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Environmental Pollution
Prevention Project

ENVIRONMENTAL IMPACT ASSESSMENT TECHNICAL ASSISTANCE PROJECT THAILAND

Final Report

Prepared for:

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The EIA Technical Assistance Project reported on herein was conducted by a team of EP3 and government representatives. The primary purpose was to assist the Thai Government and its Office of Environmental Policy and Planning in the development of an EIA Checklist for use in the planning of urban infrastructure projects. This report presents the Checklist and Guidelines, two case studies and supporting documentation.

The overall EP3 program in the countries in which EP3 has activities includes a wide range of activities including audit/assessments, information dissemination, training and small scale demonstrations. These country programs are all designed to create the conditions in the country which will assure the continuation of urban and industrial pollution prevention and establish locally sustainable pollution prevention programs.

This report was prepared for RCG/Hagler Bailly, Inc. by Joel P. Epstein. Other contributors include Mary C. Harris of Hagler Bailly and Denny Cruz of the U.S. Environmental Protection Agency. The Project Team was extensively assisted by Ken Caplan, Curtis Borden and Mintara Silawatshananai from the U.S. AID mission in Bangkok and David Foster of U.S. AID Washington. Dr. Sudhin Yoosook of the Mahidol University served as local editor and translator, as well as a technical resource on the project. Additionally, Wanida Srichai of the U.S. - Thailand Development Partnership provided ongoing assistance throughout the Project Team's visit to Thailand.

We would especially like to acknowledge the support and assistance of Sonthi Vanasaeng, Director, Environmental Impact Evaluation Division, of the Office of Environmental Policy and Planning and his Environmental Officer, Usanee Siwawuth. Additionally, we offer acknowledgement and thanks to the many public officials we met in Nonthaburi and Ubon Ratchathani, without whom this mission would not have been possible.

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The United States Agency for International Development (U.S. AID) has provided assistance to the government of Thailand in the preparation of guidelines for urban environmental impact assessments through its Environmental Pollution Prevention Project (EP3). The following excerpt from the scope of services summarizes the objective of the EIA Technical Assistance Project:

> *RHUDO Bangkok and the Regional Support Mission for East Asia is committed to comply with the requirements of the Environmental Procedures called for under 22 CFR Part 216. Under an agreement reached with the Asia Bureau, the mission will conform with the spirit of these provisions by working with counterpart institutions in Thailand to upgrade their capacity for environmental impact assessments (EIA) associated with urban environmental infrastructure.*
>
> *This activity will assist Thai institutions to improve their capacity to conduct, supervise, and evaluate environmental impact assessments associated with the design and construction of urban infrastructure. The Contractor will provide a team of three environmental specialists with expertise in impact assessment, environmental engineering, and environmental planning.*

To meet this objective, RCG/Hagler Bailly, Inc. (Hagler Bailly) was selected as the Contractor to plan and conduct the technical assistance project. The following professional staff comprised the technical assistance team:

Joel Epstein, an environmental planning specialist from Hagler Bailly, who served as Project Team Leader;

Mary Harris, an environmental impact specialist from Hagler Bailly;

Denny Cruz, an environmental engineer from the U.S. Environmental Protection Agency.

During the period between November 30 and December 19, 1994, approximately 15 meetings and site visits were held in Bangkok, and the provinces of Nonthaburi and Ubon Ratchathani. These included discussions with local, provincial and national government officials and visits to existing and planned landfills, wastewater management systems and water supply plants. Appendix 1 provides a detailed schedule of activities.

The Project Team researched and analyzed two case studies: development of a solid waste facility in Nonthaburi (Chapter 4) and development of a wastewater management system in Ubon Ratchathani (Chapter 5).

The case studies contained the following sections:

Background. A description of the geographic and natural setting, demographic information and other descriptive facts and statistics.

Existing Practices and Facilities. A description of the solid waste and wastewater management systems currently in place.

New Facility/System Development. A description of the plans for the construction of a new landfill and wastewater collection/treatment system and other development plans that could affect implementation.

Significant Issues Related to the Development. Identification of project specific environmental and other impacts resulting from the development of the proposed facilities.

Implications for Solid Waste and Wastewater Management in Thailand. Identification of the implications for development of similar projects in other communities in Thailand.

Based upon the findings contained in the case studies, a checklist and set of guidelines were prepared to assist the Thai government in the preparation of Environmental Impact Assessments for urban infrastructure projects. This document is contained in Chapter 3.

2.1 Project Planning

Planning for this assignment commenced in mid-November, 1994 upon notification from U.S. AID. Initial planning efforts were directed towards compiling baseline information on Thailand's geography, history, demographics, government and environmental institutions, laws and regulations. Additionally, The Project Team compiled information, guidelines, and procedures for the conduct of environmental assessments from the U.S. AID, World Bank, Asian Development Bank, U.S. EPA, and selected U.S. state environmental agencies. A complete list of reference documents is contained in Appendix 2.

The Project Team was extensively assisted in its preparation by Ken Caplan and Mintara Silawatshananai from the U.S. AID mission in Bangkok. Additionally, Wanida Srichai, Environmental Infrastructure Advisor to the U.S. - Thailand Development Partnership, identified Dr. Sudhin Yoosook, Assistant Professor of Environmental Engineering at the Mahidol University in Bangkok, to serve as the Local Editor and Translator for the Project Team. She also provided continuing advice throughout the trip.

An initial project meeting was held on November 7, 1994 in the Washington D.C. offices of U.S. AID. Those in attendance were David Foster, Senior Environmental Advisor for U.S. AID and Joel Epstein and Mary Harris of Hagler Bailly. Mr. Foster presented the goals, objectives and methods for carrying out the EIA Technical Assistance Project.

2.2 In-Country Activities

The in-country engagement began on November 30, 1994 with a meeting of the Team Leader with Ken Caplan of the RHUDO staff to discuss the project's goals, his expectations and the logistical arrangements for the project.

On December 6, 1994, the Project Team met with the RHUDO staff and identified the following goals for the project:

- Assist the Ministry of Science, Technology, and Environment (MOSTE) and its Office of Environmental Policy and Planning (OEPP) to recognize the need for requiring EIA's for urban infrastructure projects.

- Develop a practical understanding of the urban infrastructure development process by conducting two field case studies of proposed projects.

- Provide a simple, concise Environmental Impact Assessment (or, as it is termed in Thailand, an Initial Environmental Examination) checklist and set of guidelines for use

by OEPP and local/provincial governments. The checklist should be in the form of questions and the guidelines should identify data required to assess potential impacts.

- Identify roles and responsibilities in the existing IEE/EIA process and potential conflicts that could arise as a result of requiring IEE/EIA's for urban infrastructure projects.

- Begin developing an understanding between MOSTE and the Public Works Department (PWD) on the need for and process of conducting EIA's for urban infrastructure projects.

During the period between November 30 and December 19, 1994, approximately 15 meetings and site visits were held in Bangkok, and the provinces of Nonthaburi and Ubon Ratchathani. These included discussions with local, provincial and national government officials and visits to existing and planned landfills, wastewater management systems and water supply plants. Appendix A provides a detailed schedule of activities.

2.3 Project Documents

A series of documents was prepared by the Project Team during its stay in Thailand. These include:

- An introduction of the Project Team, its mission and sample EIA/EIS case studies of solid waste and wastewater management projects in the U.S. (Appendix 3)

- Draft Environmental Impact Analysis Checklist and Guidelines for Urban Infrastructure in Thailand. (finalized in Chapter 3)

- Case Study: Development of a New Solid Waste Landfill in Nonthaburi, Thailand. (Chapter 4)

- Case Study: Development of a New Wastewater Management System in Ubon Ratchathani, Thailand. (Chapter 5)

2.4 Project Presentations and Follow-up Activities

On December 16, 1994, the Project Team debriefed AID officials on the results of the assignment and suggested follow-up activities. Also on that day, the Project Team presented the results of the project to over 30 government officials at the invitation of the Office of Environmental Policy and Planning in the Ministry of Science, Technology and Environment.

The documents cited above were presented to U.S. AID on December 16, 1994. A Project Trip Report was provided to that office on December 19, 1994.

Follow-up activities include:

- Review and comment on the draft Checklist and Guidelines by OEPP and U.S. AID (to be received by OEPP and conveyed to U.S. AID and RCG/Hagler, Bailly no later than January 1, 1994).

- Revision of draft guidelines and preparation of the Final Report in English by RCG/Hagler, Bailly (January 15, 1995).

- Translation of the Final Report into Thai (March 15, 1995). A request for continuation without cost for this translation was filed with U.S. AID upon return of the Project Team to the U.S.

2.5 Case Study Development

The Project Team researched and analyzed two case studies: development of a solid waste facility in Nonthaburi and development of a wastewater management system in Ubon Ratchathani.

The case studies contained the following sections:

- Background. A description of the geographic and natural setting, demographic information and other descriptive facts and statistics.

- Existing Practices and Facilities. A description of the solid waste and wastewater management systems currently in place.

- New Facility/System Development. A description of the plans for the construction of a new landfill and wastewater collection/treatment system and other development plans that could affect implementation.

- Significant Issues Related to the Development. Identification of project specific environmental and other impacts resulting from the development of the proposed facilities.

- Implications for Solid Waste and Wastewater Management in Thailand. Identification of the implications for development of similar projects in other communities in Thailand.

2.6 Summary of Findings - January 16, 1995

The following two tables summarize the project-specific significant issues and generalized implications related to the development of infrastructure in Thailand.

Table 1
Solid Waste Management Facilities

SIGNIFICANT ISSUES IN NONTHABURI	IMPLICATIONS FOR THAILAND
Land cost and availability determined site selection.	Cost of land for new sites in growth areas will increase.
Cost to build and operate will require increase in fees or more subsidy from municipal budget.	Future costs increase to generators/ municipalities for development and O/M.
Site conflicts with existing and proposed land uses.	Site selection should incorporate environmental as well as economic considerations.
Public skepticism that facility can be designed and operated correctly.	Old practices/facilities create negative public perceptions of new facilities.
Existing landfill practices raise credibility questions for the public.	Old practices/facilities create negative public perceptions of new facilities.
Waste imports from other communities pose equity questions.	Host benefit packages and other innovative techniques should be applied to offset equity issues.
IEE conducted with no participation by OEPP or local municipality.	Requiring EIA's for waste management projects would involve all levels of government and provide structure for resolution of environmental and social issues.

Table 2
Wastewater Management Facilities

SIGNIFICANT ISSUES IN UBON RATCHATHANI	IMPLICATIONS FOR THAILAND
New facilities provide added environmental protection but no national standards exist for wastewater treatment.	New facilities will require specific national wastewater standards.
Existing part-time residents compensated for relocation.	Innovative programs for relocation minimize public opposition.
Treatment plant site could have impact on unique habitats.	Site costs/availability will determine nature, extent, costs of facilities.
Lack of coordination between city, Province and PWD caused major impact during construction.	National urban infrastructure planning/development will require added coordination with municipal and local governments.
Municipality responsible for O/M costs; no revenue raising structure exists.	Increased financial impact on local communities; if not supported, O/M practices could suffer potentially creating environmental problems.
	Requiring EIA's for wastewater management systems will resolve many of the significant issues cited in Ubon.

2.7 Environmental Impact Assessment Checklist and Guidelines

The Environmental Impact Assessment Checklist and Guidelines provide a concise method for incorporating EIA principles into the development of urban infrastructure projects. They are based upon commonly accepted practices used by international, national and other governmental and financial institutions. Additionally, the Checklist and Guidelines respond to many of the significant issues - and their implications - identified in the two case studies.

Rather than presenting detailed impact analysis models, methodologies and protocols (which will be required in the future), the Checklist poses key questions to aid in the identification of specific effects that could result from urban instrastructure projects. If an impact is identified, the Guidelines ask the analyst to determine: 1) the data required to aid in the assessment; 2) the

communications necessary to ensure intergovernmental coordination; 3) an estimate of the costs for mitigation and operation/maintenance; and 4) specific public relations/public involvement procedures to minimize socioeconomic impacts and allay community concerns.

The Checklist and Guidelines are divided into seven categories of impacts:

- Land Use
- Water Quality
- Air Quality
- Natural Resources
- Socioeconomic
- Human Health and Safety
- Public Relations / Public Involvement

2.8 Roles and Responsibilities in the EIA Process

Currently, EIA's are not required for wastewater and solid waste management projects. The Public Works Department (PWD) is primarily responsible for the planning, design and construction of such projects. The Department's planning process requires an Initial Environmental Examination (IEE) to be prepared as a part of the project's Feasibility Study.

The Office of Environmental Policy and Planning (OEPP) has two responsibilities in the approval process for EIA's for projects sponsored by government agencies: 1) approval of the Terms of Reference (TOR's) or scope of services to be used by PWD's consultants in planning and design and 2) review and comment on the Feasibility Study. The Ministry of Science, Technology and Environment, of which OEPP is a part, has representation on the National Environmental Board, the primary link with the Cabinet, who has final project approval.

Currently, the only mandated time frames for OEPP activities relate to the development, review and comment on EIA's that are required for private sector projects. These include a 15 day EIA review period and, if changes in the document are required, an additional 15 days to provide preliminary comments on the modifications.

Although OEPP believes that it has adhered, for the most part, with these schedule deadlines, the EIA process becomes significantly delayed for public projects due to the involvement of an Expert Review Committee (composed of government agencies and/or their outside consultants), the National Environment Board and, finally, the Cabinet.

Another factor affecting the timing and response of OEPP is the sheer number of EIA's it is being asked to review. The following provides an indication of the EIA level of activity during the period between June 4, 1992 and June 30, 1994:

Mining:

Total Received:	360
Approved:	220
Being Revised or Revised:	134
Disapproved:	6

Industry:

Total Received:	52
Approved:	28
Being Revised or Revised:	24
Disapproved:	0

Transportation:

Total Received:	39
Approved:	19
Being Revised or Revised:	17
Disapproved:	3

Totals:

Total Received:	451
Approved:	267
Being Revised or Revised:	175
Disapproved:	9

During this 25 month period, the OEPP has received about 18 EIA's per month. This represents a significant level of activity for reviewing and analyzing private and government projects (of those that currently require EIA's). If MOSTE promulgates a Notification (the legally mandated vehicle requiring the preparation of EIA's) as expected, the level of effort will increase substantially. This will require additional funding and technical expertise.

2.9 Relationship/Conflict of Proposed Guidelines and Existing EIA Mechanisms

The proposed Checklist and Guidelines were designed to provide a concise method of reviewing EIA's, identifying potential impacts and gathering pertinent information to conduct impact analysis. Since the underlying principles represent generally accepted methods for conducting EIA's, there should be little conflict among various Thai government agencies.

But conflicts may be expected to occur when the EIA development process moves beyond impact identification and data requirements and into models and protocols to gauge actual environmental effects, their consequences and methods for mitigation. This will be particularly true for urban infrastructure projects since it is commonly assumed that the net environmental benefit of providing these facilities offsets any negative environmental impacts that they may create. Additionally, experience in other countries demonstrate that there is a real or perceived "conflict of interest" in having the development agency (i.e., PWD) develop IEE's and EIA's that could negatively effect the timing and ability to meet its mission to construct projects.

Another potential conflict that could arise was identified by participants in the OEPP sponsored presentation given by the Project Team on the draft EIA Checklist and Guidelines. Currently, OEPP uses a different set of impact categories: physical, ecological, land use and quality of life. This conflict is probably minimal, since many of the same environmental attributes are analyzed, despite being grouped under different categories.

The purpose of this Checklist and the Guidelines it contains is to provide those conducting Initial Environmental Examinations (IEE) and Environmental Impact Assessments (EIA) with a concise method for reviewing the impact of proposed solid waste and wastewater management infrastructure and systems.

This checklist is based upon generally accepted IEE, EIA and Environmental Impact Statement methodologies and guidelines developed by institutions such as the World Bank, the Asian Development Bank, the U.S. Environmental Protection Agency, the U.S. Agency for International Development and other national, state and multilateral bodies. A complete list of references is contained in Appendix B of this report.

Generally, the difference between an IEE and EIA is the extent to which a project's impacts are studied. For instance, an IEE may only utilize existing data sources to measure impacts; in contrast, an EIA may require detailed scientific, socioeconomic and other technical studies to produce new, site-specific information. The Ministry of Science, Technology and Environment is considering promulgating a Notification requiring EIA's for wastewater and solid waste management projects which will contain guidelines for eligible projects and the nature and extent of the appropriate analysis and quantification of impacts.

This Checklist should be considered a management tool to assist MOSTE in its determinations. Specifically, the checklist can be used to:

- Assess the completeness of an IEE/EIA.
- Categorize existing baseline information.
- Determine the nature and extent of new data requirements.
- Determine appropriate study methodologies in performance of impact analysis.

The Checklist is divided into seven categories:

- Land Use
- Water Quality
- Air Quality
- Natural Resources
- Socioeconomic
- Human Health and Safety
- Public Relations / Public Involvement

Each Checklist question contains - if an impact is determined to exist - Guidelines for data collection to be used in impact analysis and requirements to specify proposed mitigation measures.

EIA/IEE CHECKLIST

3.1 Project Background

The initial section of the checklist should include filing, tracking and other administrative information such as project initiation dates, review dates, regulatory actions and other data required by the government agency concerning the project under examination. This section should also include a project description, site description, and the rationale for the selection of the site

Impact Category	Impact Identification		Impact Assessment
Land Use	Will the proposed project disturb any structures or areas of historic, cultural, archaeologic or paleontological importance?	Yes No	If yes, specify the extent of the disturbance and what measures have been or can be incorporated into the design of the proposed project to avoid or minimize the disturbance.
	Does the site of the proposed project or areas located near it have unique aesthetic value?	Yes No	If yes, describe the areas that have unique aesthetic value.
	Does the proposed use of the site conflict with to the existing development plans or any of its mandated elements (e.g., land use, housing, circulation, open space, conservation, noise, safety)?	Yes No	If yes, specify the extent of conflict and how the design of the proposed project might be modified to minimize the conflict.

Impact Category	Impact Identification		Impact Assessment
Land Use	Does the proposed project conflict with the character of the surrounding area?	Yes No	If yes, specify the nature of the conflict and the steps that will be taken to resolve or minimize it.
	Does the proposed use foreclose important and perhaps better uses of the land (e.g., housing, agriculture, fishing, recreation)?	Yes No	If yes, specify why the proposed project represents the best use of this site.
Water Quality	Is the site located near any surface water features such as lakes, ponds, streams, etc.?	Yes No	If yes, describe the size, location and distance from the project site of each surface water feature.
	Is the site located in a floodplain area?	Yes No	If yes, delineate the portions of the site located in the floodplain area, the nature of the encroachment and the steps (e.g., site layout, facility design) that will be taken to minimize potential flooding impacts.
	Is there a source of water supply on the site?	Yes No	If yes, specify the location and quantity of the water supply source
	Will the proposed project pollute (e.g., human wastes, toxic wastes, surface water runoff) or seriously affect any on-site water sources?	Yes No	If yes, specify the type and source of the pollutant, the amount, and the relative level of risk to terrestrial, biotic and human ecosystems.

Impact Category	Impact Identification		Impact Assessment
Air Quality	Will the proposed project generate pollutants (e.g., hydrocarbon thermal, odor, dust or smoke particulates, radiation, etc.) that will seriously affect the existing air quality?	Yes No	If yes, specify the type and source pollutant, amount and relative risk to terrestrial, biotic and human ecosystems and the steps that will be taken to mitigate such impacts.
Natural Resources	Has the site been officially designated as having preservation value (e.g., open space, unique biotic habitat, mineral, water, agricultural, forests, recreational)?	Yes No	If yes, specify the type of designation, the area of the site that conflicts with it and the steps that will be taken to avoid or minimize the impact. If yes, demonstrate that the authority responsible for officially designating and/or maintaining the natural resource area has been notified and has approved the proposed project.
	Is the site subject to or will the proposed project create geologic hazards (e.g., seismic, landslides or mudslides)?	Yes No	If yes, specify which hazard, the extent and the relative level of risk associated with the proposed project's location at the site. If yes, specify the steps that will be taken (e.g., design, site layout) to minimize the risk.
	Is the site subject to or will the proposed project create soil hazards (e.g., subsidence, erosion)?	Yes No	If yes, specify which hazard, the extent and the relative level of risk associated with the proposed project's location at the site. If yes, specify the steps that will be taken (e.g., design, site layout) to minimize the risk.
	Is the site subject to or will the proposed project create any hazard that will affect the biotic ecosystem?	Yes No	If yes, specify which hazard, the extent and the relative level of risk associated with the proposed project's location at the site. If yes, specify the steps that will be taken (e.g., design, site layout) to minimize the risk.

Impact Category	Impact Identification		Impact Assessment
Natural Resources	Are there any rare or endangered plant or animal species or unique biotic habitats (e.g., wetlands, spawning grounds) and will the proposed project disturb any of these natural resources?	Yes No	If yes, specify which hazard and the relative level of risk associated with the project's location at the site. If yes, specify the steps that will be taken (e.g., design, site layout) to minimize the risk.
	Is the site used as a nesting place for migrating fowl and will the project affect nesting areas?	Yes No	If yes, specify the specie and extent of the nesting area. If yes, specify the area that will be disturbed, the extent of the disturbance and steps that will be taken to avoid or minimize it (e.g., site layout, design, replacement habitat)
Socioeconomic	Will the activity resolve or aid in the resolution of a public health, safety or nuisance condition?	Yes No	If yes, describe the existing condition and indicate how this activity will resolve or help resolve it.
	Is the site of the proposed project located near any public gathering places (e.g., housing estates, schools, parks, religious institutions, commercial establishments, hospitals)?	Yes No	If yes, describe the size, location and distance from the project site of each public gathering place.
	Are there existing persons or businesses located on the project site either full-time, part-time or during different seasons?	Yes No	If yes, specify who these persons and businesses are, their total number, what measures are available to assist their relocation, and whether or not suitable comparable facilities exist to which these persons or businesses may relocate.
	Will construction of the proposed project cause relocation of any persons, businesses or other institutions?	Yes No	If yes, specify what persons or business will be dislocated, what measures will be used to relocate them, and to what comparable facilities.

Impact Category	Impact Identification		Impact Assessment
Socioeconomic	Can the proposed project design be modified to avoid this relocation including the use of an alternate location?	Yes No	If yes, provide details of design changes or alternate locations. If no, provide a relocation plan that describes measures that will be taken, potential compensation to relocated persons, businesses or other institutions, and steps taken to achieve approval from those who must be relocated.
	Will the proposed project have any effects on reducing or increasing the population in the area?	Yes No	If yes, describe the nature and extent of the effects.
	Will the proposed project change local lifestyles and/or patterns of activity?	Yes No	If yes, describe these changes and the steps that are being taken to avoid or minimize them.
	Will the proposed project create or maintain employment opportunities?	Yes No	If yes, describe the nature and number of jobs created or maintained, the expected longevity, and the ability to utilize local labor.
	Will the proposed project result in increased local costs and the need to raise taxes or borrow additional funds?	Yes No	If yes, describe the nature of required expenditures (e.g., related infrastructure improvements, operating and maintenance requirements) and estimate the costs to local governments.
Human Health and Safety	Will construction of the project cause any direct health and or safety impacts (e.g., noise, traffic, dust, discontinuation of existing public services, short-term environmental impacts)	Yes No	If yes, describe the direct impacts and the steps that will be taken to minimize them.

Impact Category	Impact Identification		Impact Assessment
Human Health and Safety	Will the proposed project cause any direct health and or safety impacts (e.g., noise, traffic, dust, discontinuation of existing public services, short-term environmental impacts)	Yes No	If yes, describe the direct impacts and the steps that will be taken to minimize them.
	Will the environmental impacts delineated in the Water Quality, Air Quality and/or Natural Resources sections of this checklist result in any long term human health or safety impacts?	Yes No	If yes, describe the nature and extent of the health or safety impacts, the relative risk to people and the steps that will be taken to minimize these impacts.
	Will the operation of the proposed facility create any long term human health or safety impacts?	Yes No	If yes, describe the nature and extent of the health or safety impacts, the relative risk to people and the steps that will be taken to minimize these impacts.
Public Relations / Public Involvement	Are community residents and their government officials aware of the proposed project?	Yes No	If no, describe the steps that will be taken to inform community residents and government officials, the timing of such actions and the method(s) that will be used (e.g., letters, meetings).

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Impact Category	Impact Identification		Impact Assessment
Public Relations / Public Involvement	Has the proposed project - if it is known to the public - generated public concern or controversy among community residents and/or local officials?	Yes No	If **yes**, describe the nature of the concerns and/or controversies, the steps that will be taken to ameliorate them, the timing of such actions and the method(s) that will be used (e.g., public education, public meetings, community advisory committees). If **no**, describe the steps that will be taken to avoid or minimize concerns and/or controversies, the timing of such actions and the method(s) that will be used (e.g., public education, public meetings, community advisory committees).
	Are there public relations and involvement plans ready to be implemented once the facility has begun operating?	Yes No	If **yes**, describe the steps that will be taken to involve the public during the operation of the facility (e.g., permanent community advisory committee, independent community inspectors, public meetings).

The municipality of Nonthaburi is planning to develop a new landfill for the disposal of municipal solid waste. Currently, the municipality is disposing its wastes in a landfill that is operated by the Province and rapidly reaching its capacity limits. To assure future disposal needs are met, the municipality has selected and purchased a site, designed the facility and currently plans to construct the landfill. Community opposition has delayed these plans.

4.1 Background

Nonthaburi - the city and the Province - is located in the greater Bangkok Metropolitan Region. The Province is administratively divided into six districts (i.e., Amphoe Nonthaburi, Pak Kret, Bang Kruai, Bang Bua Thong, Bang Yai and Sai Noi), three municipalities and four sanitary districts.

The municipality of Nonthaburi's population is estimated to be 258,000 people. Another 70,000 residents are classified as "unregistered". Its density is approximately 6,632 persons per square kilometer. The population of the Province is about 703,000 people.

Both the Province and city have experienced dramatic growth of about 5.1% per annum as a result of Bangkok's expansion throughout the metropolitan region due to rapid economic development. New highways have enabled residents to commute from Nonthaburi to Bangkok's central business district and residents from surrounding provinces can also travel to newly created jobs in Nonthaburi.

The city's and Province's natural setting is characterized by flat, lowlands with a high water table. It is located in the central lower plain where the Chao Phraya River divides the Province into the east and west sides. Population density is greater on the east side of the River.

4.2 Existing Solid Waste Management Practices and Facilities

The city of Nonthaburi generates approximately 187 tons per day of municipal solid waste; the Province produces about 300 tons per day. It is estimated that an additional 50 tons per day is uncollected by the city. Approximately 65% comes from residences, 30% from commercial establishments and 5% from local industries. The city charges households 20 Baht per month, regardless of the amount of waste generated.

Figures from a recent Public Works Department study indicate that almost half of the waste is composed of organic material, 20% fabrics, 13% plastics, 10% wastepaper with remaining portions containing glass, yard wastes, metals and other materials.

Garbage is collected seven days per week by 50 city trucks. Compactor vehicles make one trip per day and standard collection vehicles make twice daily trips to the Provincial landfill, located some 35 kilometers from the city. It takes approximately 1.5 hours from the end of collection routes to reach the landfill.

There are three existing landfills in Nonthaburi Province. The facility where the city takes its waste is rapidly running out of space and is expected to be closed within two years.

The Provincial landfill covers an area of approximately 26 acres / 10 hectares / 65 rai. The access road leading to the facility is approximately 200 meters long, seemingly sufficient to avoid lengthy truck delays and idling. Although there is an entrance gate and guardhouse, it appeared that loads pass through uninspected. A scavenging/recycling operation is located at the entrance to the access road, where potentially marketable materials are hand-picked directly from the trucks.

The site is surrounded on one side by housing for about 100 people. A seasonal fish pond, guava and rice farming, irrigation canals, and potential water fowl nesting areas are adjacent to the landfill but appear undisturbed by disposal activity. The facility does not affect cultural resources such as wat, shrine, archaeologic or historic sites.

Trucks entering the landfill gate pass a series of leachate collection ponds. (Although filled to capacity, there was no evidence of migration off the site.) Waste is taken directly to the disposal area and dumped. A front-end loader stood ready to mix and level the material. Waste was visible throughout the site and there was no evidence of daily cover practices. Despite this, odors were detected only when standing directly over the waste.

A small scavenging operation also exists directly on the landfill site. Children and adults gather by trucks waiting to separate recyclables. It appeared that the scavenging was unregulated, with public health risks associated with these activities (e.g., children were barefoot, food was prepared and consumed on the dumping area, people were perilously close to the trucks).

Another existing disposal facility is located and used by the municipality of Bang Bua Thong. Adjacent to a slaughterhouse, the landfill was clean, well managed and maintained. The small site (approximately 4 acres / 1.6 hectares / 10 rai) is just off a highway, contains 10-12 meter high smoking piles of waste (probably to increase capacity but degrading air quality and causing citizen complaints). A small drainage culvert that was dry on the day of the site visit appeared to be, based upon the nature of the vegetation, a filled creek. No wildlife was visible. The facility does not affect cultural resources such as wat, shrine, archaeologic or historic sites. No loose garbage or odors were apparent. Housing and industry are being developed along the highway and are beginning to encroach on the landfill.

4.3 New Landfill Development

The city of Nonthaburi recognized its need for a new landfill over two years ago. The distance to the landfill (35 kilometers) and impending closure of the Provincial facility necessitated a search for a new site.

Price and availability of sufficient land were the major criteria used in site selection. Other stated criteria (as recommended by the OEPP) included: groundwater, proximity to people, suitability of soils, vehicle access and distance from the city.

The selected site of approximately 50 acres / 20 hectares / 125 rai is located outside of the Nonthaburi municipality in Sai Noi District. The 42,403,071 Baht funding for acquisition was financed by a loan of 29,682,150 Baht (70%) from the Ministry of the Interior's Municipal Development Fund (with an annual payback of 3,700,000 Baht) and 12,720,921 Baht from the municipality.

The site is located in a rural, scenic setting with surrounding agricultural and residential land uses. The land is flat with a groundwater table approximately 2 to 5 meters (depending on the season) below the surface. A khlong is located opposite the existing road that is planned to be used for access to the site. Abundant wildlife and flora including frogs, fish, lotus, wildflowers, birds and butterflies were observed on and near the proposed site. There are no apparent topographic or geologic faults. Since Environmental Impact Assessments are not required for solid waste management projects, little documented evidence is available.

Approximately 250 meters from the proposed site is a small established community. The existing (and planned access) road could potentially cause conflict between trucks using the landfill and vehicles going to the town. It appears that a facility at this location will not affect cultural resources such as wat, shrine, archaeologic or historic sites.

The planned facility incorporates a sophisticated design utilizing state-of-the-art leachate collection system and treatment technology, a synthetic protective membrane or liner that contains the waste and leachate to protect groundwater, and a unique development approach for phased landfilling. The feasibility study for the facility estimates that it will require revenue of approximately 60 Baht per month per generator (in contrast to the existing charge of 20 Baht per month) to finance and maintain the environmental protection measures incorporated into the design.

Community opposition has been apparent since public disclosure of the city's acquisition of the site and intention to develop a landfill. Led by a local religious leader, nearby residents have been adamantly against the landfill despite recent attempts to engage in a dialogue between city officials and the community. Reasons for concern include: the perception that the city can not

operate the facility in a suitable manner (based upon the belief that the existing Provincial facility is poorly run); the presence of three existing landfills in the area (i.e., equity or fairness); and site specific issues (e.g., groundwater contamination, traffic, odors, disease baring vectors). Residents have responded by communicating their concerns in writing to all levels of government and refusal to participate in city-sponsored forums.

The city is currently continuing the feasibility study for the new landfill development project.

4.4 Significant Issues Related to the Landfill Development

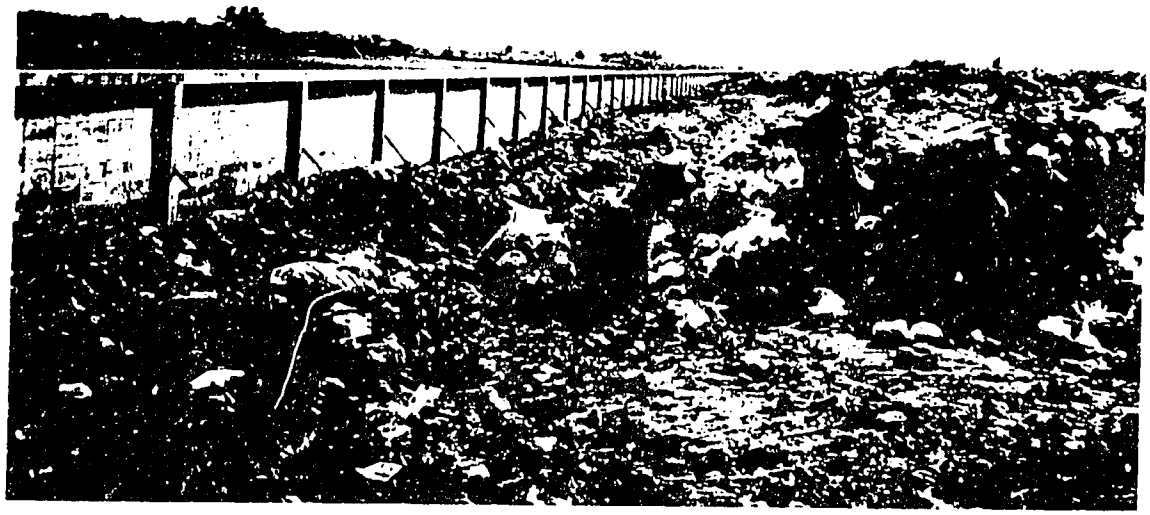
Based upon discussions with city and Provincial officials, a review of project documents, and a visit to the proposed site, significant issues related to the development of the Nonthaburi landfill include:

- The cost and availability of land in Nonthaburi Province limits the number of potential sites that could provide a place for the future landfill.
- The cost to build and operate the proposed landfill will require an increase in collection/disposal charges from the current rate of 20 Baht per month per generator to 60 Baht (exceeding the mandated ceiling of 40 Baht per month).
- The site conflicts with existing and proposed land uses desired by the surrounding area. These include a possible new housing development and existing agricultural activities.
- Although residents near the site believe that landfills can be designed to minimize adverse impacts, it is generally felt that the design as proposed will not be implemented and proper operating procedures will not be maintained.
- Nearby residents do not want waste imported from urban areas. Adding to the number of existing landfills in the area is perceived as unfair.
- City commitments to maintain the landfill's security (limiting scavenging, reducing accidents, improving health conditions of workers) conflicts with the existing practices observed by residents at the current Provincial landfill.

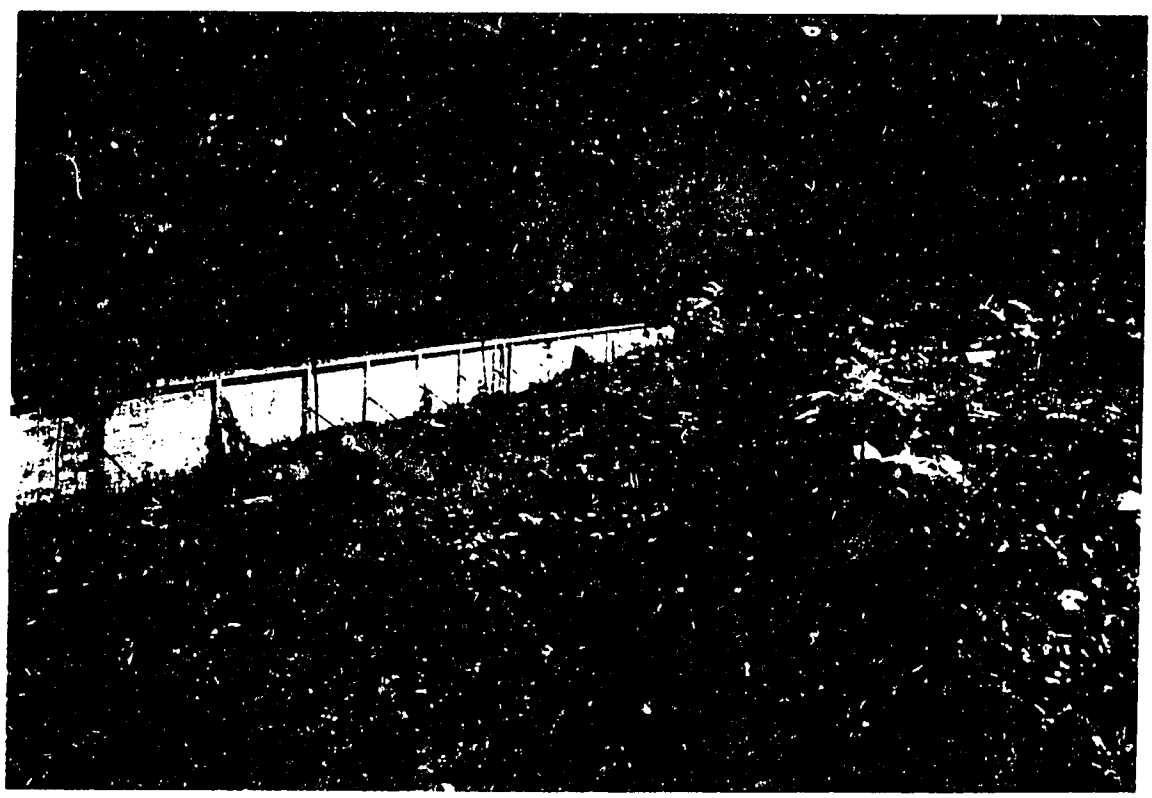
4.5 Implications for Solid Waste Management in Thailand

Although we recognize and acknowledge the limitations of this analysis (i.e., one case study, three days of investigation, one site visit), the Nonthaburi situation may provide some useful lessons in other attempts to develop new solid waste management systems. These include:

- There is a need to consider environmental aspects of solid waste projects early in the development process.
- Social concerns about solid waste facilities may delay or prevent progress in meeting national goals for environmental improvement.
- The selection of sites for solid waste facilities should consider social, environmental and technical conditions, as well as economic factors.
- The demand by large cities to meet future disposal needs will result in added costs and fewer parcels of land available for solid waste facilities.
- Generators and municipalities are likely to spend much more in the future to develop and operate solid waste management programs and facilities.
- Old practices and facilities create negative perceptions and increase the difficulty of building new state-of-the-art landfills.
- Early and extensive public relations will be needed to gain social acceptance for solid waste management projects.
- Innovative public participation techniques such as community advisory committees and independent, trained community inspectors will provide residents with additional assurance of environmental compliance during facility operations.
- Host benefit packages (i.e., financial compensation) should be explored to offset any perceptions of unfairness and to mitigate potential environmental and socioeconomic impacts.
- Requiring Environmental Impact Assessments for solid waste management projects could serve to frame the issues, inform the community, and offer a structure to build consensus around mitigation measures.



NONTHABURI PROVINCE LANDFILL
LANDFILL FACE AND ADJACENT AGRICULTURE



NONTHABURI PROVINCE LANDFILL
ADJACENT SURFACE WATERS AND WETLANDS

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NONTHABURI MUNICIPAL LANDFILL SITE
SITE LOCATED TO LEFT OF AGRICULTURAL AREA

NONTHABURI MUNICIPAL LANDFILL SITE
SITE LOCATED IN BACKGROUND; UNIQUE HABITAT IN FOREGROUND

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Construction of a new wastewater collection and treatment system is currently underway in the city of Ubon Ratchathani. With funds provided by the national government, the Public Works Department has designed and is managing construction of a wastewater collection system covering 30% of the city's land area and a treatment plant with an estimated capacity to accommodate 225,000 people. Recently, the city has completed modifications in its stormwater management system to ameliorate chronic flooding conditions.

5.1 Background

Ubon Ratchathani - the city and the Province - is located in the northeast region of Thailand. Besides the city of Ubon, there are two other municipalities within the Province - Warin Chamrad (located across a river from Ubon) and Phibun Mangsahan.

The municipality of Ubon's population is estimated to be 105,000 people or 22,273 households. The population of the Province is 1,676,328 people.

The Ubon region is one of the poorest in Thailand. Major economic activity is centered around agriculture and livestock breeding.

The city's and Province's natural features are characterized by flat, green fields with areas of dense forest. The city is located in a flood plain on the north shore of the Mun River. To the west, the city is bounded by the Little Moon River. A bridge across the Mun River leads south to the municipality of Warin Chamrad.

5.2 Existing Wastewater Management Practices and Facilities

The city of Ubon relies upon a combined system for wastewater and stormwater collection (i.e., one pipe handles both). The wastewater/stormwater is discharged untreated into the Mun River.

Households and businesses hook-up directly to the sewers which are located under the walkways and, sometimes, the streets. A fee is charged for the connection. For new buildings, connections are made and fees are collected during construction.

Some choose not to tie into the municipal system and, instead, have their wastewater go into septic tanks or cesspools. Private waste collectors take it away; no system is in place to determine the final point of discharge/disposal. Reportedly, some commercial establishments collect their wastes in septic tanks and discharge directly into the sewer system. The city provides some septic tank services and generally focuses on maintaining drains for storm and wastewater collection.

No data is available on the amount and nature of the storm and wastewater. Figures for revenues from sewer hook-ups and operation/maintenance costs were not available.

In response to street flooding during the rainy season, Ubon received 26,000,000 Baht for road improvements that would - through reconstruction - solve the problem. The six month building period took place just prior to the beginning of the new wastewater collection and treatment system by PWD in 1993 (see below).

5.3 New Wastewater System Development

Although the city of Ubon recognized the need to upgrade its drainage and stormwater system, it did not anticipate any modifications to its wastewater collection system. The PWD, acting on its special mandate to improve environmental infrastructure in Provinces with more than 1,000,000 people, began planning and designing a new wastewater collection system and treatment plant.

Approximately 400,000,000 Baht was budgeted for the project. It was to be conducted in two phases: Phase I - September, 1993 through 1995 (for interceptor sewers east of the bridge over the Mun River) and Phase II - September, 1995 through 1996 (for interceptor sewers west of the bridge and the treatment plant).

The municipality was, initially, unaware of the plans for the new system. They were not involved in planning the interceptor sewers that would collect storm and wastewater from their current system. Logistics and road-closings were not coordinated with the city. The site for the treatment plant was not selected jointly by the municipality and the PWD. If, as required, the PWD prepared an Initial Environmental Examination as part of the feasibility study, the municipality was not involved in its development and does not know its findings. Additionally, the municipality was not represented on the inspection team whose role it is to provide quality assurance and control. As a result, the previous Ubon mayor did not support the new wastewater project.

An additional reason for lack of political support is the imposition of wastewater collection and treatment fees that will be necessary for the city to operate and maintain the system. Currently, Ubon only charges fees for hook-ups to the existing system and a new "tax" is expected to result in a negative public reaction. The city states that it is extremely difficult to collect waste collection and disposal charges and expects wastewater fees to pose similar enforcement problems.

The PWD considered two sites for the location of the treatment plant - one to the east and the other to the west of the Mun River bridge. Since planning and feasibility studies were not available, it is difficult to determine the criteria utilized in final site selection. The municipal officials believe that the east site was selected because it was public land and had only seasonal inhabitants. Also, there was no threat to public water supplies since the plant outfall was located below the water intake. In contrast, the west site had a higher population density, was a smaller

parcel of land and had the potential to affect water supplies for Warin Chamrap.

The selected site, located in a flood plain on the north side of the Mun River approximately 3 kilometers east of the bridge, is approximately 90 acres / 35 hectares / 200 rai in size. The treatment plant would have a footprint of approximately 45 acres / 18 hectares / 100 rai. Approximately 200 meters north of the site is relatively dense housing.

During the dry seasons, 16 families settle on the site. The PWD, despite the public ownership of the site, took effective steps in compensating (200,000 Baht) and relocating these seasonal residents, thus minimizing the probability of a contentious "host" community dispute that could have resulted in lengthy project delays.

Due to the unavailability of project documents and the inability to go on-site (visual inspection took place from the shoreline overlooking the site), it is difficult to characterize the natural setting and potential environmental impacts. The most apparent natural feature is wetlands on the north portion of the site that seem to be used for fishing (a fisherman in his boat was sighted during the visit). It appeared that this represented a potentially unique habitat. Since Environmental Impact Assessments are not required for development of wastewater systems, information identifying the nature and extent of the effects on the site could not be analyzed.

The treatment facility was designed to meet storm and wastewater demand for the next 20 years. Based upon a study of an engineering drawing obtained from the city and using a standard design formula (i.e., 1 square meter of the area designated for aerated oxidation = 1 person's treatment capacity needs), it is estimated that the plant's overall capacity could handle wastewater generated by a population of 225,000 people (in contrast to Ubon's existing population of 105,000).

The treatment system selected is appropriate for a community such as Ubon. The technology used for the treatment of the wastewater consists of a two cell system aerated lagoon. Each lagoon makes use of a series of mechanical surface aerators providing partial wastewater mixing which results in stratification of the wastewater due to aerobic and anaerobic digestion. It's easy to operate with low-skilled personnel, should provide relatively low cost operation and maintenance and can be expanded to meet future needs.

Although the site is located in a flood plain. design features such as birms and thoughtful site layout could minimize any potential affects. The design is expected to meet related Class A (the highest) effluent standards.

The wastewater collection system is composed of a series of interceptor sewers that are to intersect with the existing storm and wastewater collection system in the city. Gravity feeds will predominate with some pumping required to convey wastewater to the treatment plant.

Both Phase I and Phase II construction has commenced. Heavy equipment for grading and filling the treatment plant site was observed. Open trenches in streets point out current collection system construction activities.

The construction of the collection system creates the most apparent impacts. According to municipal officials (PWD officials were unavailable for discussions with the Project Team), the lack of knowledge of and coordination with PWD's planning, design and construction activities created serious negative effects on the city. These include:

- The city was unaware of street closings necessitated by construction; major traffic congestion resulted.
- Open trenches for long stretches in streets (despite the city's requests to limit ongoing construction activities to 20 meters) could result in soil erosion causing dust and affecting the ability to meet suspended particulates standards. Few warning signs alerting vehicles and pedestrians to the location of the trenches were observed.
- Construction on some streets restricted access to business, educational and residential properties "almost bankrupting some businesses".
- Public parks, parking lots, and undeveloped land were used as staging areas for equipment, materials and soil.
- Streets that had previously been reconstructed for the drainage improvements were excavated, in some cases, just six months after the city's project had been completed.
- There was a lack of compatibility among the drainage, water supply and wastewater collection systems that cause additional disruption and restricted future modifications.

5.4 Significant Issues Related to the Wastewater System Development

The Project Team did not have the opportunity to meet with PWD officials or review their project documents (except for detailed design drawings given to the city). Despite this limitation the following issues appear to be significant:

- The new wastewater collection and treatment system will ultimately result in a net environmental improvement. The site selected offers the most advantages of the two considered. The design of the treatment plant is appropriate to the financial and technical resources available. It can accommodate future growth and changing environmental standards.

- Visual inspection (at a distance) of the site seems to indicate that there are natural features and, in all likelihood, unique habitats for birds, fish, plants and flowers. These issues may have been considered in the PWD's Initial Environmental Examination.

- The apparent lack of coordination between the city and PWD has resulted in a direct negative impact on the community during interceptor sewer construction.

- Uncertainty of operation and maintenance costs and absence of any mechanism to raise revenues creates both a financial and political burden on the city and its officials.

5.5 Implications for Wastewater Management in Thailand

Although we recognize and acknowledge the limitations of this analysis (i.e., one case study, three days of investigation, one site visit, the unavailability of PWD personnel and documents), the Ubon situation may provide some useful lessons in other attempts to develop new wastewater management systems. These include:

- There is a need to coordinate national environmental improvement programs and projects with the cities and provinces in which such development will occur. Jointly developed "action plans" can significantly reduce the effects of compatibility with other urban infrastructure activities and minimize disruptions to the community.

- Financial impacts that result from operation and maintenance costs for urban infrastructure projects should be identified and communicated to local and provincial officials during the planning process.

- The availability of land (i.e., size, location, cost) can determine the nature and extent of wastewater treatment technology. Less land means more costly mechanical processing and treatment.

- No national standards currently exist for wastewater treatment. Class A standards that are used to regulate other large-scale development projects should be applied to wastewater treatment plants.

- The PWD's efforts to engage and compensate affected residents represents a significant step towards securing public support and facilitating project implementation.

- Wastewater management systems should be required to have an Environmental Impact Assessment conducted not only to measure the effects of the projects, but as a management tool to assist local, provincial and national government agencies in the development of "action plans" to offset environmental and other community impacts.

UBON RATCHATHANI WASTEWATER COLLECTION SYSTEM
CONSTRUCTION IMPACTS

UBON RATCHATHANI WASTEWATER COLLECTION SYSTEM
CONSTRUCTION IMPACTS

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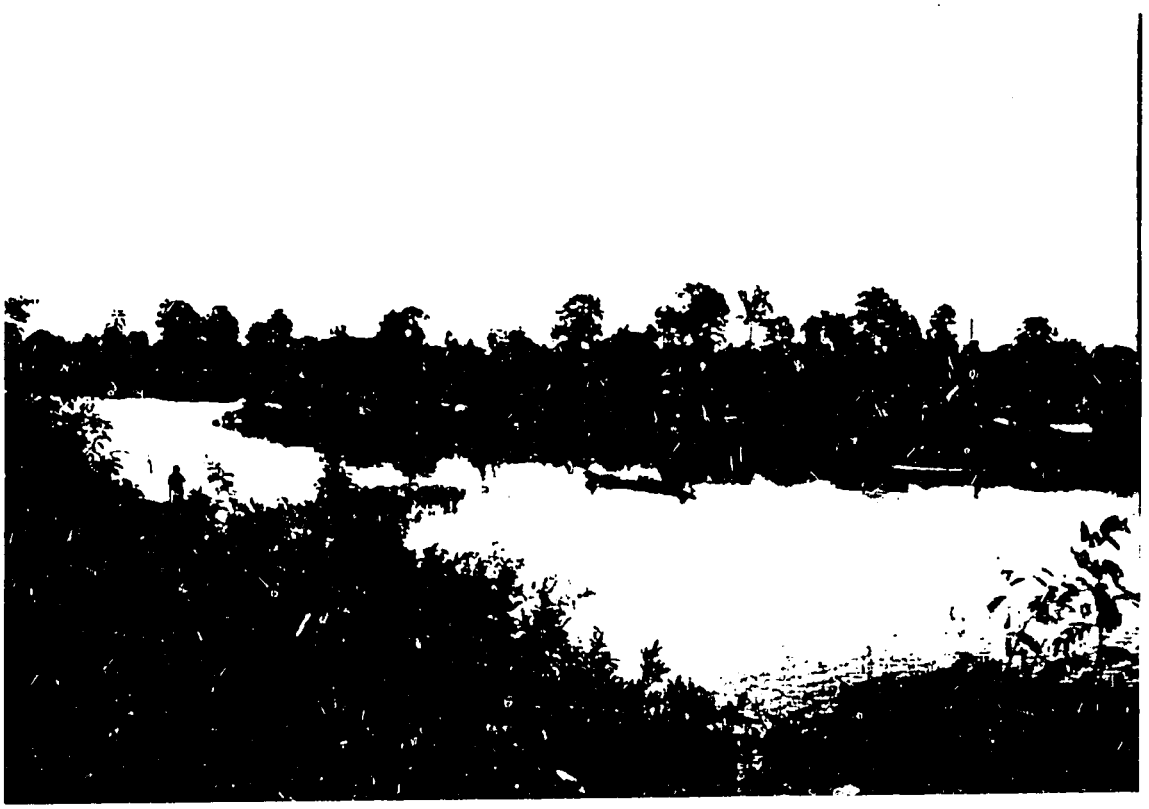
UBON RATCHATHANI WASTEWATER TREATMENT PLANT SITE SEEN FROM ADJACENT SHORELINE



UBON RATCHATHANI WASTEWATER TREATMENT PLANT SITE UNIQUE HABITATS AND FISHING ACTIVITY

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APPENDIX 1

Schedule of Activities

ENVIRONMENTAL IMPACT ASSESSMENT TEAM

Mr. Joel P. Epstein
Mr. Denny Cruz
Ms. Mary C. Harris

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			November 30 1300 Meet with USAID staff	*December 1* 0800 Meet with EIA Team	*December 2* 0930 Meet with OEPP 1400 Meet with HED Nonthaburi Municipality	*December 3*
December 4 EIA presentation preparation	*December 5* Thai Holiday (H.M. the King's Birthday)	*December 6* 0800 Meet with USAID staff 1000 Meet with PWD, OEPP, PCD, et al. at OEPP	*December 7* 0900 Meet with EHD staff Nonthaburi Municipality and visit solid waste site 1430 Meet with Vice Governor of Nonthaburi	*December 8* 0900 Meet with HED staff Nonthaburi Municipality and visit solid waste site	*December 9* Nonthaburi case study preparation	*December 10*

December 11	December 12	December 13	December 14	December 15	December 16	December 17
0710 Leave for Ubon Ratchathani by air	Meet with provincial PW office and Ubon Ratchathani Municipality Visit provincial water supply treatment plant	Meet with Mayor Ubon Ratchathani Municipality Visit city collection system and WWTP site 1940 Leave for Bangkok by air	Preparation of draft report	Preparation of draft report	0800 Debriefing at USAID Director's conference room 1330 Presentation to OEPP and others	
	December 19 0900 Preparation of documents to leave to USAID					

APPENDIX 2

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APPENDIX 3

Introduction of the Project Team and EIA/EIS Case Studies

INTRODUCTION

Joel Epstein, Team Leader, is an environmental planning specialist with more than 20 years experience. At the U. S. Environmental Protection Agency, he prepared environmental impact statements for proposed urban infrastructure projects such as wastewater treatment plants and highways. He coordinated the environmental review of industrial, transportation and other development projects for the Commonwealth of Pennsylvania. As senior advisor with RCG/Hagler Bailly, Inc., he has sited environmental management faciltities in the U.S. and other countries. Mr. Epstein has a Master of Science in city and regional planning.

Denny Cruz has worked for the U.S. Environmental Protection Agency for the past eight years. He is an environmental/chemical engineer with the Office of Water where he provides technical assistance to local governments for the national Safe Drinking Water Act. Previously, he worked for the Office of Solid Waste providing policy guidance and technical expertise in the areas of waste characterization and identification and risk and exposure assessment.

Mary Harris has 23 years of experience in environmental management. With RCG/Hagler Bailly, she works for the Philippine Department of Environment and Natural Resources to develop guidelines for financing environmental investments and expand EIA to programmatic issues. She has worked with ASEAN environmental experts as technical coordinator for the 1992 Megacities on the Pacific Rim Conference on Air Pollution in Jakarta. She is a consultant to the USEPA and Australia's DASET on the environmental impacts of energy, transport and waste facilities. Ms. Harris was the Director of the Environmental Quality Board for the state of Pennsylvania and is currently a director of the U.S. National Wildlife Federation. She holds an MBA in finance and a BS in chemistry and philosophy.

EIS AND THE USEPA

The National Environmental Policy Act (NEPA) requires ALL agencies of the national government to consider the effects of any actions they may take on "man's environment".

Any legislative proposals or "other major actions" of the national government significantly affecting the quality of the human environment must include a "detailed statement by the responsible official" on the environmental impact of the proposed action.

The purpose of the Environmental Impact Statement - or the EIS - is to improve national decisionmaking, avoid or minimize environmental impacts and restore and enhance environmental quality.

The criteria guiding the preparation of an EIS include:

- Any proposal that could adversely affect human health or the environment; such as changing ambient or effluent standards, policies to allow development in a protected area or funding new construction programs.
- An EIS should be prepared at the earliest possible time in the "life" of a project.

The procedures for preparing an EIS include:

- An initial environmental review
- An environmental assessment

The possible outcomes of the review and assessment of EPA actions are:

- Immediate preparation of an environmental impact statement.
- Publish in a public place a "Notice of Intent" to prepare an EIS.
- Report a "Finding of no significant impact" and move ahead with consideration of the project.

Based on national priorities, EIS is initiated when it is found an action affects ambient air, surface water or groundwater quality; the pattern and type of land use; endangered species or wetlands.

How does EPA make EIS work ?

- EPA works closely with local governments
- EPA establishes collaborative relationships with other national agencies with environmental responsibility or expertise
- EPA encourages public involvement at all levels and all stages of project or activity environmental review

ROLE OF EIS IN URBAN PROJECTS IN THE USA

WASTEWATER TREATMENT FACILITIES

All wastewater treatment projects funded by the national government are subject to EIS requirements.

Since 1972 more than 11,000 municipal wastewater treatment projects have received grants from the federal government to install, expand or upgrade wastewater treatment facilities.

Only 2% of these projects required a full Environmental Impact Statement (EIS). The others were determined to have "no significant impact".

The major environmental impacts of wastewater treatment plants include:

- Loss or disturbance of environmentally sensitive areas; such as, floodplains or wetlands, important wildlife habitat, aesthetic or recreational areas, historic or archeaologic sites.

- Stimulated growth ("urban sprawl") in areas unsuitable for dense residential, commercial and industrial development.

- "Cross-media" effects of sludge disposal. Solving one problem may create another of equal proportion through the landfilling or incineration of sludges.

- Damage to groundwater resources; such as, decreasing recharge rates, changing the depth of water saturation and lowering the quality of drinking water from wells.

Three major benefits have resulted from conducting EIS for wastewater facilities:

- Over 70% of the EIS resulted in projects which were more protective of surface water resources than the "original" project.

- More than half resulted in reduced development impacts, typically through changing the planned capacity of the plant and/or the area served.

- In a smaller number projects, environmentally sensitive areas were preserved.

MANASQUAN RIVER WWTP, NEW JERSEY

Description:	Construction of a 12.0 MGD treatment plant and interceptors in a coastal plain experiencing rapid residential growth in high value watershed
Benefits:	"Piggybacked" EIS to speed project implementation and allow orderly growth outside New York metro. Highly desirable home sites at low land cost Local employment in construction & operation
Adverse Effects:	Loss of riverine wetlands and salt marsh. Degradation of high quality surface water. Floodplain encroachment Continued rapid growth
Mitigation Measures:	Reroute interceptors away from floodplain and around wetlands. Reduce capacity to 6 to 8 MGD (smaller service area). Provide dechlorination to protect surface waters.
Public Participation:	One public hearing; 4 open workshops; 4 Information Center meetings and 3 special meetings. An EIS newsletter mailed to all interested people.
Cost/Timing:	Estimated project costs reduced by 26%. Although piggybacked, 14 month delay due to EIS.

ROLE OF URBAN PROJECTS IN THE USA

SOLID WASTE DISPOSAL FACILITIES

The USEPA does not require an EIA for the development of solid waste facilities such as landfills and incinerators.

Landfills and incinerators must meet all national standards for air and water quality.

Local governments (or their private sector contractors) prepare EIAs as part of the feasibility and permitting process.

The reasons for the preparation of EIAs include:

- Identification of the benefits and problems created by the development of a facility
- Development of the most effective and least cost mitigation measures to minimize adverse environmental effects of the facility.
- Provide a mechanism to inform and allow participation of the public to avoid lengthy delays in construction.

NORTHWEST SANITARY LANDFILL, PENNSYLVANIA

Description:	Development of a 42 acre, municipal solid waste landfill at the site of an abandoned coal mine that was filled with trash.
Benefits:	Restoration of abandoned mine filled with trash. Less costly than mine clean-up. Safe solid waste disposal for region (15 years). Employment opportunities.
Adverse Effects:	"new" garbage on top of "old" garbage. Groundwater contamination. Odors/Disease-baring vectors Truck traffic.
Mitigation Measures:	Remove "old" trash, dig trench, 2 liners, leachate collection/treatment. New access road. Chemical foam for daily cover.
Public Participation:	Community meetings. Community Inspector. Community Advisory Committee.
Cost/Timing:	Less cost than mine reclamation and separate landfill development. Project completed in record time.