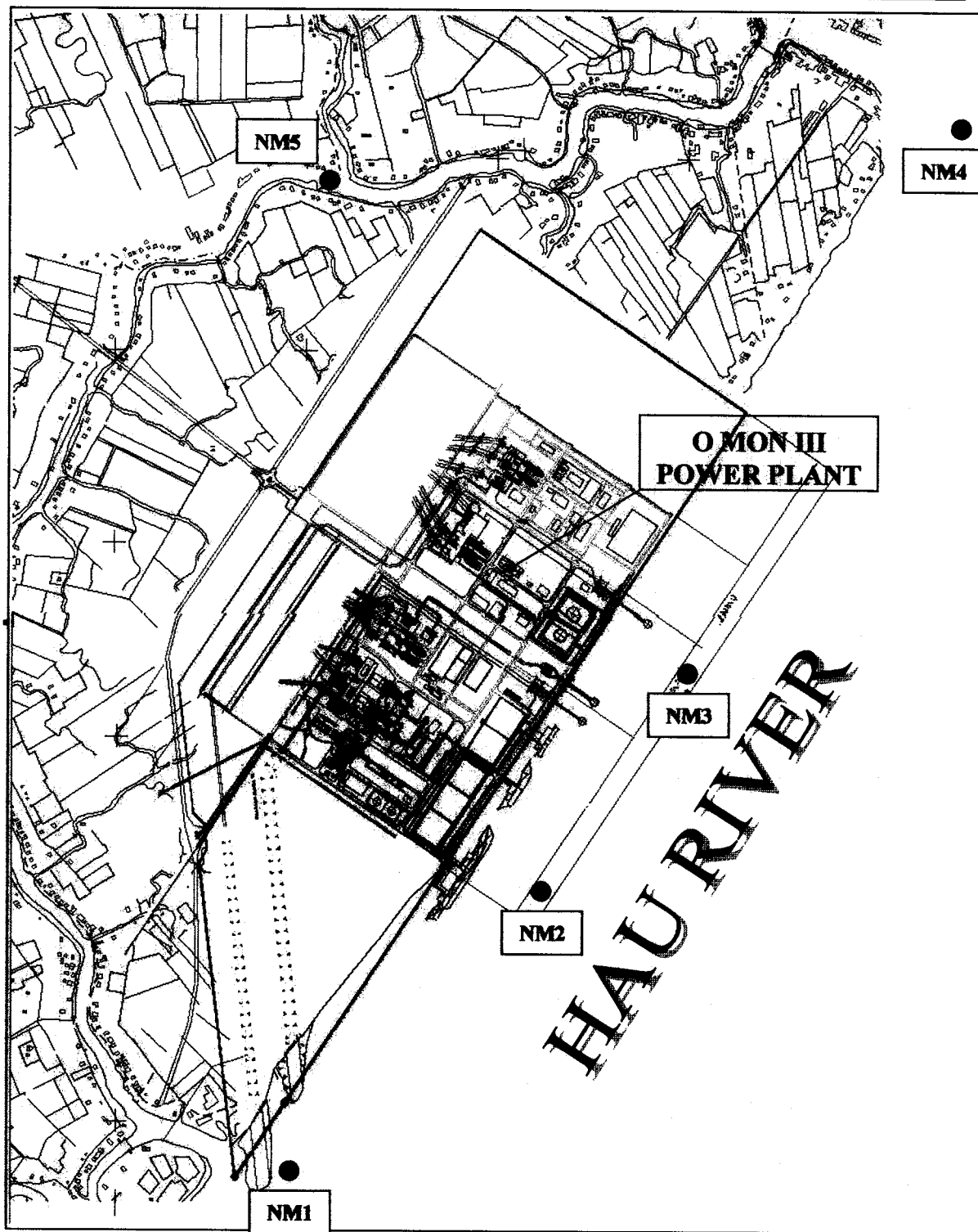


Table 2.15 The observed surface water quality locations

No.	Symbol	Surface water quality sampling location
1	NM-1	Hau river, waste cooling water outlet of O Mon III Thermal Plant
2	NM-2	Hau river, oil port area
3	NM-3	Hau river, water intake of O Mon III thermal plant
4	NM-4	O Mon river, Hau & O Mon interflow point
5	NM-5	Chanh canal, Thoi Loi village, Phuoc Thoi commune, O Mon district (200m)

Table 2.16 The results of surface water quality in the rivers, canals in the project area (April, 2008)

No	Factor	Unit	Analysis results					
			NM-1	NM-2	NM-3	NM-4	NM-5	VN standard 5942-1995
1	pH	-	7.03	6.80	7.04	6.62	6.43	6-8.5
2	EC	μS/cm	187	186	186	185	225	-
3	turbidity	NTU	28.02	16.01	19.82	28.82	100	-
4	SS	mg/l	17	11	8	25	98	20
5	DO	mg/l	3.4	3.7	3.8	2.7	2.5	≥6
6	BOD ₅	mg/l	13	6	9	11	17	<4
7	COD	mg/l	22	11	16	19	26	>10
8	NO ₃ ⁻	mg/l	0.47	0.52	0.46	0.65	0.88	10
9	NO ₂ ⁻	mg/l	0.014	0.010	0.009	0.012	0.007	0.01
10	NH ₄ ⁺	mg/l	0.85	0.73	0.67	0.56	1.34	0.05
11	Total N	mg/l	2.26	1.69	1.83	2.85	3.36	-
12	Total P	mg/l	0.23	0.46	0.37	0.22	0.78	-
13	Cl ⁻	mg/l	12.5	13.6	12.8	11.5	14.1	-
14	Fe	mg/l	0.76	0.82	0.54	0.29	0.43	1
15	Oil	mg/l	0.02	0.05	0.04	0.06	0.04	No
16	Total Coliform	MPN/100 ml	11 x 10 ³	23 x 10 ²	63 x 10 ¹	21 x 10 ³	34 x 10 ³	5000

Source: Environment Institute and STUD, 4. 2008.

• Comments on the surface water quality

Based on the analysis result of the surface water quality in the rivers, canals in the project area, we can give some comments as below:

The quality of the water in the rivers, canals in the project area is rather good. pH value is neutral varied from 6.43 to 7.04. pH value of the rivers and canals in the project area is in the allowable limit about A class (pH: 6-8,5) as stipulated in the Vietnamese Standard: TCVN 5942-1995.

The Fe content in the water is varied from 0.29 to 0.82 mg/l, lower than the allowable limit of A class as stipulated in the Vietnamese Standard: TCVN

Suspended solid

The content of the suspended solid in the water of the rivers, canals in the project areas is varied in a wide range between the sample collected points from 8 to 98mg/l, at some sample collected point, this content is over the allowable limit of A class for water supply source as stipulated in the (SS: 20mg/l) TCVN 5942-1995. The content of the suspended solid in the water is high, mainly depends on the natural water with a lot of alluvial in the Mekong Delta and affected by the production activities in the area.

Salt intrusion

Based on the observed results, the water in the rivers, canals in the project area is free from salinity. The electric conductivity of water is low, varied from 185 to 225 μ S/cm. Based on the survey results from the local people who have been living in the project area, the water in the rivers and canals in this area is free from salinity in whole year.

Organic pollution (BOD₅)

The BOD₅ content in the water of the rivers, canals in the all of the observation points is varied from 6-17mg/l higher than the allowable limit about water supply at class A (BOD₅ < 4mg/l) as stipulated in the Vietnamese Standard: TCVN 5942-1995, special at the observation points where the samples were taken in dry season and at the time of tidal fall.

Nutrient pollution

The nutrient content in water of the rivers, canals: The water is polluted by the nutrient content. The NH₄⁺ content is varied from 0.56 to 1.34 mg/l and over the allowable limit of class A water supply (0.05mg/l –TCVN 5942-1995). The phosphor content (P) is about 0.22 to 0.78 mg/l NO₃⁻ content from 0.46 to 0.88 mg/l meeting the Vietnamese standard: TCVN 5942-1995 (10mg/l)

Oil pollution

The water of the rivers in the project area has the phenomenon of oil contamination. The observed oil content in April 2008 is varied from 0.02 to 0.06mg/l, exceeding the allowable limit of class A water supply (oil content: 0mg/l) but lower than the allowable limit of class B water supply (oil content: 0.3mg/l) as stipulated in the Vietnamese standard namely TCVN 5942-1995.

Heavy metal polluted water

Degree of heavy metal pollution at the sampling points is insignificantly and the heavy metal content is within the allowable limit as stipulated in the standard of Vietnam TCVN 5942-1995 on class A water supply.

Coliform polluted water

The total Coliform content in water is varied from 63×10^1 to 34×10^3 MPN/100ml, it is showed that the water has been polluted by Coliform. At the sampling points, the total Coliform content in water is higher than the allowable limit with the water supply source in class A (Coliform: 5000MPN/100ml) which stipulated in the Vietnamese standard namely TCVN 5942-1995, special at the sampling points in small channel or at the junction of river and canal.

In general, based on the result of surface water quality in the project area, it is showed that the surface water in the area is not qualified for domestic use, it is only used for agriculture production.

Ground-water quality

Ground-water samples have been collected by PECC2 in the O Mon III project area at a lot of sampling points and analyzed in April, 2008. The location of investigation points is indicated in figure 2.2. The analyzed results are showed in table 2.18.

Table 2.17 Location of ground-water sampling point

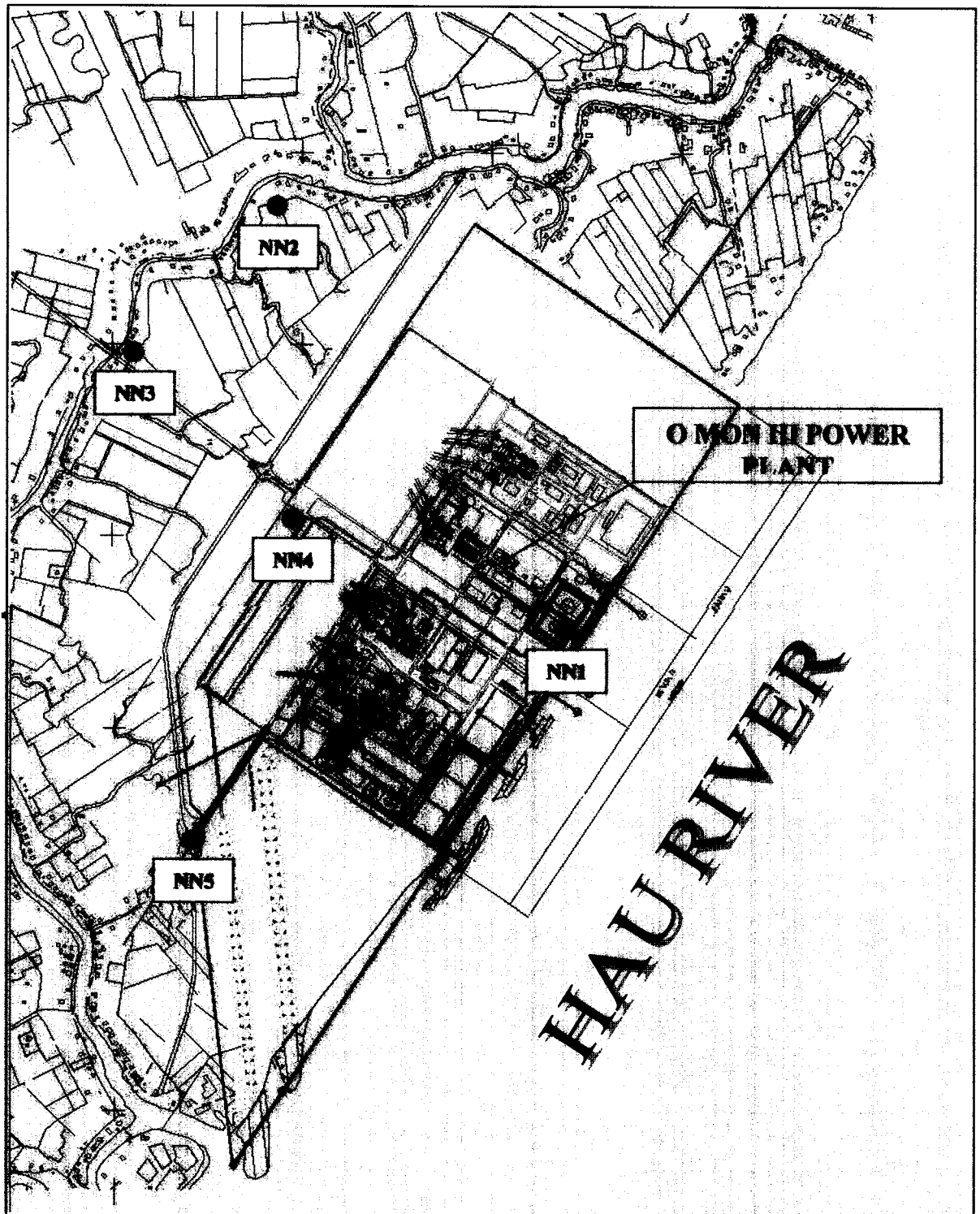
No.	Symbol	Location of ground-water sampling points
1	NN1	Bui Van Ly household, Thoi Loi area, Phuoc Thoi commune, O Mon district (80 m depth)
2	NN2	Huynh Van Tho household, Thoi Loi area, Thoi An commune, O Mon district (100 m depth)
3	NN3	Ly Thi Manh household, Thoi Loi area, Phuoc Thoi commune, O Mon district (100 m depth)
4	NN4	Household No. 412 Thoi Loi area, Thoi An commune, O Mon district (88 m depth)
5	NN5	Chau Dan Phuoc household, Thoi Loi area, Phuoc Thoi commune, O Mon district (80 m depth)

Table 2.18 Result of the ground-water quality in the project area

No	Factor	Analyzed result					
		NM-1	NM-2	NM-3	NM-4	NM-5	Standard: TCVN 5942-1995
1	pH	7,02	6,78	6,57	6,46	6,68	6-8.5
2	EC (μS/cm)	988	665	650	586	760	-
3	Turbidness (NTU)	4,04	8,70	8,98	5,26	6,68	-
4	SS (mg/l)	7	11	23	15	10	20
5	BOD (mg/l)	2	2	1	6	3	<6
6	NH ₄ ⁺ (mg/l)	0,053	0,172	0,194	1,054	0,047	0.05
7	NO ₃ ⁻ (mg/l)	0,08	0,11	0,16	0,06	0,12	10
8	NO ₂ ⁻ (mg/l)	0,006	0,010	KPH	0,008	KPH	0.01
9	As (μg/l)	1,46	1,23	0,67	0,92	0,48	50
10	Fe (mg/l)	0,10	0,16	0,12	0,06	0,05	1
11	Cl ⁻ (mg/l)	14,62	25,31	17,56	23,2	18,6	-
12	Total N (mg/l)	0,46	0,74	0,92	3,25	0,29	-
13	Total P (mg/l)	0,12	0,10	0,15	0,21	0,14	-
14	Total Coliform (MPN/100ml)	3	14	2	7	11	5000

Source: Environment Institute and STUD, 4. 2008.

Figure 2.2 Locations of ground-water sampling points



- **Remark on the ground-water quality**

In general, the ground-water quality in this area is rather good. Almost of the characteristics of ground-water quality is to meet the allowable limit.

Ground-water in the area has no indications of pollution by heavy metal. However, it is needed to have the aluminous treatment before using for domestic purpose.

Coliform pollution in the ground-water is lower than the allowable limit.

2.3.2. Soil quality

Soil samples have been collected in the O Mon III thermal power plant by PECC2 and analysed in April 2008. The location of survey points is indicated in figure 1.4. The location of the sampling points is represented in table 2.19. The analysed result is showed in table 2.20.

Table 2.19 Location of sampling points

No.	Symbol	Sampling point
1	Đ1	At the end of the project area, nearby the Hau river
2	Đ2	At the center of O Mon III Power Plant
3	Đ3	At the top of the project area (near switchyard)
4	Đ4	Access road No.2 to O Mon Power Plant

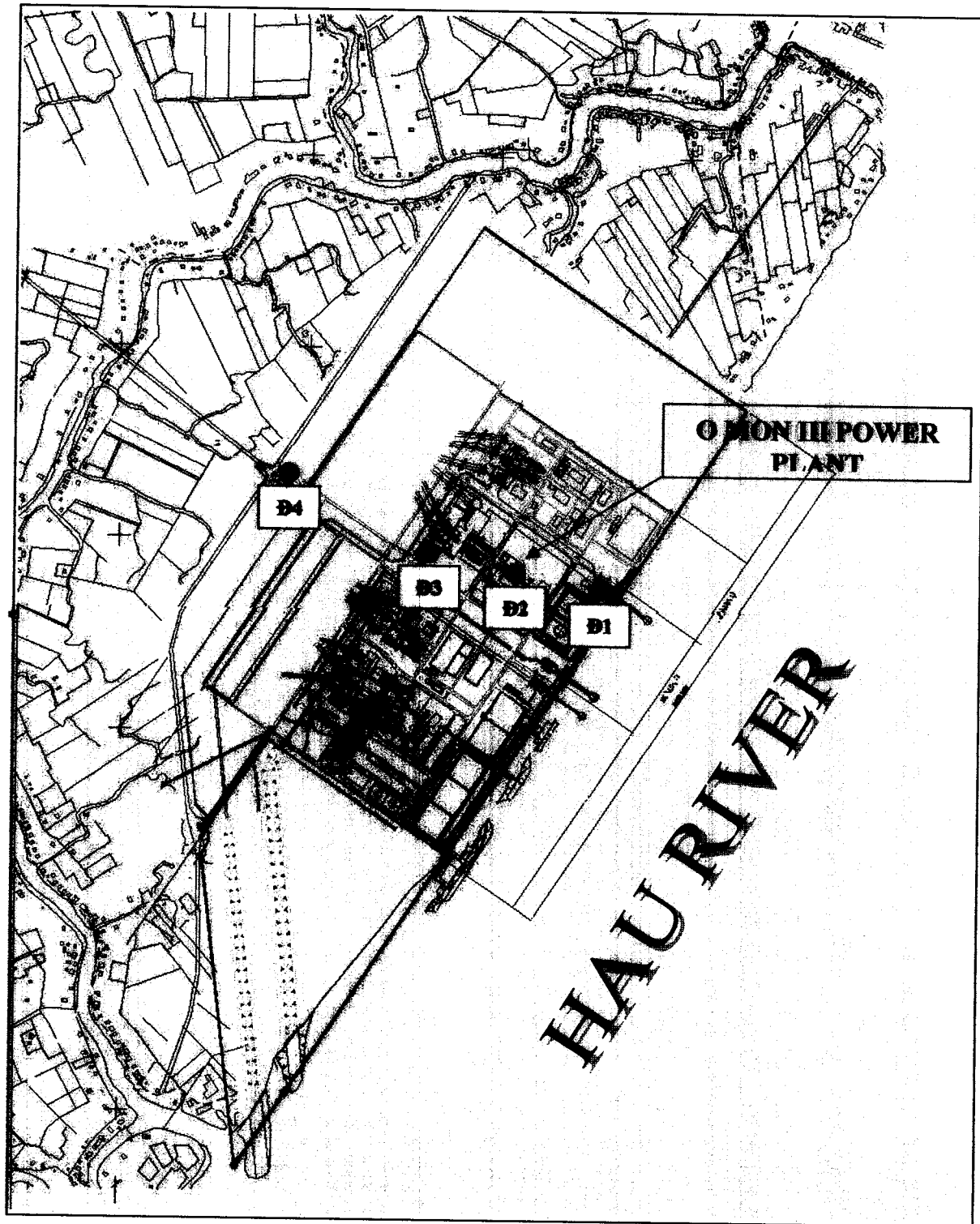
Table 2.20 Analyzed result on the heavy metal in the soil

No.	Symbol	Depth (cm)	Result (mg/kg dry soil)				
			Cr	Pb	Zn	As	Oil
1	Đ-1	0-200	1,48	1,17	43,24	0,074	0,07
2	Đ-2	0-200	0,63	0,78	36,23	0,126	0,14
3	Đ-3	0-200	0,37	2,35	28,36	0,095	0,09
4	Đ-4	0-200	0,54	0,64	57,48	0,083	0,11

- **Remark on the soil quality**

In general, the soil in the project area has no indications of pollution by heavy metal. Almost of the heavy metal contents in the soil are lower than the allowable limit.

Figure 2.3 Location of the Soil sampling points



2.3.3. Characteristics of the air quality

In order to assess the air quality in the project area comprehensive, the survey points for air quality are showed in the table 2.21 and figure 2.4 (Location of air quality survey points using for EIA) as below:

Table 2.21 Location of the air quality sampling points in O Mon III Thermal Power Plant

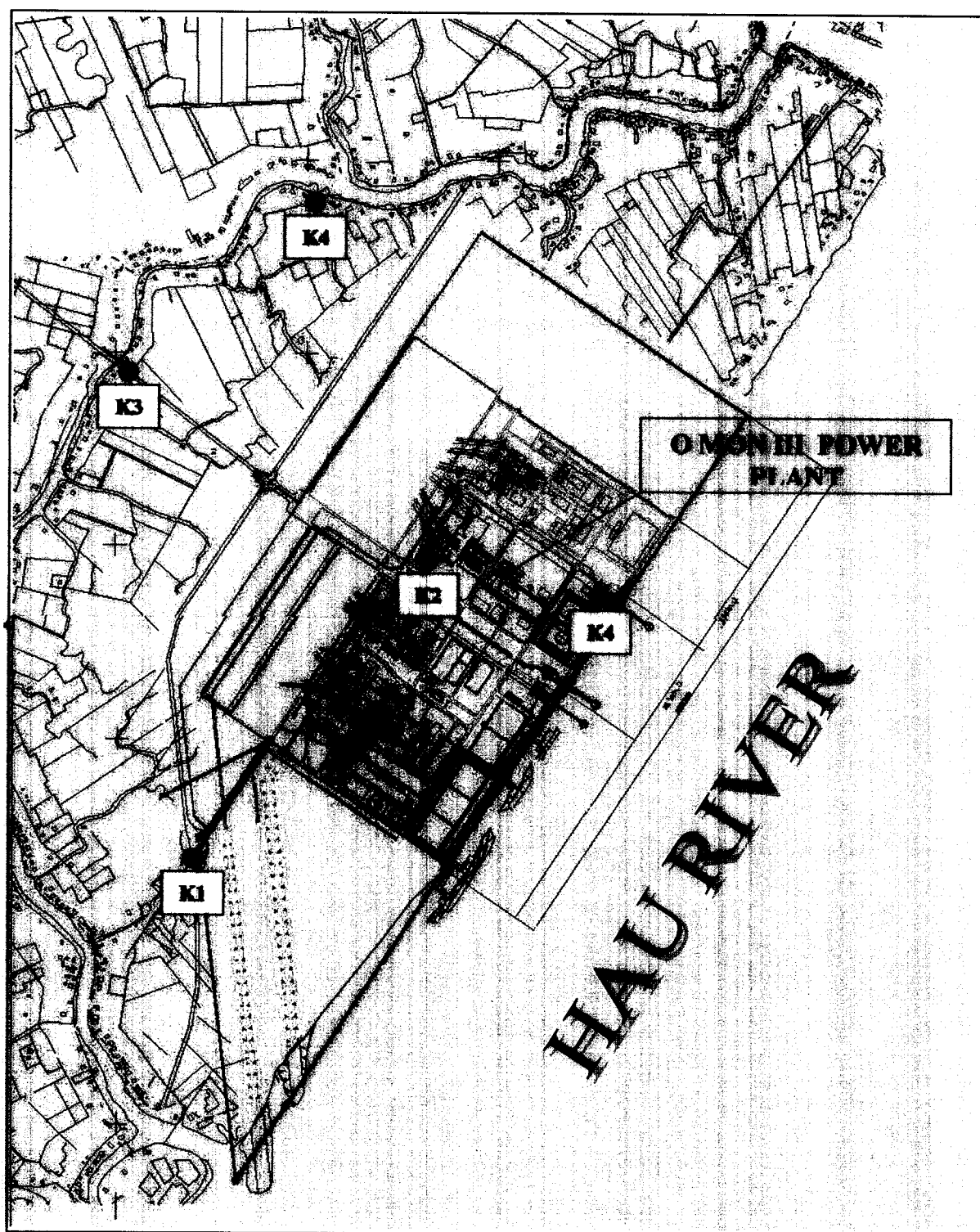
No.	Symbol	Sampling points
1	K-1	At the road intersection, on the access road to O Mon Power Centre, about 500 m from Thermal Power Centre, Thoi Loi area, Phuoc Thoi commune.
2	K-2	In the O Mon III Thermal Power Plant, nearby O Mon II.
3	K-3	In the crossing area between the proposed road No.2 and Chanh canal.
4	K-4	In the project area along the Hau river
5	K-5	In the residential area along the Chanh canal in the South-west direction of the project and 200 m far from project area.

The survey result on the air quality is showed in the table 2.22.

Table 2.22 Analysed result on the air pollution in the project area.

No.	Factor	Analyzed result					
		K-1	K-2	K-3	K-4	K-5	TCVN 5937-2005
Content of pollutants							
	Dust content (mg/m3)	0.28	0.18	0.15	0.10	0.17	0.3
	Dust PM10	0,12	0,04	0,06	KPH	0,06	-
	CO (mg/m3)	4,8	2,3	3,6	2,4	3,7	30
	SO2 (mg/m3)	0,069	0,039	0,046	0,054	0,041	0.35
	NO2 (mg/m3)	0,079	0,044	0,054	0,041	0,058	0.2
Microclimate's characteristic							
	Temperature	28,7	34,2	34,8	34,2	35,4	-
	Humidity	63,6	56,2	52,6	59,9	54,1	-
	Wind speed	1,4-4,4	1,2-1,5	0,5-1,3	0,1-1,6	0,2-1,8	-

Source: Environment Institute and STUD, 4. 2008.

Figure 2.4 Air quality sampling points in the project area

● : Air sampling point

Table 2.23 Result on the noise survey in the project area

No.	Point	Result - Noise			
		LAeq (dBA)	L _{Amin} (dBA)	L _{Amax} (dBA)	Standard: TCVN 5949-1998
1	K1	62,2	52,7	76,9	75
2	K2	52,4	44,8	67,7	75
3	K3	57,7	41,6	78,4	75
4	K4	57,6	48,3	71,0	75
5	K5	59,4	43,3	78,2	75

Source: Environment Institute and STUD, 4. 2008.

Table 2.24 Result on vibration in the project area

No.	Point	Result -vibrates acceleration					
		Lva(x)		Lva(y)		Lva(z)	
		[m/s ²]	[dB]	[m/s ²]	[dB]	[m/s ²]	[dB]
1	K1	0,00120	41,6	0,00085	38,7	0,00410	52,3
2	K2	0,00017	24,6	0,00013	22,3	0,00095	39,6
3	K3	0,00040	32,1	0,00047	33,4	0,00215	46,6
4	K4	0,00016	24,1	0,00015	23,5	0,00087	38,8
5	K5	0,00027	28,6	0,00034	30,6	0,00134	42,5

• Comments

Based on the air quality survey result in the project area in April 2008, there are some comments as below:

- Dust content in the air is varied from 0,1 to 0,28 mg/m³, the maximum dust content which is recorded at sampling point K1 (access road to O Mon Power Centre) is about 0,28 mg/m³ nearly equal to the maximum value of the allowable limit for dust content in the air environment surrounding (0,3 mg/m³), other survey points has the dust content much less than the threshold value stipulated in the Vietnam Environmental Standard: TCVN 5937-2005.
- The content of the other pollutants such as SO₂, NO₂, CO is much less than the threshold value stipulated in the Vietnam Environmental Standard: TCVN 5937-2005.
- Noise survey result in the project area showed that, the noise in this area is varied from 41,6 to 78,4dBA. The maximum noise which has been recorded at the point K-3 (crossing area between the road No.2 and Chanh canal) is about 78,4dBA, this value is higher than the threshold value (75,0dBA) stipulated in

the Vietnam Environmental Standard: TCVN 5937-2005 but not much, other survey points has the noise level lower than the allowable limit.

2.4. PRESENT CONDITION OF BIOLOGICAL RESOURCE

2.4.1. Present condition of vegetable cover in the project area

In April 2008, the study team of PECC2 has surveyed the inland ecosystem in the project area. The result of the inland ecosystem study is presented as below:

+ Species composition

The total of flora species in the project is about 157 species belong to 56 flora families, the detail of the species composition is presented in the table 2.25.

In the total of 157 flora species, there are 154 species belong to 54 flora families representing for angiosperm with two classes: 02 gemma class (Dicotyledonea) and 01 gemma class (Monocotyledonea), there are only 3 species belong to 2 families which are represented for the Polypodiophyta branch and there is not any present of gymnosperm branch (Pinophyta).

Some branches of flora have no role or insignificant role in the structure of vegetable cover in the project area such as moss branch (Bryophyta), equisetum branch (Equisetophyta), Psilotophyta branch, etc..which have been studied.

Some flora families have a lot of species including:

- <i>Fabaceae</i> (bean)	16 species
- <i>Poaceae</i>	13 species
- <i>Asteraceae</i> (daisy)	11 species
- <i>Amaranthaceae</i> (amaranth)	8 species
- <i>Euphorbiaceae</i> (castor)	7 species
- <i>Rutaceae</i> (orange)	6 species

However, in fact, some of the flora families have no advantage in the species composition but the number of the individual is very large such as in the Anacardiaceae family (cashew) there is a mango tree which has the numerous of individual (*Magifera indica*), in the Sapindaceae family (longan) there is the *Dimocarpus longan* having the numerous of individual comparing with other species. These species will create the present composition of the vegetable cover as well create the economic value of the vegetable cover in the area.

+ Form of life of flora

To analysis the form of life of the flora in the project area, it is showed that:

There are 82 species belong to 33 flora families are soft trunk or ochreate trunk or ground-trunk style.

There are 48 species belong to 23 flora families are timber, they are not divided into defined groups on the dimension, height, trunk diameter, etc..

There are 27 species belong to 10 flora families are bushes.

There are 110 species have the wild origin occupied about 70% of total species in the area. There are 47 species which are crop plants occupied about 30%.

+ Present condition of the vegetable cover in the project area.

Due to affects from the agricultural activities of the local people, the ecosystem in the area is the mixture of natural & man-made ecosystems.

The fruit-tree ecosystem is the important ecosystem and it is an advantage ecosystem in the area. In which, there are mainly the long-term fruit trees such as orange, lemon, coconut, etc.. but due to affects of the natural & socio-economic conditions so that the fruit tree structure is not stable. This style is distributed mainly in the project area.

The miscellaneous garden ecosystem is included a lot of the fruit-trees such as: coconut, banana, plum, etc.. This kind of ecosystem is to supply the demand of the households, hasn't the high economic value. This kind of ecosystem is distributed in the Vam, Chanh canal areas, and around the proposed road.

Field ecosystem is represented for the Mekong Delta, however, the area of this ecosystem is reducing and replacing by the specific gardens which are better served for the demand of socio-economic development.

The submerged ecosystem is mainly distributed along the rivers, canals. This composition is mainly of cybress (*Sonneratia caeseonilis*), distributed along the Hau river created a protective forest (it is not thick about from some meters to some tens meters), with other species such as: water hyacinth, wild pineapple, etc... This protective forest can protect the river banks against the erosion. Along the rivers, small canals, the submerged ecosystem is the mixture of a lot of species such as: cybress, water hyacinth, etc..

The band of protective forest is not thick and separated into the small segments, special in the project area along the Hau river, this band is disappeared and there are not any indications to recover or replace other species.

+ The species distribution level

During the investigation period, the study team has defined as below:

There are 61 species, occupied about 39,1% of the total flora species have the low distributed level (+), it means that they are only recorded as being in the ecosystem.

There are 76 species, occupied of 48,8% of the total flora species have the average distributed level (++). They are the collectives of some individuals of the same branch in the same studied area but they are not able to create the landscape for this area or not create a separated community.

There are 20 species occupied of 12,1% of the total flora species have the high density distributed level (+++). They are the collectives of a lot of individuals in the studied area and the main component of the ecosystem structure as well as creating the type of ecosystem, affected to the socio-economic activities in the area.

+ Use value

Analysis on the use value as below:

There are 28 species which can be used for food and food products occupied of 17,3% of total flora species which have been investigated. Almost of these flora species are man-made planted.

There are 24 species can be used for timber using in the construction or in consumption or for fuel occupied of 15,4% of total flora species. In which, there are 8 species are from original source (33,3%) and 16 species are man-made planted. (66,7%).

There are 51 species can be used for medical (traditional medicine) using popular in the local people occupied of 32,7% of total flora species. In which, there are 41 species, occupied of 80,4% of total flora species, which are the natural vegetation, almost of other medical vegetation species are planted for other purposes (food, food product or timber).

There are 5 species having the original sources from salted soil or more or less affected by salted flood, occupied of 3,3% of total studied flora species.

There are 61 species which have the role for cover the land, protect the land from erosion, occupied about 39,1% of total studied flora species. Almost of them are wild plants with soft trunks, distributed in the bare land area, along the rivers or roads, etc..

2.4.2. Aquatic ecosystem

- *Composition structure of the aquatic ecosystem*

Analysis the composition structure of the aquatic ecosystem of 3 groups: ephemeral flora, ephemeral fauna and spineless fauna in the bottom, we can differentiate the species indicate for the characteristics of river & canal ecosystem in the O Mon III thermal power plant – Can Tho city.

- The composition structure of the ephemeral fauna includes the species indicated for Mekong downstream area: 3 species such as Diaptomidae family: *Eodiaptomus draconisignivomi*, *Tropodiaptomus vicinus*, and 2 species of mussel family (*Corbicula leviuscula*, *Corbicula tenuis*), and river oyster family (Amblemidae: *Pilsbryconcha exilis*, *Ensidens ingallsianus*), and shrimp family *Macrobrachium equidens*.
- There are 3 character species which are emigrated from the coastal river mouths to the project area including: ephemeral flora: diatom such as *Melosira varians*, *Achnanthes sp.*, *Coscinodiscus subtilis*, *Nitzschia palea*. Ephemeral fauna: *Schmackeria bulbosa* and larva of shrimp and crab. The fauna in the bottom: there are some species such as: *Nephty polybranchia*, *Namalycastis abiuma*, *Melita sp.*, *Alpheus sp.*.
- The species indicate for the characteristics of Vam & Chanh canals concentrated distribution in this area including: ephemeral flora: *Navicula sp.*, *Eunotia pectinalis*, *Pinnularia braunii*, *Pinnularia viridis*, *Pinnularia divergens*, ephemeral fauna: *Brachionus quadridentatus*, *Macrothrix triserialis*, *Ilyocryptus halyi*, *Moinodaphnia macleayii*. Bottom fauna: *Melanoides tuberculatus*: These species have the lives connecting closely with small river & canal in the project area.
- The species indicate for the nutrition environment including ephemeral flora: Cyanophyta (Cyanophyta), dinophyta (Euglenophyta), Bacillariophyta: *Melosira granulata*, *Cyclotella meneghiniana*, *Synedra ulna*, *Nitzschia palea*, Chlorophyta: *Chlamydomonas sp.*, ephemeral fauna: zooplankton *Brachionus quadridentatus*, *Bosmina longirostis*, *Moina dubia*, *Moinodaphnia macleayii*, *Mesocyclops leuckarti*. Bottom fauna: *Limnodrilus hoffmeisteri*, *Branchiura sowerby*.

- *Quantity*

- The quantity of the ephemeral flora from 2.500.000 – 8.800.000 individuals/m². The species of Bacillariophyta indicated for the nutrition environment: *Melosira granulata*, *Synedra ulna*, *Cyclotella meneghiniana* are advantage. The quantity of the flora in the river & canal in the project area is small.
- The quantity of the ephemeral fauna from 1500 – 14.000 individuals/m² in which *Thermocyclops hyalinus* and *nauplius* are advantage.

The quantity of the ephemeral fauna in Hau river is from 1500 – 6.500 individuals/m² however in Vam & Chanh canal area it is about 6.500 – 14.000 individuals/m².

- The quantity of the bottom fauna is about 90 – 900 individuals/m².

The fauna ecosystem in the river & canal in the O Mon III project area – Can Tho city is established on the high temperature environment of the tropical climate (sub-equator)– the water temperature is about 28 – 31⁰C – the fauna ecosystem includes the typical species of tropical climate in the downstream of Mekong river, and affected by the light acid water and waste water from the domestic use.

The composition structure of the aquatic ecosystem is presented in the table 2.25.

Table 2.25 The composition structure of ephenerous flora (Phytoplankton)

Branch	Species	%
Cyanophyta	7	9,6
Bacillariophyta	29	39,7
Chlorophyta	17	23,3
Euglenophyta	19	26,0
Dinophyta	1	1,4
3. Total	73	100

Source: Environment Institute and STUD, 4. 2008.

Table 2.26 The composition structure of ephenerous fauna

Branch	Species	%
Rotatoria	4	13,8
Oligochaeta	2	6,9
Cladocera	9	31,1
Copepoda	9	31,1
Ostracoda	1	3,5
Larva	4	13,8
4. Total	29	100

Table 2.27 The composition structure of bottom fauna

Branch	Species	%
Polychaeta	2	10,5
Oligochaeta	2	10,5
Gastropoda	4	20,1
Bivalvia	8	42,1
Crustacea	3	15,8
5. Total	19	100

Source: Environment Institute and STUD, 4. 2008.

Table 2.28 The quantity of the Phytoplankton

Sampling point	Quantity (in./l)	Advantage species	Quantity of advantage species (in./l)
1	7600	<i>Synedra ulna</i>	2600
2	4600	<i>Melosira granulata</i>	1000
3	5800	<i>Melosira granulata</i>	2600
4	3400	<i>Synedra ulna</i>	1000
5	4200	<i>Synedra ulna</i>	600

Source: Environment Institute and STUD, 4. 2008.

2.4.6. Aquatic resources in Hau river

Based on the collected documents from long time ago, it can be summeraize some characteristics of aquatic resources in Hau river as below:

Composition structure of Fish

The recent studies have definted out of 217 species of fish belong to 115 varieties and 40 families in Hau river, in which the families are advantage in species or have high economic value including: Cyprinidae (67 species), Siluriformes (51 species), Gobiidae (10 species), Clupeidae (7 species), Anababidae (6 species), Engraulidae (5 species), Mastacembelidae (4 species) and Ophiocephalidae (4 species).

In general, the species of fish is divided into 3 groups as below:

- *River fish (white fish)*

This group includes the freshwater fish with all of sizes, with scales or without scales, their bodies are white such as: Puntius, Cirrhinus, Pangasius,

Leptobarbus, Osteochilus.

- *Field fish (black fish)*

Some black fishes have no scales or have scales such as: eel, catfish, jewfish, etc., belong to black fish group. They are living in the rice field and depression area next to the river.

- *Sea fish*

Some species of fish belong to families such as Clupeidae, Mugilidae, Scaenidae, Soleidae...have migrated from the sea to Hau river in dry season when the degree of salting is higher than in wet season. Otherwise, there are some species which have imported and feed in the fish reservoir as African carp (*Oreochromis mossambicus*, *O.niloticus*), *Helostoma teminckii*, *Osphronemus goramy*, carp (*Cyprinus carpio*), white dory (*Aristichthys nobilis*).

Fish distribution in Hau river

Based on the result on investigation of the fish distribution in Hau river, it is showed that some species of fish which are catch at the Chau Doc, Thot Not, O Mon, Can Tho, Dai Ngai, the number of species of fish at these locations as 124; 61; 86; 150 and 132 species.

At the Can Tho section, the number of species of fish is highest. However, the number of species belongs to Cyprinidae and Siluriformes are reducing while the sea fish such as Clupeidae, Engraulidae, Gobiidae, Ariidae, and Cynoglossidae are increasing significantly.

Economic value fish

Based on the selling price in the market and production of the fish, it has defined out about 57 species which are economic value fish in Hau river, in which the Cyprinidae family has 19 species, Schilbeidae: 7 species, Anabantidae: 4 species, and other families has from 1-2 species. Almost fishes of these species have been catch when they are only 01 year old.

The weight of the economic value fish is from 0,1 – 1 kg/head. Some species such as *Ophiocephalus micropeltes*, *Pangasius pangasius*, *P.micronemus*, *Plotosus canius*, their weight can be reached to 10 kg/head, but they are catch when their weight is only reached to 1- 3 kg/head

The biggest economic fish in Hau river is *Catlocarpio siamensis* (150 kg/head), *Pangasianodon gigas* (110 kg/head) and the smallest one is *Cirrhinus jullieni* (40 – 50 g/head).

Special, there are 15 species of fish in Hau river which have been used for feeding.

Biological characteristics of some economic fishes

The age of fish

In general, the young fish group (from 0+ - 1+ year old) is advantage in the exploited haul, the older group (from 4+ - 7+ years old) is insignificantly.

Green crayfish (Macrobrachium rosenbergii De Man)

There are a lot of crustaceans in Hau river, but only green crayfish has the high economic value. The green crayfish (*Macrobrachium rosenbergii* De Man) can popular live in the fresh water or in aluminous water. It likes to live in the flowing water special in the areas affected by semidiurnal tide.

In the breeding season (from March to April and from August to October), mother crayfish brings its eggs migrant to the river mouth where has the degree of salting at 14 – 18 ‰, and water temperature about 25 – 30°C. After hatched the larva and through the progress to be after-larva and migrant to the fresh water area for growth.

2.5. SOCIO-ECONOMIC SITUATION

The socio-economic condition in the project & surrounding areas (Phuoc Thoi and Thoi An communes, O Mon district) before construction of O Mon III Power Plant has been analyzed as below:

2.5.1. Population, culture and social situation

Population

O Mon district has the area of 125,4 km². The population in 2005 is about 128,000 persons. There are 7 wards in O Mon district including Chau Van Liem, Thoi Hoa, Thoi Long, Thoi An, Phuoc Thoi, Truong Lac, Long Hung. These wards were belong to O Mon district of Can Tho province and recently switched to the wards when O Mon district became one of districts belong to Can Tho city (2004). So that in general, this district is located in the rural area with the low urbanisation & industrialization level.

The project is located in the Hau river basin belong to Phuoc Thoi ward and a small part of Thoi An ward. The local people in this area are living by aquaculture and agriculture. The mode of production is rather manual. The

labor productivity is depended on the climate. The average per capita income per year is about 10.000.000 VND.

The composition structure of the local people is rather multiform but mainly is Kinh ethnic group, otherwise there are some Cham ethnic (about some tens of households). However, almost of life activities, productivity forms are familiar with the Kinh people. Some characteristics of socio-economic condition in Phuoc Thoi ward in 2007 as below:

Culture – Education - Sporting

Education: Year end summation of the school year of 2006 – 2007 for 6 schools, the number of the good – pretty good students in secondary schools is 567/1115 occupied of 50,8% of total students, approved the students to 5th grade is 100% . The students have participated in the Festival of competition “Red Flamboyant” and other movements and have received the high positions. Organization of the New school year of 2007 – 2008, the pupils of the nursery schools are 537 occupied of 119,33% comparing with the proposed plan, the children at the age of 6 entering the 1st grade of primary school is 260/260 (100%), the pupils in the primary school are 1.366/1220 (111,96%), pupils of 6 grade: 281/260 (108,07%), the total pupils of secondary school are 1.138/1080 (105,37%). It is finished the documents to re-admit the Phuoc Thai & Phuoc Thoi 3 primary schools as Standard National Primary School in 2007. To campaign the local people and companies, enterprices, etc .. to get 390 presents for the poor students equal to 25.500.000 VND, organized the Mid-Autumn Festival for the students with 340 presents equal to 8.500.00 VND. In which, 40 presents from district’s Labor Union and the Ward People Committee spends 800.000 VND for the schools which organized the Mid-Autumn Festival.

** Education universalization situation:*

Carried out very good the education universalization at the secondary education and unlettered against. Summarized the study movement on the unlettered against in 2006 and to carry out the movement for education universalization & unlettered against in the year of 2007, well-prepared the documents to submit to the higher authorities for approval of this ward reached the National Standard Ward on secondary & primary education universalization in 2007.

** Public health and health care for local people:*

It is wel-done on the examine and treat medically for the local peopl. In 2007, there are 24.276/23.590 cases which have been examined and treated medically reached 102,98%. It has organized to eye examine, surgery for 96 old persons, carried out the movements on petechial fever prevention and there are 171 persons who are the corperators and local officers, maintained the inoculation for children on 06 transmitted diseases, inoculation on hepatitis B and maintain 10 national standards on the public health.

** Committee for population and family & children planning:*

It has organized and deployed the plan on family planning stage I/2007 for 15 areas. Social works have affected to the knowledge of the local people on family planning so that the population increased rate has been reduced to 1,07%, provided 206 free of charge medical cards for the children under 6 years old and increased the total medical cards to 2.8736 cards.

The historical & religious monuments

In the project area, there are not any historical, cultural and religious monuments.

2.5.2. Economic situation

Agriculture

a) Rice: The area of the rice field in winter-spring crop in 2006-2007 is about 1.169/1169ha (100% comparing to the proposed plan), the production capacity is 6 tones/ha, total production is 7.014/7.725 tones equal to 90% of the plan. The area of the rice field in spring-summer crop in 2006-2007 is about 612,4 ha, the production capacity is 4.2 tones/ha, total production is 2.572/3.340 tones equal to 77% of the plan. The area of the rice field in spring-summer crop in 2006-2007 is about 975 ha, the production capacity is 3.6 tones/ha, total production is 3.510 tones. The Ward's People Committee has ordered the local people and agricultural extension center to clean the fields and prepare for rice sowing of the winter-spring crop in 2008. At present, the farmers have sowed rice about 1.054,5ha.

b) Farm produce:

The area of farm produce is about 470,7/460 ha, (102,3%) mainly is soy-bean, sesame and other ones. It has harvested about 128 ha in which soy-bean is a main product.

c) Animal husbandry

Domestic fowls have about 18.188 heads which have been inoculated occupied about 87% of total domestic fowls in the whole ward.

Cow: 114 heads (134%)

Pig: 4.674 heads in which pig raised for food: 4300 heads, sow-pig: 374 heads

d) Aquaculture:

The area of aquaculture is about 73 ha, increasing about 2,8 ha comparing with the last year, in which there are 6 ha using for shrimp feeding.

Industry - small scale industry – trade and public service

Industrial production: The production of industry, small scale industry is about 491,450 millions / 491,300 millions VND (100.03% comparing with the proposed plan).

Trade – public service: in the ward, in 2007, there are 195 agents, increased 5 agents comparing with the same time of the last year. These agents have attracted a lot of workers, contributed to increase the income of the local households.

Trade and public service have developed such as: construction material, variety stores, agriculture material, oil & gas, tourist gardens, mechanical and repair services, etc.. in special, the People Committee has paid attention to fit up the electricity meters for the poor & policy households, up to date, there are 99,9% of the poor & policy households having the electricity increasing the number of households using the electricity to 99,5% of the total households in the ward equivalent to 4,192 / 4291 households (97,6%).

Finance & tax:

+ Finance: Collect for state budget in the area: 4.378.138.931 VND, about 126,41% comparing with the proposed plan.

+ Collect for ward's budget: 2.707.783.031 VND (129,92%)

+ Payment from the ward's budget: 1.938.208.582 VND (93%).

+ Balance: 769.574.449 VND.

Credit: From the sources of the Banks, the local people have borrowed over 30 billion VND for trade and production, livestock, food & food product processing, aquaculture, etc (25 billions) and housing construction (5 billions). After reviewing, all of households used the borrowed money for the right purposes and in trade and production, livestock, food & food product processing, aquaculture activities, it has got the high effects for home economics.

*Urban & capital construction management**a) Rural transportation:*** Road:*

From beginning of the year 2008, there are 3 routes which have been upgraded with the total length of 7 km, in which 2,8 km (in Thoi Trinh area) the district authorities have invested the fund of 1.000.000.000đ, the remaining: 4.200 m in Thoi Nguon B and Binh Phuoc areas, has been constructed with the fund from the stage budget of 100 000 000 VND and

contribution of the local people is 155.000.000 VND (total expenditure is 255 000 000 VND). Other roads in the ward have been repaired with the length of 4.650 m by the contribution of the local people (46.500.000 VND).

*** Bridge:**

Construction 3 concrete bridges, one in Binh Lap area, one in Binh Phuoc – Binh Hoa A area, one in Thoi Binh – Thoi Nguon A area, the total length of the bridges is 62 m with the total expenditure is 87.000.000 VND in which from the stage budget is 70 000 000 VND, the remaining from contribution of the local people.

Repairing 3 concrete bridges with the length of 74 m with the total expenditure is 60.700 000 VND in which from stage budget is 52.000.000 VND and the remaining from the contribution of the local people. Repairing 6 timber bridges with the total length of 73 m and with the total expenditure of 30.100.000 VND contributed by the local people and the man-power from the local people about 880 man-days.

Dredging the Rach Dung canal in the Binh Khanh, Binh Lap area with the length of 2,203 m with the expenditure of 276,00,000 VND from the irrigation fee of the district.

Construction of 2 sluices (Binh Hoa B and Binh Hoa A areas) with the expenditure of 15 000 000 VN contributed by the local people.

b. Construction management: Confirmed 33 cases of application for construction license, taken the minutes for 20 cases of construction without the licenses and issued the Decisions to fine 14 cases in which 01 case constructed in the public land area which is located fronting the road, the owner hasn't implemented the regulations and has been reported to the district's People Committee for solving. Purchased the pieces of land and constructed 02 communication houses in Binh Hoa A and Binh Hoa B areas.

Thoi An ward

In 2007, the People Committee of Thoi An ward has considered the administrative reform and transportation works as breakthrough works, based on the planned target assigned from the O Mon district's People Committee, the People Committee of Thoi An ward has deployed these works and achieved some results as below:

Industry:

- There are 1.007 enterprises which are stable and development, increasing 32 enterprises and one co-operative comparing with the last year at the same period, and the value of industry is reached to 202,758,000 VND.
- The district authorities have invested 4 projects in the Thoi An ward

including 1 road with the expenditure of over 1 billion VND, upgraded the Thoi An market, and constructed the Primary school No.3 & 01 bridge.

** Electricity network development:*

- At present, there are 37 substations in the ward area with the capacity of 1.312KVA. National network station: 34 stations, private network station: 3 stations with the total length of 54 km

- Total households use the electricity is 5.524/5.560 households about 99,35%

+ Households were installed the electricity meter: 5.188/5.560 households equal to 93,30% (households connecting without electricity meter: 336/5.524 households equal to 6,04%).

+ Households using the electricity with difference in price: 336 households with the unit price is from 700 VND/kWh.

Households without using electricity: 36 households.

Agriculture:

*** Rice:**

The total area of the rice field is 2.606 ha with the average production of 5,46 tones/hectare, the total production is 13.393 tones (03 crops). Agriculture price in the year has been increased so that the local people are very happy.

- Winter-spring crop with the area of 1000/1000 hectare, the production capacity is 6,69 tones/ha, total production is 6.693 tones.

- Summer-Autumn crop with the area of 656/600 ha (107%), the production capacity is 4,5 tones/ha, total production is 2811 tones.

- Autumn-Winter crop with the area of 950 ha, the production capacity is 4,1 tones/ha, total production is 3895 tones.

In which: Seed rice area: 225 hectare, high quality rice: 2.151 hectare.

*** Farm produce:**

The area of farm produce is about 616/610 ha, (100,9%) mainly is soy-bean, sesame, corn and other ones. The total production is about 1 278 tones.

Established one co-operative on the safe-vegetable production including 16 households in Thoi Hoa area with the area for planting of 3.7 ha.

*** Aquaculture and Animal husbandry**

The area of aquaculture is about 324.1 ha, increasing about 7 ha comparing

with the last year. The total production is 97.230 tones with the production value of 1,361 billion VND and profit is about 376 billion VND .

In which:

- + intensive cultivation fish : 165,5 hectare.
- + No intensive cultivation fish : 124 hectare.
- + Other : 34,6 hectare. (small young fish for breeding)
- + Cage, raft fish : 12 rafts

*** Animal husbandry**

- + Pig: 2,816 heads in which pig raised for food: 2,441 heads, sow-pig: 375 heads
- + Cow: 24 heads (96%) in which: milk cow: 3 heads, raised for food cow: 21
- + domestic fowls: 29,653 heads (118,6%.) in which duck: 25,056 heads.
- + Total production: 317 tones, 89,3 %.

*** Inoculation:**

- livestock and domestic fowls have been inoculated according to the regulations. The domestic fowls have been planned in the specific areas so that the number of their groups has been increased over the target.

*** Reinforcement on the cooperative form:**

- At present, there are 02 co-operatives. Beginning of this year, the Thoi An co-operative has mobilized of 6 billion VND for feeding 800 tones of catfish for export, get profit of 3 billion, equal to 50% of shares for its members.
- Agriculture extension clubs: 6 clubs (90%); established one new safety-vegetable club in Thoi Hoa area. There are 52 cooperate groups to support each other in production in the fields of: dyke, irrigation, nurseling, technical, etc..
- In field irrigation & dyke: It has paid attention on the dyke improvement for initiative in all work. At present, there are 53 dykes protect for 1,761 ha (100%).
- Agriculture extension: Organized 27 seminars with 945 farmers attending with the content of technology transfer, technique, etc. and organized 04 training courses on the safe-vegetable.

Financial : (to the date of 30/10/2007)

Collect for budget in the area: 1,983,000,000 VND equal to 73,69%.

Collect for budget through the Government treasury: 1,295,000,000.00 VND equal to 85,81%.

Transfer from the year of 2006: 570,728,000.00 VND.

Expenditure through the Government treasury: 1,309,000,000.00 VND (92,18%).

State budget balance: 556,000,000.00 VND.

Advance payment : 38,000,000.00 VND

Urban & capital construction management:

*** Bridge:**

Construction 14 concrete bridges, with the total length of the bridges is 331 m with the total expenditure is 673,750,000.00 VND in which from the stage budget is 101,000,000.00 VND, the remaining (572,750,000.00 VND) from contribution of the local people and over 1,000 man-days contributed by the local people..

Improvement 03 bridges with the length of 48 m, the expenditure is 13,000,000.00 VND contributed by the local people.

***Road:**

- From beginning of the year up to date, ballasting the road with the length of 11,000.00 m equal to 2,200.00 cubic meters, the expenditure is about 300 million VND contributed by the local people.
- The district has invested about over 01 billion VND for surface hardened of the road from Vam canal to Ba Diem bridge with the length of 4,000 m and the expenditure is over 01 billion VND.

*** Market management:**

- Improvement 2 routes accessing to the market gates of Thoi An market. Improvement and re-arrange the Thoi Trinh A market, divided the lots for sellers in order to decorate the market, making it stable, clean, and beautiful.
- restoring public order, civilization, urbanization have been paid attention, special in re-arrange the markets. The district has invested for construction of 2 routes accessing to the market gates, and the local people contributed about 100 million VND for lean-to of the markets.

*** Culture - social**

Education:

- Deployed the plan for the children entering the class at the right age according to the regulations. The classes has been arranged and entered in the teaching stably.
- There is one secondary school, 03 primary schools and one kindergarten.
- Total teachers, staffs of the school is: 197 teachers in which secondary school: 68 teachers, primary school: 99 teachers, kindergarten: 30 teachers.
- Total classes: 116 classes. Total pupils: 3,422 children in which:
+ kindergarten: 22 classes : 540 pupils

- + Primary: 62 classes : 1.820 pupils
- + Secondary S. 32 classes : 1.062 pupilsh.

Population, family planning & children:

- It has organized and deployed the plan on family planning and has met the norm assigned by the higher authorities..
- There are 11 / 18 areas where the households have no given birth the 3rd child.
- Deployed the commemorated activities of the public holidays in the year: month of action for the children, Vietnam family day 28 June, world-population day.

2.5.3. Socio-economic conditions of the households which are affected by the project

Total area of the project: (plant precinct, operating road, office and operation & management areas): 450,000 m² in which:

+ Non-agriculture land (residential area)	23.663 m ² .
+ Non-agriculture land (non-residential area)	16.696 m ² .
+ Rice field	932.187 m ²
+ Irrigation land	101.274 m ² .

Total affected households: there are 721 households using the land areas which located in the plant precinct, operating road, office and operation & management areas and 5 enterprises including Phu Quy & Vinh Thinh enterprises, 3 brick kilns: Tien Dung, Ngoc Duong and Nhan Nghia.

The affected households which are mainly living on the agriculture (annual crops, rice production and long-term trees) with the low production. One part of the affected area, the local people have changed the purpose use such as construction of the house or aquaculture, etc..

Based on the inventory of loss and the expectation of the affected people, it is planned to arrange a resettlement area in Can Tho Education Union Project and some households will resettle separately. Other resettlement area is in Phuoc Thoi ward, O Mon district with the area of 10,421 m². This resettlement area has been transferred from Can Tho city's People Committee to Land Development Fund Center to construct the new resettlement area for O Mon Power Centre according to the Official Letter No.435/UBND-QH dated 25 April 2007.

Up to date, there are 151 households which have enough conditions for resettlement and 62 households have been approved for resettlement in which:

- Have bought 30 pieces of land in the resettlement area of the district Education Union and arranged for 6 households to receive the pieces of land there.
- There are 53 households which their owners agreed to receive the compensation by cash and resettle by themselves.
- There are 3 households which are waiting for Compensation Committee preparing the documents for receiving the pieces of land.
- 89 remaining households, the Compensation Committee has submitted the list of them to Can Tho city's People Committee and requested instructions for compensation (difference in price) for the cases of the local people constructed the houses in the agriculture land before 1993 and from 1993 to before 1st July 2004.

ASSESSMENT OF ENVIRONMENTAL IMPACTS

3.1. TECHNICAL FACILITIES RELATED TO THE PROJECT

The study scope in EAI report in feasible phrase will be forecasted, impact assessment to environmental of the construction of O Mon III combined cycle power plant (hereafter: the project or O Mon III CCPP) with total area 42 hectare.

The project deploys to construct O Mon III CCPP. If it doesn't manage well, it bring about many impact to natural and social environment.

The project with capacity of 750 MW is one of four plants in O Mon Power Complex (with total capacity of 2910 MW).

The main technical facilities of O Mon III CCPP including:

- The facilities in power plant: gas turbine, Heat Recovery Steam Generation
- The cooling water intake channel and discharge channel system
- Recieving oil area and oil tank
- Switchyard 500 KV/220KV
- Internal roads
- Office room, working house
- Waste water treatment system
- Chemical and materials storage

The construction and operation of those items will cause negative environmental impacts. This Chapter Three will evaluate latent impacts of the project on the environment on all three phases, The EIA is presented as stipulated in Annex 4 to Circular 80/2006/TT-BTNMT dated 08/09/2006 by the MONRE.

Note: This report does not include EIA and mitigation measures in relation with the port. The EIA report on the port for O Mon Energy Complex were approved by assessment council in October, 2000

3.2. SOURCES OF IMPACTS

3.2.1. Sources of impacts related to wastes

During its implementation, the project will produce various kinds of waste matters which are causative of negative impacts on the environment. It is acceptable to group those waste matters as follows:

- Emissions
- Effluent
- Solid waste
- Hazardous waste

- Noise
- Vibration
- High temperature

For specifying environmental impacts of those waste matters, their sources and characteristics will be determined separately in phases of the project, i.e. pre-construction, construction and operation phases.

Details of sources and characteristics of every flow of waste matters in phases of the project are given below.

3.2.1.1. Waste generation in the Pre-Construction Stage

In the pre-construction and construction phases of the project, some works will be done for the entire O Mon III CCPP. The works to be done in these phases include:

- Minesweeping
- Relocation and construction of resettlement sites for people residing in the project site
- Destruction and relocation of some construction works in the project site
- Removal of vegetation cover
- Construction of discharging water system
- Building of temporary and permanent camps

Above activities may generate the following waste flows:

- **Dust and emissions**
- Dust is produced from digging, embankment, and transport of spoil for leveling; cutting and transport of trees; construction of access routes, the zones for storing construction materials; construction of cooling water canals and others. This small amount of dust will spread largely over the Project area and along the transport roads. A minor part of dust will distribute over the entire project site and along transport routes. The emission of dust is discontinuous, i.e. it is on when those activities occur and off when they are stopped. Although the volume of dust from those sources cannot be precisely estimated, it is predicted as great, particularly in dry days.
- During the pre-construction stage earthwork activities with the use of motorized equipments (bulldozers, compactors, excavators, generators, pneumatic hammers, trucks etc.) may create air pollutants as SO_x, NO_x, CO, VOC and dust. Volume of this air emission may not be calculated but pollutants load may be forecasted. According to a WHO's statistical data, 1 ton of fuel when used for heavy duty diesel powered vehicles of 16 T may generate 4.3 kg TSP, 64 kg SO₂, 55 kg NO₂, 28 kg CO, 12 kg VOC, and 1 ton of gasoline when used for heavy duty gasoline powered vehicles greater than 3.5 ton may generate 3.5 kg TSP, 64 kg SO₂, 300 kg CO, 20 kg VOC (Table 3.1). Thus, 6 heavy-duty diesel

powered vehicles working for duration of 8 hours may use 1 ton of fuel oil creating the above estimated quantity of exhaust emissions

Table 3.1. Air Emission Inventories for Transport

Vehicles	Unit (v)	TSP	SO ₂	NO _x	CO	VOC
		Kg/v	kg/v	kg/v	kg/v	kg/v
● Heavy Duty gasoline						
- Urban Driving	1000 km	0.4	4.5S	4.5	70	7
	Per ton of fuel	3.5	20S	20	300	30
- Highway Driving	1000 km	0.6	3.3S	7.5	50	3.5
	Per ton of fuel	3.6	20S	45	300	20
● Heavy Duty Diesel powered vehicles- 3.5-16 ton						
- Urban Driving	1000 km	0.9	4.29S	11.8	60	2.6
	Per ton of fuel	4.3	20S	55	28	12
● Car						
Engine 1400 – 2000 cc	1000 km	0.07	1.62S	1.78	15.73	2.23
	Per ton of fuel	0.86	20S	22.02	194.7	27.65
Engine >2000cc	1000 km	0.07	1.85S	2.51	15.73	2.23
	Per ton of fuel	0.76	20S	27.11	169.7	24.09

Source: WHO, Geneva, 1993

- Wastewaters

In the pre-construction stage, waste water will be generated from the three following main sources.

- Domestic Wastewater from Worker Camps

During construction of plant foundation and supporting technical facilities at the peak number of construction workers may be approximately 100 persons.

In the pre-construction stage, average amount of domestic waste water to be

produced daily by a maximum 100 workers is estimated as 15 m³, containing high concentration of organic matters, nutrient and bacteria. (Table 3.2)

Table 3.2. Estimation of Main Pollutants Load in Domestic Wastewater Produced by 100 workers

Parameters	Daily pollution load produced by one person (g/person)	Total pollution load (kg/day), maximum value
BOD ₅ 20	45-54 (50)	5
COD	85-102 (94)	9,4
TS	170-220 (195)	19,5
SS	70-145 (107)	10,7
Grease and oil	0-30 (15)	1,5
Total nitrogen	6-12 (9)	0,9
Organic nitrogen	2,4-4,8 (3,6)	0,36
NH ₄ ⁺	3,6-7.2 (5,4)	0,54
Total phosphor	0,8-4 (2,4)	0,24
Total coliform	10 ⁶ -10 ¹⁰ (10 ⁸) (MPN/100 ml)	-

Source: PECC 2, 2008

The main pollutants concentration in domestic wastewater are estimated to be as follow.

BOD: 333,3 (mg/l)

COD: 1300 (mg/l)

SS: 713 (mg/l)

- Run-off Water

In the pre-construction stage, area of construction sites may be about 42 ha at the plant side. Volume of run-off water estimated for a rainfall rate of 100 mm per hour, continuing one hour, is 42,000 m³/h. It is difficult to clearly identify compositions of run-off water. However, the main pollutants in run-off water may be turbidity, suspend solids and little amounts of grease and oil.

- Solid Wastes

Solid wastes generated in the pre-construction stage include:

- Domestic solid wastes produced by workers;

- Cut vegetation generated from vegetation clearing activities;
- Construction solid wastes generated from activities in construction of plant foundation and other facilities.

Table 3.3. Solid Waste Inventory – The Pre-construction stage of the project

Waste Stream Component	Source	Physical and Chemical Composition	Approximate Volume of Waste Generated
Excess excavated soil and stone	Exceeded Soil and stone used for leveling and filling of site	Areas of past wild plant use may not be contaminated in terms of heavy metals, oils/ fuels. There is not hazardous material.	65.100 m ³
General construction waste	Removal of houses and graves on site	Inorganic matter including concrete, brick, wood. The majority of waste is expected to be inert and non-hazardous. A small portion of the waste such as wooden, ceramic materials from graves may be hazardous or potentially hazardous (due to contains bacteria).	Not have detailed calculation.
Cleared vegetation	Site clearing activities	Organic matter – vegetation, wood. Non-hazardous	210 tons (based on an approximate biomass of 5 ton /ha)
Domestic waste from construction	Average of 100 workers	Organic (approximately 50%) and non-organic	Maximum of 80 kg / day (based on

Waste Stream Component	Source	Physical and Chemical Composition	Approximate Volume of Waste Generated
camps	on site for construction of plant foundation, cooling water system and ash ponds	matter including vegetation, paper, waste food, plastics. The majority of this waste is expected to be non-hazardous. A very small proportion of waste such as any medical waste from the first aid station may be hazardous.	generation rate of 0.8 kg/person/day ¹)
Solid waste from toilets	Domestic wastewater from maximum of 100 construction workers on site	Organic matter high in bacterial and pathogens.	Maximum of 5 kg /day (based on solid waste generation rate of 0.05 kg / person / day)

- Hazardous wastes

Hazardous wastes generated in the Pre-construction stage may include unexploded ordnances and oily wastes.

- *UXO*: Although detailed information was not available at the time of EIA preparation, UXO is likely to occur on some previously undisturbed parts of the Project site. Location and clearing of UXO would be a high-priority activity during the Pre-construction stage.
- *Oily wastes*: It is difficult to estimate volume of oily wastes but it is expected

¹ Figure adapted from 'Stage of the Vietnam Environment, Solid Waste' (World Bank, 2004)

that oily wastes included oil sediment and other oily solid wastes may be created from activities of motorized equipments on construction sites. However, oily wastes are expected to be minor.

3.2.1.2 Waste Generated in the Construction Stage

Following activities will be carried out during the construction stage of the Project

- (i) Levelling from average level from +0,7 m to +1m to designed level +2.7m, using of 830.000 m³ land for levelling.
- (ii) Construction of the temporary B40 fence.
- (iii) Construction of cooling water system, included intake channel and discharge channel.
- (iv) Construction of items of the project.

Sources and characteristics of waste flows generated in this stage are identified below

- Air Emission

Main sources of air pollution during the construction stage of the Power Plant may be dust generated from earthwork construction activities and delivery of construction materials. In addition, dust may be produced by digging, excavating, filling, leveling and use of motorized machines. In the construction stage, air pollution will be also created by dust (total suspended particulate, TSP and PM10) and toxic gases (SO₂, NO_x, CO, volatile organic compound-VOC) from motorized construction machines.

- **Dust**

In the construction stage, dust may be produced by digging, excavating, filling, leveling and delivery of construction materials may cause pollute on site and surrounding area and end of the wind direction in particular. According to experience of other construction site in Mekong delta area, in dry season days, at the peak time, dust pollution area is about 50m from site by main wind direction. In these area, TSP value could higher than standard TCVN 5937-2005. However, dust generated is mainly with big speck dimension and high sediment ability, therefore impact on health is not significant. In addition, dust pollution during construction period is short-term.

- **polluted air**

- During the construction stage construction activities with the use of motorized equipments (excavators, generators, pneumatic hammers, trucks etc.) may create air pollutants as SO_x, NO_x, CO, VOC and dust. Volume of this air emission may not be calculated but pollutants load may be forecasted the same as pre-construction phase.
- According to monitoring result at many site in Vietnam in normal climate condition, impact of construction on air quality is local and near the site only and on traffic route to the site.

- Wastewater

Wastewater generated during the construction stage of the Project may be produced by following sources.

- *Run-off Water*: It is estimated as total volume water run-off may reach in pre construction phase, containing suspended solids, turbidity, grease and oil and bacteria.
- *Domestic Wastewater*: Total volume of domestic wastewater generated by 1000 workers during the construction stages of the Plant (average waste water about 150 litres/day/head) may be high and such wastewater may contain high concentrations of organic compound, suspended solid, bacteria, etc. At the peak construction times, this number of workers may produce around 150 m³ of sanitary wastewater per day.
- *Other Wastewaters*: washing water of equipments and vehicles in the construction stage may contain high concentration of suspend solid and may be polluted by fuel oil.

- Solid waste

Table 3.4 describes the solid waste inventory for the construction stage of the Project.

- Hazardous waste

The hazardous wastes that may arise in the construction phases of the project include oily waste matters. Although the amount of oily waste matters in this phase is not easy to estimate, it is predictable that they (inclusive of oily mud and others) will be produced in the operations, repair and washing of machines and equipment. The amount is however predicted as small.

Table 3.4. Solid Waste Inventory – The Construction Stage of the project

Waste Stream Component	Source	Physical and Chemical Composition	Volume Generated
General construction waste – concrete, stone, plastics, glass etc.	Leftover waste from construction of power plant, cooling water system, ash ponds and associated infrastructure	Inorganic matter including concrete, stone, plastics, glass etc. The majority of waste is expected to be inert and non-hazardous. A small portion of the waste such as packaging from chemicals or damaged / waste chemicals may be hazardous or potentially hazardous.	
Domestic waste from construction camps	Maximum of 1000 construction workers on site	Organic (approximately 50%) and non-organic matter including vegetation, paper, foodstuffs, plastics. The majority of this waste is expected to be non-hazardous. A very small proportion of waste such as any medical waste from the first aid station may be hazardous.	Maximum of 800 kg / day (based on generation rate of 0.8 kg/person/day)
Sludge from wastewater	Domestic wastewater	High organic in matters (BOD, COD), and in	Maximum of 50 kg /day (based on

Waste Stream Component	Source	Physical and Chemical Composition	Volume Generated
treatment facility	from maximum of 1000 construction workers on site	bacteria, pathogens	solid waste generation rate of 0.05 kg / person / day)

- Noise

- Noise may generate from use of construction machines in this stage. Noise level is forecasted to be similar to that of in the Pre-construction stage.

- Vibration

- During the construction stage of the Project, the major vibration sources are mine blasting, construction equipments and vehicles used for material transport, particularly pile drivers.

3.2.1.3. Waste Generated In the Operation Stage

The following activities will be carried out during the operation stage of the Project.

- Electricity generation.
- Gas and fuel handling and storage.
- Freshwater abstraction.
- Cooling intake and water discharge
- Wastewater treatment and discharge
- Air emissions and pollution control
- Solid waste management

Sources and characteristics of waste flows generated in this stage are presented as follow.

- Air Emission

Sources of air emission in this stage may include.

- Fuel combustion (gas or oil) at the plant.
- Generation of dust and other air pollutants from transport activities for the plant.

- Generation of offensive odor from degradation of domestic waste water treatment system.

Summary of characteristics of air emission flow from the plant are presented as follow.

Concentrations of air pollutants in flue gas are listed in *Table 3.7*.

Table 3.5. Emission Concentrations and Rates in flue gas

Unit: mg/Nm³

Pollutant	Emission (Gas fire) (ton/day)	Concentration (Gas fire)	Emission (DO fire) (ton/day)	Concentration (DO fire)
TSP	0.218	5	0.426	10
SO ₂	9.95	9.9	13.54	305.7
NO ₂	2.243	51.34	6.38	150

Source: PECC 2, 2008

- *Fuel Oil Combustion at the Project*

In breakdown case of gas pipe line, the power plant will run on fuel oil. More detail of air pollution caused by fuel oil combustion is assessed in *Section 3.4.3*.

- *Generation of Dust from Transport Activities for the Plant*

Transport of materials, equipment and workers for the Plant may emit dust along transport roads (National Road No 91 and local roads). With the number of vehicle of used for transport will be small (about 20 vehicles/day). Load of dust generated from this source is forecasted to be minor and it is smaller than many times of construction phase of the project.

- *Generation of offensive Odor from Degradation of Domestic Solid Waste*

If domestic solid waste is not well managed, degradation of organic matters will generate offensive odor and pollute the surrounding area. It is not possible to estimate volume of odor generation. However it is expected to be minor because of the plant will implement good solid waste management.

- *Waste waters*

Wastewaters generated during the operation stage of Plant includes: regular and irregular with the characteristic is pH is not stable, SS content is high, may be produced by following sources.

- *Run-off water:* It is estimated 6984 m³/h. However, it includes two types as follow: (i) polluted water run-off from storage areas of fuel oil and coal (ii) unpolluted water run-off from the remaining areas. Total volume of polluted run-off water is forecasted to be much lower than unpolluted run-off water and will be collected along the internal road route and discharged to the Hau river.
- *Cooling water:* Flow of cooling water for the whole of o Mon III will be around 18 m³/s. Water temperature may rise up to 7~8 °C after condenser. Thermal impact of cooling water discharged to the river may rise up to 8 °C after condenser but in any case shall not be higher 40 °C what is Vietnamese Permissible Temperature for industrial effluent (TCVN 5945 – 2005- A class). Thermal impact of cooling water discharged to the Hau river is presented in *Section 3.4.3*.
- *Wastewater pollution chemicals:* the flow of about 759 m³/day, including waste water from washing furnace heat recovery determined by the operation and the manufacturer of Boiler; Wastewater from demineralization treatment System, is calculated by the demineralization system design: 20-25% discharge continuity or re-generation of 72h in 4h/cycle; Wastewater from the processing of preliminary water treatment, waste water from the chemical adding area and heat recovery; Wastewater from cleaning gas turbine compressor; Wastewater cleaning boiler (Wastewater irregular, total water quantity /1 boiler about 600m³, blow-down continuity within 10h, with a frequency of 1-2 years / 1time.
- *Oil contaminated waste water:* estimated 195 m³/day from areas in the main power house, transformer, switchyard, oil tanks areas and other area.
- *Domestic wastewater:* Total permanent workforce at the Plant would be approximately 191 people. Domestic wastewater is mainly from administration area, canteen, toilet...Domestic wastewater containing high concentration of organic matters, nutrient and bacteria. According to norm of domestic water is about 200 liter/head/day, total domestic wastewater generated in this stage may be around 35 m³/day. Pollutants load in domestic wastewater is estimated to be similar as in the Pre-construction stage and is presented in *Table 3.2*.

The main pollutants concentration in domestic wastewater are estimated to be as follow:

BOD	: 245.6 ÷ 294.7 mg/l
COD	: 463.9 ÷ 645.9 mg/l

SS : $382 \div 791.3$ mg/l

All the above concentrations exceed several times the permissible level of the Vietnamese Standard (TCVN 6672-2000) in several times.

However, domestic waste water system will be designed and constructed to reduce these impacts.

- **Solid wastes**

Table 3.6 provides an inventory of other solid wastes for the operation stage of the O Mon III Power Plant.

Table 3.6. Solid Waste Inventory - the Operation Stage of the Power Plant

Waste Stream Component	Source	Physical and Chemical Composition	Volume Generated
Maintenance dredge	Maintenance dredging of cooling water intake and discharge channels	Sediment, soil. Thus dredge material is not considered to be hazardous waste material.	Unknown
Domestic waste from plant	Maximum of 191 staff	Organic (approximately 50%) and non-organic matter including vegetation, paper, foodstuffs, plastics. The majority of this waste is expected to be inert.	152.8 kg/day (assume 0.8 kg per person per day ²)
Sludge from wastewater treatment	Wastewater treatment plant at plant	Organic matter high in coliforms, BOD, COD from both clarifier and activated coal filter	1-2 m ³ /day on dry basis
Used damaged chemicals and materials	Cleaning materials, chlorine use, chemical use	Used chemical containers, unused materials, spilt materials. Depending on the nature of the chemical some of this waste may be hazardous or potentially hazardous.	Unknown but minor volumes expected
Office waste	Offices at the plant (about 50 people)	Paper, plastics and other items	40 kg/day (assume 0.8 kg / person/ day from office staff)

² Figure adapted from 'Vietnam Environment Monitor 2004 Solid Waste' (World Bank, 2004)

General site waste	Collected from site grounds during cleaning of common areas	Small volumes of paper, plastic, stone, dust, vegetation	Unknown but minor volumes expected
Intake screen wastes	Cooling water intake screen	Organic matter – vegetation and dead fishes that are caught on intake screens General waste including paper and plastics floating in water	Unknown but minor volumes expected
Oil sludge	Oil separators, machine cleaning and maintenance	Oil sludge, waste oil, cleaning materials.	Unknown but minor volumes expected

- Hazardous waste

The chlorination of cooling water is a necessary feature in thermal power plants in order to prevent fouling in the heat exchange unit.

3.2.2. Sources of Impacts May Not Relate to Wastes

3.2.2.1. In the Pre-Construction Stage

- Landuse and landscape:

- Land acquisition for the Power plant, earthwork activities, clearing vegetation, etc. may affect to landuse and landscape of Phuoc Thoi and Thoi An Commune. Land tenure of local population will be reclaimed for construction of the project. Clearance, leveling, infrastructure construction activities will make change area of 42 ha includes vegetable, tree...into industrial zone.

- Transport:

- Transport of earthwork materials, equipments, etc. may deteriorate National Road 91, internal roads in O Mon District area and may increase accidents on these roads.

- Labour accidents:

- Labour accidents may occur during the pre-construction stage of the Project. Reason of accidents is multiform. It is from accidents caused by construction activities to traffic accidents.

3.2.2.2. Sources of Impacts May Not Relate to Wastes in the Construction Stage

- Land Use and landscape:

- Construction activities of the plant and ancillary facilities, transport of construction material and equipments, etc during construction stage of the Project may give the Project area and the transport roads a bad look (National road No 91, local internal roads)

- Transport:

- Transport of construction material and equipments may damage National Road No. 91, internal roads in O Mon District and may increase accidents on these roads. Additionally, transport activities on water way may increase traffic density on this waterway. This is a reason for increasing waterway accidents in this area.

- Erosion:

- Construction activities in this stage may increase erosion during rain in the Project area.

- Labour accidentence:

- Labour accidents of construction workers may be in multi-form. It may be caused by construction activities or by transportation of construction materials and equipments, or by unloading of such materials and equipment, etc.

- Sources of impacts on socio-economic and cultural environment:

- Concentration of workforce, construction activities, transport of materials and equipments and other activities during this stage may negatively affect economic activities, household income, health and safety, etc. in the Project area and Phuoc Thoi and Thoi An Commune.

- Noise

During the construction stage, noise may be created from following sources:

- Noise caused by earthwork equipments (bulldozers, mixing machines, compacting, shoveling machines, etc.) and earth excavating activity by machines.
- Vehicles and barge transporting excavated material and equipment.

According to data from the US EPA, noise caused by construction equipments is

presented in Table 3.7

Table 3.7. Construction equipment noise ranges

			Noise level at 50 ft, dBA					
			60	70	80	90	100	110
Equipment powered by internal combustion engines	Earth - moving	Compactors (roller)		—				
		Front loaders		—				
		Backhoes		—				
		Tractors		—				
		Scrapers, grader		—				
		Pavers			—			
		Trucks		—				
	Materials Handling	Concrete mixers		—				
		Concrete pumps			—			
		Cranes, movables		—				
		Cranes, derrick				—		
	Stationary	Pumps		—				
		Generators		—				
		Compressors			—			
Impact equipment		Pneumatic wrenches			—			
		Jackhammers and rock drills				—		
		Impact pile drivers, peaks		—				
Other		Vibrator		—				
		Saws						

Source: US Environmental Protection Agency, 1972 (adapted from Canter - Environmental Impact Assessment, Mc Graw Hill, (1996))

Data in Table 3.7 shows that, most of construction equipments may create moderate noise (> 70 dBA) within a distance of 50 ft. Noise level in the surrounding area of these equipments is unlikely to exceed Vietnamese Standard (TCVN 5949 – 1998, 70 dBA during daytime).

- Vibration

Table 3.8. During the construction stage of the Project, the major vibration sources are earthwork equipments and vehicles used for material transport. Vibration generated by pile driving is the highest.

3.2.2.3. Sources of Impacts May Not Relate to Wastes in the Operation Stage

- Land Use and landscape:

- Environmental pollution including air pollution, water pollution and solid waste disposal, etc. caused by operation of the O Mon III Power Plant may affect the land use and landscape of area.

- Transport:

- Transport of materials and fuel oil for the Power Plant may increase traffic density on National Road No91 and along the river. Quality of National Road No91 may be affected.

- Labour accidentence:

- Traffic accidents caused by transport of materials and fuel oil for the project may occur along the National Road No91 and river way. Other accidents caused by cooling water may occur along the cooling water discharge channel.

- Sources of impacts on socio-economic and cultural environment:

- Concentration of workforce and environmental pollution caused by operation of the Power Plant may negatively affect economic activities, health and safety, etc. in the Project area and O Mon district area.

- Noise

The main sources of noise during operation stage are as follows:

- Operation of engines, generators and turbines inside powerhouse
- Operation of various pumps, fans and motors

Noise from the power house caused by operation of engines, generators and turbines inside powerhouse is expected to be high and continuous, but will not exceed 85dBA at 5 m from the equipment. However, noise level decreases rapidly with distance.

Operation of various pumps, fans and motors may create big noise. Noise level in surrounding area will not exceed 75dBA.

- Vibration

The main sources of noise during operation stage are as follows.

- Operation of engines, generators and turbines inside powerhouse
- Delivery of equipment and raw materials by trucks

However, vibration level is expected as minor.

- High Temperature

High temperature may be around boiler, transfer-thermal tower, cooling water discharge system, etc..

3.2.3. Identification of Environmental Risks Caused by the Project

During the construction stages environmental risks rarely occur, due to there are not large-sized sources of environmental risks (fire, serious pollution) in those stages.

In the operation stage in case of improper risks management the following environmental risks may be happened.

- Gas pipeline risk. This is quantitatively assessed in *Section 3.4.2*.
- Oil spill due to accident at oil tankers. This is quantitatively assessed in a separated EIA Report for the Jetty System of O Mon power complex. These report has been approved by DONRE of Can Tho Province in October, 2000.

3.1. OBJECTS AND SCOPE MAY BE IMPACTED

3.3.1. Natural Objects and Scope May Be Impacted

- Land resources:

Areas affected by implementation of the project include project area, included the plant site the proposed cooling water discharge channel. At present, in the project area there is agricultural land and house shrub trees and rocky soils.

- Water resources:

Water resources that are likely to be affected by wastewater and cooling water from the project are Hau river water. All of waste water of the plant after through waste water treatment system will be connected into cooling water discharged culvert system and go to Hau river. (From G9 and G10 point in drawing NĐ. 0253.10.C.G.002)

- Air environment:

Polluted areas caused by implementation of the Project includes plant area and the surrounding areas belonging to Phuoc Thoi and Thoi An commune O Mon

district and along of the transportation Roads.

(Air quality modeling for this project is summarized in *section 3.4.2*).

- *Biological resources:*

Terrestrial ecosystem on the whole Project area and a part of aquatic ecosystem at area will be affected by land clearance, plant construction.

3.3.2. Socio-Economic and Cultural Objects and Scope May Be Impacted

- *National Road No.91:*

National Road No. 91A going near the project area may be damaged by movement of heavy trucks during the construction stages to operation phase of the project.

- *Aquaculture activities:*

Quality of local water may be affected by increased temperature, turbidity, oil / grease, chlorine caused by wastewater and cooling water from the Power Plant. This will effect on aqua-farming of local area.

- *People affected by project:*

There are 721 households and about 5 companies affected by project, in which have 151 households will be relocated during land clearance for project construction.

3.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS

3.4.1. Assessment of the Potential Impacts in the Pre-Construction and Construction Stages

3.4.1.1. *Assessment of the Potential Impacts Caused by Land Acquisition*

The total land to be permanently acquired will be around 42 hectares (ha) included mainly agriculture land .

In pre-construction phase, the land recovery shall cause difficulties of lives for many land lost people, especially households removed to new residential area. It is the fact that:

- Many households have to leave the area that they have lived for along

time with plentiful customs and relative relations, partners. They have to establish and make new relations in the new residential area. It is difficult for farmers traditionally living in a same place with their family, especially for ones in Cuu Long river delta.

- The compensation for farm produce, house shall account remarkable amount to the households in comparison with their current incomes. However, with such amount, it is very difficult for them to buy a land lot with similar area and condition. Current trend of urban development in rural area and increasing land transfer price shall contribute to their difficulties in self-resettlement
- The difficulties in providing agricultural land and residential area as well as changes of custom, cultivation habit shall cause many obstacles for households in the course of getting familiar with conditions in a new residential area.
- People in the project area are generally low educated; some people of resettled households are illiterate. They mainly earn their breads by agriculture. With a considerable amount of money in hand from the compensation and low education, it is really a challenge for local people. The survey shows that many households have intension of investing in construction of housing and small business and trading.
- For households which are partially lost their cultivation land and not required to resettle, shall face difficult in income loss. Unemployment shall occur in the region. Many people shall be forced to find new jobs due to shortage of cultivation land or to work in other places due to incensement of leisure after harvest time.
- Accordingly, the implementation of the project is a right policy of the Government, and supported by local people and authorities of Can Tho city. In addition to the socio-economic development of the region by the project, it shall cause negative impact on land lost family, especially removed households.

3.4.1.2. *Assessment of the Potential Impacts on Landuse and Landscape*

During the pre-construction and construction stages of Power Plant there will be significant disturbance to land surfaces at various locations outside the power plant. These locations will include:

- The access road to the plant from National Road No 91,
- The area of destroyed works,
- Impact on landscape and land use of other due to construction activities.

Clearing vegetation as well as filling and leveling of an area of about 42 ha of the plant site will bring about significant change to the existing landscape and land use over a large area.

The storage yard of equipment in this phase shall require to cut down and remove the vegetable layer and make ground leveling for a considerable area. This activities shall affect to landscape and land usage in this region.

Excavation, embankment and ground leveling shall cause negative impact on local landscape. The local quiet and natural landscape shall be disappeared and a construction site with many operating equipment is instead of.

Above impacts are *considered negative but unavoidable*.

- Impact due to land usage structure

Site clearance

Construction site of 42 ha for O Mon III thermal power plant shall be cleared before execution of construction.

The responses from land holders and local authorities are very positive. They all support the project. Lands in the project area are legally registered. Almost households processed those lands before the Liberation, and others were traded recently. All project affected households require compensation suitable with their investment in houses and income from the crop plants.

Changes of land usage structure

The project area is located on considerably high area (+2m), composing of heavy clay suitable for processing brick, cultivation of farm produce, fruit bearing trees but not for cultivation of rice. The low land area along river bank can cultivate rice with average productivity of 4.2 tons/years (2 crops).

According to the survey for compensation and resettlement, it is estimated that losses caused by conversion of agricultural land into industrial one including loss of land, damage of houses, architectural objects, farm produce are about 64.55 bil. VND.

In reality, those losses and damage is insignificant in comparison with benefits from the Project, however, they shall reduce remarkably the annual average income of the project affected households since their main incomes come from agricultural activities.

- Impact due to removal, clearance and resettlement

In the process of project land recovery and site clearance, about 152 households in territories of Phuoc Thoi and Thoi An wards, O Mon district. Those activities shall affect negatively to the socio-economic conditions as well as the lives of removed households.

“Resettlement Reaction Plan -RAP” shall be prepared by project owner in a separate report, in which, negative and positive impacts on socio-economic condition as well as site clearance, compensation, support and resettlement shall be made in details. Accordingly, the contents of this Environment Impact Assessment Report just mentions the main impacts caused by land recovery, removal and resettlement.

3.4.1.3. Assessment of the Potential Impacts on Air Quality

An air quality impact during land clearance and construction of the plant facilities in the form of dust resulting from the removal of vegetation and heavy earthmoving activities. Air quality may also be significantly degraded by air emission from construction equipments and vehicles. During dry days in site areas can be significant sources of dust with dust pollution level is higher than 10 times standard (TCVN 5937-2005, 1 hour average: 0,3 mg/m³). According to the Rapid Assessment Method guided by WHO (1993) have not 1 hour average TSP content, have 24 hour average TSP content standard (230 mg/m³). Dust pollution due to these activities could be higher than standard in case of these activities occurred in many hours continuously.

However, dust generated during earthmoving tends to be made up of large particles that readily settle to the ground due to gravitation. As leveling time with only about 1 month, more projects will apply measures to limit the dust released into the environment (see Chapter Four) to this effect is small and can reduce .

Range dust pollution affected by this activity is not large and can be controlled.

Air pollution can also occur due to gas from the machinery, equipment and heavy trucks. The waste gas from diesel engines of machinery and trucks this contains many of pollution such as SO₂, NO_x, CO, dust (PM₁₀), VOC. The level of polluted air in the area around the construction and points along the transport route mud, soil, stone, machinery and equipment will increase. However, the value of the parameters of pollution is still lower than the standard allows TCVN 5937 - 2005 (except dust) by the amount of equipment used is not too big and environmental background of these area is still good. Dust pollution occur in this stage is mainly due to dust and waste from the ground during the operation of machinery and trucks.

3.4.1.4. *Impacts Caused by Noise and vibration*

- Assessment of the Potential Impacts Caused by Noise

Operation of machinery and heavy trucks in the construction phase of the project will cause noise pollution and increase the vibration in the project area and along the routes of transportation. This noisy high bad influence to people's health as causing loss of sleep, fatigue, create psychological uncomfortable. Noise also reduces labor productivity, health officials, public employees. Exposed to noise in the long run can make the appropriate reduction in actual income. According to statistics by the Ministry of Health and Research Institute of Scientific and Labour Protection - Labour Union of Vietnam, the noise disrupting bad to most parts of the human body. The impact of noise as described in Table 3.9.

Table 3.9. The impact of noise in the frequency range

Noise level (dBA)	Impact to hear
0	threshold hear
100	Start making changes of heart beats
110	stimulating strong tympanum
120	threshold grating
130 - 135	cause his nerves and vomiting, and with vision and weak muscles
140	grating, causes disease dementia, dementia
145	limit that he can be subject to noise
150	If the bear long term will be bin tympanum
160	If long exposure will cause dangerous consequences for long-term health

Source :PECC 2, 2008

To obtain an idea of the magnitude of noise from the Project, levels from construction activities and equipment summarized by Canter (1996) were used as bases of a prediction model. This prediction model assumes that the decrease of noise levels from a point source is proportional to the logarithm of the distance to the source. A well-known consequence of this model is that levels decrease by 6 dBA for every doubling of distance. The results of this prediction model are shown in *Table 3.10*.

Table 3.9. Table 3.10 Reduction of noise depending on distance (Canter 1996)

Equipment	Noise at 15 m (dBA)		Distance (m) to 75 dBA		Distance (m) to 45 dBA	
	Min	Max	Min	Max	Min	Max
Compactor	72	73	0	0	383	383
Front loader	72	82	0	34	341	1079
Backhoe	72	92	0	108	341	3412
Tractor	77	94	19	136	607	4295
Grader	80	92	27	108	857	3412
Asphalt Finisher	88	88	68	0	2153	2153

Equipment	Noise at 15 m (dBA)		Distance (m) to 75 dBA		Distance (m) to 45 dBA	
	Min	Max	Min	Max	Min	Max
Heavy truck	83	93	38	121	1211	3828
Concrete mixer	74	85	0	48	430	1524
Concrete pump	81	83	30	38	962	1211
Movable crane	74	84	0	43	430	1358
Derrick crane	87	90	61	86	1919	2710
Pump	70	70	0	0	271	271
Generator	73	82	0	34	383	1079
Compressor	76	87	17	61	541	1919

Table 3.10. From the data in Table 3.10 can draw the following conclusions:

- The distance of noise standards in the Vietnamese TCVN 5949-1998 (regulations for the residential area is alternately in to the production area in time from 6h - 18h DBA is 75) usually located within a few dozen to over 100m.
- The noise distance from heavy trucks create achieve a minimum of 38 m and can be up to 121m. Thus, in this range along the road transport of mud, soil, stone, vegetation, Noise levels exceed permitted standards TCVN 5959-1998.
- The noise distance of the equipment achieved allowing standards of WB (45 DBA in residential areas) can be up to 2 - 5 km depending on the type of equipment. In case of the operation of pile driver noise distance achieved permitted standard could up to 12 km.
- The noise distance of the trucks create achieve standards allowed by WB (45 DBA at the residential area) is from 1.2 to 4 km. So the object is in this range along the roads will be noise pollution from trucks serving the project.

Due to the operation of equipment during this phase same place and same time, noise distance achieve allowed standards will increased. However, the level of increase is not big so noisy in general in a point is not the total of noise cause by machinery at that point. On the other hand, leveling activities only occur in about 1 month so the impact of noise will only affect on site, impact of noise to the around residential area is negative but small and be temporary.

The results calculated in Table 3.9 is the case with flat terrain and the level of reflection of the noise is highest. In fact, vegetable terrain in the project area will

be absorbed in part or reflection of the noise and therefore the level of noise reduction will more quickly and the scope of noise pollution will be much lower than compared with the data in Table 3.9.

In addition, the noise in areas along the Highway 91 is a relatively large due to the traffic activities in this region, especially the noise from the container car. Therefore, the noise cause by trucks serving the Project is not significant.

- Impact of vibration.

- Vibration due to the operation of heavy trucks as well as by most types of machinery and equipment construction is small.

3.4.1.5. *Assessment of the Potential Impacts on Water Quality*

- The impact to water quality due to activities site cleaning in project

Activities remove land, leveling with rainfall and water flow through the site area will increase turbidity of river water along the river side and the canal around the project area. However, this impact is small because the scope of pollution is only about a few dozen meters around the project area and only last for about 1 month work place. River water pollution due to operation of land transport, sand is not significant.

According to estimates, the total amount excavation of soil, rock in this period is about 65,100 m³. Excavation activities in the area will increase the erode, especially on heavy rain days, which increase the content of suspended solids and cause pollution of water resources in this area. Total of TSS content in the water in this region will exceed the standards TCVN 5943-2005 (regulations SS = 50 mg/l for aquaculture). Can predict that TSS content in valley around the project area will exceed the standards of the World Bank (WB) on waste water (50 mg / l).

However, the SS content in the water will quickly reduce by the distance from the construction area due to the sedimentation. The impact to water quality due to excavation and leveling activities, assessed is negative but small and temporary.

- *Potential Impacts on Water Quality Caused by Construction and Vegetation Removal.*

The process of vegetation removal in the area of the project will increase the erode in the area occurred when heavy rain, especially in areas have big slope and other areas are in the process of the soil excavation. Rainwater will be pulled by the increase of SS content and the sedimentation in areas along the river. Impact of polluted water cause by the construction of drainage systems, roads and to remove vegetable in the project area is small and is temporary.

- *Potential Impacts on Water Quality Caused by Sewage*

It is assumed that the pre-construction activities would require 100 workers respectively. Domestic waste water is generated from these workers is about 15 m³/day.

The domestic sewage have high content organic matters, SS, bacteria and other pollution matters (table 3.2) will impact surface water and to groundwater. The main pollutants are organic components and microorganism. If overflow or contaminated storm water runoff from the toilets enter waterways, organic and bacterial pollution may result.

In case of workers sanitation in the location have underground water are rising high, the osmosis of the pollution in domestic waste water can cause pollution of underground water sources.

Impact of domestic waste water of workers in the construction phase of the project is negative, significant, but is temporary.

- Potential Impacts on Water Quality Caused by Construction Wastewater

Construction process would include fabrication of concrete and related water usage. Most wastewater would derive from washing of production components, vehicles etc. The generation of wastewater from washing components of the concrete fabrication line could potentially carry inorganic solids and react alkaline above applicable discharge standards. Due to volume of construction wastewater will be small and the project constructor will install settlement facilities at the construction sites the potential impact is considered minor and it mostly occurs during construction period and has no long-term impact with view to persistent pollution.

- Potential Impacts on Water Quality Caused by Oily Wastewater

Oily wastewater could be generated by accidental spills and chronic losses of hydraulic and motor oil during the construction process. The deposition of oily waste could potentially be an adverse impact in the long-term. However the massive earth movements during construction and related washouts of solids and organic matter are paramount to expected losses of oil. Contaminated water would potentially impact the water quality in surface water and possibly groundwater. The impact is considered minor and overall no persistent impact is anticipated.

- Impacts on water quality caused by solid waste

Rain water flow through the containing stored domestic solid waste area and the types of harmful wastes can cause pollution receiving sources. However, solid waste and harmful waste of the project will be collected in the area having lean-to, with the wall so will not be occurred in rain water can flow through the area contains this type of waste .

Rain water flow through the containing mud, soil, stone yard temporarily in regional projects in the period before being transported to the dumping ground or used for other purposes will be high turbidity and suspended solids and can cause pollution receiving sources. This rain water is relatively large, arising in the short time, adding that the area around the terrain are relatively low it can cause immediately flooded. However, the terrain around the area with the slopes of the Hau River, the ability of natural drainage areas of good so not to occur flooded phenomenon in the surroundings area. Therefore, this impact is negative but small and is temporary because most of the stone and mud will be transported immediately to the spilling area or to use for other purposes.

3.4.1.6. *Impacts on biological environment*

Impacts on Biological Environment caused by Earth work and Land leveling

Land leveling activities at scope of project area will destroy all terrestrial vegetation species. Total land area of project approximately 42 ha, mainly rice plant land, fruit-tree land...In project area have only wetland ecosystem with Sonneratia at Hau riverbank belongs to natural ecosystem can be injured. However, these Sonneratia rows at project area are very thin and scattered (almost no) so the project's impact to terrestrial ecosystem is insignificant.

Increasing suspended solids content in water caused by soil erosion and land leveling is within 0.5 km from the regional project. The accretion at valleys near the point of earthworking and land leveling will affect us negatively to the bottom animals of this area by the species will be covered new suspended solids and decreased ability to consistently able by light

Along with the system of bottom animals are affected negatively, many species of fish will be affected by the lost supplies of food and where to eggs as well as by the level of turbidity too high.

The field study process in this area doesn't discover to appear valuable animals having name of Vietnamese Red Book. Thus, impacts on earthworking, land leveling activities in pre-construction of project to aquatic ecosystem is assessed as negative but temporary.

Impacts on biological environment caused by worker's domestic waste water

Domestic waste water of the workers worked in project in this phase contain high nutritional content cause negative effect to aquatic ecosystem of water resource.

Nevertheless, waste water flow arising from worker camp isn't large so the impacts caused by domestic waste water to aquatic ecosystem is assessed as negative but minor, temporary and minimize.

- *Losing vegetational cover*

In pre-construction of project, about 42 hectares is effected directly due to earthworking, land leveling activities.

Losing vegetational cover caused by land leveling activities in pre-construction can't be avoid. this impacts is assessed as negative and it is not controllable.

- Losing terrestrial animals in project area

Terrestrial animals which live in area will lose living environment when vegetational cover is cut off. However, influence limit to these animals will smaller and the impacts on terrestrial animals is assessed as minor due to in project area without animals which have name in Vietnamese Red Book and these majority animals have ability migration well

3.4.1.7. Impacts on traffic at site.

- Impacts on traffic caused by material, machine and equipment transportation activities

Machine and equipment transportation come in and out project area in pre-construction will increase traffic density on Highway 91, especially road section pass through residential belong to Phuoc Thoi and Phuoc An ward and project area. However, this impacts is assessed as temporary and minimize.

With 830.000 m³ sand and 65.100 m³ land by barge will increase traffic density on Hau river. A number of sand, land transported barge's trip 200 m³ come in and out project area estimated about 9.950 trips. Proposed land leveling process is carry out about one months, like this an hour average barge's trip go in and out project area about 34 trips (one days operate 10 hours). Thus, traffic density on section of Hau river pass through project area will increase significant. This fact increase waterway traffic accident risks in this area. This impacts is assessed as significant but it can be controled and minimized by reasonable traffic distribution methods (see chapter four)

- Impacts on traffic caused by solid waste

Domestic solid waste transportation of worker (up to 45 kg/day) to O Mon district dumping ground will need one truck 5 tons with frequently 1 week/time. So, this impact to traffic activity in area is assess as insignificant.

If using 10 tons trucks to transport construction solids is necessary trip quantity about from 2.400 – 2.600 trips for whole pre-construction in the project. Every week average have about 33 – 36 trips of 10 tons truck come in and out project area for this purpose. With this truck flow, this impact to traffic activity on Highway 91 due to construction waste transportation is assessed as insignificant.

An increase in traffic density caused by construction waste transportation can't traffic jam on highway 91, road section through pass power complex plant. However, it can be increase traffic accident risks and cause damaged to transportation routes. This impacts is assessed as negative but minor, temporary and minimize.

The solid waste is cut tree-trunk, root, leaves and materials of destroyed house in land leveling. Due to project area have scattered plants and small so domestic waste quantity aren't large (10m³/hectares). Almost all solid waste is collected by local inhabitants to make firewood so effecting bad environment is insignificant.

3.4.1.8. Impacts on social environment.

- Impacts on unplanned Migration

In pre-construction stage of project, worker quantity don't gather much this area. Active impacts caused by workers will promote service activities, business at surrounding area. Since time, to promote economical activities and increase local inhabitants's income

The negative impacts caused by gathering worker (mainly men worker) such as:

- To increase social evils as a drug addict, harlotry, thief ...
- To increase the risks of transmitting epidemic diseases.
- Having to occur conflict with worker and local local inhabitant
- Increasing pressure to services and infrastructure
- Polluted environment in camp area and surrounding area because of domestic solid wastes. .

This impacts is assessed as minor and temporary due to worker force will manage well

The contradiction between workers and local inhabitant can be occurred therefore different with habits, cultures, income... and due to workers violate to local inhabitant's culture, religion. However the project will apply worker managed methods so this problem is assessed no occurrence.

-Impacts on sex site.

The women take the part of economical activities related to catch and aquaculture. So, this impact can be effect significant impact to their job, reduce their income.

- Impacts on health and safety Issues

Impacts on health and safety caused by solid wastes.

The impacts to healthy and safety in community can be occurred due to the germ transmitting from worker's domestic waste in pre-construction stage. However this impacts is assessed as minor and minimized by collection, treatment this waste corresponding (see Chapter four).

Negative impact to community healthy can be occurred as contracting with solid waste type, especially harmful waste in entrepot or this waste collection and transportation this impact is assessed as minor and minimize

The gathering of big labour force in area will demand to supply big domestic water flow. Besides, Pressure to healthy, environmental sanitation will also increase significant. this impact is assessed as minor and minimize.

Polluted environment can be occurred worker camp because of domestic waste (including waste water and domestic solid waste). In case of not to collect and treat well, domestic waste will emit odour and germ organisms to environment and effect to worker healthy. However, this problem doesn't occur if having good

management and treatment methods about domestic waste from worker camp (see chapter four).

- Impacts on healthy an safety due to dust

The ill respiratory system of worker in poject and people living in surrounding area. Especially, people who living traffic roadside serving project can be increased due to dust emits to activitites in pre-construction. Dust emission can be effected community healthy, the noticeable is mad, land, rock transporting activities serving project.

In dry day and having strong wind, dust content in construction area can be reached to 1 mg/m³ and exceed permitted standard TCVN 5937-1995 (0,3 mg/m³) up to three times

However, this impact is assessed as negative but only narrow scope and temporary.

- Impacts on education

At present, pupil rate go to school fairly high in project area and surrounding area. The impacts on education due to the activities in pre – construction stage is caused only occur to with resettlement households in the area. The children of household can be replaced their school and spend about time to incorporate new study environment.

- Impacts to infrastructure

At present, infrastructure in project area and surrounding areas is fairly good, expect water supply infrastructure. O Mon I project is in perfect phase, O Mon II and O Mon IV power plant have constructed yet so without impact to two projects and power plant master plan.

Traffic activities which serve project in pre-construction can effect to cause damaged traffic routes in area (No.91 highway and internal routes in area).

The number of woker gather in project area in this stage will increase pressure rise for infrasstructure about health and water supply.

- Impacts on physical and cultural heritage

The project area haven't physical and cultural heritage.

3.4.2. Assessment of the potential impacts in the construction stages

3.4.2.1. Assessment of the Potential Impacts on Landuse and Landscape

- To Impact on landuse and landscape of project due to land levelling

The activities of land levelling will be negative impact to the site's landscape.

This impact is evaluated negative but not to avoid.

3.4.2.2. Assessment of the Potential Impacts on air quality

- Air pollution caused by stench

The stench is emitted from these water-closet, domestic waste and others waste storage,... can be caused polluted environment in areas. However, this impact is evaluated insignificant.

- Air pollution caused by activities of digging and land levelling

An air quality impacts due to digging and land levelling, transport equipment and building materials which evaluated similar to in pre-construction stage of project

Air pollution due to burning fuel in these activities

In the construction phase of the project, expectation have 1000 people in the construction site, burning fuel: oil, gas, charcoal for cooking, if a person uses the average of fuel about 0,5kg fuel/person/day, the total of using fuel is expected about 500kg/day. The process of burning fuel create mainly ash, dust, SO₂, CO₂ ..., but gas is created with low concentration, due to area influence is narrow and it just happen in the construction phase.

- Air pollution due to transporting building materials

Transporting materials, equipments to the construction site by road or waterway about 672.000m³ in 16 months. This transporting will affect on the air environment around Nation Road 91, estimating about 20 trip (two-way) per hour with use 10 ton's truck.

- Air pollution due to transporting solid waste

Transporting activities of many domestic's solid types of labour from project's area to dumping ground by 10 ton's truck which only need 2 trips/week. Due to affect on air by transporting solid waste of labour and dangerous waste is estimated minor.

However, if add alternative waste solid transporting activities, a number of trip of 10's truck in and out project's area, is estimated about 4000-5000 trips during construction phase (16 months). In the average, every week there are 24-30 truck's trips in and out construction site. This truck's flow is not quite big due to if only counting the transporting of solid waste, don't affect on air quality is estimated minor

3.4.2.3. *Impacts due to noises and vibration.*

Amount of building materials and equipment need to transport to the construction site by road and waterway, is estimated about 672.000m³ and take about 16 months. The truck is estimated to serve this phase of the project which circulate on the Nation Road 1 about 35-70 trips/hour (10 ton's truck) in the rush hour. However, reducing this impact, a lot of materials is had to transport by waterway.

These activities of heavy-duty trucks will cause noise pollution during the road. According to Canter (1996), the noises are caused by the heavy-duty trucks can reach to 90 dBA in 15 meters and distance is affected by the noise, can reach to hundreds of meters

The noise is caused by the operations of machines which is estimated the same the pre-construction phase.

The vibration by the trucks and all of building machines is estimated minor

3.4.2.4. Impacts on water quality

Water pollutions due to waste water.

The workers gather in the project's area in the highest construction phase, is estimated about 1000 workers. Volume of domestic waste water is arised by this worker, may be 150m^3 per day. Element of domestic waste water of workers is arised in the construction phase, is the same the pre-construction phase and can be poluttet water and underground water around the worker's camp.

By gathering a lot of workers in the construction phase, so volume of domestic waste water are discharged from the camps, bathrooms, toilets, refectory, combine with overflowing the rain water, will be polluted the river. If the average of water norm for every workers is 150 litters per worker.day, the averge's volume of domestic waste water for 1000workers is about 150m^3 per day, with mainly polluted elements in domestic waste water is suspended solid (SS), organic matters (show in bio-oxygen demand BOD and chemical oxygen demand COD), oil, nitrogen (N), phosphorus (P) and virus (T.Coloform).

According to appraising method of Aveirala, maximum polluted tonnage and concentration due to sewage is discharged in the environment per day and night, is caculated :

- **Industry waste water**

The waste water from train's, ship's, traffic's toilets and oil are leak out the transporting ship. The waste water from these resources contains high suspended solid and high oil, can cause polluted river around the construction site.

- **Overflowing water**

Due to rain or activities of the construction, this type of waste water have high element suspended solid, beside containing oil, organic substance, microorganism. Rain water overflow through the construction site can cause pollution of the river around the project's area.

- **Polluted water due to solid waste**

Polluted water can be happened due to mud from the worker's toilet and rain water overflow throught areas which contain the solid waste and dangerous waste. However, these impacts is estimated not considerable.

3.4.2.5. Impacts on bio-environment

- **Impacts on bio-environment due to solid waste**

Solid wastes are arised in the construction phase of the project, don't affect on bio-resources much in the project's area and surrounding area.

3.4.2.6. Impacts on gathering worker

In the height construction phase, workers gather in the project's area, can reach 1000 workers. These workers aren't almost local people. The impacts due to gathering workers, can happen in the pre-construction phase of the project, happen in this phase too.

The mainly impacts can happen due to gathering too many workers which spread many epidemic diseases. These impacts are estimated the same construction phase of the project.

3.4.2.7. *Impacts on digging, leveling*

Land leveling phase can cause these impacts:

- Acidifier

If sand backfill are taken in the alum earth, we must to pay attention acidifier land and water. In the latent alum earth, alum operate, pyrite (FeS_2) in the alum earth if exposed in the sun shine and contact with water, it is oxidized with photosynthesis of microorganism. This process will create sulfuric acid (H_2SO_4) and cause acidifier land and water:

Water flow thought digging and leveling area will be acidified and thence transporting to river, arroyo which cause acidifier fresh water, harm aquatic resources. Many kind of shrimp and fish can be dead if pH concentration of water resource is low.

However, at this construction site, element of soil is mainly silt along the bank of a river; the latent alum earth almost haven't in the upper. Beside, according to design sand backfill after ramming hardly, will be covered by sand layer, macadam and concrete, so that capacity oxidize this sand layer is too difficult to happen and absorb acid water (if any) from sand layer to river, is not considerable.

- Erosion land, changing the landscape and polluted water resources

Erosion land often happen when digging and leveling. When building factory, erosion often happen due to follow these reasons:

- Operations of digging will carry out in project's area for areas have level is higher design's level;
- At once a big quantity of soil, sand will be covered project's area for area have level is lower design's level and this quantity isn't covered tight;
- Soil, sand aren't rammed tight.

So that, in the rainy day, erodent activities will happen.

In this case have rain water overflow, erosion land will increase turbidity, suspended solid concentration in the canal, arroyo receive from another around construction site. So that, water boundary will be polluted.

Besides, land erosion is caused accumulations in Hau river and canals, water discharging Ditch which a reason decrease water discharging capacity of these system. However, this impact is assessed minor, temporariness and can be controlled.

Land erosion is also increased turbidity and suspended solid in water in hydraulic zone when receiving waste water from site area and it is caused bad impacts to aquaculture environment and biological diverse. However, these impact is only locally, temporary and insignificant.

At one, landscape in site also effects in construction process. Previous agriculture cultivated area and garden will be replayed by industrial factory project, the

ground is constructed by concrete. This impact is considered no avoided and controllable.

• Environmental Risks

Environmental Risks are able to occur in construction stage in project include:

Ship of accident and strike against risks, transporting filling materials barge on river can be leaked out fuel. However, probability happening is minor because ship's output isn't large and need control closely in construction process.

Environmental risks can be occur in site is detonating combustion risk in gathering worker area as worker camp area and location which gathering equipments, machines.

It is reason detonating combustion risk can be started many causes, from daily usual activities, from careless of workers as dropping steel materials which create electric spark, smoking in the restricted area, sprak from the machines, electric line is uncovered, leak alcohol out in high temperature condition,.....

Detonating combustion risk will destroy equipments, machines, contruction,... at impact radius boundary of detonating combustion and harm the health, even life of the worker worker near there.

3.4.3. Impacts on operation phase of the project

3.4.3.1. Impacts on air quality

• Air pollution caused by power plant emissions

Air pollution Dispersion Modeling

An air quality model is applied for prediction of the dispersion of flue gas from the stacks of O Mon III CCPP. It covers all parameters of discharging sources, climate, atmospheric stability and terrain. Details of the model are given in *Annex 3.1*.

Data of monthly averages of wind, rainfall, temperature, evaporation, and continuously sunny days in 4 years (2002 - 2005) that were recorded at the nearest meteo-station (Cân Tho) is utilized in modeling.

Meteorological data and inputs of discharging sources are tabulated in *Tables 3.11*.

Table 3.11. Summary of wind conditions at the project area in year at the site's project

Wind derection	Speech (m/s)	Frequency(%)
West - W	3,1	9,4
Southwest - SW	2,5	9,5
South - S	2,0	4,1
Southeast - SE	2,4	8,8
East - E	2,7	11,3
Northeast - NE	2,5	4,1
North - N	2,6	4,7
Northwest - NW	2,7	2,0
Calm	0	46,2

Source: PECC2, April 2008

Other climate factors utilized in modeling include: air temperature: 30.0 °C ;
atmospheric stability in rural areas: B

Table 3.12. Input data on flue gas emission

Parameter	Bypass Stack (Gas)	Main Stack (gas)	Main Stack(DO)
Height of stack (m)	30	40	40
Inner diameter of stack (m)	6.8	6.8	6.8
Flue gas flow(m ³ /s)	1564.6	685.39	747.49
Dust content in flue gas (mg/m ³)	1.62	3.69	6.6
SO ₂ content in flue gas (mg/m ³)	3.2	7.3	209.59
NO ₂ content in flue gas (mg/m ³)	16.16	37.9	98.85
Flue gas velocity (m/s)	42.9	18.8	20.5
Flue gas temperature (°C)	594	97	141

Source: PECC2, April 2008

- Predicted scenarios of ground concentrations of dust, SO₂ and NO₂**

Table 3.13. Options of capacity used for computation

Contend	Operation	Total capacity
Gas fired	Open cycle	500 MW
Gas fired	750 MW	750 MW
DO+FO fired	660 MW+750MW	1410 MW

- Standards applicable for O Mon III CCPP's project.**

- TCVN 7440 – 2005: Standard of emissions of thermal power plants

As the capacity is higher than 600 MW and the project site is industrial, Kp = 0.7 and Kv = 1.

- TCVN 5937: 2005: Standard of air quality – standard of ambient air.
- TCVN 5938: 2005 :Air quality – allowable limits of concentrations of toxic gases in the air.

The location of the project site, technical data, discharging sources, concentrations of NO_x, SO₂ and dust for modeling the dispersion of flue gas of O Mon III CCPP's project are identified in Table 3.14 and 3.15

Table 3.14. Standard of ground concentrations of pollutants in the air

Unit: mg/Nm ³		
Parameter (TCVN 5937-2005)	1-hour average	24-hour average

Parameter (TCVN 5937-2005)	1-hour average	24-hour average
NO _x	0,2	-
SO _x	0,35	0,125
Dust(TSP)	0,3	0,2
PM10	-	0,15

- **Computation of concentrations of dust, NO_x and SO₂ in flue gas**

Table 3.15. The results of polluted emissions in stack compare to air emission standard.

Pollutants	Concentration (Gas fired)	Concentration (Oil fired)	Standard TCVN 7440-2005 (applied for O Mon III CCPP , factor Kp = 0.7 Kv=1)	
			Oil fired DO	Gas fired
NO _x	51.34	149.9	420 (600)	175 (250)
SO _x	9.9	305.7	350 (500)	210 (300)
Dust	5	10	105 (150)	35 (50)

- **Calculation of dust, Nox, Sox concentration in flue gas**

Option of calculation

- *Option 1A and 1B:* Air Emission Dispersion from O Mon III CCPP in case of gas fired, open cycle, with capacity of 500 MW, wet season and dry season (in case of heat recovery steam generation or maintaining)
- *Option 2A and 2B:* Air Emission Dispersion from O Mon III CCPP in case of gas fired, with capacity of 750 MW, wet season and dry season .
- *Option 3A and 3B:* Air Emission Dispersion from O Mon III CCPP in case of DO fired, with capacity of 750 MW, wet season and dry season .
- *Option 4A and 4B (integration):* Air Emission Dispersion from O Mon I power plant in case of Do fired and O Mon III CCPP, Do fired, wet season and dry season .

The technical, technological parameters and atmosphere condition applied in calculation are as follows:

- Vertical gradient of temperature: $Gz = 0.002 \text{ }^{\circ}\text{C/m}$
- Average temperature: $T_{kk} = 30 \text{ }^{\circ}\text{C}$
- Wind speed at 10m elevation: 2,5 m/s in the rainy season and 2,7 m/s in the dry season.
- Atmospheric stability of the project site in the dry and rainy seasons: B, according to Pasquill-Gifford classification
- Dominant wind direction at the project site: East in the rainy season and South West in the dry season

• Results of emission prediction

Details of computing results are given in *Annex 3.1*.

• Computation for selection of flue height

Stack heights are selected based on conditions as follows:

- Capacity of the plant
- Allowable concentrations of pollutants according to Vietnamese Standard of Air Quality (TCVN 5937-2005).
- Concentrations of pollutants in the site (baseline environment)
- Fuel quality and technologies of the plant
- Reserve of toxic gases concentrations (for stricter limits in the future).

From assumption above, calculated result show that main stack height is 40 m and bypass stack height is 30 m ensure toxic substances meet Vietnamese standard.

• Comparison of ground concentrations of pollutants

- Rainy season

The concentrations of dust and toxic gases (NO_x and SO₂) in the air at the ground level (ground concentrations) in the rainy season are computed with results shown in *Table 3.16*.

Table 3.16. Computing results of prediction of ground concentrations of pollutants in the rainy season

Parameters	TCVN 5937 - 2005		Option 1A	Option 2A	Option 3A	Option 4A
SO _x	1h	0,35	-	-	0,0663	0.129
	24h	0,125	-	-	0,0352	0.073
NO _x	1h	0,2	0,0035	0,0186	0,0313	0.152
	24h	-	0,0019	0,0098	0,0166	0.084
Dust PM10	24h	0,2	0,000186	0,00096	0,0011	0.0081
Stack height (m)			30	40	40	-
Average Xmax (m)			4893	2069	2692	2197

- Dry season

The concentrations of dust and toxic gases (NO_x and SO₂) in the air at the ground level (ground concentrations) in the dry season are computed with results shown in *Table 3.17*.

Table 3.17. Computing results of prediction of ground concentrations of pollutants in the dry season

Parameters	TCVN 5937 - 2005		Option 1A	Option 2A	Option 3A	Option 4A
SO _x	1h	0,35	-	-	0,0681	0.13
	24h	0,125	-	-	0,0361	0.07
NO _x	1h	0,2	0,0036	0,019	0,0321	0.149
	24h	-	0,0019	0,01	0,017	0.08
Dust PM10	24h	0,2	0,00019	0,00098	0.0078	0.0078
Stack height (m)			30	40	40	-
Average Xmax (m)			4625	1976,55	2776,52	1991

From the obtained results in Table 3.16 3.17 and App. 3.1 the following comments may be made:

- **In case that O Mon III CCPP , gas-fired , open cycle**

In case that gas-fired, open cycle, bypass stack of the plant is 30 meters polluted concentrate (dust NO_x and SO₂) average one hour and 24 hours on land in dry season and rain season (follow all wind way) will lower than regulations on TCVN 5937-2005

- **In case that O Mon III CCPP, DO-fired , combined cycle**

In case that DO fired, main stack of the plant is 40 meters polluted concentrate (dust NO_x and SO₂) average one hour and 24 hours on land in dry season and rain season (follow all wind way) will lower than regulations on TCVN 5937-2005

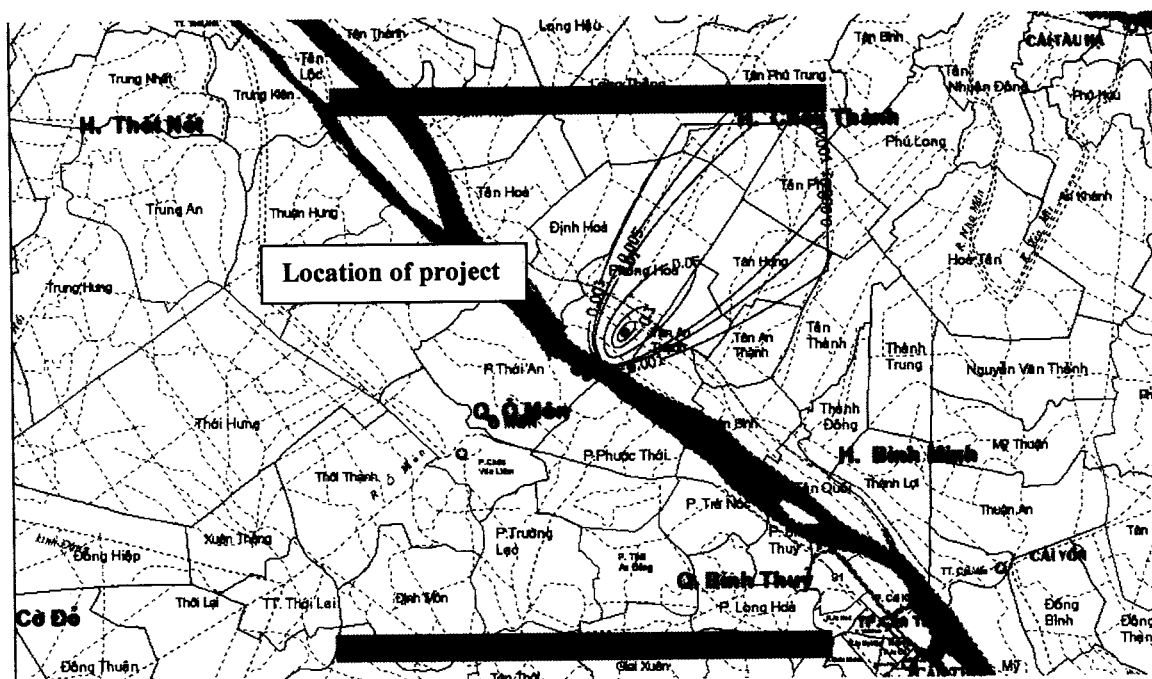
- **In case of 4 (integrated impacts of 2 O Mon I and III power Plant)**

In case of O Mon I and III power plant have total capacity 1.410MW operate together and height of stack is 140 meters and 40 meters

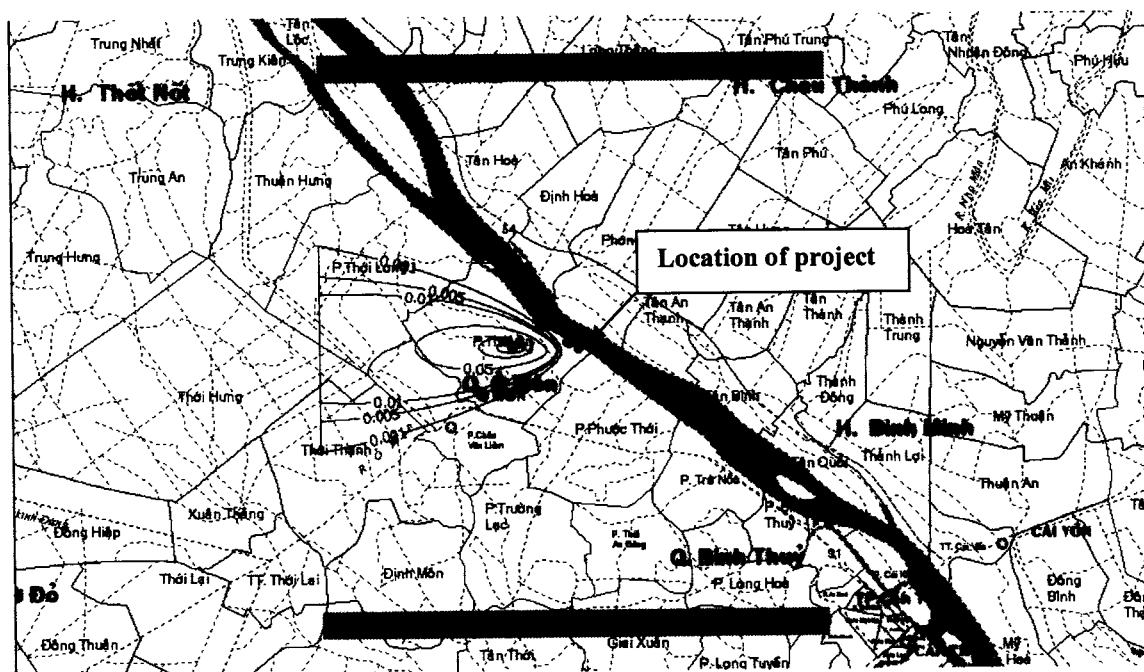
The maximum 1-hour average of ground concentration of SO₂ in dry and rain season is 0,129 mg/m³, 0,13 mg/m³, lower than limited level in regulation TCVN 5937-2005 (0,35 mg/m³)(picture. 3.1 and 3.2)

The maximum 1-hour average of ground concentration of NO_x in dry and rain season is 0,152 mg/m³, 0,149 mg/m³, lower than limited level in regulation TCVN 5937-2005 (0,2 mg/m³). Area have concentration of NO_x is higher 0,1 mg/m³ belong Thoi An street, about 2 km distance from plant (picture. 3.3 and 3.4)

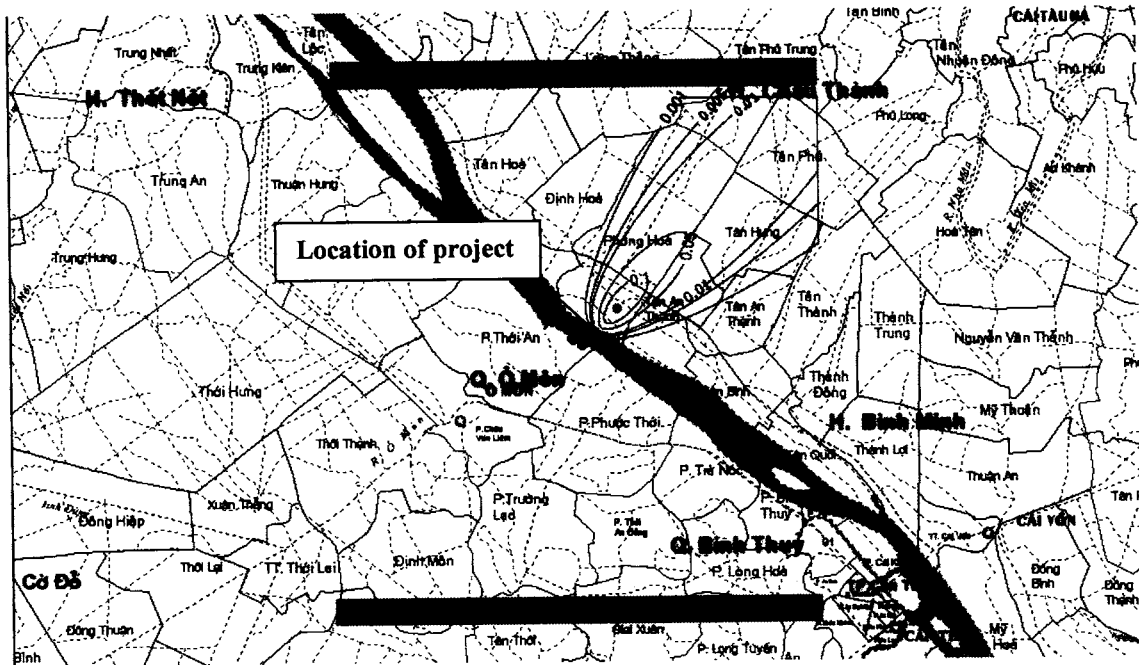
Following some pictures to improve. Calculated result and pictures show concentrates of dust, SO₂ and NO_x for the cases in dry and rain season, be shown in appendix 3.1



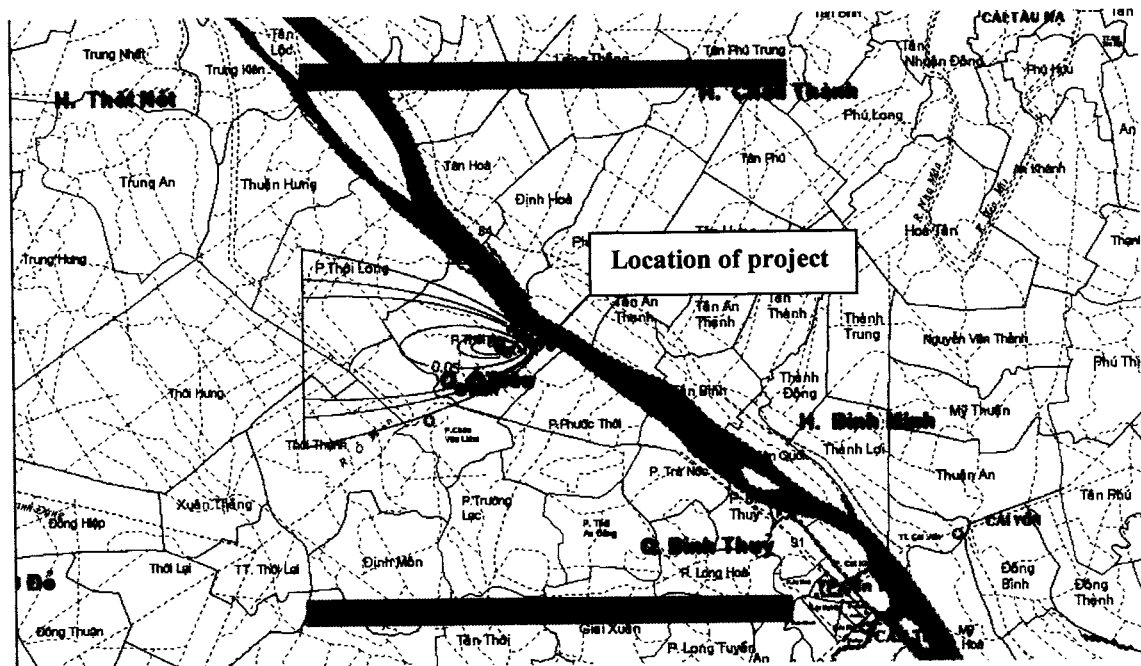
Pic. 3.1: The maximum 1-hour average of ground concentration of SO_2 in rain season



Pic. 3.2: The maximum 1-hour average of ground concentration of SO_2 in dry season



Pic. 3.3: The maximum 1-hour average of ground concentration of NO_2 in rain season



Pic. 3.4: The maximum 1-hour average of ground concentration of NO_x in dry season

Conclusion:

When burning fuel is gas, with methods to reduce NO_x of manufacturer, all quota about concentration of NO_x , SO_2 , dust at resource (stack) satisfy standard. Main stack is 40m, bypass stack is 30m

In case that combining toxic emissions between O Mon power plant I and III

When calculating impacts of combining toxic emissions of O Mon power plant I and III, in case that O Mon I power plant installs FGD system with alternately main stack is 140 m (for O Mon I power plant) and 40m (for O Mon III CCPP), toxic concentrations in ground will meet the Vietnam Standard for Ambient Air Quality (TCVN 5937-2005)

3.4.3.2. *Impacts on noise and vibration in contruction phase of the project*

- **Noise due to machines and equipments of plant**

Operations of turbin, fan, compressor .. can cause noise, vibration which affect on worker's health and officer of the plant. Nosit and high vibration cause insomnia, tiresome. High noise reduce labour productivity of worker in the product area, hard to concentrate and lead to industrial accident. So the plant must pay attention to anti-noise methods for vibrate equipments. Vietnamese standards (TCVN 5949-1995) and rule of Department of health (505BYT/QD date 13.04.1992 about noise and vibration will be applied strictly by the plant)

Noise is from the turbin system, motor, pump and fan in the plant is quite high, can reach to 80-90 dBA. However, according to surveying at the plant have power the same with Phu My #3 (burning gas 750 MW) noise doesn't affect on worker health because they work in capsule, anti-heat equipment and good anti-noise, good System of controlling pollutant. According to survey data, termly from 2004-2007 of VESDI, noise is meter near at Phu My centre terminal fences about 100m, it is always lower 75 dBA, satisfy Vietnamese Standard of environment about noise in produce area, is lay between residential quarter, time from 6 A.M to 6 P.M

Noise and vibration due to operations of the thermal plant is estimated quite high, continuous and happen in the long time. However, design and apply methods of attenuation of sound, so noise in the area doesn't exceed 70 dBA, satisfy permit standard of WB. Although, noise is quite high but residential area are far away from the plant (over 300m), impacts of noise is estimated minor and can be controlled.

3.4.3.3. *Assessment of the potential impacts on water quality*

- **Impacts of cooling water intake and discharge on river water quality**

O Mon III CCPP locates in Hau riverbank, cooling water is pumped from upstream of Hau river by cooling water system into the plant, near confluence between Hau river and Chanh canal. Maximum cooling water of water flow for plant about 18 m³/s.

Water temperature after discharging cooling system rise of about 7°C in comparison with river water temperature (average temperature of Hau river is 28-30°C, however at time up to 30-31°C, in dry season).

If Vietnam standard TCVN 5945-200, permitted waste water temperature $\leq 40^{\circ}\text{C}$, discharging cooling water doesn't infringe upon discharging standard. Because maximum temperature of cooling water $31^{\circ}\text{C} + 7^{\circ}\text{C} = 38^{\circ}\text{C}$

However, ecological field intaking and discharging cooling water can be effect negative to water ecosystem and aquiculture resources.

Table 3.18. Impacts to thermal Plume Model

Parameter	Value
Type of discharge	Parallelepiped canal perpendicular to riverbank
Dimension of the discharge gate	26.3 m Wide, 4 m deep
Discharge flow rate	- Option 1 (Only O Mon III CCPP): 18 m ³ /s - Option 2 (integration to two I and III power plant): 48.1 m ³ /s
Length of cooling water discharge trench	2000 m
Temperature difference	7,5 - 8 °C
Current of surrounding medium	Bounded, straight no winding
Tide	Diurnal, water level difference: 2.1m. Tidal current: 0.0 – 2.0 m/s.
Wind	Average speed: 2.5 m/s ; max speed: 34 m/s

- **Impacts caused intaking cooling water**

With water flow is taken in cooling system is 18m³/s, a big amount of fish eggs, young fish, shrimp and plankton will be took in cooling system. In the dash condition in the cooling system of the plant and high temperature almost shirmp, fish will be dead. This is negative impact of the project. With lossing a part og shrimp, fish on the Hau river will take apart in reducing aquatic production in provinces along Hau river.

However, so intaking water flow into the plant compared with Hau river water flow is fairly small (about < 25 minimum flow of Hau river (18m³/s : 1000m³/s) and less than 0,1% maximum flow (18m³/s: 20.000m³/s), therefore loss level about source of income of aquatic product in Hau river because maximum water intake isn't up to 2%. Breeding fish season and harvesting fry fish is primarily in torriental rain season (May-July) when having high water flow. Consequently, this early season source of income of aquatic product will bw loss due to plant is insignificant. Besides, at present source of income economic of aquatic product in provinces along Hau river (An Giang, Can Thơ, Vinh Long, Soc Trang, Ben Tre) is primary vessels fish hatching. Therefore, no effect due to water intaking of Hau river to power plant.

- **Impacts of polluted heat due to cooling water discharging.**

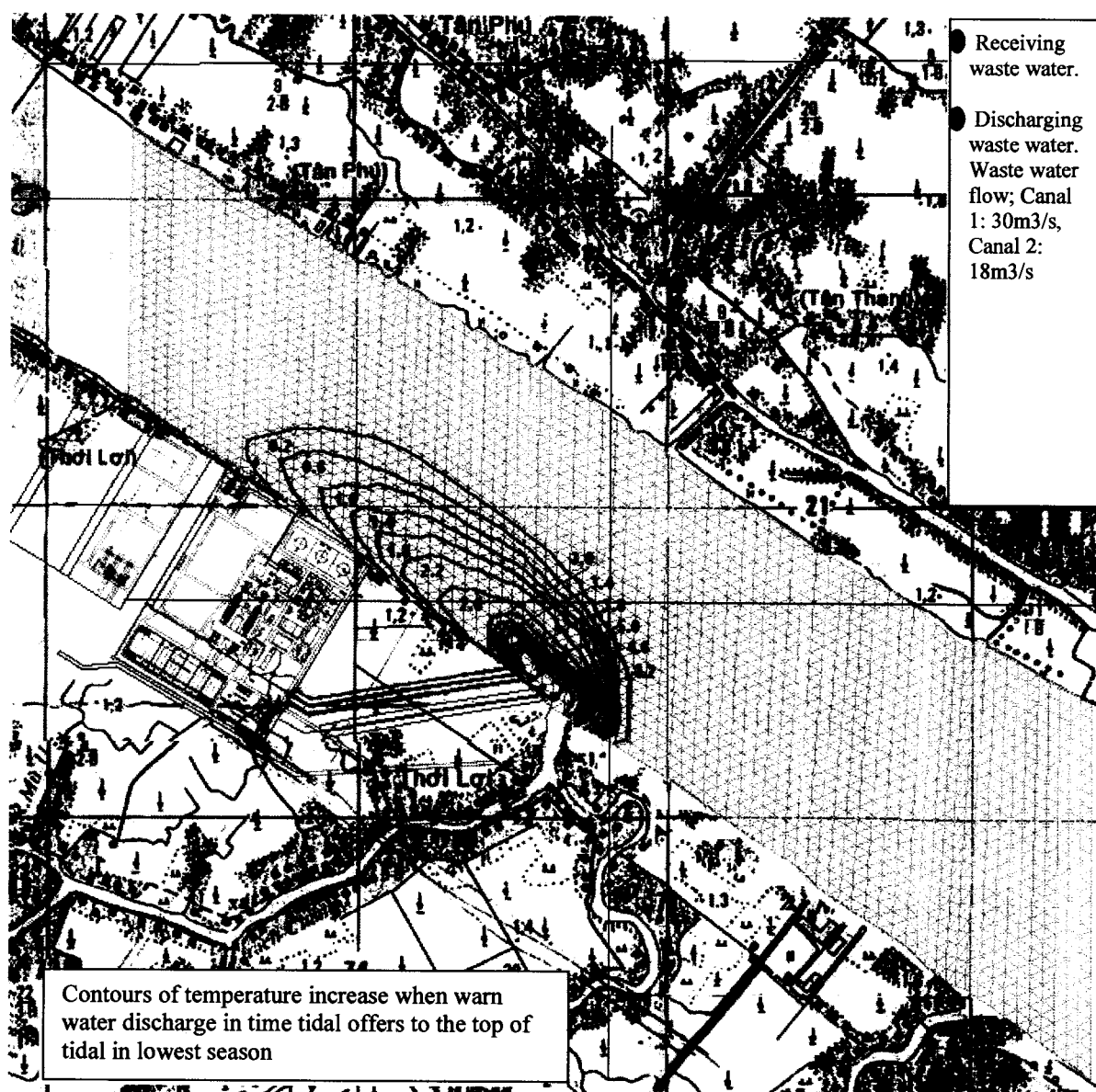
In an attempt to predict the impact of cooling water river water quality and aquatic organism, PECC2 has cooperated with the Applied Mechanics Institute in modeling of heat diffusion. A 2-D Surface Water Flow and Solute Transport program (SW - FAST 2D) was utilized in modeling and computation.

Cooling water of O Mon III CCPP with flow $18 \text{ m}^3/\text{s}$ and temperature 38°C will discharge to Hau river. Cooling water of this plant will be discharged together with O Mon IV power plant by cooling water discharge system

Details of the diffusion model are given in *Annex 3.2*. Detailed data on topography, tide, meteorology used for modeling are shown in *Annex 3.2*.

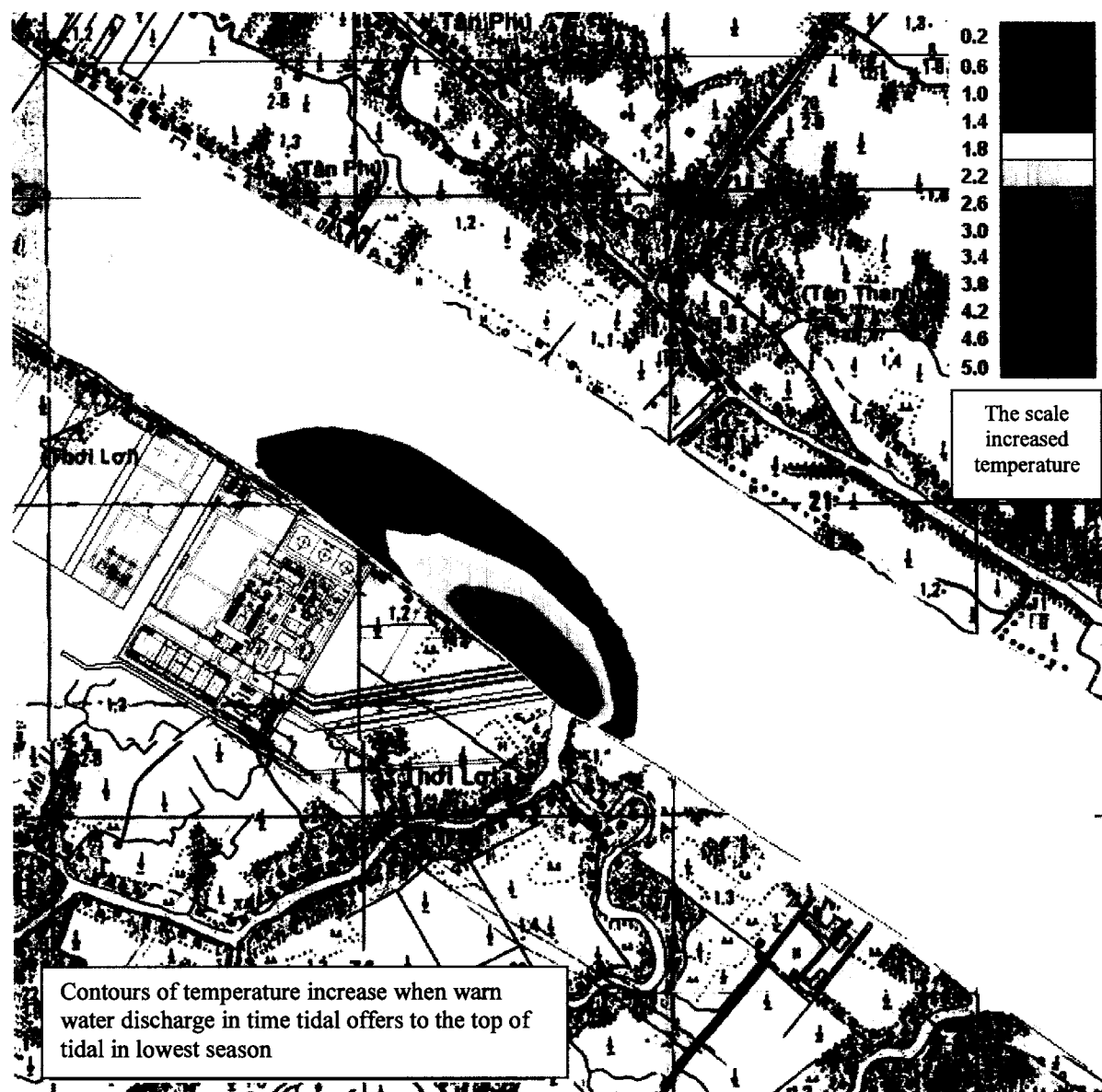
Based on input parameters shown in *Table 3.18* and in combination with meteorological data of the project site, the model of cooling water diffusion is computed with scenarios as follows:

Figure 3.5. Modeling of unequal temperature at calculated button in case of tidal flow of water level to tidal leak in lowest season



Distance from water intake point (green button) to water outlet I+II ($30 \text{ m}^3/\text{s}$) is 1127 metres

Figure 3.6. Modeling of unequal temperature at calculated button in case of tidal flow of water level to tidal peak in lowest season



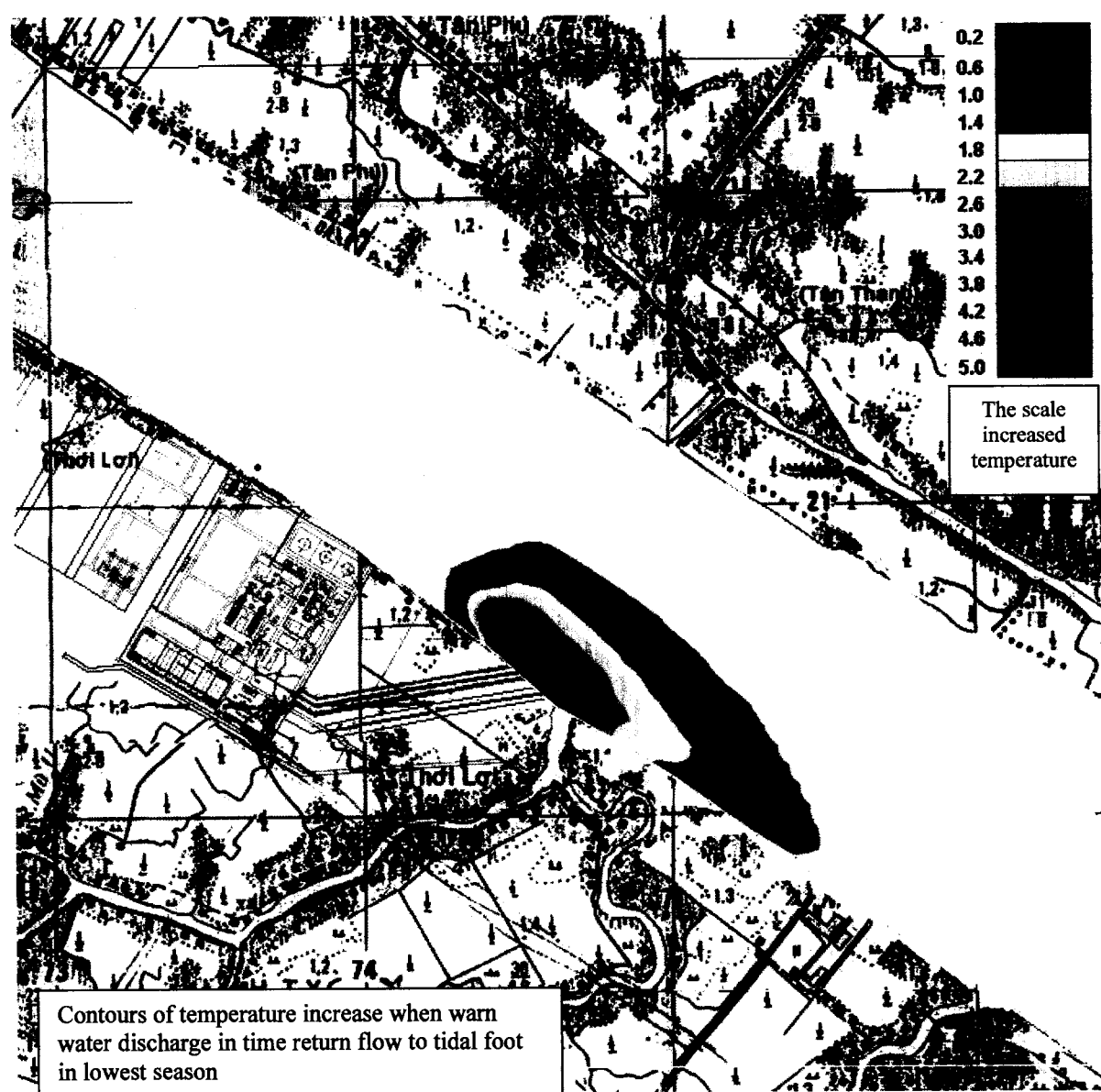
Distance from water intake point (green button) to water outlet I+II (30m³/s) is 1127 meters

Figure 3.7. Modeling of unequal temperature at calculated button in case of return flow of water level to tidal foot in lowest season



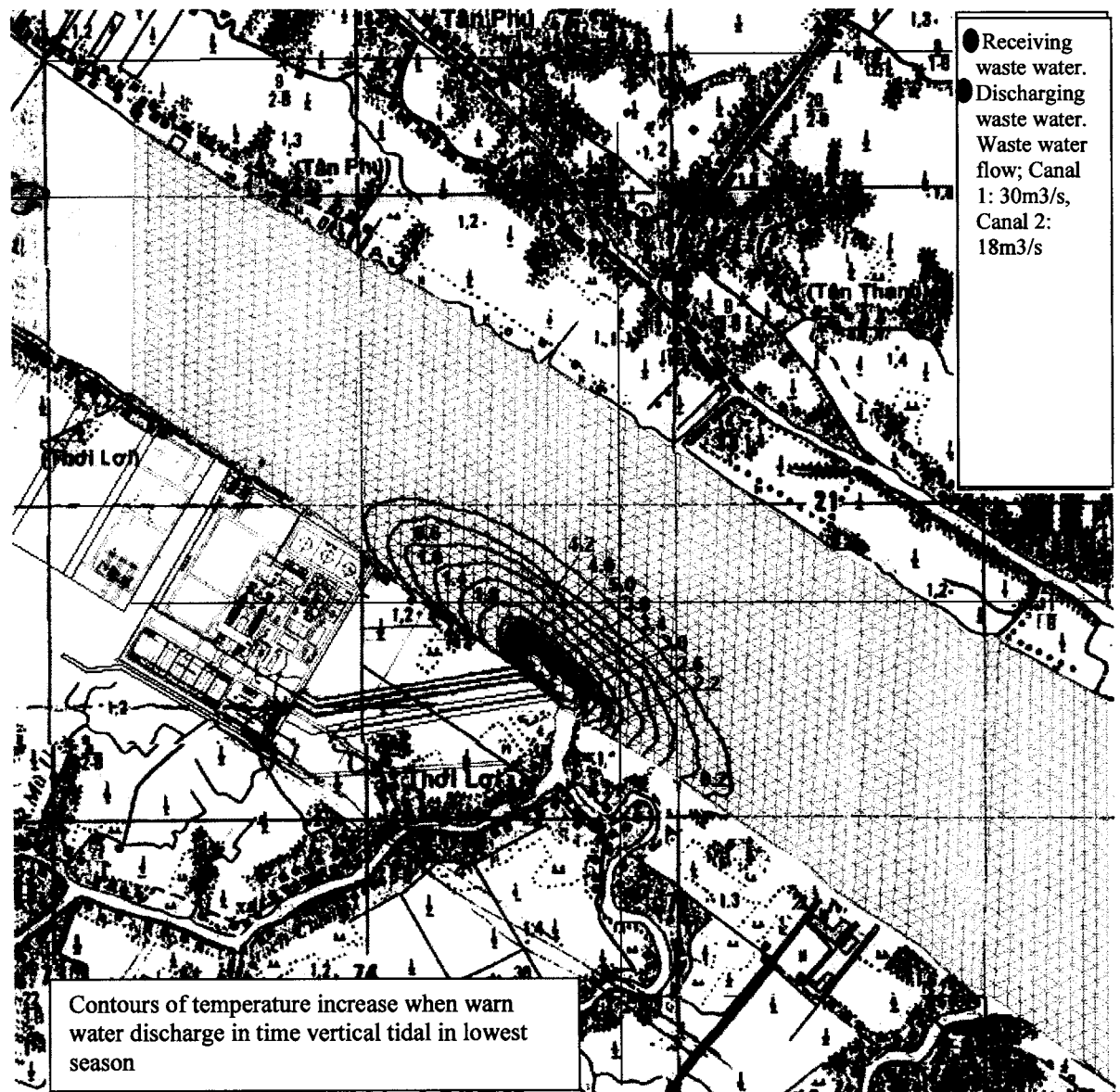
Distance from water intake point (green button) to water outlet I+II (30m3/s) is 1127 meters

Figure 3.8. Modeling of unequal temperature at calculated button in case of return flow of water level to tidal foot in lowest season



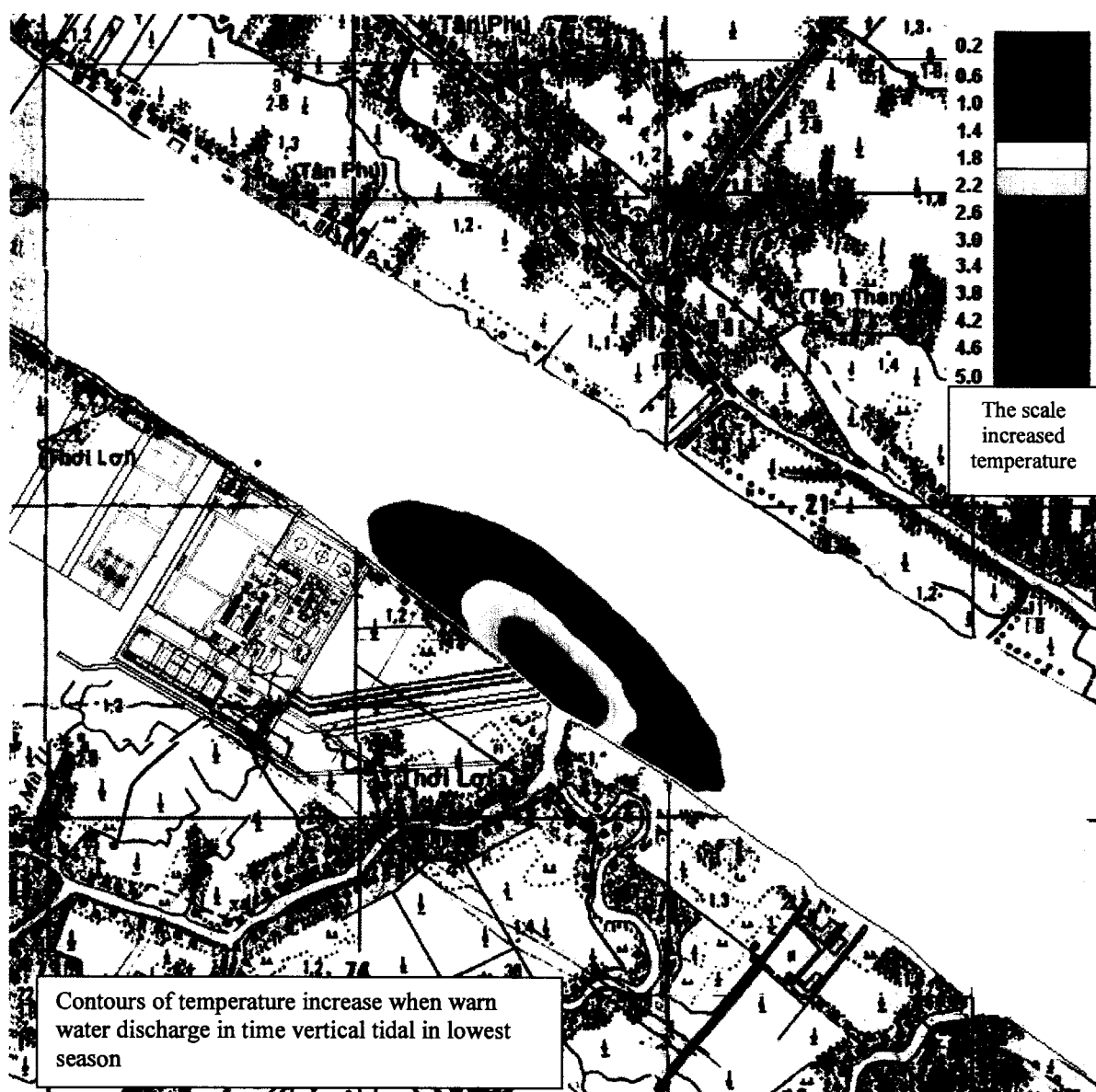
Distance from water intake point (green button) to water outlet I + II (30m³/s) is 1127 meters

Figure 3.9. Modeling of unequal temperature at calculated button in case of water level to vertical tidal in lowest season



Distance from water intake point (green button) to water outlet I+II (30m³/s) is 1127 meters

Figure 3.10. Modeling of unequal temperature at calculated button in case of water level to vertical tidal in lowest season



Distance from water intake point (green button) to water outlet I +II (30m³/s) is 1127 meters

Table 3.19. Unequal temperature distribution at calculated button in case of tidal flow of water level to tidal leak in lowest season

Button	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.03	0.14	0.23	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.07	0.27	0.38	0.37	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.19	0.38	0.42	0.54	0.39	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.35	0.51	0.63	0.70	0.53	0.48	0.24	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.43	0.62	0.70	0.78	0.67	0.55	0.43	0.22	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.51	0.74	0.83	0.91	0.78	0.63	0.56	0.38	0.16	0.04	0.00	0.00	0.00	0.00	0.00	0.00
17	0.62	0.92	1.08	1.03	0.89	0.72	0.60	0.48	0.31	0.11	0.00	0.00	0.00	0.00	0.00	0.00
18	0.73	1.10	1.20	1.21	1.12	0.91	0.67	0.57	0.40	0.22	0.05	0.00	0.00	0.00	0.00	0.00
19	0.97	1.21	1.35	1.40	1.25	1.13	0.78	0.70	0.48	0.28	0.12	0.00	0.00	0.00	0.00	0.00
20	1.13	1.34	1.59	1.62	1.44	1.22	1.03	0.78	0.53	0.34	0.25	0.03	0.00	0.00	0.00	0.00
21	1.24	1.72	1.78	1.80	1.57	1.32	1.15	1.03	0.62	0.39	0.30	0.10	0.00	0.00	0.00	0.00
22	1.42	1.81	1.90	1.90	1.68	1.51	1.25	1.15	0.78	0.44	0.34	0.16	0.00	0.00	0.00	0.00
23	1.65	2.19	2.15	2.05	1.82	1.63	1.43	1.23	0.93	0.50	0.39	0.21	0.00	0.00	0.00	0.00
24	1.94	2.27	2.30	2.23	1.97	1.74	1.55	1.30	1.04	0.62	0.41	0.23	0.01	0.00	0.00	0.00
25	2.01	2.48	2.50	2.30	2.22	1.93	1.73	1.43	1.15	0.73	0.45	0.24	0.02	0.00	0.00	0.00
26	2.38	2.57	2.54	2.45	2.30	2.12	1.80	1.50	1.23	0.85	0.47	0.24	0.03	0.00	0.00	0.00
27	2.46	2.66	2.60	2.56	2.41	2.16	1.94	1.57	1.26	0.88	0.53	0.25	0.03	0.00	0.00	0.00
28	2.53	2.74	2.63	2.60	2.52	2.20	2.08	1.63	1.28	0.90	0.58	0.25	0.03	0.00	0.00	0.00
29	2.68	2.83	2.78	2.75	2.60	2.35	2.15	1.75	1.35	0.93	0.69	0.25	0.03	0.00	0.00	0.00
30	2.83	2.91	2.90	2.80	2.70	2.45	2.25	1.90	1.45	0.98	0.78	0.25	0.03	0.00	0.00	0.00
31	2.90	3.66	3.81	3.43	2.80	2.56	2.29	1.98	1.53	1.03	0.84	0.25	0.03	0.00	0.00	0.00
32	3.68	4.47	4.54	4.22	3.21	2.75	2.35	2.10	1.65	1.12	0.85	0.25	0.03	0.00	0.00	0.00
33	4.45	5.12	5.41	4.50	3.43	2.88	2.44	2.23	1.70	1.15	0.85	0.26	0.03	0.00	0.00	0.00
34	4.47	5.06	5.37	4.48	3.39	2.78	2.41	2.21	1.60	1.10	0.73	0.25	0.03	0.00	0.00	0.00
35	4.44	4.82	4.98	4.14	3.34	2.74	2.39	2.18	1.55	1.06	0.65	0.23	0.02	0.00	0.00	0.00
36	4.43	4.70	4.81	4.07	3.27	2.65	2.34	2.13	1.47	0.97	0.51	0.16	0.01	0.00	0.00	0.00
37	4.12	4.43	4.52	3.86	2.94	2.48	2.16	1.89	1.28	0.77	0.35	0.07	0.00	0.00	0.00	0.00
38	2.86	3.81	3.95	3.41	2.72	2.30	2.02	1.76	1.13	0.63	0.14	0.01	0.00	0.00	0.00	0.00
39	1.74	2.50	2.89	2.53	2.14	1.89	1.58	1.40	0.68	0.17	0.00	0.00	0.00	0.00	0.00	0.00
40	0.52	1.65	1.96	1.62	1.49	1.31	1.17	0.68	0.23	0.01	0.00	0.00	0.00	0.00	0.00	0.00
41	0.00	0.43	0.61	0.59	0.52	0.48	0.25	0.13	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	0.00	0.00	0.02	0.03	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 3.20. Unequal temperature distribution at calculated button in case of return flow of water level to tidal foot in lowest season

Button	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.02	0.06	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.31	0.52	0.61	0.52	0.21	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.48	1.70	1.96	1.62	0.73	0.31	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	1.69	2.55	2.89	2.53	1.77	0.89	0.47	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

30	2.68	3.47	3.71	3.28	2.62	1.57	1.01	0.46	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	3.79	4.45	4.46	3.86	3.19	2.32	1.58	0.77	0.38	0.01	0.00	0.00	0.00	0.00	0.00	0.00
32	4.61	4.96	4.83	4.42	3.48	2.89	2.20	1.54	0.87	0.34	0.05	0.00	0.00	0.00	0.00	0.00
33	4.54	5.35	5.40	4.60	3.51	2.94	2.38	1.83	1.36	0.67	0.25	0.02	0.00	0.00	0.00	0.00
34	4.52	5.21	5.34	4.43	3.45	2.97	2.57	2.16	1.53	0.85	0.48	0.14	0.00	0.00	0.00	0.00
35	4.51	5.03	5.12	4.40	3.40	2.96	2.56	2.17	1.66	1.03	0.64	0.25	0.02	0.00	0.00	0.00
36	4.57	4.92	5.01	4.41	3.35	2.84	2.45	2.14	1.63	1.10	0.64	0.28	0.03	0.00	0.00	0.00
37	4.43	4.62	4.78	4.12	3.17	2.75	2.29	1.98	1.53	1.03	0.60	0.27	0.03	0.00	0.00	0.00
38	3.40	3.99	4.25	3.43	2.95	2.56	2.25	1.90	1.45	0.98	0.56	0.27	0.03	0.00	0.00	0.00
39	3.14	3.63	3.80	3.11	2.84	2.45	2.15	1.75	1.35	0.93	0.52	0.26	0.03	0.00	0.00	0.00
40	2.63	2.82	3.01	2.65	2.56	2.35	2.08	1.63	1.28	0.90	0.48	0.25	0.03	0.00	0.00	0.00
41	2.28	2.41	2.70	2.48	2.31	2.20	1.80	1.50	1.23	0.85	0.43	0.22	0.03	0.00	0.00	0.00
42	1.91	2.23	2.45	2.31	2.16	1.97	1.73	1.43	1.15	0.73	0.39	0.20	0.02	0.00	0.00	0.00
43	1.85	2.11	2.31	2.23	2.03	1.74	1.55	1.30	1.04	0.61	0.35	0.18	0.01	0.00	0.00	0.00
44	1.56	1.95	2.12	2.05	1.82	1.63	1.43	1.23	0.93	0.50	0.30	0.11	0.00	0.00	0.00	0.00
45	1.30	1.78	1.90	1.90	1.68	1.51	1.25	1.15	0.89	0.44	0.26	0.07	0.00	0.00	0.00	0.00
46	1.20	1.59	1.78	1.80	1.50	1.32	1.15	1.03	0.62	0.41	0.21	0.04	0.00	0.00	0.00	0.00
47	1.03	1.41	1.55	1.62	1.35	1.22	1.03	0.78	0.53	0.36	0.15	0.02	0.00	0.00	0.00	0.00
48	0.81	1.20	1.35	1.40	1.25	1.13	0.78	0.70	0.48	0.30	0.08	0.00	0.00	0.00	0.00	0.00
49	0.70	1.03	1.20	1.21	1.12	0.91	0.67	0.57	0.40	0.21	0.00	0.00	0.00	0.00	0.00	0.00
50	0.66	0.92	1.14	1.12	1.01	0.82	0.64	0.51	0.34	0.17	0.00	0.00	0.00	0.00	0.00	0.00
51	0.62	0.81	1.08	1.03	0.89	0.72	0.60	0.45	0.28	0.13	0.00	0.00	0.00	0.00	0.00	0.00
52	0.51	0.68	0.83	0.91	0.78	0.63	0.56	0.38	0.16	0.02	0.00	0.00	0.00	0.00	0.00	0.00
53	0.39	0.53	0.75	0.82	0.67	0.55	0.43	0.22	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	0.27	0.35	0.63	0.70	0.53	0.48	0.25	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	0.15	0.32	0.42	0.54	0.37	0.26	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	0.03	0.26	0.38	0.37	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57	0.00	0.03	0.21	0.18	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
58	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 3.21. Unequal temperature distribution at calculated button in case of water level to vertical tidal in lowest season

Button	1	2	3	4	5	6	7	8	9	10	1	12	13	14	15	16
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.02	0.06	0.10	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.03	0.19	0.28	0.36	0.23	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.07	0.37	0.53	0.48	0.34	0.27	0.11	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.42	0.66	0.80	0.85	0.70	0.51	0.23	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.58	0.79	1.04	1.07	0.89	0.62	0.48	0.23	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.69	1.17	1.23	1.25	1.02	0.77	0.60	0.48	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.87	1.26	1.35	1.35	1.13	0.96	0.70	0.60	0.23	0.02	0.00	0.00	0.00	0.00	0.00	0.00
26	1.10	1.64	1.60	1.50	1.38	1.08	0.88	0.68	0.38	0.08	0.00	0.00	0.00	0.00	0.00	0.00
27	1.39	1.72	1.75	1.68	1.53	1.30	1.12	0.82	0.52	0.19	0.03	0.00	0.00	0.00	0.00	0.00

28	1.83	2.02	1.99	1.90	1.75	1.57	1.25	0.95	0.68	0.30	0.07	0.00	0.00	0.00	0.00	0.00
29	2.13	2.28	2.23	2.10	2.05	1.80	1.60	1.20	0.80	0.38	0.12	0.00	0.00	0.00	0.00	0.00
30	2.28	2.36	2.35	2.25	2.15	1.90	1.70	1.35	0.90	0.43	0.17	0.03	0.00	0.00	0.00	0.00
31	2.35	3.11	3.26	2.88	2.25	2.01	1.78	1.43	0.98	0.48	0.18	0.05	0.00	0.00	0.00	0.00
32	3.13	4.72	4.69	4.22	2.66	2.20	1.83	1.55	1.10	0.57	0.21	0.08	0.00	0.00	0.00	0.00
33	3.90	5.24	5.41	4.55	2.88	2.22	1.89	1.68	1.15	0.60	0.25	0.11	0.00	0.00	0.00	0.00
34	3.92	5.14	5.36	4.46	2.84	2.28	1.86	1.66	1.21	0.55	0.30	0.12	0.00	0.00	0.00	0.00
35	3.96	4.93	5.05	4.27	2.85	2.31	2.01	1.62	1.18	0.48	0.30	0.11	0.00	0.00	0.00	0.00
36	4.02	4.81	4.91	4.24	2.80	2.29	1.90	1.59	1.06	0.55	0.26	0.10	0.00	0.00	0.00	0.00
37	3.88	4.53	4.65	3.55	2.53	2.20	1.74	1.43	0.98	0.48	0.22	0.08	0.00	0.00	0.00	0.00
38	2.85	3.44	3.63	2.88	2.40	2.01	1.70	1.35	0.85	0.43	0.19	0.05	0.00	0.00	0.00	0.00
39	2.49	3.01	3.25	2.56	2.20	1.90	1.60	1.20	0.70	0.38	0.15	0.03	0.00	0.00	0.00	0.00
40	2.08	2.27	2.38	2.22	2.01	1.80	1.53	1.08	0.57	0.31	0.10	0.02	0.00	0.00	0.00	0.00
41	1.73	1.86	1.94	1.93	1.74	1.65	1.25	0.95	0.46	0.24	0.07	0.00	0.00	0.00	0.00	0.00
42	1.36	1.57	1.78	1.76	1.52	1.42	1.18	0.88	0.33	0.15	0.02	0.00	0.00	0.00	0.00	0.00
43	1.01	1.22	1.42	1.34	1.15	1.01	0.84	0.58	0.21	0.11	0.00	0.00	0.00	0.00	0.00	0.00
44	0.75	0.92	1.00	1.05	0.96	0.85	0.70	0.35	0.13	0.04	0.00	0.00	0.00	0.00	0.00	0.00
45	0.48	0.71	0.82	0.76	0.78	0.67	0.48	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
46	0.29	0.53	0.64	0.57	0.57	0.36	0.24	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	0.11	0.32	0.43	0.38	0.41	0.27	0.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	0.03	0.13	0.20	0.17	0.24	0.17	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	0.00	0.09	0.16	0.12	0.10	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.03	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* data column are correlative with 16 vertical net line follow the river is numbered increase from right blank, data row are correlative with horizontal net line follow the river is numbered from upstream to lower section of river section.

Through surveying and calculating by model, can be seen flow at region around the outlet in the dry season: average water level about 0.12m and waver about -1.35m to 1.01m, , the flow speech vary about 0.2m/s to 1m/s. The flood season have the highest water level is 1.95m

Stream topography where placed outlet advantage to discharge warm water due to: depth and near main stream of river. If putlet is lower 5 metres deep and outlet far from coast about 50 metre, diffusing capacity and exchange heat get high productivity. In environment conducted, heat scatter long every cannal to cửa xả is about 0.86°C in the dry season. Scattered capacity of warm water along cannal from discharge place to outlet is quite considerable. Due to need to clear entrails of cannal and surface of discharge cannal for increasing capacity of discharging heat in the channal when discharging to outlet.

Result of heat spread show through distributing temperature of warm water follow stream rule in the dry season agree with another cases of tidal current is shown in tables 4,5,6 and pictures 3.5 to 3.7 (appendix 3.2). degree of heat difference in 4,6 metre deep agree with another tidal current is shown in table 7,8 and 9 (appendix 3.2) Only tidal flow case reach to top heat can be scattered to intake and cool the nearest (see pic. 3.5-3.7) can reach 0,2°C. However this case suit with dry condition, in the rain season capacity drop heat status, it is hard to happen.

• Impacts of accumulating cooling water of the plant

Calculating accmulating water of the O Mon Generation Complex which discharge to the Hau River, performed in the O Mon generation complex master plan report. This report mention sum up total estimation of waste water of four plants:

The result show:

- ◆ In the worse case, the temperature has just increased only March and April in a year (dry season), but it is still in permitted level.
- ◆ Reproduced result in the April (see appendix 3.2) show cooling water doesn't affect to water point which cool the plant in the project.
- ◆ Combining with referring the results of auditing the account of Phu My 1 CCPP can conclude in the real operation, Hau river of water temperature in water receiving area. In worse case, febrifuge water will increase $2,5^{\circ}\text{C}$

- **Impacts on aquatic ecosystem due to temperature**

Increasing river temperature will decrease dissolved oxygen concentration in water and decrease water density. This impact affect basic physics of water ecosystem, from that affect negative to life aquatic in the region. According to research of the foreign scientist:

- In the condition, river temperature is higher average temperature of the river, fish species stand temperature bad, they will be dead. Meanwhile, some species can stand temperature, will increase amount untill they change their community structure. At that time, exotic species like tubificid *Branchiura sowerbyi* will have big density. At high temperature, speech of respiration and aquatic development can be changed untill changing respritory speech of creatures, reproductive cycle and development increase with speech, too. At high temperature, aquatic creatuers will be affected by pollutant in the water. Like this, decreasing dissolved oxygen concentration in the polluted organic water, it is easy to decline sensitive creature.
- For aquatic sensitive creature with temperature, body temperature usually differ with environment about $0,5$ to 1°C , so that water temperature can affect much and directly to thier process of metabolism. In the natural, fish is easy to get used to temperature changing like temperature range in temperate country between winter and summer from 0 to 30°C . However, fish is shocked with abrupt temperature changes of $8 - 12^{\circ}\text{C}$. In those cases, fish can be dead, have paralytic symptom of respiration and myocardium. For young fish, this case happen when water temperature change suddenly from $1,5-3^{\circ}\text{C}$.
- When increasing river temperature, speech of respiration and nhip tim of fish will increase to absorb oxygen to satisfy speech of transfromation when dissolved oxygen concentration decrease. A research show *Cyprinus carpio* in 1°C can stand low oxygen concentration is $0,5\text{mg/l}$ but in 35°C can alive when oxygen concentration is $1,5\text{mg/l}$

If warm water of O Mon III CCPP cause river temperature near exhusted gate in 20meters region increase 4°C , the highest temperature is $34-35^{\circ}\text{C}$. This temperature affect on bottom creatures in the exhusted drain. Some bottom creatures are sensitive with temperature like *Artemia salina*, *Metapenacuseusis* *Macrobrachium rosenbergii* *Mytilus smargadinus* have the highest limited temperature 100% (LC100) is $40-42^{\circ}\text{C}$. In fact, temperature range for reproducing of bottom creatures in tropical country is $20-34^{\circ}\text{C}$, optimum temperature for reproducing of bottom creatures in tropical country is $25-28^{\circ}\text{C}$. So that, river temperature Increase 1°C only affect on reproductive output of these creatures but can't be dead.

Increasing temperature affect on microorganism. In temperature 16-19⁰C, property of microorganism is the highest. This property will be decrease according to increasing temperature but increasing amount of individual.

However causing negative to water ecosystem, harm level due to heat pollution from cooling water discharge from the plant is not dangerous. Temperature chang in the long time isn't in the big level, aquatic creatures easy to get used to new condition and immigrate to area far exhausted gate of cooling water.

Can be forecasted big affect of the project and long-term. This impact need to constantly observe

3.4.3.4. Impacts on environment of water waste

- **Industrial waste from O Mon thermal plant**

- *Chemical wastewater*

Chemical wastewater include wastewater from the system of chemical wastewater treatment and clean up condenser (188m³ per day), wastewater from the system of water demineralization treatment (222m³ per day) and blowdown (309m³/ngày)

Waste water from this system include neutralize salt, soda, acid inorganic. Waste water is gathered into the neutral pond to treat. In the normal condition, amount of soda and acid are the same equivalent so they can be neutralized themself. When amount of acid or odd alkali, system of water treatment will add alkali or acid to neutralize. So that wastewater from demineralization system will be treated to sastify Vietnam standards before discharging to environment and don't harm environment.

- *Wastewater is cleaned up by chemical equipment method*

To cleaning up boiler equipment, air compressor, air turbine to avoid deposits and stick things, using cleaning chemical method. This task is carried out one time per year with output 600m³ per day, is a unusual wastewater. This wastewater contain inorganic substances (CaCl₂, MgCl₂, NaCl ...) and toxic substances like salt compound of Fe, Cu, Si and another organic substances

This type of wastewater isn't treated will affect on water environment quality and affect on life of aquatic creatures.

- **Oil contaminated waste water**

Resources arise and output of Oil contaminated waste water from O Mon III CCPP with output 195m³ per day, include:

- Wastewater from main machine STG+GTG and HRSG

- Wastewater from transformer area, distribution yard.

- Wastewater from another support area

- Wastewater from diesel factory

- Wastewater from oil tank area

With low density and high lively when in the water, oil is easy to spread to thin layer to cover the water surface, prevent oxygen infiltrate into water, to reduce DO concentrate in water, so lead to decrease itself cleaning capacity of water resource and harm life of aquatic creatures. Oil infiltrate into respiratory organs of shrimp, fish and prevent from breathe process. Oil have stick capacity in the tree root, leaves prevent photosynthesis capacity and metabolism. Flora of Hau river bank like cypress, nipa, ... capacity is sticker highly by oil. Due to impact of element environment (temperature, wind, radiation, flow, microorganism ... impact of oil decrease slowly

Some heavy oil can be sunk to the bottom, stick mud, hard to disintegrate will affect water quality and aquatic creatures long.

Thus, if it is not treated to reach permit standards, wastewater contain oil can affect on aquatic ecosystem of Hau river which receive wastewater of plant and canal, arroyo around the plant.

Wastewater standard for O Mon III CCPP obey Vietnam standard TCVN 5945-2005, type A

- **Domestic wastewater**

When the plant operate stably, worker needs for operation estimate maximum 191 people. Domestic wastewater is mainly in administrative area and bathroom, refectory, toilet Domestic wastewater contain organic concentrate, suspended solid, oil, high nutriment.

Amount of domestic wastewater are calculated average about 35m³ per day and night with concentrate of pollutant in the wastewater which are estimated follow the estimated method of WHO:

BOD	: 245.6 - 294.7 mg/l
COD	: 463.9 – 645.9 mg/l
SS	: 382 - 791.3 mg/l
Virus	: 10 ⁶ - 10 ⁹ mg/l

TCVN 6772-2000 fix permit limit polluted parameter in the wastewater as: (table 4.15)

Table 3.22.- Vietnam standard of domestic wastewater (TCVN 6772-2000)

Polluted parameter	Unit	Permitted limit				
		Level I	Level II	Level III	Level IV	Level V
1. pH		5-9	5-9	5-9	5-9	5-9
2. BOD	mg/l	30	30	40	50	200
3. Suspended solid	mg/l	50	50	60	100	100
4. Total coliforms	MPN/ 100ml	1000	1000	5000	5000	10000

Note: Level I is applied for project case

This above estimation and table 3.22 show pollutant concentrate in the domestic wastewater surpass many times of regulation of Vietnamese standard. However, the project will be designed and build treatment system of domestic wastewater (Chapter four) so this impact will reduce.

- **Estimating impact of pollutant wastewater**

- **Organic substance**

Level of polluted organic substance in water resource is show through BOD₅ parameter. With high organism substance concentrate, it lead to decline oxygen concentrate dissolve in water due to microorganism use this oxygen concentrate for

disintegrating organism substances. Dissolve oxygen concentrate reduce down level 50% saturated will cause harm dangerous aquatic resource. Quality standard of FAO fishing fix dissolved oxygen concentrate (DO) in water must be higher 50% saturated value, it is higher 4mg/l in 25⁰C. In the tropical area this limit is about 3,8mg/l. Beside, low oxygen concentrate affect cleaning itself capacity of river. Standard of water surface quality serve the water supply factory is fixed BOD value is 2,5-6,0 mg/l.

- *Suspended solid (SS):*

Suspended solid is agent affect negative to aquatic resource, at once impact on the sense organs, increasing opaque degree of water resource and cause to raise the level of canal and arroyo.

- *Nutritive substances (N,P):*

Water resource have reasonable nutritive level is a good condition for marine algae, aquatic creature develop, create develop condition of aquatic produce. When nutritive concentrate is too high (sugar-coat phenomenon) lead to develop explosion of marine algae. Sugar-coat cause to reduce water quality due to increasing opaque degree, increase organic concentrate and can have toxic for marine algae discharge, cause an obstruction the life of aquatic creatures and affect on supply domestic water.

3.4.3.5. *Impacts of environment due to solid waste*

- ***Industrial solid waste***

Industrial solid waste like many types of packing, wiper have oil, ash if not gathering and treating, it will be polluted water environment and affect sight area around the plant

Sediments from the wastewater treatment: about 0.1 ton per day. Wastewater treatment can separate specific suspended solid, garbage before treating biology and chemistry.

Beside, due to the plant use DO oil so oil contaminated sediment of the plant discharge from the plant is quite big. Oil sediment are created from process of cleaning tank follow periodic 3 years per one time. Amount of oil contaminated sediment water, oil and some metal Mg, Vanadi ... estimated for 1 tank 10000 tons have 3 tons sediment. Oil sediment are rank dangerous lees is easy to explore, thus impact on environment is big if don't have effective treatment method.

Types of solid waste will be gathered separate and taken to treatment area. The plant have contract with company have transport capacity, recycle treatment and destroy according to regulation about control dangerous waste.

- ***Domestic solid waste***

With amount of worker worked in this project when operating establish about 191 people and average a person discharge about 0,8kg, amount solid waste estimate about 152.8kg per day. This type of solid waste contain many organic substances, easy to disintegrate, if not gathering and have control method, it will cause bad odor and lose beautiful sight of the plant.

In summary, solid waste of power plant aren't much but multiform chemical element. Main amount are recycle substance. So impact on solid waste from the plant is not considerable and have controllabe.

3.4.3.6. Rain water overflow

Rain water overflow through the plant roll dropping materials on the road, cause to increase high suspended solid concentrations, thus impact on water quality.

The project is designed drain system is made of ferro-steel separate with rain drain system and domestic. Rain water overflow thorough project area is gathering into rain drain system, reduce impacts on water environment area.

3.4.3.7. Heat polluted

In the dry months (from January to March), temperature in some plant position (yard, transformer, outside factories) can reach to 40⁰C. High temperature affect worker's health at this position.

High temperature will cause physiological changes and in the human body like losing sweat, enclose to lose amount of mineral salt as ion K,Na,Ca,I,Fe... Beside, working in this heat environment, ratio get an illness is higher than group working in the more advantageous environment, example digestive ill take 15% compare with 7,5%, skin ill 6,3% compare with 1,6%,... High temperature affect on worker's output, ensure health for workers

3.4.3.8. Economy society

Building and operation O Mon III CCPP will create impacts for developing economy society at the local, solve jobs for big local workforce and near area. Adding power for developing economy, improving material facilities.

With industrialization is gathered people. In general, O Mon Generation Complex and in particular, O Mon III CCPP operate will change economic constructure of some household due to changing directly to living standards and lifeway of households is some service and indirect workers. Income of worker in the plant will be higher average of local. Some people will change to do business. However, developing economic society in infrastructure of surrounding project still miss. It is latent polluted reason in the area.

Nowaday, lower population density is one of reason to make clear environment. When the power plant operate, it attract big amount of workers. Gathering workers will change way life at the local fromer is agricultural area, it will be polluted environment due domestic activities, especially applying environment treatment.

Beside, gathering worker and non-resident will affect on public order at the local. Differences, non-equal relations, contradictions between workers in the factory and locals. Especially young people happen definitely. This fact happened in many big factory, terminal centre main reason because all of this worker are from many places due to local worker satisfy about technical requirement

3.4.3.9. Environment problem

Leak fuel problem: transporting process and storing fuel in the factory (petrol, oil DO...) and chemicals are used in operation phase of the plant.

The project will build 2 tanks DO, each volume of tank has 10.000m³. Fire can happen around tank area and round gas pipeline. Burning natural gas or oil DO will affect dangerous to environment of the plant and around.

In the area in dry season, air temperature is high, humidity is low due to burning storage tank are easy to happen, especially when hydrocarbon concentrate is high and reach to fire point.

Oil spill problem, exploring oil pipeline, storage tanks: when lossing into the environment, oil and another organic substances is easy to evaporate and diffuse into atmosphere and polluted air and harm human health.

Oil spill when spilling to land and absorb into underground water will be polluted underground water resource and land.

Impacts on explore, fire will be too dangerous in the dry season. When having explore problem, affected range is not only belong to factory area but also near area. If with big pressure in the storage tanks, explosion will happen bigger impacts.

Industrial accidents: in the work, problems don't desire but sometimes it still happen. The reasons lead to accidents are diversified with a power plant has big size. Can separate 2 group: objective reason and subjective reason from management to sense of workers.

With technologies, advanced technology are applied for power plant, regularies, close operation process with test process, care regular, this impacts will be limited to minimu and estimated little, can be controlled and be reduced.

3.5. ASSESSMENT OF METHODS USED IN IMPACT PREDICTION

The methods are applied in estimating impacts on environment of the project include:

- The real survey

Collecting air samples, water surface, underground water, aquatic. Observe actuality natural environment.

- Analyzing in the lab

Analyzing the samples are gathering at the scene for the basis to estimate actuality environment.

- Consulting references and guessing

Base on international document and experience to guess the impacts can have in the project to environment and economic - society

- Compare and statistics

Base on survey result are survey and analysis at since and analyze in the lab and the result calculation is compared with Vietnamese standard for estimating environment quality at the local

Relationship with impacts of project activities to environment problems are show in the checking table. In that basic, it orient research content for every activities.

- Rapid Assessment

The methods are estimated rapid polluted land, water, air resources due to Economopolus edit, WHO published 1993 applied to calculate tonnage of pollutant due to air waste, wastewater in the building and operation phase.

- Model of environment

Model of environment is applied this research to calculating and assessing impact of project:

- Modeling of Air Pollution Dispersion caused by SO₂, NO_x, dust in toxic emission from the plant

Modeling of heat dispersion caused by discharging cooling waste water from canal to Hau river. All above methods which national organizations advise to use and be used commodious in DAA for developing project in the world. At Vietnam, above methods are applied and have good result of the forecast for DAA research for another project.

In this research, above methods are research and applied DAA by environment specialist. So, all methods are the same forecast result are estimated high trust.

4

MITIGATION METHODS AND ENVIRONMENTAL HAZARD RESPONSE

The Law on Environment Protection regulates that the Environment Impact Assessment Report must recommend mitigation methods for negative impact of the project on environment in details as well as environmental hazard prevention and response potentially caused by the project.

In this study on Environment Impact Assessment for O Mon III Combined Cycle Thermal Power Plant Project (hereinafter called the Project), the following recommended methods shall be implemented by the project owner – Vietnam Electricity – in order to prevent and eliminate potential negative impacts of the project. The study also specifies agencies/unit in charge of corresponding to each impact.

4.1 MITIGATION METHODS DURING CONSTRUCTION PHASE

4.1.1. Elimination of land, house and construction work losses

There is not any public works (temple, school and so forth) in the project area as well as conserving natural ecosystem other than cultivated land and houses of local inhabitants. Accordingly, the activities of the project shall mainly cause the damages of land and houses.

The following measures shall be applied in an attempt to reduce the damages and losses of land and houses:

Assess road, power plant and approach channel, etc shall be selected and designed suitably, in appropriate location and less effect on land and house of the local inhabitants.

Temporarily occupied area for project's activities such as camps, temporary houses and stores, etc shall be selected in location nearby the project and less effect on land and house, especially in the wide area. It is committed to compensate for all damages and losses as well as to restore to original condition upon completion.

4.1.2. Mitigation methods for impacts of site clearance

4.1.3. Implementation of compensation and resettlement program for project affected people

The construction of the project certainly shall cause socio-economic impacts affecting directly to the lives of local inhabitants.

According to compensation alternative applicable to entire O Mon Power Complex and approval letter No.734 on 02/03/2006 by Can Tho city People's Committee, all lands, houses permanently affected by the project, and trees, crops and properties permanently or temporarily affected by the project shall be compensated by the project owner (Vietnam Electricity) via the Project Management Unit in accordance with compensation unit price submitted by Appraising Committee to Can Tho city People's Committee. Total compensation cost for O Mon III thermal Power plant is estimated of more than 64 bil. VND. Up to now, there are 151 documents satisfactory to requirements of resettlement and the alternative of resettlement for 62 households was approved, for the 89 remaining documents, the Damage Compensation and Site Clearance Board had submitted the list and asked for direction on compensation of

price difference for the houses that constructed on agricultural land before 1993 and from 1993 to before 01/07/2004..

Foundations for preparation of compensation, support and site clearance of the project are current laws, decrees, circulars and regulations issued by the State and local Authorities.

At present, the Damage Compensation and Site Clearance Board is urgently implementing compensation and solving claims of local inhabitants in order to minimize negative impact on the lives of local inhabitants and to meet project's schedule.

Some households, who had not received compensation due to claims related to housing area constructed after the planning declaration, have been explained clearly by local authorities and the board and now they agreed and followed the removal policy.

4.1.4. Mitigation methods for physical environment

Environment pollution in this phase is mainly explainable to activities of site clearance, operation of machines and transport means. The project shall conduct the following specific measures:

The drainage ditches around the project site shall be excavated to collect rain water and create convenient water source for spraying during ground leveling. This process shall help to deposit sand and silt in those drainage ditches before discharging to the river.

Oil and lubricant leaked from machines shall be collected and treated at specified location in order to prevent pollutions of river surface water and adjacent arroyos.

Boundary slopes of the project area (with elevation higher than natural ground of adjacent areas) shall be reinforced to prevent slides of leveling materials in the course of leveling process and operation of powerhouse.

Vegetable layer, which is removed, shall be dumped at specified location and covered with canvas. The contractor shall take responsibility of transporting it to the specified location. In addition, during the ground leveling process, attention should be paid to balance the excavated and filled volumes to minimize disposal quantity, dust and emission due to transport activities.

Water spraying shall be carried out continuously during the ground leveling period to meet technical requirements and prevent dust causing air pollution.

During the ground leveling process, it is unavoidable to employ many transport means which generate noise exceeding allowable level. In order to reduce vibration and noise, the most suitable method for current condition of Vietnam is to employ equipment with technical parameters within environmental allowable level (or in other words, the machines are inspected by competent authorities). This matter shall be included in the bidding document of construction contractor and supervised successful contractors for entire construction period.

All trucks, which transport construction materials and rock in the project area and residential area, shall be covered with canvas.

4.1.5. Mitigation methods for ecological environment

Impacts on biological resources and landscape in this phase are unavoidable. The occupation area of plant is about 42 ha on rice field and land growing with mango, longan, orange, mandarin orange trees, etc and flooding soil ecosystem of sonnertia along Hau river which is very vulnerable. However, this strip of sonnertia in the project area is very scattered (almost disappeared), impacts of the project on this land ecosystem is insignificant. As a result, it is seem unnecessary to implement any mitigation measure.

4.2. MITIGATION METHODS DURING CONSTRUCTION PHASE

4.2.1. Impacts on air environment

Actives of construction, concrete mixing, material transport, etc were assessed in the Chapter 3. Air pollution is the main concern in this phase. It is recommended the following measures to eliminate above mentioned impacts:

Rock and material transporting trucks shall be covered during travel, tools and heavy equipment shall be transported by dedicated trucks and drivers shall comply with legal provisions on traffic to prevent traffic congestion and transportation safety.

It is unallowable to transport materials for construction process exceeding the permissible loads.

The construction units shall have suitable plan avoiding concentration of vehicles at one place at the same time in order to eliminate dust caused by material transportation and earth excavation.

The project owner shall apply suitable methods to reduce impacts of vibration and noise during construction phase on nearby areas.

In order to prevent disturbance of people living along transport route, all transport means shall not allowable to operate from 21:00pm to 6:00am of the next day.

In order to reduce impacts of noise and vibration on adjacent regions of the project, the project owner shall apply methods such as arrangement of equipment at suitable interval of vibration and noise sources and at least 200m distance from the house of local people. The construction units shall make use of modern technology of low noise level to drive piles. If it is impossible to ensure noise safety distance, the contractors shall apply silencing methods such as construction of noise abatement wall surrounding noise sensitive objects. Depending on the materials selected for construction of the wall, noise level could be reduced in range from 10 to 40 dBA at locations in front of and before the wall.

Noise level shall be checked regularly in order to make suitable construction schedule and arrange equipment and machines operating at suitable distances, within allowable noise level and avoiding concentration of noise sources in one place.

All construction machines and equipment shall be provided together with adequate documents and checked in terms of technical parameters regularly.

All employees working at the construction site shall be equipped with labor safety. At the same time, the abeyance of labor regulations shall be supervised strictly and warned.

4.2.2. Mitigation methods for surface water environment

In the course of construction, temporary rain drainage ditches shall be constructed to prevent accumulating water in the leveling area. This water drainage system shall be regularly maintained to increase rain discharge capacity of the region.

All petroleum and lubricant leakages and dropped construction materials shall be minimized and collected daily in order to prevent sweeping them away to the arroyos and changing flows.

Temporary WCs for construction workers shall be furnished. The contractor could hire removable WCs or sign contract with functional units to collect and treat such wastes.

Slopes surround the project area shall be reinforced to eliminate rock and soil slides from construction area, deposition of arroyos as well as incensement of turbidity in Hau river.

4.2.3. Mitigation methods for underground water and soil pollution

After construction, a layer of waterproofing materials such as concrete, asphalt shall reduce the restoration of ground water artery. As a result, the design for construction of the project should pay due attention to the following matters:

To strengthen the rain water penetrability of soil by not fully asphaltting all passageway, parking, etc but making grass chases and constructing rain water drainage system with grass in order to prevent corrosion and make landscape for the region.

To eliminate domestic sewage water and penetration of petroleum and lubricant as well as to protect the uncompleted foundation excavation areas.

To specify the disposal site of solid wastes for treatment

To minimize the excavated and backfilled rock and soil volumes in order to prevent disturbance of soil horizon.

To treat foundation in line with technical requirements.

4.2.4. Mitigation methods for worker concentration

In the course of construction, the surrounding environment could be in danger of solid wastes and domestic sewage water from worker's camps where usually gather about 300 people.

The construction contractor shall construct or provide suitable sanitary equipment such as removable WCs, waste bins, etc at the worker's camps in order to eliminate

such impacts. One septic tank system shall be constructed at each camping area to treat domestic sewage water.

The construction contractor shall sign contract with Urban Facilities Enterprise of Can Tho city to collect periodically wastes at worker's camps and transport them to the local disposal area. It is recommended waste collection frequency of 2 times/weeks.

Before collection and treatment, the contractor shall execute the following management methods of solid wastes:

Solid wastes shall be classified into construction waste (residual construction material), risky wastes (petroleum, lubricant and chemical wastes) and domestic solid wastes.

Everyday, solid wastes shall be collected from construction site, worker's camps and then classified into containers as regulated and transported by trucks to the disposal area of the city.

The contractor shall apply the following measures to prevent conflict between construction workers and the inhabitants:

To employ labor force in the district or others in Can Tho city at the highest level for simple works such as rock and soil excavations, material transports, cooking and so forth)

To propagandize and educate the construction workers to establish relations with inhabitants.

To make statement of temporary residence for construction workers with the police of Phuoc Thoi and Thoi An wards

To organize exchange meeting with People's Committee of wards and O Mon District on matters related to the relation between workers and inhabitant.

In an attempt to prevent transmission of infectious disease such as water borne, middle agents (such as insects) to workers and vice versa, the contractor shall comply with:

The requirements made by the project owner on arranging clinics at the construction site and nurses and providing timely all medicines, health care services and first aid to the workers when they are sick or engage in industrial accidents.

The contractor shall educate the construction workers on prevention measures and termination of disease agents such as fly, mosquito and larva, etc.

The contractor shall organize training course on labor safety for the construction workers.

The contractor shall coordinate closely with clinic of Phuoc Thoi ward in taking care of health and disease prevention.

4.2.5. Mitigation methods for matters related to the incensement of traffic on access roads of the project

In order to reduce the effects of material and equipment transportations on traffic operation on the access road, the construction contractor shall coordinate with Transport and Public works Department, Police Department of Can Tho city to execute measures such as installation of light and sign systems on section of National highway 91 crossing over the project site. The signs shall be provided at potential accident place.

Those signs also specify maximum speed at each road section.

Transport police shall control strictly traffic safety along roads used to transport materials and equipment for the project.

National highway 91 could be damaged by operation of heavy trucks. The contractor undertakes to repair the damaged road section (caused by the trucks of the project) after construction completion.

4.2.6. Fire and explosion risks

The project shall apply the following measures to eliminate fire and explosion:

To plan fuel storage area with guard, protection and water spraying in the hot days.

To inspect and maintain regularly and prevent all leakage.

To have plan, make available of fire and explosion fighting and response means and materials in case of fire and explosion events.

To raise awareness of workers and train hazard response to them

To follow labor principles and regulations on labor safety.

4.3. MITIGATION METHODS IN PROJECT OPERATION PHASE

When O Mon III Combined Cycle Power Plant is put into operation, if environmental monitoring methods do not implemented properly, many negative impacts on environment will occur as forecasted in the Chapter III as follows:

- Increasing air pollution due to dust and toxic gas (SO_2 , NO_x) from stack of the power plant.
- Increasing noise pollution and vibration due to operations of machines and equipment in the power plant.
- Increasing environment pollution due do the increscent of industrial and domestic sewage water
- Increasing environment pollution due do the increscent of industrial solid wastes
- Causing negative impacts on aquatic ecosystem of the region due to usage and discharge of cooling water
- Environmental hazards due to accident, fire and explosion in the power plant

Above impacts not only affect to the health of operators but also the health and existence of local inhabitants.

The following measures shall be applied to prevent and control above mentioned impacts.

4.3.1. Mitigation methods for taking water for cooling purpose

The following measures shall be applied in order to reduce the loss of aquatic living things due to take water for cooling purpose:

Protective and behavior screens are currently used to prevent suction of aquatic living things to the approach channel.

4.3.1.1. Protective screen

In order to prevent young fish and spawn from entering to the power plant together with cooling water, some technical measures have been applied successfully in some thermal power plants such as application of movable trash rack. When the trash rack is installed, cooling water shall be provided through small cells with dimension of 1cm x 1cm before flowing to the cooling pump.

High of trash rack shall be calculated suitably with tide and may be above 30m. Back cleaning shower is arranged near the removable top or of front face or back of the trash rack or on both sides. With the help of this structure, water hammer time shall be reduced due to its continuous movement.

However, the removable trash rack is unable to prevent fishes smaller than cells and those fish can be swept to the power plant together with cooling water.

4.3.1.2. Behavior screen

The behavior screen use one or several agents to direct the movement of fish to the expected direction. This screen is designed according to habit of some fishes such as reaction against sound, light, flow or electronic field. One thermal power plant in Lake Michigan (USD), screen with application of air bubble flow from an air compressor has made significant results in reducing impact of fish and screen. Fishes normally have habit of avoiding sudden change of horizontal flow. This principle can be applied for flow converting plate or inclined arrangement of screen in order to prevent impact of fish at the intake. Above design uses the principle of changing vertical flow into horizontal flow. However, the effectiveness of behavior screen depends on fishes and many factors such as physical condition or temperature, radiation.

O Mon III Combined Cycle Power Plant shall be equipped with a suitable rack to prevent sweeping away aquatic living things.

4.3.2. Mitigation measures for cooling waste water

4.3.2.1. Reduction of heat pollution due to cooling waste water

The cooling waste water from the power house, which has temperature in range of about 37°C, will be discharged to the cooling waste water system including one pipeline and open canal of 2 km long, 26.5 m wide and 4m deep and then to Hau

river. Accordingly, water will make heat exchange on the discharge canal with environment. Temperature of waste water will reduce corresponding to the traveling time and length of canal. On another hand, discharge and flow velocity of Hau river are very high, after discharging to the river and exchanging heat with the river, temperature of water at outlet shall increase about less than 3°C, as a result, the affected area is regarded insignificant.

Accordingly, the project shall not apply additional technical methods to reduce the impact caused by cooling waste water.

4.3.2.2. *Control of flow in cooling water waste canal*

In an attempt to reduce at the lowest level of impacts on aquatic ecosystem at the locations around cooling water waste outlet, the cooling water waste canal shall be calculated for extension and deep excavation to reduce flow velocity of cooling water waste in the canal. This method shall effectively contribute to reduce temperature of cooling water waste in the canal.

4.3.2.3. *Control of residual chlorine in cooling water*

One modern Chlorine meter shall be installed to ensure chlorine concentration not exceeding the requirement. Accordingly, the cooling water waste shall not affect to aquatic ecosystem in Hau river.

4.3.3. Mitigation methods for sewage water discharging to Hau river

4.3.3.1. *Sewage water classification*

Sewage waters from O Mon III combined cycle thermal power plant are diversified in terms of components and characteristics. The following groups are classified based on discharge sources:

- Overflow rain water depending on natural condition, rain regime, area and topographical condition of the project.
- Domestic sewage water of operators.
- Production sewage water: in general, this source is the most diversified and depends largely on production phases of the power plant.

Regarding to discharge source, waste water from the powerhouse heat polluted waste water, oil polluted waste water, chemical polluted waste water, domestic waste water, etc...

Regarding to the time, waste water from the power plant can be classified into regular and irregular waste water.

Irregular waste includes boiler cleaning water, gas turbine and compressor cleaning water

Regular waste water includes boiler waste water, waste water from cooling water system, recovered waste water of demineralized water treatment system, back washing water of raw water treatment system, laboratory waste water and domestic waste water.

Table 4.1. Summary of waste water from O Mon III thermal power plant

No.	Description	Value		Note
		m ³ /day	m ³ /h	
I	Chemical polluted water			
1	Waste water from Blowdown of heat recovery boiler	309		According to operation regime and boiler manufacturer + heat neutralization amount
2	Waste water from demineralized treatment system	222		Estimating according to the design of demineralizing system, loss factor in range of 20-25%
3	Waste water from domestic filtering chamber	20		Estimating according to the back washing water.
3	Waste water from primary treatment zone	188		Estimating according to the back washing water and sludge (excluding from water amount used in construction phase)
4	Waste water from chemical and HRSG feeding area	10		Estimating
5	Waste water from gas turbine compressor cleaning water	10		
6	Waste water from boiler cleaning water	600		Irregular waste water, total cleaning water per boiler is about 600m ³ , for 10 consecutive hours
	Total chemical polluted waste water	1359		
		759	31.6	Estimating for regular waste water
II	Oil polluted waste water			
7	Waste water from main machine hall of STG+GTG and HRSG	170		Estimating according to capacity of gas turbine/steam
8	Waste water from transformer, distribution switchyard	216		Estimating for irregular waste water
9	Waste water from other	20		Estimating for additional waste

No.	Description	Value		Note
		m ³ /day	m ³ /h	
	auxiliary areas			water
11	Waste water from area of oil tanks	324		Irregular waste water
	<i>Total oil polluted waste water</i>	730		
		195	8	Calculating for regular discharge
III	Domestic waste water			
12	Waste water from septic tank	35	1.7	According to the design and number of people (on 24hour basis)
IV	Total waste water	2124		
		989		Calculating for regular discharge

Total volume of regular discharge is about $Q = 989 \text{ m}^3/\text{day}$ ($41.2 \text{ m}^3/\text{h}$).

Calculation capacity with design tolerance of 20%, and consideration of Max discharge factor and irregular discharge is of $41.2 \times 1.2 = 49.45 \text{ m}^3/\text{h}$. In which selected design capacity necessary for the O Mon III thermal Power plant is $50 \text{ m}^3/\text{h}$.

4.3.3.2. *Standard applied for sewage water*

Main standards applied to assess water quality of water source and sewage water include:

TCVN 5945 –2005: Industrial waste water standard. This standard regulates limit value of parameters and concentration of sewage water components from production, processing, trading and service, etc (hereinafter called industrial sewage water), and monitor industrial sewage water before discharging to water area.

4.3.3.3. *Receipt source*

Treating according to type A of TCVN 5945 – 2005 and discharging to Hau river.

4.3.3.4. *Waste water management alternative*

In order to ensure the treated waste water satisfactorily to discharge into the environment and reduce treatment expense, each group of waste water generated during the operation of power plant shall be managed separately.

- Domestic waste water: waste water from WCs shall be treated preliminarily by three-chamber septic tank (sediment storage chamber, deposition chamber and

filtering chamber) or advanced septic tank namely BASTAF, Depending on number of operators and location of the WC, septic tank can be constructed in form of designed modules or assembling modules as required by treatment capacity. Waste water from WCs after running through septic tank and waste water from bathing activities shall be conveyed to the general waste water treatment system of the power plant. Treated waste water with contents within allowable limits shall be discharged to the receipt source.

- Production waste water: Waste water with different pollution characteristics shall be designed with local waste water treatment system and treated there before discharging to the general production waste water treatment station. However, operation phase with similar waste shall be collected and treated at the same place. Treated waste water must have contents within allowable limits of the receipt source.

4.3.3.5. Domestic waste water treatment

O Mon III Combined Cycle thermal power plant with total employees of 191 shall generate an amount of domestic waste water of about 35 m³/day (equivalent to 90% water supply), it will be treated by anaerobic method (septic tank).

Table 4.2. Pollutants at inlet and outlet of the septic tank

No.	Pollutant	Rated value (g/people/ day)	Total (kg/people/day)	Pollution concentration (mg/m3)	• Pollution concentration after treated by the septic tank (mg/m3)	TCVN 5945-2005 (Type A)
1	BOD	45 -54	8.6 - 10.3	294.7	103.1	30
2	COD	85-120	16.23 – 22.92	645.9	229.2	50
3	SS	70-145	13.37 – 27.7	791.3	276.9	50
4	Total nitrogen	6-12	1.15 – 2.29	65.5	22.9	15
5	Total phosphor	0,8- 4	0.15 -1.37	21.8	7.64	4
6	Total coli from	-	-	-	-	

Source: Vietnam Institute for Tropical Technology & Environmental Protection

BASTAF is used to treat domestic waste water for its advantage over other traditional septic tank, BASTAF has treatment efficiency of 2-3 times than the latter and average treatment efficiency of SS, requirements of COD, and BOD₅ is in range of 70 - 75%.

BASTAF is a anaerobic reaction tank with thin partition walls separating upward gas flow, it can treat domestic waste water and other waste waters with characteristic similar to that of domestic waste water (see figure 4.2).

Technological process and equipment of BASTAF

In principle, waste water is conveyed to the first chamber acting the function as sediment, anaerobic fermentation chamber and balancing flow and pollutant content in waste water flow. With the help of partition wall, waste water flows in direction from the bottom-up in the next chambers contacting with anaerobic micro-organism in the sludge layer existing on tank bottom under active condition and allowable to separate into two phase (acid fermentation and alkali fermentation). BASTAF allows increasing the sludge storage time, as a result, treatment efficiency is increased and sludge subject to the treatment is decreased. The final chambers are anaerobic filtering ones. Those chamber shall further treat the waste water by anaerobic micro-organism on the surface of filtering materials and prevent suspended sludge from flowing together with water.

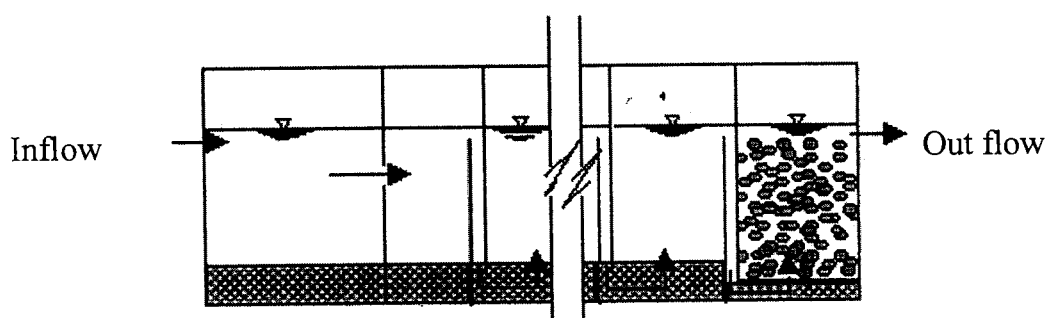


Figure 4.1 - Model of advanced septic tank - BASTAF

In comparison with TCVN 5945 -2005 type A, concentration of pollutants at outlet such as BOD₅ and SS are greater than allowable limits about 2.4 – 3.4 times, and 2.7 – 5.5 times respectively, so this preliminarily treated waste water shall be conveyed to the general waste water treatment station to process satisfactorily to the standard before discharging to the receipt source.

4.3.3.6. Mitigation methods for oil contaminated waste water

During the operation, the power plant shall use DO to operate generator, ignition, etc. oil could be spilled in the process of oil loading and unloading or leaked from connecting conduit, oil valves or in the course of operation. As a result, the power plant shall apply treatment measures of oil polluted waste water as well as mitigation methods in case of accident. Specific measures are as follows:

- Oil tank and oil pump station shall be provided with roof to prevent rainwater from sweeping away spilled oil, they shall be compassed by dikes to eliminate the spilled oil running out.

- Oil tank shall be located on high support and regularly checked in order to find out all phenomenon such as leakage and spill during feeding or operation process
- Oil conduit also shall be checked regularly to avoid leakage and failure. If leakage at the connecting conduit, oil valves or during feeding and operation process is found, it is recommended to use cellular materials to wipe the spill oil, those materials shall be treated together with other hazardous solid wastes.
- In addition, oil polluted waste water from the operation of power plant is estimated at $195\text{m}^3/\text{day}$. That waste water shall separates oil at oil separator with capacity of $10\text{ m}^3/\text{h}$, preliminarily treated waste water shall be conveyed to the general production waste water treatment station of the power plant.

4.3.3.7. Mitigation methods for water supply treatment and demineralizing systems

Sewage water generated from raw water treatment and demineralization processes is estimated at about $430\text{m}^3/\text{day}$. The main components of the sewage water are suspended solid substances, heavy metal and acidosis (base). This sewage water shall be stored in preliminary storage tank and then discharged to the general sewage water treatment system together with other sewage water sources of the power plant.

Sludge from this system shall be transported to the treatment site of district together with other wastes by local waste collection services.

4.3.3.8. Mitigation methods for chemical cleaning water of boiler

Waste water from chemical cleaning water of heat exchange surface of boiler shall be collected and neutralized at final drain tank with discharge of about $600\text{ m}^3/\text{day}$. Since this waste water source is not regular, it is generated annually, as a result, it shall be stored and treated gradually together with regular sewage.

4.3.3.9. General sewage treatment system

Regular sewage water from different sources such as water supply treatment system, water demineralizing system, domestic sewage after passing the septic tanks or oil separating system shall be discharged to collection tank of the general sewage treatment system.

Components of sewage water are suspended solid materials, several salt compound of Fe, Si... of unstable pH. This sewage water shall treat physically and chemically to separate suspended solid materials and neutralize before discharging to the environment.

The treatment station of production wastes is designed with capacity of $50\text{ m}^3/\text{h}$. Main components of the system include sewage tank, aeration and pH monitoring tank, reaction tank, deposition tank and filtering tank. *Flow line diagram of production waste treatment technology are shown in figures 4.2 and 4.3*

Presentation of production sewage treatment line

Sewage water generated from phases or primarily treated sewage water shall be collected and discharge through trash rack to the sewage tank. After that, sewage water shall be pumped to aeration tank to adjust pH by alkali or acid.

The sewage water shall be conveyed to the mixing tank to balance concentration of pollution substances, and make sludge of suspended solid substance by $\text{Al}_2(\text{SO}_4)_3 \cdot 10\text{H}_2\text{O}$ (feather alum). After that it shall be discharged to the reaction tank where flocculating agents are added to accelerate flocculating reaction and increase the effectiveness of sedimentation process.

After that sewage water is taken to the deposition tank to eliminate at highest level all contaminants. At the deposition tank, the sludge is removed regularly 4 times/day to the sludge storage tank, water generated from the deposition process shall be drained to sand - carbon tank to separate residual contaminant then to neutralizing tank and finally discharged to Hau river.

For irregular waste water such as cleaning water of gas boiler and gas heater, this sewage water is characterized by high concentration of COD, it shall be pumped to the irregular waste water storage tank. It shall be added with NaOCl to reduce the concentration of COD and supplement air by air blower to mix waste water to reduce COD and make homogenous quality of waste water. After that, waste water shall be treated as described as treatment for regular waste water.

Sludge from the sludge storage tank shall be pumped to the sludge compression tank to reduce volume of sludge compound by extracting water in the compound. Humidity of the sludge compound shall be reduced from 99% to 97%. Finally, sludge shall be conveyed to belt press in order to reduce volume of water and increase 3% of sediment content to 40%. Compressed sludge shall be made into piece shape and collected by Urban Environment Company of Can Tho city for treatment as regulated.

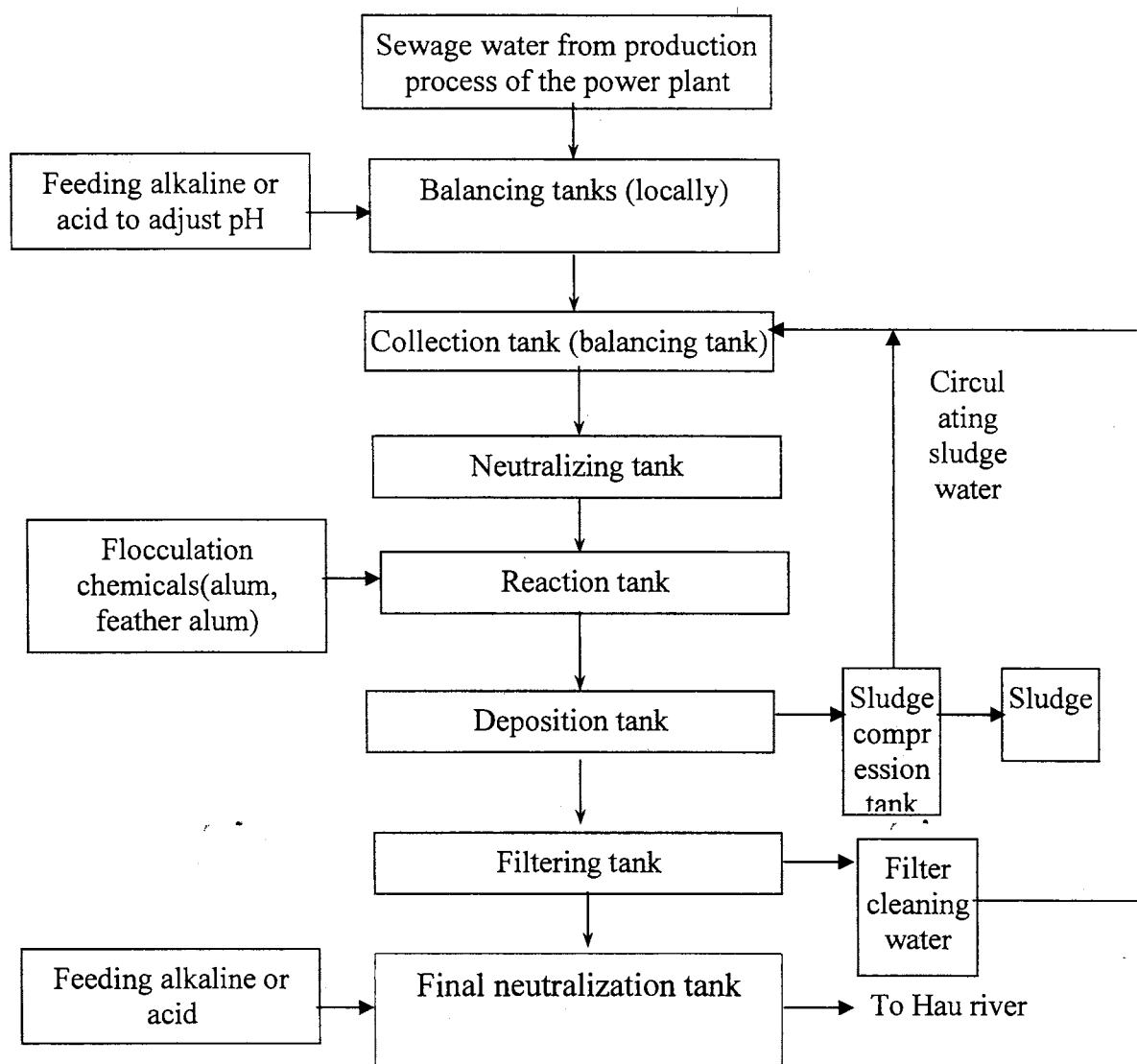


Figure 4.3: Block diagram of production sewage water treatment line of the power plant

Table 4.3. Treatment efficiency by tanks in the sewage water treatment line

No.	Main tanks	Treatment efficiency of pollutants (%)		
		BOD	COD	SS
1	Balancing tank	5	5	-
2	flocculating tank + deposition tank	30-40	30-40	65-70
3	Active coal filtering tank	65-85	65-85	65-85

Source: Summary by Power Engineering Consulting Joint stock Company, December 2008

Table 4.4. Main equipment of general sewage water treatment system

No.	Equipment	Specification	Unit	Quantity
1	Regular sewage water storage tank	V=500m ³ , semi-submerged, in rectangular shape, reinforced concrete with corrosive proof material	Set	1
2	Irregular sewage water storage tank	V=400m ³ , semi-submerged, in rectangular shape, reinforced concrete with corrosive proof material	Set	2
3	pH control tank	V=10m ³ , in rectangular shape, reinforced concrete with corrosive proof material	Set	1
4	Mixing tank	V=20m ³ , in rectangular shape, reinforced concrete with corrosive proof material	Set	1
5	Deposition tank	Ø5000mm x H4800mm	Set	1
6	Interim water storage tank	V=17m ³ , in rectangular shape, reinforced concrete with corrosive proof material	Set	1
7	Active coal filtering tank	Ø1500mm x H3000mm	Set	2
8	Final neutralization tank	V=50m ³ , in rectangular shape, reinforced concrete with corrosive proof material	Set	1
10	Clean water storage tank	V=25 m ³ , in rectangular shape, reinforced concrete with corrosive proof material	Set	1
11	Sludge thickener	Ø6700mm x H4200mm	Set	1
12	Sludge compression equipment	Q=3,5~4m ³ /h	Set	1

Source: Summary by Power Engineering Consulting Joint stock Company, December 2008

The above mentioned treatment facilities have been constructed and verified their effectiveness in many projects, it is seem feasible to apply in this project.

4.3.4. Mitigation methods for exhaust emission

According to the calculation presented in section 3.4.3.1, contents of SO₂, NO_x, CO,... and dust in exhaust for stack of the power plant meets standards in both cases of main fuels of clean fuel (natural gas) or DO. Accordingly, the project shall not invest in exhaust treatment system, content of air pollutants including SO₂, NO_x, dust in the exhaust shall be reduced by diffusion via stack with high of 30m (for single cycle) or 40m (for combined cycle) to meet requirements of SO₂, CO, NO_x and dust on ground as regulated by Vietnam standard.

According to calculation in section 3.4.3.1, NO₂, SO₂ on ground is lower than Vietnam standard (TCVN 5937-2005) when the project operates individually or in parallel with other project.

4.3.5. Mitigation methods for noise

The main sources of noise are equipment operation, equipment in the area of boiler, generator turbine, air compressed chamber, etc.

Measures used to keep the noise within allowable limit are:

Gas turbine should be located in insulation cover, Air conduct of gas turbine should be installed with silencers.

The equipments such as condensed water pump, water feed pump should be designed to reduce noise or arranged in an isolation cover.

Grease oil, control oil and lubricant of parts should be located in filtered chamber.

Gas turbine and steam turbine buildings should be designed with isolation walls to increase noise absorption capacity.

Exhaust pipes of gas turbine should be installed with silencers, exhaust pipes of ancillary system should be installed with silencers.

Air intake of air compressor should be installed with silencers.

Equipment shall be arranged logically in order to prevent concentration of equipment with high noise within a small area.

Area, where operators usually work at, shall be provided with noise insulation and operator shall be equipped with noise proof devices such as earplug.

Green trees should be grown surround the Facility, along the transportation roads to prevent noise and dust. Area of green trees as plan is about 15% area of general layout.

With the application of above measures, the noise level shall be kept within the following limits:

Are of the substation: 105 dB(A).

Air filter: 105 dB(A).

Noise level at distance of 100m from noise generating equipment: 60 dB(A).

4.3.6. Mitigation methods for heat impacts

The impacts of the project on human being and environment are regarded insignificant. However, the power plant should strengthen natural and forced ventilations to improve working conditions of the workers.

Ventilation and air conditioning systems shall be provided for rooms, machine hall and workshop to create favorable working conditions for workers and equipment.

The design of ventilation and air conditioning systems shall consider the fire potential of each area so that it is allowable to aerate firing substances and reduce risks to operators and equipment.

The ventilation system shall be provided at places without air conditioning system to keep local temperature of at least $10\text{--}10^{\circ}\text{C}$ lower than ambient temperature and less than 45°C .

The ventilation system shall be equipped with suitable filters to prevent intrusion of dust.

Temperature at areas of electrical and electronic equipment shall be kept at bellow 20°C in all environmental conditions.

At the areas with operators working continuously, temperature shall be kept in range of $20^{\circ}\text{C} - 25^{\circ}\text{C}$.

The ventilation and air conditioning systems shall be designed on the basis of average maximum environment conditions in the summer.

Outdoor design conditions:

- Ambient air temperature : 33°C .
- Ambient air humidity: 80%.

Indoor design conditions:

- Turbine hall, auxiliary house, hydrogen production house (as if): 5°C higher than ambient air temperature.
- Battery cell: $18\text{--}32^{\circ}\text{C}$.
- Central control house, local control rooms, relay rooms, administrative building, chemical laboratory, guard house, rooms of electrical equipment, etc: temperature of 25°C and humidity of 50%.

4.3.7. Mitigation methods for pollution and treatment methods for solid wastes

4.3.7.1. Industrial wastes

Industrial wastes in O Mon III Combined Cycle thermal Power Plant includes fuel disposals such as packages, sludge from water treatment system, etc.

Those wastes shall be classified for recycling or transporting to specified places. The power plant shall sign contract with Urban and Environment Company of Can Tho city to collect and treat such wastes.

4.3.7.2. Domestic wastes

There are about 191 operators working in the power plant. The maximum waste volume is about 152.8 kg/day. Domestic wastes include wastes from rest house, public facilities and canteen. They mainly compose of leftover foods, bags (plastic, paper, carton, grass, tin, etc). Main methods for treatment of domestic wastes are sanitary landfill, burning or making fertilizer by fermenting. The power plant shall sign contract with Urban and Environment Company of Can Tho city to collect and treat the domestic wastes.

At the working places in the power plant shall be provided with small wastebaskets of about 35-40 liters and three waste containers of 240 liters/each. Everyday, sanitary team of the project management unit shall collect waste with frequency of 1 time/day.

4.3.7.3. Harmful wastes

Harmful wastes of the power plant are oil sludge generated from rinsing and cleaning of petroleum tanks, oil from waste water treatment and oil clouts, etc.

Can Tho Province currently has not any treatment place for harmful wastes. Harmful wastes of the power plant shall be collected, stored and transported for treatment as regulated. One furnace for harmful wastes with capacity of 250kg/hour shall be provided for the entire power complex. Location of the furnace refers to General layout – Chapter 1.

4.3.8. Prevention and control of environment hazards

4.3.8.1. Suitable planning of general project layout

Prevention and environmental hazard response shall be considered from the planning stage. It shall reduce potential risks and facilitate response in case of accident and impacts on other facilities.

Meteogeological conditions at the project site shall be utilized in order to select suitable direction making use of natural ventilation to improve working conditions in the power plant.

Work items at the power house and adjacent areas shall be arranged at suitable distance as required by fire prevention and fighting. Especially, DO storage basin shall be arranged near the bank and far way from turbine house, control building in order to facilitate fuel pumping, fire prevention and fighting as well as for safety reason in case of occurring accidents.

The green trees in the power plant shall account for 15% of total power plant area.

4.3.8.2. Prevention of oil pipeline failures

It is necessary to work together with professional units capable of designing and installing pipeline system in accordance with codes and standards; at the same time, regulations on operation shall be issued to the operators.

Due attention shall be paid to organize professional training on technical safety and operation.

All detailed regulations and rules on labor safety shall be issued and monitored closely.

The power plant shall inspect regularly the pipeline, valves and distribution stations in order to prevent pollution caused by gas leakage.

It is unallowable to smoke or to make heat source or fuse at the petroleum storage basin and gas pipe line.

4.3.8.3. *Prevention of leakage, evaporation at the area of petroleum basin*

The power plant shall apply the following measures to prevent leakage and evaporation at the area of petroleum basin:

All basins shall be designed in line with usage purpose; pipe line, pumps and valves shall be operated within design capacities.

The power plant shall apply effectively technical measures and management to prevent leakage of DO from petroleum basin. The area of petroleum shall be constructed with a safety distance from the power plant.

Operation of oil pump system and valves shall be inspected regularly and evaporation proof valves shall be provided inside the basin.

Equipment shall be maintained and cured regularly.

Water spraying system for the basin on hot day shall be equipped.

All operation shall be made in accordance with regulations.

Environment monitoring program shall be strictly implemented in the power plant and adjacent areas.

Green trees in the territory of the power plant and adjacent area shall be grown.

4.3.8.4. *Fire prevention and fighting*

Fire fighting pump station shall be provided with design capacity satisfactory to the requirements of discharge and pressure to all work items in the power plant. Water source for the fire fighting system shall be taken from primarily treated water tank. The pump station shall include 01 electric pump, 01 diesel pump (standby), 02 Jockey pumps (to maintain pressure for the entire system).

The plant is designed to ensure a safe operation environment for human and equipment.

Power plant will be equipped with the following fire prevention and fighting systems:

- Fire detection and alarming system
- Fire fighting water supply loop system
- Spray system
- Sprinkler system
- Deluge system
- Fixed fire fighting foam system

- Mobile fire fighting foam system
- System for injecting cooling water for oil tank enclosure
- CO₂ automatic system
- Portable fire extinguishers and other fire fighting devices
- Firefighting vehicle, fire resistance clothes and other appliances.

Fixed and mobile foam extinguishing systems will be equipped at oil terminal. A cooling water system for oil tanks will be also equipped in order to stabilize temperature inside tanks in case of increase of air temperature.

Automatic and manual extinguishing systems will be also provided to limit fire consequences at main works of the power plant and mitigate damages of power generation drop.

Water fire-fighting systems will be supplied with water from main fire-fighting water supply conduit. Water distribution system will be arranged in ring and branch conduits to auxiliary buildings.

Fire-fighting water source will be taken from water tank.

Automatic water spray system will be arranged at necessary areas such as fire-fighting pump station, cable ditches, administration building, workshop, storage and other auxiliary areas.

- CO₂ fire-fighting system will be arranged at electric equipment, control rooms, starting hall by diesel oil.

Portable extinguisher will be arranged at necessary locations in the power plant.

Central control room will be equipped one central fire-fighting control panel in order to receive and solve signals from all fire detection and alarm systems in the power plants.

One water fire-fighting vehicle and one chemical fire-fighting vehicle will be equipped generally for the whole power plant.

Design of protection and fire-fighting system shall comply with Vietnamese and International standards on fire prevention and fighting as well as provisions fire prevention and fighting issued by fire prevention and fighting agency of Can Tho city.

4.3.9. Labor safety and hygiene

The power plant shall consider to microclimate factor to ensure clean labor environment for workers. The power plant shall conform to the Standards on working environment issued by the Ministry of Health. Conditions of light, air ventilation, temperature and noise, etc. according to regulations of the Ministry of Health shall be implemented by the power plant.

Engineers, workers working at workshop with noise greater than 90dBA will be equipped noise-protective capsules and plugs. Engineers, workers working in high and medium voltage areas or subject to electric shock shall be equipped specialized clothing, shoes, gloves, cap to prevent electric shock.

Table 4.5. Environmental Management Plan of O Mon III Combined Cycle Power Plant

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
(i) CONSTRUCTION STAGE						
Excavation, embankment, ground leveling and construction work items	Dust emission	1. To spraying water at construction area and disposal site.	Project area and access roads	Undefined	Construction Contractor	Project Management Unit
		2. To minimize size and occupied time of disposal heap.	Project area and access roads	Undefined	Construction Contractor	Project Management Unit
		3. Sodding and planting of trees that grow strongly on disposal heaps.	Project area	Undefined	Construction Contractor	Project Management Unit
	Generating noise	4. Maintaining construction machines, equipment and vehicles in the best operation conditions.	Project area	Undefined	Construction Contractor	Project Management Unit
		5. Repairing and maintaining regularly construction machines, equipment and vehicles	Project area	Undefined	Construction Contractor	Project Management Unit
		6. Implementing high noise activities in the daytime.	Project area	Undefined	Construction Contractor	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		7. Announced widely in community the time period and construction plan of the project	Project area	Undefined	EVN	Project Management Unit
		8. Establishing community consultation hotline	Project area	Undefined	EVN	Project Management Unit
		9. Constructing a noise wall or installing noise reducer at noise affected area	Project area	Undefined	Construction Contractor	Project Management Unit
	Sedimentation of water sources surrounding project area	10. Preparing and implementing land erosion control plan at construction area by construction of girdle dike for collection and sedimentation of overflow rainwater prior to pour it to the receipt source	Project area	Undefined	Detail design Consultant	Project Management Unit
	Negative impacts on landscape of the project area	11. Preparing and implementing landscape rehabilitation plan of the project area	Surroundings of project area	Undefined	Construction Contractor	Project Management Unit
	Pollution of water	12. Implementing	Project area	Undefined	Construction	Project

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
	source by waste water	sedimentation and oil collection from waste water prior to discharge to environment			Contractor	Management Unit
Concentration of workers	Impacts of domestic waste water of workers on quality of surface and underground water, and community health	13. Applying environmental sanitation methods, construction of detritus pit at camp area of workers	Project area	Undefined	Construction Contractor	Project Management Unit
	Conflict between construction workers and local people	14. Employing local people, especially project affected people on construction activities	Project area	Undefined	Construction Contractor	Project Management Unit
		15. Having good management measure for workers	Project area	Undefined	Construction Contractor	Project Management Unit
	Impacts of health of construction workers	16. Maintaining environmental sanitation and living conditions and ensuring community health on camp area of	Camp area of workers	Undefined	Construction Contractor	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		workers				
		17. Supplying sufficiently fresh water and sanitary food to workers	Project area	Undefined	Construction Contractor	Project Management Unit
		18. Constructing clinic for health care of workers	Project area	Undefined	Construction Contractor	Project Management Unit
		19. Supplying sufficiently garbage can and periodical collection of garbage	Camp area of workers	Undefined	Construction Contractor	Project Management Unit
		20. Improving awareness of construction workers on environmental sanitation at camp area	Camp area of workers	Undefined	Construction Contractor	Project Management Unit
Dredging of cooling water channel	Disappearance of benthos and living environment	21. Do not have feasible measure	Project area	Undefined	Construction Contractor	Project Management Unit
Storage yard of	Negative impacts on land, surface	22. Treating oil polluted waste water by oil	Project area	Undefined	Construction	Project Management

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
construction materials, machines and equipment	and underground water	separation system			Contractor	Unit
		23. Storing chemicals at area with roof and concrete floor	Project area	Undefined	Construction Contractor	Project Management Unit
		24. Training workers on cleaning measures in case of chemical spill accident	Project area	Undefined	Construction Contractor	Project Management Unit
Transportation of materials and waste	Dust emission, exhaust gas, noise and other social issues	25. Covering vehicle during transportation time	Project area	Undefined	Construction Contractor	Project Management Unit
		26. Limiting operation of vehicle at daytime if possible	Project area	Undefined	Construction Contractor	Project Management Unit
		27. Ensuring vehicles running in the project area in good condition.	Project area	Undefined	Construction Contractor	Project Management Unit
		28. Enhancing awareness of drivers on traffic safety	Project area	Undefined	Construction Contractor	Project Management Unit
	Increase of traffic density on National Highway No.91	29. Establishing and implementing traffic management plan in order to regulate vehicles	Project area	Undefined	Construction Contractor and Traffic consultant	Project Management Unit
Disposal of	Pollution of soil,	30. Designing and	Project area	Undefined	Construction	Project

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
<i>waste out of the project area</i>	surface water impact on community health, and bad odour from temporary disposal area	constructing of temporary disposal area at camp area of workers			Contractor	Management Unit
		31. Classifying waste into harmful waste and normal waste prior to transport for reusage or burying	Project area	Undefined	Construction Contractor	Project Management Unit
	Pollution of odour, surface water and soil related to uncontrollable waste	32. Arranging garbage can surrounding construction and worker camp areas	Project area	Undefined	Construction Contractor	Project Management Unit
						Project Management Unit
		33. Using information of solid waste treatment to training program of construction workers including classification of harmful waste and waste possibly harmful waste	Project area	Undefined	Construction Contractor	Project Management Unit
		34. Contracting with Urban Works Enterprise of Can Tho City on collection of	-	Undefined	Construction Contractor	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		construction waste from project site to district disposal landfill at least one time in a week				
		35. Prohibiting disposal of waste into Hau River as well as surroundings of the project area	Project area	Undefined	Construction Contractor	Project Management Unit
Construction of O Mon III Thermal Power Plant and Balance of Plant	Land erosion and deposition near to the project area	36. Minimizing range of influence and impact time	Project area	Undefined	Construction Contractor	Project Management Unit
		37. Implementing erosion and deposition mitigation methods such as construction of girdle dike and debris basin of overflow rainwater prior to discharge it into the river	Project area	Undefined	Construction Contractor	Project Management Unit
		38. Installing setting basin of overflow rainwater at outlet prior to discharge it into Hau River	Project area	Undefined	Construction Contractor	Project Management Unit
		39. Maintaining machines,	Project area	Undefined	Construction	Project
	Pollution of noise					

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		equipment and vehicles in good condition			Contractor	Management Unit
		40. Announcing widely in community the time period and construction plan of the project	Project area	Undefined	Construction Contractor	Project Management Unit
		41. Constructing noise wall or installation of noise reducer in high noise affected area	Project area	Undefined	Construction Contractor	Project Management Unit
	Dust emission	42. spraying water in construction and disposal areas in dry and sunny days	Project area	Undefined	Construction Contractor	Project Management Unit
	Pollution of surface water source due to waste water	43. Sedimenting and collecting oil in waste water prior to discharge it into the environment	Project area	Undefined	Construction Contractor	Project Management Unit
OPERATION SATAGE						
Operation process of power plant	Exhaust gas	44. Installing, designing stack in accordance with standards	Project area	Undefined	Project Operator (assigned by EVN)	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
	Pollution of noise	45. In case of noise in the power plant or local surrounding residential areas exceeding permit standard due to operation of power plant, then noise reducer and noise wall, etc. will be installed surround big noise sources.	Project area	Undefined	Project Operator	Project Management Unit
	Water pollution by waste water	46. Treating waste water in accordance with permit standard TCVN 5945-2005 – type A prior to discharge it into environment	Project area	Undefined	Project Operator	Project Management Unit
	Impact on quality of coastal water due to overflow rainwater	47. Separating rainwater running through polluted area from rainwater drainage system of the power plant	Project area	Undefined	Construction Contractor	Project Management Unit
		48. Determining potential oil-spill area. Collecting rainwater overflowing through that area to the oil separation system before treating directly or discharging into receipt	Project area	Undefined	Project Operator	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		source				
	Impacts on aquatic ecosystem due to taking of cooling water	49. Installing mesh and river-return system for aquatic creature at inlet, if possible, based on observed results on quantity and species of aquatic creature caught in the first stage after the first mesh installed.	Cooling water channel	20.000	Project Operator	Project Management Unit
	Impact on aquatic ecosystem due to disposal of cooling water	50. Arranging cooling water outlet far away from cooling water inlet in order to ensure temperature of water flow below 40°C prior to discharge it into river	Project area	Undefined	PECC2	Project Management Unit
		51. Considering the feasibility of increasing pump speed in order to decrease flow velocity of cooling water in waste canal	Project area	Undefined	Project Operator	Project Management Unit

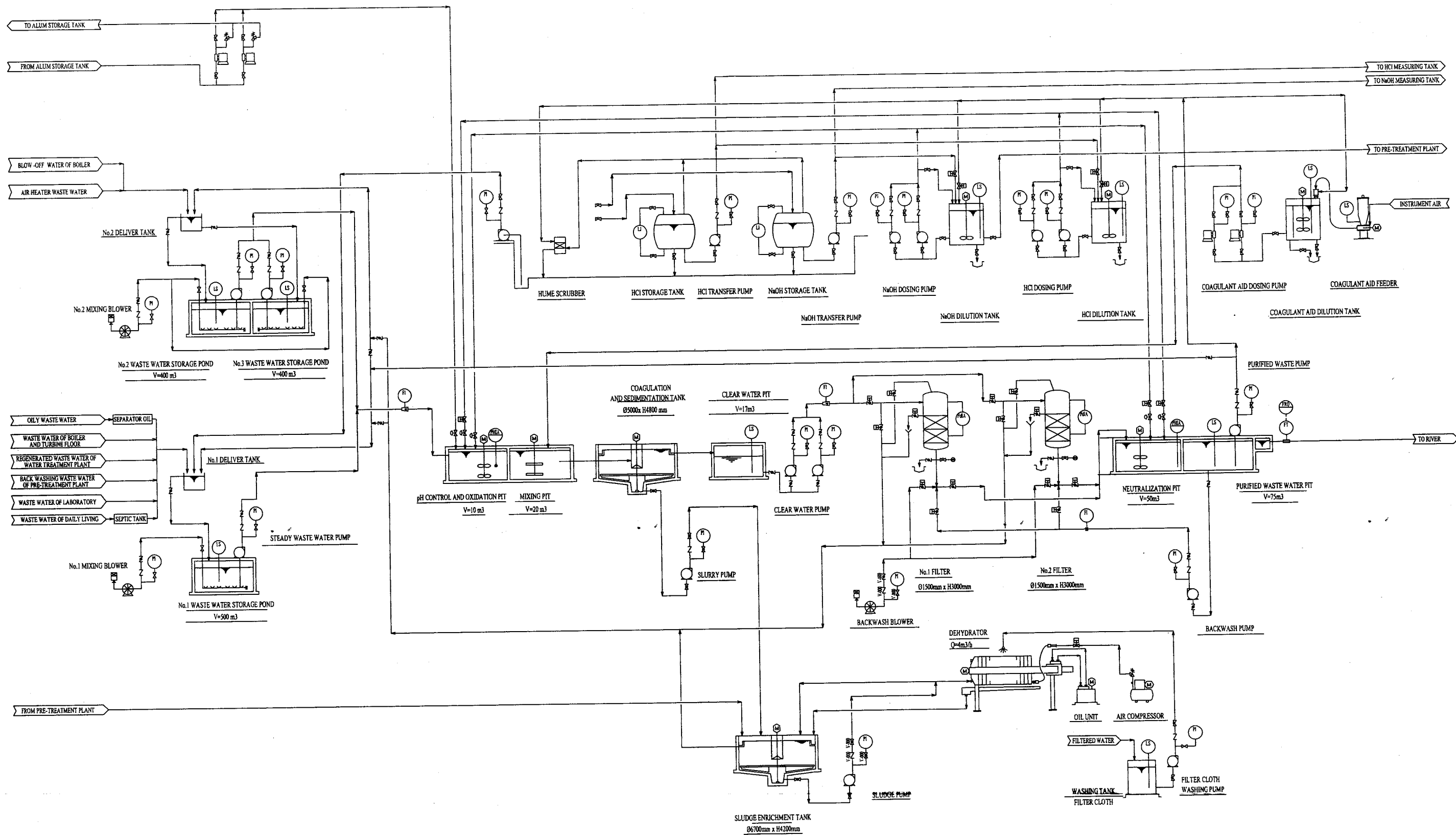
Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
<i>Dredging of cooling water intake and drainage canals</i>	Deposition of navigation route	52. Implementing dredging during low tide period and minimizing dredging time if possible	Project area	Undefined	Project Operator	Project Management Unit
<i>Transportation of fuel, Clo and other materials to project site</i>	Dust emission and noise; affecting traffic safety and people health	53. Covering vehicle during materials transportation time	Project area	Undefined	Project Operator	Project Management Unit
		54. Limiting operation time of vehicle during daytime if possible	Project area	Undefined	Project Operator	Project Management Unit
		55. Using barge at the highest allowable level in transportation of materials, fuels and chemicals for the power plant	Project area	Undefined	Project Operator	Project Management Unit
		56. All vehicle types using in the project shall be certificated satisfactorily to the standards	Project area	Undefined	Project Operator	Project Management Unit
		57. If transportation activities generate high noise and increase dust density in air excessively permit level,	Project area	48	Project Operator	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		then pollution mitigation methods will be implemented such as installation of noise reducer, water spray, ect.				
		58. Harmful chemicals shall be transported by specialized devices or stored in specialized containers according to regulations of the Government on transportation of harmful chemicals.	Project area	Undefined	Project Operator	Project Management Unit
Storage yard of materials, equipment	Pollution of surface, underground water and negative impacts on community health due to fire and combustion accident at fuel tank area	59. Equipment of protection and fire-fighting and other first aid will be equipped at fuel tank area in accordance with regulations	Project area	Undefined	Project Operator	Project Management Unit
		60. Implementing procedures for safety and first aid in accordance with provisions and training staffs working in the area on application of these procedures	Project area	Undefined	Project Operator	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
	Pollution of surface, underground water and negative impacts on community health due to failure of Clo tank	61. Providing necessary information on fuel tank area and safety procedures to local health bases	Project area	Undefined	Project Operator	Project Management Unit
		62. Minimizing chemical volume in storage, including Clo	Project area	Undefined	Project Operator	Project Management Unit
		63. Implementing procedures for safety and first aid according to provisions and training staffs working in the area on application of these procedures	Project area	Undefined	Project Operator	Project Management Unit
		64. Storing chemicals in containers and safety area with clear warning sign	Project area	Undefined	Project Operator	Project Management Unit
Disposal of waste	Pollution of soil, surface water, impacts on health community and bad odour	65. Designing collection system of domestic waste. After that, transporting domestic waste periodically to the general local disposal area	Project area	40	Project Operator	Project Management Unit
		66. Classifying wastes into harmful waste and normal waste prior to transport and	Project area	Undefined	Project Operator	Project Management Unit

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		dump it to the general disposal area of district				
		67. Signing contract with Urban Works Enterprise of Can Tho City on collection and treatment of waste of the power plant	Project area	Undefined	Project Operator	Project Management Unit
Staffs building area of power plant	Conflict between construction workers and local people	68. Creating job in the power plant for local people	Project area	Undefined	Project Operator	Project Management Unit
	Issues of health and safety of workers and community	69. Supplying sufficiently fresh water, safety food and electricity to staffs building area	Camp area of worker	Undefined	Project Operator	Project Management Unit
		70. Collecting and transporting domestic wastes from workers' building area with frequency of 1 time/week	Camp area of worker	Undefined	Project Operator	Project Management Unit
		71. Building area of workers shall be equipped sufficiently lavatory and other sanitary equipment	Camp area of worker	Undefined	Project Operator	Project Management Unit
		72. Preventing epidemic	-	Undefined	Project Operator	Project

Project activities	Environmental impacts	Mitigation methods	Location	Cost estimation (maximum value) (USD)	Responsibility	
					Implementation	Supervision
		diseases				Management Unit
		73. Constructing clinic at the power plant for health care of workers	-	In project cost	Project Operator	Project Management Unit
	Impacts on surface water quality	74. Treating all domestic waste water from staffs building according to waste standards prior to discharge it		Undefined	Project Operator	Project Management Unit
		75. Collecting and storing all solid domestic waste from workers' building area in temporary disposal area, and then transporting it to disposal area for burying		Undefined	Project Operator	Project Management Unit



INDUSTRIAL WASTE WATER TREATMENT SYSTEM DIAGRAM P&ID

LEGEND: SYSTEM CAPACITY IS 50M³/H

**COMMITMENT TO IMPLEMENT MEASURES
FOR ENVIRONMENTAL PROTECTION**

During the implementation of the O Mon III Power Plant project, The Owner is EVN strongly commit to take the following measures for environmental protection

5.1. In the pre-construction stage

- Cooperating with the PC of commune, O Mon district for proper implementation of the plan for compensation and rehabilitation of life of the project affected households, to assure their living standards after relocation will be better than that at the present time;
- Implementing the methods for mitigation environmental pollution suggested in Chapters Four.

5.2. In the construction stage

- Applying suitable measures in order to control dust, noise, water and soil pollution, created by cons of plant.
- Well organizing construction works and environmental sanitation to minimize environmental pollution by workers and construction equipment.
- Well managing the workforce, so that adverse social problems caused by construction workers could be avoided.
- Well implementing the methods for mitigation environmental pollution suggested in Chapters Four.

5.3. During the operation stage

- Ensure that the flue gas emissions meet the Vietnamese Standard TCVN 7440-2005 and that the ambient air quality of the surroundings of the plant meets Vietnam Standard TCVN 5937 - 2005.
- Continuously operating the waste water treatment system and the cooling water discharge system such that the effluent discharged to the river meets Vietnam Standards for Industrial Effluent (TCVN 5945-2005).
- Collecting and well managing solid wastes produced by the plant during implementation of the project.
- Well implementing the recommended managerial, technological and monitoring measures for protection of the biological environment, aquaculture of Hau river.
- The investor commits to cover all the expenses on designing, installation, operation and maintenance of pollution control equipment as well as the environmental management of the project.

5.4. Commitment of Owner

1. The investor undertakes to comply strictly with Vietnamese environmental standards issued under Decision 22/2006/QĐ-BTNMT dated 18 December 2006 by the Ministry of Resources and Environment on obliged application of Vietnamese environmental standards.
2. The investor undertakes to follow the designs, installation, operation and maintenance of pollution control equipment as well as the environmental management program of the project.
3. The investor undertakes to comply strictly with the Law on Environmental Protection, and other laws and regulations relating to preservation of natural resources and Vietnamese standards as well.
4. The investor needs prompt compensation, site clearance and resettlement for the households in the project site and undertakes to be fully responsible for compensation. The investor undertakes to be fully responsible before laws in case of any environmental matters of the project.
5. The investor undertakes to proper implement of the plan for compensation and rehabilitation of life of the project affected households, to assure their living standards after relocation will be better than that at the present time;
6. The investor undertakes to be fully responsible before laws in case of any environmental matters of the project.

**ENVIRONMENTAL TREATMENT FACILITIES,
ENVIRONMENTAL MANAGEMENT AND
MONITORING PROGRAM**

6.1. LIST OF ENVIRONMENTAL TREATMENT FACILITIES

The following environmental treatment equipment and facilities will be invested and constructed in the project:

6.1.1. Construction phase

Table 6.1: List of environmental treatment facilities

No.	Name of facility	Quantity	Scale
1	Surface water collection and drainage system	-	Discharge of 6,984 m ³ /s
2	Removable WC	6	Volume of waste tank of 500liters, by composite, 2.5m in high.
3	Garbage can	20	By plastic, 90 liters
4	Sprinkler	5	Water spraying tank truck of 10m ³

6.1.2. Operation phase

Table 6.2: List of environmental treatment facilities

No.	Name of facility	Quantity	Scale
1	Fresh water treatment system	-	Design treatment capacity of 60m ³ /h
2	Industrial waste water system	1	Design treatment capacity of 50m ³ /h
3	Open waste canal and box culvert discharge cooling circulating water	-	Satisfying the cooling waste water discharge for O Mon III and IV (36m ³ /s)
4	Air ventilation, vacuum cleaning and air conditioning systems	-	
5	Exhaust gas emission system – main stack	1	40m high
6	Industrial solid and harmful waste refuse furnace	1	Capacity of 250kg/h
7	Fire prevention and fighting system	-	Extinguishing deluge system by carbon dioxide (CO ₂); automatic atomizing and water spray systems
8	Green system for landscape	-	Occupying at least 15% of total area of power plant

These facilities and equipment will be constructed, installed, checked and put into operation concurrently with operation time of O Mon III Combined Cycle Power Plant.

6. ENVIRONMENTAL MANAGEMENT PROGRAM

6.2.1. Environmental management training for officers and operators

The Project Management Unit and operation management agent of the power plant will organize short-term training programs of theory and practice of environmental protection in construction and operation process of O Mon III Combined Cycle Power Plant. Training cost will be added to project investment cost (construction phase) or operation cost of power plant.

Contents and cost of training programs are shown in the following table:

Table 6.3: Training cost of qualification improvement on safety and environmental protection

Item		Requirement	Cost estimation	Cost (VND)
Construction phase				
1	Training of technical, environmental officers of the Project Management Unit	Number of trainees: 02 people	02 people x 7 day x 100,000 VND/day	1,400,000
		Cost of course	3,000,000 VND/course	3,000,000
	Total cost in construction phase			4,400,000
Operation phase				
1	Training of technical, environmental officers of the Power Plant	Number of trainees: 05 people	05 people x 7 days x 100,000 VND/day	3,500,000
		Employing consulting expert	01 people	3,000,000
		Other costs (classroom rent, teaching aids, etc.)	The whole course	2,000,000
2	Visit and learning of environmental protection experiences	Number of people: 05	05 people x 7 day x 300,000 VND/day	3,000,000
	Total cost of construction phase			11,500,000
Total				15,900,000

6.2.2. Environmental management

In construction phase, the Project Management Unit will assign officers in charge of environmental management. These officers will organize and monitor and supervise the observation and implementation of environmental protection measures by construction contractors and report periodically to the competent authorities (Table 6.2).

In operation phase, the O Mon III Combined Cycle Power Plant will assign unit and individual in charge of environmental management. The most important function of these unit and individual is to organize, monitor and supervise the observation, check environmental pollution control system, especially, exhaust gas and cooling waste water, and report periodically to the competent authorities (Table 6.2).

The power plant will coordinate with the Department of Natural Resources and Environment of Can Tho City in Environmental management program. Close co-ordination between management and operation of the power plant and functional authorities will affect positively to environmental protection and socio-economic development.

The Hau river system will bring about the highest profit for long time when it is managed jointly. The establishment of comprehensive management and coordination of functional agencies with necessary power shall prevent environment impacts and promote the long-term development of Cuu Long River Delta.

6.2.3. Reporting system

Table 6.2: Environmental reporting system

TYPE OF REPORT	REPORT OF LEVEL 1			REPORT OF LEVEL 2		
	FROM	TO	PERIODIC	FROM	TO	PERIODIC
Environmental monitoring during construction phase	Construction contractor	Project Management Unit	three months/time	Project Management Unit	Department of Natural Resources and Environment of Can Tho City	Quarterly
Environmental monitoring during operation phase	Technicians in charge of environment of the power plant	O Mon III Combined Cycle Power Plant	Biannual	O Mon III Combined Cycle Power Plant	Department of Natural Resources and Environment of Can Tho City	Biannual

6.3. ENVIRONMENTAL OBSERVATION AND MONITORING PROGRAMS

6.3.1. Environmental monitoring during construction phase

Requirements on implementation of environmental mitigation measures as well as environmental quality monitoring during construction phase shall be included in the contract with construction contractors. Therefore, contractors shall be responsible for environmental monitoring during construction phase. In addition, the Project Management Unit will assign monitoring officer of environmental protection activities done by construction contractors.

Accordingly, technical officers (have been trained on environment) of the Project Management Unit will monitor the following contents:

- Monitoring of implementation of pollution mitigation measures of the contractor;
- Summary of environmental monitoring activities of construction contractors in order to make an environmental monitoring report for construction phase and submit it to the Department of Natural Resources and Environment of Can Tho City.

Responsibilities of construction contractors are shown as follows:

- Implementation of pollution mitigation measures during construction phase;
- Measurement and monitoring of environmental quality during construction phase;
- Preparation of Environmental Quality Monitoring Report for Project Management Unit.

Cost for monitoring activities as above mentioned is included in investment cost of the project.

6.3.2. Environmental monitoring during operation phase

After the project putting into operation and exploitation, the operation unit of power plant will coordinate with professional agencies to implement environmental pollution monitoring program in order to monitor environmental impact as well as to assess effect of pollution treatment and mitigation measures.

On the other hand, O Mon Electric Power Complex will be equipped with one mobile air quality observation station in order to have necessary and timely mitigation measures in case of pollution.

6.3.2.1. *Objects and indexes of environmental observation and monitoring*

Monitoring of air environment

Table 6.3: Monitoring of air environment

Observation index	Observation location	Sampling equipment	Number of samples
Emission of power plant			
- CO - SO₂ - NO_x - Total suspended dust (TSP) - Noise	- Top of stack	- Sampling by DESAGE GS 312 (1hr.) sampler, analyzing according to GRISS-Saltman method in accordance with ISO 6768/1995 - Measurement of volume according to TCVN 5067: 1995 - Integral equivalent noise meter	01
Ambient air			
- CO - CO₂ - SO₂ - NO_x - TSP - Temperature - Humidity - Noise	- DO storage - Boiler area - In power plant according to wind direction - Cooling water outlet - Intake - Surrounding residential areas according wind direction (500m, 1000m, 1500m, 2000m, 2500m from power plant)	- Sampling by DESAGE GS 312 (1hr.) sampler, analyzing according to GRISS-Saltman method in accordance with ISO 6768/1995 - Measurement of volume according to TCVN 5067: 1995 - Temperature meter - Humidity meter - Integral equivalent noise meter	10

Comparative standard:

- Ambient air quality standard: TCVN 5937: 2005, TCVN 5938: 2005, TCVN 6438: 2001, TCVN 5948: 1995, TCVN 5949: 1995.
- Exhaust gas standard: TCVN 5939: 2005, TCVN 7440: 2005 applied together with QĐ 07/2005/QĐ-BTNMT.



FIGURE 6.1: LOCATION OF AIR QUALITY MONITORING SITES FOR O MON III CCPP

Water environment monitoring:

Table 6.4: Water environment monitoring

Observation Index	Observation location	Sampling/analysing equipment	Number of samples
Underground water			
-pH - SS - Fe - NH ₃ - NO ₃ - NO ₂ - Coliforms	Underground water at local houses surround the project area	- pH meter with glass electrode - Measurement of volume according to TCVN 5067: 1995 - Atomic absorption spectrum - Visible light spectrum colourimetry - Visible light spectrum colourimetry - Visible light spectrum colourimetry - Membrane filter and culture in temperature of 43°C	02
Surface water			
-pH - Turbidity - BOD ₅ - COD - Grease - Heavy metal - Temperature - Coliforms	- Behind general waste water treatment system - Behind domestic waste water treatment system - Cooling waste water outlet and 100m from outlet - Pump station	- pH meter with glass electrode - Turbidity meter - Oxygen consumption after 5 days at 20°C - Oxidize by K ₂ CR ₂ O ₇ - Gas chromatograph (TCVN 5070: 1995) - Atomic absorption spectrum - Temperature meter - Membrane filter and culture in temperature of 43°C	06
Waste water treatment system			
-pH - Turbidity - BOD ₅ - COD - Grease - Heavy metal - Temperature - Coliforms	- Behind and front of general waste water treatment system	- pH meter with glass electrode - Turbidity meter - Oxygen consumption after 5 days at 20°C - Oxidize by K ₂ CR ₂ O ₇ - Gas chromatograph (TCVN 5070: 1995) - Atomic absorption spectrum - Temperature meter - Membrane filter and culture in temperature of 43°C	02

Comparative standard:

- Underground Water Quality Standard: TCVN 5944: 1995
- Surface Water Quality Standard: TCVN 5942: 1995
- Industrial Waste Water Quality Standard: TCVN 5945-2005, class A



6.3.2.2. *Time and frequency of observation and monitoring*

Environmental observation and monitoring work items are implemented with frequency of 2 times/year during project operation process. A number of selected parameters such as temperature, pH of waste cooling water will be observed 1 times/day in the first month.

6.3.2.3. *Cost estimation for observation and monitoring*

Cost for environmental observation program as above mentioned is determined in Table 6.5. The cost is included in the project investment cost.

Table 6.5: Cost estimation of environmental observation program

No.	Description	Cost (VND)
Construction phase (16 months)		
1	Observation cost (lump-sum): traveling, sampling, analysizing samples, report preparation, etc.: 8 trips	60,000,000
	Total of 8 trips	480,000,000
Operation phase (the first-three year)		
2	Observation cost (lump-sum): travel, sampling, sample analysis, report preparation, etc.: 12 trips	60,000,000
	Total of 12 trips	720,000,000
	Total	1,200,000,000

7

COST ESTIMATE FOR ENVIRONMENTAL FACILITIES

7.1. COST FOR ENVIRONMENTAL MONITORING SYSTEMS

7.1.1. Construction phase

Unit: VND

NO.	Facility	Number	Unit price	Amount
1	Surface water collection and discharge system	-	1,200,000,000	1,200,000,000
2	Movable WC	6	50,000,000	300,000,000
3	Dust bin	20	500,000	10,000,000
4	Sprinkler	5	Lease	160,000,000

7.1.2. Operation phase

Unit: USD

NO.	Facility	Equipment cost	Operation cost
1	Air ventilation and conditioning system	2,562,150	115,297
2	Chimney system	2,200,000	99,000
3	Water treatment system	1,897,986	85,409
4	Sewage water treatment system	1,097,900	49,405
5	Solid waste control system	900	40,5
6	Environmental monitoring system	75,000	3,375
7	Total	7,833,936	352,527

Note: Above values are for reference only and shall be verified in next phases.

7.2. OTHER EXPENSES

7.2.1. Expense for aquatic resources and biological diversification

The effects of pumping water for cooling purpose on plankton and fishes could be eliminated by installing of wire mesh at the intake. Cost for those wire mash system is estimated at about 500,000 USD.

7.2.2. Expenses for health care and socio-economic development assistance in the local area

During its operation, O Mon III thermal power plant shall assist the local area in social actives such as construction of health clinic, water supply system and local transport

system, etc. That expense shall be determined after discussion and agreement with O Mon District People's Committee.

7.2.3. Expense for environmental monitoring

Expense of environmental monitoring is presented in Chapter 6, section 6.3.2.3

PUBLIC CONSULTATION

According to the provision in Circular No.08/2006/BTNMT by Ministry of Environment and Natural Resources, the project owner of O Mon III thermal power plant (Vietnam Electricity) had issued Official Letter No.1282/CV-NĐCT-AOM on 18 April 2008 to People's Committees and Fatherland Front Committees Of Phuoc Thoi And Thoi An Wards (project location) in attachment with summary of Environmental Impact Assessment Report of the project in order to ask for their opinion contributions (wards in O Mon District, Can Tho city) on environmental matters related to the O Mon III combined cycle thermal power plant project. Detailed contents of the letter are given in the Appendix 8.1. At the same time, PECC2 also organized a meeting with local wards related to public consultation of the project.

Official Letter No.14/UBND-NC on 09 May 2008 issued by People's Committee of Phuoc Thoi ward, Official Letter No.16/CV-UBND on 22 May 2008 by People's Committee of Thoi An ward, Official Letter No.03/CV-MT.VT on 12 May 2008 by Fatherland Front Committee of Thoi An ward on contributing opinions on the implementation of O Mon III combined cycle thermal power plant project in Thoi An and Phuoc Thoi wards, O Mon District, Can Tho province in reply to the Official Letter No.1282/CV-NĐCT-AOM on 18 April 2008 by EVN expressed the opinion of People's Committee and Fatherland Front Committee of wards as summarized as follows.

8.1. MATTERS AGREED BY PEOPLE'S COMMITTEES AND FATHERLAND FRONT COMMITTEES OF PHUOC THOI AND THOI AN WARDS

They supported the construction of O Mon III combined cycle thermal power plant project in the wards. This project will speed up the socio-economic development of the wards in particular and O Mon District and Can Tho Province in general.

8.2. MATTERS DID NOT AGREE BY PEOPLE'S COMMITTEES AND FATHERLAND FRONT COMMITTEES OF PHUOC THOI AND THOI AN WARDS

Forecasted environmental impacts and recommended mitigation methods given in the summary of Environmental Impact Assessment Report are suitable and comprehensive. People's Committee and Fatherland Front Committee of Phuoc Thoi Ward did not reject any environmental matter related to the project.

8.3. SUGGESTIONS MADE BY PEOPLE'S COMMITTEES AND FATHERLAND FRONT COMMITTEES OF PHUOC THOI AND THOI AN WARDS

8.3.1. Suggestions

Regarding environment, they required the Project Management Unit to implement the following measures to protect environment in the course of operation:

- a. To manage labor force effectively to preserve security and social order as well as spiritual life of the inhabitants.
- b. The project owner has to implement adequately all measures of environmental protection, noise and vibration generated during construction and operation of the project, to ensure water drainage and avoid obstacles to production and daily activities of inhabitants.
- c. If it is allowable, the project should provide work opportunities and make use of local labor force.
- d. The project owner shall responsible for compensating and settling satisfactorily in accordance with the laws of Socialist Republic of Vietnam in case of environment pollution during project implementation.

8.4. EXPLANATION OF PROJECT OWNER TO THE SUGGESTIONS MADE BY PEOPLE'S COMMITTEES AND FATHERLAND FRONT COMMITTEES OF WARDS

Vietnam Electricity (the project owner) acquired all opinions and suggestion made by People's Committees and Fatherland Front Committees Of Phuoc Thoi And Thoi An Wards related to environmental matters of O Mon III combined cycle thermal power plant project. The project owner committed to implement perfectly all measures of environmental protection, waste treatment from the project. At the same time, technical methods and management should be executed to prevent and minimize negative effects on natural and socio-economic environments of the local area as forecasted in this Environmental Impact Assessment Report.

The project owner committed to comply with all provisions on environmental protection as regulated in the Law on environmental protection passed by National Assembly, Session XI, 8th meeting on 29 November 2005 and declared on 12 December 2005 according to Order No. 29/2005/L/CTN by President.

The project owner committed to comply with all Vietnam standards on environment issued together with Decision No.22/2006/QĐ-BTNMT on 18 December 2006 by Ministry of Environment and Natural Resources on compulsory to apply Vietnam standards.

The project owner committed to take full responsible before the Laws of the Socialist Republic of Vietnam for occurrence of environmental pollution affecting to the health of local inhabitants in the course of project implementation.

SOURCES OF DATA AND ASSESSMENT METHODS

9.1. SOURCES OF DATA

9.1.1. Reference materials

- **Legal instruments**

1. The Law on Environmental Protection, promulgated under Ordinance 29/2005/L/CTN dated 12 December 2005 by the President.
2. Decree 80/2006/ND-CP dated 9 August 2006 by the Government on detailed procedures and guidance for implementation of the Law on Environmental Protection.
3. Circular 08/2006/TT-BTNMT dated 8 September 2006 by the MONRE with guidance for strategic environmental assessment, environmental impact assessment and undertaking on environmental protection.
4. The Law on Water Resources, promulgated under Ordinance 05 L/CTN dated 01 June 1998 by the President.
5. The Law on Forest Protection and Development, passed by the National Assembly on 03 December 2004.
6. The Land Law, promulgated under Ordinance 23/2003/L-CTN dated 10 December 2003 by the President.
7. Decision 153/2004/QĐ-TTg by the Prime Minister on issuance of the Environmental Protection Strategy of Vietnam.
8. 31 Vietnamese environmental standards, by the MOSTE in 2001.

- **Technical literature**

1. WB. Environmental Source Books – Guidelines for Environmental Assessment, 1991.
2. P.A. Economopolous Rapid Assessment for Water, Solid, Air and Land Pollution Sources, WHO, Geneva, 1993
3. WHO. International Chemical Safety Program – Books on SO₂, NO₂, CO, dust and hydrocarbons, Geneva, 1992-1998
4. Waste water treatment, Lam Minh Triet, 2006.

9.1.2. Materials and database established by the investor

1. Electrical Construction and Consultancy JSC No 2. Technical explanation– Vol. 1 – Planning revision for O Mon Power Center, April, 2008.
2. Investment project report for O Mon III Power Plant, May, 2008, PECC 2.
3. Report on compensation – resettlement planning for O Mon Power Center.
4. CEECO, Results of investigation and analyses of the natural environment of the project site of O Mon III Power Plant, 2008
5. CEECO, Results of investigation and analyses of terrestrial and aquatic ecosystems and fishery in the project site of O Mon III Power Plant, 2008.

6. Nguyen Phi Khu, modeling of transfer of heat from cooling water of O Mon III Thermal Power Plant, prepared at request of PECC 2, 2008.

9.1.3. Sources of environmental, socio-economic data of the project site

1. Yearbook of Can Tho province, 2005.
2. Report on climate-hydrography characteristic of Can tho province, 2005.
3. Socio-economic reports of Phuoc Thoi ward, 2007.

9.2. METHODS EMPLOYED FOR EIA

Methods employed for the EIA on O Mon III Combine cycle Power Plant include methods of investigation, study, research and experiments. Those are studied and recommended by scientists and research institutes in developed nations and the uses thereof in EIA is required by international organizations (WB, ADB, UNEP...). The methods are detailed in the literature of EIA published in Vietnam (Le Trinh, 1997 ; 2006; Le Thac Can, 1995, Tran Van Y, 2006...) and applied by many research institutes and centers.

Those methods have been employed by PECC2 in EIA for domestic and international projects and allowed by EIA appraisal boards. The methods are outlined below.

9.2.1. EIA methods

- **Rapid Assessment**

Compositions, flow rates and pollution loads of emissions, effluent, and solid waste from activities of machines and equipment and living activities are determined and quantitatively predicted based on pollution coefficients issued by the World Health Organization (WHO) in 1993.

- **Checklist**

Relations of impacts of each activity of the project on each environmental factor are shown in a checklist, from which details of the study are orientated.

- **Modeling**

In an attempt to quantify the impacting scope and level, two mathematical models were utilized in this EIA, those include:

- *Model of emissions dispersion*: for calculation and forecast air pollution from flue gas of the power plant.
- *Model of transfer of heat from cooling water*: Developed by Vietnam Science and Technology Institute, this has been used in many EIA studies.

Input data for those models: data of climate, hydrological and topographic characteristics are described in details and obtained from governmental agencies/organizations.

- **Sociological investigation**

This is employed in interviews with local leaders and inhabitants. Questionnaires are designed for investigation targets. In this EIA study, a software product has been used for assessment of socio-economic matters and people's opinions based on results from investigation with questionnaires.

9.2.2. Methods of investigation and analysis of environmental components

Main methods and equipment hereinafter were employed by the EIA study team in EIA study of O Mon III power plant. They are advanced with high capacity of quantification. In fact, they are prevailing in the world and in many specialized laboratories in Vietnam.

- **Global Positioning System**

Garmin- GPS 12 (US).

- **Analyses of air quality and pollution**

- Temperature, humidity and wind speed: STI, (US)

- Integrated noise: RION-2100 (Japan), noise frequency analysis

- Vibration: VM 3400 (US), vibration frequency analysis.

- Total suspended particles and PM₁₀: Hight Sample HVS 500 (SIBATA - Japan), analytical balance: Sartorius BP 211 D, sensitivity of $1 \times 10^{-5} \text{g}$ (Germany). Analysis method: TCVN 5067 – 1995.

- CO: Spectrophotometer "Spectronic genesys - 5" (US), Desaga 312 (Germany), measure by Multilog 2000 (US). Analysis according to standard No 52 TCN 352-89.

- SO_x: Desaga 312 (Germany). Spectrophotometer "Spectronic genesys - 5" (Mỹ). Analysis according to method TCVN 5971 – 1995 (ISO 6767 – 1990)

- NO_x: Desaga 312 (Germany). Spectrophotometer "Spectronic genesys - 5" (Mỹ). Analysis according to method TCVN 6137 – 1996 (ISO 6768 - 1985).

- **Analyses of water quality and pollution**

- **Sampling**

Water samples of the sea, water and underground water were taken and stored observing the guidance of the Environmental Department (MOSTE) (1999), with reference to methods of the Global Environmental Monitoring System (GEMS), 1995.

- **Analyses**

Field analyses

This was performed in compliance with standard methods set forth by the Environmental Department under the MOSTE in combination with methods proposed by equipment manufacturers.

- pH: measured at site with a SENSION156

- Electrical conductivity (EC): measured at site with the SENSION156, Unit: $\mu\text{S}/\text{cm}$.
- Total dissolved solid (TDS): measured at site with the SENSION156, Unit: mg/l .
- Salinity (Sal): measured at site with the SENSION156, Unit: ‰.
- Dissolved oxygen (DO): measured at site with the SENSION156, Unit: mg/l and % saturation.

Lab analyses

The following parameters were analyzed in the laboratory of the Southern Meteo Station under the MONRE:

- Chemical oxygen demand (COD): digestion of samples and colorimetry with a spectrophotometer at 420 nm with COD digestion reagent vial.
- Biological oxygen demand (BOD_5): pressure gauge method: thermal insulation at 20°C for 5 days then measurement of pressure changes
- TSS: Colorimetry with a photometer with reference to a standard color scale.
- Heavy metals (Pb, As, Zn): micro-elements were analyzed with an atomic adsorption photometer (Varian, US).
- NH_4^+ : Colorimetry with a spectrophotometer at 655 nm with ammonia cyanurate and ammonia salicylate kit.
- NO_3^- : Colorimetry with a spectrophotometer, Drel 2400 (Hach – US) at 500 nm with NitraVer 5 kit.
- PO_4^{3-} : Analyzed based on the reaction with ammonium molybdate in acidic medium, colorimetry on a spectrophotometer at 880 nm with PhosVer 3 kit.
- NO_2^- : Colorimetry with a spectrophotometer at 507 nm with NitriVer 3 kit.
- Coliform: as provided in ISO 93081: 2000

- **Analyses of soil quality and pollution**

- ***Sampling***

- Removing the superficial layer;

- Taking samples at the depth of 10 to 20 cm;

- Marking samples as stipulated.

- ***Analyzing***

- Heavy metals***

- After digesting samples in compliance with standard procedures, filtrates were analyzed with an Atomic Adsorption Spectrograph (AAS).

- Oil and grease***

- Removing impurities from soil samples, which were then extracted with N-hexane, filtrates were evaporated then oil and grease were determined by weighing.

Soil pollution was analyzed at the laboratory of the Chemical Technology Institute under Vietnam Science and Technology Institute (under supervision of Associate Professor, PhD. Nguyen Thi Dung).

- **Sampling and analyzing of aquatic species**

The study into the composition and density of aquatic biota was performed to obtain additional information for assessment of water quality, bio-resources as well as environmental impacts of water pollution.

- **Field work**

Phytoplankton was caught with a specializing net of 25 μ m mesh, made in Switzerland with the throughput of 60 l.

Zooplankton was caught with a Juday net of 40 μ m and a throughput of 60 l.

Zoobenthos was collected with a Petersen pick with a surface are of 0.025 m², made in China, and 4 picks of 0.025 x 4 = 0.1 m² for each sample.

- **Lab work**

Counting each Phytoplankton species in samples.

Counting each Zooplankton species in samples.

Counting each Zoobenthos species in samples.

Resultant numbers were used for analyzing and determining typical species and dominant species as well as other coefficients related to homogeneity and diversity for assessment of water quality at the sampling points and related basins.

Aquatic sampling and analyses were performed by Researcher Pham Van Mien, VESDI.

- **Study into the terrestrial ecosystem**

Wild animal species were studied by means of site observation and recordal of local inhabitants' opinions.

9.2.3. Reliability of employed methods

All methods employed in this EIA study are proposed by international and domestic organizations for application to EIA studies in development projects.

In this EIA study, all methods mentioned above were performed by environmental experts with due knowledge and experience of EIA study for thermal power projects with reports appraised by the Appraisal Board of the MOSTE (before 2003) and the MONRE (after 2003). Therefore, all employed methods and obtained results in this EIA are assessed as reliable.

CONCLUSIONS

Considering results of the EIA study as mentioned above, it is possible to draw some main conclusions as follows:

1. O Mon III Power Plant (the Project) will play an important role in supply electricity for socio-economic development of the Mekong delta area as well as the national energy source. Since the project is located in a riverside and far from residential areas, it is possible to minimize negative environmental and socio-economic impacts during its implementation. The selected location of the project with is appropriate, because there is no need to remove a large number of houses and technical work.
2. With regard to designed parameters and location, in case of no appropriate measures to protect the environment, the Project will cause various environmental and socio-economic impacts:
 - a) *Main impacts in the construction stage:*
 - Removal of vegetation cover for construction of technical supporting facilities.
 - Air pollution and water pollution as a result of dredging and leveling activities, construction wastes and workers' sanitary wastes;
 - Noise and vibration pollution produced by construction machines;
 - Social problems due to concentration of great number of workers in the area.

Those impacts in the construction stage are assessed as *negative* and *short term* but *mitigable*.

b) *Main impacts in the operation stage.*

- Air pollution due to flue gas emissions from the plant. Main pollutants include dust, SO₂ and NO_x pollution may be slight.
- Noise and vibration pollution inside the plant.
- Air pollution due to ash handling at the plant and the ash ponds
- Possible pollution of river water consequently impact on aquatic biota and aquaculture due to discharge of cooling water and waste waters from the plant if without suitable treatment method.

All the aforementioned negative impacts in the operation stage are assessed as *acceptable* and those impacts will be minimized due to the Project will employ highly effective technologies in treatment of its emissions, effluent and solid wastes.

3. In order to well prevent and mitigate negative impacts, the following measures will be taken by the project owners

a) In the construction stage

Under the supervision of the project owner, sub-contractors will well take managerial and technical measures necessary to minimize pollutions of the air, water, noise and vibration as well as social problems that may emerge out construction activities and aggregation of workers.

b) In the operation stage

In order to prevent and mitigate environmental pollution, the project has designed and will install and operate advanced technologies in electricity production. Furthermore, the project will install and properly operate highly effective technologies for emission treatment. Those include low NOx burner, many stages burner, flue gas recirculation and other advanced technologies of collection and treatment waste waters and solid waste. By means of those measures, O Mon III Power Plant will minimize negative impacts on air, surface water, underground water, soil and ecosystems.

4. The project owner will implement all the measures in environmental management and monitoring program to fully comply with Vietnamese Laws and Standards on Environmental Protection. The measures recommended in this EIA report are reasonable and feasible.

APPENDIX OPEN CHAPTER

Appendix 1. Ambient Air Quality Standards

Vietnamese Standard TCVN 5937-20005

The limits of main parameters in ambient air are shown in the table 1

Unit: $\mu\text{g}/\text{m}^3$

No	Parameter	1hr - averaging time	8hr - averaging time	24hr - averaging time	Year averaging time
1	CO	30000	10000	-	-
2	NO ₂	200	-	-	40
3	SO ₂	350	-	125	50
4	Lead	-	-	1.5	0.5
5	O ₃	180	120	80	-
6	Suspended particulate matter	300	-	200	140
7	Dust $\leq 10\mu\text{m}$ (PM10)	-	-	150	50

Appendix 2. Emission standards for thermal power industry

Vietnamese Standard TCVN 7440 – 2005

The limits of main parameters NOX, SO2 and Particulate matter in flue gas of thermal power plant

Unit: mg/Nm^3

Parameters	Fossil Fuel			Definite Method
	Coal	Oil	Gas	
Particulate	200	150	50	TCVN 5977: 1995
NOx	650 (coal have volatile content > 10%)	600	250	TCVN 7172: 2002
	1 000 (coal have volatile content $\leq 10\%$)			
SO2	500	500	300	TCVN 6750: 2000

Appendix 3. The maximum limits of main parameters in flue gas in road traffic vehicles

Vietnamese Standard TCVN 6438 – 2001

The maximum limits of main parameters in polluted flue gas

Parameters	Petrol installed engine of vehicles						Oil installed engine of vehicles		
	Car				Motorcycle		Car		
	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 1	Level 2	Level 3
CO (% volume)	6,5	6,0	4,5	3,5	6,0	4,5	-	-	-
Or (ppm volume)					10.000	7.800			
- Four stoke engine	-	1500	1200	600			-	-	-
- Two stoke engine	-	7800	7800	7800			-	-	-
Different structuring engine	-	3300	3300	3300			-	-	-
Smoking degree (% HSU)	-	-	-	-	-	-	85	72	50

Appendix 4. Noise in public and residential areas

Vietnamese Standard TCVN 5949 – 1998

Maximum permitted noise level in public and residential areas

Unit: dBA

No.	Area	Time		
		6h-18h	18h-22h	22h-6h
1	Quiet areas: - Hospitals - Libraries - Sanatoria - Kindergartens, schools - Church - Pagoda	50	45	40
2	Residential area: - Hotels, administration offices - Houses, apartment houses, etc.	60	55	45
3	Commercial, Service area	70	70	50
4	Production workshop located intermix residential area.	75	70	50

Appendix 5. Surface water quality standard

Vietnamese Standard TCVN 5942 – 1995

Parameter Limits and Maximum Allowable Concentration of Pollutants in Surface Water

N ^o	Parameter and substance	Unit	Limitation value	
			A	B
1	pH value	-	6 - 8.5	5.5 - 9
2	BOD ₅ (20°C)	mg/l	< 4	< 25
3	COD	mg/l	< 10	< 35
4	DO	mg/l	≥ 6	≥ 2
5	SS	mg/l	20	80
6	Arsenic	mg/l	0.05	0.1

7	Barium	mg/l	1	4
8	Cadimium	mg/l	0.01	0.02
9	Lead	mg/l	0.05	0.1
10	Chromium. Hexavalent	mg/l	0.05	0.05
11	Chromium. Trivalent	mg/l	0.1	1
12	Copper	mg/l	0.1	1
13	Zinc	mg/l	1	2
14	Manganese	mg/l	0.1	0.8
15	Nickel	mg/l	0.1	1
16	Iron	mg/l	1	2
17	Mercury	mg/l	0.001	0.002
18	Tin	mg/l	1	2
19	Amonia (as N)	mg/l	0.05	1
20	Fluoride	mg/l	1	1.5
21	Nitrate (as N)	mg/l	10	15
22	Nitrite (as N)	mg/l	0.01	0.05
23	Cyanide	mg/l	0.01	0.05
24	Phenol compounds	mg/l	0.001	0.02
25	Oil and grease	mg/l	ND	0.3
26	Detergent	mg/l	0.5	0.5
27	Coliform	MPN/100 ml	5.000	10.000
28	Total pesticide (except DDT)	mg/l	0.15	0.15
29	DDT	mg/l	0.01	0.01
30	Gross α activity	Bq/l	0.1	0.1
31	Gross β activity	Bq/l	1.0	1.0

Note

- Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.
- Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard

Appendix 6. Coastal water quality standard
Vietnamese Standard TCVN 5943 – 1995

Parameter Limits and Allowable Concentrations of Pollutants in Coastal Water

N ^o	Parameter and substance	Unit	Limitation value		
			Bathing and recreation area	Aquatic cultivation area	Other
1	Temperature	°C	30	-	-
2	Odor	-	unobjectio- -nable	-	-
3	pH value	-	6.5 - 8.5	6.5 – 8.5	6.5 – 8.5
4	Disolved solid (DO)	mg/l	≥ 4	≥ 5	≥ 4
5	BOD ₅ (20°C)	mg/l	< 20	<10	<20
6	Suspended solid	mg/l	25	50	200
7	Asen	mg/l	0.05	0.01	0.05
8	Amonia (as N)	mg/l	0.1	0.5	0.5
9	Cadmium	mg/l	0.005	0.005	0.01
10	Lead	mg/l	0.1	0.05	0.1
11	Chromium (VI)	mg/l	0.05	0.05	0.05
12	Chromium (III)	mg/l	0.1	0.1	0.2
13	Chloride	mg/l	-	0.01	-
14	Copper	mg/l	0.02	0.01	0.02
15	Fluoride	mg/l	1.5	1.5	1.5
16	Zinc	mg/l	0.1	0.01	0.1
17	Manganese	mg/l	0.1	0.1	0.1
18	Iron	mg/l	0.1	0.1	0.3
19	Mercury	mg/l	0.005	0.005	0.01
20	Sulfide	mg/l	0.01	0.005	0.01
21	Cyanide	mg/l	0.01	0.01	0.02
22	Phenol compounds	mg/l	0.001	0.001	0.002
23	Oil and fat film	mg/l	none	none	0.3
24	Oil and fat suspension	mg/l	2	1	5
25	Total pesticides	mg/l	0.05	0.01	0.05
26	Coliform	MPN/100ml	1000	1000	1000

Appendix 7. *Ground water quality standard* Vietnamese Standard TCVN 5944 – 1995

Parameter limits and maximum allowable concentrationsof pollutants in ground water

No	Parameter and pollutant	Unit	Limitation value
1	pH value		6,5 ÷ 8,5
2	Colour	Pt - Co	5 ÷ 50
3	Hardness (as CaCO ₃)	mg/l	300 ÷ 500
4	Total solids	mg/l	750 ÷ 1500
5	Arsenic	mg/l	0,05
6	Cadmium	mg/l	0,01
7	Chloride	mg/l	200 ÷ 600
8	Lead	mg/l	0,05
9	Chromium (VI)	mg/l	0,05
10	Cyanide	mg/l	0,01
11	Copper	mg/l	1,0
12	Fluoride	mg/l	1,0
13	Zink	mg/l	5,0
14	Manganese	mg/l	0,1 ÷ 0,5
15	Nitrate	mg/l	45
16	Phenol compound	mg/l	0,001
17	Iron	mg/l	1 ÷ 5
18	Sulphate	mg/l	200÷400
19	Mercury	mg/l	0,001
20	Selenium	mg/l	0,01
21	Fecal coli	MPN/100 ml	Not detectable
22	Coliform	MPN/100 ml	3

Appendix 8. Industrial waste water Discharge standards

Vietnamese Standard TCVN 5945 – 2005

Limit values of parameters and maximum allowable concentration of pollutants

N ^o	Parameter	Unit	Limitation value		
			A	B	C
1	Temperature	^o C	40	40	45
2	pH	-	6 - 9	5.5 - 9	5 - 9
3	Odor	-	unobjecti- onable	unobjecti- onable	-
4	Colour, Co – Pt at pH = 7		20	50	-
5	BOD ₅ (20 ^o C)	mg/l	20	50	100
6	COD	mg/l	50	80	400
7	Suspended solids(SS)	mg/l	50	100	200
8	Asenic	mg/l	0.05	0.1	0.5
9	Mercury	mg/l	0.005	0.01	0.5
10	Lead	mg/l	0.1	0.5	1
11	Cadimi	mg/l	0.005	0.01	0.5
12	Chromium (VI)	mg/l	0.05	0.1	0.5
13	Chromium (III)	mg/l	0.2	1	2
14	Copper	mg/l	2	2	5
15	Zinc	mg/l	3	3	5
16	Niken	mg/l	0.2	0.5	2
17	Manganese	mg/l	0.5	1	5
18	Iron	mg/l	1	5	10
19	Tin	mg/l	0.2	1	5
20	Cyanide	mg/l	0.07	0.1	0.2
21	Phenol	mg/l	0.1	0.5	1
22	Oil and grease	mg/l	5	5	10
23	Oil and fat	mg/l	10	20	30
24	Clorine	mg/l	1	2	-
25	PCBs	mg/l	0.003	0.01	-
26	Pesticide: Organic phosphorus	mg/l	0.3	1	
27	Pesticide: Organic Clorine	mg/l	0.1	0.1	-
28	Sunfua	mg/l	0.2	0.5	1
29	Florua	mg/l	5	10	15
30	Clorua	mg/l	500	600	1000
31	Amoni (as N)	mg/l	5	10	15
32	Total Nitrogen	mg/l	15	30	60
33	Total Phosphorus	mg/l	4	6	8

34	Coliform	MNP/100ml	3000	5000	-
35	Bioassay		In 100% waste water. fish are alive 90% in 96 hour		-
36	Gross α activity	Bq/l	0.1	0.1	-
37	Gross β activity	Bq/l	1.0	1.0	-

Appendix 9 TCVN 6962-2001: Maximum Allowable Vibration Level Created by Construction Works in Public and Residential areas

No.	Area	Period of Time	Allowable Value	Remark
1	Areas needed special low vibration	7 h – 19 h	75	Continuous time work is not over 10 hr/day
		19 h – 7 h	Baseline value	
2	Residential, hotel, guest house, office etc.	7 h – 19 h	75	Continuous time work is not over 10 hr/day
		19 h – 7 h	Baseline value	
3	Residential area inside commercial, service and industrial areas	6 h – 22 h	75	Continuous time work is not over 14 hr/day
		22 h – 6 h	Baseline value	

Note: Exchange of vibration acceleration value into dB and vibration acceleration per m/s^2

Vibration acceleration value, dB	55	60	65	70	75
Vibration acceleration, m/s^2	0.006	0.010	0.018	0.030	0.055

APPENDIX OF CHAPTER TWO

2. BIOLOGICAL ENVIRONMENT OF THE PROJECT

2.1 The existing of aquatic organism

The species component structuring analysis of three group as Phytoplankton, Zooplankton, benthic macroinvertebrates in bottom river can distinguish feature species group for characteristic of river canal ecosystem in O Mon III power plant area

- Zooplankton component has feature species group about lower section of Mekong river, including 3 species (crustacean belong to Diaptomidae group: *Eodiaptomus draconisignivomi*, *Tropodiaptomus vicinu*, two shell pieces species belong to mussel group: *Corbicula leviuscula*, *Corbicula tenuis*, *Amblemida* mussel river group: *Pilsbryconcha exilis*, *Ensidens ingallsianus*, shrimp group *Macrobrachium equidens*
- Three group which feature species migrate from coastal estuary into project's area including: Phytoplankton: such as siliceous algae: *Melosira varians*, *Achnanthes sp.*, *Coscinodiscus subtilis*, *Nitzschia palea*. Zooplankton: *Schmackeria bulbosa*, larva of shellfishes. The bottom zoology have much silk worm species: *Nephthys polybranchia*, *Namalycastis abiuma*, Crustacean Malita species, *Alpheus* shrimp species.
- Indication Species group for river and canal water environment which distributed in Vam canal va Chanh canal including as: Phytoplankton: *Navicula sp.*, *Eunotia pectinalis*, *Pinnularia braunii*, *Pinnularia viridis*, *Pinnularia divergen*, Zooplankton: *Brachionus quadridentatus*, *Macrothrix triserialis*, *Ilyocryptus halyi*, *Moinodaphnia macleayii*. Bottom zoology: *Melanoides tuberculatus*. Species belong to this species group have life that associated with small and narrow river at project area.
- Indication Species group for much organic substance express in three group: Phytoplankton: Cyanophyta, Euglenophyta, siliceous algae species: *Melosira granulata*, *Cyclotella meneghiniana*, *Synedra ulna*, *Nitzschia palea*, *Chlorophyta species: Chlamydomonas sp.*, Zooplankton: consist of *Brachionus quadridentatus*, *Bosmina longirostis*, *Moina dubia*, *Moinodaphnia macleayii*, *Mesocyclops leuckarti*. Bottom zoology: *Limnodrilus hoffmeisteri*, *Branchiura sowerby*.

- *Quantity*

- The quantity of Phytoplankton from 2.500.000 – 8.800.000 individuals/m². Siliceous algae species indicate to much organic substances *Melosira gramilata*, *Synedra ulna*, *Cyclotella meneghiniana* were dominant. Plant quantity in river and canal is lower at the project' site.
- The quantity of Zooplankton from 1500 – 14.000 individuals/m². *Thermocyclops hyalinus* and *their naupliuslarve* were dominant.
- The quantity of Zooplankton in Hau river have from 1.500 – 6.500 individuals/m³. Whereas in Vam canal and Rach canal have higher quantity from 6.500 – 14.000 individuals/m³.
- The quantity of bottom zoology : from 90 – 900 individuals/m².

Aquatic organism system in canal river at O Mon III power plant – Can Tho is taken form on high temperature environment of subequatorial tropical climate area – water temperature often fluctuates about 28-31^{oC} – consist of typical tropic species belong to lower section of Mekong river, were influenced by weak acid environmental water to neuter and domestic waste water which much organic.

The structure of aquatic organism is specified in Tables

Table 1. The component structure of Phytoplankton species

Branch	Species	Rate %
Cyanophyta	7	9,6
Bacillariophyta	29	39,7
Chlorophyta	17	23,3
Euglenophyta	19	26,0
Dinophyta	1	1,4
Total	73	100

Table 2. *The component structure of zooplankton*

Branch	Species	Rate %
Rotatoria	4	13,8
Oligochaeta	2	6,9
Cladocera	9	31,1
Copepoda	9	31,1
Ostracoda	1	3,5
Larva	4	13,8
Total	29	100

Table 3. *The component structure of bottom organism species*

Layer	Species	Rate %
Polychaeta	2	10,5
Oligochaeta	2	10,5
Gastropoda	4	20,1
Bivalvia	8	42,1
Crustacea	3	15,8
Total	19	100

Table 4. *The Quantity of Phytoplankton*

Sampling Point	Quantity (individual/litres)	Dominant species	Quantity of dominant species (individuals/L)
1	7600	<i>Synedra ulna</i>	2600
2	4600	<i>Melosira granulata</i>	1000
3	5800	<i>Melosira granulata</i>	2600

4	3400	<i>Synedra ulna</i>	1000
5	4200	<i>Synedra ulna</i>	600

Table 5. The list of phytoplankton species in project's area

No.	SCIENTIFIC NAME	Sampling Point				
		1	2	3	4	5
	CYANOPHYTA					
1	Microcystis sp.			+		
2	Anabaena sp.	+				
3	Oscillatoria cf. acutissima					
4	Oscillatoria limnetica					
5	Oscillatoria splendida					+
6	Oscillatoria tenuis		+			
7	Oscillatoria sp.					
	BACILLARIOPHYTA					
8	Melosira granulata	+	+	+	+	+
9	Melosira granulata v. muzzanensis					
10	Melosira varians			+		
11	Cyclotella meneghiniana	+		+	+	
12	Cyclotella stylum		+	+		
13	Coscinodiscus subtilis	+				
14	Synedra ulna	+	+	+	+	+
15	Eunotia cf. pectinalis					
16	Eunotia sp.					
17	Achnanthes sp.	+				
18	Cocconeis cf. placentula	+				
19	Navicula sp.1		+			
20	Navicula sp.2		+	+		
21	Navicula sp.3					+
22	Navicula sp.4					
23	Pinnularia cf. braunii				+	+
24	Pinnularia cf. divergens		+			
25	Pinnularia viridis	+				
26	Caloneis cf. westii		+			
27	Gyrosigma kuetzingii					

28	Cymbella sp.				+	
29	Gomphonema gracile	+			+	
30	Gomphonema intricatum					+
31	Epithemia sp.		+	+		
32	Nitzschia palea					+
33	Nitzschia cf. vermicularis	+				
34	Nitzschia sp.					+
35	Surirella biseriata	+			+	
36	Surirella robusta			+		
	CHLOROPHYTA					
37	Pandorina morum		+		+	
38	Chlamydomonas sp.	+			+	+
39	Dictyosphaerium pulchellum					+
40	Coelastrum microporum					
41	Oocystis sp.					
42	Closteriopsis longissima					
43	Monoraphidium griffithii					
44	Scenedesmus acuminatus v. biseratus		+			+
45	Scenedesmus perforatus					
46	Scenedesmus quadricauda					
47	Closterium acutum					
48	Closterium acutum v. variabile					
49	Closterium sp.	+				
50	Cosmarium sp.					
51	Staurastrum cf. paradoxum		+			
52	Spirogyra sp.					
53	Mougeotia sp.	+	+		+	
	EUGLENOPHYTA					
54	Euglena acus					+
55	Euglena cf. rostrifera					
56	Euglena spirogyra					
57	Euglena sp.1		+			+
58	Euglena sp.2	+				+
59	Euglena sp.3					
60	Lepocinclis fusiformis					

61	Phacus tortus					
62	Phacus triqueter					
63	Trachelomonas hispida		+			
64	Trachelomonas cf. ovalis	+				
65	Trachelomonas cf. pulcherrima v. minor		+			
66	Trachelomonas volvocina					+
67	Trachelomonas volvocina v. compressa			+		
68	Trachelomonas volvocina v. derephora	+		+		+
69	Trachelomonas sp.1		+		+	
70	Trachelomonas sp.2				+	
71	Strombomonas costata					
72	Strombomonas napiformis v. brevicollis					
	DINOPHYTA					
73	Peridinium sp.					
	Total species	17	17	11	12	16

Table 6. The list of zooplanktons species in project's area

No.	SCIENTIFIC NAME	Sampling Point				
		N1	N2	N3	N4	N5
	I. ROTATORIA					
	Asplanchnidae					
1	Asplanchna sieboldi (Leydig)					1
	Euchlanidae					
2	Dipleuchlanis propatula (Gosse)		1			
	Brachionidae					
3	Brachionus quadridentatus (Hermann)	2				
4	Platyias patulus (Muller)					
	II. OLIGOCHAETA					
	Naididae					
5	Stylaria fossularis Leidy	1		1		1
6	Nais sp.					

	III. CLADOCERA					
	Bosminidae					
7	Bosmina longirostris (O.F.Muller)					
8	Bosminopsis deitersi Richard	1				1
	Sididae					
9	Diaphanosoma excisum Sars				2	
	Macrothricidae					
10	Macrothrix triserialis Brady					
11	Ilyocryptus halyi Brady					
	Daphniidae					
12	Moinadubia de Guerne et Richard			1	1	2
13	Ceriodaphnia rigaudi Richard				2	4
14	Moinodaphnia macleayii (King)	1			1	
	Chydoridae					
15	Chydorus sphaericus (O.F.Muller)		1			
	IV. COPEPODA					
	Diaptomidae					
16	Eodiaptomus draconisignivomi Brehm	3	2	1	5	9
17	Tropodiaptomus vicinus Kiefer				1	
18	Neodiaptomus malaindosinensis Lai and Fernando				1	
	Pseudodiaptomidae					
19	Pseudodiaptomus beieri Brehm					1
20	Schmackeria bullesa Shen and Tai		1	2	2	4
	Cyclopidae					
21	Ectocyclops phaleratus (Koch)				1	
22	Microcyclops varicans Sars	12	4	2		2
23	Mesocyclops leuckarti (Claus)				1	1
24	Thermocyclops hyalinus Rehberg	16	4		13	33
	V. OSTRACODA					
	Cypridae					
25	Heterocypris anomala Klie	2			2	
	VI. LARVA					

26	Nauplius copepoda	9	34	12	28	41
27	Zoe				1	4
28	Mysis		2		1	1
29	Trứng cá và cá con		2		3	2
A number of species		9	8	6	16	15
Quantity of 1 m ³		4700	5100	1900	6500	10900

Table 7. The list of bottom organism species in project's area

No.	SCIENTIFIC NAME	Sampling Point				
		N1	N2	N3	N4	N5
	POLYCHAETA					
	Errantia					
	<i>Nephtyidae</i>					
1	Nephtys polybranchia (Southern)				6	
	<i>Nereidae</i>					
2	Namalycastis abiuma Muller					
	OLIGOCHAETA					
	<i>Tubificidae</i>					
3	Limnodrilus hoffmeisteri Claparede	11				20
4	Branchiura sowerbyi Beddard	7				8
	MOLLUSCA					
	Gastropoda					
	<i>Thiaridae</i>					
5	Sermyla tornatella (Lea)					7
6	Melanoides tuberculatus (Muler)					
	<i>Stenothyridae</i>					
7	Stenothyra mcmulleni Brandt		2			
	<i>Hydrobiidae</i>					
8	Pachydrobia sp.					
	Bivalvia					
	<i>Mytilidae</i>					

9	Limnoperna siamensis (Morelet)				3	
	<i>Dreissenidae</i>					
10	Sinomytilus harmandi (Rocherbrune)	2				
	<i>Corbiculidae</i>					
11	Corbicula leviuscula Prime					
12	Corbicula tenuis Clessin	2	27		2	11
13	Corbicula blandiana Prime		4			2
	<i>Amblemidae</i>					
14	Pilsbryoconcha exilis exilis (Martens)					
15	Ensis ingallsianus ingallsianus (Lea)					
16	Physunio microptenus (Morelet)					
	CRUSTACEA					
	Amphipoda					
	<i>Gammaridae</i>					
17	Melita sp.	8				
	Decapoda					
	<i>Palaemonidae</i>					
18	Macrobrachium equidens (Dana)				1	
	<i>Alpheidae</i>					
19	Alpheus sp.					
A number of species		5	3	0	4	5
Quantity/m2		300	330	0	120	480

APPENDIX OF CHAPTER THREE

APPENDIX 3.1

CALCULATED AIR POLLUTION DISPERSION

**OPTION 1A: RAINY SEASON
O MON III COMBINED CYCLE POWER PLANT 750MW
GAS FIRE - OPEN CYCLE
STACK HEIGHT H: $H = 30$ (m)**

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-OPEN CYCLE-GAS FIRE- PM10 DUST - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-OPEN CYCLE-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 572971.48(m)

Y: 1120923.93(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: 505.5(m³/s)

Tonnage: 2.53(g/s)

Concentration: 5(mg/m³)

Flue Gas Temperature: 594(°C)

2. STACK 2

X: 572921.71(m)

Y: 1120957.25(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: 505.5(m³/s)

Tonnage: 2.53(g/s)

Concentration: 5(mg/m³)

Flue Gas Temperature: 594(°C)

VII. GRID BOARD:

X: 562921.71(m)

Y: 1110923.93(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 5E-05(mg/m³): 45342472.791(m²)

2. Concentration Level Contour 0.0001(mg/m³): 34430331.417(m²)

3. Concentration Level Contour 0.0002(mg/m³): 11606220.274(m²)

4. Concentration Level Contour 0.0003(mg/m³): 2558228.94(m²)

5. Concentration Level Contour $0.00035(\text{mg}/\text{m}^3)$: $37250.834(\text{m}^2)$

Total: $93974504.257(\text{m}^2)$

Maximum Concentration:

CMax: $0.000351045(\text{mg}/\text{m}^3)$, $(X=576401.71, Y=1124403.93)$

Distance from STACK 1: $4886.4(\text{m})$

Distance from STACK 2: $4897.96(\text{m})$

Average: $4892.18(\text{m})$

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-OPEN CYCLE-GAS FIRE - PM10 DUST - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-OPEN CYCLE-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: $30(^{\circ}\text{C})$

4. Pressure: $1013(\text{Mbar})$

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: $572971.48(\text{m})$

Y: $1120923.93(\text{m})$

Plant: O Mon III Combined Cycle Power Plant

Stack Height: $30(\text{m})$

Diameter: $6.8(\text{m})$

Flow: $505.5(\text{m}^3/\text{s})$

Tonnage: $2.53(\text{g}/\text{s})$

Concentration: $5(\text{mg}/\text{m}^3)$

Flue Gas Temperature: $594(^{\circ}\text{C})$

2. STACK 2

X: $572921.71(\text{m})$

Y: $1120957.25(\text{m})$

Plant: O Mon III Combined Cycle Power Plant

Stack Height: $30(\text{m})$

Diameter: $6.8(\text{m})$

Flow: $505.5(\text{m}^3/\text{s})$

Tonnage: $2.53(\text{g}/\text{s})$

Concentration: $5(\text{mg}/\text{m}^3)$

Flue Gas Temperature: $594(^{\circ}\text{C})$

VII. GRID BOARD:

X: $562921.71(\text{m})$

Y: $1110923.93(\text{m})$

Δx column distance: $40(\text{m})$

Δx row distance: $40(\text{m})$

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour $5E-05(mg/m^3)$: 61352718.711(m^2)
 2. Concentration Level Contour $0.0001(mg/m^3)$: 25011961.589(m^2)
 3. Concentration Level Contour $0.00015(mg/m^3)$: 6841738.351(m^2)
- Total: 93206418.651(m^2)

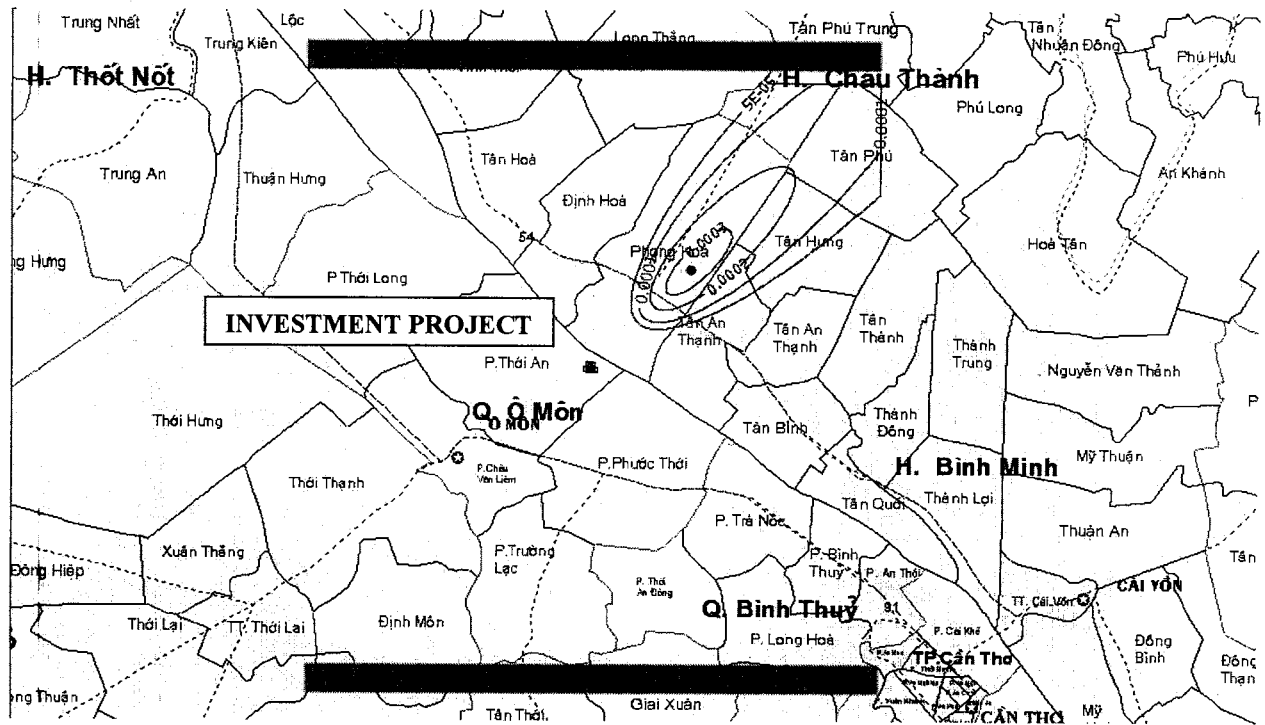
Maximum Concentration:

CMax: $0.000185989(mg/m^3)$, (X=576401.71 , Y=1124403.93)

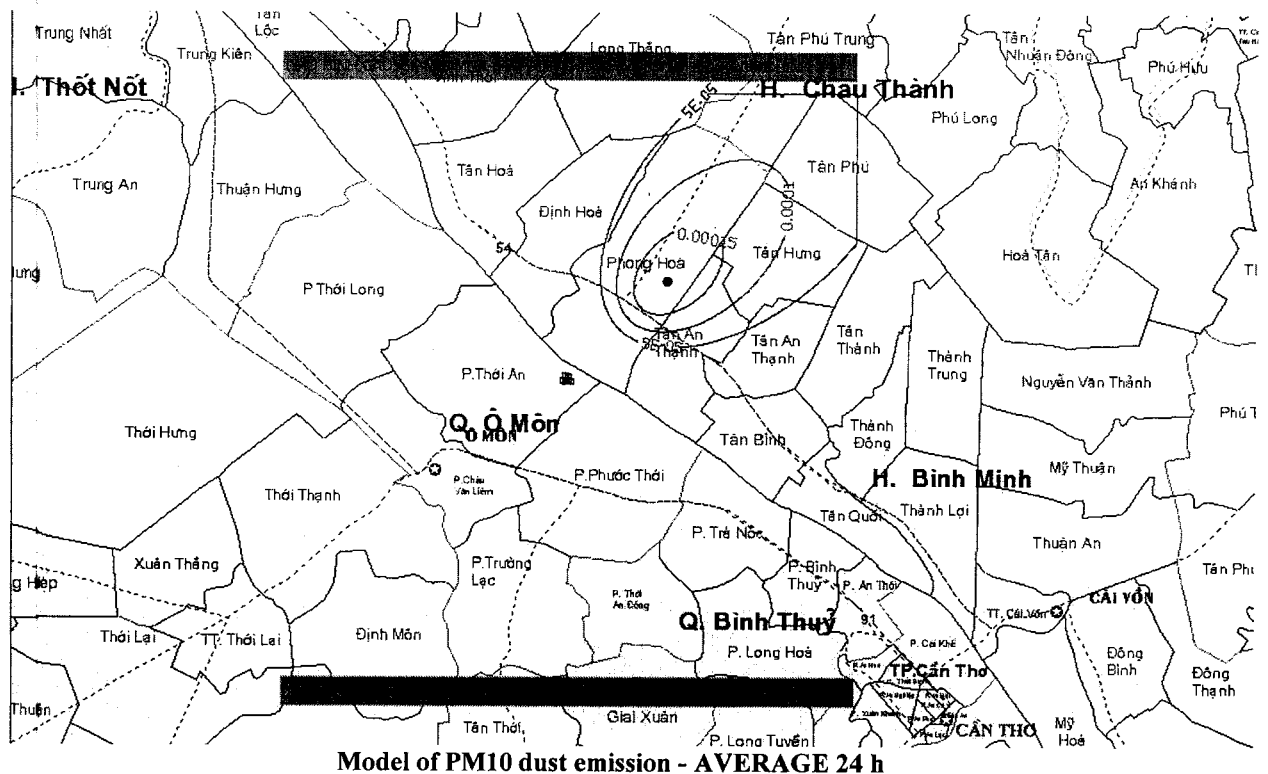
Distance from STACK 1: 4886.4(m)

Distance from STACK 2: 4897.96(m)

Average: 4892.18(m)



Model of PM10 dust emission - AVERAGE 1 h



MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-OPEN CYCLE-GAS FIRE - NO2 - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-OPEN CYCLE-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 572971.48(m)

Y: 1120923.93(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: 505.5(m³/ s)
Tonnage:25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

2. STACK 2

X: 572921.71(m)
Y: 1120957.25(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 30(m)
Diameter: 6.8(m)
Flow: 505.5(m³/ s)
Tonnage:25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

VII. GRID BOARD:

X: 562921.71(m)
Y: 1110923.93(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0005(mg/m³): 45337553.615(m²)
 2. Concentration Level Contour 0.001(mg/m³): 34422016.489(m²)
 3. Concentration Level Contour 0.002(mg/m³): 11595383.83(m²)
 4. Concentration Level Contour 0.003(mg/m³): 2551257.216(m²)
 5. Concentration Level Contour 0.0035(mg/m³): 31676.029(m²)
- Total: 93937887.18(m²)

Maximum Concentration:

CMax: 0.003509061(mg/m³) ,(X=576401.71 ,Y=1124403.93)
Distance from STACK 1: 4886.4(m)
Distance from STACK 2: 4897.96(m)
Average: 4892.18(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-OPEN CYCLE-GAS FIRE - NO2 - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-OPEN CYCLE-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area
Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 572971.48(m)
Y: 1120923.93(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 30(m)
Diameter: 6.8(m)
Flow: 505.5(m³/ s)
Tonnage: 25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

2. STACK 2

X: 572921.71(m)
Y: 1120957.25(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 30(m)
Diameter: 6.8(m)
Flow: 505.5(m³/ s)
Tonnage: 25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

VII. GRID BOARD:

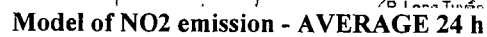
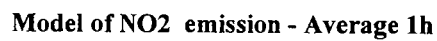
X: 562921.71(m)
Y: 1110923.93(m)
Δx column distance: 40(m)
Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0005(mg/m³): 61342863.143(m²)
 2. Concentration Level Contour 0.001(mg/m³): 24990138.362(m²)
 3. Concentration Level Contour 0.0015(mg/m³): 6827646.816(m²)
- Total: 93160648.321(m²)

Maximum Concentration:

CMax: 0.001859153(mg/m³) , (X=576401.71 , Y=1124403.93)
Distance from STACK 1: 4886.4(m)
Distance from STACK 2: 4897.96(m)
Average: 4892.18(m)



**OPTION 1B: DRY SEASON
O MON III COMBINED CYCLE POWER PLANT 750MW
GAS FIRE - OPEN CYCLE
STACK HEIGHT H: H = 30 (m)**

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-OPEN CYCLE-GAS FIRE - PM10 DUST - AVERAGE 1H

I. TIME:

Time: DRY SEASON-OPEN CYCLE-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 572971.48(m)

Y: 1120923.93(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: 505.5(m³/ s)

Tonnage: 2.53(g/ s)

Concentration: 5(mg/m³)

Flue Gas Temperature: 594(°C)

2. STACK 2

X: 572921.71(m)

Y: 1120957.25(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: 505.5(m³/ s)

Tonnage: 2.53(g/ s)

Concentration: 5(mg/m³)

Flue Gas Temperature: 594(°C)

VII. GRID BOARD:

X: 562921.71(m)

Y: 1110923.93(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 5E-05(mg/m³): 30656910.995(m²)

2. Concentration Level Contour 0.0001(mg/m³): 23104458.175(m²)

3. Concentration Level Contour 0.0002(mg/m³): 11155671.811(m²)

4. Concentration Level Contour 0.0003(mg/m³): 2770294.913(m²)

5. Concentration Level Contour 0.00035(mg/m³): 431166.192(m²)

Total: 68118502.086(m²)

Maximum Concentration:

CMax: 0.000361398(mg/m³), (X=568321.71, Y=1120923.93)

Distance from STACK 1: 4649.77(m)

Distance from STACK 2: 4600.12(m)

Average: 4624.95(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-OPEN CYCLE-GAS FIRE - PM10 DUST - AVERAGE 24H

I. TIME:

Time: DRY SEASON-OPEN CYCLE-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 572971.48(m)

Y: 1120923.93(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: 505.5(m³/s)

Tonnage: 2.53(g/s)

Concentration: 5(mg/m³)

Flue Gas Temperature: 594(°C)

2. STACK 2

X: 572921.71(m)

Y: 1120957.25(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: 505.5(m³/s)

Tonnage: 2.53(g/s)

Concentration: 5(mg/m³)

Flue Gas Temperature: 594(°C)

VII. GRID BOARD:

X: 562921.71(m)

Y: 1110923.93(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

VIII. POLLUTED AREA

- Maximum Concentration:**

Average: 4624.95(m)





THE GAUSS- DRY SEASON-OPEN CYCLE-GAS FIRE - NO2 - AVERAGE 1H

Time: DRY SEASON-OPEN CYCLE-GAS FIRE

Pollution name: NO2

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concawe

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 572971.48(m)

Y: 1120923.93(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 30(m)

Diameter: 6.8(m)

Flow: $505.5(\text{m}^3/\text{s})$

Tonnage:25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

2. STACK 2

X: 572921.71(m)
Y: 1120957.25(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 30(m)
Diameter: 6.8(m)
Flow: 505.5(m³/ s)
Tonnage:25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

VII. GRID BOARD:

X: 562921.71(m)
Y: 1110923.93(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0005(mg/m³): 30653095.805(m²)
 2. Concentration Level Contour 0.001(mg/m³): 23099506.591(m²)
 3. Concentration Level Contour 0.002(mg/m³): 11145639.626(m²)
 4. Concentration Level Contour 0.003(mg/m³): 2763862.183(m²)
 5. Concentration Level Contour 0.0035(mg/m³): 425757.028(m²)
- Total: 68087861.233(m²)

Maximum Concentration:

CMax: 0.003612548(mg/m³), (X=568321.71 ,Y=1120923.93)
Distance from STACK 1: 4649.77(m)
Distance from STACK 2: 4600.12(m)
Average: 4624.95(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-OPEN CYCLE-GAS FIRE - NO2 - AVERAGE 24H

I. TIME:

Time: DRY SEASON-OPEN CYCLE-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 572971.48(m)
Y: 1120923.93(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 30(m)
Diameter: 6.8(m)
Flow: 505.5(m³/ s)
Tonnage: 25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

2. STACK 2

X: 572921.71(m)
Y: 1120957.25(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 30(m)
Diameter: 6.8(m)
Flow: 505.5(m³/ s)
Tonnage: 25.29(g/ s)
Concentration: 50.03(mg/m³)
Flue Gas Temperature: 594(°C)

VII. GRID BOARD:

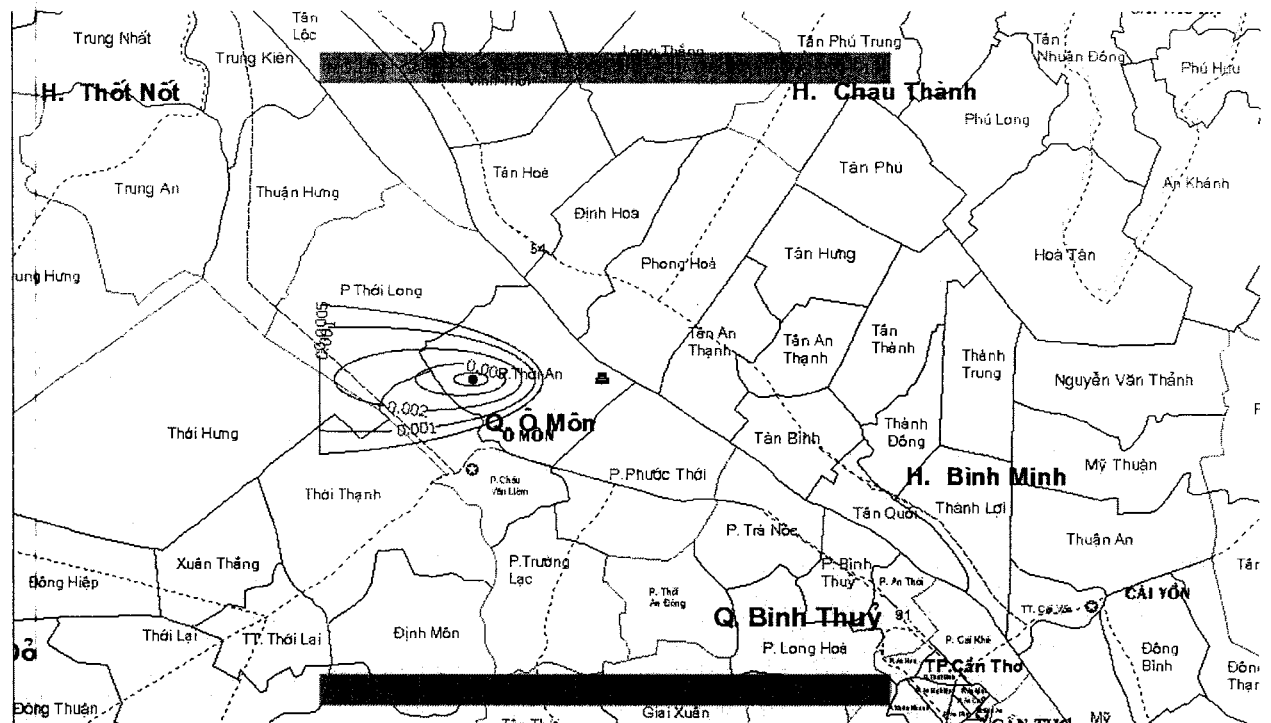
X: 562921.71(m)
Y: 1110923.93(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

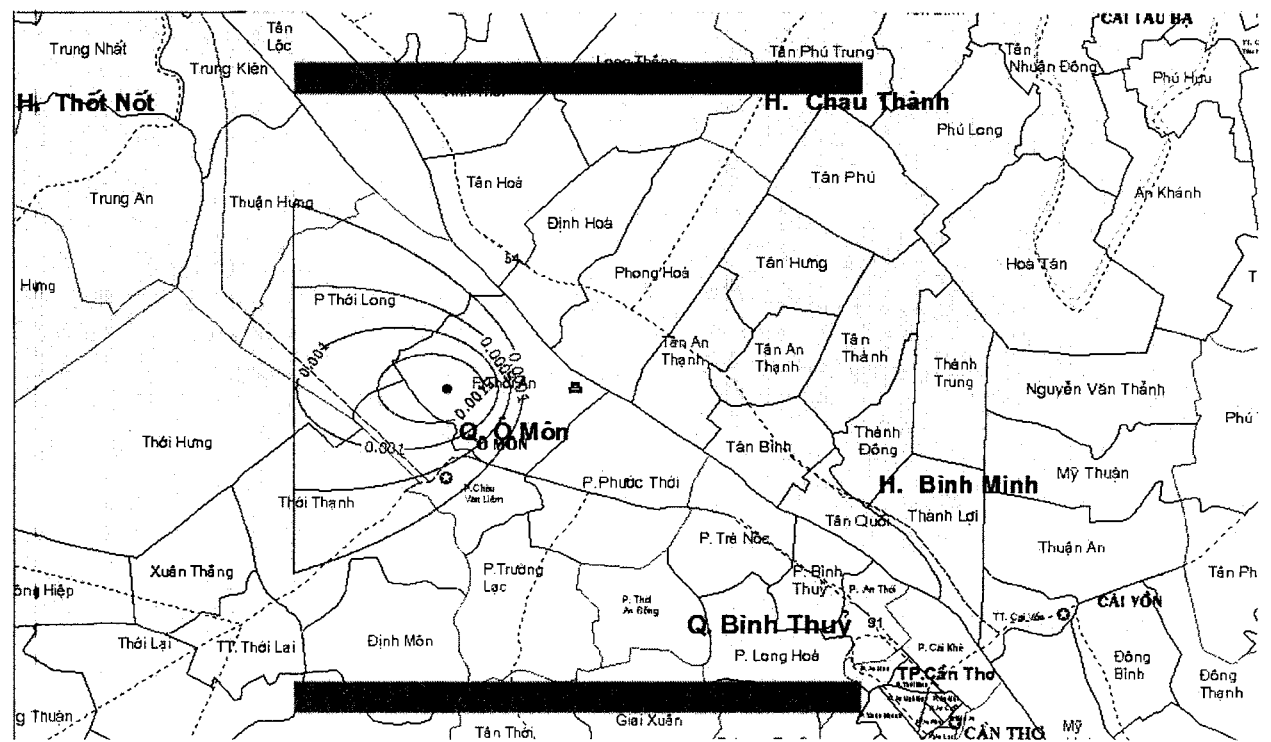
1. Concentration Level Contour 0.0001(mg/m³): 73672608.314(m²)
 2. Concentration Level Contour 0.0005(mg/m³): 44958701.488(m²)
 3. Concentration Level Contour 0.001(mg/m³): 23910974.551(m²)
 4. Concentration Level Contour 0.0015(mg/m³): 7076957.42(m²)
- Total: 149619241.772(m²)

Maximum Concentration:

CMax: 0.001913752(mg/m³) , (X=568321.71 , Y=1120923.93)
Distance from STACK 1: 4649.77(m)
Distance from STACK 2: 4600.12(m)
Average: 4624.95(m)



Model of NO2 emission - AVERAGE 1 h



Model of NO2 emission - AVERAGE 24 h

OPTION 2A: RAINY SEASON
O MON III COMBINED CYCLE POWER PLANT 750MW
GAS FIRE - COMBINED CYCLE
STACK HEIGHT H: $H = 40$ (M)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-GAS FIRE- PM10 DUST - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-CCPP-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/ s)

Tonnage: 2.53(g/ s)

Concentration: 3.69(mg/m³)

Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/ s)

Tonnage: 2.53(g/ s)

Concentration: 3.69(mg/m³)

Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 44901812.798(m²)

2. Concentration Level Contour 0.0005(mg/m³): 7996581.862(m²)

3. Concentration Level Contour 0.001(mg/m³): 2392131.865(m²)

4. Concentration Level Contour 0.0012(mg/m³): 1483989.169(m²)

5. Concentration Level Contour 0.0016(mg/m³): 368839.359(m²)

Total: 57143355.052(m²)

Maximum Concentration:

CMax: 0.001807898(mg/m³), (X=574440.07, Y=1122436.46)

Distance from STACK 1: 2062.99(m)

Distance from STACK 2: 2076.82(m)

Average: 2069.9(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-GAS FIRE- PM10 DUST - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/ s)

Tonnage: 2.53(g/ s)

Concentration: 3.69(mg/m³)

Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/ s)

Tonnage: 2.53(g/ s)

Concentration: 3.69(mg/m³)

Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

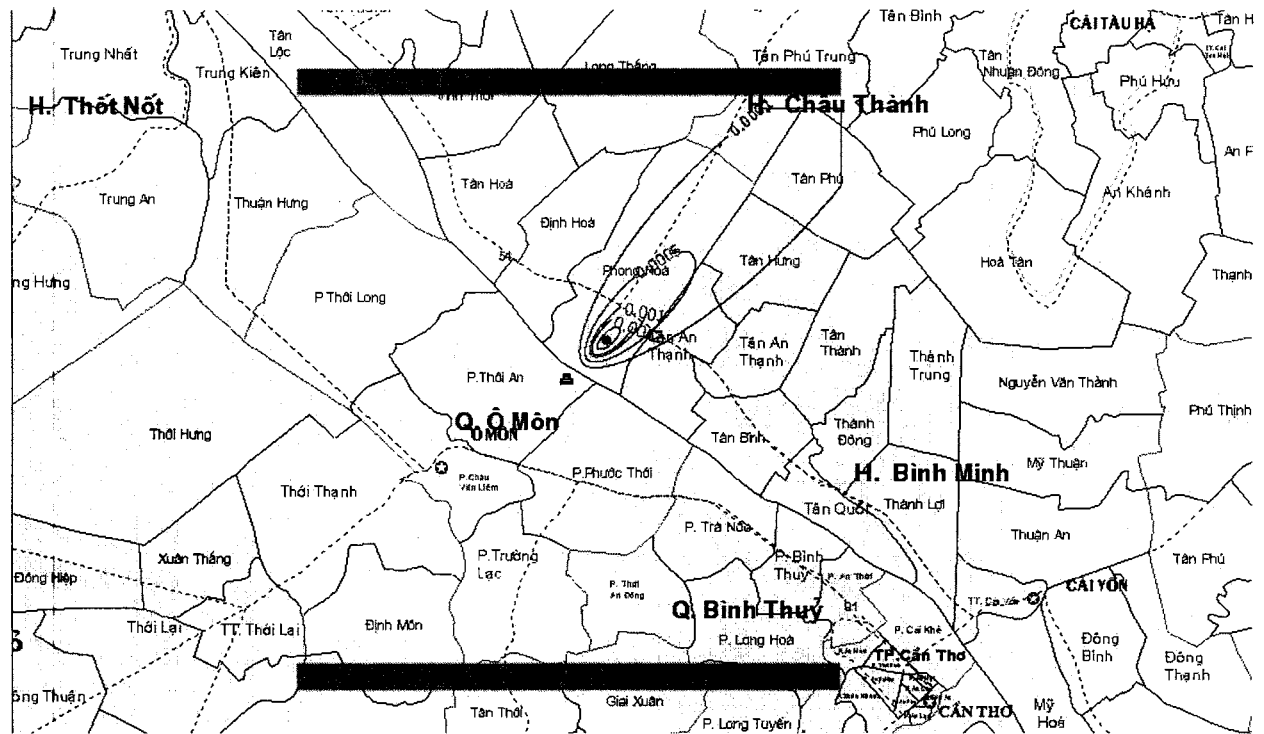
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 51505583.463(m²)
 2. Concentration Level Contour 0.0003(mg/m³): 12590128.866(m²)
 3. Concentration Level Contour 0.0006(mg/m³): 3321688.244(m²)
 4. Concentration Level Contour 0.0095(mg/m³): 0(m²)
- Total: 67417400.573(m²)

Maximum Concentration:

CMax: 0.0009592(mg/m³) , (X=574440.07 , Y=1122436.46)
Distance from STACK 1: 2062.99(m)
Distance from STACK 2: 2076.82(m)
Average: 2069.9(m)



Model of PM10 dust emission - AVERAGE 1 h



Data:

THE GAUSS- RAINY SEASON-CCPP-GAS FIRE- NO2 - AVERAGE 1H

Time: RAINY SEASON-CCPP-GAS FIRE

Pollution name: NO2

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concawe

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/ s)

Tonnage:25.96(g/ s)

Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage: 25.96(g/ s)
Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 45317122.551(m²)
 2. Concentration Level Contour 0.004(mg/m³): 11237671.669(m²)
 3. Concentration Level Contour 0.008(mg/m³): 3953147.266(m²)
 4. Concentration Level Contour 0.01(mg/m³): 2534538.489(m²)
 5. Concentration Level Contour 0.015(mg/m³): 681506.283(m²)
- Total: 63723986.258(m²)

Maximum Concentration:

CMax: 0.018550601(mg/m³) , (X=574440.07 , Y=1122436.46)
Distance from STACK 1: 2062.99(m)
Distance from STACK 2: 2076.82(m)
Average: 2069.9(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-GAS FIRE- NO2 - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage: 25.96(g/ s)
Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage: 25.96(g/ s)
Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

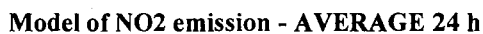
X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 97608063.003(m²)
 2. Concentration Level Contour 0.0005(mg/m³): 78785040.693(m²)
 3. Concentration Level Contour 0.001(mg/m³): 53060580.499(m²)
 4. Concentration Level Contour 0.003(mg/m³): 13082434.867(m²)
 5. Concentration Level Contour 0.006(mg/m³): 3557481.879(m²)
 6. Concentration Level Contour 0.009(mg/m³): 501392.06(m²)
- Total: 246594993.001(m²)

Maximum Concentration:

CMax: 0.009842222(mg/m³) , (X=574440.07 , Y=1122436.46)
Distance from STACK 1: 2062.99(m)
Distance from STACK 2: 2076.82(m)
Average: 2069.9(m)



OPTION 2B: DRY SEASON
O MON III COMBINED CYCLE POWER PLANT 750MW
GAS FIRE - COMBINED CYCLE
STACK HEIGHT H: $H = 40$ (m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-GAS FIRE- PM10 DUST - AVERAGE 1H

I. TIME:

Time: DRY SEASON-CCPP-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/s)

Tonnage: 2.53(g/s)

Concentration: 3.69(mg/m³)

Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/s)

Tonnage: 2.53(g/s)

Concentration: 3.69(mg/m³)

Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 31153747.117(m²)

2. Concentration Level Contour 0.0004(mg/m³): 10133085.424(m²)

3. Concentration Level Contour 0.0008(mg/m³): 3562778.479(m²)

4. Concentration Level Contour 0.001(mg/m³): 2284140.805(m²)

5. Concentration Level Contour 0.012(mg/m³): 0(m²)

6. Concentration Level Contour 0.018(mg/m³): 0(m²)
Total: 47133751.826(m²)

Maximum Concentration:

CMax: 0.001852494(mg/m³), (X=571000.07, Y=1120956.46)
Distance from STACK 1: 2002.81(m)
Distance from STACK 2: 1950.29(m)
Average: 1976.55(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-GAS FIRE- PM10 DUST - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage: 2.53(g/ s)
Concentration: 3.69(mg/m³)
Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage: 2.53(g/ s)
Concentration: 3.69(mg/m³)
Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 44272205.376(m²)
2. Concentration Level Contour 0.0003(mg/m³): 11796132.647(m²)
3. Concentration Level Contour 0.0006(mg/m³): 3201353.339(m²)
4. Concentration Level Contour 0.0009(mg/m³): 443976.772(m²)
- Total: 59713668.135(m²)

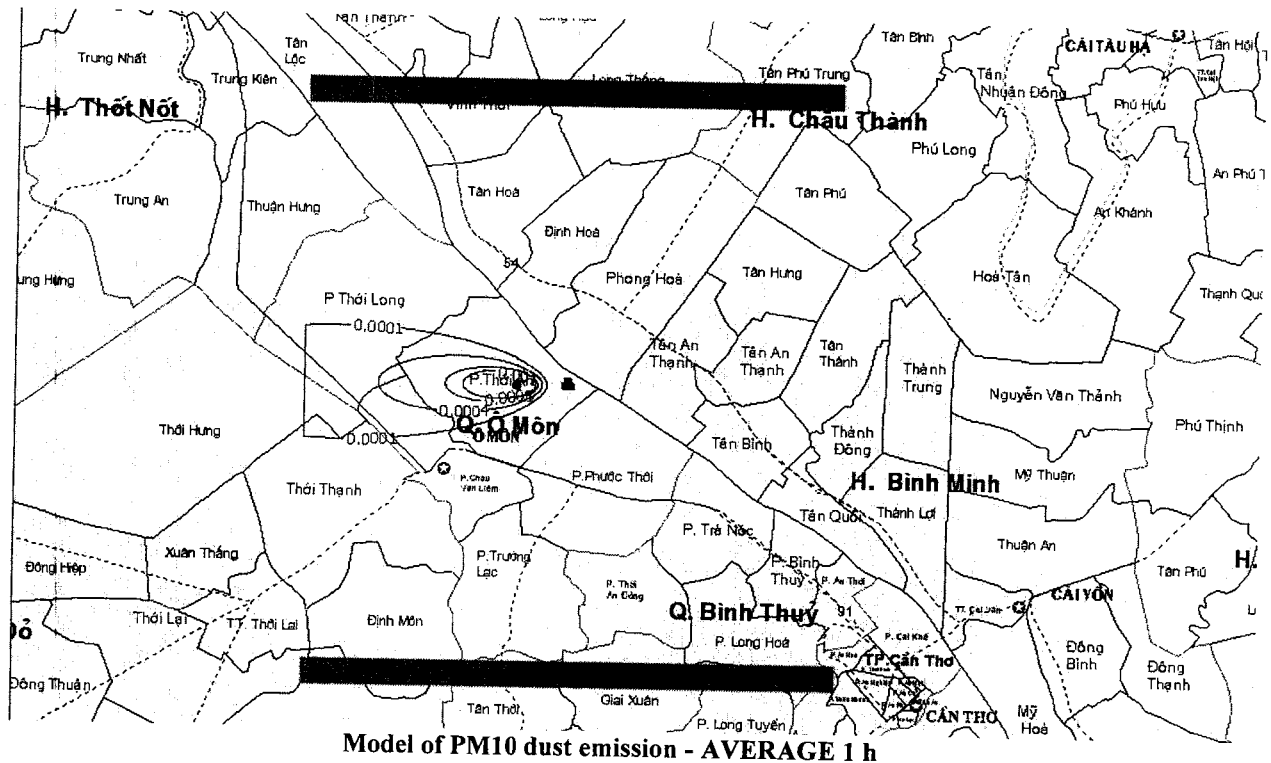
Maximum Concentration:

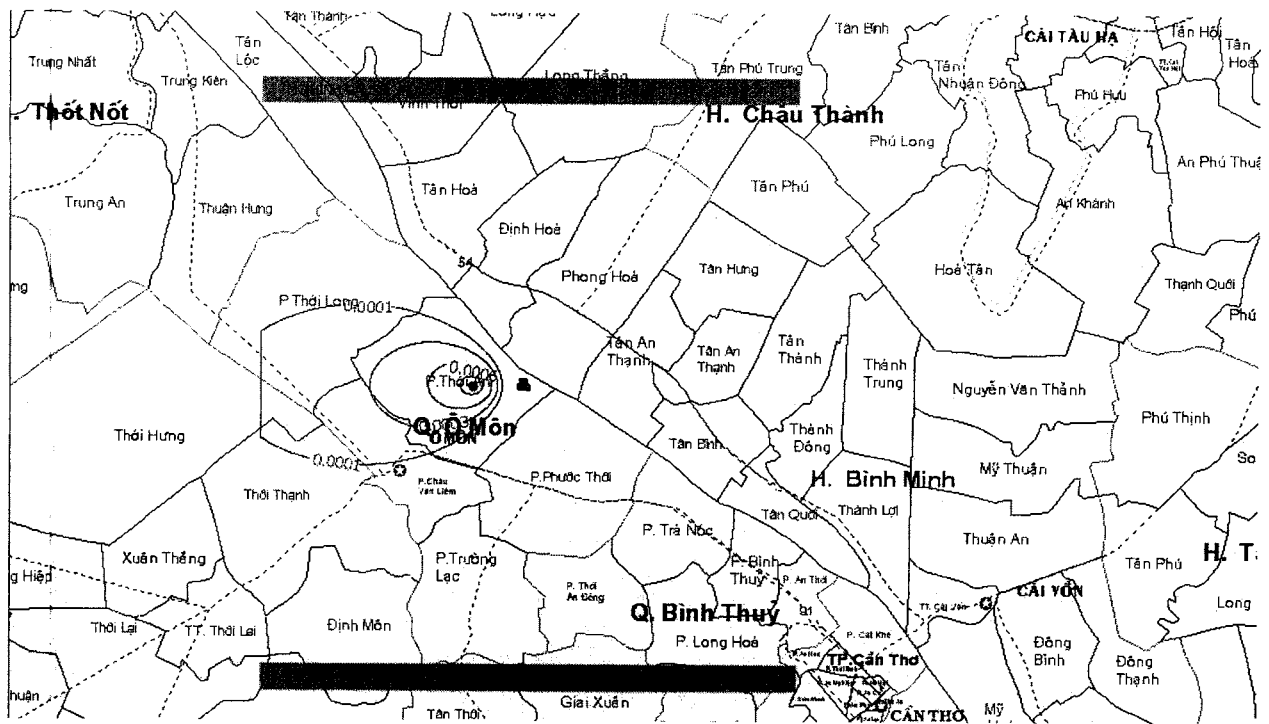
CMax: 0.000982272(mg/m³), (X=571000.07, Y=1120956.46)

Distance from STACK 1: 2002.81(m)

Distance from STACK 2: 1950.29(m)

Average: 1976.55(m)





Model of PM10 dust emission - AVERAGE 24 h

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-GAS FIRE- NO2 - AVERAGE 1H

I. TIME:

Time: DRY SEASON-CCPP-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 685.39(m³/s)

Tonnage:25.96(g/ s)
Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage:25.96(g/ s)
Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 31419595.925(m²)
 2. Concentration Level Contour 0.005(mg/m³): 7754729.952(m²)
 3. Concentration Level Contour 0.01(mg/m³): 2416745.53(m²)
 4. Concentration Level Contour 0.012(mg/m³): 1551564.336(m²)
 5. Concentration Level Contour 0.015(mg/m³): 698904.081(m²)
- Total: 43841539.824(m²)

Maximum Concentration:

CMax: 0.019008204(mg/m³) ,(X=571000.07 ,Y=1120956.46)
Distance from STACK 1: 2002.81(m)
Distance from STACK 2: 1950.29(m)
Average: 1976.55(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-GAS FIRE- NO2 - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-GAS FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage: 25.96(g/ s)
Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 685.39(m³/ s)
Tonnage: 25.96(g/ s)
Concentration: 37.88(mg/m³)
Flue Gas Temperature: 97(°C)

VII. GRID BOARD:

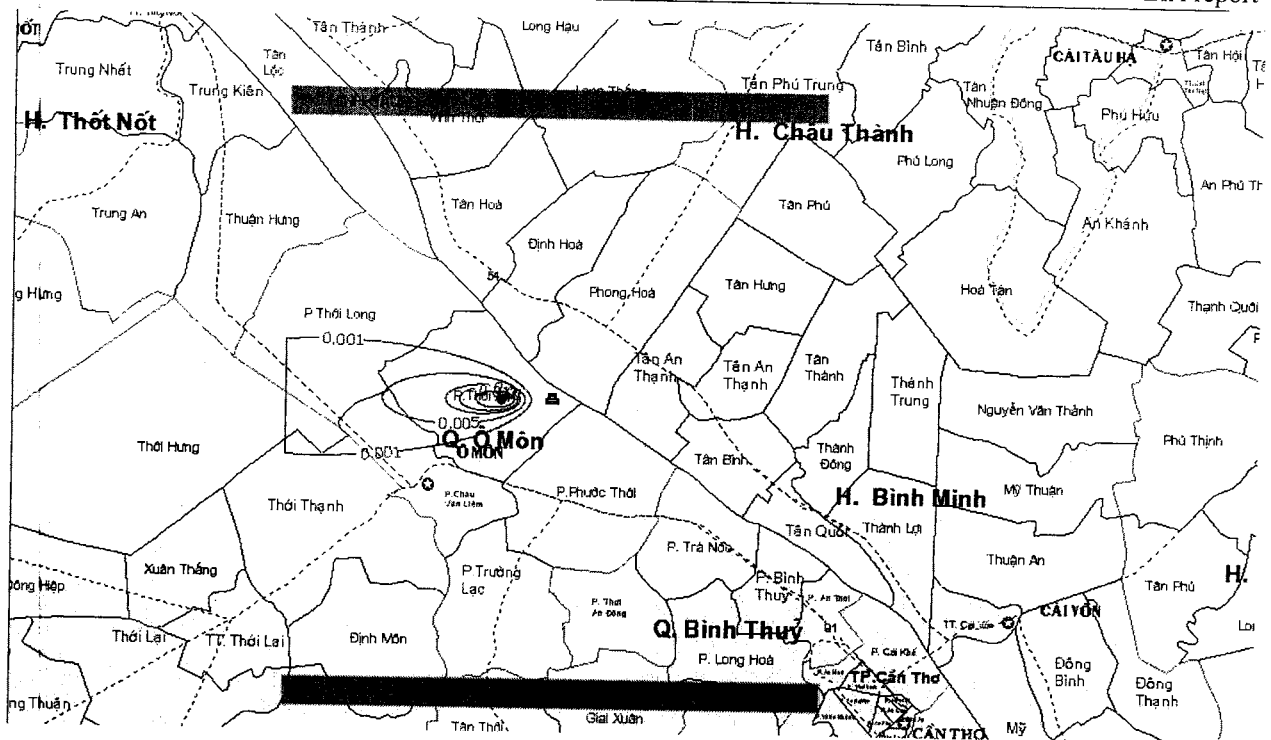
X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII POLLUTED AREA

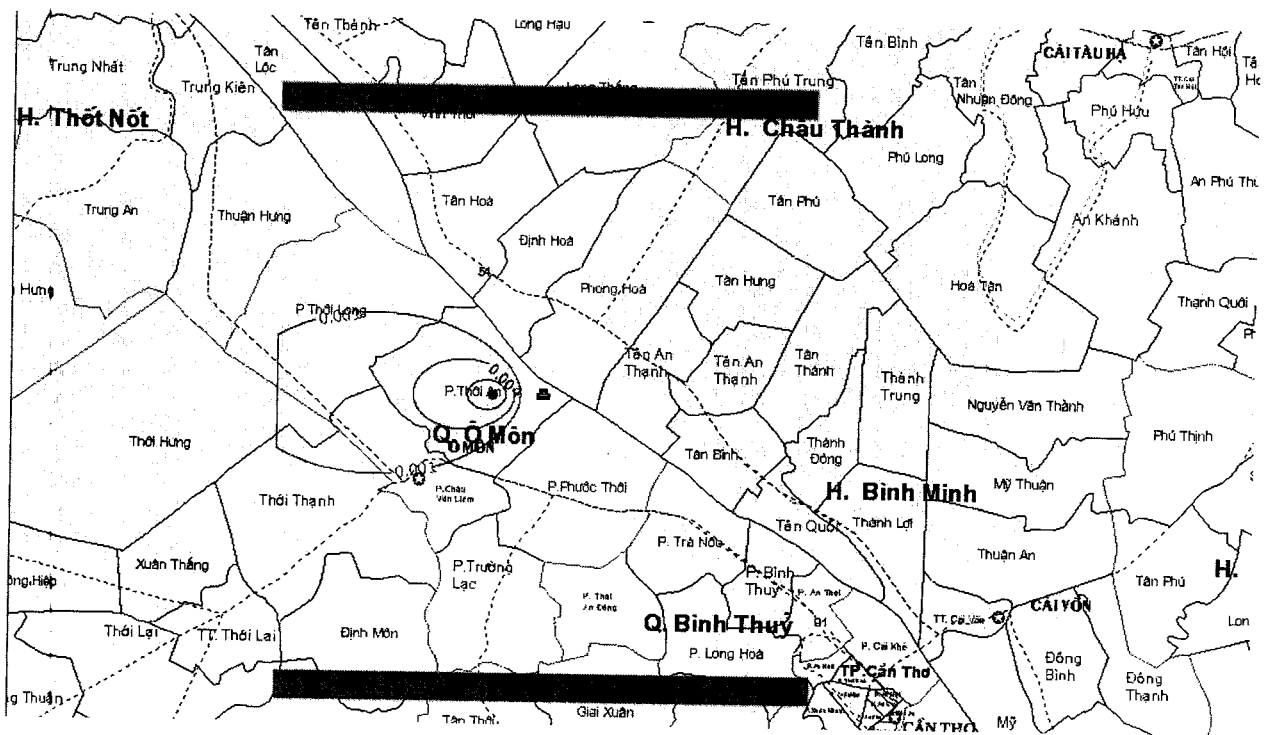
1. Concentration Level Contour 0.001(mg/m³): 44983792.076(m²)
 2. Concentration Level Contour 0.004(mg/m³): 7793525.065(m²)
 3. Concentration Level Contour 0.008(mg/m³): 1285488.803(m²)
 4. Concentration Level Contour 0.01(mg/m³): 31316.453(m²)
- Total: 54094122.398(m²)

Maximum Concentration:

CMax: 0.010078968(mg/m³) , (X=571000.07 , Y=1120956.46)
Distance from STACK 1: 2002.81(m)
Distance from STACK 2: 1950.29(m)
Average: 1976.55(m)



Model of NO₂ emission - AVERAGE 1 h



Model of NO₂ emission - AVERAGE 24 h

**OPTION 3A: RAINY SEASON
O MON III COMBINED CYCLE POWER PLANT 750MW
DO OIL FIRE - COMBINED CYCLE
STACK HEIGHT H: $H = 40$ (m)**

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 4.93(g/ s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 4.93(g/ s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 52049057.043(m²)

2. Concentration Level Contour 0.0005(mg/m³): 16493353.908(m²)

3. Concentration Level Contour 0.001(mg/m³): 5476635.845(m²)

4. Concentration Level Contour 0.0015(mg/m³): 1930252.88(m²)

5. Concentration Level Contour 0.006(mg/m³): 0(m²)

Total: 75949299.676(m²)

Maximum Concentration:

CMax: 0.002087851(mg/m³), (X=574880.07, Y=1122876.46)

Distance from STACK 1: 2685.19(m)

Distance from STACK 2: 2699.03(m)

Average: 2692.11(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 4.93(g/ s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 4.93(g/ s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

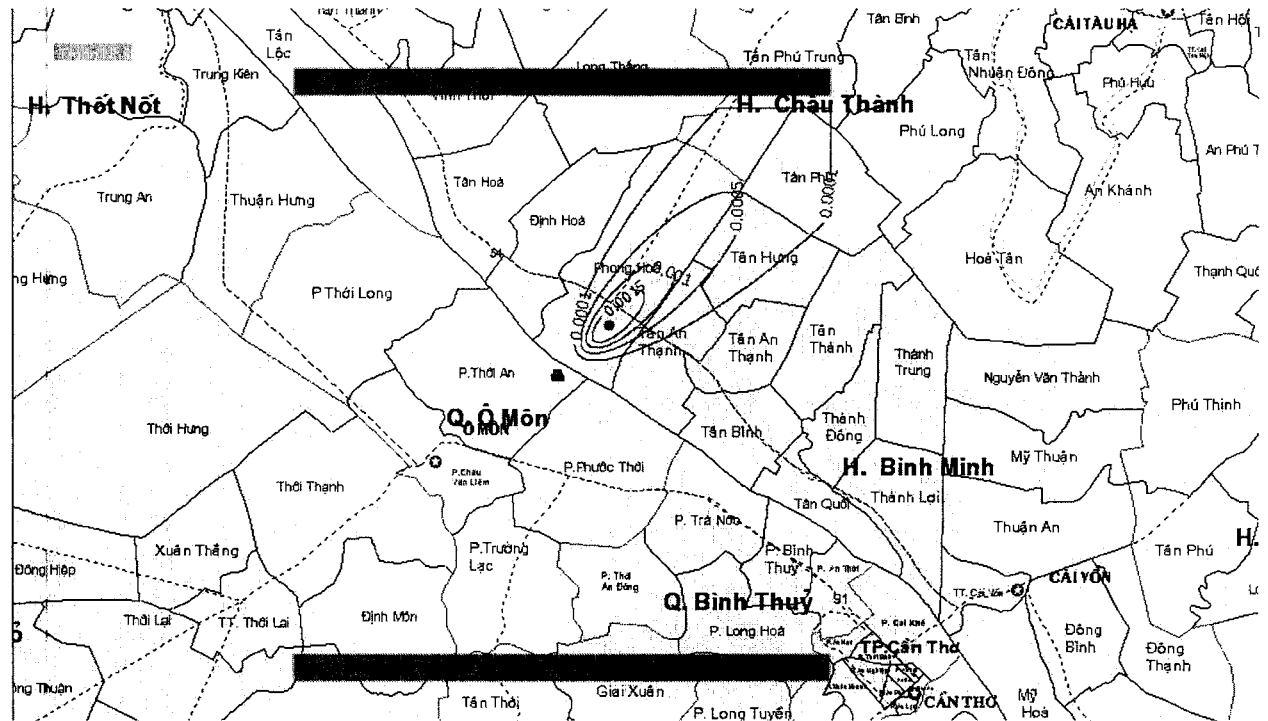
Width: 20000(m)

VIII. POLLUTED AREA

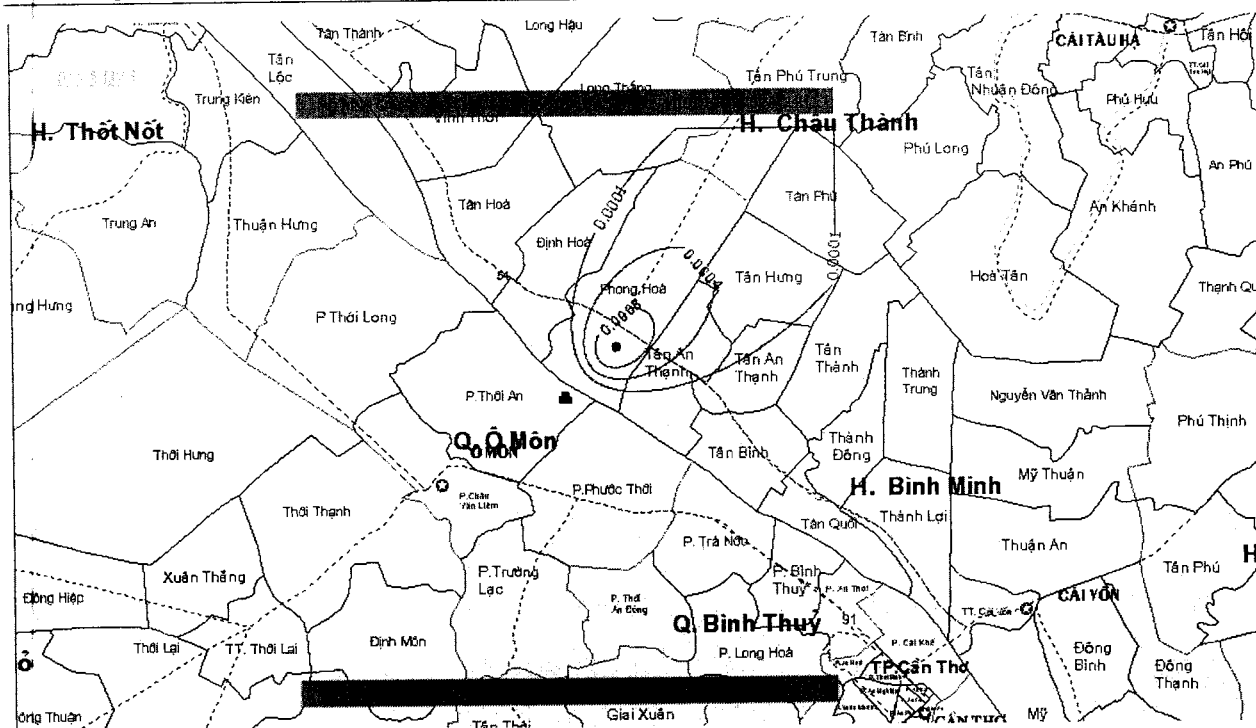
1. Concentration Level Contour 0.0001(mg/m³): 74742883.003(m²)
 2. Concentration Level Contour 0.0004(mg/m³): 17000187.759(m²)
 3. Concentration Level Contour 0.0008(mg/m³): 3569612.423(m²)
 4. Concentration Level Contour 0.001(mg/m³): 977389.303(m²)
- Total: 96290072.488(m²)

Maximum Concentration:

CMax: 0.001106982(mg/m³), (X=574880.07, Y=1122876.46)
Distance from STACK 1: 2685.19(m)
Distance from STACK 2: 2699.03(m)
Average: 2692.11(m)



Model of PM10 dust emission - AVERAGE 1 h



MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK I

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/s)

Tonnage:73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage:73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 56193829.142(m²)
 2. Concentration Level Contour 0.005(mg/m³): 27781762.507(m²)
 3. Concentration Level Contour 0.01(mg/m³): 10920098.794(m²)
 4. Concentration Level Contour 0.02(mg/m³): 2800382.785(m²)
 5. Concentration Level Contour 0.03(mg/m³): 201877.429(m²)
- Total: 97897950.657(m²)

Maximum Concentration:

CMax: 0.031292349(mg/m³) ,(X=574880.07 ,Y=1122876.46)
Distance from STACK 1: 2685.19(m)
Distance from STACK 2: 2699.03(m)
Average: 2692.11(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Site: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

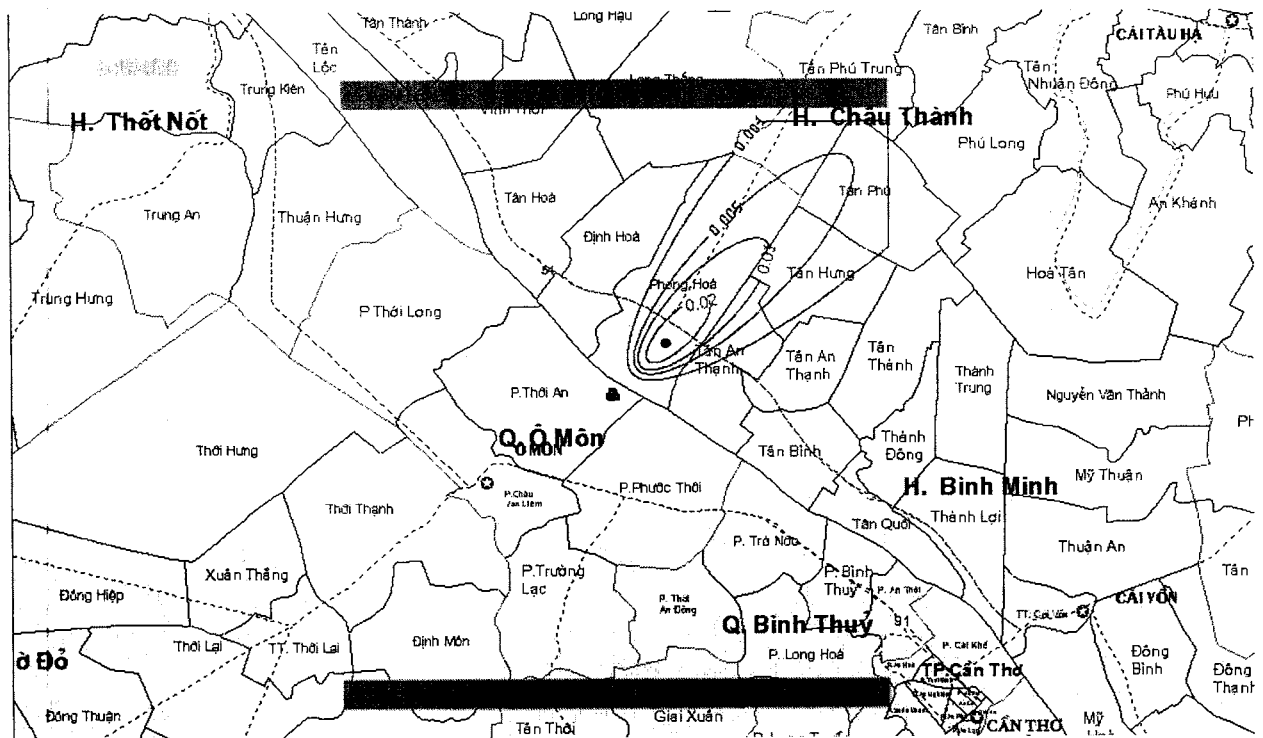
X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

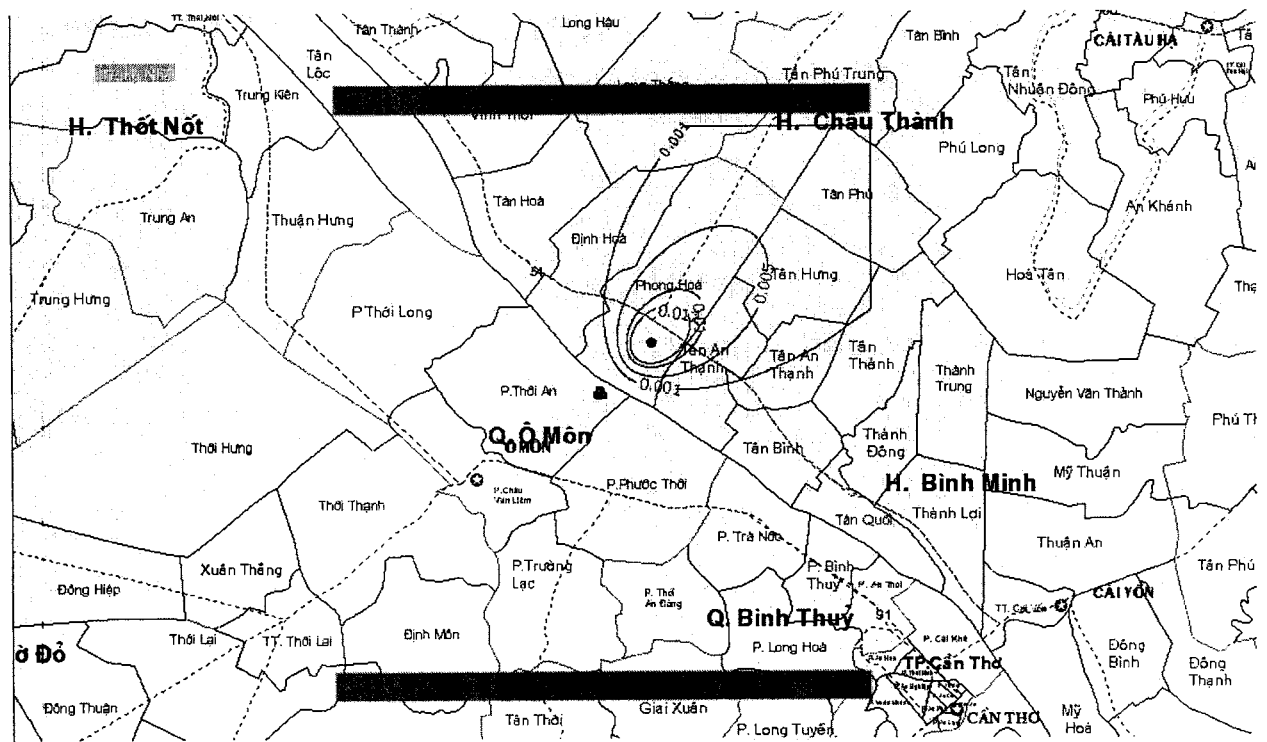
1. Concentration Level Contour 0.001(mg/m³): 81628079.84(m²)
 2. Concentration Level Contour 0.005(mg/m³): 22477242.751(m²)
 3. Concentration Level Contour 0.01(mg/m³): 6190014.305(m²)
 4. Concentration Level Contour 0.012(mg/m³): 3559034.811(m²)
 5. Concentration Level Contour 0.016(mg/m³): 331155.333(m²)
- Total: 114185527.04(m²)

Maximum Concentration:

CMax: 0.016591252(mg/m³) , (X=574880.07 , Y=1122876.46)
Distance from STACK 1: 2685.19(m)
Distance from STACK 2: 2699.03(m)
Average: 2692.11(m)



Model of NO2 emission - AVERAGE 1 h



Model of NO2 emission - AVERAGE 24 h

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - S02 - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S02

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 62465891.278(m²)

2. Concentration Level Contour 0.005(mg/m³): 46333863.176(m²)

3. Concentration Level Contour 0.01(mg/m³): 29843532.181(m²)

4. Concentration Level Contour 0.03(mg/m³): 6116618.05(m²)

5. Concentration Level Contour 0.06(mg/m³): 507549.706(m²)

6. Concentration Level Contour 0.065(mg/m³): 93096.009(m²)

Total: 145360550.4(m²)

Maximum Concentration:

CMax: 0.066349604(mg/m³), (X=574880.07, Y=1122876.46)

Distance from STACK 1: 2685.19(m)

Distance from STACK 2: 2699.03(m)

Average: 2692.11(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - S02 - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S02

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 90747163.374(m²)

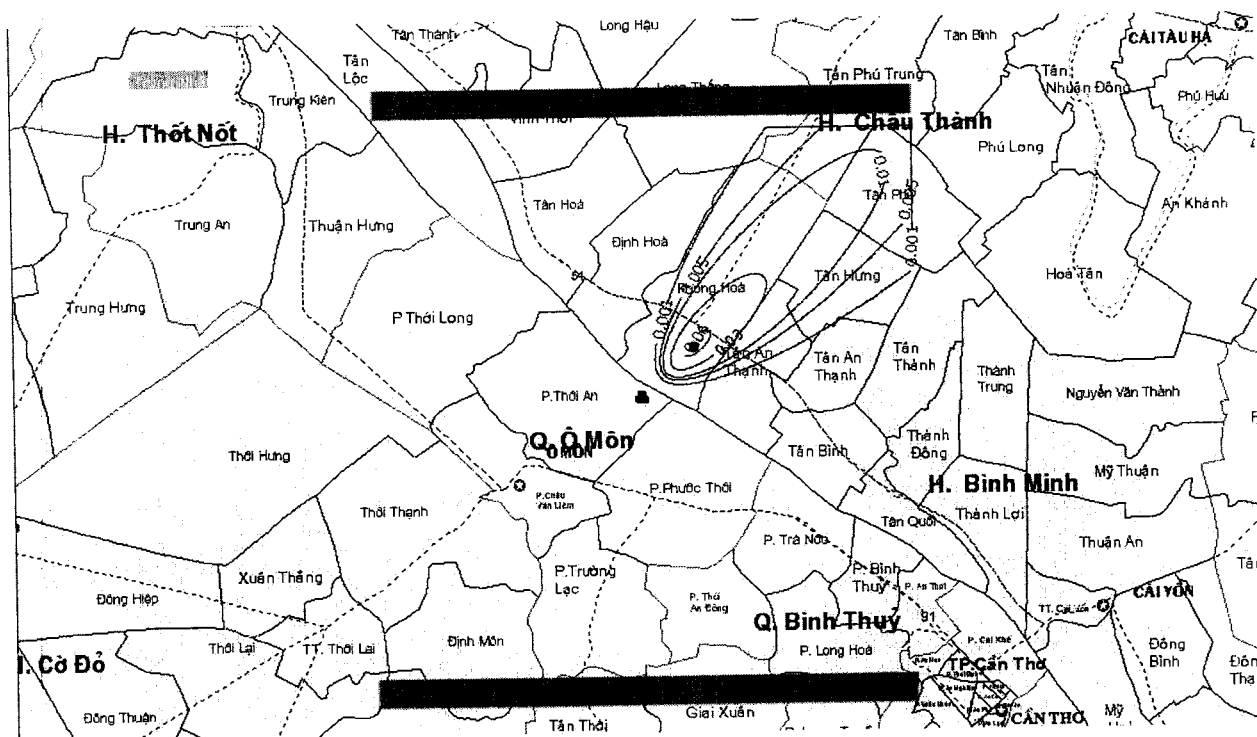
2. Concentration Level Contour 0.005(mg/m³): 60420585.009(m²)

3. Concentration Level Contour 0.01(mg/m³): 24475025.075(m²)

4. Concentration Level Contour 0.02(mg/m³): 7148112.045(m²)

5. Concentration Level Contour 0.03(mg/m³): 1588443.918(m²)

CMax: 0.035178663(mg/m³) ,(X=574880.07 ,Y=1122876.46)
Distance from STACK 1: 2685.19(m)
Distance from STACK 2: 2699.03(m)
Average: 2692.11(m)

[illegible]

Model of SO₂ emission - AVERAGE 24 h

OPTION 3B: DRY SEASON
O MON III COMBINED CYCLE POWER PLANT 750MW
DO OIL FIRE - COMBINED CYCLE
STACK HEIGHT H: $H = 40$ (m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 1H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/s)

Tonnage: 4.93(g/s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/s)

Tonnage: 4.93(g/s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 36024608.152(m²)

2. Concentration Level Contour 0.0005(mg/m³): 15405675.985(m²)

3. Concentration Level Contour 0.001(mg/m³): 5196601.837(m²)

4. Concentration Level Contour 0.002(mg/m³): 308918.058(m²)

Total: 56935804.032(m²)

Maximum Concentration:

CMax: 0.002143796(mg/m³), (X=570400.07, Y=1120956.46)
Distance from STACK 1: 2602.81(m)
Distance from STACK 2: 2550.22(m)
Average: 2576.52(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

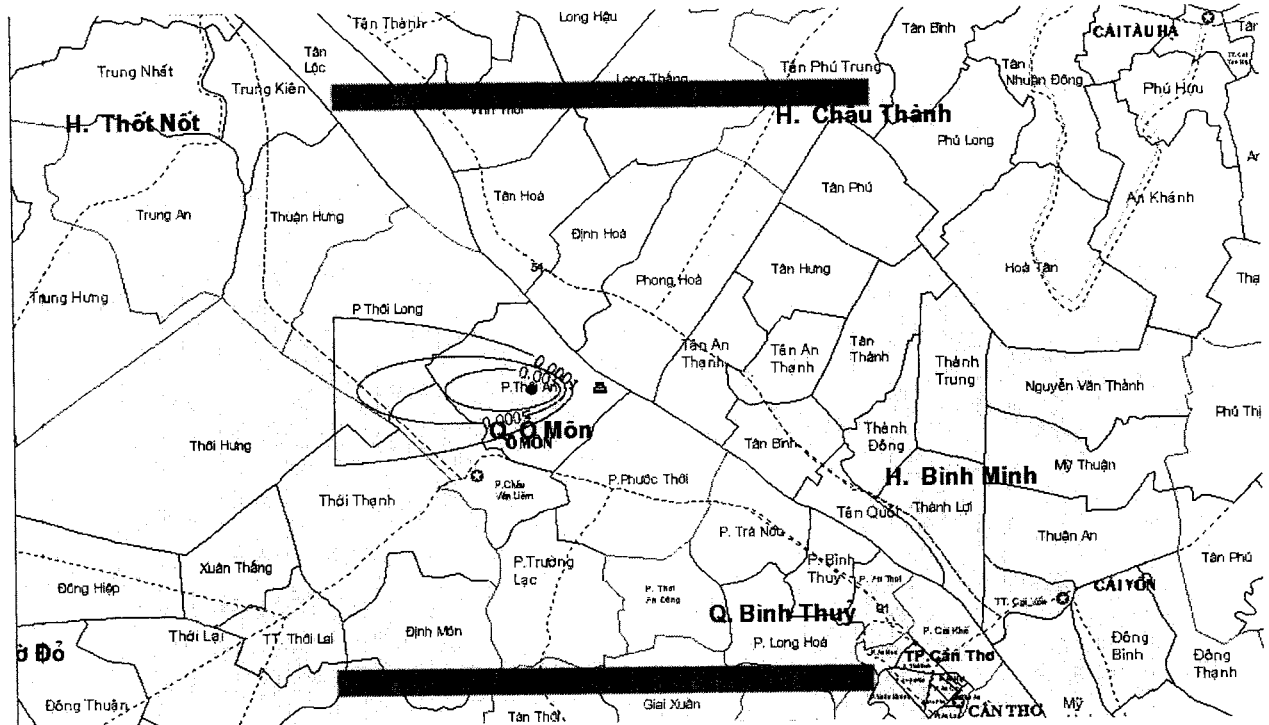
X: 563000.07(m)
Y: 1110956.46(m)
Δx column distance: 40(m)
Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 56553862.831(m²)
 2. Concentration Level Contour 0.0004(mg/m³): 15983577.091(m²)
 3. Concentration Level Contour 0.0008(mg/m³): 3530774.436(m²)
 4. Concentration Level Contour 0.001(mg/m³): 1126691.145(m²)
- Total: 77194905.503(m²)

Maximum Concentration:

CMax: 0.001136211(mg/m³) ,(X=570400.07 ,Y=1120956.46)
Distance from STACK 1: 2602.81(m)
Distance from STACK 2: 2550.22(m)
Average: 2576.52(m)



Model of PM10 dust emission - AVERAGE 1 h



THE GAUSS- DRY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 1H

Time: DRY SEASON-CCPP-OIL FIRE

Pollution name: NO2

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concawe

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage:73.89(g/ s)

Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)
Y: 1110956.46(m)
 Δ x column distance: 40(m)
 Δ x row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 39392089.319(m²)
 2. Concentration Level Contour 0.005(mg/m³): 23043546.914(m²)
 3. Concentration Level Contour 0.01(mg/m³): 10241858.308(m²)
 4. Concentration Level Contour 0.02(mg/m³): 2715794.848(m²)
 5. Concentration Level Contour 0.03(mg/m³): 305292.543(m²)
 6. Concentration Level Contour 0.032(mg/m³): 11806.888(m²)
- Total: 75710388.821(m²)

Maximum Concentration:

CMax: 0.03213085(mg/m³) , (X=570400.07 , Y=1120956.46)
Distance from STACK 1: 2602.81(m)
Distance from STACK 2: 2550.22(m)
Average: 2576.52(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

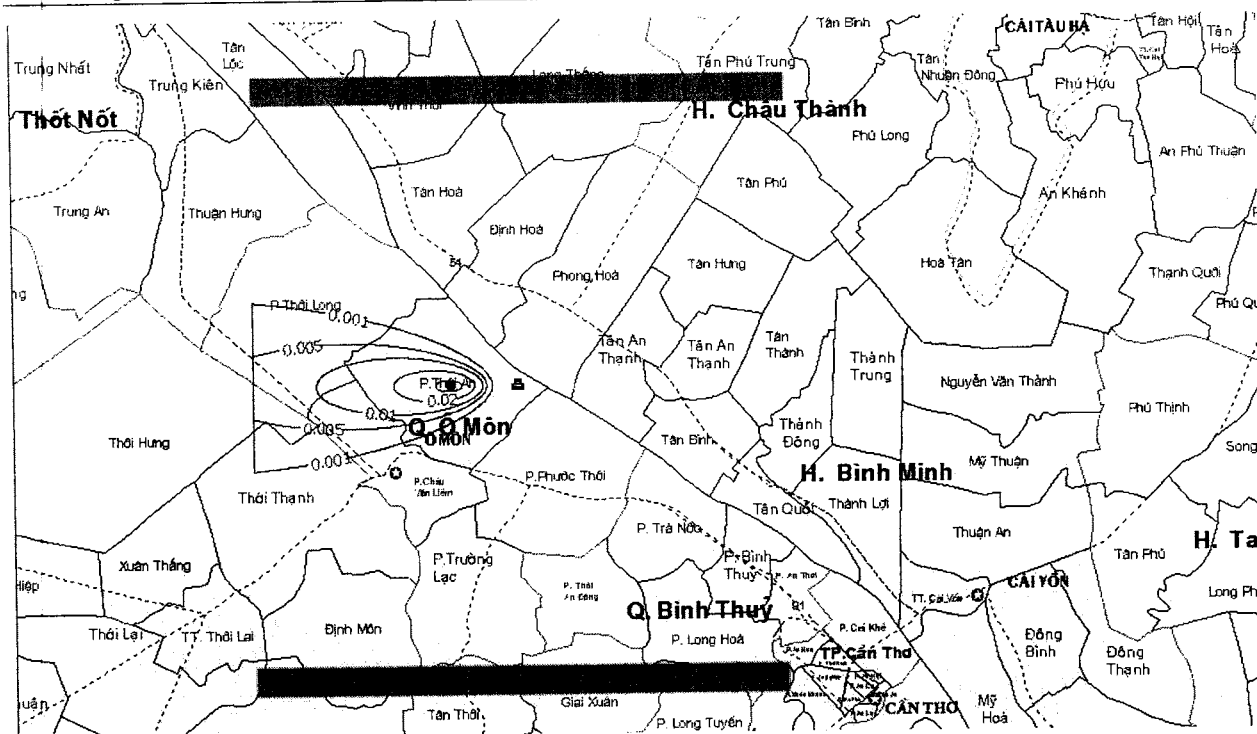
X: 563000.07(m)
Y: 1110956.46(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

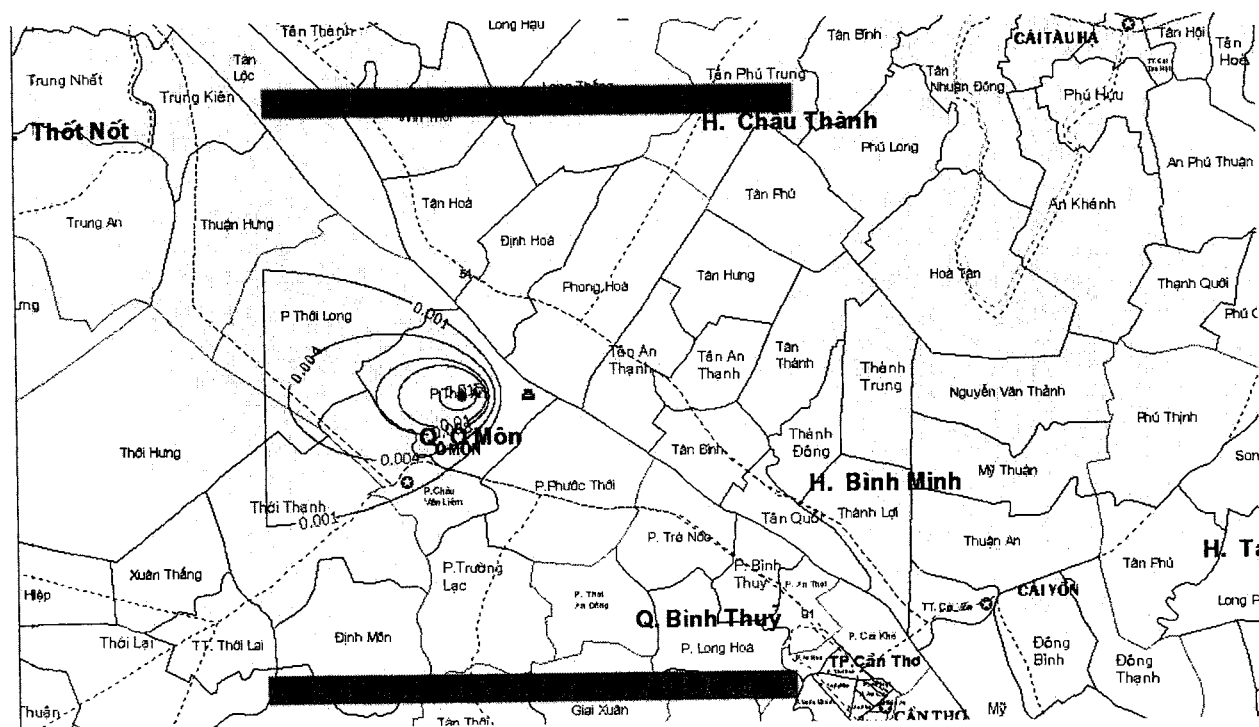
1. Concentration Level Contour 0.001(mg/m³): 64096058.284(m²)
 2. Concentration Level Contour 0.004(mg/m³): 28788307.107(m²)
 3. Concentration Level Contour 0.008(mg/m³): 9674378.891(m²)
 4. Concentration Level Contour 0.01(mg/m³): 5961518.52(m²)
 5. Concentration Level Contour 0.015(mg/m³): 1119038.208(m²)
- Total: 109639301.01(m²)

Maximum Concentration:

CMax: 0.017029334(mg/m³) , (X=570400.07 , Y=1120956.46)
Distance from STACK 1: 2602.81(m)
Distance from STACK 2: 2550.22(m)
Average: 2576.52(m)



Model of NO₂ emission - AVERAGE 1 h



Model of NO₂ emission - AVERAGE 24 h

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - S0₂ - AVERAGE 1H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S0₂

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 44977767.121(m²)

2. Concentration Level Contour 0.005(mg/m³): 31820986.133(m²)

3. Concentration Level Contour 0.01(mg/m³): 23865235.511(m²)

4. Concentration Level Contour 0.03(mg/m³): 5790176.275(m²)

5. Concentration Level Contour 0.06(mg/m³): 590957.6(m²)

6. Concentration Level Contour 0.065(mg/m³): 204756.343(m²)

Total: 107249878.983(m²)

Maximum Concentration:

CMax: 0.06812749(mg/m³), (X=570400.07, Y=1120956.46)

Distance from STACK 1: 2602.81(m)

Distance from STACK 2: 2550.22(m)

Average: 2576.52(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - S02 - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S02

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

2. STACK 2

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 156.67(g/ s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563000.07(m)

Y: 1110956.46(m)

Δx column distance: 40(m)

Δx row distance: 40(m)

Length: 20000(m)

Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 76091446.055(m²)

2. Concentration Level Contour 0.005(mg/m³): 46522720.802(m²)

3. Concentration Level Contour 0.01(mg/m³): 22911300.082(m²)

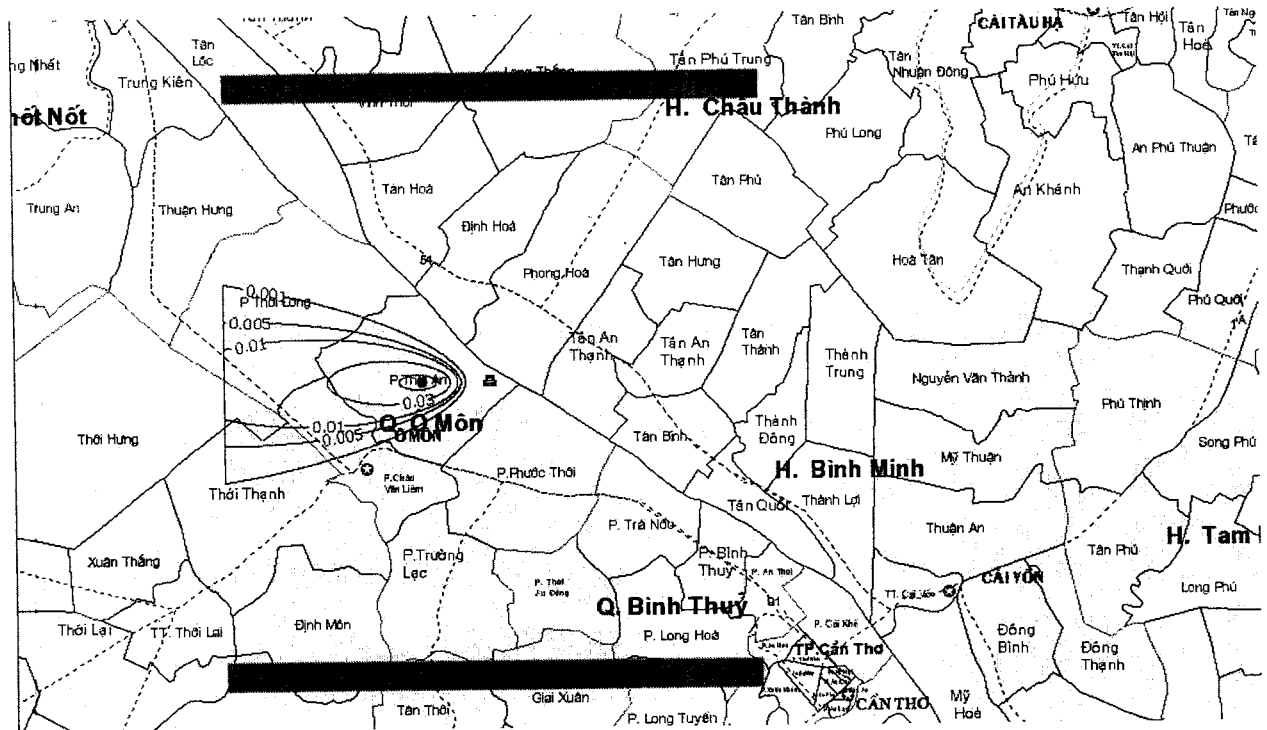
4. Concentration Level Contour 0.015(mg/m³): 12129792.323(m²)

5. Concentration Level Contour 0.03(mg/m³): 1693254.845(m²)

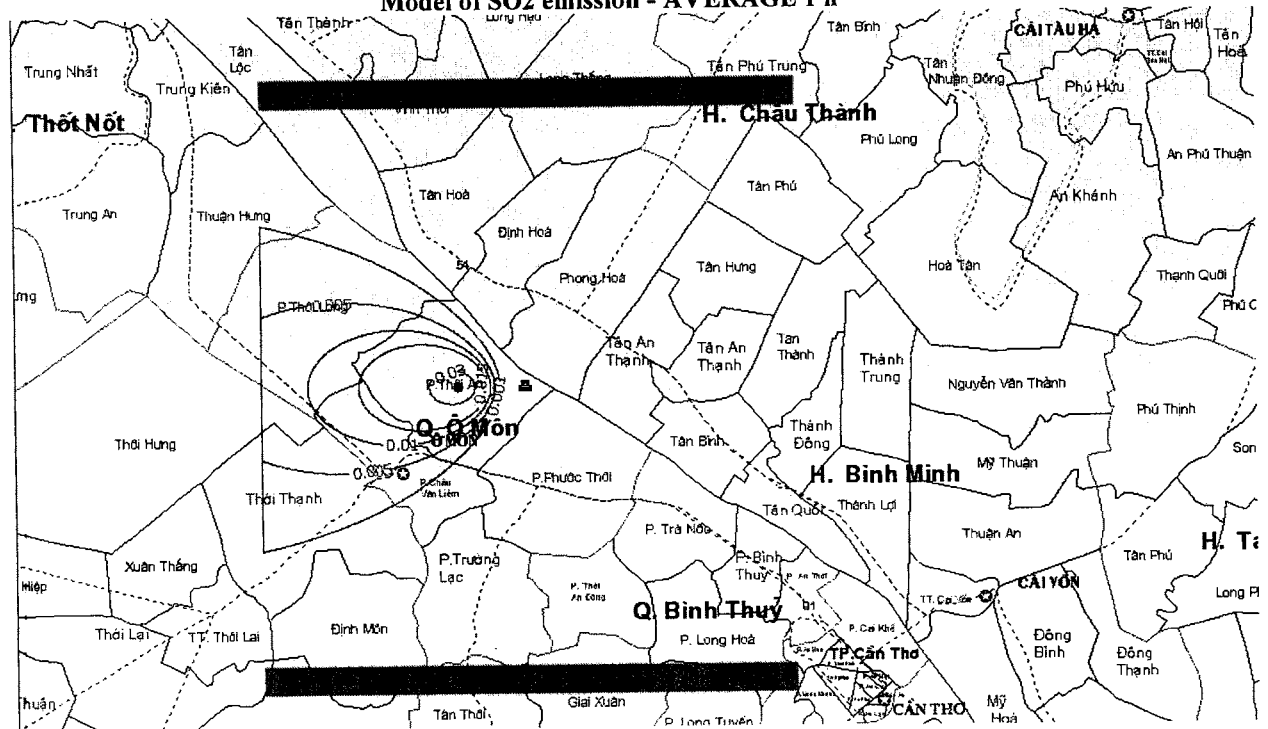
6. Concentration Level Contour 0.035(mg/m³): 254223.466(m²)
Total: 159602737.574(m²)

Maximum Concentration:

CMax: 0.036107536(mg/m³), (X=570400.07, Y=1120956.46)
Distance from STACK 1: 2602.81(m)
Distance from STACK 2: 2550.22(m)
Average: 2576.52(m)



Model of SO₂ emission - AVERAGE 1 h



Model of SO₂ emission - AVERAGE 24 h

OPTION 4A: RAINY SEASON
O MON I THERMAL POWER PLANT (660MW): FO OIL
FIRE
O MON III THERMAL POWER PLANT (660MW): DO OIL
FIRE-COMBINED CYCLE
STACK HEIGHT H: H = 40 (m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)

Y: 1120730.51(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/ s)

Tonnage: 18.06(g/ s)

Concentration: 52.02(mg/m³)

Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)

Y: 1120733.82(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/ s)

Tonnage: 18.06(g/ s)

Concentration: 52.02(mg/m³)

Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 4.93(g/ s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)

Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)

Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 43282224.7(m²)
 2. Concentration Level Contour 0.004(mg/m³): 9319009.731(m²)
 3. Concentration Level Contour 0.008(mg/m³): 2856419.211(m²)
 4. Concentration Level Contour 0.01(mg/m³): 1601720.583(m²)
 5. Concentration Level Contour 0.012(mg/m³): 777302.402(m²)
- Total: 57836676.627(m²)

Maximum Concentration:

CMax: 0.014905502(mg/m³) , (X=574830.07 , Y=1122240.51)
Distance from STACK 1: 2096.58(m)
Distance from STACK 2: 2096.71(m)
Distance from STACK 3: 2233.25(m)
Distance from STACK 4: 2258.08(m)
Average: 2171.15(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area
Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)
Y: 1120730.51(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 18.06(g/ s)
Concentration: 52.02(mg/m³)
Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)
Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 18.06(g/ s)
Concentration: 52.02(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

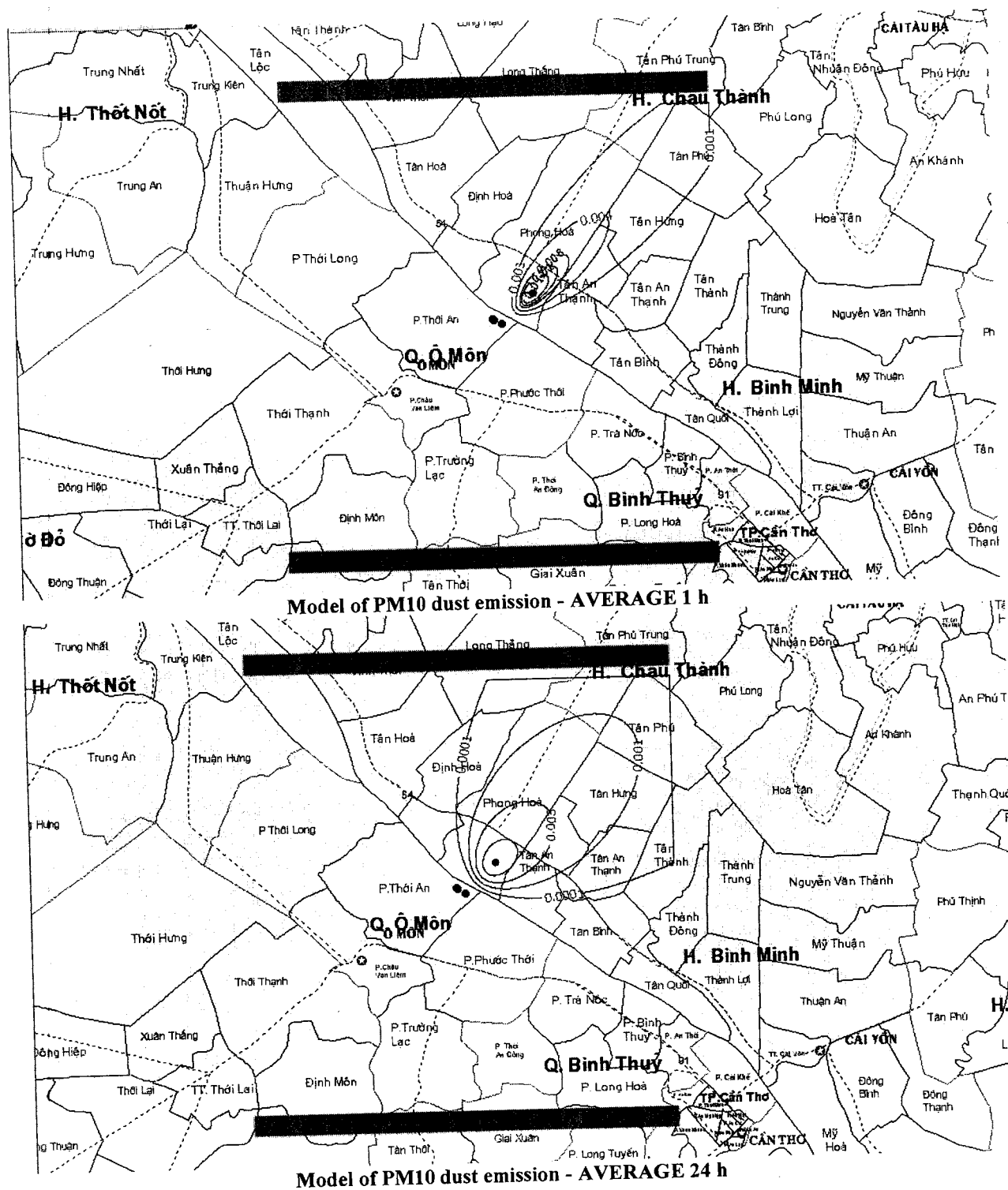
X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 96238684.594(m²)
 2. Concentration Level Contour 0.001(mg/m³): 45600249.725(m²)
 3. Concentration Level Contour 0.003(mg/m³): 10441823.999(m²)
 4. Concentration Level Contour 0.006(mg/m³): 2098167.709(m²)
 5. Concentration Level Contour 0.008(mg/m³): 95269.265(m²)
- Total: 154474195.291(m²)

Maximum Concentration:

CMax: 0.008143565(mg/m³) , (X=574830.07, Y=1122240.51)
Distance from STACK 1: 2096.58(m)
Distance from STACK 2: 2096.71(m)
Distance from STACK 3: 2233.25(m)
Distance from STACK 4: 2258.08(m)
Average: 2171.15(m)



MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)

Y: 1120730.51(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/s)

Tonnage: 176.13(g/s)

Concentration: 507.32(mg/m³)

Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)

Y: 1120733.82(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/s)

Tonnage: 176.13(g/s)

Concentration: 507.32(mg/m³)

Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/s)

Tonnage: 73.89(g/s)

Concentration: 98.85(mg/m³)

Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/s)

Tonnage: 73.89(g/s)

Concentration: 98.85(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563150.07(m)

Y: 1110880.51(m)

Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 67554433.825(m²)
 2. Concentration Level Contour 0.005(mg/m³): 54054959.184(m²)
 3. Concentration Level Contour 0.01(mg/m³): 44768377.026(m²)
 4. Concentration Level Contour 0.05(mg/m³): 7445472.779(m²)
 5. Concentration Level Contour 0.1(mg/m³): 1842956.404(m²)
 6. Concentration Level Contour 0.15(mg/m³): 42717.904(m²)
- Total: 175708917.122(m²)

Maximum Concentration:

CMax: 0.152154894(mg/m³), (X=574830.07, Y=1122280.51)
Distance from STACK 1: 2125.57(m)
Distance from STACK 2: 2125.63(m)
Distance from STACK 3: 2256.48(m)
Distance from STACK 4: 2280.48(m)
Average: 2197.04(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)

Y: 1120730.51(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/s)

Tonnage: 176.13(g/s)

Concentration: 507.32(mg/m³)

Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)

Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 176.13(g/ s)
Concentration: 507.32(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)

Length: 20000(m)

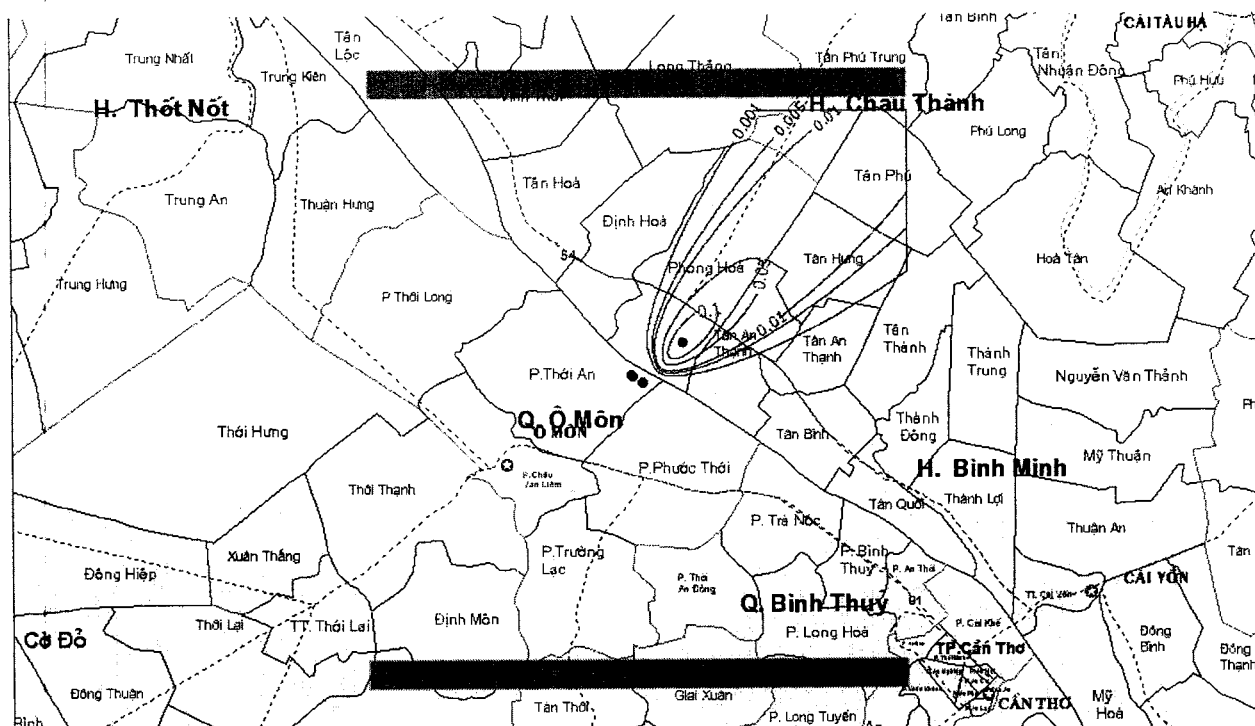
Width: 20000(m)

VIII. POLLUTED AREA

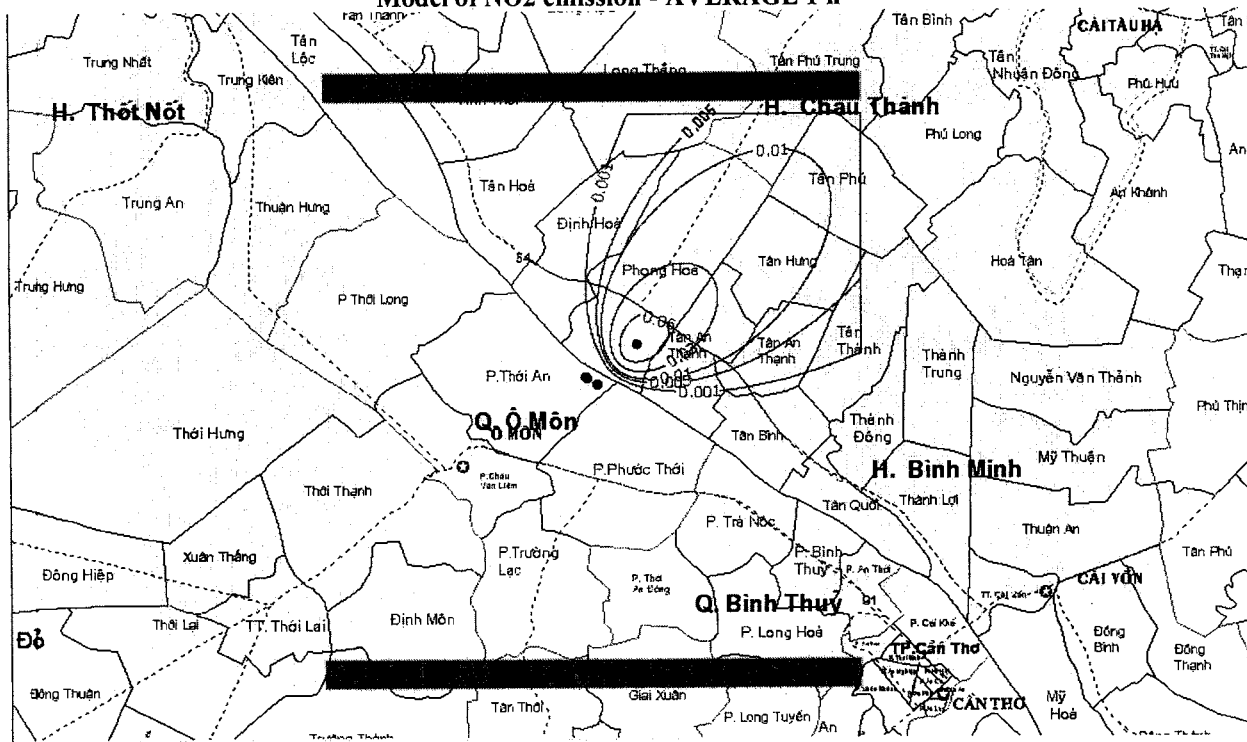
1. Concentration Level Contour 0.001(mg/m³): 96986868.577(m²)
 2. Concentration Level Contour 0.005(mg/m³): 77580890.065(m²)
 3. Concentration Level Contour 0.01(mg/m³): 49944687.128(m²)
 4. Concentration Level Contour 0.03(mg/m³): 11613057.635(m²)
 5. Concentration Level Contour 0.06(mg/m³): 2504102.984(m²)
 6. Concentration Level Contour 0.08(mg/m³): 314439.231(m²)
- Total: 238944045.619(m²)

Maximum Concentration:

CMax: 0.084219547(mg/m³), (X=574830.07, Y=1122280.51)
Distance from STACK 1: 2125.57(m)
Distance from STACK 2: 2125.63(m)
Distance from STACK 3: 2256.48(m)
Distance from STACK 4: 2280.48(m)
Average: 2197.04(m)



Model of NO2 emission - AVERAGE 1 h



Model of NO2 emission - AVERAGE 24 h

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - S02 - AVERAGE 1H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S02

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)

Y: 1120730.51(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/s)

Tonnage: 106.18(g/s)

Concentration: 305.84(mg/m³)

Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)

Y: 1120733.82(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/s)

Tonnage: 106.18(g/s)

Concentration: 305.84(mg/m³)

Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/s)

Tonnage: 156.67(g/s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/s)

Tonnage: 156.67(g/s)

Concentration: 209.59(mg/m³)

Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563150.07(m)

Y: 1110880.51(m)

Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 68038140.014(m²)
 2. Concentration Level Contour 0.005(mg/m³): 54582494.103(m²)
 3. Concentration Level Contour 0.01(mg/m³): 45384331.327(m²)
 4. Concentration Level Contour 0.05(mg/m³): 7324970.783(m²)
 5. Concentration Level Contour 0.1(mg/m³): 1325810.554(m²)
 6. Concentration Level Contour 0.12(mg/m³): 328035.841(m²)
- Total: 176983782.622(m²)

Maximum Concentration:

CMax: 0.128638016(mg/m³), (X=574910.07, Y=1122560.51)
Distance from STACK 1: 2388.22(m)
Distance from STACK 2: 2388(m)
Distance from STACK 3: 2492.06(m)
Distance from STACK 4: 2511.78(m)
Average: 2445.01(m)

MODEL TEST RESULT

Data:

THE GAUSS- RAINY SEASON-CCPP-OIL FIRE - S02 - AVERAGE 24H

I. TIME:

Time: RAINY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S02

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	2.5	100
South	0	0
South East	0	0
East	0	0
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)
Y: 1120730.51(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/s)
Tonnage: 106.18(g/s)
Concentration: 305.84(mg/m³)
Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)

Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 106.18(g/ s)
Concentration: 305.84(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 156.67(g/ s)
Concentration: 209.59(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 156.67(g/ s)
Concentration: 209.59(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

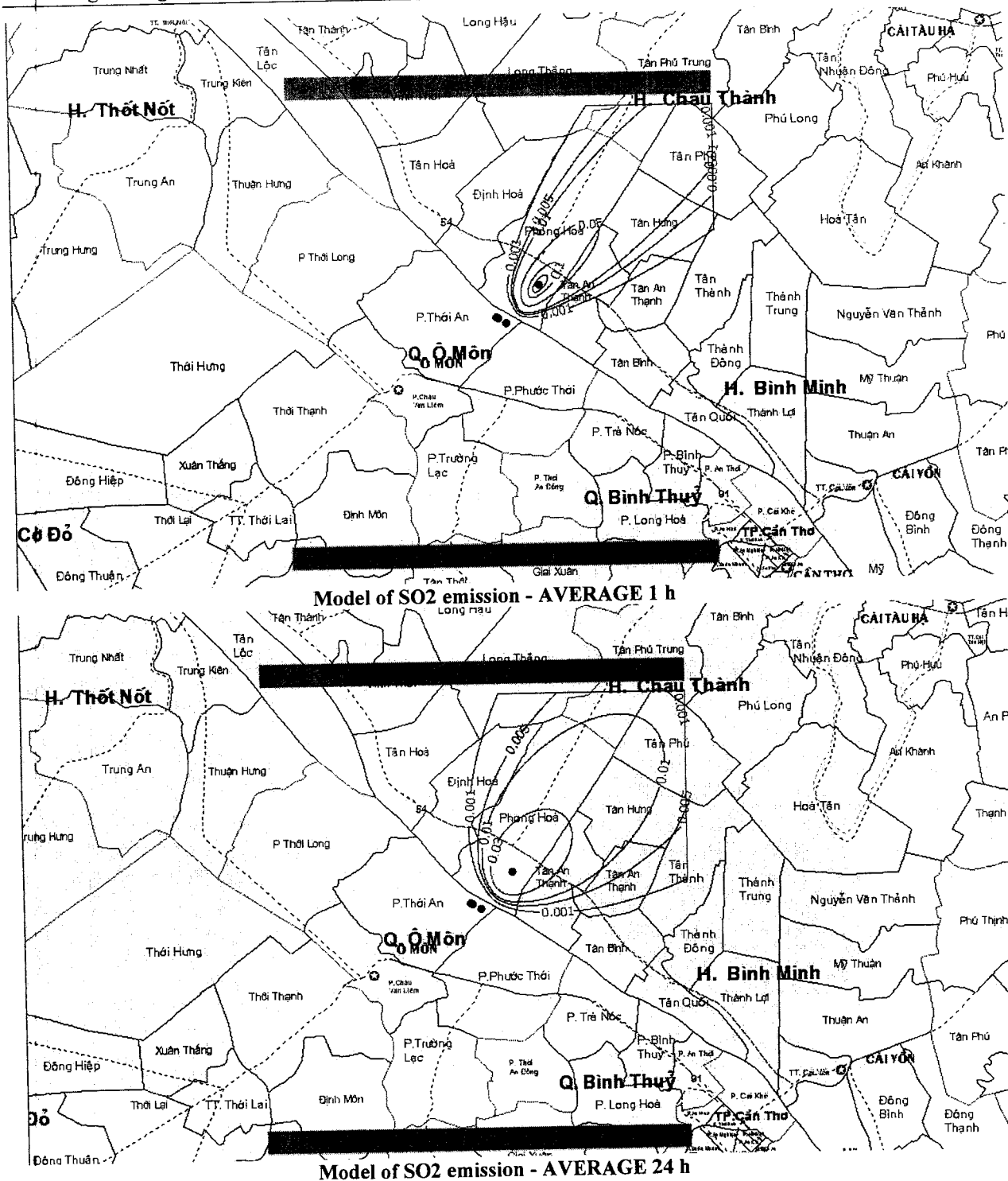
X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 97317217.191(m²)
 2. Concentration Level Contour 0.005(mg/m³): 77995723.361(m²)
 3. Concentration Level Contour 0.01(mg/m³): 51410428.813(m²)
 4. Concentration Level Contour 0.03(mg/m³): 11251800.964(m²)
 5. Concentration Level Contour 0.06(mg/m³): 1683975.594(m²)
 6. Concentration Level Contour 0.07(mg/m³): 356924.483(m²)
- Total: 240016070.406(m²)

Maximum Concentration:

CMax: 0.073392466(mg/m³) ,(X=574870.07 ,Y=1122520.51)
Distance from STACK 1: 2331.87(m)
Distance from STACK 2: 2331.65(m)
Distance from STACK 3: 2435.7(m)
Distance from STACK 4: 2455.56(m)
Average: 2388.69(m)



OPTION 4B: DRY SEASON
O MON I THERMAL POWER PLANT (660MW): FO OIL
FIRE
O MON III THERMAL POWER PLANT (660MW): DO OIL
FIRE-COMBINED CYCLE
STACK HEIGHT H: $H = 40$ (m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 1H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)

Y: 1120730.51(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/ s)

Tonnage: 18.06(g/ s)

Concentration: 52.02(mg/m³)

Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)

Y: 1120733.82(m)

Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)

Diameter: 4.41(m)

Flow: 347.18(m³/ s)

Tonnage: 18.06(g/ s)

Concentration: 52.02(mg/m³)

Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)

Y: 1120956.46(m)

Plant: O Mon III Combined Cycle Power Plant

Stack Height: 40(m)

Diameter: 6.8(m)

Flow: 747.49(m³/ s)

Tonnage: 4.93(g/ s)

Concentration: 6.6(mg/m³)

Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)

Y: 1120989.7(m)

Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563150.07(m)
Y: 1110880.51(m)
Δx column distance: 40(m)
Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.0001(mg/m³): 50324340.993(m²)
 2. Concentration Level Contour 0.001(mg/m³): 30814233.317(m²)
 3. Concentration Level Contour 0.005(mg/m³): 6255863.226(m²)
 4. Concentration Level Contour 0.01(mg/m³): 1484949.189(m²)
 5. Concentration Level Contour 0.012(mg/m³): 695200.97(m²)
- Total: 89574587.696(m²)

Maximum Concentration:

CMax: 0.014579034(mg/m³), (X=571270.07, Y=1120760.51)
Distance from STACK 1: 2105.72(m)
Distance from STACK 2: 2102.07(m)
Distance from STACK 3: 1743.86(m)
Distance from STACK 4: 1695.56(m)
Average: 1911.8(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - PM10 DUST - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: PM10 DUST

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area
Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK I

X: 573375.58(m)
Y: 1120730.51(m)

Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage:18.06(g/ s)
Concentration: 52.02(mg/m³)
Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)
Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage:18.06(g/ s)
Concentration: 52.02(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage:4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage:4.93(g/ s)
Concentration: 6.6(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

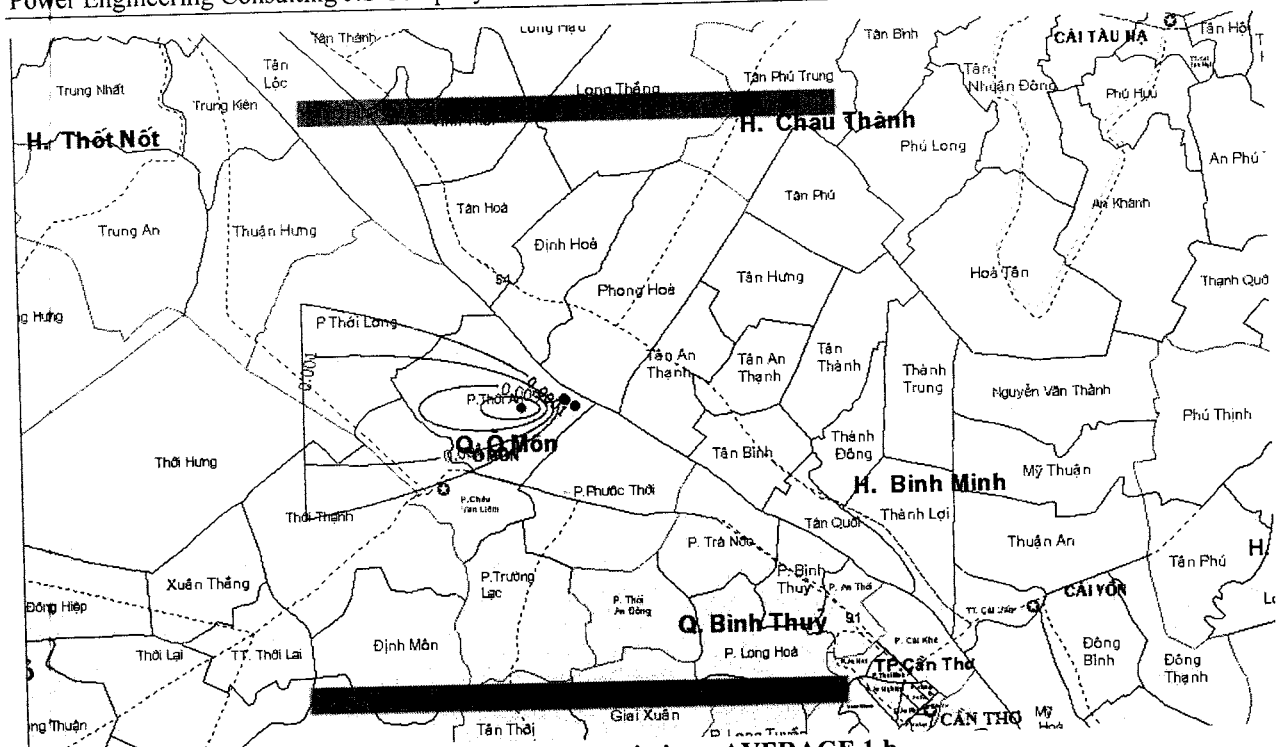
X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

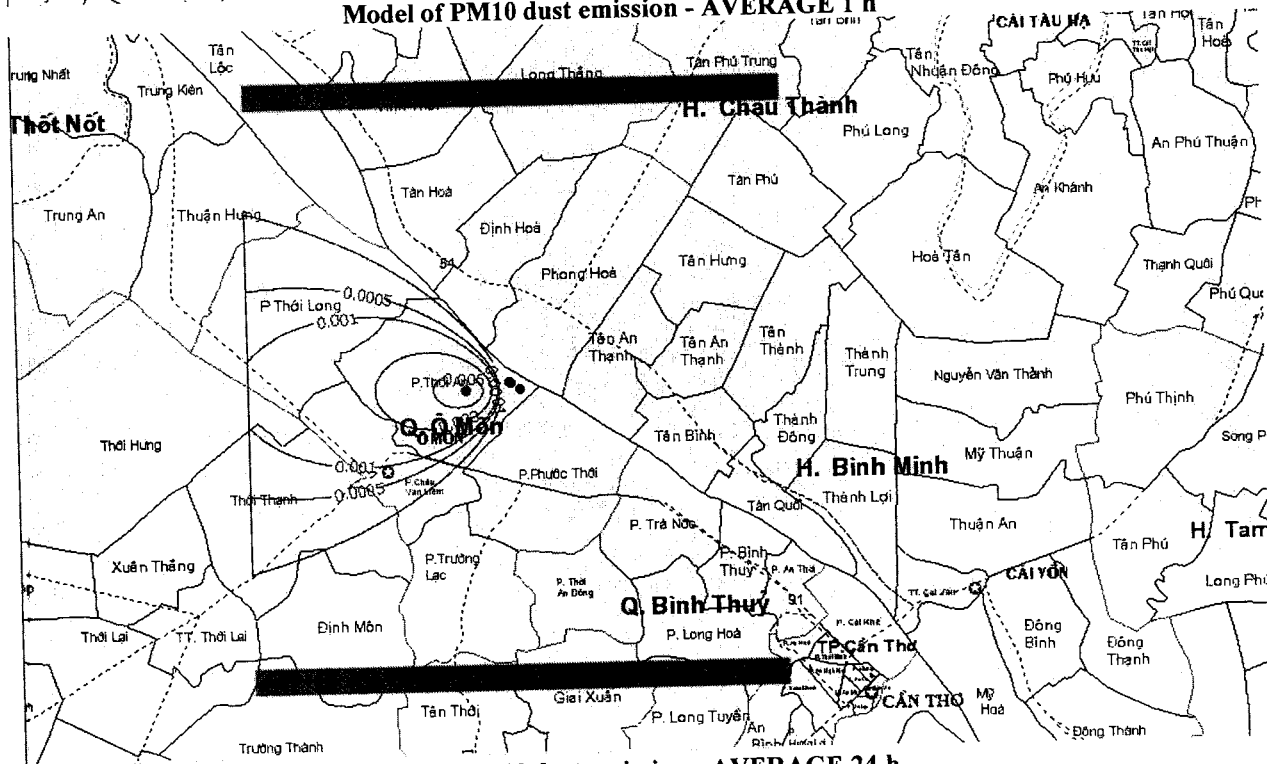
1. Concentration Level Contour 0.0001(mg/m³): 86279303.255(m²)
 2. Concentration Level Contour 0.0005(mg/m³): 59255228.045(m²)
 3. Concentration Level Contour 0.001(mg/m³): 41563701.254(m²)
 4. Concentration Level Contour 0.003(mg/m³): 9695955.505(m²)
 5. Concentration Level Contour 0.006(mg/m³): 1813558.376(m²)
 6. Concentration Level Contour 0.0075(mg/m³): 245362.066(m²)
- Total: 198853108.501(m²)

Maximum Concentration:

CMax: 0.007815713(mg/m³), (X=571270.07, Y=1120760.51)
Distance from STACK 1: 2105.72(m)
Distance from STACK 2: 2102.07(m)
Distance from STACK 3: 1743.86(m)
Distance from STACK 4: 1695.56(m)
Average: 1911.8(m)



Model of PM10 dust emission - AVERAGE 1 h



Model of PM10 dust emission - AVERAGE 24 h

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 1H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0

South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability
Sort: rural area
Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)
Y: 1120730.51(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 176.13(g/ s)
Concentration: 507.32(mg/m³)
Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)
Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 176.13(g/ s)
Concentration: 507.32(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)

Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 50705453.657(m²)
 2. Concentration Level Contour 0.005(mg/m³): 38401270.402(m²)
 3. Concentration Level Contour 0.01(mg/m³): 31593212.753(m²)
 4. Concentration Level Contour 0.05(mg/m³): 6960654.206(m²)
 5. Concentration Level Contour 0.1(mg/m³): 1729236.902(m²)
 6. Concentration Level Contour 0.12(mg/m³): 854853.254(m²)
- Total: 130244681.175(m²)

Maximum Concentration:

CMax: 0.148892429(mg/m³), (X=571190.07, Y=1120760.51)
Distance from STACK 1: 2185.71(m)
Distance from STACK 2: 2182.06(m)
Distance from STACK 3: 1823.37(m)
Distance from STACK 4: 1774.86(m)
Average: 1991.5(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - NO2 - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: NO2

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area
Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)
Y: 1120730.51(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/s)
Tonnage: 176.13(g/s)
Concentration: 507.32(mg/m³)
Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)
Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant

Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 176.13(g/ s)
Concentration: 507.32(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 73.89(g/ s)
Concentration: 98.85(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

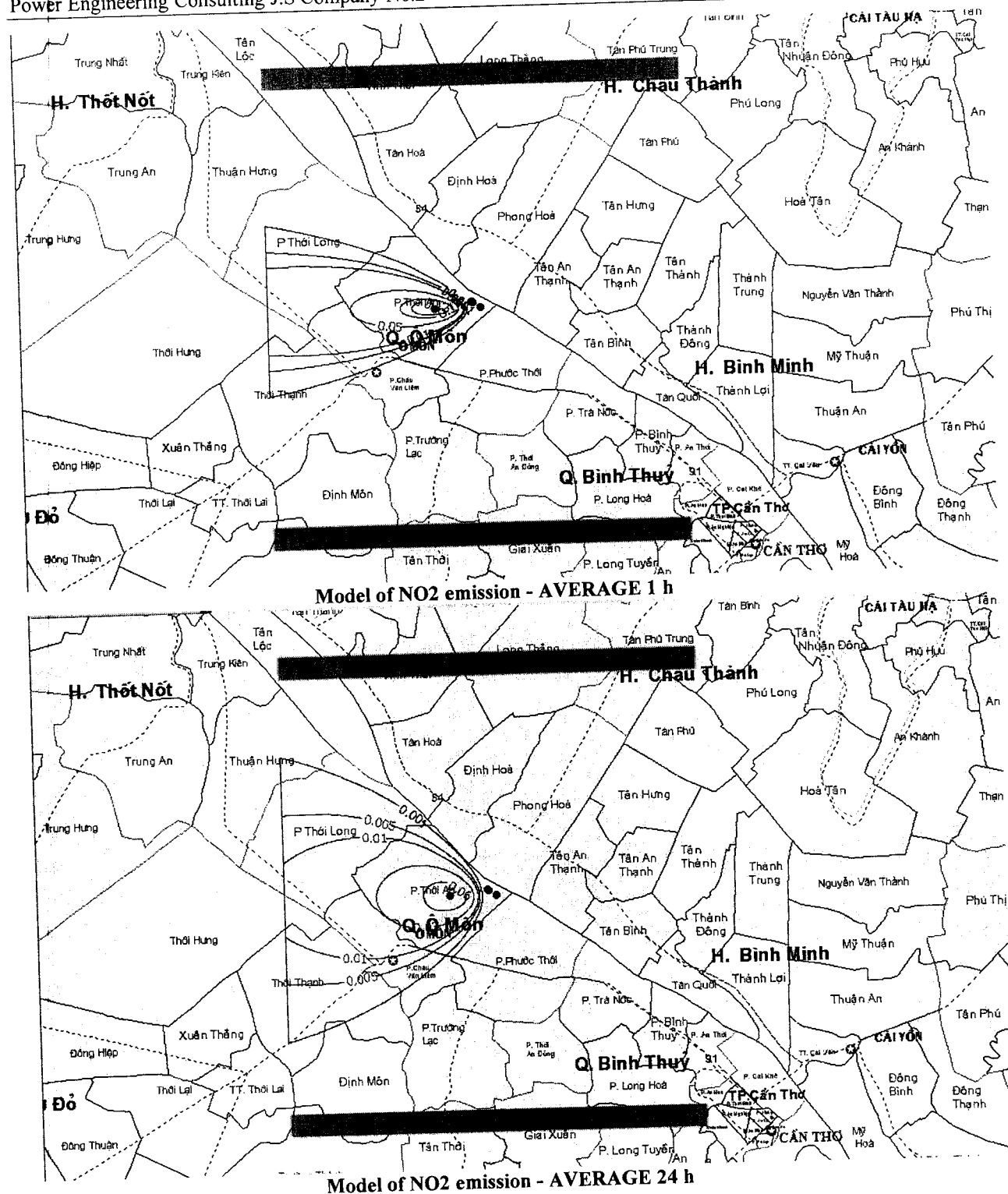
X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 87052460.954(m²)
 2. Concentration Level Contour 0.005(mg/m³): 60636532.807(m²)
 3. Concentration Level Contour 0.01(mg/m³): 43964839.995(m²)
 4. Concentration Level Contour 0.03(mg/m³): 10821859.187(m²)
 5. Concentration Level Contour 0.06(mg/m³): 2178803.252(m²)
 6. Concentration Level Contour 0.08(mg/m³): 15242.347(m²)
- Total: 204669738.542(m²)

Maximum Concentration:

CMax: 0.080251227(mg/m³) , (X=571150.07 , Y=1120800.51)
Distance from STACK 1: 2226.61(m)
Distance from STACK 2: 2222.9(m)
Distance from STACK 3: 1859.37(m)
Distance from STACK 4: 1809.92(m)
Average: 2029.7(m)



MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - S02 - AVERAGE 1H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S02

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability
Sort: rural area
Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)
Y: 1120730.51(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 106.18(g/ s)
Concentration: 305.84(mg/m³)
Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)
Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 106.18(g/ s)
Concentration: 305.84(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 156.67(g/ s)
Concentration: 209.59(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 156.67(g/ s)
Concentration: 209.59(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

X: 563150.07(m)

Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 50160450.466(m²)
 2. Concentration Level Contour 0.005(mg/m³): 38044857.175(m²)
 3. Concentration Level Contour 0.01(mg/m³): 31387861.994(m²)
 4. Concentration Level Contour 0.05(mg/m³): 6869343.608(m²)
 5. Concentration Level Contour 0.1(mg/m³): 1280416.683(m²)
 6. Concentration Level Contour 0.12(mg/m³): 364172.028(m²)
- Total: 128107101.953(m²)

Maximum Concentration:

CMax: 0.130683322(mg/m³), (X=570750.07, Y=1120880.51)
Distance from STACK 1: 2629.79(m)
Distance from STACK 2: 2626(m)
Distance from STACK 3: 2254.09(m)
Distance from STACK 4: 2202.71(m)
Average: 2428.15(m)

MODEL TEST RESULT

Data:

THE GAUSS- DRY SEASON-CCPP-OIL FIRE - S02 - AVERAGE 24H

I. TIME:

Time: DRY SEASON-CCPP-OIL FIRE

II. POLLUTION SUBSTANCE:

Pollution name: S02

III. METEOROLOGICAL CONDITION

1. Wind:

Direction	Speed(m/s)	Frequency(%)
West	0	0
South West	0	0
South	0	0
South East	0	0
East	2.7	100
North East	0	0
North	0	0
North West	0	0
Calm	0	0

2. Atmosphere Stability

Sort: rural area

Level: B

3. Temperature: 30(°C)

4. Pressure: 1013(Mbar)

IV. CONDITION: Reflex

V. PLUME: Concave

VI. AIR POLLUTION SOURCES:

1. STACK 1

X: 573375.58(m)
Y: 1120730.51(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/s)
Tonnage: 106.18(g/s)
Concentration: 305.84(mg/m³)
Flue Gas Temperature: 91(°C)

2. STACK 2

X: 573371.97(m)
Y: 1120733.82(m)
Plant: O Mon I Thermal Power Plant
Stack Height: 140(m)
Diameter: 4.41(m)
Flow: 347.18(m³/ s)
Tonnage: 106.18(g/ s)
Concentration: 305.84(mg/m³)
Flue Gas Temperature: 91(°C)

3. STACK 3

X: 573002.88(m)
Y: 1120956.46(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 156.67(g/ s)
Concentration: 209.59(mg/m³)
Flue Gas Temperature: 141(°C)

4. STACK 4

X: 572950.07(m)
Y: 1120989.7(m)
Plant: O Mon III Combined Cycle Power Plant
Stack Height: 40(m)
Diameter: 6.8(m)
Flow: 747.49(m³/ s)
Tonnage: 156.67(g/ s)
Concentration: 209.59(mg/m³)
Flue Gas Temperature: 141(°C)

VII. GRID BOARD:

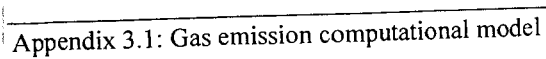
X: 563150.07(m)
Y: 1110880.51(m)
 Δx column distance: 40(m)
 Δx row distance: 40(m)
Length: 20000(m)
Width: 20000(m)

VIII. POLLUTED AREA

1. Concentration Level Contour 0.001(mg/m³): 85998681.206(m²)
 2. Concentration Level Contour 0.005(mg/m³): 60131724.301(m²)
 3. Concentration Level Contour 0.01(mg/m³): 44114023.984(m²)
 4. Concentration Level Contour 0.03(mg/m³): 10508507.982(m²)
 5. Concentration Level Contour 0.06(mg/m³): 1350338.906(m²)
 6. Concentration Level Contour 0.07(mg/m³): 73055.535(m²)
- Total: 202176331.914(m²)

Maximum Concentration:

CMax: 0.070758903(mg/m³), (X=570790.07, Y=1120880.51)
Distance from STACK 1: 2589.85(m)
Distance from STACK 2: 2586.06(m)
Distance from STACK 3: 2214.12(m)
Distance from STACK 4: 2162.76(m)
Average: 2388.2(m)



APPENDIX 3.2

HEAT DIFFUSION CALCULATION

Chapter 1

INTRODUCTION

Produce heat from the thermal power plant is cooling with natural water and exhausted to surrounding area cause increasing environment temperature in there, harm to the environment. Therefore the construction of thermal power plant has generated much interest of the society and needs to assess the impact of heating spread in environments where cooling exhaust water is exhausted, which is the most common surface water environment along river and sea.

Meet this demand, we need to solve many problems for heat transfer problem, including determining the flow and heat diffusion process from warm exhausted water source. A resolution of this problem will help us predict the domains where affected by warm water causing bad impact to the species living in the water, identify measures to minimize the impact of warm waste water . The research so it should be conducted in a serious point on environmental protection.

Heat diffusion and transmission mechanism from warm waste water in a water surface environment have been studied from many sides, including the survey of theory and experience of hydraulic models, the flow and spread heat transfer. The application results are reflected clearly in the research of models of mathematic-mechanic items and boundary value problems describes the process of flow and material transmit. In which the hydrographical meteorological factors, environment standard and water quality, the initial conditions, boundary value of the flow, .. are the key factors to find a resolution for problems and predicted impact range of the warm waste water.

Simulation analysis method has many different with using empiric formula to predict temperature of water environment which is received from warm waste water sources. These formulas help to calculating temperature differential following statistical model method in specific conditions so they can not fully

reflect physical nature of getting warm waste water environment and are difficult to predict spread heat transfer in marine habitats.

Meanwhile, the simulation of the spread of thermal field following models of mathematic-mechanic is deduced from the general analysis about theory and experience of the transmission and material diffusion. Based on that, the problem is solved by numerical methods to adapt to conditions of space and time of warm waste water areas. The basic problems need to compare the results of calculation and measurement at the research areas to ensure the reliability of predicted data. But the assessment as that can only conditions for the implementation to the factory which was built. Thus, for the pre-feasibility or feasibility project we can only predict model with previous research results and datas on terrain, hydrographical meteorologic, event of flow in warm water areas.

O Mon Power Complex are planning to build the capacity of design including 4 thermal power plant: O Mon I, II, III and IV. O Mon I Thermal Power Plant exhaust warm water which has temperature differential of 70°C with flow of $30.1 \text{ m}^3 / \text{s}$ to channel No.1. According to design, O Mon III Thermal Power Plant will exhaust warm water, with the same temperature differential of 70°C compared with the natural water in Hau River, the flow of $18 \text{ m}^3 / \text{s}$ to channel No.2. The position of the channel and warm water outlet are presented in drawings 250.10.AG001 number of versions the month 4-2008 of Power Engineering Consulting Joint Stock Company No.2 (PECC2).

Calculation is done in maximum flow speed condition respective to two cases: rising tide and fall of the tide. The purpose of this calculation is to serve the needs assessment of environmental impact when plant work.

This report is based on a theory in [1] [2] [4] [7], methods of research in [9] to simulate numerical of the heat transfer process by reason of the warm water of the plant on the river. Terrain data, meteorological hydrographic and flow, .. are provided by [14] with the reference datas used to O Mon I Thermal Power Plant,

see [13] and the assessment of environmental impact reports of PECC2 and PECC3 about O Mon-Can Tho Power Complex. The process of calculation and graphics simulation are done by computer program FAST2D-SW (Surface Water Flow and Solute Transport in 2 Dimensions) referred to as FAST 2D. The limit volume method [11] [12], is used to determine numerical solution of the flow and heat transfer process. Graphics engineering based on DirectX technology and methods of Thompson determine contour line. Stability and accuracy of the algorithm and numerical solution of the computer program has been appraised by basis council and national council experts about this specific. In the application to calculate Nghi Son-Thanh Hoa Thermal Power Plant, or Vinh Tan- Binh Thuan, .. This program has been a specialist Japan [9], and China test when compared with the calculation TIDEFLOW (UK), or MIKE11 and MIKE21 (Netherlands).

Project implementation group expected to receive the comments, suggestions and recommendations of readers to improve research on a better. Thanks.

Ho Ch Minh City, 29-4-2008

Chapter 2

FLOW AT O MON RAPIRIAN OF HAURIVER

2.1. CALCULATION OF GROUND FEATURE

a. Location

The investigate location at $105^{\circ}40'$ longitude and $10^{\circ}07'$ latitude, on the riverside of Hau river, in Phước Thới Ward, O Mon district, and about 18km distance from Can Tho city in North-Western. The West is O Mon canal, at South West is bordering national road 91, at the North East is Hau river, their as flowing at Picture 4. The ground level of O Mon power plant is about 0.8 to 1m.

b. The meteorology and hydrologic

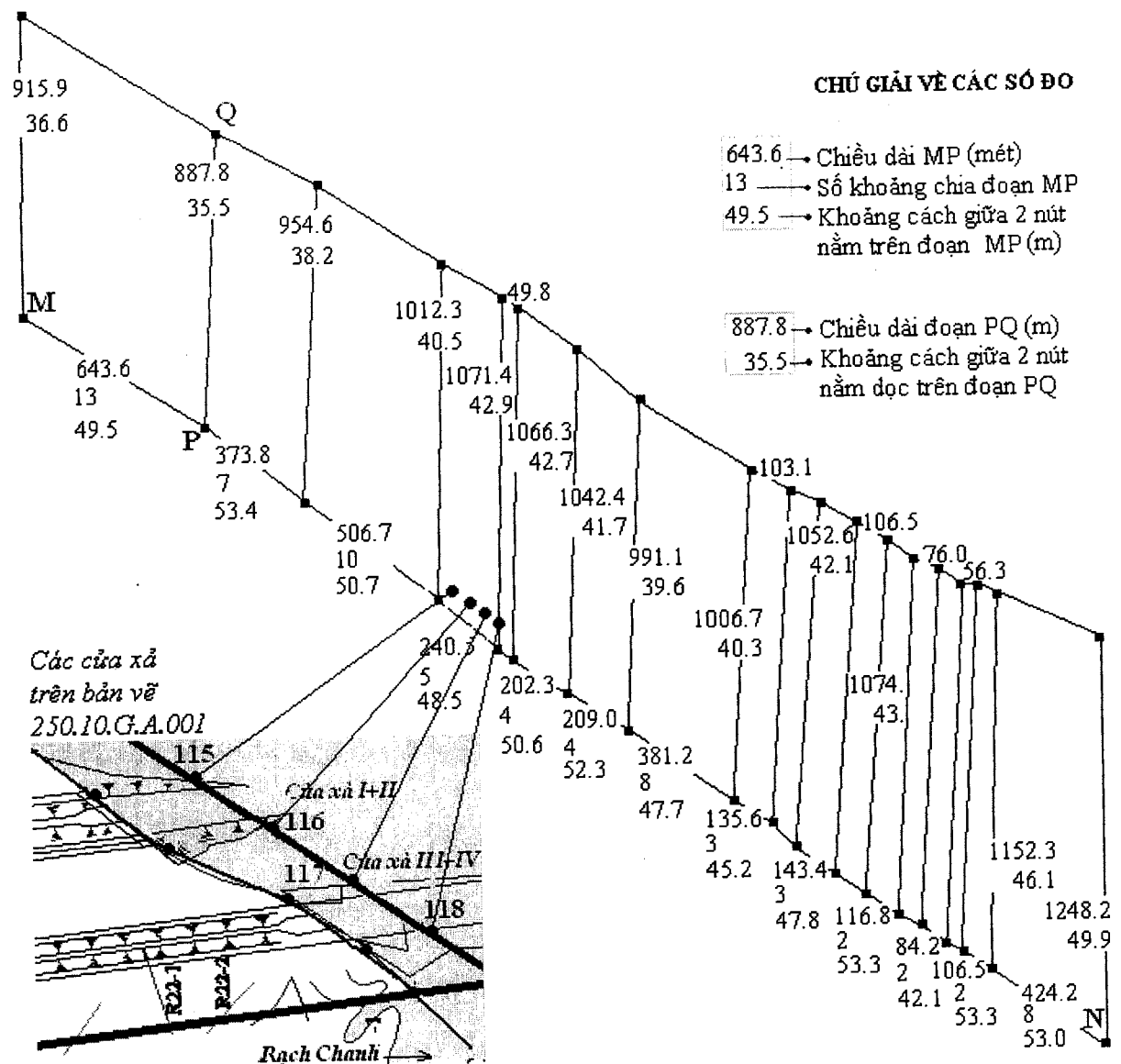
Annual average temperature is about $26^{\circ}4$ to $27^{\circ}4$, highest temperature is $36^{\circ}7$. Relative humidity is about 85%, the lowest relative humidity is about 47%, and highest is about 99%. Annual average vilocity of wind is 1,6 m/s (5,76 km/h), the strongest of SouthWest wind can be achieved 31m/s (111,6 km/h). The mean annual ranfall is about 1583,7 mm ; lowest is 1106,7 mm, highest is 1831,5 mm.

c. Calculation area

The riverside of Hau river near O Mon powert plant is static and few soil crosion. Accoring the newest data of The South Bureau, SW-FAST2D computer program was installed the graphic model about bottom depth of Hau river as following Picture 5,6. Average depth of all calculation area is 12,8m, and maximum depth is 23,9m. At right riverside near O Mon power plant is more deep than the left riverside.

d. Mesh calculation

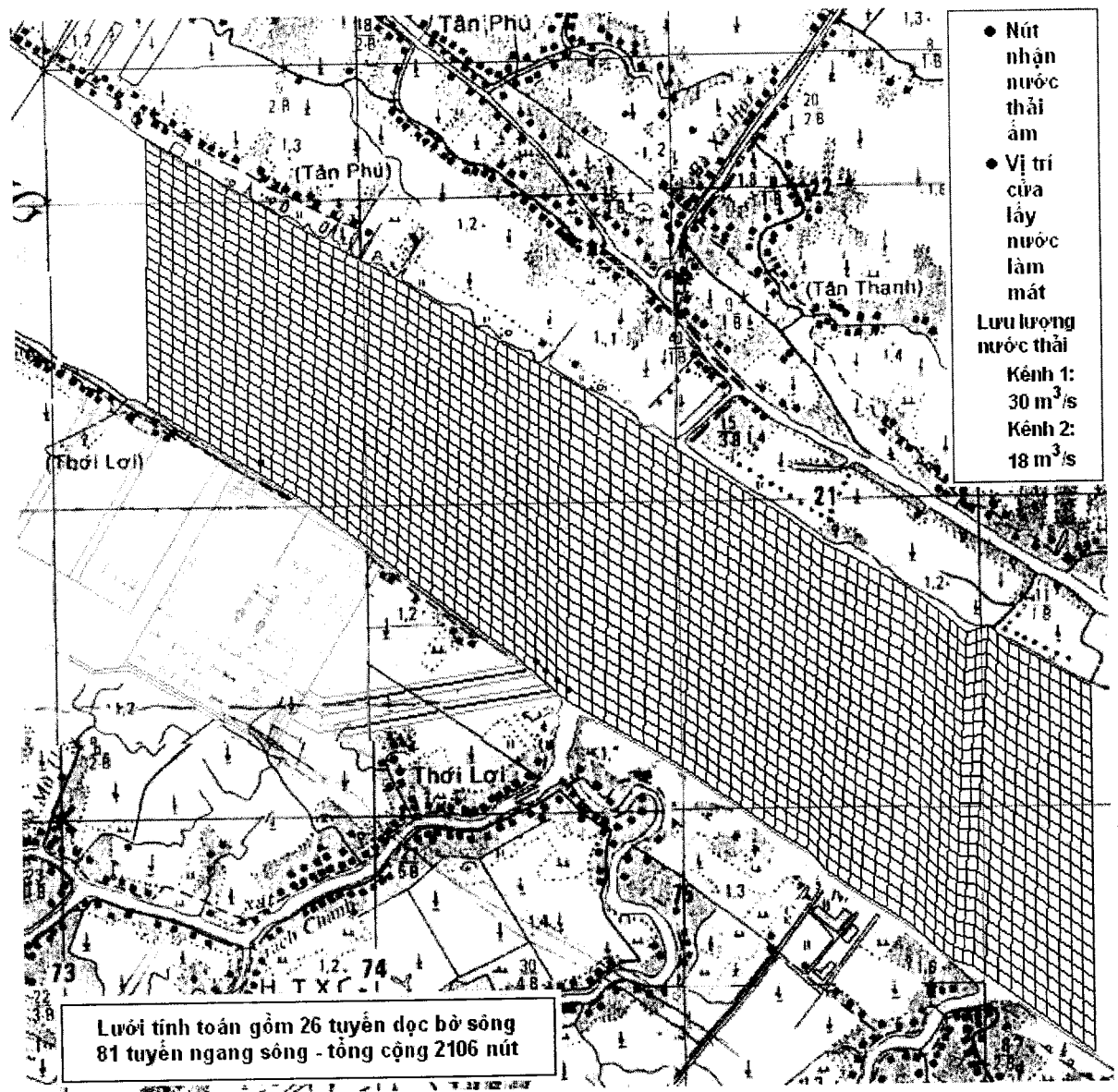
Mesh calculation is tetragonal system inclue 81x26 mesh grid, 2106 mesh point, showed in Picture 4. Which, red mesh point is discharghe source, it was fixed at discharge drawing design, discharge altitude was defined at refference point in riverside.



Picture 4. Calculation mesh and location of discharge point

Length calculation mesh is 3960 m, cross mesh of river near discharge point is about 1km length. Distance from discharge point to the nearest intake point is 1128m. Distance from N0.2 discharge point to last mesh point in back-river is 1,96km

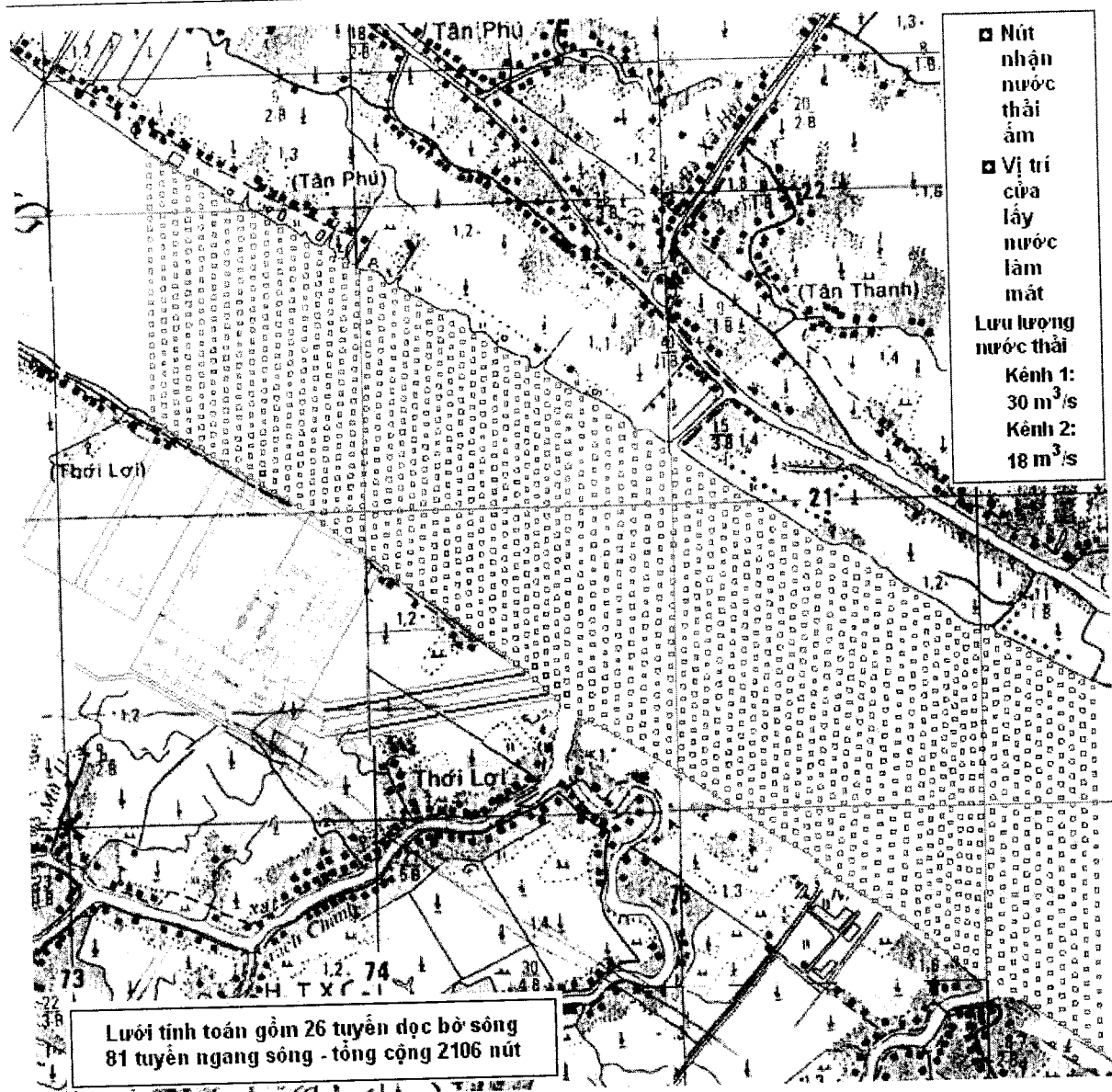
Location of discharge point is followed at drawing 250.10.G.A.001, and Picture 4, discharge point is set up at point 115, 116, 117, 118. Picture 5 is showed calculation mesh:



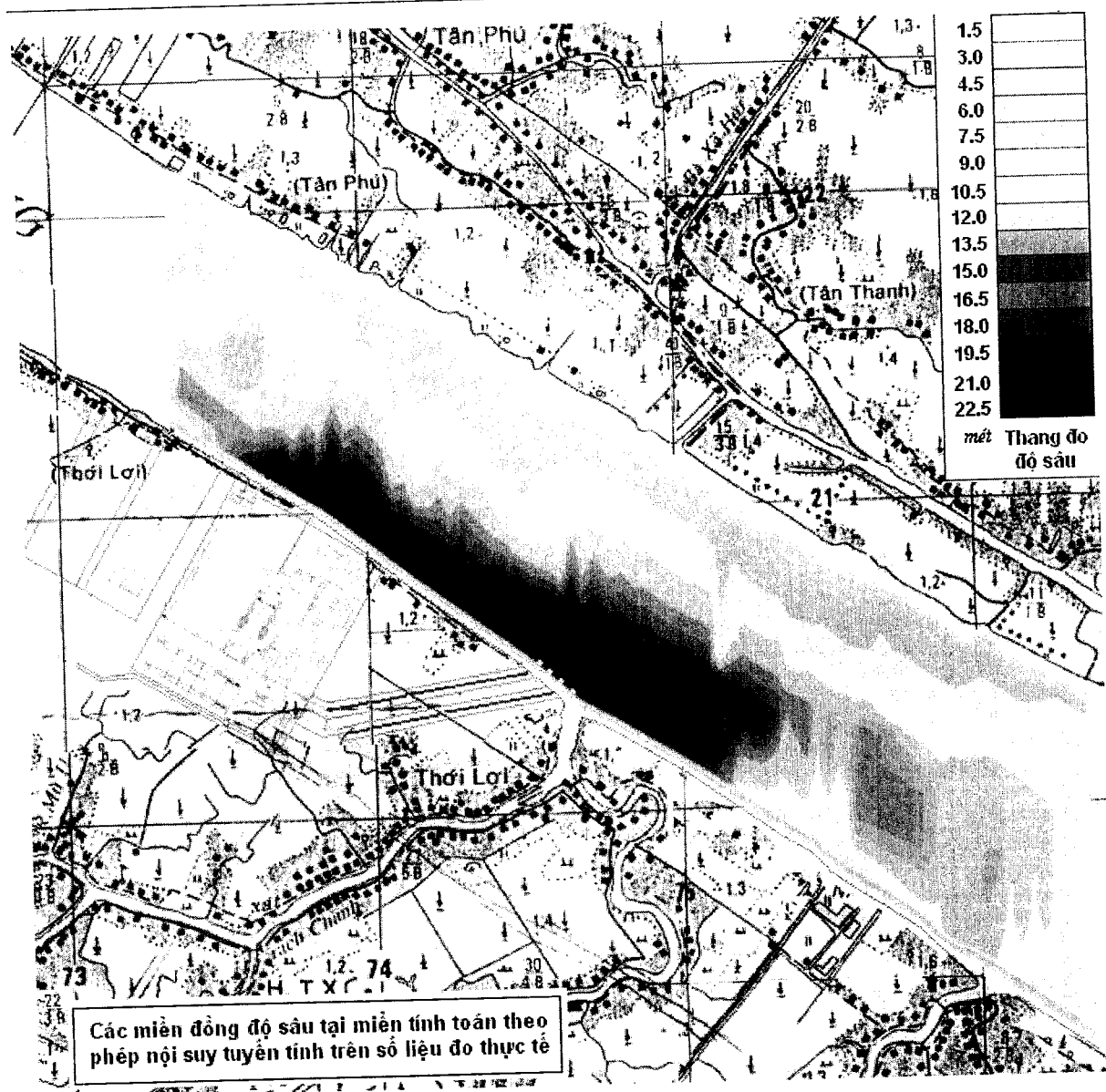
Picture 5. Calculation mesh at O Mon Power Plant

Blue Point: is intake point nearest the discharge point, Red point: Discharge point of warm water

Average point distance of longitude mesh is 50m and altitude mesh is 42m.
Discharge point and intake point is showed in Picture 5, 6 and 7.

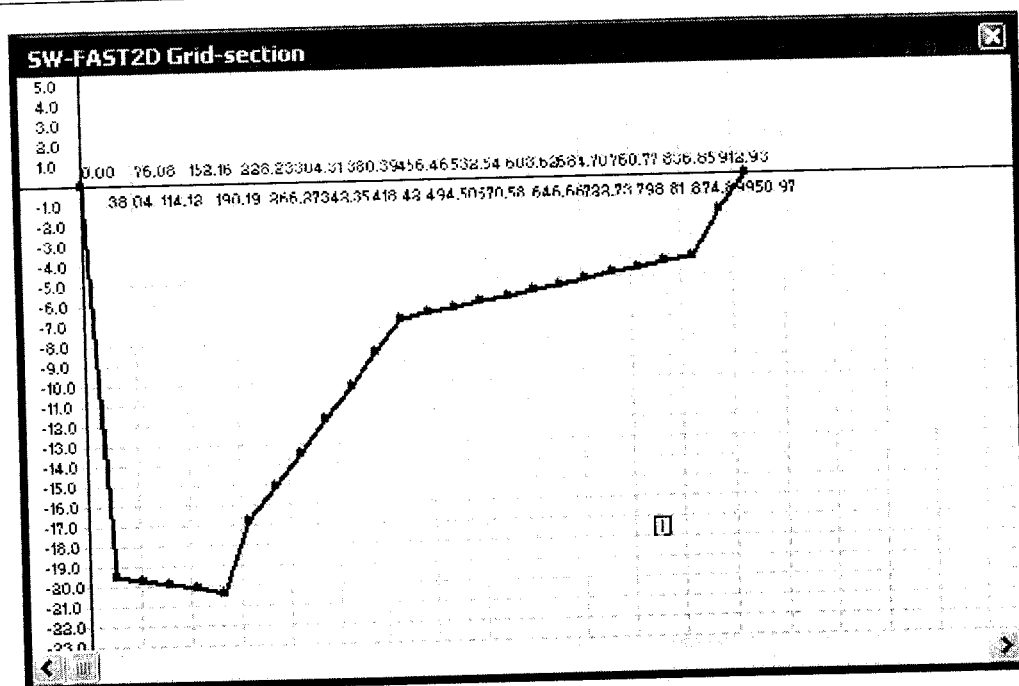


Picture 6. Data piont of mesh calculation at O Mon Power Plant.

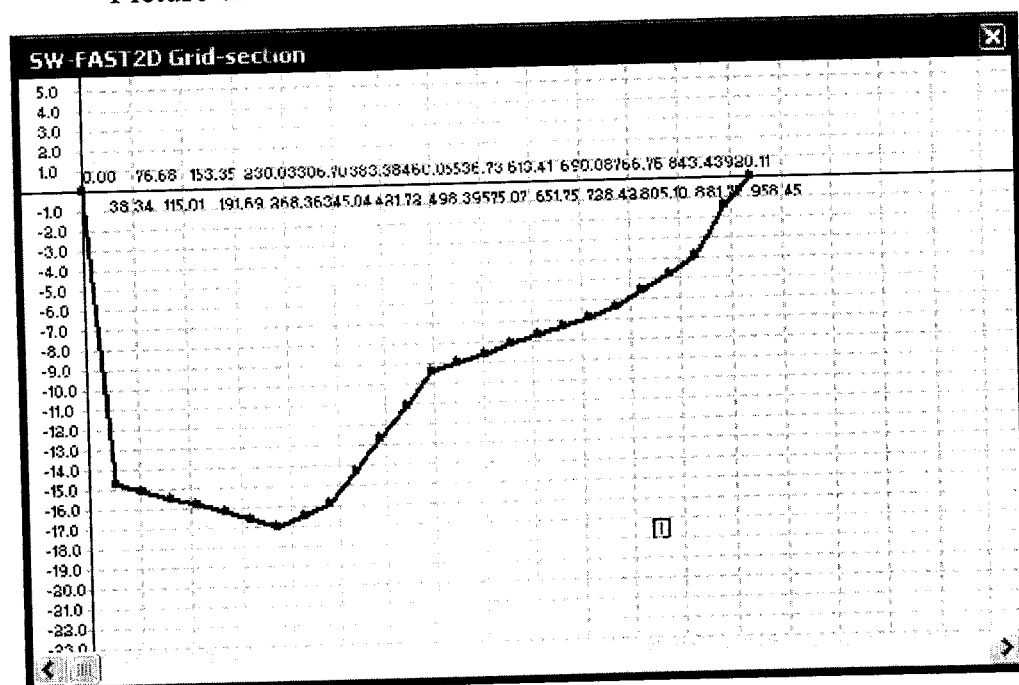


Hình 7. Calculation deepness simulate at O Mon Power Plant

Cross-section of mesh at discharge point No.01 and No.02 is simulated at Picture 8, 9. From the nearest discharge point of intake point, in direction of downstream, the river bed more deeper but river degree of extension reduce at opposite side, as followed Picture 8,9. In direction of downstream, the depth of river reduce but not exceed 9m. So this discharge point is ensured the mixing and vertical heat transfer take place better.



Picture 8. Cross-section of mesh at discharge point No.01



Picture 9. Cross-section of mesh at discharge point No.02.

e. Flow characteristics

Flow is a decision factor of warm water heat transfer, which tide regime is most important. In dry season, average flow of Hau river is about $10000 \text{ m}^3/\text{s}$, boundary flow of pool is $1500 \text{ m}^3/\text{s}$. According to "O Mon I EIA report" (June,1998), on April, 1990 is the month most exhausted and was chosen to calculate (lowest

level" -0.9m and highest level is 0.7m, as following Picture 4.12, chapter IV).

According to data at Table 1 and 2, the water level in dry season at 1977-2004 as: lowest -1.75m, highest 0.19m. And, the water level in high water period as: lowest 0.81m and highest 1.95m. So that, the choosen value is average data of this time, the minimum of water level fluctuation is about -1.35m to -1.05m(calculated the possibility occur water exhausted at 4-1990) the minimum of water level fluctuation is about 0.6 to 1.1m, Picture 12.

At Table 1 and 2 is show the monthly data of water level from 1977 to 2004. Average level is from -1.0m to 1.35m. Minimum level is -1.75m and maximum level is 1.95m. At O mon EIA report (June-1998): wind vilocity is 1,6m/s, relative humidity is 80%, atmostphere temperature is 27⁰C, water temperture is 28⁰C, discharge flow is m³/s(at No.1 Discharge point). The lowest water temperature is about 25⁰1, average water temperature is 29⁰2, temperature difference of warm water is 7⁰C. Calculation variables is from DTM [10] and [13] O Mon Power Plant Project and Các tham biến tính toán ở đây căn cứ trên tài liệu DTM: [10] và [13] Omon Power Plan Project and another change are updated as: relative humidity is 85%, atmostphere temperature 27⁰4C, average water temperature is 29,5⁰C, độ temperature difference of warm water is 7⁰C. Heat transfer cofficiency of two discharge point as: (Chapter 3): Q₀ as 530cal/m²/s, and Q₁ as 13cal/m²s⁰C.

Table1. Maximum monthly water level from 1977 to 2004 .

Year	1	2	3	4	5	6	7	8	9	10	11	12
1977	1.31	1.16	1.14	1.12	1.09	1.85	1.03	1.29	1.50	1.54	1.40	1.39
1978	1.35	1.10	1.06	1.14	1.14	1.07	1.17	1.44	1.53	1.66	1.58	1.34
1979	1.20	1.13	1.13	1.11	1.00	0.98	1.26	1.29	1.52	1.65	1.45	1.25
1980	1.16	1.09	1.05	1.22	0.96	1.04	1.15	1.22	1.63	1.53	1.52	1.32
1981	1.17	1.17	1.15	1.07	1.13	1.35	1.33	1.41	1.50	1.56	1.57	1.44
1982	1.26	1.13	1.11	1.09	1.09	0.94	1.20	1.27	1.49	1.60	1.52	1.37
1983	1.30	1.17	1.07	0.97	0.81	1.04	1.02	1.27	1.46	1.54	1.60	1.45
1984	1.22	1.24	1.13	1.04	1.00	1.00	1.13	1.47	1.60	1.66	1.57	1.31
985	1.17	1.08	1.23	1.11	1.00	1.02	1.14	1.26	1.54	1.50	1.52	1.37

1986	1.34	1.34	1.12	1.05	1.10	1.06	1.17	1.32	1.39	1.56	1.59	1.40
1987	1.30	1.27	1.20	1.08	0.95	0.87	1.06	1.22	1.42	1.57	1.44	1.37
1988	1.27	1.26	1.11	1.10	1.02	0.92	1.10	1.42	1.43	1.50	1.37	1.21
1989	1.16	1.19	1.25	1.07	1.02	1.01	1.10	1.31	1.52	1.69	1.51	1.41
1990	1.30	1.15	1.08	1.20	1.01	1.12	1.16	1.25	1.44	1.53	1.51	1.48
1991	1.31	1.38	1.20	1.06	1.03	0.97	1.21	1.31	1.51	1.58	1.47	1.37
1992	1.33	1.14	1.09	1.09	0.92	0.95	1.25	1.44	1.66	1.63	1.42	1.21
1993	1.23	1.17	1.18	1.14	0.94	0.90	1.27	1.36	1.49	1.64	1.48	1.36
1994	1.21	1.19	1.30	1.10	1.03	1.16	1.30	1.47	1.56	1.76	1.70	1.44
1995	1.40	1.38	1.22	1.04	1.03	1.08	1.28	1.37	1.64	1.67	1.54	1.41
1996	1.29	1.31	1.05	1.24	1.07	1.10	1.34	1.59	1.73	1.72	1.59	1.58
1997	1.49	1.34	1.25	1.11	1.02	0.94	1.41	1.55	1.67	1.79	1.84	1.45
1998	1.37	1.25	1.30	1.13	1.01	0.95	1.17	1.35	1.41	1.67	1.55	1.48
1999	1.33	1.22	1.25	1.12	1.30	1.26	1.23	1.49	1.75	1.79	1.75	1.64
2000	1.47	1.29	1.13	1.12	1.08	1.34	1.53	1.56	1.79	1.73	1.73	1.57
2001	1.41	1.47	1.39	1.20	1.07	1.17	1.46	1.67	1.85	1.90	1.83	1.58
2002	1.56	1.52	1.33	1.27	1.16	1.18	1.43	1.58	1.78	1.95	1.86	1.62
2003	1.51	1.41	1.31	1.17	1.13	1.06	1.23	1.57	1.83	1.81	1.67	1.47
2004	1.46	1.26	1.21	1.13	1.23	1.33	1.22	1.57	1.93	1.89	1.59	1.61
Maximum level :											Ave	1.32
Min											0.81	Max 1.95

Table 2. Minimum monthly water level from 1977 to 2004 .

Year	1	2	3	4	5	6	7	8	9	10	11	12
1977	-1.05	-1.20	-1.52	-1.60	-1.75	-1.73	-0.64	-1.13	-0.92	-0.39	-0.58	-1.12
1978	-1.25	-1.23	-1.49	-1.45	-1.59	-1.39	-1.10	-0.93	-0.23	-0.08	-0.31	-0.88
1979	-1.10	-1.51	-1.37	-1.36	-1.62	-1.46	-0.95	-0.90	-0.39	-0.16	-0.47	-1.02
1980	-1.42	-1.43	-1.46	-1.62	-1.69	-1.48	-1.41	-0.95	-0.59	-0.05	-0.17	-0.61
1981	-0.94	-1.39	-1.40	-1.47	-1.50	-1.49	-0.98	-0.69	-0.32	-0.42	-0.29	-0.81
1982	-0.99	-1.38	-1.52	-1.49	-1.62	-1.55	-1.35	-1.17	-0.68	-0.26	-0.29	-1.03
1983	-1.15	-1.66	-1.37	-1.50	-1.62	-1.70	-1.46	-1.14	-0.68	-0.60	-0.13	-0.56
1984	-1.08	-1.20	-1.54	-1.53	-1.58	-1.54	-1.22	-0.93	-0.16	-0.06	-0.20	-0.72
1985	-1.05	-1.22	-1.36	-1.57	-1.44	-1.66	-1.13	-0.95	-0.44	-0.09	-0.40	-0.78
1986	-1.04	-1.39	-1.55	-1.57	-1.75	-1.40	-1.23	-0.95	-0.62	-0.10	-0.30	-0.85
1987	-1.02	-1.43	-1.48	-1.38	-1.50	-1.58	-1.52	-1.10	-0.68	-0.28	-0.50	-0.81
1988	-1.00	-1.28	-1.54	-1.42	-1.62	-1.60	-1.40	-1.05	-0.73	-0.60	-0.49	-0.92
1989	-0.99	-1.46	-1.57	-1.48	-1.60	-1.50	-1.42	-1.05	-0.70	-0.11	-0.32	-0.89

1990	-0.86	-1.43	-1.47	-1.44	-1.46	-1.40	-1.12	-0.86	-0.64	-0.24	-0.18	-0.86
1991	-0.92	-1.26	-1.46	-1.39	-1.39	-1.42	-1.20	-1.63	-0.29	-0.13	-0.23	-0.67
1992	-1.10	-1.26	-1.31	-1.32	-1.40	-1.50	-1.28	-1.24	-0.66	-0.17	-0.44	-0.93
1993	-0.94	-1.42	-1.43	-1.42	-1.44	-1.46	-1.22	-0.92	-0.58	-0.19	-0.46	-0.80
1994	-0.96	-1.32	-1.31	-1.33	-1.51	-1.36	-1.08	-0.67	-0.38	-0.06	-0.25	-0.76
1995	-0.83	-1.15	-1.24	-1.25	-1.42	-1.37	-1.22	-0.78	-0.45	-0.02	-0.35	-0.60
1996	-1.01	-1.17	-1.23	-1.16	-1.35	-1.24	-1.11	-0.66	-0.38	-0.23	-0.04	-0.50
1997	-0.74	-0.92	-1.15	-1.17	-1.35	-1.29	-1.03	-0.54	-0.19	-0.10	-0.42	-0.76
1998	-0.99	-1.14	-1.17	-1.26	-1.30	-1.33	-1.10	-0.92	-0.74	-0.45	-0.63	-0.76
1999	-1.00	-1.10	-1.19	-1.36	-1.16	-1.04	-0.88	-0.52	-0.33	0.09	0.06	-0.44
2000	-0.74	-0.89	-1.05	-1.19	-1.15	-1.01	-0.48	-0.37	-0.13	-0.01	-0.09	-0.55
2001	-0.91	-0.96	-1.00	-1.13	-1.31	-1.11	-0.83	-0.68	-0.12	0.19	-0.07	-0.62
2002	-0.82	-0.98	-1.23	-1.25	-1.30	-1.15	-0.84	-0.59	-0.15	0.16	-0.13	-0.55
2003	-0.79	-0.99	-1.14	-1.30	-1.30	-1.26	-1.09	-0.79	-0.54	-0.03	-0.37	-0.87
2004	-1.02	-1.20	-1.32	-1.30	-1.42	-1.17	-1.14	-0.71	-0.25	-0.10	-0.47	-0.79
Minimum level:											Ave	-0.96
											Min	-1.75
											max	0.19

2.2. COMPUTING BASE OF FLOW

Flow process at discharge point is simulated by hydrolic boundary equation, consist of: derivation differential equation, initial condition and boundary condition. At [12], are presented the equation condition and find solution of this math.

Assume region of flow is shallow area, there are effected of Coriolis acceleration and acceleration of gravity. So the system of equations is described two dimension of flow as flowing simple turbulent flow:

$$\frac{\partial H}{\partial t} + \sum_{k=1}^2 \frac{\partial H V_k}{\partial x_k} = q$$

$$\frac{\partial}{\partial t} (H V_i) + \nabla (H J^i) + g_o H \nabla \zeta + f_b V_i = f_i \quad i=1,2 \quad (1)$$

With, $J^i = (J_{i1}, J_{i2})$ is flow field of kinetic quantity :

$$J_{ik} = \varepsilon_{ik} V_i V_k - D^{ki} \frac{\partial V_i}{\partial x_k}, \quad i, k = 1, 2 \quad (2)$$

$V_1 V_2$ or $U V$ as average vertical velocity at point (x, y) , H is depth, q : flow exchange; g_0 : acceleration of gravity, ε_{ij} : correction coefficient, f_b bottom friction factor, ζ water level, D^{ki} : turbulent diffusion factor.

f_i factor of (1) as following:

$$f_1 = \Omega H V_2 + C_w |\mathbf{W}|^2 \cos \psi \quad f_2 = -\Omega H V_1 + C_w |\mathbf{W}|^2 \sin \psi \quad (3)$$

With $\Omega = 2\omega \sin \lambda$, ω is rotation speed of earth, λ : is latitude angel; $\mathbf{W}$: wind velocity vector, ψ : angle of wind direction and ox axis, C_w wind friction.

Mesh calculation are divided semi-automatic as tetralogal tile along boundary to fixed with approximation linear low range as following Picture 4 and 5. we use the finite volume method to solution this math without use transformation of coordinate.

Uses Green function, Ostrowgradski and approximate solution surface integral method, and curvilinear integral per finite volume, function (1) determine U, V at P central of finite volume as following:

$$\sum_{nP+} u_x^P U_x = \sum_{nP} m_x^P \zeta_x + \hat{u}_0^P \quad \sum_{nP+} v_x^P V_x = \sum_{nP} n_x^P \zeta_x + \hat{v}_0^P \quad (4)$$

With $u_x^P, m_x^P, \hat{u}_0^P, v_x^P, n_x^P, \hat{v}_0^P$ is discontinuous factor according to numerical method, nP is composed of P adjacent mesh point, and $nP+$ is composed of nP and added P point

Assume ζ^* is water level estimate receive from actual measurement test. According to (4), we can be determined U^*, V^* . After convert and digitize, then we can be determined $\alpha_Y^P, \beta_Y^P, \gamma_P$ with U^*, V^* of ζ^* we have deviation ζ' reduce to minimum. So ζ' will be determined by linear equation system:

$$\sum_{Y \in nP} \sum_{a \in Y} \left(m_a^Y \frac{\alpha_Y^P}{u_Y^Y} - n_b^Y \frac{\beta_Y^P}{v_Y^Y} \right) \zeta'_a = \gamma_P \quad (5)$$

After solution, if ζ' complete small, ζ^* will require water level of U^*, V^* . Opposite, replaced ζ^* with $\zeta^* + \theta\zeta'$, with $0 < \theta \leq 1$ and 0.65 is accepted value, after that, we resolved to finding result. We use parallel to approximation algorithm to find U, V, ζ .

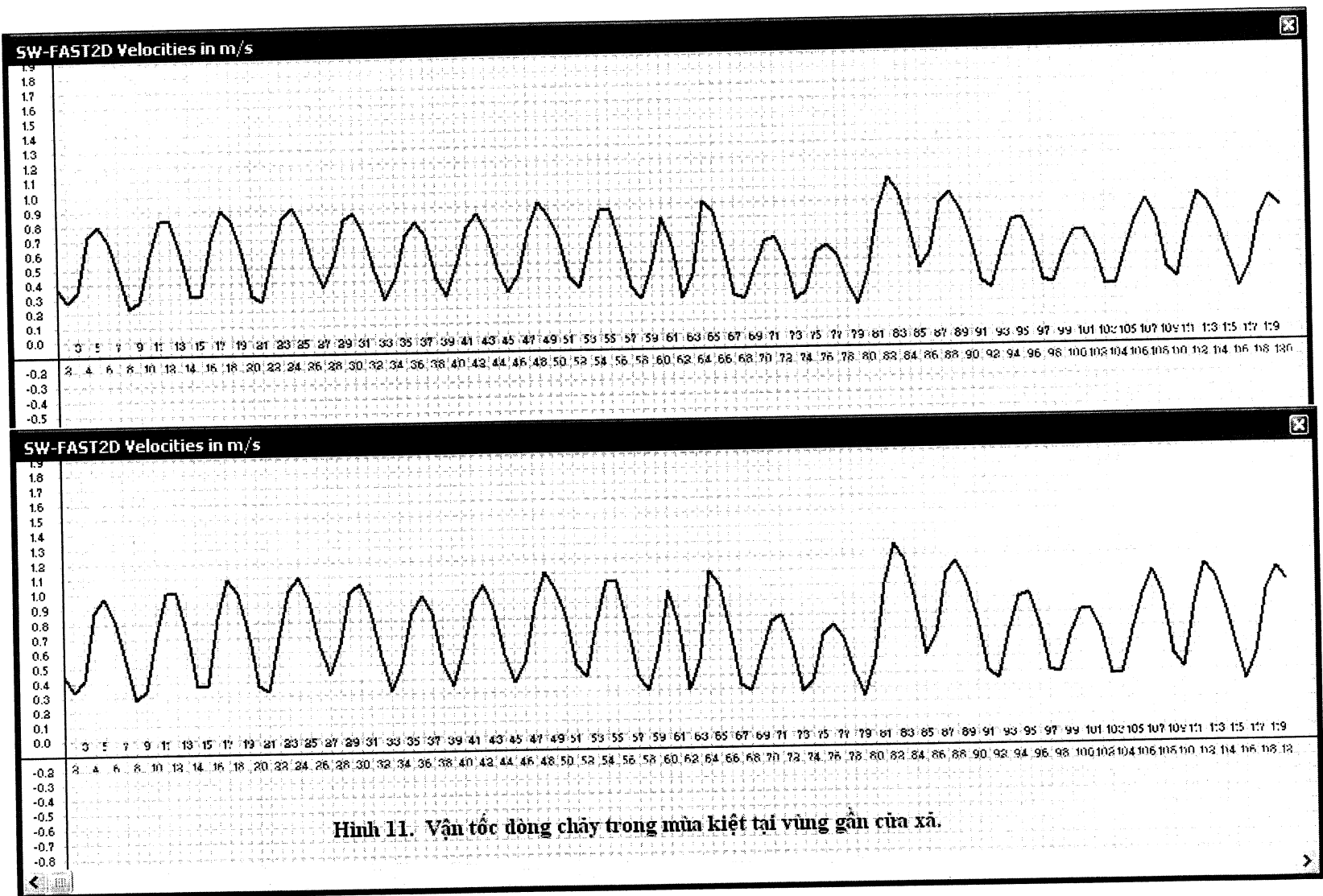
2.3. HAU RIVER FLOW AT O MON POWER PLANT

We use data of The South Bureau and reference the construction data of TamBinh Port to calculate flow. We used data on April and October to calculate as following exhausted flow and flood flow. According to calculation, flow of channel near discharge point is about $22 \text{ m}^3/\text{s}$. Flow of channel in middle of channel near No.01 discharge is shown in Picture 10. Maximum flow velocity is 1 m/s and minimum flow velocity is 0.2 m/s as following 120h calculation and calculated for 4 month, it shown in Picture 1. Level calculation (blue line) and average measurement data (red point) at Phuoc Thoi location are shown in Picture 12. Level is fluctuated from -1.35 to 1.01 m . As Table 1,2 the result calculation is accommodated with amplitude.

We use Fisher diffusion and Student factor to compare gradient of level calculation and measurement, as shown in Table 3 with 5% frequency:

i. $f = 0.982$ is variance value, without violate assume standard refuse: $\{ f < 0.729 ; f > 1.431 \}$. So that, we approve the deviation of calculation and measurement at type I error is 5%.

ii. $t = 0.0028$ is average difference, it so less and : $\{ -1.98 < t < 1.98 \}$. So we insufficient condition to define deviation of calculation value and measurement data. Notice that, t very small so this value is type II error.



Hình 11. Vận tốc dòng chảy trong mùa kiệt tại vùng gần cửa xả.

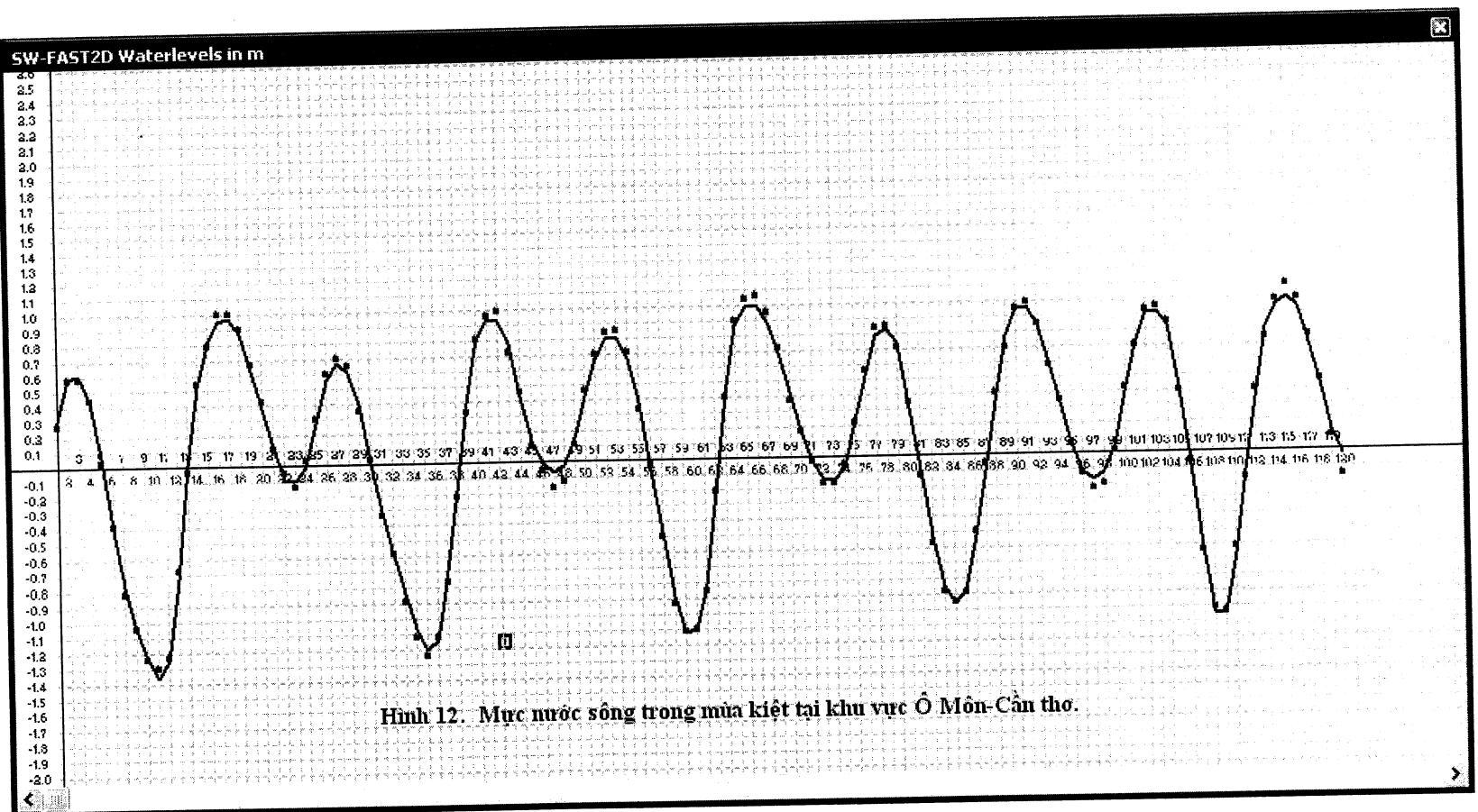


Table3. Comparison of water level calculation and measurement at Phuoc Thoi Ward.

Calculation	Measure	Calculation	Measure	Calculation	Measure	Calculation	Measure

1	0.270	0.313	-0.340	-0.313	-0.850	-0.817	0.990	0.965
2	0.590	0.599	-0.590	-0.594	-0.210	-0.228	0.860	0.849
3	0.590	0.617	-0.890	-0.838	0.410	0.420	0.590	0.599
4	0.440	0.447	-1.130	-1.060	0.910	0.875	0.350	0.331
5	0.020	0.072	-1.240	-1.201	1.040	0.991	0.060	0.069
6	-0.390	-0.407	-1.130	-1.147	1.060	1.009	-0.130	-0.130
7	-0.830	-0.772	-0.770	-0.710	0.960	0.893	-0.230	-0.175
8	-1.040	-1.040	-0.220	-0.184	0.730	0.697	-0.200	-0.130
9	-1.240	-1.236	0.330	0.394	0.380	0.438	0.010	0.042
10	-1.300	-1.361	0.820	0.813	0.180	0.177	0.430	0.394
11	-1.230	-1.254	0.970	0.947	-0.030	-0.032	0.710	0.715
12	-0.690	-0.737	0.990	0.938	-0.170	-0.141	0.930	0.911
13	-0.040	0.019	0.730	0.786	-0.180	-0.151	0.960	0.929
14	0.540	0.527	0.470	0.438	-0.050	-0.074	0.860	0.831
15	0.790	0.813	0.100	0.147	0.220	0.235	0.400	0.429
16	1.000	0.956	-0.060	-0.014	0.570	0.527	-0.060	-0.085
17	1.000	0.974	-0.170	-0.070	0.840	0.795	-0.640	-0.630
18	0.900	0.875	-0.130	-0.032	0.860	0.831	-1.020	-1.040
19	0.670	0.635	0.110	0.153	0.720	0.742	-1.040	-1.058
20	0.420	0.385	0.460	0.420	0.350	0.313	-0.630	-0.674
21	0.120	0.130	0.700	0.670	-0.130	-0.094	-0.180	-0.139
22	-0.050	-0.091	0.840	0.804	-0.580	-0.532	0.400	0.340
23	-0.140	-0.102	0.850	0.813	-0.880	-0.853	0.740	0.802
24	0.030	-0.011	0.720	0.670	-0.950	-0.969	0.980	0.956
25	0.300	0.278	0.330	0.381	-0.890	-0.880	1.080	1.008
26	0.610	0.563	-0.030	-0.078	-0.510	-0.532	0.990	0.947
27	0.700	0.670	-0.500	-0.478	-0.060	-0.112	0.750	0.706
28	0.650	0.617	-0.930	-0.888	0.400	0.340	0.460	0.447
29	0.360	0.403	-1.110	-1.129	0.710	0.777	0.090	0.139
30	0.030	0.019	-1.100	-1.103	0.960	0.956	-0.160	-0.032
Sample size		120	F= 0.982 in (+0.729, 1.431)					
		Com.	Obs.	*Non-Significant var-difference !				
Stand.Dev:		0.6611	0.6732	t= 0.0028 in (-1.980,1.980)				
Averages		0.1280	0.1277	*Non-Significant average difference.				

The result indicated:: not indication to show a difference from calculation and measurement.

Chapter 3

HEAT DIFFUSION OF WARM WATER COASTAL O MON IN HAU RIVER

3.1. TH COOLING ENVIRONMENT OF WARM WATER

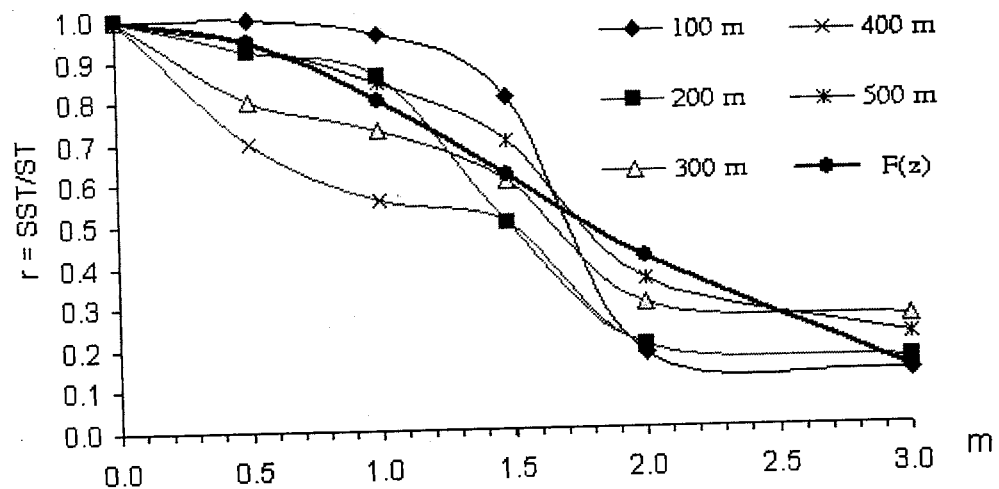
The temperature of the water discharged into aquatic environment is about 5 to 10°C higher than the water temperature in the region. Due to the discharged warm water has already gone from the condenser to the outlet water temperature at the outlets may be smaller.. The process of diffusion and cooling of this kind of water is mainly done by three complicated phenomena combined with one another, including: advection caused by discharge and flow itself, heat dissipation by mixing with water flow, and radiation into the atmosphere.

The action of the wind helps heat transfer to the atmosphere caused by evaporation from the sea surface and promotes cooling affect. The scale of these factors strongly affect to the mixing process. The dominated thermal diffusion of cooling water derives from lower layer, eddy turbulent diffusion, and tidal mixing,... The water waves promote mixing and cooling in the surface zone and convective effect of random waves increases dispersion in offing.

However, the actual measurement and the statistic from the Central Research Institute of Electricity Power Industry-Abiko Japan [9] was confirm as following: the horizontal thermal diffusivity is at least 50 times greater than the vertical and the vertical distribution of heat transfer often take place at 2-3m distance from the sea surface.

The warmed cooling water discharged from the outlet in the seaside overflows as upper layer because of its inertial momentum. According to the field survey C:73001 from the Central Research Institute of Electricity Power Industry-Abiko Japan, it is found that: the horizontal thermal diffusivity is at least 50 times greater than the vertical and the vertical distribution of heat transfer ratios r may be represented as statistical exponential models in the form $F(z) = \exp[-2(z/h)^2]$, where h is the maximum, z : distance in meter from the sea surface to the location.

The Fig. 1 and 2 show experimental data source from seaside of Shimonoseki, Japan[9]. This result is demonstrated heat not transfer exceed 3m depth at proximity zone of seaside with respect to the distances: 1km or without exceed 5m at guft location.



Hinh 13. *Vertical distribution of heat-transfer in Z depths from sea surface*
Data source: Shimonoseki Coastal, Japan [9].

From the above analysis can identify that when discharge warm water to surface water environment, it should take advantage of the flow at the position and set discharge point deep under water surface layers to increase the effective mix , and diffusive exchange with the water running. Also to note that the ability to promote the spread of warm water while waste from surrounding areas also depend on how to design the exit of warm water, flow, flow speed, the surface wind where warm water discharge.

3.2. HEATING SPREAD EQUATION

In this section, a physico-mathematical model for thermal convective-diffusive spreading is established. Since the warmed cooling water emission probably changes the aquatic environment, the prediction of such water plays an important role on EIA. The behavior of discharged warm water is studied under the influence of the water flow process the natural heat exchange between water surface and the atmosphere. Generally, the heat transfer model is written in three dimensions [11]. However, the horizontally two dimensional model assuming on

vertical profile of water temperature is introduced for the shallow water areas, especially for the Binhthuan coastal.

Just as a mass balance can be written for a volume of water, a heat balance can also be developed. The heat balance for a completely mixed system can be expressed as follows:

$$\text{Accumulation} = \text{inflow} - \text{outflow} \pm \text{surface heat exchange} \quad (6)$$

Although this is labeled “inflow-outflow”, but it represents both heat entering as well as pointed discharges. This principle can be extended to natural system and the following equation is obtained

$$C_p \left(\frac{\partial T}{\partial t} + U \frac{\partial T}{\partial x} + V \frac{\partial T}{\partial y} + W \frac{\partial T}{\partial z} \right) = \frac{\partial T}{\partial x} \left(K_x \frac{\partial T}{\partial x} \right) + \frac{\partial T}{\partial y} \left(K_y \frac{\partial T}{\partial y} \right) + \frac{\partial T}{\partial z} \left(K_z \frac{\partial T}{\partial z} \right) + Q - \beta T \quad (7)$$

where, C_p : specific heat capacity ($\text{Kcal}/^\circ\text{C}\cdot\text{m}^3$); x, y, z : coordinates (m); U, V, W : velocity components with respect to x, y, z (m/s); K_x, K_y, K_z : heat diffusion coefficients ($\text{Kcal}/^\circ\text{C}\cdot\text{m}\cdot\text{s}$); Q : heat source/sink ($\text{Kcal}/\text{m}^3\cdot\text{s}$); β : heat loss coefficient ($\text{Kcal}/^\circ\text{C}\cdot\text{m}^3\cdot\text{s}$). Assuming that the vertical temperature distribution is given by

$$T(x, y, z, t) = T_0 + (T_s - T_0) g(z) \quad (8)$$

With T : water temperature; T_0 : natural water temperature; $T_s = T_s(x, y, z, t)$: surface water temperature and $g(z)$: a function statistically determined by

$$g(z) = \exp \left[-2 \left(\frac{z + \eta}{H + \eta} \right)^2 \right] \quad (9)$$

η is level of water; H : warmed water depth. By integration (7) from $-\eta$ to H the heat diffusion equation is obtained as follows

$$\frac{\partial T_s}{\partial t} + \epsilon_T U_s \frac{\partial T_s}{\partial x} + \epsilon_T V_s \frac{\partial T_s}{\partial y} = K_x \frac{\partial^2 T_s}{\partial x^2} + K_y \frac{\partial^2 T_s}{\partial y^2} + \frac{1}{C_p} (Q_0 - \beta_0 T_s) \quad (10)$$

The subscript s is to denote values of variables on the surface, ϵ_T adjust factor.

⊗ *Initial condition*: water temperature at the beginning of flow domain.

⊗ *Boundary condition*: temperature of discharged warm water on boundary, it may be given as heat flux of Neumann type:

$$K_x \frac{\partial T}{\partial x} n_x + K_y \frac{\partial T}{\partial x} n_y + K_y \frac{\partial T}{\partial x} n_y + \delta(T - T_e) + q = 0 \quad (11)$$

Here n_x, n_y, n_z : direction cosines of outward normal vector; q : heat flux ($\text{Kcal/m}^2 \cdot \text{s}$); δ : heat conductivity ($\text{Kcal/}^\circ\text{C} \cdot \text{m}^2 \cdot \text{s}$); T_e : temperature in the exterior of the domain. Integration (11) implies the boundary condition in horizontal

$$K_x \frac{\partial T_s}{\partial x} n_x + K_y \frac{\partial T_s}{\partial x} n_y + \bar{\delta} T_s + \bar{q} = 0 \quad (12)$$

$$\bar{\delta} = \delta - \frac{0.9049K_z}{H + \eta}, \quad \bar{q} = 1.672(q - \delta T_e) + \left[\frac{0.9049K_z}{(H + \eta)^2} + 0.672\delta \right] T_o \quad (13)$$

Condition adiabatic: $dg_s/dz|_H = 0$ may be included for a shallow water domain and

$$\bar{q} = \frac{H + \eta}{B} (q - \delta T_e) - \delta \left(1 - \frac{H + \eta}{B} \right) T_o \quad (14)$$

⊗ *Surface heat exchange* based on five processes and divided in two ways. First refers to radiative and non-radiative mechanisms. Radiation refers to energy that is transmitted in the form of electromagnetic waves and thus does not depend on matter for its transmission. In contrast, processes such as conduction and evaporation depend on the motion of molecules. The second way in which the mechanisms can be divided is based on whether they are dependent on the temperature of the water. This division relates to whether the process acts as a model forcing function or includes the dependent variable: water temperature.

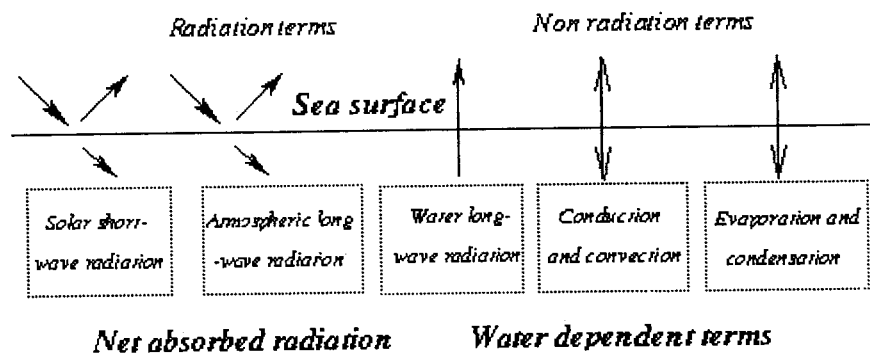


Fig 2 The components of surface heat exchange

Processes such as solar radiation and atmospheric long wave radiation are independent of the condition of the water. Hence these terms act as forcing functions. In contrast, although they are dependent on external conditions e.g. air temperature, moisture, wind speed, etc. processes such as evaporation are also a function of water temperature. The total surface heat flux can be represented as :

$$J = J_s + J_a - (J_b + J_c + J_e) \quad (15)$$

$\uparrow$ Bức xạ ròng hấp thụ $\uparrow$ Thành phần phụ thuộc nước

Where J_s : net solar shortwave radiation, J_a : net atmospheric long wave radiation, J_b : long wave back radiation from the water, J_c : conduction, J_e : evaporation.

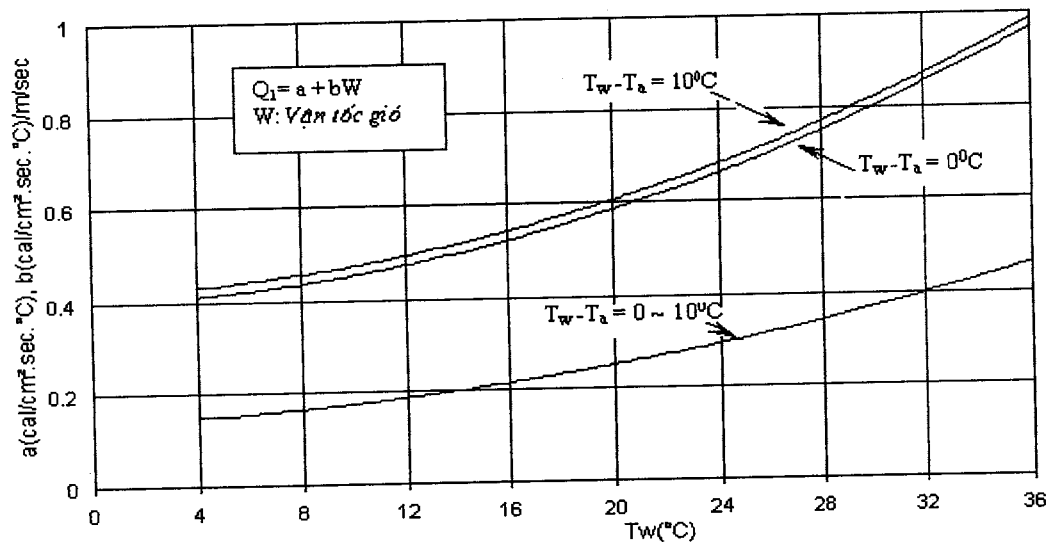


Fig 3. Estimation chart for heat transfer between the air and sea surface

Where J_s : net solar shortwave radiation, J_a : net atmospheric long wave radiation, J_b : long wave back radiation from the water, J_c : conduction, J_e : evaporation.

Cooling heat Q from the sea surface in the heat transfer equation can be modeled statistically. The net-exchange rate across the sea surface is then represented by the following linear combination:

$$Q^* = Q_0 - Q_1 T \quad (16)$$

Natural environment water temperature may be derived from the above equation as $T_s = Q_0 / Q_1$ the coefficient of heat dissipation Q_1 as follows:

$$Q_1 = a + bW \quad (17)$$

In which, a and b are the coefficients relating with the water temperature (T_w) and the air temperature (T_a). The above coefficients of a, b are given as monograph in the Fig 3.

⊗ *Numerical method*: By integration (4) on finite volumes τ centered at P, after manipulating the following linear equation is obtained to solve for the temperature T_P at the interior node P:

$$\tilde{c}_P T_P = \sum_{x \in nP} \tilde{c}_x T_x + \tilde{c}_P^0 \quad (18)$$

Where $\tilde{c}_P^0, \tilde{c}_x, x \in nP$ is factors determined by the numerical method, nP is the set of neighbor nodes of P. Using the alternative direction method (18) can be partitioned into a couple of three-diagonal system to be solved directly by Thomas algorithm:

$$-\tilde{c}_W T_W^* + \tilde{c}_P T_P^* - \tilde{c}_E T_E^* = c'_P \quad (19)$$

$$-\tilde{c}_S T_S + \tilde{c}_P T_P - \tilde{c}_N T_N = c'_P \quad (20)$$

In which N, E, W, S neighbor nodes in the Northern, Eastern, Western and Southern of P. $T_x^*, x \in nP$ temperature at the semi-step of time step Δt in solving the problem.

⊗ *Computational parameters*: A estimation value for β is chosen as 0.0117 Kcal/m²·s, similarly $Q_0 = 0.167$ Kcal/m²·s. Heat diffusion coefficients K_x, K_y is referred to field experimental data in [9] and approximate of 40 Kcal/°C·m·s. Hydraulic data such as: water level, win velocity, atmosphere radiation, etc is based on [10]. Tidal regime, coefficient of wind, and bottom friction are determined of the same way in [5] and [8].

3.3. DIFFUSION OF HEAT PROPAGATION

Temperature of warm water is reduced by heat transfer to cooling water while discharged to discharge channel. According to aerography and hydrographic data

in design parameter report of O Mon power plant, we can determine loss heat along discharge channel to discharge gate.

According Raudkivi (1979), the average temperature of atmosphere is 27°C and the mean humidity is about 85%, air vapour pressure as following:

$$E_{\text{sat}} = 0.85 \cdot 4.596 \cdot \exp(17.27 \cdot 26.7 / [237.3 + 26.7]) = 26.35904 \text{ mmHg}$$

Other side, the saturation vapour pressure E_{svp} in accordance with warm water surface temperature: $29^{\circ}\text{C} + 7^{\circ} = 36^{\circ}\text{C}$ (the average temperature of river water is 29°C)

$$E_{\text{svp}} = 4.596 \cdot \exp[17.27 \cdot 36.5 / (237.3 + 36.5)] = 45.944425 \text{ mmHg}$$

According to Dalton, heat loss depend on Bowen factor and statistic function $f(w)$ depend on wind velocity(w), it was calculated on dry season as following:

$$J_e = -k \cdot f(w)(E_{\text{svp}} - E_{\text{sat}}) = -2528635204 \text{ Joule/m}^2/\text{s},$$

According to heat balance principle, the weir discharge in option 1 and option 2 from discharge outlet, the length of DW is 750-770m, average wetted perimeter is 6m, we estimate the decrement of warm water temperature δT at discharge gate with average river temperature on dry season as following:

$$\delta T = 6450 \cdot J_e / (52 \cdot 24 \cdot 3600 \cdot 998.2 \cdot 4182) = -0.86^{\circ}\text{C}, \text{ mùa khô-khết}$$

With, density of water: 998.2 kg/m^3 , specific heat capacity as $4182 \text{ Joule/(kg} \cdot \text{OC)}$.

At discharge gate, is a location 10m depth of water, so the mixed efficiency of water on vertical was happened more greater, this result is showed at picture 13. this is an advantage of discharge point. The table from table 4 to table 6 are described about calculation result of heat diffusion in proximity of No.1 and No.2 discharge point, correspondence to the top rising tide, the bottom low tide and still tide. On their table, the value on every cell is mean temperature difference on horizontal row and vertical column. The mesh size at proximity

zone of discharge point on horizontal (row) are approximated 40m, and on vertical (column) are approximated 50m.

Table 4. Simulate difference temperature at calculation mesh point conform with rising tide to top level in exhausted water season .

Nut	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.03	0.14	0.23	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.07	0.27	0.38	0.37	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.19	0.38	0.42	0.54	0.39	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.35	0.51	0.63	0.70	0.53	0.48	0.24	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.43	0.62	0.70	0.78	0.67	0.55	0.43	0.22	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.51	0.74	0.83	0.91	0.78	0.63	0.56	0.38	0.16	0.04	0.00	0.00	0.00	0.00	0.00	0.00
17	0.62	0.92	1.08	1.03	0.89	0.72	0.60	0.48	0.31	0.11	0.00	0.00	0.00	0.00	0.00	0.00
18	0.73	1.10	1.20	1.21	1.12	0.91	0.67	0.57	0.40	0.22	0.05	0.00	0.00	0.00	0.00	0.00
19	0.97	1.21	1.35	1.40	1.25	1.13	0.78	0.70	0.48	0.28	0.12	0.00	0.00	0.00	0.00	0.00
20	1.13	1.34	1.59	1.62	1.44	1.22	1.03	0.78	0.53	0.34	0.25	0.03	0.00	0.00	0.00	0.00
21	1.24	1.72	1.78	1.80	1.57	1.32	1.15	1.03	0.62	0.39	0.30	0.10	0.00	0.00	0.00	0.00
22	1.42	1.81	1.90	1.90	1.68	1.51	1.25	1.15	0.78	0.44	0.34	0.16	0.00	0.00	0.00	0.00
23	1.65	2.19	2.15	2.05	1.82	1.63	1.43	1.23	0.93	0.50	0.39	0.21	0.00	0.00	0.00	0.00
24	1.94	2.27	2.30	2.23	1.97	1.74	1.55	1.30	1.04	0.62	0.41	0.23	0.01	0.00	0.00	0.00
25	2.01	2.48	2.50	2.30	2.22	1.93	1.73	1.43	1.15	0.73	0.45	0.24	0.02	0.00	0.00	0.00
26	2.38	2.57	2.54	2.45	2.30	2.12	1.80	1.50	1.23	0.85	0.47	0.24	0.03	0.00	0.00	0.00
27	2.46	2.66	2.60	2.56	2.41	2.16	1.94	1.57	1.26	0.88	0.53	0.25	0.03	0.00	0.00	0.00
28	2.53	2.74	2.63	2.60	2.52	2.20	2.08	1.63	1.28	0.90	0.58	0.25	0.03	0.00	0.00	0.00
29	2.68	2.83	2.78	2.75	2.60	2.35	2.15	1.75	1.35	0.93	0.69	0.25	0.03	0.00	0.00	0.00
30	2.83	2.91	2.90	2.80	2.70	2.45	2.25	1.90	1.45	0.98	0.78	0.25	0.03	0.00	0.00	0.00
31	2.90	3.66	3.81	3.43	2.80	2.56	2.29	1.98	1.53	1.03	0.84	0.25	0.03	0.00	0.00	0.00
32	3.68	4.47	4.54	4.22	3.21	2.75	2.35	2.10	1.65	1.12	0.85	0.25	0.03	0.00	0.00	0.00
33	4.45	5.12	5.41	4.50	3.43	2.88	2.44	2.23	1.70	1.15	0.85	0.26	0.03	0.00	0.00	0.00
34	4.47	5.06	5.37	4.48	3.39	2.78	2.41	2.21	1.60	1.10	0.73	0.25	0.03	0.00	0.00	0.00
35	4.44	4.82	4.98	4.14	3.34	2.74	2.39	2.18	1.55	1.06	0.65	0.23	0.02	0.00	0.00	0.00
36	4.43	4.70	4.81	4.07	3.27	2.65	2.34	2.13	1.47	0.97	0.51	0.16	0.01	0.00	0.00	0.00
37	4.12	4.43	4.52	3.86	2.94	2.48	2.16	1.89	1.28	0.77	0.35	0.07	0.00	0.00	0.00	0.00
38	2.86	3.81	3.95	3.41	2.72	2.30	2.02	1.76	1.13	0.63	0.14	0.01	0.00	0.00	0.00	0.00
39	1.74	2.50	2.89	2.53	2.14	1.89	1.58	1.40	0.68	0.17	0.00	0.00	0.00	0.00	0.00	0.00
40	0.52	1.65	1.96	1.62	1.49	1.31	1.17	0.68	0.23	0.01	0.00	0.00	0.00	0.00	0.00	0.00

41	0.00	0.43	0.61	0.59	0.52	0.48	0.25	0.13	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	0.00	0.00	0.02	0.03	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* Notes: column data is conform with 16 vertical mesh lines of river and numbering increase from right riverside, column data is conform with horizontal mesh line and numbering increase from back river to downriver

Table 5. Simulate diffirence temperature at calculation mesh point conform with tidal fall to level in exhausted water season .

Nut	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.02	0.06	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.31	0.52	0.61	0.52	0.21	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.48	1.70	1.96	1.62	0.73	0.31	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	1.69	2.55	2.89	2.53	1.77	0.89	0.47	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	2.68	3.47	3.71	3.28	2.62	1.57	1.01	0.46	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	3.79	4.45	4.46	3.86	3.19	2.32	1.58	0.77	0.38	0.01	0.00	0.00	0.00	0.00	0.00	0.00
32	4.61	4.96	4.83	4.42	3.48	2.89	2.20	1.54	0.87	0.34	0.05	0.00	0.00	0.00	0.00	0.00
33	4.54	5.35	5.40	4.60	3.51	2.94	2.38	1.83	1.36	0.67	0.25	0.02	0.00	0.00	0.00	0.00
34	4.52	5.21	5.34	4.43	3.45	2.97	2.57	2.16	1.53	0.85	0.48	0.14	0.00	0.00	0.00	0.00
35	4.51	5.03	5.12	4.40	3.40	2.96	2.56	2.17	1.66	1.03	0.64	0.25	0.02	0.00	0.00	0.00
36	4.57	4.92	5.01	4.41	3.35	2.84	2.45	2.14	1.63	1.10	0.64	0.28	0.03	0.00	0.00	0.00
37	4.43	4.62	4.78	4.12	3.17	2.75	2.29	1.98	1.53	1.03	0.60	0.27	0.03	0.00	0.00	0.00
38	3.40	3.99	4.25	3.43	2.95	2.56	2.25	1.90	1.45	0.98	0.56	0.27	0.03	0.00	0.00	0.00
39	3.14	3.63	3.80	3.11	2.84	2.45	2.15	1.75	1.35	0.93	0.52	0.26	0.03	0.00	0.00	0.00
40	2.63	2.82	3.01	2.65	2.56	2.35	2.08	1.63	1.28	0.90	0.48	0.25	0.03	0.00	0.00	0.00
41	2.28	2.41	2.70	2.48	2.31	2.20	1.80	1.50	1.23	0.85	0.43	0.22	0.03	0.00	0.00	0.00
42	1.91	2.23	2.45	2.31	2.16	1.97	1.73	1.43	1.15	0.73	0.39	0.20	0.02	0.00	0.00	0.00
43	1.85	2.11	2.31	2.23	2.03	1.74	1.55	1.30	1.04	0.61	0.35	0.18	0.01	0.00	0.00	0.00
44	1.56	1.95	2.12	2.05	1.82	1.63	1.43	1.23	0.93	0.50	0.30	0.11	0.00	0.00	0.00	0.00
45	1.30	1.78	1.90	1.90	1.68	1.51	1.25	1.15	0.89	0.44	0.26	0.07	0.00	0.00	0.00	0.00
46	1.20	1.59	1.78	1.80	1.50	1.32	1.15	1.03	0.62	0.41	0.21	0.04	0.00	0.00	0.00	0.00
47	1.03	1.41	1.55	1.62	1.35	1.22	1.03	0.78	0.53	0.36	0.15	0.02	0.00	0.00	0.00	0.00
48	0.81	1.20	1.35	1.40	1.25	1.13	0.78	0.70	0.48	0.30	0.08	0.00	0.00	0.00	0.00	0.00
49	0.70	1.03	1.20	1.21	1.12	0.91	0.67	0.57	0.40	0.21	0.00	0.00	0.00	0.00	0.00	0.00
50	0.66	0.92	1.14	1.12	1.01	0.82	0.64	0.51	0.34	0.17	0.00	0.00	0.00	0.00	0.00	0.00
51	0.62	0.81	1.08	1.03	0.89	0.72	0.60	0.45	0.28	0.13	0.00	0.00	0.00	0.00	0.00	0.00
52	0.51	0.68	0.83	0.91	0.78	0.63	0.56	0.38	0.16	0.02	0.00	0.00	0.00	0.00	0.00	0.00
53	0.39	0.53	0.75	0.82	0.67	0.55	0.43	0.22	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	0.27	0.35	0.63	0.70	0.53	0.48	0.25	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

55	0.15	0.32	0.42	0.54	0.37	0.26	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	0.03	0.26	0.38	0.37	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57	0.00	0.03	0.21	0.18	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
58	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* Notes: column data is conform with 16 vertical mesh lines of river and numbering increase from right riverside, column data is conform with horizontal mesh line and numbering increase from back river to downriver

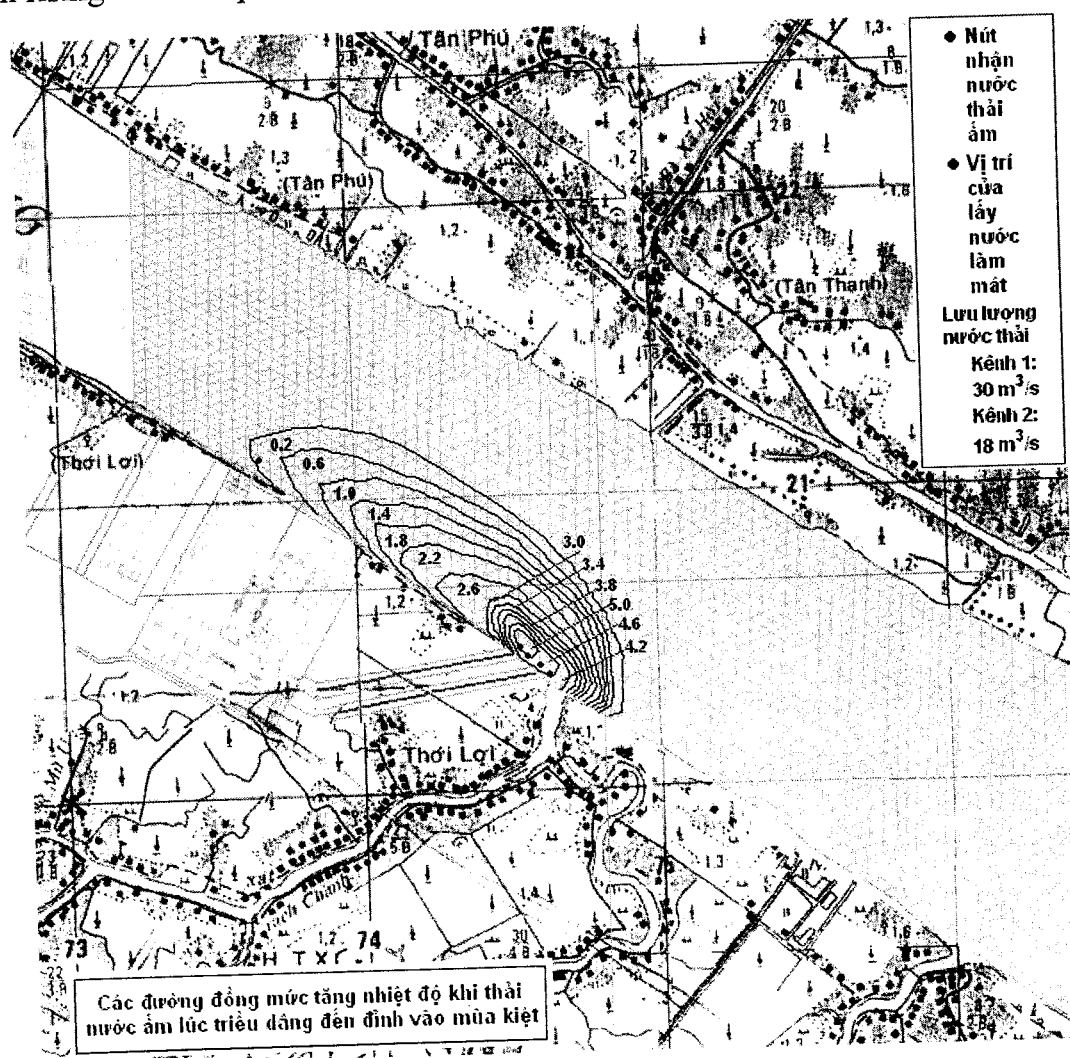
Table 6. Simulate diffrence temperature at calculation mesh point conform with still tide level in exhausted water season.

Nut	1	2	3	4	5	6	7	8	9	10	1	12	13	14	15	16
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.02	0.06	0.10	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.03	0.19	0.28	0.36	0.23	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.07	0.37	0.53	0.48	0.34	0.27	0.11	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.42	0.66	0.80	0.85	0.70	0.51	0.23	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.58	0.79	1.04	1.07	0.89	0.62	0.48	0.23	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.69	1.17	1.23	1.25	1.02	0.77	0.60	0.48	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.87	1.26	1.35	1.35	1.13	0.96	0.70	0.60	0.23	0.02	0.00	0.00	0.00	0.00	0.00	0.00
26	1.10	1.64	1.60	1.50	1.38	1.08	0.88	0.68	0.38	0.08	0.00	0.00	0.00	0.00	0.00	0.00
27	1.39	1.72	1.75	1.68	1.53	1.30	1.12	0.82	0.52	0.19	0.03	0.00	0.00	0.00	0.00	0.00
28	1.83	2.02	1.99	1.90	1.75	1.57	1.25	0.95	0.68	0.30	0.07	0.00	0.00	0.00	0.00	0.00
29	2.13	2.28	2.23	2.10	2.05	1.80	1.60	1.20	0.80	0.38	0.12	0.00	0.00	0.00	0.00	0.00
30	2.28	2.36	2.35	2.25	2.15	1.90	1.70	1.35	0.90	0.43	0.17	0.03	0.00	0.00	0.00	0.00
31	2.35	3.11	3.26	2.88	2.25	2.01	1.78	1.43	0.98	0.48	0.18	0.05	0.00	0.00	0.00	0.00
32	3.13	4.72	4.69	4.22	2.66	2.20	1.83	1.55	1.10	0.57	0.21	0.08	0.00	0.00	0.00	0.00
33	3.90	5.24	5.41	4.55	2.88	2.22	1.89	1.68	1.15	0.60	0.25	0.11	0.00	0.00	0.00	0.00
34	3.92	5.14	5.36	4.46	2.84	2.28	1.86	1.66	1.21	0.55	0.30	0.12	0.00	0.00	0.00	0.00
35	3.96	4.93	5.05	4.27	2.85	2.31	2.01	1.62	1.18	0.48	0.30	0.11	0.00	0.00	0.00	0.00
36	4.02	4.81	4.91	4.24	2.80	2.29	1.90	1.59	1.06	0.55	0.26	0.10	0.00	0.00	0.00	0.00
37	3.88	4.53	4.65	3.55	2.53	2.20	1.74	1.43	0.98	0.48	0.22	0.08	0.00	0.00	0.00	0.00
38	2.85	3.44	3.63	2.88	2.40	2.01	1.70	1.35	0.85	0.43	0.19	0.05	0.00	0.00	0.00	0.00

39	2.49	3.01	3.25	2.56	2.20	1.90	1.60	1.20	0.70	0.38	0.15	0.03	0.00	0.00	0.00	0.00
40	2.08	2.27	2.38	2.22	2.01	1.80	1.53	1.08	0.57	0.31	0.10	0.02	0.00	0.00	0.00	0.00
41	1.73	1.86	1.94	1.93	1.74	1.65	1.25	0.95	0.46	0.24	0.07	0.00	0.00	0.00	0.00	0.00
42	1.36	1.57	1.78	1.76	1.52	1.42	1.18	0.88	0.33	0.15	0.02	0.00	0.00	0.00	0.00	0.00
43	1.01	1.22	1.42	1.34	1.15	1.01	0.84	0.58	0.21	0.11	0.00	0.00	0.00	0.00	0.00	0.00
44	0.75	0.92	1.00	1.05	0.96	0.85	0.70	0.35	0.13	0.04	0.00	0.00	0.00	0.00	0.00	0.00
45	0.48	0.71	0.82	0.76	0.78	0.67	0.48	0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
46	0.29	0.53	0.64	0.57	0.57	0.36	0.24	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	0.11	0.32	0.43	0.38	0.41	0.27	0.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	0.03	0.13	0.20	0.17	0.24	0.17	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	0.00	0.09	0.16	0.12	0.10	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.03	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

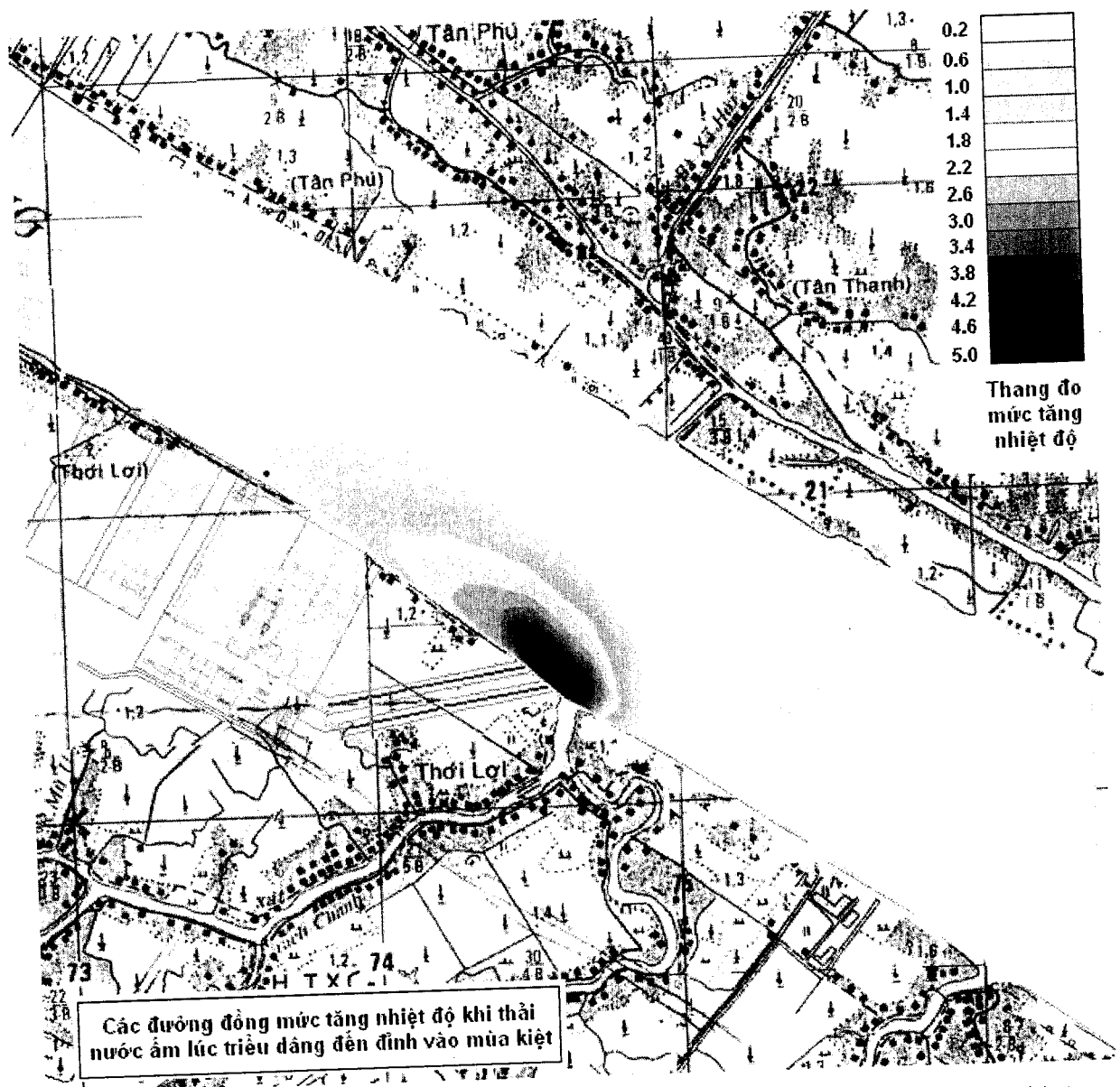
* Notes: column data is conform with 16 vertical mesh lines of river and numbering increase from right riverside, column data is conform with horizontal mesh line and numbering increase from back river to downriver

Picture 14 a. Simulate diffrence temperature at calculation mesh point conform with rising tide to top level in exhausted water season.



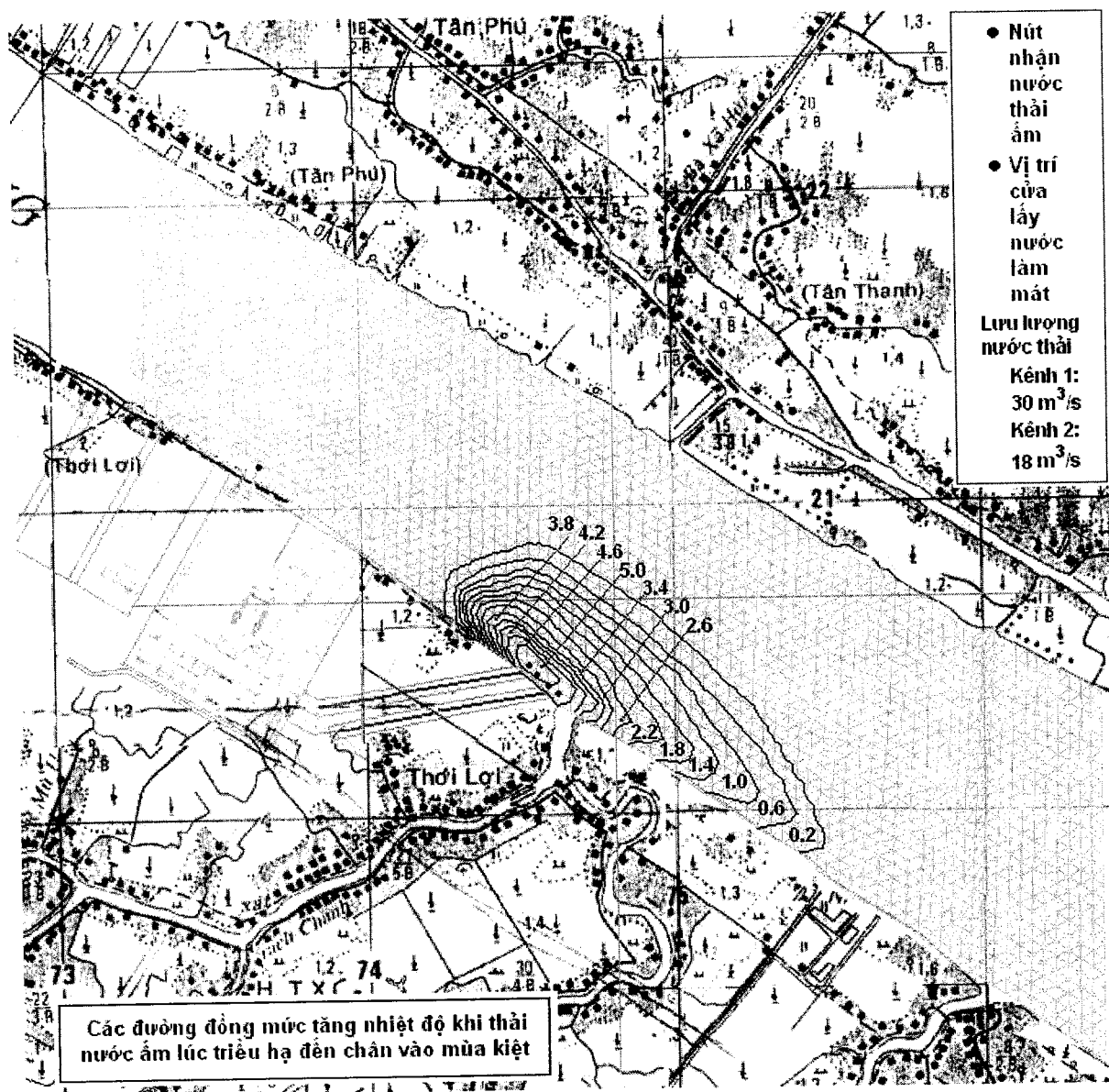
Distance from intake point (blue piont) to No 1and No.2 discharge point(30m3/s) is 1127m

Picture14 b. Simulate diffirence temperature at calculation mesh point conform with rising tide to top level in exhausted water season.



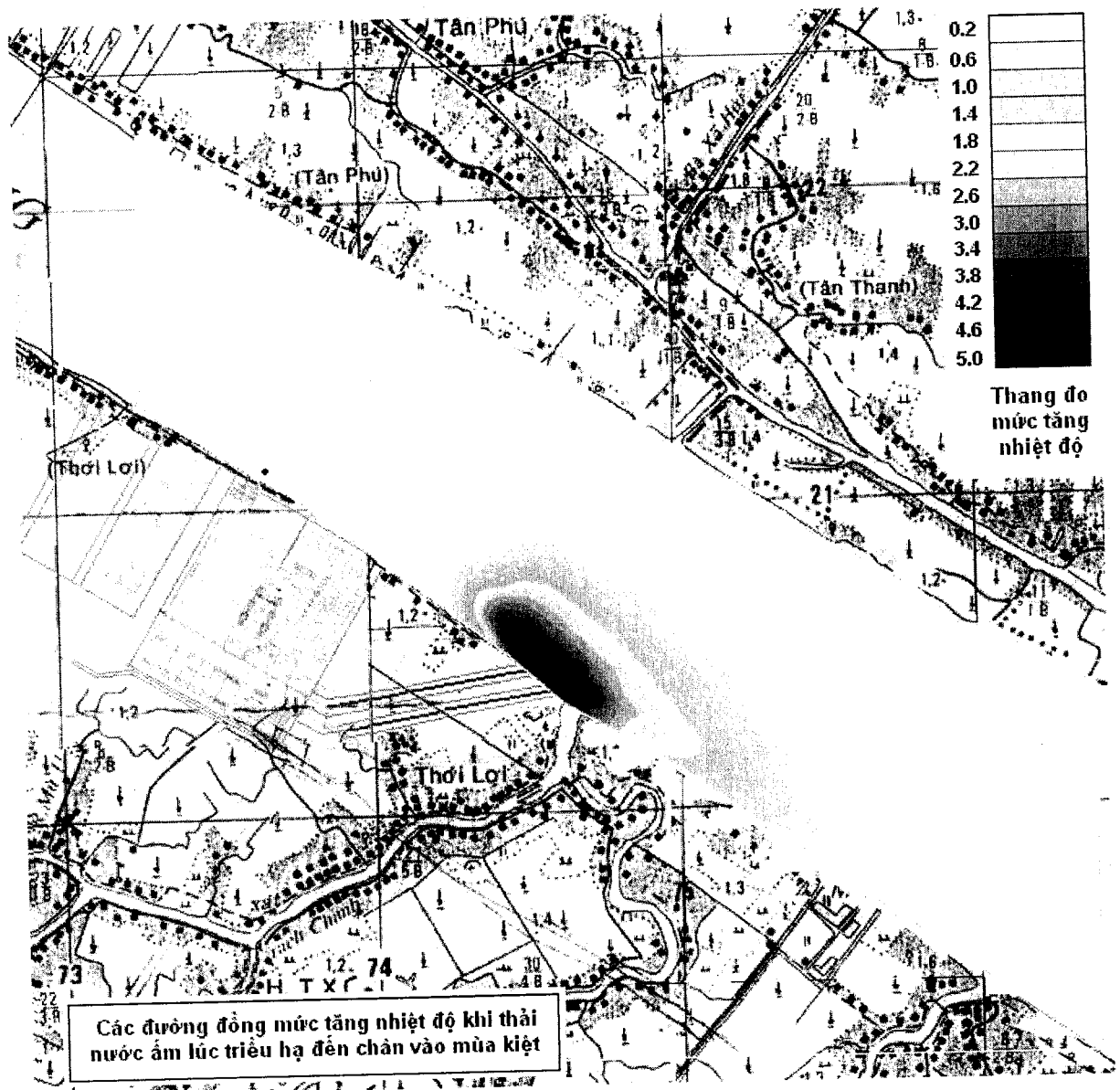
Distance from intake point (blue piont) to No 1and No.2 discharge point(30m3/s) is 1127m

Picture 15 a .Simulate diffirence temperature at calculation mesh point conform with tidal fall to bottom level in exhausted water season.



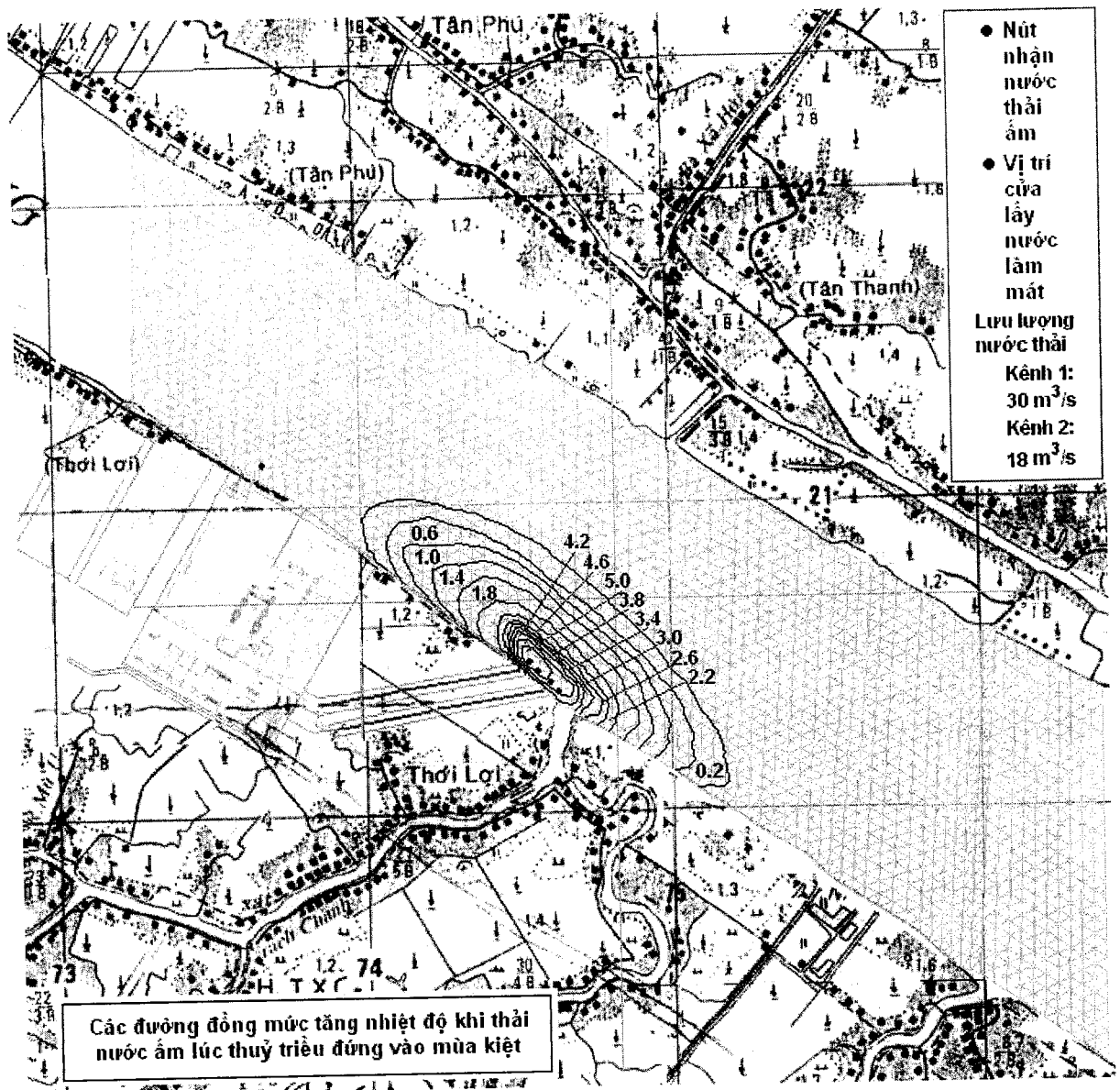
Distance from intake point (blue piont) to No 1and No.2 discharge point(30m3/s) is 1127m

Picture 15 b. Simulate difference temperature at calculation mesh point conform with tidal fall to bottom level in exhausted water season.



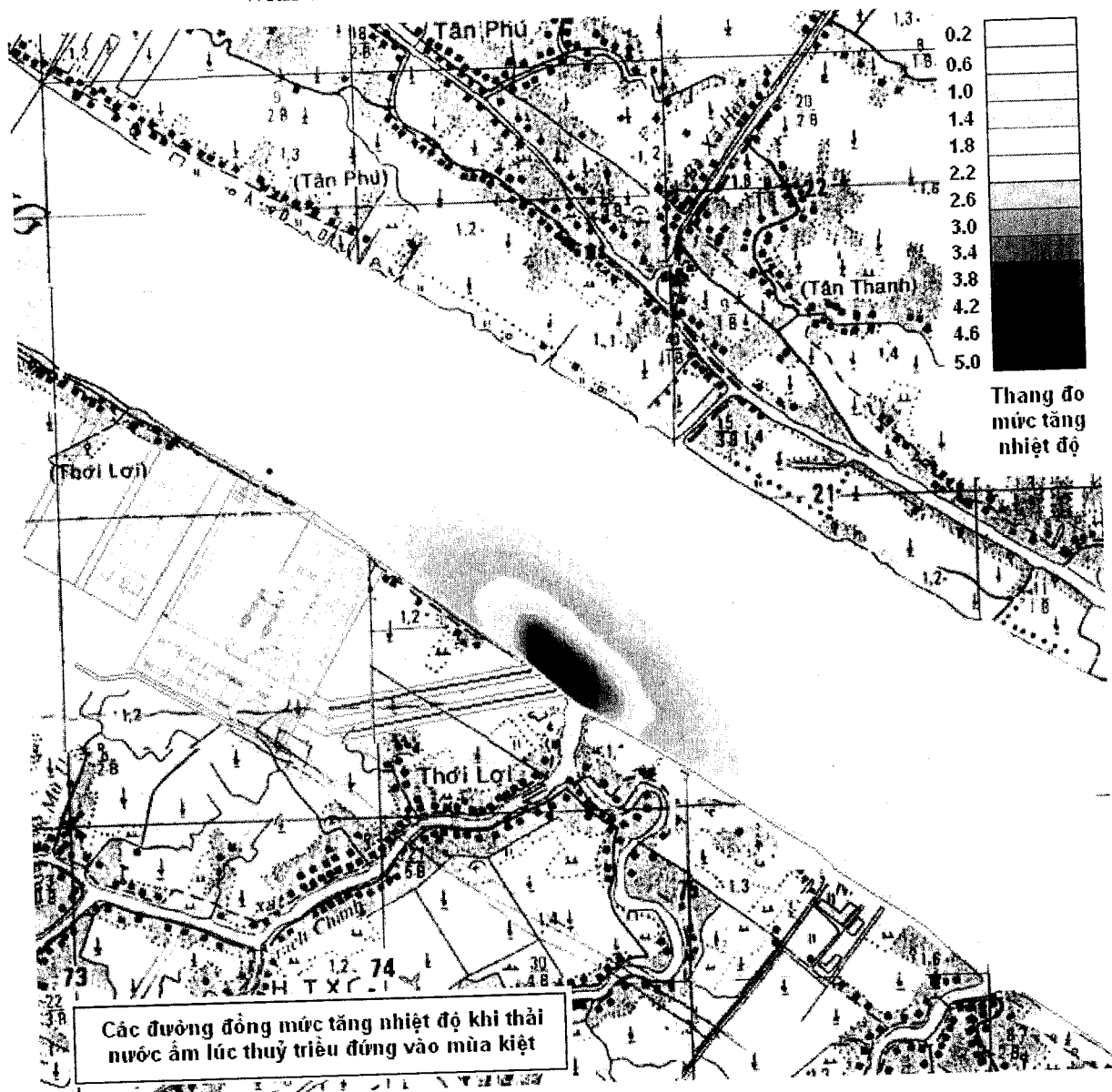
Distance from intake point (blue piont) to No 1and No.2 discharge point(30m3/s) is 1127m

Picture 16 a. Simulate diffirence temperature at calculation mesh point conform with still tide level in exhausted water season.



Distance from intake point (blue piont) to No 1and No.2 discharge point($30\text{m}^3/\text{s}$) is 1127m

Picture 16 a. Simulate difference temperature at calculation mesh point conform with still tide level in exhausted water season.



Distance from intake point (blue piont) to No 1 and No.2 discharge point(30m3/s) is 1127m

Notices:

1. This result is calculated in exhausted condition: exhausted season, with problem: tide rising to top level, tidal fall to bottom or still tidal.

2. As following the result at picture 13, depth heat transfer capacity with Shimonoseki - Japan and other result similar to Fukusshima, Takasago, Karita,...

warm water heat transfer efficiency at η level, warm water thickness H , to z depth are determine as function following:

$$g(z) = \exp \left[-2 \left(\frac{z + \eta}{H + \eta} \right)^2 \right]$$

So, water temperature T at (x, y, z) at the t time is determined by atmosphere temperature T_0 and water surface temperature T_s as following:

$$T = T(x, y, z, t) = T_0 + (T_s - T_0) g(z)$$

According [9], maximum heat transfer capacity is 3 to 5 m depth from bottom level of warm water discharged.

At tables 4, 5, 6, $H = 2.09$ m : level, η average water level is 0.47 m, we confirm that heat won't be transferred to more than 9m depth location.

Tables 7, 8, 9 are showed relative altitude of water level from 3m depth to bottom level, that is deep 4.6m.

Table 7. Temperature distribution at mesh point – in exhausted water condition and tide up-at 4.6 depth to match up average level.

Nut	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.01	0.04	0.07	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.02	0.09	0.12	0.12	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.06	0.12	0.13	0.17	0.12	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.11	0.16	0.20	0.22	0.17	0.15	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.14	0.20	0.22	0.25	0.21	0.17	0.14	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00
16	0.16	0.23	0.26	0.29	0.25	0.20	0.18	0.12	0.05	0.01	0.00	0.00	0.00	0.00	0.00
17	0.20	0.29	0.34	0.33	0.28	0.23	0.19	0.15	0.10	0.03	0.00	0.00	0.00	0.00	0.00
18	0.23	0.35	0.38	0.38	0.36	0.29	0.21	0.18	0.13	0.07	0.02	0.00	0.00	0.00	0.00
19	0.31	0.38	0.43	0.44	0.40	0.36	0.25	0.22	0.15	0.09	0.04	0.00	0.00	0.00	0.00
20	0.36	0.42	0.50	0.51	0.46	0.39	0.33	0.25	0.17	0.11	0.08	0.01	0.00	0.00	0.00
21	0.39	0.55	0.56	0.57	0.50	0.42	0.36	0.33	0.20	0.12	0.10	0.03	0.00	0.00	0.00

22	0.45	0.57	0.60	0.60	0.53	0.48	0.40	0.36	0.25	0.14	0.11	0.05	0.00	0.00	0.00
23	0.52	0.69	0.68	0.65	0.58	0.52	0.45	0.39	0.29	0.16	0.12	0.07	0.00	0.00	0.00
24	0.62	0.72	0.73	0.71	0.62	0.55	0.49	0.41	0.33	0.20	0.13	0.07	0.00	0.00	0.00
25	0.64	0.79	0.79	0.73	0.70	0.61	0.55	0.45	0.36	0.23	0.14	0.08	0.01	0.00	0.00
26	0.75	0.82	0.81	0.78	0.73	0.67	0.57	0.48	0.39	0.27	0.15	0.08	0.01	0.00	0.00
27	0.78	0.84	0.82	0.81	0.76	0.69	0.62	0.50	0.40	0.28	0.17	0.08	0.01	0.00	0.00
28	0.80	0.87	0.83	0.82	0.80	0.70	0.66	0.52	0.41	0.29	0.18	0.08	0.01	0.00	0.00
29	0.85	0.90	0.88	0.87	0.82	0.75	0.68	0.55	0.43	0.29	0.22	0.08	0.01	0.00	0.00
30	0.90	0.92	0.92	0.89	0.86	0.78	0.71	0.60	0.46	0.31	0.25	0.08	0.01	0.00	0.00
31	0.92	1.16	1.21	1.09	0.89	0.81	0.73	0.63	0.49	0.33	0.27	0.08	0.01	0.00	0.00
32	1.17	1.42	1.44	1.34	1.02	0.87	0.75	0.67	0.52	0.36	0.27	0.08	0.01	0.00	0.00
33	1.41	1.62	1.72	1.43	1.09	0.91	0.77	0.71	0.54	0.36	0.27	0.08	0.01	0.00	0.00
34	1.42	1.60	1.70	1.42	1.08	0.88	0.76	0.70	0.51	0.35	0.23	0.08	0.01	0.00	0.00
35	1.41	1.53	1.58	1.31	1.06	0.87	0.76	0.69	0.49	0.34	0.21	0.07	0.01	0.00	0.00
36	1.40	1.49	1.53	1.29	1.04	0.84	0.74	0.68	0.47	0.31	0.16	0.05	0.00	0.00	0.00
37	1.31	1.40	1.43	1.22	0.93	0.78	0.69	0.60	0.41	0.24	0.11	0.02	0.00	0.00	0.00
38	0.91	1.21	1.25	1.08	0.86	0.73	0.64	0.56	0.36	0.20	0.04	0.00	0.00	0.00	0.00
39	0.55	0.79	0.92	0.80	0.68	0.60	0.50	0.44	0.21	0.05	0.00	0.00	0.00	0.00	0.00
40	0.17	0.52	0.62	0.51	0.47	0.41	0.37	0.21	0.07	0.00	0.00	0.00	0.00	0.00	0.00
41	0.00	0.14	0.19	0.19	0.17	0.15	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* Notes: column data is conform with 15 vertical mesh lines of river and numbering increase from right riverside, column data is conform with horizontal mesh line and numbering increase from back river to downriver

Table 8. Temperature distribution at mesh point – in exhausted water condition and tide down-at 4.6 depth to match up average level.

Nut	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.01	0.02	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.01	0.06	0.09	0.11	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.02	0.12	0.17	0.15	0.11	0.09	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.13	0.21	0.25	0.27	0.22	0.16	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00

23	0.18	0.25	0.33	0.34	0.28	0.20	0.15	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.22	0.37	0.39	0.40	0.32	0.24	0.19	0.15	0.03	0.00	0.00	0.00	0.00	0.00	0.00
25	0.28	0.40	0.43	0.43	0.36	0.30	0.22	0.19	0.07	0.01	0.00	0.00	0.00	0.00	0.00
26	0.35	0.52	0.51	0.48	0.44	0.34	0.28	0.22	0.12	0.03	0.00	0.00	0.00	0.00	0.00
27	0.44	0.55	0.55	0.53	0.49	0.41	0.36	0.26	0.16	0.06	0.01	0.00	0.00	0.00	0.00
28	0.58	0.64	0.63	0.60	0.55	0.50	0.40	0.30	0.22	0.10	0.02	0.00	0.00	0.00	0.00
29	0.68	0.72	0.71	0.67	0.65	0.57	0.51	0.38	0.25	0.12	0.04	0.00	0.00	0.00	0.00
30	0.72	0.75	0.75	0.71	0.68	0.60	0.54	0.43	0.29	0.14	0.05	0.01	0.00	0.00	0.00
31	0.75	0.99	1.03	0.91	0.71	0.64	0.56	0.45	0.31	0.15	0.06	0.02	0.00	0.00	0.00
32	0.99	1.50	1.49	1.34	0.84	0.70	0.58	0.49	0.35	0.18	0.07	0.03	0.00	0.00	0.00
33	1.24	1.66	1.71	1.44	0.91	0.70	0.60	0.53	0.36	0.19	0.08	0.03	0.00	0.00	0.00
34	1.24	1.63	1.70	1.41	0.90	0.72	0.59	0.53	0.38	0.17	0.10	0.04	0.00	0.00	0.00
35	1.26	1.56	1.60	1.35	0.90	0.73	0.64	0.51	0.37	0.15	0.10	0.03	0.00	0.00	0.00
36	1.27	1.53	1.56	1.34	0.89	0.73	0.60	0.50	0.34	0.17	0.08	0.03	0.00	0.00	0.00
37	1.23	1.44	1.47	1.13	0.80	0.70	0.55	0.45	0.31	0.15	0.07	0.03	0.00	0.00	0.00
38	0.90	1.09	1.15	0.91	0.76	0.64	0.54	0.43	0.27	0.14	0.06	0.02	0.00	0.00	0.00
39	0.79	0.95	1.03	0.81	0.70	0.60	0.51	0.38	0.22	0.12	0.05	0.01	0.00	0.00	0.00
40	0.66	0.72	0.75	0.70	0.64	0.57	0.49	0.34	0.18	0.10	0.03	0.01	0.00	0.00	0.00
41	0.55	0.59	0.62	0.61	0.55	0.52	0.40	0.30	0.15	0.08	0.02	0.00	0.00	0.00	0.00
42	0.43	0.50	0.56	0.56	0.48	0.45	0.37	0.28	0.10	0.05	0.01	0.00	0.00	0.00	0.00
43	0.32	0.39	0.45	0.42	0.36	0.32	0.27	0.18	0.07	0.03	0.00	0.00	0.00	0.00	0.00
44	0.24	0.29	0.32	0.33	0.30	0.27	0.22	0.11	0.04	0.01	0.00	0.00	0.00	0.00	0.00
45	0.15	0.23	0.26	0.24	0.25	0.21	0.15	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00
46	0.09	0.17	0.20	0.18	0.18	0.11	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	0.03	0.10	0.14	0.12	0.13	0.08	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	0.01	0.04	0.06	0.05	0.08	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	0.00	0.03	0.05	0.04	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* Notes: column data is conform with 15 vertical mesh lines of river and numbering increase from right riverside, column data is conform with horizontal mesh line and numbering increase from back river to downriver

Table 9. Temperature distribution at mesh point – in exhausted water condition and tide down-at 4.6 depth to match up average level.

Nut	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.10	0.17	0.19	0.17	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.15	0.54	0.62	0.51	0.23	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

29	0.54	0.81	0.92	0.80	0.56	0.28	0.15	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.85	1.10	1.18	1.04	0.83	0.50	0.32	0.15	0.03	0.00	0.00	0.00	0.00	0.00	0.00
31	1.20	1.41	1.41	1.22	1.01	0.74	0.50	0.24	0.12	0.00	0.00	0.00	0.00	0.00	0.00
32	1.46	1.57	1.53	1.40	1.10	0.92	0.70	0.49	0.28	0.11	0.02	0.00	0.00	0.00	0.00
33	1.44	1.70	1.71	1.46	1.11	0.93	0.75	0.58	0.43	0.21	0.08	0.01	0.00	0.00	0.00
34	1.43	1.65	1.69	1.40	1.09	0.94	0.82	0.69	0.49	0.27	0.15	0.04	0.00	0.00	0.00
35	1.43	1.60	1.62	1.40	1.08	0.94	0.81	0.69	0.53	0.33	0.20	0.08	0.01	0.00	0.00
36	1.45	1.56	1.59	1.40	1.06	0.90	0.78	0.68	0.52	0.35	0.20	0.09	0.01	0.00	0.00
37	1.40	1.47	1.52	1.31	1.01	0.87	0.73	0.63	0.49	0.33	0.19	0.09	0.01	0.00	0.00
38	1.08	1.27	1.35	1.09	0.94	0.81	0.71	0.60	0.46	0.31	0.18	0.09	0.01	0.00	0.00
39	1.00	1.15	1.21	0.99	0.90	0.78	0.68	0.55	0.43	0.29	0.16	0.08	0.01	0.00	0.00
40	0.83	0.89	0.95	0.84	0.81	0.75	0.66	0.52	0.41	0.29	0.15	0.08	0.01	0.00	0.00
41	0.72	0.76	0.86	0.79	0.73	0.70	0.57	0.48	0.39	0.27	0.14	0.07	0.01	0.00	0.00
42	0.61	0.71	0.78	0.73	0.69	0.62	0.55	0.45	0.36	0.23	0.12	0.06	0.01	0.00	0.00
43	0.59	0.67	0.73	0.71	0.64	0.55	0.49	0.41	0.33	0.19	0.11	0.06	0.00	0.00	0.00
44	0.49	0.62	0.67	0.65	0.58	0.52	0.45	0.39	0.29	0.16	0.10	0.03	0.00	0.00	0.00
45	0.41	0.56	0.60	0.60	0.53	0.48	0.40	0.36	0.28	0.14	0.08	0.02	0.00	0.00	0.00
46	0.38	0.50	0.56	0.57	0.48	0.42	0.36	0.33	0.20	0.13	0.07	0.01	0.00	0.00	0.00
47	0.33	0.45	0.49	0.51	0.43	0.39	0.33	0.25	0.17	0.11	0.05	0.01	0.00	0.00	0.00
48	0.26	0.38	0.43	0.44	0.40	0.36	0.25	0.22	0.15	0.10	0.03	0.00	0.00	0.00	0.00
49	0.22	0.33	0.38	0.38	0.36	0.29	0.21	0.18	0.13	0.07	0.00	0.00	0.00	0.00	0.00
50	0.21	0.29	0.36	0.36	0.32	0.26	0.20	0.16	0.11	0.05	0.00	0.00	0.00	0.00	0.00
51	0.20	0.26	0.34	0.33	0.28	0.23	0.19	0.14	0.09	0.04	0.00	0.00	0.00	0.00	0.00
52	0.16	0.22	0.26	0.29	0.25	0.20	0.18	0.12	0.05	0.01	0.00	0.00	0.00	0.00	0.00
53	0.12	0.17	0.24	0.26	0.21	0.17	0.14	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00
54	0.09	0.11	0.20	0.22	0.17	0.15	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	0.05	0.10	0.13	0.17	0.12	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	0.01	0.08	0.12	0.12	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57	0.00	0.01	0.07	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
58	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* Notes: column data is conform with 15 vertical mesh lines of river and numbering increase from right riverside, column data is conform with horizontal mesh line and numbering increase from back river to downriver

CONCLUSION

1. Through measurement and calculation using the model, can recognize that the flow in the coastal areas at discharge gate in exhausted season: rising water about 0:12 average and a variation in a range from -1.35 to 1:01 meters; speed

flow variability in the range from 0.2 m / s to 1 m / s. Season high flood water squid can reach up to 1.95 meters.

2. Topography domain where the layout commune very convenient to waste due to warm water is the depth and near-line of the river. If discharge point under 5m deep and separated the shore about 50 m more than the ability to spread and promote exchange of achieving high performance.
3. In this conditions, the heat transfer along each channel the discharge gate is about 0.86OC in the dry season. The ability to dissipate heat of warm water along the channel distance from the discharge gate is very significant because it should lead to the river and surface channels to lose the ability to escape the warm water in the channel before landing at the discharge away
4. Results can spread through the heat distribution of the main warm water by the flow in the dry season with cases of different tidal stream is presented in the table from Table 4, 5, 6 and pictures from 14 to 16. The main heat at the depth of 4.6 meters with the case, the line presented in tables 7, 8, and 9
5. Only cases, the tide rising to top level can spread to the liver get water cooling nearest (see the pictures 14-16) can 0.20C. However, this is the case with the exhausted dry conditions; in the rainy season likely to fall in "exhausted condition" can not be take place.

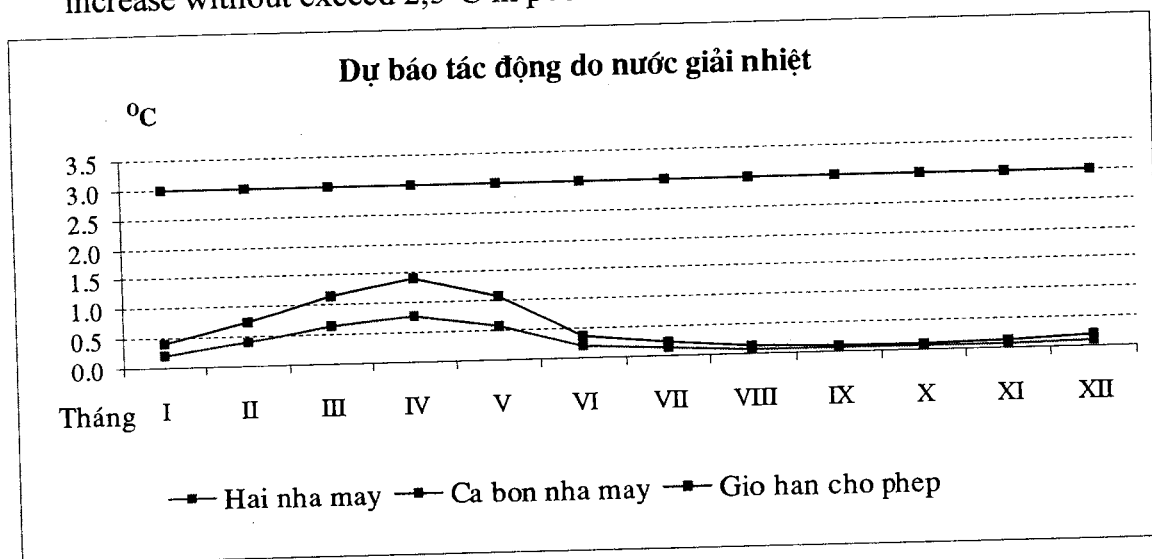
Chapter 4

CUMULATIVE IMPACT OF COOLING WATER FROM POWER PLANT

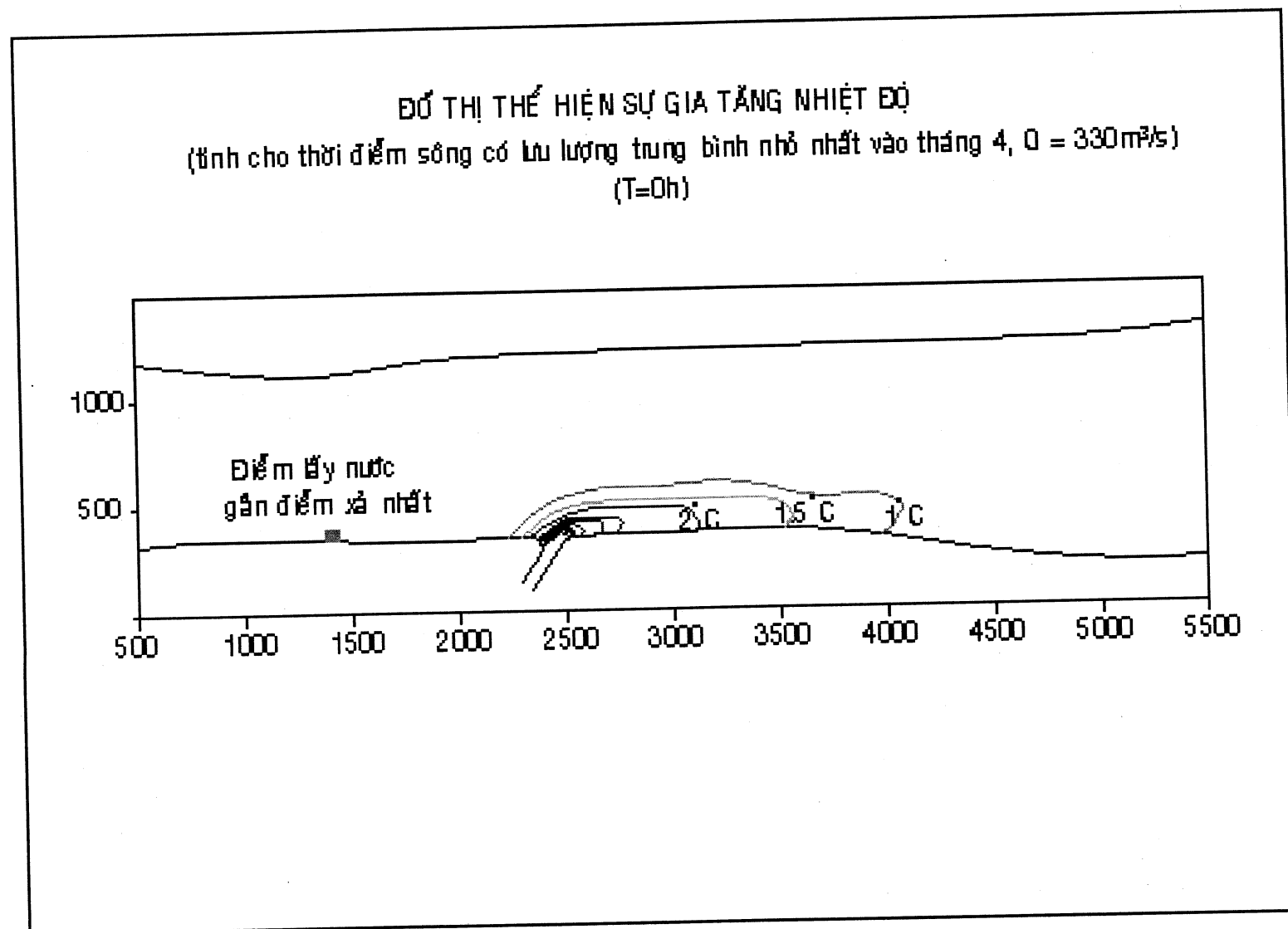
Demand of CW for plant in O Mon Power plant is about 84 m³/s and is supplied by Hau river. The annual average flow of Hau river is about 2440m³/s, therefore, the water for cooling is supplied by Hau river account of 3.36% about flow of the river.

The result reputation about flow statistical and river temperature and efficiency of cooling as following:

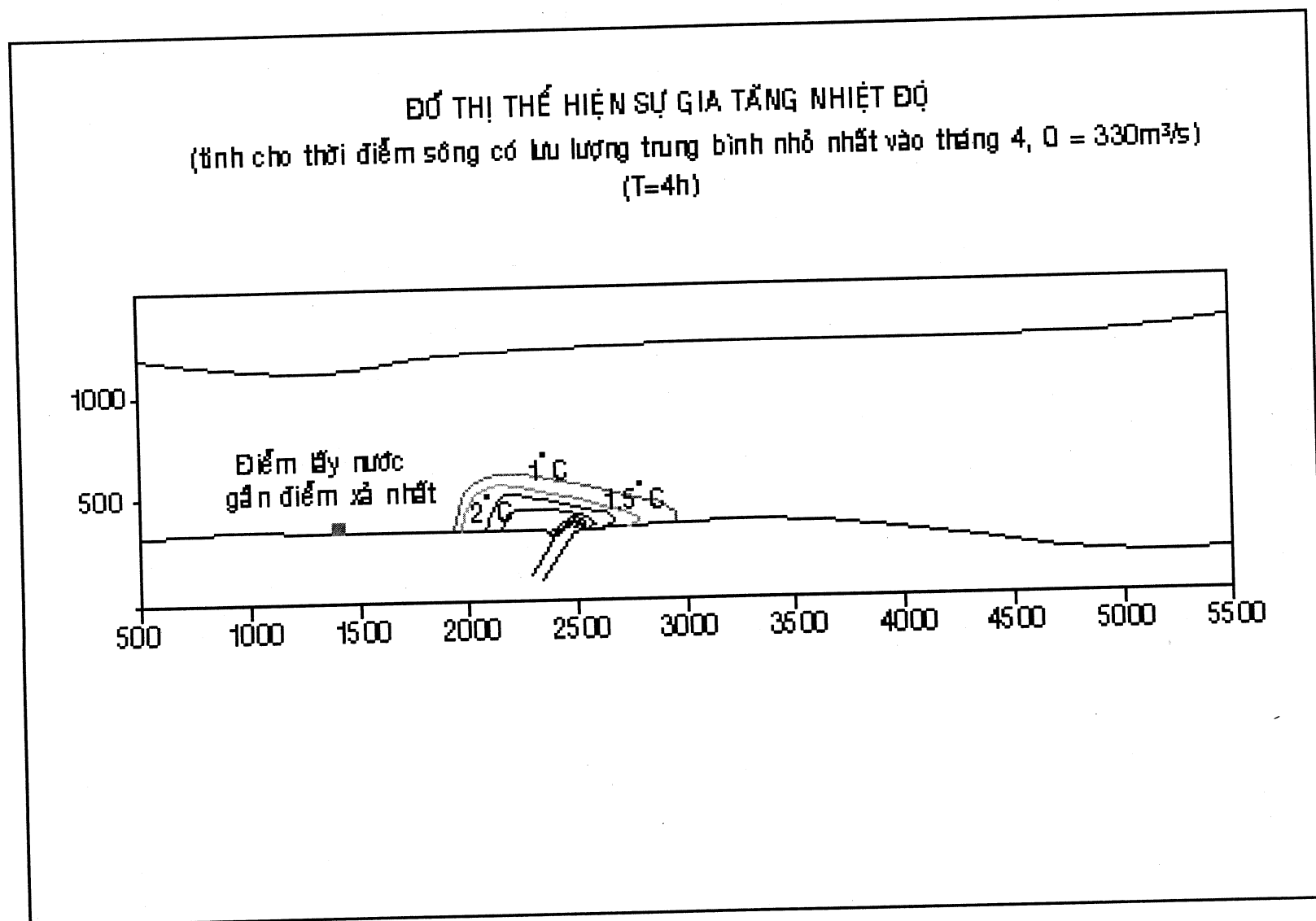
- ◆ In poor case, the increment of river water temperature are happened on March or April, but it is allowable temperature.
- ◆ As follow the model of test result on April (picture 4.14-4.19), the cooling water without influent to the nearest intake point of plant.
- ◆ After combined the operation audit result of Phu My 1 CCPP, we conclude as: in actual operation, the temperature of water at discharge point will increase without exceed 2,5⁰C in poor condition.



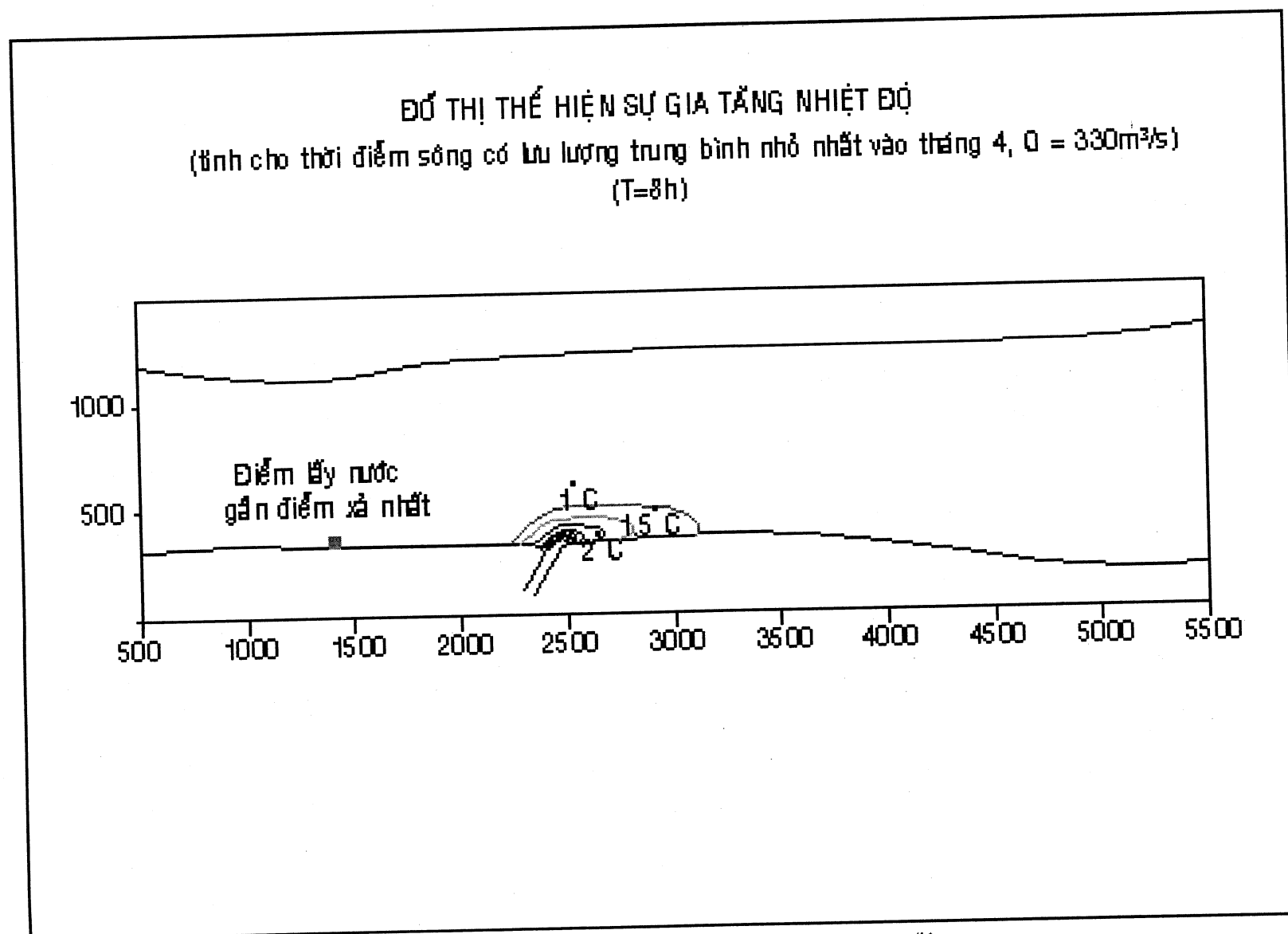
Picture 4.13. Charts show how increasing the temperature in the river water level situation by increasing the temperature of water after the temperature compared with the first water is 7 OC



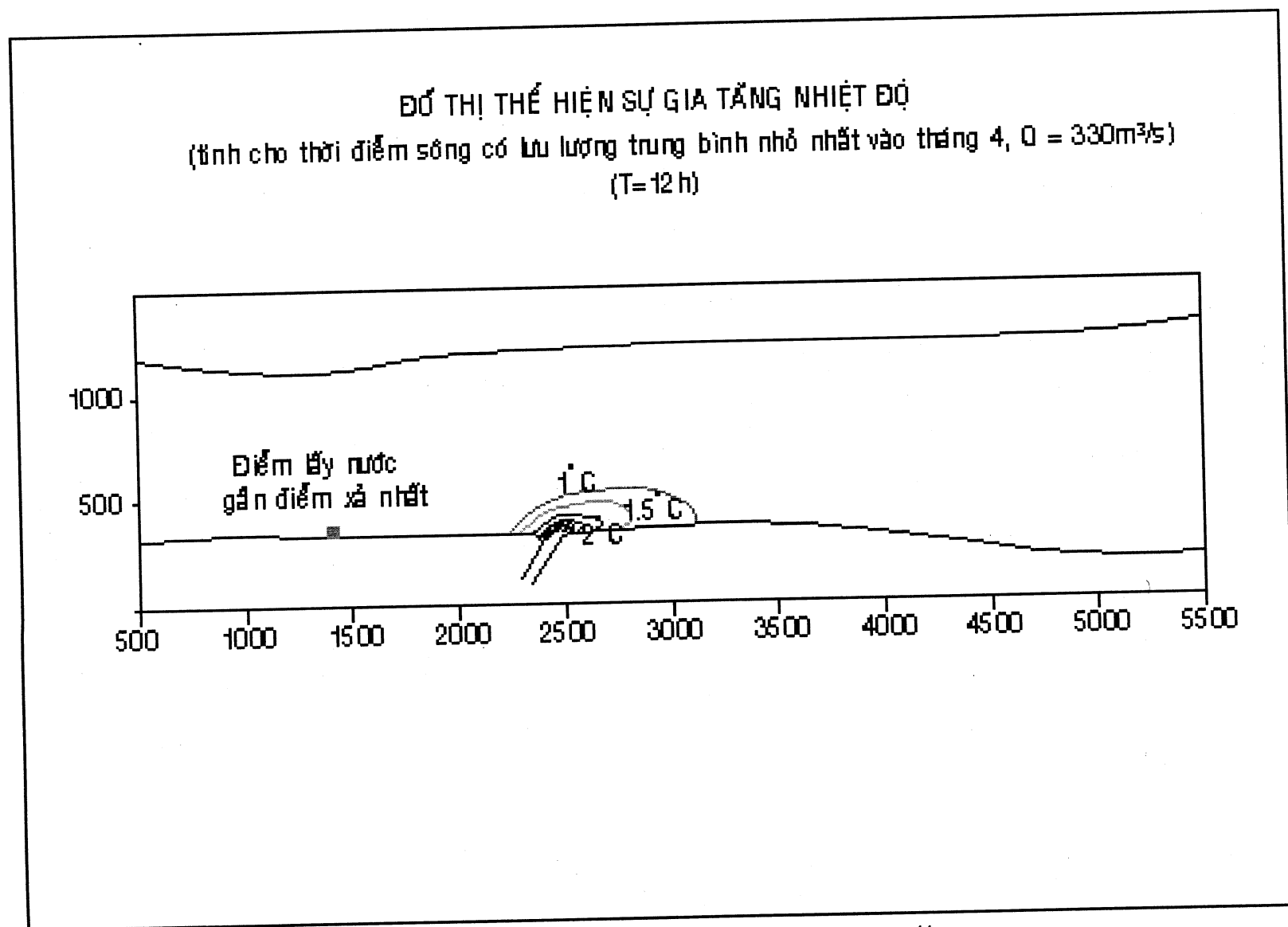
Picture 4.14



Picture 4.15

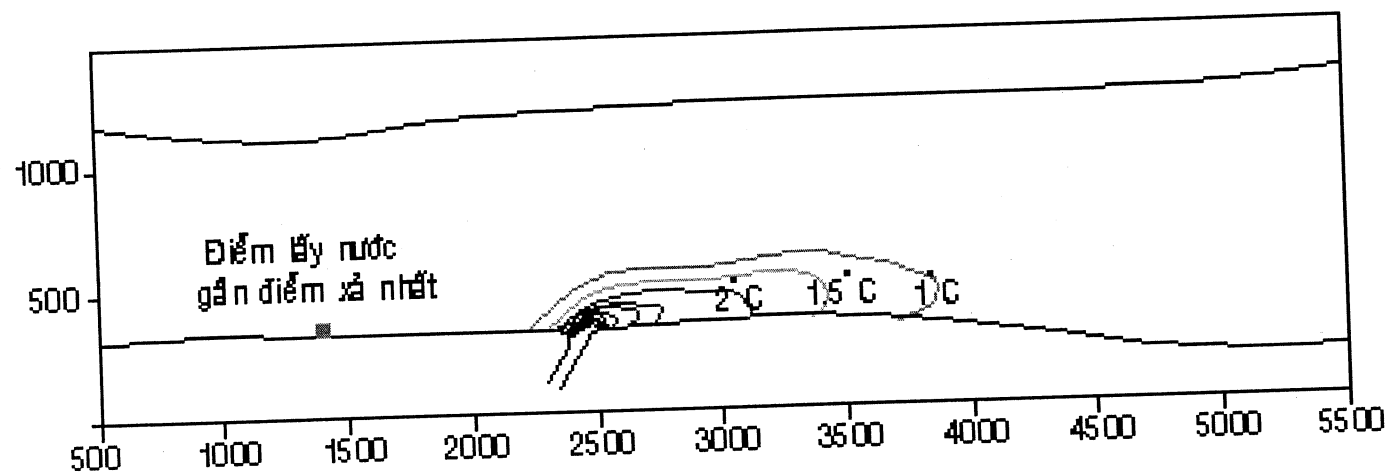


Picture 4.16

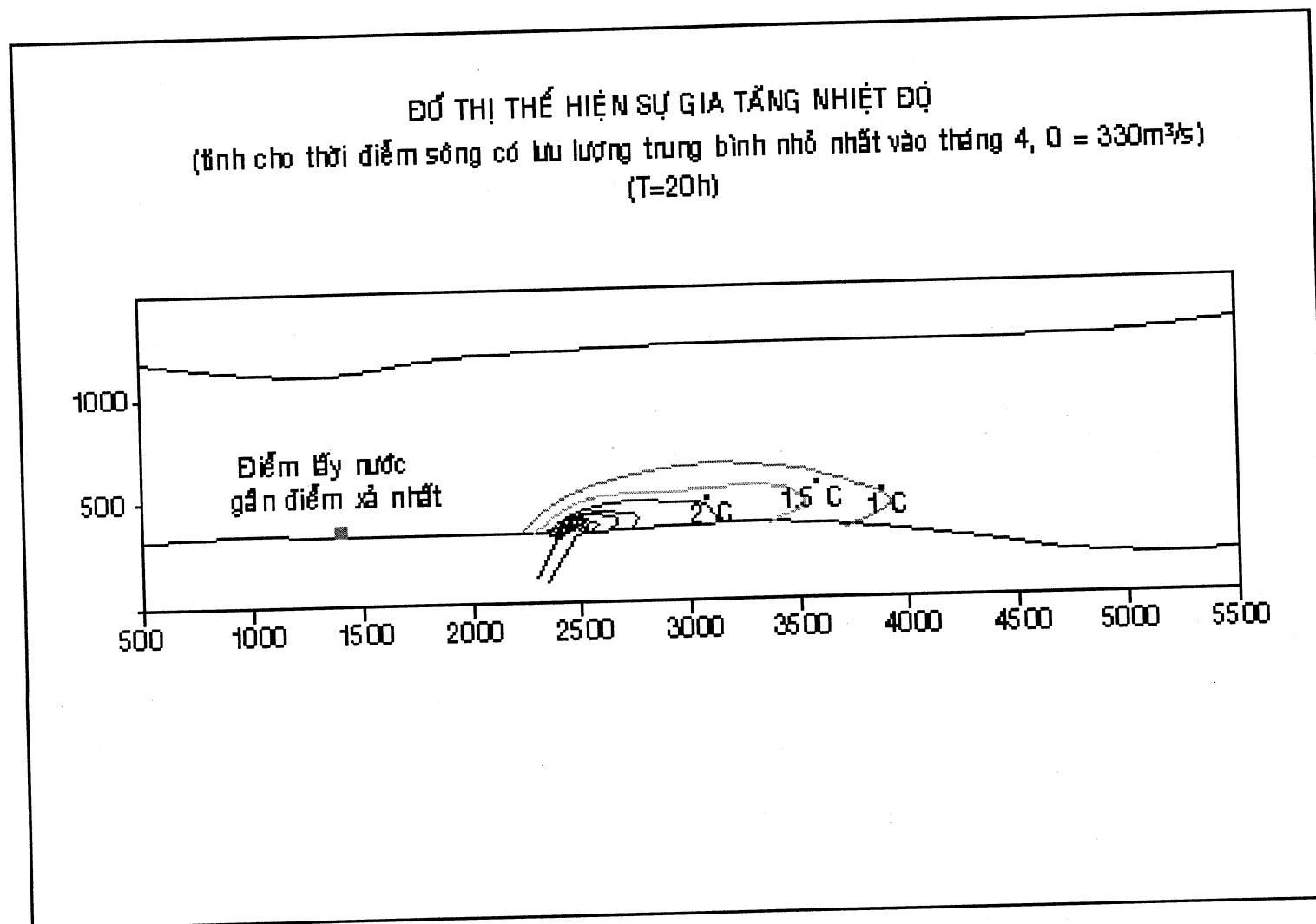


Picture 4.17.

ĐỒ THỊ THỂ HIỆN SỰ GIA TĂNG NHIỆT ĐỘ
(tính cho thời điểm sông có lưu lượng trung bình nhỏ nhất vào tháng 4, $Q = 330\text{m}^3/\text{s}$)
($T=16\text{h}$)



Picture 4.18



Picture 4.1

CHAPTER 8

APPENDIX

VIETNAM ELECTRICITY
**CANTHO THERMAL POWER
COMPANY LIMITED**

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom – Happiness
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No. : 1282 CV-NDCT-AOM
Ref. : Opinion contribution to the implementation
Of O Mon III Thermal Power Plant Project

Can Tho, 18 April 2008

To : - People's Committee of Phuoc Thoi Ward - O Mon District, Can Tho city
- Fatherland Front Committee of Phuoc Thoi Ward - O Mon District, Can Tho city

Can Tho thermal power company limited is the representative of Vietnam Electricity managing the O Mon III Thermal Power Plant Project with capacity of 750MW in the O Mon Power Complex in the territory of Phuoc Thoi ward, O Mon district, Can Tho city. According to the Official Letter No.6196/CV-EVN-KH on 21/11/2007 issued by Vietnam Electricity on preparing investment project of O Mon III thermal Power Plant, the company is currently coordinating with Consultant to adjust the investment project of O Mon III thermal Power Plant.

According to the Circular No.08/2006/TT-BTNMT on 08/9/2006 by the Ministry of Environment and Natural Resources and in order to make foundation for submission to the Ministry of Environment and Natural Resources for issuance of operation permit, it kindly requests People's Committee and Fatherland Front Committee of Phuoc Thoi Ward - O Mon District, Can Tho city to contribute your opinions on the following contents:

1. Socio-economic impacts of the project on the region.
2. Impacts on environment in the course of construction and operation phases of the project.
3. Other suggestions

For all responses, please send to the following address:

Can Tho thermal power company limited
1 Le Hong Phong, Tra Noc ward, Binh Thuy District, Can Tho city
Tell: 0710-221218 - Fax: 0710-841699

In order to ensure the project implementation schedule, Can Tho thermal power company limited kindly request Committees to consider and respond to the company above information.

Best regards,

C/C:

- As above mentioned
- Files

FOR DIRECTOR
VICE-DIRECTOR
(Signed & sealed)
PHAN DUC HON

PEOPLE'S COMMITTEE
OF THOI AN WARD

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom – Happiness

No. : 16/CV-UBND

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Ref. : *Opinion contribution on environment of
O Mon III Thermal Power Plant Project
with capacity of 750MW*

Thoi An, 22 May 2008

To : - Project Management Unit of O Mon III Thermal Power Plant

Pursuant to the Official Letter No.1282/CV-NECT-AOM on 12 April 2008 by Can Tho thermal power company limited on asking for opinion contribution in writing on the implementation of O Mon III Thermal Power Plant Project.

Basing the construction plan of O Mon III Thermal Power Plant, People's Committee of Thoi An Ward, O Mon district, Can Tho city highly appreciates the construction policy of such project in terms of creating employment opportunities to the inhabitants in Thoi An ward and changing socio-economic condition of the ward.

The People's Committee hereby makes the following opinions to the project owner in order to implement perfectly environment protection and eliminate negative impacts on society and economy during construction and operation of the project.

1. In the course of construction and operation (including trial operation), to cease the operations and to report to authorities concerned for inspection and monitoring, in the event of occurring pollution.
2. to perform all environment protection measures and conduct environment monitoring in line with requirements in the approved environment impact assessment report during construction phase.
3. To take responsible for and contribute actively in movements of public awareness improvement, environment protection and community.
4. To have suitable and acceptable compensation policy
5. To apply modern and sound technologies in construction as well as in operation in order to minimize environment pollution caused by smoke, dust, noise, vibration, sewage water, solid wastes and ensure health of local inhabitants, bio-environment, air, soil, underground water source in the ward.
6. To take responsible for compensating for all damages of environment, health and production if it is explainable to the project's fault.
7. To ensure the social order and security and social evils in the region.

People's Committee of Thoi An ward expresses it strong support to this project and kindly request the project owner to implement adequately all mentioned matters

C/C:

- People's Committee of District
- Party Committee of ward (for report)
- People's Council of ward (for report)
- Files

FOR PEOPLE'S COMMITTEE OF WARD

PP. CHAIRMAN

VICE-CHAIRMAN

(Signed & sealed)

NGUYEN NGOC THANH

**FATHERLAND FRONT COMMITTEE
OF THOI AN WARD**

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom – Happiness

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Thoi An, 12 May 2008

To : - Project Management Unit of O Mon III Thermal Power Plant

Pursuant to the Official Letter No.1202/CưA VAN/TVD2-P11 on 12 April 2008 by Can Tho thermal power company limited on asking for opinion contribution in writing on the implementation of O Mon III Thermal Power Plant Project.

Basing the construction plan of O Mon III Thermal Power Plant, Fatherland Front Committee of Thoi An Ward, O Mon district, Can Tho city highly appreciates the construction policy of such project in terms of creating employment opportunities to the inhabitants in Thoi An ward and changing socio-economic condition of the ward.

The Fatherland Front Committee hereby makes the following opinions to the project owner in order to implement perfectly environment protection and eliminate negative impacts on society and economy during construction and operation of the project.

1. In the course of construction and operation (including trial operation), to cease the operations and to report to authorities concerned for inspection and monitoring, in the event of occurring pollution.
2. to perform all environment protection measures and conduct environment monitoring in line with requirements in the approved environment impact assessment report during construction phase.
3. To take responsible for and contribute actively in movements of public awareness improvement, environment protection and community.
4. To have suitable and acceptable compensation policy
5. To apply modern and sound technologies in construction as well as in operation in order to minimize environment pollution caused by smoke, dust, noise, vibration, sewage water, solid wastes and ensure health of local inhabitants, bio-environment, air, soil, underground water source in the ward.
6. To take responsible for compensating for all damages of environment, health and production if it is explainable to the project's fault.

Fatherland Front Committee of Thoi An ward expresses its strong support to this project and kindly request the project owner to implement adequately all mentioned matters

FOR FATHERLAND FRONT COMMITTEE OF WARD

CHAIRMAN

(Signed & sealed)

LE VAN HUNG

PEOPLE'S COMMITTEE
OF PHUOC THOI WARD

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom – Happiness

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No. : 14/UBND-NC

Ref. : *Opinion contribution on environment of
O Mon III Thermal Power Plant Project
with capacity of 750MW*

Phuoc Thoi, 09 May 2008

To : - Project Management Unit of O Mon III Thermal Power Plant

The People's Committee of Phuoc Thoi ward received the Official Letter No.1282/CV-NECT-AOM on 12 April 2008 on asking for opinion contribution in writing on the implementation of O Mon III Thermal Power Plant Project with capacity of 750MW.

Basing the construction plan of O Mon III Thermal Power Plant, People's Committee of Phuoc Thoi Ward, O Mon district, Can Tho city highly appreciates the construction policy of such project in terms of creating employment opportunities to the inhabitants in Phuoc Thoi ward and changing socio-economic condition of the ward.

The People's Committee hereby makes the following opinions to the project owner in order to implement perfectly environment protection and eliminate negative impacts on society and economy during construction and operation of the project.

1. In the course of construction and operation (including trial operation), to cease the operations and to report to authorities concerned for inspection and monitoring, in the event of occurring pollution.
2. to perform all environment protection measures and conduct environment monitoring in line with requirements in the approved environment impact assessment report during construction phase.
3. To take responsible for and contribute actively in movements of public awareness improvement, environment protection and community.
4. To have suitable and acceptable compensation policy, especially resettlement to the household who have houses and architectural objects in the project area
5. To manage strictly labor force during construction and operation phases.
6. To apply modern and sound technologies in construction as well as in operation in order to minimize environment pollution caused by smoke, dust, noise, vibration, sewage water, solid wastes and ensure health of local inhabitants, bio-environment, air, soil, underground water source in the ward.
7. To take responsible for compensating for all damages of environment, health and production if it is explainable to the project's fault.

People's Committee of Phuoc Thoi ward expresses it strong support to this project and kindly request the project owner to implement adequately all mentioned matters

FOR PEOPLE'S COMMITTEE

PP. CHAIRMAN

VICE-CHAIRMAN

(Signed & sealed)

TRUONG VAN HAI

APPENDIX PICTURES

SOME PICTURES OF ENVIRONMENTAL SAMPLING AT THE PROJECT SITE (IN APRIL 2008)



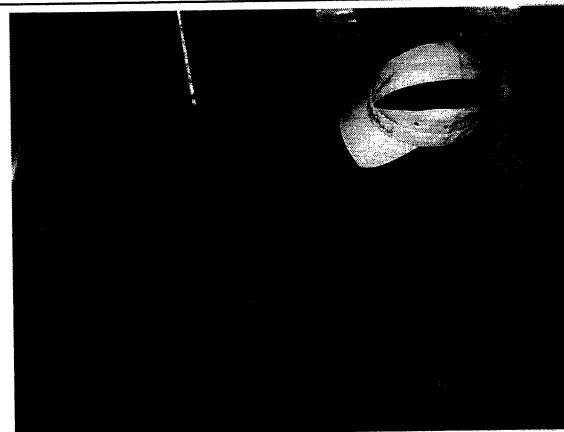
Water sampling of Hau river



Water sampling in the territory of Chanh arroyo



Water sampling in the territory of Vam arroyo



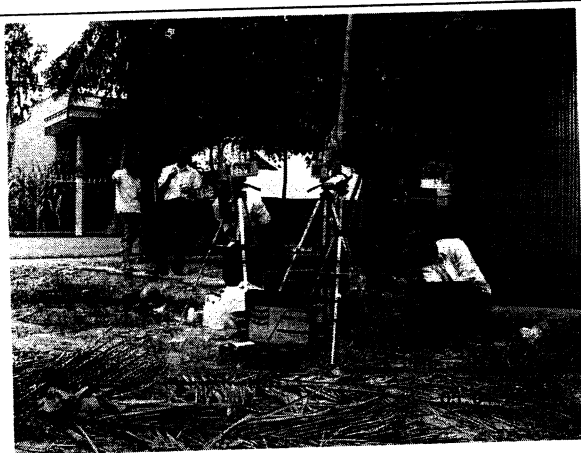
Underground water sampling at house of Mr. Bui Van



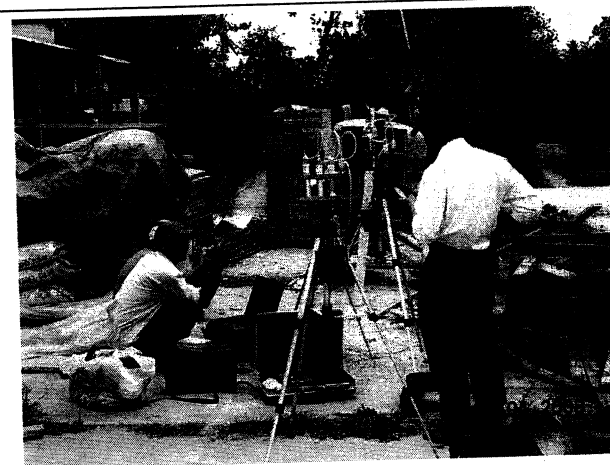
**Underground water sampling at house of Mr. Huynh
Van Tho - Phuoc Thoi ward**

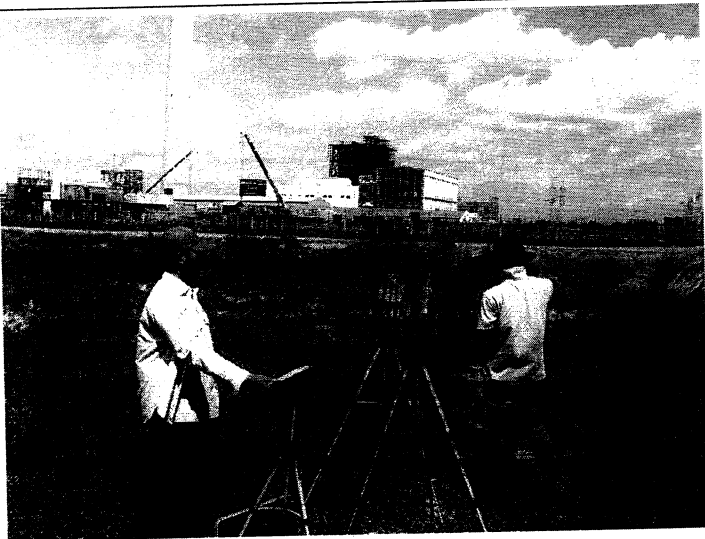


Air sampling along Hau river



Air and noise sampling at residential area along Chanh



arroyo	Air and noise sampling at residential area along expected road No.2
	
Air and noise sampling at residential area nearby the project site	Soil sampling