PROCEEDINGS

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Environmental Protection for Urban and Industrial Zones in adaptation to Climate Change

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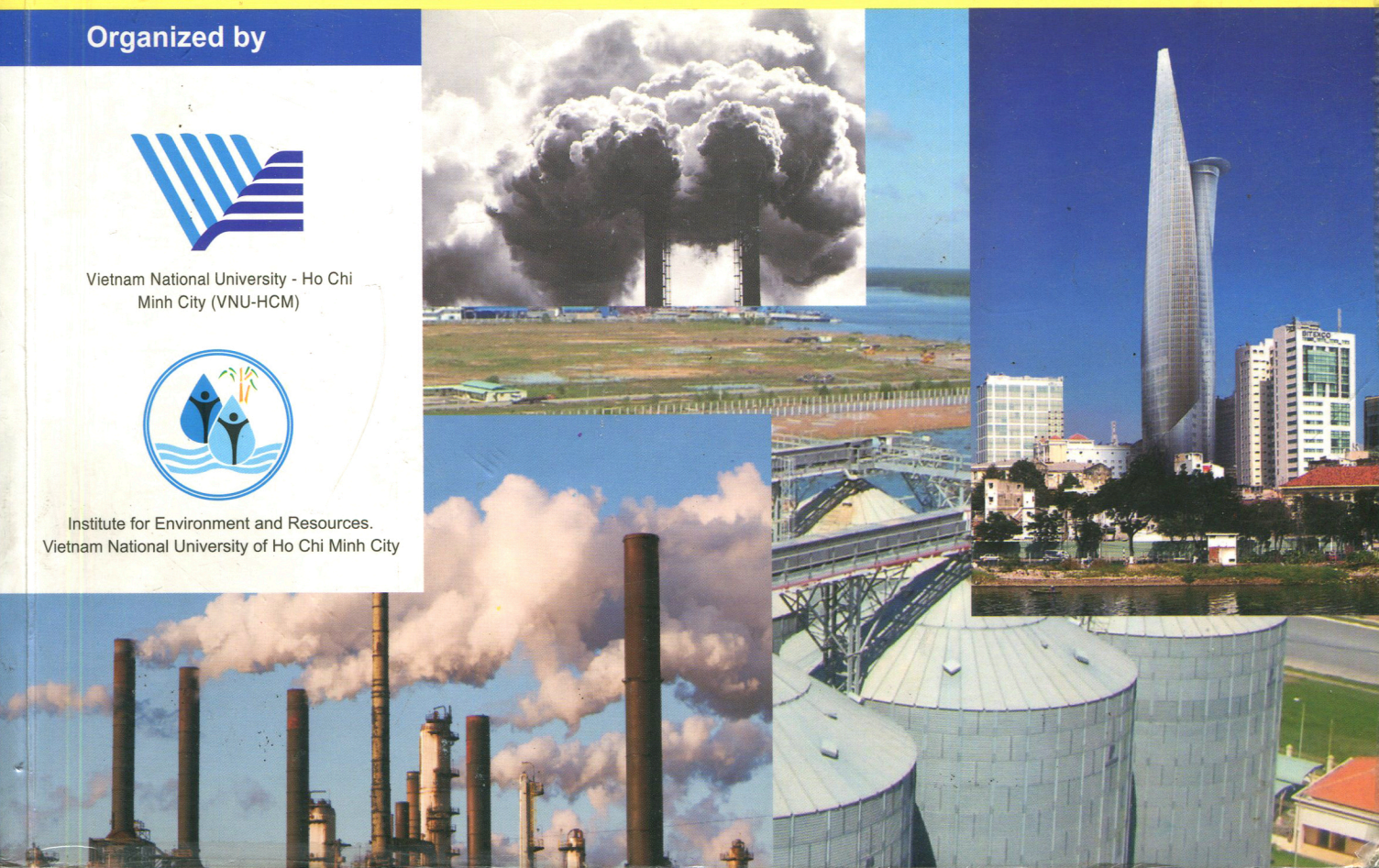
Vietnam National University - Ho Chi Minh City (VNU-HCM)

Institute for Environment and Resources. Vietnam National University of Ho Chi Minh City



ORAL SESSIONS

Day 1 02 December 2010
Time 13h30 – 17h00

Session 3 **Environmental Quality Management**
Room N 202
Chairman: **Prof. Luiz Felippe De Alencastro – Prof. Le Trinh**

S3.01 The Challenges in Environmental Protection in the Central Region Economic Focal Zone in the Period 2010-2020
Le Trinh

S3.02 Financing Demand for Addressing Water Pollution in The Dong Nai River Basin
Phan Thi Giac Tam

S3.03 Benchmarking on environmental infrastructure management in selected cities of Southeast Asia
Vo Le Phu

S3.04 Economic Analysis of Using and Protecting Water Resources in the lower area of Dong Nai River Basin, Vietnam
Nguyen Thanh Hung

S3.05 Identification of urgent environmental issues and proposal of control measures in the Southern Economic Focal Zone
Phung Chi Sy

S3.06 Using the alkline bentonite in nha me deposit (Binh Thuan province) for Producing adsorbent material and organoclay
Tran Kim Phuong

S3.07 Research on environmental protection planning for Dong Nai river system basin
Phung Chi Sy

S3.08 Economic assessment of damages for Thu Duc Water Plant due to polluted Dong Nai river
Bui Ta Long

S3.09 To apply growing tree for biofuel to serve everyday use – decrease pollution
Nguyen Thi Ngoc An

S3.10 Implementing environmental management system for hotels: a case study at Sen Viet Hotel, Ho Chi Minh City
Le Nguyen Que Huong

S3.11 Initial development of a waste minimisation audit toolkit for agro-food processing industry in Vietnam
Do Thi Thu Huyen

ORAL SESSIONS

Day 2 03 December 2010
Time 08h00 – 11h30

Session 3 **Environmental Quality Management**
Room N 202
Chairman: **Prof. Luiz Felippe De Alencastro – Prof. Le Trinh**

S3.12 Restoration water quality of urban lake by eco-technology solutions
Tran Van Quang

S3.13 Reducing water loss for HCM City city water supply system
Vo Anh Tuan

S3.14 Assessment of the water resources transfer capacity from Phuoc Hoa hydraulic-work to Dau Tieng reservoir
Nguyen Hai Au

S3.15 The prospects of rainwater havesting in Ho Chi Minh City
Nguyen Thuy Lan Chi

S3.16 Research for compilation of the textbook: "Environment and our lives" for the 12th grade students
Pham Quang Tien

S3.17 Contamination of persistent organochlorines in sediments from Thivai river basin, Southern Vietnam
Nguyen Ngoc Vinh

S3.18 Assessment on the thms formation potential of Sai Gon river water
Vu Nha Trang

S3.19 Wisdom information system prototype for the Mekong Delta
Floria Moder

S3.20 Using echolot equipment and GIS in surveying water level of Dau Tieng reservoir
Nguyen Cong Hiep

S3.21 Research on setting up the zero emission models for farms and proposing some recommentdation to popularizize the models in Vietnam
Nguyen Thi Doan Trang

POSTER SESSIONS

P.01 Impact of nitrogen loading rates on nitrogen transformation for anaerobic effluent from latex processing industry
Do Thi Thuy Phuong - Bui Xuan Thanh

P.02 Development of a method to analyse organotin compounds in sediment samples: application to evaluate organotin contamination in Ba Son site
Ho Quoc Bang - Tu Thi Cam Loan

P.03 Preliminary assessment of risk of ozone impact to rice in the continental South East Asia
Le Hoang Nghiem

P.04 Basic of law and psychocology on the environmental education in subjects in secondery schools
Nguyen Thi Hoi

P.05 Assesment of Saigon river water quality for water supply in Hochiminh City
Nguyen Thi Tuyet Nam

P.06 Study on ranking of indices using benthic macroinvertebrates for lower Dongnai river system, Vietnam
Nguyen Thi Mai Linh

P.07 Using ozonation to reduce non- biodegradable organic matters in drinking water
Phan Thi Hai Van - Nguyen Phuoc Dan

P.08 Assessment the current situation of environmental pollution from distributing and using pesticide process and propose solution for improving environmental conditions in distributing and using pesticide at An Giang province
Le Thi Hong Tran-Phan Thi Pham

P.09 Coping with urban inundation in Ho Chi Minh City: a forecasting solution & performance
Tran Ngoc Tien Dung

P.10 Effects of environmental factors on aquatic biodiversity of Hau Giang province, Vietnam
Tran Thi Mai Phuong

P.11 Application of a distributed hydrological model coupled with dam opepation for stream flow prediction
Truong Nguyen Cung Que

P.12 Controlling eutrophication of water source by using hybrid wetland – study experiment at 29th March Park's lake, Danang city
Tran Van Quang

P.13 Research on suitable technology of rubber latex processing wastewater treatment in Vietnam condition
Nguyen Van Phuoc - Nguyen Thi Thanh Phuong

P.14 Contamination of arsenic and other metals in groundwater of Long An province, Viet Nam
Duong Ngoc Linh - Bui Xuan Thanh

P.15 A study on advanced primary treatment of waste water using a bio-flocculation-adsorption sedimentation process on the wastewater of fishy process
Huynh Ngoc Loan

P.16 Study on swim-bed technology for COD removal and nitrification for latex wastewater treatment
Nguyen Le

P.17 Modelling approach for reduction potential of greenhouse gas emissions in the production sector
Michaela Titz

FULL PAPERS

LIST OF FULL PAPERS

		PAGE
S1.01	Study on classification of "Green Enterprise" in Binh Duong province *Nguyen Dinh Tuan*	1
S1.02	Researching measures of climate change adaptation for urban development in Vietnam *Pham Ngoc Dang*	7
S1.03	Capable carbon storage and reduction of carbon dioxide (CO_2) emission in peatland in the Lower Mekong Basin, Vietnam *Le Phat Quoi*	19
S1.04	Impact of urbanization to leveling process of river system and inundation in district 7 - Hochiminh city *Tran Bao Tran*	32
S1.05	Suggestion of an Environmental Vulnerability Index (EVI) at Provincial Level To Measure And Monitor The Impacts Of Climate Change in Vietnam *Che Dinh Ly*	41
S1.07	The impact of energy consumption, income and population density on CO_2 emissions: Thailand data *Nisit Panthamit*	49
S1.08	Assessment the impact of climate change to An Giang province and propose some adaptation measures *Ton That Lang*	55
S1.09	Recent research and perspective in assessment of climate change impact on water resources in Vietnam *Nguyen Hong Quan*	63
S1.10	Study on application of anaerobic pva gel carrier reactor for latex processing wastewater treatment *Le Thi Thuy Phuong, Nguyen Phuoc Dan, Le Hoang Nghiem, Kenji Furukawa*	72
S1.11	A new approach to compute road traffic emissions and their uncertainties for air quality modeling *Ho Quoc Bang*	79
S1.12	Impacts of income inequality on CO_2 emissions Thailand case study *Chira Bureecam*	88
S1.13	Benchmarking on environmental infrastructure management in selected cities of Southeast Asia *Vo Le Phu, Nguyen Phuoc Dan, Vilas Nitivattananon, Nguyen Thi Chau Huyen, Nguyen Pham Khuong Duy*	95
S1.14	Reducing greenhouse gas emissions by tree-planting – getting a new business opportunity in the global economy *Truong My Diem*	104

S1.15 The change of urban surface temperature under impact of urbanization in Hochiminh City 111
Tran Thi Van

S1.16 Sustainable consumption and development of energy in Hochiminh city, Vietnam 118
Ly Ngoc Minh

S1.17 Potential impact assessment of climate change on aquatic ecosystems in south Vietnam 122
Pham Anh Duc

S1.18 Risk and impact assessments for adaption of Climate Change – A case of the low catchment of Cu De river – Danang city 132
Phung Khanh Chuyen - Tran Thi Yen Anh

S1.20 Some primary results 141
Le Thi Quynh Ha, Le Thi Huong Giang

S2.01 Potential of wastewater reclamation to reduce fresh water stress in Hochiminh City-Vietnam 148
Nguyen Phuoc Dan

S2.02 A study on nickel and copper removal by *Aspergillus niger* immobilized in a fixed-bed column 157
Dang Vu Bich Hanh

S2.03 Monitoring of dioxin contamination residue in southern provinces of Vietnam: reality and challenges 163
Mai Tuan Anh

S2.04 Construction of filter sewer system for dioxin treatment in Phu Cat airport zone (Binh Dinh province) 172
Tran Kim Phuong

S2.06 Anaerobic, anoxic, aerobic integrated processes study for treatment of domestic waste water with two step feed 182
Nguyen Thanh Hung

S2.07 Aerobic granular sludge process on tapioca wastewater in sequencing batch airlift reactor 189
Thi Thanh Phuong Nguyen, Van Phuoc Nguyen, Thi Bich Hong Truong

S2.08 Simultaneous organic and nitrogen removal of aerobic granular sludge in a sequencing batch airlift reactor 201
Duong Hieu Linh, Hoang Tu Loan, Bui Xuan Thanh

S2.09 Water purification using *moringa oleifera* as a natural coagulant in Vietnam 211
Vo Hong Thi

S2.11 Bacterial and archaeal communities in intermittent and continuous aeration landfill bioreactors using t-rflp analysis 220
Nguyen Nhu Sang, Satoshi Soda, Daisuke Inoue, Kazunari Sei, Michihiko Ike

S2.12 Distribution and roles of alkalinity in a two-stage anaerobic digestion system treating foodwaste recycling wastewater 228
Xuanduong Nguyen, Juntaek Lim, Seunggu Shin, Gyuseong Han, Seokhwan Hwang

S2.14	Application of upflow multi-layer bioreactor (UMBR) for domestic wastewater treatment in HCMC *Nguyen Phuoc Dan*	233
S2.15	Study of swim-bed technology for cod removal and nitrification for latex wastewater treament *Nguyen Le, Dang Viet Hung, Nguyen Phuoc Dan, Nguyen Ngoc Bich, Kenji Furukawa*	242
S2.16	A study degradation of reactive dyes with the electrochemical oxidation on titanium electrodes *Tang Ba Quang, Nguyen Văn Phuoc*	253
S2.17	Waste water treatment plan of paint manufacture factory *Thuong Man Le, Huu Tam Nguyen*	265
S2.18	Application of full-scale submerged membrane bioreactor (smbr) treating wastewater of caravelle hotel in Hochiminh city, Viet nam *Tran Yen Trang, Bui Xuan Thanh, Nguyen Phuoc Dan, Haiping Dai*	273
S2.19	First study on nitrogen removal by the anammox process using polyester non-woven carrier reactor (pnbcr) *Phan The Nhat, Nguyen Phuoc Dan, Dang Viet Hung, Kenji Furukawa*	283
S2.20	Study of *annamox* process using biomass carrier for nitrogen removal in latex wastewater treatment *Phan The Nhat*	435
S3.01	Environmental challenges of the middle focal economic zone in the period 2010 – 2020 *Le Trinh*	291
S3.03	Benchmarking on environmental infrastructure management in selected cities of Southeast Asia *Vo Le Phu, Nguyen Phuoc Dan, Vilas Nitivattananon, Nguyen Thi Chau Huyen, Nguyen Pham Khuong Duy*	424
S3.06	Using the alkline bentonite in nha me deposit (Binh Thuan province) for Producing adsorbent material and organoclay *Tran Kim Phuong*	299
S3.07	Impacts of Phuoc Hoa irrigation project on water quality in the downstream of the Dong nai river system *Phung Chi Sy*	309
S3.08	Economic assessment of damages for Thu Duc Water Plant due to polluted Dong Nai river *Bui Ta Long*	318
S3.11	Implementing environmental management system for hotels: a case study at Sen Viet Hotel, Ho Chi Minh City *Le Nguyen Que Huong*	324
S3.12	Restoration water quality of urban lake by eco-technology solutions *Tran Van Quang*	333

S3.13 Initial development of a waste minimisation audit toolkit for agro-food processing industry in vietnam 340
Luu Thi Hai Ly, Le Thanh Hai, Do Thi Thu Huyen

S3.14 *Reduce the water loss to the hcm city water supply networks* 350
Vo Anh Tuan

S3.15 Assessment of the water resources transfer capacity from Phuoc Hoa hydraulic-work to Dau Tieng reservoir 361
Hai Au Nguyen, Van Nghi Vu

S3.16 Research for compilation of the textbook: "Environment and our lives" for the 12th grade students 371
Pham Quang Tien

S3.17 Contamination of persistent organochlorines in sediments from Thivai river basin, Southern Vietnam 381
Nguyen Ngoc Vinh

S3.18 The prospects of rainwater harvesting in Hochiminh city 390
Hoang Khanh Hoa, Nguyen Thuy Lan Chi

S3.19 Assessment on the thms formation potential of Sai gon river water 397
Vu Nha Trang, Lai Duy Phuong And Nguyen Phuoc Dan,

S3.21 Using echolot equipment and GIS in surveying water level of Dau Tieng reservoir 408
Nguyen Cong Hiep, Nguyen Thi Van Ha

S3.22 Research on setting up the zero emission models for farms and proposing some recommentdation to popularizize the models in Vietnam 417
Nguyen Hoang Long, Nguyen Thi Doan Trang, Le Thanh Hai

P1.01 Impact of nitrogen loading rates on nitrogen transformation for anaerobic effluent from latex processing industry 444
Do Thi Thuy Phuong, Phan Le Thanh Nha, Do Dang Khoa, Bui Xuan Thanh, Nguyen Phuoc Dan, Tran Thị Phi Oanh, Nguyen Ngọc Bich

P1.02 Determination of air pollutants emission factors for vehicles on road traffic in Hochiminh city 452
Ho Minh Dung, Ho Quoc Bang, Alain Clappier, Dinh Xuan Thang

P1.03 A new approach to compute road traffic emissions and their uncertainties for air quality modeling 463
Bang Quoc Ho, Minh Dung Ho, Alain Clappier

P1.04 Application of ecotoxicological risk assessment to evaluate the efficiency of constructed wetland of industrial wastewater treatment 471
Nguyen Phuoc Dan, Đo Hong Lan Chi, Pham Hoang Lạm

P1.05 Basic of law and psychology on the environmental education in subjects in secondary schools 478
Nguyen Thi Hoi, Pham Quang Tien

P1.06 Assessment of Saigon river water quality for water supply in Hochiminh city 487
Nguyen Thi Tuyet Nam, Nguyen Thi Van Ha, Nguyen Cong Thanh

P1.07 Study on ranking of bio -indices using benthic macroinvertebrate for lower Dongnai river System Vietnam 498
Pham Anh Duc, Le Phat Quoi, Le Phi Nga,

P1.08 Using ozonation to reduce non- biodegradable organic matters in drinking water 509
Phan Thi Hai Van, Nguyen Phuoc Dan, Nguyen Thi Thu Trang

P1.09 Assessment the current situation of environmental pollution and propose solution for improving environmental condition in distributing and using pesticide process in an giang province 517
Le Thi Hong Tran, Phan Thi Pham

P1.10 Active coping with urban inundation in ho chi minh city a forecasting solution and performance 531
Tran Ngoc Tien Dung

P1.11 Effects of environmental factors on aquatic biodiversity of hau giang province, Vietnam 543
Tran Thi Mai Phuong, Philippe Usseglio Polatera, Le Thanh Hai, Jean Francois Ferard

P1.12 Coupling of distributed hydrological model and dam opepation for stream flow prediction, A case sudy of Dongnai river basin-Vietnam 552
Nguyen Cung Que Truong

P1.13 Controlling eutrophication of water source by using hybrid wetland – study experiment in 29th March park's lake, Danang city 561
Tran Van Quang, Nguyen Duong Quang Chanh, Hoang Hai Tho and collaborators

P1.14 Research on suitable technology of rubber latex processing wastewater treatment in vietnam condition 569
Nguyen Van Phuoc, Nguyen Thi Thanh Phuong

P1.15 Contamination of arsenic and other metals in groundwater of long an province, Vietnam 581
Duong Ngoc Linh, Bui Xuan Thanh, Sunbeak Bang, Nguyen Phuoc Dan

P1.16 Enhacement the effect of seafood processing industries's waste water treatment plans by coagulation/flocculation system 588
Thuong Man Le, Huu Tam Nguyen

P1.17 Waste water treatment plan of paint manufacture factory 593
Thuong Man Le, Huu Tam Nguyen

P1.18 Evaluate the efficiency of constructed wetland of industrial wastewater treatment 600
Nguyen Phuoc Dan, Đo Hong Lan Chi, Pham Hoang Lam

P1.19 Removal of cod and colour from textile wastewater by using aerobic biofilter and anaerobic biofilter technology 607
Nguyen Van Phuoc, Nguyen Thi Thanh Phuong, Li Thien My, Tran Thi Giang Huong

P1.20 Preparation of polymer blend from photoresist waste 616
Vuong Quang Viet, Le Thi Hong Tran, Nguyen Van Phuoc

ECONOMIC ASSESSMENT OF DAMAGES FOR THU DUC WATER PLANT DUE TO POLLUTED DONG NAI RIVER

ĐÁNH GIÁ TỔN HẠI KINH TẾ CHO NHÀ MÁY NƯỚC THỦ ĐỨC DO Ô NHIỄM SÔNG ĐỒNG NAI

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ABSTRACT

Dong Nai river flows through Bien Hoa city is an important source of water supply for this area. Currently ,Thu Duc water plant in operating with maximum power, to source raw water from Hoa An water supply station are located in Bien Hoa city to provide water for both Bien Hoa and Ho Chi Minh city.

In previous years, Dong Nai river keep an stable quality and meet surface water quality standards as prescribed. But now, Dong Nai river water quality is showing signs of pollution in some areas through the reception of waste from residential areas, industrial zones .etc. From that status quo, the water plants in the region are at increased risk of several types of costs for water treatment. The development orientation up to 2020, Bien Hoa city will continue to focus investment in industrial development, trade and services, which contribute to pollution is increasing in the Dong Nai river basin. This article is done with the aim of clarifying the dependencies between the scenarios developed (comes as the difference in discharge) for costs incurred due to water pollution. Tool used here is the Mike11 model and the methods of economic environment is being widely applied.

Keywords: *Model, Mike11, economic damages, water quality, water pollution*

Tóm tắt

Sông Đồng Nai đoạn chảy qua thành phố Biên Hòa là nguồn cấp nước quan trọng của khu vực. Hiện tại nhà máy nước Thủ Đức đang khai thác với công suất lớn nhất, lấy nguồn nước thô từ trạm cấp nước Hóa An được đặt tại thành phố Biên Hòa để cung cấp nước cho thành phố Biên Hòa và cả thành phố Hồ Chí Minh.

Trong nhiều năm trước đây, chất lượng nước sông Đồng Nai diễn biến khá ổn định và đạt tiêu chuẩn chất lượng nước mặt theo quy định. Tuy nhiên, hiện nay chất lượng nước sông Đồng Nai đang có dấu hiệu ô nhiễm ở một số đoạn đi qua khu vực tiếp nhận nguồn thải của từ các khu dân cư, các KCN.... Trước thực trạng trên các nhà máy nước trong khu vực đang đứng trước nguy cơ gia tăng nhiều loại chi phí cho việc xử lí nước cấp. Theo định hướng phát triển tới 2020 trên địa bàn thành phố Biên Hòa sẽ tiếp tục tập trung đầu tư phát triển công nghiệp, thương mại và dịch vụ, điều này góp phần dẫn đến tình trạng ô nhiễm ngày càng tăng trên lưu vực sông Đồng Nai. Bài báo này được thực hiện với mục tiêu làm rõ sự phụ thuộc giữa các kịch bản phát triển (đi kèm là sự khác biệt về xả thải) với chi phí phát sinh do ô nhiễm nước. Công cụ được sử dụng ở đây là mô hình Mike11 và các phương pháp kinh tế môi trường đang được áp dụng rộng rãi.

1. INTRODUCTION

The Dong Nai river flows through Bien Hoa city is an important source of water supply for economic - social activities both Bien Hoa and Ho Chi Minh city. With a length of about 8.8 km, the average flow rate in the year of about 770.65 m^3/ s. In previous years, Dong Nai river keep an

stable quality and meet surface water quality standards as prescribed, due to advantages in length and high flow capacity, Dong Nai river is very high self-cleaning. But now, Dong Nai river water quality is showing signs of pollution in some areas through the reception of waste from residential areas, industrial zones..etc. The environmental pollution at the local parts of the basin began to show signs of alarm, while the environmental impact of the process of economic - society development will continue to increase in coming time.

This situation was placed on water plants in the area at risk of increased costs for many types of water treatment. According the oriented development up to 2020, Bien Hoa city will continue to focus investment in industrial development, trade and services, which contribute to pollution is increasing in Dong Nai river basins. Among water plants that use water in Dong Nai river, Thu Duc is the biggest one. This is the production company of internal accounting belong to the Water Supply Corporation Saigon. With the line "Production - Transmission - Distribution" of the Corporation, the Thu Duc water plant keeps the main task is to pump water from the Dong Nai river to the Thu Duc water treatment to clarify the water to meet quality standards and pumped into the main transmission pipes from factories to Dien Bien Phu distribution stations, from which, the water will be distributed to supply water network 1, 2, and 3 to consumers in the Ho Chi Minh city.

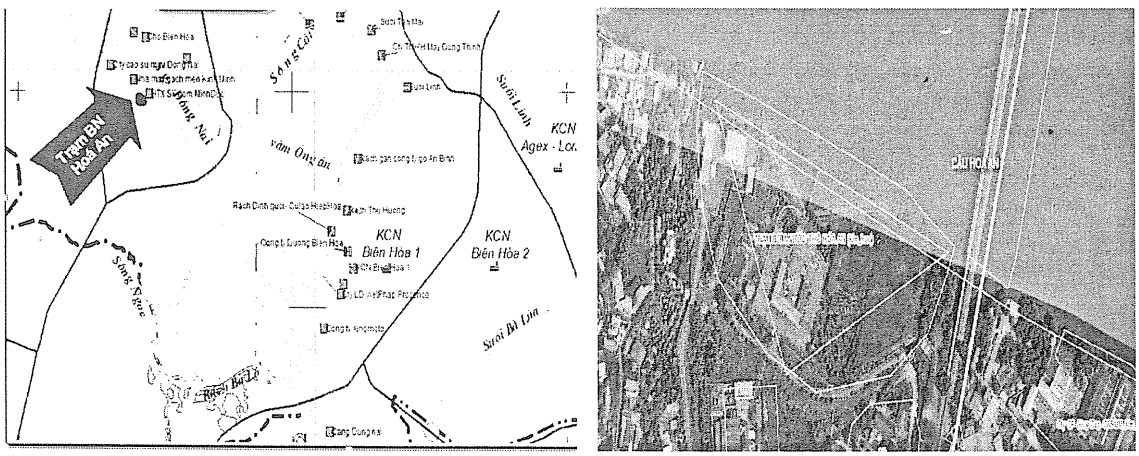


Fig. 1. Sketch the overall scope of research

Previous researches that related to this subject /0/ in our country, in general and in Ho Chi Minh City ,in particular, mainly focused on technical perspective in order to observe movement and water quality which haven't taken economic factors into the service of exploitation and management. In other countries in the world, studies of economic water resources is also not much.The reason is the source of secondary data needed is not available and difficult to collect. In addition, research on the economic damage caused by water pollution to the water plant is an essential research problem in the framework of environmental protection. This is the goal of this study.

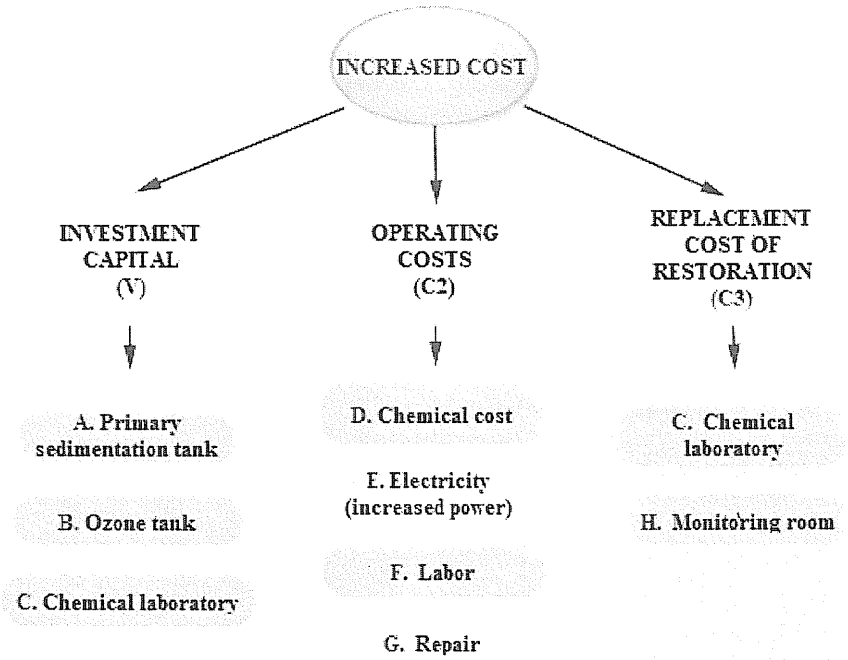
2. METHODOLOGY OF RESEARCH

Research method is determined by objects of the research. This is the most important stage in calculating progress. In the research, MIKE software is selected base on some criteria such as: the integrated multiple function software which was tested in practical situation and it can provide a high accurate calculation for the quality of water, easy-use interface, GIS technology application which is a new technique with high efficiency.

The MIKE model is a specific technology software that is provided by DHI (Denmark Hydraulic Institute). The software is built and improved within 20 years until now to simulate the flow and quality of water and transport silt sand in estuaries, rivers, irrigation systems, canals and

other water systems. The MIKE module includes a lot of software with the functions and duties such as MIKE 11, MIKE 21, MIKE 31, MIKE GIS, MIKE Basin, MIKE SHE, MIKE MOUSE..etc. This study used MIKE11.

Field surveys show that at the scene when the first water station on the factory taken from Hoa An water supply station in Dong Nai River is polluted and it means that the water treatment process of the water supply station will not be able to meet the requirements for handling standard water, so that the water station will be equipped with primary sedimentation tanks and Ozone aeration tanks in water treatment processes themselves. This will give rise to additional costs for water treatment process in this assumption. Calculate the increased cost refer to the documents /[3], [5]/.



The increased costs for the water station include the investment costs for drinking water treatment systems. These costs are: investment costs (V), increased operating costs (C2); overhaul costs, increased costs for changing equipment (C3). The costs calculation diagram is demonstrated.

Increased costs for processing polluted water = (V) + (C2) + (C3). Among them: the initial investment costs (V): (V) = A + B + C (1); increased operating costs (C2): (C2) = D+ E+F+G, increased costs of chemicals (D) = chemical cost after contamination – chemical cost before contamination. Where chemicals costs before contamination = Σ (total water volume per year * the amount used for each chemical when water is not polluted), chemical cost after contamination = Σ (total water volume per year * the amount used for each chemical when water is polluted).

Increased electrical energy costs (E) = (amount of electricity is used for sedimentation tank / m^3 water + electricity is used for Ozon tank/m^3 water) * total volume of water in the plant *current price of electricity. Labor cost (F) = Σ (the number of each type of labor * wages incurred for each of the subjects respectively). Regular repair cost (G): the calculating method is used to determine the regular repair coefficient (O_{sctx}). It's determined base on experience, the method is based on regular repair coefficient. O_{sctx} is determined as follows: $O_{sctx} = O_{isctx} = S_iKb_i$, where O_{isctx} is the regular repair cost of often fixed asset; S_i is the coefficient of regular repair of the fixed assets is calculated as a percentage compared with the initial capital investment K_{bi}; K_{bi} is the initial capital investment of K_{bi} is the capital initial investment of fixed asset i.

The increased cost of replacement overhaul (C3) is calculated by the percentage of initial capital investment of the project, it is based on the life of each fixed asset and the specific experiences of each region. In this study, for water supply projects, all water treatment equipments are imported so the increased cost of replacement overhaul is calculated:

$$C3 = 5\% \times (GHN + GGS) \quad (3)$$

where GHN is the cost of cost of building a chemical lab, GGS is the cost of costs of building water quality monitoring room. Total investment of the project construction investment is the total estimated costs for construction investment which are recorded in the investment decision and is the basis for investors to plan and manage capital when the project is done. Total investment including construction costs, equipment costs, costs of site clearance compensation and resettlement, project management costs, consultancy costs and other costs and reserved cost. The calculation method is according to 05/2007/, Circular of Construction Ministry dated 07/25/2007.

Increased costs due to changes in process water treatment technologies include: the total additional cost of the project in the economic life of the project (construction time and estimated time of exploitation), including: initial capital investment, operating cost management increased annual replacement costs increased during the project life cycle. Construction period (primary sedimentation tanks and ozone jacuzzi) is 2 years time is expected to exploit in 15 years (from BOT Binh An Project, the source 0. The steps to calculate the economic damages, including: a. Identify the project's capital investment; b. Calculate the excess operating costs; c. Calculate the incremental salary costs; d. Calculate surplus electricity costs; e. Regular repair cost; f. Overhaul surplus cost.

3. RESULTS AND DISCUSSION

To perform water quality simulation by Mike11 for the Dong Nai river water, we need to collect the waste load discharged into the river at the present time. Based on the current scenario helps us to calculate the level poilution through pollution load of waste in the future.

- ***Waste source and data source pollution***

Discharge sources are the main sources of pollution in the river basin, formed from the human activity. Data were collected from: industrial waste water data are based on data of test and measurement at NRE of Dong Nai province in 2009 / source [6] /. Two scenarios are considered: scenario 1 with the data source and discharging of waste in 2009 is taken from the source [6]. Scenario 2: Assumption of pollution load in this region grew by 30% compared to 2009.

- ***Data flow and water level***:

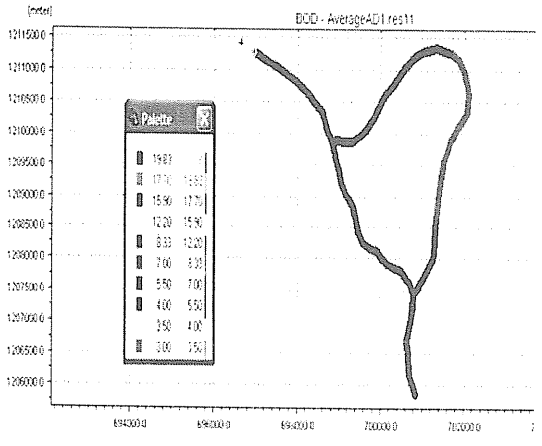


Fig. 3. The simulation results of scenario 1

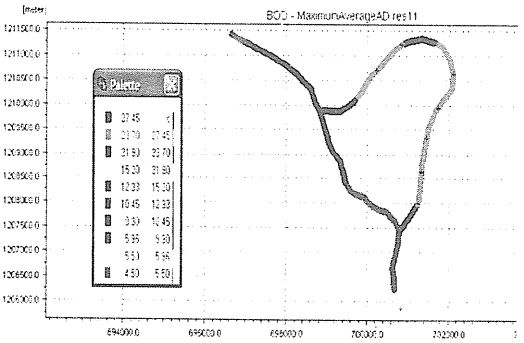


Fig. 4. Simulation results of scenario 2

Data flow data and water levels used for above, below boundary conditions and edit records, hydraulic model testing. The hydrological data (Δt = 30 seconds) from 05/1/2009 to 06/31/2009. These data are derived from the model running results for the Dong Nai river hydraulic system by the Southern Water Resources Study Institute done.

Simulation and calculation results under two scenarios is shown in Figure 3, Figure 4. BOD_5 concentration of pollutants in the study area increased from 4 - 5.5 mg / l to 9.3 - 10.5 mg / l.

Total investment of the construction project is the total estimated costs for construction investment recorded in the investment decision and will be the basis for investors to plan and manage capitals when implementation of investment projects in construction . Total investment including construction costs, equipment costs, costs of site clearance compensation and resettlement, project management costs, construction consultancy costs and expected costs. The calculating methods based on the circular 05/2007/TT of Construction Ministry.

The total capacity of Thu Duc water plant is 750,000 m^3/day that construction costs for these two items of primary sedimentation tanks and ozone jacuzzi /[7]/:

$$V' = 140.\ 10^9 * 750.000 / 100.000 = 1.050 \times 10^9 \text{ (VND)}$$

With the construction period is two years, the estimated time of exploitation is 15 years, the results of basic construction cost of the pollution water in 1 year, the water plant in Bien Hoa is /[7]/

$$V = \frac{1056,5 * 10^9}{15} = 70,43 * 10^9 \text{ (VND / year) (*)}$$

Management operation cost of the annual increase includes the main costs such as the cost of fixed assets depreciation (excluding basic depreciation), fuel energy costs, wage costs and other expenses calculated to salary, regular maintenance and repair costs, administrative and professional costs and other expenses.

The calculated result of total cost of increased chemicals for a year after the pollution water is 38,037,563,000 VND equivalent to 38 billion VND /source [7]/.

With online monitoring systems, chemical lab and equipment. The company needs at least 02 graduated chemical analysis engineers, 03 engineers who monitor the system online, 02 workers who are responsible for chemical mix and operated stations (from reference [4]). Total wage increases are:

$$(2 \times 2030.265 + 3 \times 1.829.790 + 2 \times 1.716.795) \times 12 = 0,156 \times 109 \text{ (VND)}.$$

Changing technological processes, more primary sedimentation tank and ozone tank must be added to the pumps with capacity as follows: the water tank is 0.13 Kw/$1m^3$; with the 0.002 Kw/$1m^3$ ozone water tank. Electricity current price is 862 VND / kWh (as request of the Ministry of Industry and Commerce is expected to apply from 1/7/2008 to 31/12/2009). So electricity cost increases are:

$$(0,13 + 0,002) \times 273.750.000 \times 862 = 31,15 \times 10^9 \text{ (VND)}.$$

The regular repair cost is the amount which spent to repair, maintain and protect, machinery and equipment to ensure their operation. The result of annual operating cost increase is / source [7] /:

$$C2 = (0.156 + 31.15 + 2.113 + 38.037) \times 109 = 71.456 \times 109 \text{ (VND) (**)}$$

These increased overhaul costs, replacement (major repair cost of fixed assets) include wages, cost of raw materials and energy, leasing expenses of machinery, equipment and other expenses. This cost is usually taken as a percentage of initial capital investment of the project based on the life of each fixed asset by experience in each region. Water treatment projects with equipment completely imported so overhauled replacement costs will be increased by 5% of the initial capital

investment for two categories of test rooms and online monitoring system. Time mining is expected that 15 years so we have a time of restoration. Overhaul costs, are additional alternative / [7] /:

$$C3 = 5\%(G_{HN} + G_{GS}) = 5\%(0,5 + 6)x10^9 = 0,325x10^9 \text{ VND} \quad (***)$$

From (*), (**) and (***) we have a total cost increased in a year:

$$V + C2 + C3 = 70,43 *10^9 + 71,456 \times 10^9 + 0,325x10^9 = 142,214 *10^9 \text{ (VND/ year)}$$

So each year when water sources are polluted with 10mg/l BOD_5, the living water treatment costs will increase about 142.214 billion dong/year for Thu Duc water plant

4. CONCLUSIONS AND RECOMMENDATIONS

Research results, the damage caused by water pollution in Dong Nai river flows through Bien Hoa city to show that in future, water treatment costs of the Thu Duc water plant is increasing 142 billion/year, these figures continue to increase if pollution in the vicinity haven't been improved. In the future, with such increasing water treatment costs will lead to increasing of drinking water absolutely. This will affect people's lives, reducing social welfare.

Wastewater in Bien Hoa city and Bien Hoa Industrial Zone 1 is the major source of waste caused water pollution to Dong Nai river in Bien Hoa city. Therefore, these resources need to be observed and monitored closely. Besides need to pay attention to pollution load of livestock operations and animal waste load of fish cages because they affected directly to the lake and river water quality are causing pollution locally on nutrients and organic.

Need to continue researching model methods more and more in order to make accurate forecasts and timely.

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