Annex 4-2: Record of Discussion on May 8, 2005

AMENDMENT TO THE RECORD OF DISCUSSIONS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
WASTEWATER MANAGEMENT AUTHORITY
FOR
"THE PROJECT FOR IMPROVEMENT OF SEWAGE TREATMENT PLANT MANAGEMENT IN THAILAND"

The Project for Improvement of Sewage Treatment Plant Management in Thailand (hereinafter referred to as "the Project") has been implemented in accordance with the Record of Discussion (hereinafter referred to as "R/D") signed on May 25, 2004, between the Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Wastewater Management Authority (hereinafter referred to as "WMA").

According to the R/D, the Master Plan of the Project (hereinafter referred to as "M/P") was required to be modified following the result of the study mission, which visited the Kingdom of Thailand from May 15, 2004 to June 28, 2004. Taking into consideration the result of the study mission, JICA proposed to revise the M/P and other related contents in the R/D.

In response to the proposal, the Joint Coordinating Committee held discussions on the above-mentioned revision on October 19, 2004. As the result of the discussions, the Japanese side and the Thai side agreed to change some parts of the M/P and the other related contents of R/D and recommended to their respective governments the matters referred to in the document attached hereto.

Bangkok, Kingdom of Thailand

Mar. 8, 2005.

Mr. SATO Mikiharu
Resident Representative,
Japan International Cooperation Agency
Thailand Office

Mr. Akanit Ampawasiri
Acting Director General
Wastewater Management Authority
Ministry of Natural Resources and Environment
Kingdom of Thailand

As the result of the Joint Coordinating Committee held on October 19, 2004, the Japanese side and the Thai side agreed the following revision.

1. The Section 2. of the Article I. "COOPERATION BETWEEN BOTH COUNTRIES" is revised to:
   "2. The Project will be implemented in accordance with the Master Plan, which is given in Annex-I."

2. The preamble of the Article II. "MEASURES TO BE TAKEN BY JAPANESE SIDE" is revised to:
   "In accordance with the laws and regulations in force in Japan and the provisions of Article III of Agreement on Technical Cooperation between the Government of Japan and the Government of Thailand signed on November 5, 1981 (hereinafter referred to as "the Agreement") , JICA will take, at its own expense, the following measures under the technical cooperation scheme of Japan. Such privileges and benefits will be provided for the actual implementation of the Project."

3. The Section 2. of the Article IV. "ADMINISTRATION OF THE PROJECT" is revised to:
   "2. Project Manager, assigned in ANNEX-IV, will be responsible for the managerial and technical matters of the Project."

4. The Article V. "TERM OF COOPERATION" is revised to:

   "The duration of technical cooperation for the Project under this Attached Document will be three and a half (3.5) years starting from the May 26, 2004."

5. The Article X. "OTHER" is deleted.

6. The ANNEX-I "MASTER PLAN" is revised as the ANNEX-I attached hereto.

7. The ANNEX-II "LIST OF JAPANESE EXPERTS" is revised as the ANNEX-II attached hereto.

8. The ANNEX-III "LIST OF MACHINERY AND EQUIPMENT" is revised as the ANNEX-III attached hereto.

9. The ANNEX-IV "LIST OF COUNTERPART AND ADMINISTRATIVE PERSONEL" is revised as the ANNEX-IV attached hereto.

10. The ANNEX-VI "PROJECT ORGANIZATION CHART" is revised as the ANNEX-VI attached hereto.

11. The ANNEX-VII "JOINT COORDINATING COMMITTEE" is revised as the ANNEX-VII attached hereto.

LIST OF ANNEX

ANNEX- I

Project Design Matrix (PDM)

Project Name: The Project for Improvement of Sewage Treatment Plant Management in Thailand

Duration: May 26, 2004 to November 25, 2007

Target Area: STPs under WMA management. Target Group: Central and local government officials for wastewater plant management

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Super Goal The water quality of public water bodies is improved. **Overall Goal** Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.	1. Operation and maintenance for STPs is executed appropriately. 2. Quality of effluent from STPs meets the effluent standard in Thailand.	Post evaluation study report.	● New wastewater system construction plan for overall Thailand is formulated.
Project Purpose Efficient and effective operation method of STPs is established.	1-1. STPs under WMA adopt the reference materials for their operation. 1-2. Effluent from STPs under WMA meets the water quality standard in Thailand.	Questionnaire survey (before and after) Project report	● People are willing to pay the sewage charge.
Outputs 1. Function of focused STPs is recovered.	1-1. Unit cost (Baht/m3) is reduced by 20% at focused STPs. 1-2. Treated wastewater is increased by 30% at focused STPs. 1-3. Effluent water quality meets the standard at focused STPs.	1-1. Project report,site survey 1-2. Operation report of each STP 1-3. Operation report of each STP 1-4. Report of effluent water quality	● Sufficient budget for O&M is allocated. ● Both central and local governments practically refer the outputs of the project.
2. Reference materials for improvement of sewage treatment plant management are developed.	2-1. All of the listed necessary reference materials (Activity2-1) is formulated.	2-1. The number of reference materials	
3. Qualified personnel are assigned to operate and maintain STPs appropriately.	3-1. Evaluation of personnel assigned for the focused STPs based on the Qualification standards. 3-2. All of the focused STPs are managed by qualified personnel	3-1. Questionnaire survey 3-2. Site survey	
4. Information system is established to disseminate reference materials and to collect O&M data.	4-1. Reference materials are available through information system on WMA managing STPs. 4-2.O&M data of all of the focused STPs is collected with using information system. (Focused STPs shall be decided after the project started. The number of focused STPs is supposed to three at the initial stage.)	4-1. Questionnaire survey, site survey 4-2. Data printing.	

Activities	Inputs	
1. Function of focused STPs is recovered. 1-1. Review rehabilitation plan of focused STPs 1-2. Support implementation of rehabilitation focused STPs. 1-3. Inspect rehabilitation works 1-4. Operate and maintain rehabilitated STPs. 2. Reference materials for improvement of sewage treatment management are developed. 2-1. List necessary reference materials. 2-2. Examine methodology to develop reference materials. 2-3. Conduct research works for development of reference materials. 2-4. Develop reference materials. 3. Qualified personnel are assigned to operate and maintain STPs appropriately 3-1. Establish qualification standards. 3-2. Prepare training materials. 3-3. Execute training. 4 Information system is established to disseminate reference materials and to collect O&M data. 4-1. Prepare reference materials for dissemination. 4-2. Collect operation and maintenance data report (daily, weekly, monthly, yearly report). 4-3. Collect completion document (construction drawings, plans and specifications, As-build drawings). 4-4. Investigate existing information systems. 4-5. Develop information system modifying existing ones.	Japanese Side Dispatch of Experts: Long-term experts: Chief Advisor/ Sanitary Engineering, Planning/ Design/ Construction, Mechanical/ Electrical Engineering, Coordinator/ Training Short-term experts: STP operation and maintenance, inspections and others Provision of Equipment: Mobile water quality analyzer, flow meter, computer server,etc Training: Counterpart training in Japan Thai Side Personnel: Full time counterpart staff for all the field of activities Part-time counterpart from STPs and local governments Facilities Office for Japanese experts Equipment for STPs Cost: Necessary budget for rehabilitation of STPs Necessary budget for training Necessary budget for O&M of STPs	• Trained personnel continue working for O&M.

ANNEX-II LIST OF JAPANESE EXPERTS

The following Japanese experts will be dispatched.

1. Long-term experts

The long-term experts, who will be in charge of the following fields, will be dispatched according to the PDM:

1) Chief Advisor/ Sanitary Engineering

2) Expert in Planning / Design / Construction on Sewerage System

3) Expert in Mechanical / Electrical Engineering on Sewerage System

4) Coordinator/ Training

1) **Chief Advisor/ Sanitary Engineering**

Assignment title	**Chief Advisor/Sanitary Engineering**
Period of Assignment	Approximately three and a half years from the commencement of the Project
Duty station	WMA

Duties

a) Give necessary guidance and advice on technical and administrative matters concerning the implementation of the Project

b) Take necessary measures to assure the smooth implementation of the Project.

c) Plan in detail the whole plan of the project management.

d) Arrange training program in Japan.

e) Make preparations for the evaluation and monitoring of the Project in cooperation with the Thai side.

Qualifications

a) Age	Over 40 years old
b) Educational Background	Bachelor degree or higher
c) Experience	At least 10 years in the field of wastewater management
d) Language	Fluent in English

2) **Expert in Planning / Design / Construction on Sewerage System**

Assignment title: **Expert in Planning / Design / Construction on Sewerage System**

Period of Assignment Approximately three years from the commencement of the Project

Duty station WMA

Duties

a) Give necessary guidance and advice to counterpart personnel on technical matters of planning / design/ construction for the implementation of the Project.

b) Give necessary guidance and advice to counterpart personnel for the improvement of focused STPs.

c) Give necessary guidance and advice to counterpart personnel for the training.

Qualifications

a) Age	Over 30 years old
b) Educational Background	Bachelor degree or higher
c) Experience	At least 7 years in the field of wastewater engineering
d) Language	Fluent in English

3) **Expert in Mechanical / Electrical Engineering on Sewerage System**

Assignment title: **Expert in Mechanical / Electrical Engineering on Sewerage System**

Period of Assignment Approximately two and half years from the June 2005

Duty station WMA

Duties

a) Give necessary guidance and advice to counterpart personnel on technical matters of mechanical/ electrical engineering for the implementation of the Project.

b) Give necessary guidance and advice to counterpart personnel for the improvement of focused STPs.

c) Give necessary guidance and advice to counterpart personnel for the training.

Qualifications

a) Age	Over 30 years old
b) Educational Background	Bachelor degree or higher
c) Experience	At least 7 years in the field of wastewater engineering
d) Language	Fluent in English

4) **Coordinator/ Training**

Assignment title Coordinator/ Training

Period of Assignment Approximately two and half years

ANNEX-IV LIST OF THAI COUNTERPART

1. Project Director : Mr. Akanit Ampawasiri, Acting Director General of WMA

2. Project Manager : Mr. Supparat Ittiphol, Director of Wastewater Management Department

Deputy Project manager: Ms. Hatairat Likitanupak, Director of Planning and Project Development Department

3. Counterpart Personnel:
   1) Mr. Supparat Ittiphol, Director of Wastewater Management Department
   2) Ms. Hatairat Likitanupak, Director of Planning and Project Development Department
   3) Mr. Chira Wongburana, Chief of Northern Bangkok Wastewater Management Division
   4) Mr. Thanawat Nakornchai, Chief of Statistical and Data Development Division
   5) Mr. Akrawat Wettayavatin, General Administration Officer
   6) Mr. Atirak Bupachanto, Engineer
   7) Mr. Norasingh Karnjanaprakorn, Chief of General Affairs and Board Meetings Division
   8) Ms. Rattana Chuensanao, Chief of Personnel and Employee Relations Division
   9) Ms. Valailak Komolrit, Researcher
   10) Ms. Areewan Paopiamsub, Analyst

4. Other personnel mutually agreed upon as necessary

ANNEX-V LIST OF BUILDINGS AND FACILITIES

The following will be prepared by the Government of Thailand for the implementation of the Project.

1. The land, buildings and facilities necessary for the implementation of the Project, including electricity, water supply and air conditioning facilities.

2. Office space and necessary facilities for the implementation of the Project.

3. Other facilities mutually agreed upon as necessary.

Duty station WMA

Duties

a) Coordinate the project, counterpart personnel and administrative matters concerning the implementation of the Project

b) Plan in detail the whole plan of the project management.

c) Plan and arrange the training programs in Thailand/ Japan.

d) Make preparations for the evaluation and monitoring of the Project in cooperation with the Thai side.

Qualifications

a) Age	Over 35 years old
b) Educational Background	Bachelor degree or higher
c) Experience	At least 2 years in the field of project coordination or at least 5 years in the field of international cooperation works.
d) Language	Excellent in English or Fluent in Thai

2. Short-term experts

In this relation, specific field of short-term experts for the period of the project are listed as shown. The number and the specific field of short-term experts will be determined through the discussion between both sides whenever the necessity arises, which will be reflected to the annual plan of the Project.

Following experts must be expected

1) **Expert in Mechanical / Electrical Engineering**
2) **Expert in Operation and Maintenance**
3) **Expert in Management and Inspection of Construction Works**
4) **Expert in Training**

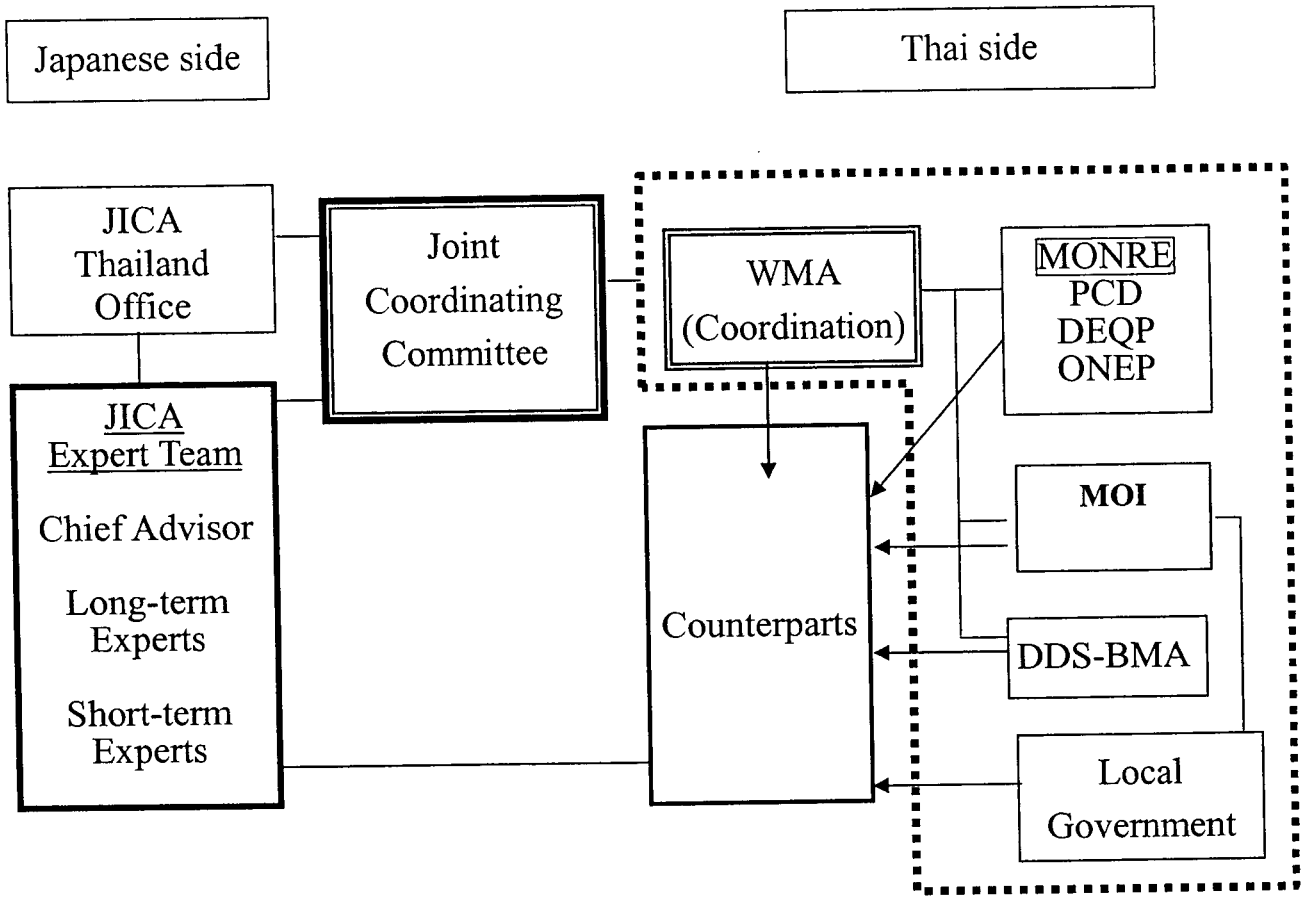
ANNEX-III LIST OF MACHINERY AND EQUIPMENT

1. The following equipment, if necessary for the implementation of the Project, will be provided.
   (1) Equipment for survey for focused STPs, such as a mobile water quality analyzer, a flow meter, etc.
   (2) Equipment for information exchange system, such as a computer server, etc.

The above mentioned equipment is limited to those necessary for the technical cooperation activities by the Japanese experts.

2. Both sides confirmed the following points:
   (1) The equipment should be utilized to achieve the Project purpose.
   (2) The Thai side will take necessary measures for the installation of the equipment, if needed.
   (3) The Thai side will provide the running expenses and consumable supplies for the equipment.
   (4) Contents, specification and quantity of the above mentioned equipment will be decided, each Japanese fiscal year, within the budget allocated for the technical cooperation.

ANNEX-VI PROJECT ORGANIZATION CHART



WMA: Wastewater Management Authority

MONRE: Ministry of Natural Resources and Environment

PCD: Pollution Control Department

DEQP: Department of Environmental Quality Promotion

ONEP: Office of the Natural Resources and Environmental Policy and Planning

MOI: Ministry of Interior

BMA: Bangkok Metropolitan Administration

DDS: Department of Drainage and Sewerage

ANNEX-VII JOINT COORDINATING COMMITTEE

1. Function

The Joint Coordinating Committee will be held at least once a year and whenever necessity arises in order to fulfill the following functions:

(1) To formulate the annual work plan of the Project based on the Plan of Operation within the framework of the Record of Discussions (hereinafter referred to as "the R/D"),

(2) To review the result of the annual work plan and the progress of the technical cooperation,

(3) To review and exchange opinions on major issues that arise during the implementation of the Project.

2. Members of the Committee

Project Director of WMA; Chairperson and Convener

(1) Thai side:

(a) Director of Wastewater Management Department
(b) Director of Planning and project Development Department
(c) Chief of Northern Bangkok Wastewater Management Division
(d) Chief of Statistical and Data Development Division
(e) Representative of Pollution Control Department (PCD)
(f) Representative of Department of Environmental Quality Promotion (DEQP)
(g) Representative of Office of the Natural Resources and Environmental Policy and Planning (ONEP)
(h) Representative of Ministry of Interior (MOI)
(i) Representative of Department of Drainage and Sewerage, Bangkok Metropolitan Administration (DDS-BMA)
(j) Representative of TICA
(k) Personnel connected with the Project to be dispatched by Chairperson, if necessary.

(2) Japanese side:

(a) Long-term experts
(b) Resident Representative of JICA Thailand Office
(c) Personnel connected with the Project to be dispatched by JICA, if necessary.

Note: Official(s) of the Embassy of Japan may attend the Committee sessions as observer(s).

Annex 5: Table of Achievement and Evaluation Grid

Annex 5: Table of Achievement and Evaluation Grid

Table of Achievement
(The Project for Improvement of Sewage Treatment Plant Management in Thailand)

Narrative Summary	Objectively Verifiable Indicators	Achievements
Super Goal The water quality of public water bodies is improved. Overall Goal Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.	1. Operation and maintenance for STPs is executed appropriately.	• By the time of the terminal evaluation, it is not certain yet whether all the STPs in Thailand are executed appropriately or not. However, some actual results were seen in the other STPs under WMA, therefore, continuous efforts will lead to disseminate the efficient and effective operation and maintenance in the future.
	2. Quality of effluent from STPs meets the effluent standard in Thailand.	• Considering the result of the project, quality of effluent from all STPs under WMA was improved and there is no problem at present. Therefore, it is possible to expand the good quality area in Thailand with dissemination of reference materials through the seminars.
Project Purpose Efficient and effective operation method of STPs is established.	1. STPs under WMA adopt the reference materials for their operation.	• By the time of the terminal evaluation, the formulation of 9 reference materials is completed. It is planned to disseminate the technical knowledge of the reference materials to STPs under WMA through the Seminars. And some part of reference materials are reflected on the actual activities such as “Occupational Safety and Health training” at Ta-rae municipality in other STPs under WMA.
	2. Effluent from STPs under WMA meets the water quality standard in Thailand.	• It is confirmed that effluent from all STPs under WMA meets the WMA requirements.

<table>
<tr><th>Narrative Summary</th><th>Objectively Verifiable Indicators</th><th>Achievements</th></tr>
<tr>
<td>Outputs
1. Function of focused STPs is recovered.</td>
<td>1-1 Unit cost (Baht/m^3) is reduced by 20% at focused STPs.</td>
<td>
Pathumthani
<table>
<tr><th></th><th>Base data
(as of May, 2005)</th><th>Actual data
(Average of
May, 2006 – May, 2007)</th><th>Cost reduction</th><th>Indicator required</th></tr>
<tr><td>Total cost</td><td>10.4 baht/m^3</td><td>6.9 baht/m^3</td><td>34%</td><td>20 %</td></tr>
<tr><td>(Electricity cost)</td><td>(3.2 bath/m^3)</td><td>(1.2 baht/m^3)</td><td>(62 %)</td><td></td></tr>
</table>
Source: O&M data from WMA
Factor of cost reduction
• Reviewing the amount of inflow, and one of the two series treatment lines was stopped.
• Electricity for aerator decreased by introducing automatic timer control for operation in accordance with inflow load.

Kamphaeng Phet
<table>
<tr><th></th><th>Base data
(Average of March – April, 2006*)</th><th>Actual data
(Average of
March – April, 2007)</th><th>Cost reduction</th><th>Indicator required</th></tr>
<tr><td>Total cost</td><td>2.4 baht/m^3</td><td>2.2 baht/m^3</td><td>10 %</td><td>20 %</td></tr>
<tr><td>(Electricity cost)</td><td>(0.54 bath/m^3)</td><td>(0.34 baht/m^3)</td><td>37 %</td><td></td></tr>
</table>
*Monthly cost was not available in January and February in 2006
Source: O&M data from WMA
Factor of cost reduction
• By closing the stop valves of the pumps which are not used during the dry season, cost reduction could be obtained.
• It was suggested by the Japanese experts to repair the leakage of check valve. It is expected that the cost reduction will be increased more than 10% after the repair of check valve has been completed.
Constraint of cost reduction
Since stabilization pond has no machinery to use much electricity, there is a limited room of O&M cost reduction.
</td>
</tr>
</table>

<table>
<tr><th>Narrative Summary</th><th>Objectively Verifiable Indicators</th><th>Achievements</th></tr>
<tr><td></td><td>1-2 Treated wastewater is increased by 30% at focused STPs.</td><td>
After the rehabilitation of STP, inflow rate mainly depends on the condition of collection system.
The following 3 factors are under each municipality' operation (beyond control of WMA):
1) The quality of the construction of the existing wastewater collection system
2) The expansion of wastewater collection system.
3) The maintenance of collection system
a) <u>Pathumthani</u>
<table>
<tr><th></th><th>Base data (Average of December 2005 – March 2006*)</th><th>Actual data (Average of February and March 2007**)</th><th>Increase in treated wastewater</th><th>Indicator required</th></tr>
<tr><td>Influent wastewater</td><td>22,001
(16,501)***
m^3/month</td><td>27,578
m^3/month</td><td>25 %
(40 %)***</td><td>30 %</td></tr>
</table>
* The base data month was reviewed to include March as dry season since review was recommended by the mid-term evaluation team.
** The actual data for December and January was not recorded.
*** Average of February and March 2006, as the same period as the actual data
Source: O&M data from WMA
b) <u>Kamphaeng Phet</u>
<table>
<tr><th></th><th>Base data (Average of December 2005 – March 2006*)</th><th>Actual data (Average of December 2006, February and March 2007**)</th><th>Increase in treated wastewater</th><th>Indicator required</th></tr>
<tr><td>Influent wastewater</td><td>90,473
m^3/month</td><td>72,037
m^3/month</td><td>-20 %</td><td>30 %</td></tr>
</table>
* The base data month was reviewed to include March as dry season since review was recommended by the mid-term evaluation team.
** The actual data for January was not recorded.
Source: O&M data from WMA
</td></tr>
</table>

Narrative Summary	Objectively Verifiable Indicators	Achievements
		• This actual data is the result that all influent into STP was pumped up. However the reason of the decrease of influent wastewater might be explained by the reasons shown below. - The average precipitation in the dry season during January-March of 2006 (year of base data: 7.00mm) is higher than that of 2007(year of actual data: 2.10mm). - The seepage of groundwater into the wastewater collection pipelines during the time of setting up "base data" may have caused the higher figure. - The trouble in the automatic screen may have caused the fewer amounts.
	1-3 Effluent water quality meets the standard at focused STPs.	• There is no effluent standard for STPs in Thailand, therefore, WMA adopts "Building Effluents Standards A" and "Industrial Effluent Standards (COD)" as a requirement with O&M contractors. BOD 20℃ (at least twice per week) Maximum 20mg/l COD (daily) Maximum 120mg/l SS (daily) Maximum 30 mg/l pH (daily) in the range of 5-9 Temperature (daily) Maximum 40℃ Note: Over 25 days in 30 days • Effluent from all the focused STPs in JFY2007 meets the requirement, although that of Kamphaeng Phet exceeded in August 2006 because of Algae outbreak.
2. Reference materials for improvement of sewage treatment plant management are developed.	2-1 All of the listed necessary reference materials is formulated.	• For developing the reference materials, the intensive surveys by a local consulting firm under the close supervision of the Japanese experts were carried out. Through the survey, 13 kinds of materials were planed to be formulated. • By discussing at the Joint Coordinating Committee, the number of the reference materials was eventually reduced from 13 to 9 kinds as follows: 1) Analysis of Existing Wastewater Treatment Systems 2) Guide for Wastewater Collection to Sewer System 3) Guideline for Pumping Station Design and O&M 4) Wastewater Treatment System O&M 5) Standards for Quality Control of Construction Works on Wastewater Systems

<table>
<tr><th>Narrative Summary</th><th>Objectively Verifiable Indicators</th><th>Achievements</th></tr>
<tr><td></td><td></td><td>
* This material consists of the following four contents
- General Specifications for Construction Works
- Supervision and Inspection Manual for Construction Works
- Technical Guideline for the Sewage Works
- Technical Document
6) Guideline for Evaluation of Rehabilitation Works
7) Cost Control for O&M of STPs
8) Troubleshooting Examples
9) Safety Manual.
• In the committee, beneficial ideas and suggestions were exchanged by its members jointly organized by the Japanese and Thai sides, related central government organizations - such as PCD and DOLA - and local authorities.
• By the time of the terminal evaluation, 9 reference materials were developed as planned.
</td></tr>
<tr><td>3. Skilled personnel are assigned to operate and maintain the focused STPs appropriately.</td><td>3-1 Personnel assigned for the focused STPs undergo trainings organized by the Project.</td><td>
• The numbers of seminar participants as follows;
<table>
<tr><th rowspan="3">Date</th><th rowspan="3">Contents</th><th rowspan="3"></th><th colspan="7">No. of Attendance</th></tr>
<tr><th rowspan="2">WMA</th><th rowspan="2">PCD/ ONEP</th><th colspan="2">Kamphaeng Phet (SP)</th><th colspan="2">Pathumthani (OD)</th><th rowspan="2">Other municipalities under WMA</th><th rowspan="2">Others municipality not under WMA</th><th rowspan="2">Total</th></tr>
<tr><th>Muni-cipality</th><th>O&M contractor</th><th>Muni-cipality</th><th>O&M contractor</th></tr>
<tr><td rowspan="2">30 Jan – 3 Feb, 2006</td><td rowspan="2">OD system</td><td>A</td><td>18</td><td>0</td><td></td><td></td><td>0*</td><td>2</td><td>3</td><td>5</td><td>28</td></tr>
<tr><td>B</td><td>18</td><td>0</td><td></td><td></td><td>0*</td><td>2</td><td>3</td><td>5</td><td>28</td></tr>
<tr><td rowspan="2">29 – 31 Jan, 2007</td><td rowspan="2">SP system</td><td>A</td><td>17</td><td>2</td><td>0</td><td>2</td><td></td><td></td><td>9</td><td>60</td><td>90</td></tr>
<tr><td>B</td><td>17</td><td>5</td><td>1</td><td>3</td><td></td><td></td><td>10</td><td>84</td><td>120</td></tr>
</table>
Note: A= No. of certified persons, B= No. of participants
* All engineers have joined the seminar as trainers
Source: Attendance lists from the Project
</td></tr>
</table>

Narrative Summary	Objectively Verifiable Indicators	Achievements
		• Since Pathumthani Municipality was selected as onsite training site of OD system, the municipality staffs had to stand-by at the plant to prepare the facility and support the training course. Therefore, it is fair to say that the municipality staffs did not participate in the lecture session but they played high significant role in practical session of the onsite training. • The Project has carried out technical follow-ups to personnel of Pathumthani Municipality afterward. • Monthly onsite trainings and OJTs at focused STPs have been conducted for appropriate operation and maintenance and the major contents are as follows; - Supervising and directing of rehabilitation works, - Automatic controlling aerators and Coarse screen installation - Energy saving operation - O&M of pumping machinery - Methods of daily maintenance and checking machinery • Short term experts have also carried out the trainings and OJT with long term experts. Their contents have been as follows; - O&M of electric system - Estimation method of pump capacity and air amount in aerated pond - Water onsite analysis method, analysis method of electricity consumption - Inventory survey of wastewater from other sources and its methods - Rehabilitation of damaged screen
	3-2 All of the focused STPs are managed by skilled personnel.	According to the interview survey with personnel in charge of the focused STP operations, the significant points in terms of their skills before and after training through the Project activities are summarized as follows: • From the view points of management personnel who have background of wastewater treatment in a certain level, personnel at the focused STPs pointed out that the technical trainings provided by the Project could remind of and strengthen their existing knowledge to be more utilized at present. • From the view points of operational personnel, they pointed that the some useful experiences and information from the experts for O&M of STP were shared and applied to their works. Although, the operation personnel trained by the Project have been transferred from both focused STPs, technical training provided by the Project was useful.

Narrative Summary	Objectively Verifiable Indicators	Achievements
4. Information system is established to disseminate reference materials and to collect O&M data.	4-1 Reference materials are available through information system on WMA managing STPs.	• The following 3 materials are available on WMA's web site in English version. - Analysis of existing wastewater systems - Guideline for wastewater collection to the sewer system - Pumping station design and O&M • All the 9 kinds of the reference materials in Thai are scheduled to be available on WMA's web site by the termination of the Project.
	4-2 O&M data of all of the focused STPs is collected with using information system.	• The past O&M data from most STPs under WMA were submitted to WMA as digital data base. • WMA is now preparing a general format for O&M data. • By the Project termination, summarized O&M data can be provided to STPs under WMA.

Evaluation Grid

(Terminal Evaluation / The Project for Improvement of Sewage Treatment Plant Management in Thailand)

Relevance

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
Does the Project match the needs of Thailand?	Does the overall project goal coincide with the Thai national policies?	Analyze the current policies, social situation and existing documents on the wastewater plant management together with opinions from C/P organization/ personnel	National Policy and Plan for Environmental Quality Promotion and Conservation B.E. 2540-2559 (A.D. 1997-2016) Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand Other related documents	The "National Policy and Plan for Environmental Quality Promotion and Conservation 1999-2016" formulated by the Office of Environmental Policy and Planning (OEPP) and ordained by the National Environment Board in 1997 has covered various environmental issues over two decades since its formulation. Under the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand, the Wastewater Treatment Authority (WMA) has been assigned as the agency to implement the Thai sewer policies. The expansion of WMA's responsibilities and opportunities since the revision of the Royal Decree in 2005 has required them, as a state-owned enterprise, to provide technical support to local authorities for sufficient operation of STPs.

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
Are the selections of C/P organization for the project appropriate?	Are there any other institutes/ organizations which should correspond to domestic wastewater management in Thailand?		WMA's policy WMA's 4 year operation plan 2008-2011	WMA, a state-owned enterprise, provides supports local authorities for the sound operation of STPs. After the revision of the Royal Decree in 2005, the service are of WMA was expanded to the whole country with regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can expand the Wastewater Management Area it self by processing to the Cabinet. Under these circumstances, fostering of skilled personnel of WMA is urgently needed.

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
Is the project in line with Japan's ODA policy and JICA's country programs?	Is the project in line with Japan's ODA policy?		Japan's ODA policy	Improvement of environmental quality is one of the main schemes of Japan's ODA. The Japanese government has been emphasizing the actions of (1) efforts to address global warming, (2) pollution control including water pollution, (3) fresh water issues and (4) conservation of the natural environment, since the formulation of the "Environmental Conservation Initiative for Sustainable Development" in 1997. Japan issued its new ODA Charter in August 2003 stating that issues on human security, including issues on health care and infectious diseases which shares causality with wastewater treatment conditions, should be considered more closely and individually. Furthermore, this project utilizes self-effort activities to promote sustainable technical skills and knowledge transfer, which is also in accordance with the ODA basic scheme.
	In the project line with JICA programs?		JICA's country programs	At present, JICA enacts its aid programs in Thailand with a focus on alleviating urban problems and improving environmental health for sustainable development defined as one of the focused priority fields. In terms of current field-specific issues, JICA also puts a strong emphasis on environmental management to assist in developing measures against water pollution caused by insufficient sewage control.

Effectiveness

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
Is the project purpose sufficient for wastewater management in Thailand?	Is the set up of the project purpose appropriate in accordance with the nature of WMA and local authorities?	Analyze the present status of WMA and existing documents on the sewage management together with opinions from C/P organization/ personnel.	MONRE, PCD and WMA policies Related documents Comments from Japanese experts	The result of assessment suggests that the degree of their realization would be considerably high when the reference materials are disseminated through the seminar/ workshops conducted by the Project. Besides, the relevance of the important assumption is confirmed as effective as before.
Has the project purpose been achieved?	To what extent has the Project purpose been achieved?		Comments from C/Ps	The result of assessment suggests that the degree of their realization would be considerably high when the reference materials are disseminated through the seminar/ workshops conducted by the Project. Besides, the relevance of the important assumption is confirmed as effective as before. Based on PDM, the Project purpose would be achieved to a certain level by the time of the Project termination.

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
	Have the STPs under WMA's control adopted the reference materials provided by the Project for their operation?			By the time of the terminal evaluation, the formulation of 9 reference materials is completed. It is planned to disseminate the technical knowledge of the reference materials to STPs under WMA through the Seminars carried out by Japanese experts. And some part of reference materials reflected the actual activities such as "Occupational Safety and Health training" at Ta-rae Municipality in other STPs under WMA.
	Has effluent from STPs under WMA met the water quality standard in Thailand?			The data of the water quality analysis is available for 11 municipalities of total 12 municipalities. In these 11 municipalities, effluent from STPs meets WMA requirements.

Efficiency

Evaluation Questions		Criteria and Method for Judgment	Required Data	
Main Questions	Sub-Questions			
What have the factors inhibiting or promoting to the efficiency of the project implementation process been?	Has the number of dispatched Japanese experts been appropriate for the activities of the project?	Survey and verify WMA's activities	List of Japanese experts Activity records Comments from C/P	A total of six long-term experts and seven short-term experts have been dispatched since the Project commencement until the present appropriately.
	Have the timing, dispatch term and technical capacity of dispatched Japanese experts been appropriate for the activities of the project?			Most answers to the questionnaire survey say that the timing, dispatch term and technical capacity of the Japanese experts have been appropriately.
	Has the equipment been provided originally?	Survey and verify WMA's activities	List of equipment Comments from C/P	Equipment has been provided for the Project as originally planned.
Have the project outputs been achieved?	Have the functions of focused STPs been recovered from the viewpoints of effective and efficient operational management?	Analyze the present performance of WMA and local government and existing reports together with opinions from C/P organization/ personnel.	Existing operation and effluent water quality reports Project activity records Comments from Japanese experts Comments from C/Ps	Total cost at the focused STP in Pathumthani reduced to 34 % Total cost at the focused STP in Kamphaeng Phet reduced to 10% Influent wastewater at the focused STP in Pathumthani increased to 25% Influent wastewater at the focused STP in Kamphaeng Phet increased to -20% Effluent from all the focused STPs JFY2007 meets the requirement, although that of Kamphaeng Phet exceeded in August 2006 because of Algae outbreak.

Evaluation Questions		Criteria and Method for Judgment	Required Data	
Main Questions	Sub-Questions			
	Have reference materials for improvement of sewage treatment plant management been developed?		List and contents of the reference materials Summary information of the reference material committee Comments from Japanese experts Comments from C/Ps	9 reference materials were developed.
	Have skilled personnel been assigned to operate and maintain the focused STPs appropriately?		Operation information at the focused STPs Comments from Japanese experts Comments from C/Ps	Skilled personnel are assigned to operate and maintain the focused STPs appropriately.
	Has information system been established to disseminate reference materials and to collect O&M data?		Activity records List and contents of reference materials Comments from Japanese experts Comments from C/Ps	Information system will be established to disseminate the reference materials to collect O&M data by the time of the Project termination.

Impact

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
Does the project have any prospects to achieve the overall goal of the project?	Is the new wastewater system construction plan for overall Thailand formulated?	Analyze the present status of WMA and existing documents on wastewater management together with opinions from C/P organization/ personnel.	"Rehabilitation and Improvement Plan for Municipal Waster water Collection and Wastewater Treatment System for Overall Thailand" Comments from Japanese experts Comments from C/P and other organizations concerned	According to the "Rehabilitation Plan" released by PCD, 46 units of STPs are planed to be rehabilitated by 2009. Referring to the Rehabilitation Plan, WMA as a part of implementing agency under this plan was assigned to responsible for 12 STPs while the remaining STPs are taken charge by PCD. It was expected that after the termination of this plan, all STPs over Thailand are operated efficiently and effectively as aimed.
Have there been any unexpected positive or negative influences including ripple effects on the project?	Have the improvement of WMA performance influenced the formation of related policies, regulations or legal system on domestic wastewater management?		Comments from C/P National policies on wastewater management Existing documents	Referring to the result of interview survey, the financial burden in terms of budget allocation from the government is a hindering factor to the achievement of Overall Goal.
Have there been any unexpected positive or negative influences including ripple effects on the project? Are there any specific impacts observed, either positive or negative changes by the project?	What have been the trends in the resident opinions and/or complaints against the sewage treatment operation?			<u>Kamphaeng Phet Municipality:</u> 90 % of people including community leaders/people, comercial sectors and government bodies agree with wastewater treatment fee collection according to public opinion surveys, though there are some conditional opinions such as desirable fee at 50 baht/month and postponement of its start.

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
				A public hearing for related regulations will be held in August 2007. Then, the fee collection system may be started from the next fiscal year if all goes as planned. <u>Pathumthani Municipality:</u> There is no plan to conduct public opinion survey on this matter since the municipality considers that the central government should take responsibility to raise people awareness and persuade them to pay the sewage charge.

Sustainability

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
Are the expected effects described in both the project purpose and the overall goal going to be sustained after the termination of assistance?	What type of capacity does WMA have sufficient in order to carry out the activities after the termination of the project? Human resource, Financial stability, or Institutional framework.		WMA's 4 year operation plan (2008-2011) WMA's revenue and expenditure information WMA annual report Comments from Japanese experts Comments from C/Ps	Although there have been personal charges in Thai side, the core members of C/Ps have not been changed since the Project commencement. According to interview surveys, WMA plans to increase the number of its employees constantly. According to 4 year operation Plan (2008-2011) approved by WMA board, it plans to increase the number of STPs under WMA and their effluents based on the request from the local governments; This plan is supported by MONRE, DOLA and MOF in the WMA promotion seminar on 7th June, 2007. There are worries whether WMA will be able to secure sufficient number of skilled persons for efficient and effective operation of STPs according to the plan.
	Are all developed techniques still effective/ conducted/ progressed since the project termination?			The reference materials are translated into Thai. The Thai materials will be able to utilized, applied and renewed widely by the Thai side with times.

Evaluation Questions		Criteria and Method for Judgment	Required Data	Result
Main Questions	Sub-Questions			
	Are there any continuations of training sessions by using reference materials provided by the project?			After the translation of the reference materials into Thai, the reference materials plan to be introduced to all STPs under WMA through technical seminars in September and October 2007. After the seminars with the materials, they are predicted to be practically referred by central and local governments.
	Are the water quality measurement equipment of the Training Center for Sewage Works (TCSW) Project transferred from the Public Works Department still utilized well?			With equipment provided for a former JICA' s Training Center for Sewage Works (TCSW) project, the Project has started analyzing quality of water collected from the whole country's STPs in Thailand.
Can the Project bring sufficient sustainability to WMA in the future?	What expectations, desires and necessities are WMA required for the future sewage works from local authorities and other organizations concerned?	Analyze the future plan of WMA and existing documents for the future on the wastewater management together with opinions from C/P organization/ personnel.	WMA's 4 year operational plan and existing documents Comments from Japanese experts Comments from C/P and other organizations concerned	The service area of WMA has been expanded to the whole country for O&M and wastewater treatment fee collection since the Royal Decree's revision in 2005. Since the revision, WMA has also redefined and expanded the wastewater management area by proposing to the cabinet.
	At present, to what extent can WMA deal with these expectation, desires and necessities for the future suitability?			The project has identified many requests from the municipalities for the technical consultation. This proves that WMA consultation is reliable at the present.

Annex 6: List of Dispatch of Japanese Experts

Annex 6: List of Dispacth of Japanese Experts

		Japanese Fiscal Year		2004												2005												2006												2007											
		TITLE	NAME	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
JICA EXPERT DISPATCH	LONG TERM	1) Chief advisor／Sanitary engineering	Mr. Tanaka Shuji	04/05/26																								06/03/31																							
		2) Chief advisor	Mr. Takahashi Haruki																									06/04/04																							
		3) Desing/Planning/Conctruction on sewage	Mr. Tanaka Matsuo	04/05/26																									06/05/26																						
		4) Desing/Planning/Conctruction on sewage	Mr. Nishi Shu																									06/05/21																							
		5) Electric & machinery engineering	Mr. Nakamura Nagahide										05/07/04																06/07/04																							
		6) Project coordinator/ Training	Mr. Usui Tetsuro										05/05/25																																						
	SHORT TERM	1) O&M Electric engineering	Mr. Matsumoto Nobuyuki										04/11/23-05/01/21																																						
		2) O&M Electric engineering	Mr. Kuramochi Akito																05/06/02-07/31																																	
		3) Training sewage works	Ms. Fujii Yuko																					05/10/31-12/29																											
		4) O&M Mechanical engineering	Mr. Sakaguchi Kazuhisa																					05/11/21-06/01/14																											
		5) Training instructor for discharge to sewer pipe and public water body	Mr. Uchimura Yutaka																												06/07/03-09/15																				
		6) Quality control by specification and inspection on rehabilitation works	Mr. Kanai Shigeo																													06/09/27-12/15																			
		7) O&M Preventive maintenance and management for equipment	Mr. Komura Yutaka																													06/10/02-11/30																		

Annex 7: List of Equipment by Japanese side

Annex 7: List of Equipment by Japanese side

No	Item	Product	Date	Quantity	Amount	Location	Purchase	Disposal	Exist	Usage	Maintenance	Management
1	Desktop Computer	HP Pa 718	04/07/12	1	B31,993	Project	Local	0	1	A	A	A
2	Notebook Computer	IBM Thinkpad R50e	04/07/20	2	B162,857	Project	Japan	0	1	A	A	A
3	Laser Printer	Canon LBP 3800	04/07/20	1	B63,571	Project	Japan	0	1	A	A	A
4	Flow Meter	ISCO 4210	04/08/17	1	B465,357	Project	Japan	0	1	A	A	A
5	Portable Dissolved Oxygen Meter	SENSIO N6	04/09/16	1	B80,357	Project	Japan	0	1	A	A	A
6	COD Reactor	HACH DRB 300	04/09/16	1	B77,857	Project	Japan	0	1	A	A	A
7	Portable Spectrophoto Meter	HACH DRB 2400	04/09/16	1	B311,429	Project	Japan	0	1	A	A	A
8	Desktop Computer	HP Pa 718	04/09/30	1	B31,993	Project	Local	0	1	A	A	A
9	Printer	Brother HL5170DN	04/12/23	1	B19,940	Project	Local	0	1	A	A	A
10	Desktop Computer	HP Pav a1052L	05/06/01	1	B36,166	Project	Local	0	1	A	A	A
11	Printer	HP Lase Jet 1020	05/06/01	1	B7,090	Project	Local	0	1	A	A	A
12	FAX	HP Lase Jet 3030	05/07/19	1	B19,790	Project	Local	0	1	A	A	A
13	Digital Video	SONY DVD653	05/12/23	1	B29,990	Project	Local	0	1	A	A	A
14	Digital Camera	SONY Cybershot n1	05/12/23	1	B21,990	Project	Local	0	1	A	A	A
15	VDO signal capture	Pinnacle Studio plus10	05/12/23	1	B11,200	Project	Local	0	1	A	A	A
16	KVM switch	IOGEA 8	05/12/27	1	B17,013	Project	Local	0	1	A	A	A
17	Proxy Server	HP Compaq ML350G4P	06/03/15	1	B283,500	Project	Local	0	1	A	A	A
18	Wireless Network	CISCO Air-Ap1121G-E-K9	06/03/15	1	B64,000	Project	Local	0	1	A	A	A
19	Notebook Computer	HP Compaq Presario B1809TU	06/03/15	1	B62,500	Project	Local	0	1	A	A	A
20	Laser Printer	HP Compaq 2420dn	06/03/15	1	B38,400	Project	Local	0	1	A	A	A
21	Scanner	RICHO Africo IS330DC	06/03/15	1	B176,000	Project	Local	0	1	A	A	A
22	24 Ports Switching	3COM Super Stack3, 4228G	06/03/15	1	B14,500	Project	Local	0	1	A	A	A
23	Color Laser Printer	HP Compaq 5550dn	06/03/15	1	B135,000	Project	Local	0	1	A	A	A
24	UPS	SOCOMEC EGYS-SE2000	06/03/15	1	B18,500	Project	Local	0	1	A	A	A

Annex 8: List of C/P Personnel Trained in Japan

Annex 8: List of Counterpart Personnel Trained in Japan

		JFY	2004	2005	2006	2007	
		Month		4 7 10 01	4 7 10 01	4 7 10 01	Total
	Name	Subject					
C/P Training in Japan	1, Mr. Akanit Ampawasiri Acting Director General	Management of Organization		━ 05/08-05/21 MLIT, JS			
	2, Mr. Supparat Ittipol Director, Project Manager	Management of Organization		━ 05/08-05/21 MLIT, JS			
	3, Mr. Phanthouch Chuncharoensoo Drawing Technician	Sewage works engineering & Stormwater drainage technology		━ 08/30-12/10, JICA, Group Training			
	4, Mr. Atilak Bupachanto Engineer	Sewage works engineering & Stormwater drainage technology		━ 08/30-12/10, JICA, Group Training			
	5, Ms. DuangjaiKhankruer Technical / Monitor & Operation	Sewage works engineering & Stormwater drainage technology			━ 08/29-12/09, JICA, Group Training		

Annex 9: List of C/P Distribution

Annex 9: List of Counterpart Distribution

	No	Name	Year / Month	2004 (4 7 10 1 3)	2005 (4 7 10 1 3)	2006 (4 7 10 1 3)	2007 (4 7 10 1 3)	Distribution Status	C/P Training in Japan
Counterpart Member	1	Mr. Akanit Ampawasiri						Full time	May 2 - May 31, 2005
	2	Mr. Suchai Janepojanat						Full time	
	3	Mr. Sarawut Srisakuna						Full time	
	4	Mr. Kitti Teerasoradech						Full time	
	5	Mr. Suppamit Yuvatana						Full time	
	6	Mr. Sombat Paneiam						Full time	
	7	Mr. Kitti Uyakul						Full time	
	8	Mr. Supparat Ittipol						Full time	May 2 - May 31, 2005
	9	Ms. Hatarirat Likitanupak						Full time	
	10	Mr. Norrasign Karnchanaprakorn						Full time	
	11	Ms. Rattana Chensanao						Full time	
	12	Mr. Chira Wongburana						Full time	
	13	Mr. Thanawat Nakornchai						Full time	
	14	Mr. Akrawat Wettayavatin						Full time	
	15	Mr. Atirak Bupachanto						Full time	August 30 - December 10, 2005
	16	Ms. Valailak Komolrit						Full time	
	17	Ms. Areewan Paopiamsub						Full time	
	18	Mr. Phanthat Chancharoensook						Full time	August 30 - December 10, 2005
	19	Mr. Phanithan Meechaiyo						Full time	
	20	Ms. Duangjai Khankruer						Full time	August 29 - December 9, 2006
	21	Mr. Kitti Teerasoradech						Full time	
	22	Mr. Supamit Yuwattana						Full time	
	23	Ms. Rosita Laosakul						Full time	
	24	Mr. Puwanart Kreangmesri						Full time	
	25	Mr. Paisarn Taetama						Full time	
	26	Mr. Somkiet Sangchaisukontakit						Full time	
	27	Mr. Kampanart Tanasadtakorn						Full time	

Annex 10: Average Precipitation Data in 2005-2007

Annex 10: Average Precipitation Data in 2005-2007

STATION: KHAMPANGPHET (48380)

Precipitation Data

Year: 2005 unit: mm

Date	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	10.3	0.0	5.2	2.9	0.0	0.0	0.0
2	0.0	0.0	0.0	5.1	0.0	0.2	T	1.8	1.4	0.0	0.0	0.0
3	0.0	0.0	0.0	117.2	0.0	0.0	0.2	2.6	0.1	0.2	1.2	0.0
4	0.0	3.0	0.0	0.4	0.2	0.2	4.3	0.1	T	17.4	49.9	0.0
5	0.0	4.8	0.0	0.7	0.0	1.7	0.0	0.7	0.0	11.5	9.1	0.0
6	0.0	0.4	0.0	0.0	0.0	12.4	3.5	0.0	T	0.4	0.0	0.0
7	0.0	0.0	0.0	0.0	T	0.0	0.0	0.0	6.2	T	8.5	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.2	14.8	4.5	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	5.8	0.0	T	36.6	2.6	T	0.0
10	0.0	0.0	0.0	0.0	0.0	15.4	0.0	T	T	0.0	4.8	0.0
11	0.0	0.0	0.0	0.0	0.0	12.0	4.0	1.1	15.7	0.0	T	0.0
12	0.0	0.0	0.0	0.0	31.2	0.0	1.2	0.2	19.0	1.1	0.0	0.0
13	0.0	5.0	0.0	0.0	T	0.7	29.2	5.6	4.7	2.4	0.0	0.0
14	0.0	0.0	4.3	0.0	0.2	12.6	0.0	0.0	39.0	35.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	4.7	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	11.7	0.0	0.9	29.8	T	1.4	0.0
17	0.0	0.0	0.0	0.0	0.0	31.0	0.0	0.6	0.2	0.0	45.6	0.0
18	0.0	0.0	0.0	0.0	0.0	6.8	2.6	16.4	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	67.9	0.0	5.2	5.6	T	2.4	0.0
20	0.0	0.0	0.0	0.0	0.9	20.3	8.0	0.4	25.5	0.0	0.0	0.0
21	0.0	0.0	T	0.0	0.0	34.3	43.8	1.6	0.4	0.0	0.0	0.0
22	0.0	T	0.0	0.0	T	9.2	8.7	0.1	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	9.8	0.9	0.0	2.0	0.0	0.0	0.0
24	0.0	0.0	3.4	0.0	0.0	2.7	11.0	0.0	0.6	0.0	0.0	0.0
25	0.0	0.0	1.1	0.0	T	0.0	0.9	0.0	0.0	17.9	0.0	0.0
26	0.0	0.0	0.0	0.2	0.0	T	8.7	0.0	0.0	5.0	0.0	0.4
27	0.0	0.0	0.0	0.0	0.0	7.5	0.0	7.5	0.0	0.8	0.0	T
28	0.0	0.0	0.0	0.0	0.0	0.8	28.8	0.0	9.1	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	48.1	0.0	0.0	0.0
30	0.0		0.0	0.9	2.2	0.0	0.2	0.0	0.0	0.0		0.0
31	0.0		0.0		10.1			3.4		0.0		0.0
Total	0.0	13.2	8.8	124.5	44.8	273.3	160.7	53.8	266.4	98.8	122.9	0.4
Days	0	4	3	6	6	21	17	19	20	12	8	1
Max.	0.0	5.0	4.3	117.2	31.2	67.9	43.8	16.4	48.1	35.0	49.9	0.4

Amount of annual precipitation: 1167.6 mm

Day of precipitation per year: 117 days

Maximum precipitation: 117.2 mm on April 3, 2005

Remark: Amount of daily precipitation is collected during 07.00-07.00;
T means precipitation data < 0.1 mm; "-" means no data

STATION: KHAMPANGPHET (48380)

Precipitation Data

Year: 2006 unit: mm

Date	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	12.6	0.0	3.2	1.4	25.7	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	2.4	0.7	1.8	44.9	3.8	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	4.7	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	T	3.0	0.0	0.0	0.2	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.0	2.6	0.0	0.0	0.0
7	0.0	0.0	0.0	0.8	T	19.6	T	0.0	0.0	6.8	0.0	0.0
8	0.0	0.0	0.0	0.0	T	6.7	2.7	14.1	T	0.3	0.0	0.0
9	0.0	0.0	0.0	0.0	T	1.7	7.0	4.1	3.6	1.2	0.0	0.0
10	0.0	0.0	0.0	0.0	2.0	5.5	T	T	0	8.6	5.3	0.0
11	0.0	0.0	0.0	0.0	4.5	0.0	16.4	T	15.3	28.3	0.0	0.0
12	0.0	0.3	0.0	0.0	0.0	2.2	3.6	0.0	31.0	33.0	0.0	0.0
13	0.0	0.0	T	0.0	0.0	17.1	0.0	0.0	4.7	1.5	0.0	0.0
14	0.0	0.0	0.0	T	0.0	0.0	18.2	11.2	0.1	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	76.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	T	0.0	0.0	7.6	0.0	8.3	2.1	10.0	0.0	0.0	0.0
17	0.0	0.0	0.0	7.0	T	0.0	12.1	0.2	1.7	12.7	0.0	0.0
18	0.0	0.0	0.0	0.0	4.2	1.0	5.9	0.0	4.6	0.0	0.0	0.0
19	0.0	11.7	T	T	15.3	31.4	0.6	0.5	8.0	0.0	0.0	0.0
20	0.0	2.1	0.0	0.0	53.2	7.4	4.1	0.0	0.7	0.0	0.0	0.0
21	0.0	0.1	0.0	8.0	33.8	5.8	0.0	26.4	4.0	7.8	0.0	0.0
22	0.0	0.0	4.5	T	11.3	0.0	0.0	0.6	22.3	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.5	44.2	0.0	0.3	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	30.0	11.9	0.0	0.2	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.9	23.4	15.6	49.7	8.8	0.0	0.0	0.0
26	0.0	0.0	0.0	T	4.1	17.0	1.3	28.4	47.5	0.0	0.0	0.0
27	0.0	0.0	0.0	5.8	3.8	4.1	1.0	5.0	18.8	0.0	0.0	0.0
28	0.0	0.0	0.0	16.0	8.0	0.2	0.0	0.0	1.8	0.0	0.0	0.0
29	0.0		0.0	0.5	4.3	1.6	22.3	6.6	1.7	0.0	0.0	0.0
30	0.0		2.3	5.2	4.4	3.1	0.5	25.7	6.7	0.0	0.0	0.0
31	0.0		0.0		14.4		0.5	1.9		0.0		0.0
Total	0.0	14.2	6.8	73.3	273.3	195.3	135.7	180.3	264.5	108.9	5.3	0.0
Days	0	4	2	8	19	20	22	18	21	12	1	0
Max.	0.0	11.7	4.5	30.0	76.5	44.2	22.3	49.7	47.5	33.0	5.3	0.0

Amount of annual precipitation: 1257.6 mm

Day of precipitation per year: 127 days

Maximum precipitation: 76.5 mm on May 15, 2006

Remark: Amount of daily precipitation is collected during 07.00-07.00;
T means precipitation data < 0.1 mm; "-" means no data

STATION: KHAMPANGPHET (48380)

Precipitation Data

Year: 2007 unit: mm

Date	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.2	0.0	6.7	0.0					
2	0.0	0.0	0.0	0.0	33.4	1.1	0.6					
3	0.0	0.0	0.0	0.0	6.4	8.6	6.9					
4	0.0	0.0	0.0	1.9	16.2	0.0	8.7					
5	0.0	0.0	0.0	0.0	23.0	46.0	T					
6	0.0	0.0	0.0	0.0	29.9	2.0	0.0					
7	0.0	0.0	0.0	0.0	16.7	0.4	0.0					
8	0.0	0.0	0.0	5.5	0.0	4.2	13.1					
9	0.0	0.0	0.0	0.0	34.8	0.0	0.5					
10	0.0	0.0	0.0	0.0	15.6	0.0	2.5					
11	0.0	0.0	0.0	2.9	T	4.2						
12	0.0	T	0.0	0.0	22.8	0.3						
13	0.0	0.0	0.0	0.0	26.4	1.9						
14	0.0	2.0	0.0	0.6	7.3	1.2						
15	0.0	0.0	0.0	4.5	0.8	0.0						
16	0.0	0.0	0.0	3.5	0.5	0.0						
17	0.0	0.0	0.0	0.0	14.8	2.7						
18	0.0	0.0	0.0	0.0	0.0	14.2						
19	0.0	0.0	0.0	0.0	0.0	19.8						
20	0.0	0.0	T	0.6	1.3	17.6						
21	0.0	0.0	0.0	0.0	1.0	1.1						
22	0.0	0.0	0.0	0.0	0.0	0.0						
23	0.2	0.0	0.0	0.0	0.0	0.0						
24	0.0	0.0	0.0	0.0	0.0	0.0						
25	0.0	0.0	0.0	2.7	0.0	0.0						
26	0.0	0.0	0.0	0.0	3.4	29.8						
27	0.0	0.0	0.0	0.0	8.8	24.9						
28	0.0	0.0	0.0	2.8	0.0	T						
29	0.0		4.1	10.1	29.6	12.7						
30	0.0		0.0	50.3	2.3	24.1						
31	0.0		0.0		5.4							
Total	0.2	2.0	4.1	85.6	300.4	223.5	32.3	0.0	0.0	0.0	0.0	0.0
Days	1	1	1	12	21	20	6					
Max.	0.2	2.0	4.1	50.3	34.8	46.0	13.1					

Amount of annual precipitation: 648.1 mm

Day of precipitation per year: 62 days

Maximum precipitation: 50.3 mm on April 30, 2007

Remark: Amount of daily precipitation is collected during 07.00-07.00;
T means precipitation data < 0.1 mm; "-" means no data

Annex 11: Wastewater Quality Data of STPs under WMA (From January, 2006 to April, 2007)

Annex 11: Wastewater Quality Data of STPs under WMA (From January 2006 to April 2007)

No.	Municipality	Parameters	Standards	2006												2007			
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Baan Pae	BOD	Max. 20mg/l							0 / 8	0 / 8		0 / 8	0 / 8		0 / 4	0 / 8	0 / 8	0 / 8
		COD	Max. 120mg/l							0 / 31	0 / 31		0 / 31	0 / 30		0 / 17	0 / 28	4 / 31	0 / 30
		SS	Max. 30mg/l							0 / 31	0 / 31		0 / 31	0 / 30		**8 / 17**	0 / 28	0 / 31	0 / 30
		pH	In range of 5-9							0 / 31	0 / 31		0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 30
		Tempreture	Max. 40℃							0 / 31	0 / 31		0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 30
2	Panguan	BOD	Max. 20mg/l							4 / 8	**10 / 10**	**8 / 8**	0 / 2	0 / 4	0 / 4	0 / 4	0 / 5	0 / 5	
		COD	Max. 120mg/l							3 / 8	0 / 10	0 / 8	0 / 5	0 / 9	0 / 8	0 / 9	0 / 9	0 / 9	
		SS	Max. 30mg/l							2 / 8	**8 / 10**	0 / 8	0 / 5	0 / 9	0 / 8	0 / 9	0 / 8	0 / 9	
		pH	In range of 5-9							0 / 31	0 / 31	0 / 30	0 / 17	0 / 30	0 / 31	0 / 30	0 / 28	0 / 31	
		Tempreture	Max. 40℃							0 / 31	0 / 31	0 / 30	0 / 17	0 / 30	0 / 31	0 / 30	0 / 28	0 / 31	
3	Chomseang	BOD	Max. 20mg/l	0 / 9	0 / 8	0 / 9	0 / 8	0 / 9	0 / 9	0 / 8	0 / 10	0 / 8				0 / 5	0 / 8	0 / 11	1 / 4
		COD	Max. 120mg/l	0 / 31	0 / 28	0 / 31	0 / 30	0 / 31	0 / 30	0 / 31	0 / 31	0 / 30				0 / 17	0 / 28	0 / 31	0 / 14
		SS	Max. 30mg/l	0 / 31	0 / 28	0 / 31	0 / 30	0 / 31	0 / 30	0 / 31	0 / 31	0 / 30				1 / 17	0 / 28	2 / 31	0 / 14
		pH	In range of 5-9	0 / 31	0 / 28	0 / 31	0 / 30	0 / 31	0 / 30	0 / 31	0 / 31	0 / 30				0 / 17	0 / 28	0 / 31	0 / 14
		Tempreture	Max. 40℃	0 / 31	0 / 28	0 / 31	0 / 30	0 / 31	0 / 30	0 / 31	0 / 31	0 / 30				0 / 17	0 / 28	0 / 31	0 / 14
4	Huankwang	BOD	Max. 20mg/l	0 / 8		0 / 15	0 / 9	0 / 11	0 / 10	0 / 9		0 / 9	0 / 8		0 / 12	0 / 10	0 / 8	0 / 9	
		COD	Max. 120mg/l	0 / 31		0 / 31	0 / 30	0 / 30	0 / 29	0 / 31		0 / 30	0 / 31		0 / 31	0 / 31	0 / 28	0 / 31	
		SS	Max. 30mg/l	**6 / 31**		4 / 31	1 / 30	0 / 31	0 / 30	0 / 30		0 / 30	0 / 31		0 / 31	0 / 31	0 / 28	0 / 31	
		pH	In range of 5-9	0 / 31		0 / 31	0 / 30	0 / 31	0 / 30	0 / 31		0 / 30	0 / 31		0 / 31	0 / 31	0 / 28	0 / 31	
		Tempreture	Max. 40℃	0 / 31		0 / 31	0 / 30	0 / 31	0 / 30	0 / 31		0 / 30	0 / 31		0 / 31	0 / 31	0 / 28	0 / 31	
5	Kamphaeng Phet	BOD	Max. 20mg/l	0 / 9	0 / 8	0 / 9	0 / 8	2 / 9	0 / 3	3 / 14	**7 / 18**	1 / 8	0 / 9	4 / 15		3 / 7	0 / 5	0 / 6	0 / 1
		COD	Max. 120mg/l	0 / 31	0 / 28	0 / 31	0 / 30	0 / 31	0 / 18	0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 14	0 / 11	0 / 5
		SS	Max. 30mg/l	0 / 31	0 / 28	1 / 31	4 / 30	1 / 31	0 / 18	1 / 31	0 / 31	1 / 30	0 / 31	0 / 30		1 / 17	1 / 14	3 / 11	0 / 5
		pH	In range of 5-9	0 / 31	0 / 28	0 / 31	0 / 30	0 / 31	0 / 22	0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 14	0 / 11	0 / 5
		Tempreture	Max. 40℃	0 / 31	0 / 28	0 / 31	0 / 30	0 / 31	0 / 21	0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 14	0 / 11	0 / 5
6	Pathumthani	BOD	Max. 20mg/l							0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14
		COD	Max. 120mg/l							0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14
		SS	Max. 30mg/l							0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14
		pH	In range of 5-9							0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14
		Tempreture	Max. 40℃							0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14
7	Phayao	BOD	Max. 20mg/l									0 / 8	0 / 9	0 / 9		0 / 5	0 / 8	0 / 4	
		COD	Max. 120mg/l									0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 14	
		SS	Max. 30mg/l									0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 14	
		pH	In range of 5-9									0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 14	
		Tempreture	Max. 40℃									0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 14	
8	Sakon Nakorn	BOD	Max. 20mg/l		0 / 9					0 / 10							0 / 8		
		COD	Max. 120mg/l		0 / 28					0 / 31							0 / 28		
		SS	Max. 30mg/l		0 / 28					1 / 31							0 / 28		
		pH	In range of 5-9		0 / 28					0 / 31							0 / 28		
		Tempreture	Max. 40℃		0 / 28					0 / 31							0 / 28		
9	Songkha	BOD	Max. 20mg/l										0 / 9	0 / 8	0 / 9	0 / 9	0 / 8	0 / 9	0 / 9
		COD	Max. 120mg/l										0 / 31	0 / 30	0 / 31	0 / 31	0 / 28	0 / 31	0 / 30
		SS	Max. 30mg/l										0 / 31	0 / 30	0 / 31	0 / 31	0 / 28	0 / 31	0 / 30
		pH	In range of 5-9										0 / 31	0 / 30	0 / 31	0 / 31	0 / 28	0 / 31	0 / 30
		Tempreture	Max. 40℃										0 / 31	0 / 30	0 / 31	0 / 31	0 / 28	0 / 31	0 / 30
10	Sri Racha	BOD	Max. 20mg/l										0 / 8	0 / 9	0 / 9	0 / 5	0 / 8	0 / 7	0 / 8
		COD	Max. 120mg/l										0 / 31	0 / 30	0 / 31	0 / 17	0 / 28	0 / 31	0 / 30
		SS	Max. 30mg/l										0 / 31	0 / 30	0 / 31	0 / 17	0 / 28	0 / 31	0 / 30
		pH	In range of 5-9										0 / 31	0 / 30	0 / 31	0 / 17	0 / 28	0 / 31	0 / 30
		Tempreture	Max. 40℃										0 / 31	0 / 30	0 / 31	0 / 17	0 / 28	0 / 31	0 / 30
11	Ta rae	BOD	Max. 20mg/l	0 / 7	0 / 8	0 / 8	0 / 8	0 / 9	0 / 8	0 / 8	0 / 9	0 / 8	0 / 9	0 / 9		0 / 6	0 / 9	0 / 9	0 / 4
		COD	Max. 120mg/l	0 / 7	0 / 8	0 / 8	0 / 8	0 / 9	0 / 30	0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14
		SS	Max. 30mg/l	0 / 7	0 / 8	0 / 8	0 / 8	0 / 9	1 / 30	1 / 31	1 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	2 / 31	0 / 14
		pH	In range of 5-9	0 / 7	0 / 8	0 / 8	0 / 8	0 / 9	0 / 30	0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14
		Tempreture	Max. 40℃	0 / 7	0 / 8	0 / 8	0 / 8	0 / 9	0 / 30	0 / 31	0 / 31	0 / 30	0 / 31	0 / 30		0 / 17	0 / 28	0 / 31	0 / 14

a / b
a : Days over stadanrd
b : Days of analysis

c / d
Month has more than 5 days over standards

Annex 12: Outline of Reference Materials Formulated in the Project

Annex 12: Outline of the Reference Materials Formulated by the Project*

"All information below except the attachment is summarized and translated from the reports of Reference Material Committee and the other reports provided by the Japanese experts"

Reference Materials

Though the Project originally planed to produce 13 reference materials, the mid-term evaluation team suggested the Project to reconsider the contents of reference materials and concentrate on materials with higher priorities and to involve organizations concerned such as PCD, DOLA, local authorities to disseminate the Project's outputs to STPs beyond STPs under WMA.

The joint coordination committee held on 24th August, 2006 including suggested organizations has approved the 9 reference materials listed below, which were modified from the original plan through the works among the Japanese experts and WMA CPs.

(Final reference materials list)

1. Analysis of Existing Wastewater Treatment Systems,
2. Guide for Wastewater Collection to Sewer System,
3. Guideline for Pumping Station Design and O&M,
4. Wastewater Treatment System O&M
5. Standards for Quality Control of Construction Works on Wastewater Systems,

*This material consists of the following four contents;

- General Specifications for Construction Works,
- Supervision and Inspection Manual for Construction Works
- Technical Guideline for the Sewage Works,
- Technical Document

6. Guideline for Evaluation of Rehabilitation Works,
7. Cost Control for O&M of STPs,
8. Troubleshooting Examples,
9. Safety Manual.

The short descriptions of each material are attached below.

Reference Materials Committee

The contents of reference materials were extensively discussed and refined in the Reference Materials Committee Meetings. The date and short descriptions of the Reference Material Committee is shown in the table below.

No	Title of Meeting	Date	Description
1	Preparatory Meeting	1/Dec/06'	It aimed on the establishment of the Reference Materials Committee. Many representatives from the Central Government, Local Municipalities and academic experts were invited to participate. The following issues were explained in the meeting. • Introduction of IST Project and Reference Materials • Objectives of the Reference Material Committee • General Specification and Supervision & Inspection Manuals The meeting agreed the establishment of the committee with the certain consideration attached below.
2	1st Reference Material Committee Meeting	16/Feb/07'	The following volumes of Reference Materials were explained in the meeting. • General Specifications for Construction Works • Supervision and Inspection Manual for Construction Work • Guideline for Pumping Station Design and O&M • Safety Manual • Technical Guideline for the Sewage Works • Technical Document Comments were given from the committee and utilized for the revision of Reference Materials.
3	2nd Reference Material Committee Meeting	9/March/07'	The Project explained the results of the revision based on the comments given in the 1st meeting and received the approval from the committee. The committee gave the suggestion to the Project on the following points. • Promotion of Reference Materials to the local authorities • Discussion on the remaining Reference

			Materials
4	3rd Reference Material Committee Meeting	Mid/Augst/07' (Plan)	It is planned to explain the plan of promotion of Reference Materials to the local authorities and the remaining Reference Materials.

The members of the Reference Material Committee and the available existing M/M are attached in the following.

Documents attached below;

1. The short description of Reference Materials
2. Consideration on the Committee for Reference Materials of JICA/WMA IST Project
3. Members of the Reference Materials Committee
4. M/M of Reference Materials Committee

The Short Description of Reference Materials

1. Analysis of Existing Wastewater Systems

Existing problems about wastewater systems reside in three fields: planning & design, construction, and O&M. for clear understanding of the problems, we must carry out case study analysis on different types of treatment systems. Case study analysis will reveal detail information of the problems.

There are mainly three types of treatment systems working in Thailand: activated sludge (including OD), stabilization ponds, and aerated lagoons. The case study must cover on these three categories of the systems. To develop this title document, above-mentioned research will be conducted in three types of wastewater systems.

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2. Guide for Wastewater Collection Sewer System

When wastewater system is constructed to protect receiving waters from pollution, the system needs to collect sufficient wastewater from its service area into the system. But it is reported that there are 63% units of wastewater systems that have wastewater inflow less than 50% of the total capacity. One of the main reasons of this small inflow is small connection rate of residences.

This guide will show you the detail technical information for building connection and provide effective way for connection of each house to the system.

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3. Guideline for Pumping Station Design and O&M

Pumping stations are essential facilities for collecting wastewater in flat areas and are necessary for high reliability. These facilities work day and night to convey wastewater into treatment systems. Once the pump stopped, there is high risk of flodding with continuously coming of wastewater or storm water.

One of the main causes of malfuntions of the pumps is clogging in thep umps with rubbish. Now design to remove the rubbish at the pumping stations and to pretect pumps from rubbish is not sufficient for such huge amount. We need to design pumping station more focusing on this matter.

Another problem we find in pumping station is selection of the capacity of pumps. Generally, existing pumps placed in the systems seem to be too big for coming daily flow rate. When we decide the size of thep umps, we must take into consideration of the small flow rate period in initial stages.

In this guideline, we will develop pumping station design and O&M in more practical and fit manner for the condition of Thailand, focusing on the rubbish problem, the appropriate pump size determination, and so on.

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6-4 Accessibility
6-5 Overhaul and Repair
6-6 Spare Parts and Supplies

4. Wastewater Treatment System O&M

Good O&M works in treatement systems are the key points to reliable water quality control as effluent. In O&M works we normally focus in three fields of works: how to get a good quality of effluent, how to keep the system in good condition, and when to procure necessary supplies including spare parts. In these three fields we must pay great attention and have enough knowledge fro the O&M works.

For limited knowledge of the operators, useful reference guide book for O&M is essential. In this reference material, we will develop them to fulfill of this requirement.

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3-7-10 Accuracy control

3-7-11 Report

4 O&M activity of wastewater treatment facility and equipment

4-1 Object and contents of implementation about inspection of wastewater treatment facility and equipment

4-2 Maintenance and inspection activity

4-2-1 Daily inspection

4-2-2 Periodical inspection

4-2-3 Temporary inspection

4-2-4 Inspection required by law

4-2-5 Supervision and operation of the facility or equipment

4-3 Evaluation of the inspection results and its response

4-3-1 How to evaluate the inspection results

4-3-2 Maintenance of inspection results

5 Record and report at the time of malfunction or accident occurrence

5. Standards for Quality Control of Construction Works on Wastewater Systems

The poor qualities in construction tend to introduce failure of the systems and to make lifetime of the systems shorten. For avoiding poor construction works, quality control including supervising/inspection works is indispensable.

There are some construction criterial in other fields (highway, architecture and so on), but there is no criterial specialized for the wastewater system field. Constructions of wastewater systems are comprehensive works of civil, mechanical and electrical works. Some criteria in other fields can be applicable with diverting to this field. And criterial for specialized wastewater systems are also necessary because of the special condition of the systems: corrosive nature of the environment of the systems, necessary of high reliability of the systems and so on.

For quality of wastewater systems, we need to develop the technical materials, such as (1) General Specifications, (2) Supervision and Inspection Manual, (3) Technical Guideline, and (4) Technical Document based on the criteria of each technical field, so that suitable quality control is undertaken in each stage of planning, designing, construction and management of the wastewater systems.

- General Specifications for Construction Works

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4-6 Product Test

- **Supervision and Inspection Manual for Construction Works**

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- **Technical Guideline for the Sewage Works**

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Part 1 : Sewer System

6-1-2 Design consideration
6-1-3 Sludge accumulation
6-2 Aerated Lagoon
6-2-1 Type of Aerated Lagoon
6-2-2 Design consideration
6-2-3 Design formulae
6-3 Activated Sludge
6-3-1 Type of reactor
6-3-2 Process modifications
6-3-3 Aeration Basin
6-3-4 Design of Activated sludge Process
6-3-5 Aeration System Design
6-3-6 Secondary Clarifier
7 Disinfection
7-1 Disinfection means
7-2 Chlorination of wastewater effluent
7-3 Chlorine dosage
7-4 Chlorine contact tanks
8 Sludge Treatment and Disposal
8-1 Sludge characteristics and quantities
8-2 Pumping of Various sludge
8-3 Sludge Treatment Process
8-3-1 Thickening
8-3-2 Stabilization
8-3-3 Sludge conditioning and dewatering

Part 2 :Civil Engineering
1 Sewer Design
1-1 Capacity of Sewer
1-1-1 Types pf Sewer Cross-Section
1-1-2 Flow capacity calculation
1-1-3 Velocity and Gradient
1-2 Type of Manhole
1-2-1 Design of manholes
1-2-2 Ready - made/Section manhole

- **Technical Document**

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2 The Laws Relating to the Wastewater User Charge Collection
3 The Laws Relating to The Powers and Duties of the Local Administration
4 Law Enforcement in case of Failure to pay the User Charge
4-1 Law Enforcement for Wastewater User Charge
5 Private Participation in Investment or Joint Operation
5-1 Wastewater Treatment Systems
6 The Regulation Relating to Drainage and Treatment Facilities in the Building
6-2 The Building Control Act B.E. 2522

Part 2 : Water Environmental Monitoring
1 Standard
1-1 Environmental standards of public water body
1-2 Standard of influent to sewer system
1-3 Standard of effluent from sewer system
1-4 Standard of analysis technique and monitoring technique to water quality items
2 Wastewater Monitoring and Control of Sewer System

Part 3 : Occupational Safety and Health
1 Introduction
2 Laws and Regulations
2-1 Legal System of Thailand
2-2 Contract / Employment
2-3 Construction Works
3 Safety in Construction
3-1 Organization chart for safety management
3-2 Safety Audit in Construction
3-3 Safety Management Plan
3-4 Safety Management measures
3-5 Safety Management Items and Inspection Methods
3-6 Safety Guideline
4 Safety in Mechanical Works
4-1 Safety Control
4-2 Safety in Installation Work
4-3 Safety in Overhaul and Repair Works
5 Electrical Safety
5-1 Introduction

6. Guideline for Evaluation of Rehabilitation Works

In order to carry out rehabilitation works efficiently and effectively, this reference material shows the required checkpoints to decide extent (repair, improvement or renewal) of a rehabilitation work. With checking out sewage systems according to this material based on some documents of inspection data, the extent of rehabilitation work can be judged intelligibly and objectively, the evaluation method is also shown by this material. If the evaluation works are carried out by this material's evaluation method, the results of the evaluation works can be explained to municipality as fair judgment.

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7. Cost Control for O&M of STPs

In operation and maintenance works, how to get a good condition of the system and how to reduce the cost are main concerns. The manager of the system must pay attention in these two fields. The cost directly reflects the ability of the manager.

We will develop cost control idea for O&M in this document.

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8. Troubleshooting Examples

When we faced some trouble in wastewater systems, one of the most useful information sources for handling the problems is experiences of ourselves. During this project period we will have some troubleshooting experiences in the focused STPs.

In this reference document, these troubleshooting experiences are collected and compiled into single book.

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9. Safety Manual

Workers in the field of wastewater face several potentially dangerous situations. There are a lot of potentially insecurity places in the wastewater systems, which are construction sites, high raised places, aerated tanks, inside of the pipes, pump pits, chemical laboratories and so on. Workers and manager need to know about their environment and must avoid accidents that jeopardize their health and life. To keep safety of workers is the priority duty for managers of wastewater systems.

Safety manual is an essential book for keeping workers away from injury, disease, and other peril.

Table of Content

December 7, 2006

<Consideration>

Committee for Reference Materials of JICA/WMA IST Project

1. Role of the Committee is to discuss the draft of reference materials. The Committee members describe their opinions/comments and discuss in the meeting.

2. WMA submits the draft of reference materials and explains briefly, supported by JICA Experts and TEAM Consultant.

3. WMA concludes the reference materials referring the opinions/comments in the Committee. The materials will be used in WMA as its own materials and distributed to/referred by local municipalities.

4. Translators are required for efficient discussions in the Committee.

5. General specifications in Thai Government are referred in drafting the GS by WMA, JICA Experts and TEAM Consultant.

6. The GS by WMA does not lead increase of consturction cost, because contractors are required quality of outputs within the contract price.

List of Reference Material Committee

No.	Name	Organization
1.	Asst. Pro Yuthana Mahutchariyawong	The Engineering Institute of Thailand Under HM The King's Patronage (EIT)
2.	Mr. Kamon Phetdee	The Department of Local Administration
3.		Department of environmental quality promotion
4.	Ms. Asanee Kulpradit	Office of The Natural Resources and Environmental Policy and Planning. (ONEP)
5.	Ms. Sutra Luangphattrarawong	Office of The Natural Resources and Environmental Policy and Planning. (ONEP)
6.		Thailand International Development Cooperation Agency (TICA)
7.	Ms. Jarutporn Jaruchaiyakul	Department of Sewerage and Drainage, BMA
8.	Ms. Vilasinee Suktawin	Pollution Control Department (PCD)
9.	Mr. Choosub Saisang	Khampangphet Municipality
10.	Mr. Aneerut Aree	Phathumthanu Municipality
11.	Dr. Thammarat Kuthottap	Asian Institute of Technology (AIT)
12.		Japan International Cooperation Agency (JICA)
13.		The Nation Municipal League of Thailand (MLT)
14.	Mr. Supparat Ittipol	Wastewater Management Authority (WMA)
15.	Ms. Hatairat Likitanupak	Wastewater Management Authority (WMA)
16.	Mr. Kitti Teerasoradech	Wastewater Management Authority (WMA)

Agenda

Pre Committee Meeting for Discussion of Reference Material

1 December 2006 at 10.00

WMA Conference Room

Agenda 1 **The Subject Chairman's Message**

1.1 Introduction of IST Project

1.2 Reference Materials

Agenda 2 **To inform and discussion**

Appoint the committee for Reference Materials

2.1 Purpose

2.2 Three volume of Reference Materials for discussion

2.3 Committees

2.4 Progress Plan

Agenda 3 **To Inform**

3.1 Presentation by JICA Expert Mr. Shigeo Kanai "General Specification and Supervision Inspection Manual"

3.2 Progress Report by Team Consultant "Study for Authorization of Technical Guideline for Quality in Sewage Works in Thailand"

Agenda 4 **Others**

Agenda

Pre Committee Meeting for Discussion of Reference Material

1 December 2006 at 10:00 AM.

WMA Conference Room

Agenda 1 The subject Chairman's messsage

1.1 Introduction of IST project

The Project for Improvement of Sewage Treatment Plant Management in Thailand (IST) was formulated to solve various problems of sewage works in Thailand and to restore STPs' primary function. The Project focused on solving the technical side of the problems, as it is difficult to solve all the problems concurrently, problems related to the collection system and financial and administrative matters, in rather short period of five or more years. The cooperation period is three years and half from May 26, 2004 to November 25, 2007

Project Objectives

1) Function of focused STPs is recovered

2) Reference materials for improvement of Sewage treatment plant management are developed

3) Skilled personnel is assigned to operate and maintain the focused STPs appropriately

4) Information system is established to disseminate Reference Materials and to collect O&M data

Project Activities

1. Rehabilitation of a few malfunctioning STPs and improvement of the method of operation and maintenance of those STPs. Kamphaeng Phet STP and Pathum Thani STP were selected as the focused STPs, which were most suitable for the model of rehabilitation work at WMA sites

2. Preparation for Reference Materials supposed to be developed during the Project. The comprehensive studies were conducted by using the local consulting firms under the close supervision of Japanese experts. Some of them are also expected to be authorized toward the national level.

3. SP Staff training. The three day training on rehabilitation work for STP which targeted the officers in charge of STPs is carried out from 29-31 January 2007 under the title "Oxidation Pond Management" at Princeton Hotel Bangkok . We invite the participants from WMA staffs, officers of local authority and contractors to participate in the training course. The practical site is Nakorn Pathom STP. Moreover, JICA Japanese Expert is invited as a special guest lecturer under training title "Working in the Confine Space and Life Security" to the trainees.

4. Development of information system, the Project ordered hardware equipment. Five WMA Officer have undergone the intensive training on programming languages. Now the IT team is organized and actively participating in the Project

5. Improvement of Training Center form Sewage Works (TCSW) Project supported by JICA under the former Public Works Department was implemented from August 1995 to July 2000. Later, Aiming at establishment of WMA Water Quality Analysis Laboratory in October 2006, the facilities of TCSW was transferred from Department of Public Works and Town & Country Planning (DPT) to WMA. Main roles of the laboratory are to implement water quality analysis service to users, support WMA works for local administration and contribute the capacity building of WMA.

1.2 Reference Materials

Reference Materials supposed to be developed in the Project are as follows;

1. Analysis of existing wastewater systems
2. Guide for wastewater collection to sewer
3. Pumping station designing and O&M
4. Wastewater treatment system O&M
5. Standards for quality control of construction works on wastewater systems

6. Guide for evaluation of rehabilitation works

7. Cost control for O&M of STPs

8. Troubleshooting example book

9. Safety manual for construction and O&M

Member Consideration

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_____

Resolution

_____

_____

_____

Agenda 2 **To inform and discussion**

Appoint the committees for Reference Material Revised

2.1 Purpose

To be discussed and given the suggestion for Reference Material Revised by the relevant department representatives and specialist

2.2 Three volume of Reference Material for discussion

3. Pumping station designing and O&M

5. Standards for quality control of construction works on wastewater systems

9. Safety manual for construction and O&M

2.3 Committees

The committees are consist of the representative from relevant department and institute as follows;

1. Representative from Local Administrative Department
2. Representative from Environment Quality Promotion Department

3. Representative from Natural Resource and Environment Policy and Planning Office

4. Representative from Thailand International Department Cooperation Agency

5. Representative from Drain and Sewerage Department

6. Representative from Pollution Control Department

7. Representative from Khamphaeng Phet Municipality

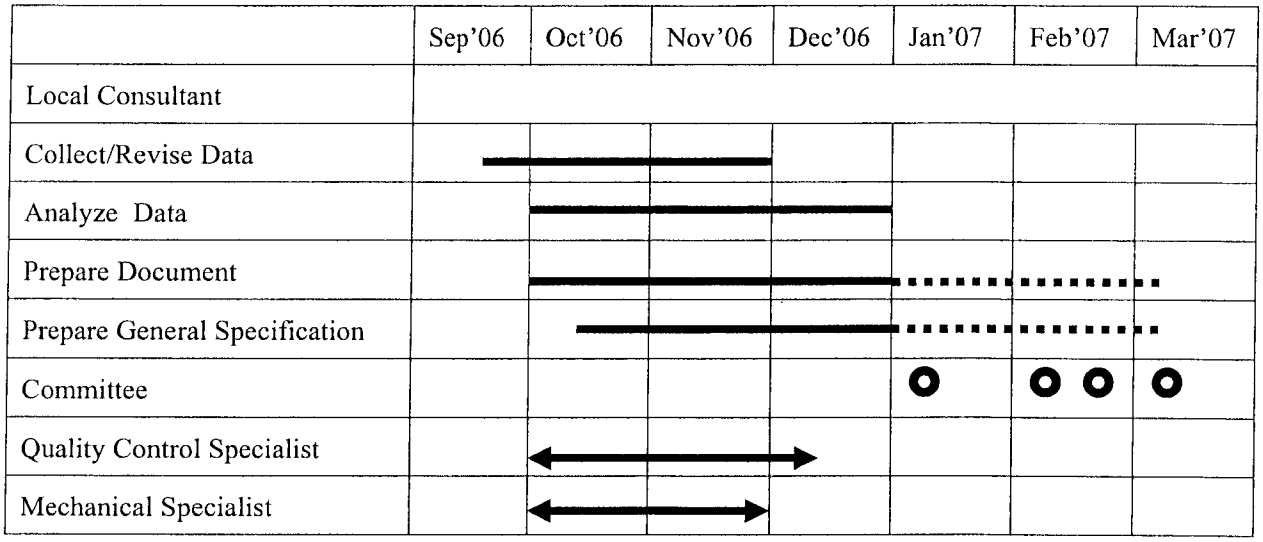
8. Representative Pathum Thani Municipality

9. Dr. Thammarat Kuthodthep Asian Institute of Technology

10. Representative from Environmental Engineering, The Engineering Institute of Thailand

11. Chairman or Representative from National Municipal League of Thailand

2.4 Progress Plan



Member Consideration

Acknowledgement

Agenda 3 To inform

3.1 Presentation by JICA Expert Mr. Shigeo Kanai "General Specification and Supervision Inspection Manual"

3.2 Progress Report by Team Consultant "Study for Authorization of Technical Guideline for Quality in Sewage Works in Thailand"

Agenda 4 Others

บันทึกการประชุม

การประชุมเตรียมการแต่งตั้งคณะกรรมการที่ปรึกษาฯ

วันศุกร์ที่ 1 ธันวาคม พ.ศ.2549 เวลา 10.00 น.

ณ ห้องประชุมองค์การจัดการน้ำเสีย ชั้น 23

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1. ผู้เข้าร่วมประชุม

1.1 JICA Expert's team

Mr. Haruki	Takahashi	Chief Advisor
Mr. Shigeo	Kanai	Short Term Expert
Mr. Shu	Nishi	Expert and Project Secretary
Ms. Suwalak	Phakdrakson	Secretary

1.2 WMA Staff

Mr. Supparat	Ittiphol	Director of Wastewater Management Dept-WMA ประธานที่ประชุม
Ms. Hatairat	Likitanupak	Director, Department of Planning and Project Development
Mr. Kitti	Teerasoradech	Section Chief

1.3 Consultant

Dr. Samran	Chooduangngern	Project Manager
Mr. Jadenarong	Chaochudetch	Document and Specification Expert
Mr. Akachat	Saisuwan	Mechanical Engineer
Mr.Somsak	Rittiboon	Electrical Engineer
Ms. Pitukarn	Charoensombut	Environmental Engineer

1.4 ผู้แทนจากหน่วยงานที่เกี่ยวข้อง (บุคคลที่คาดหมายว่าจะเป็น Authorizing Committee)

ดร.ธรรมรัตน์ คุตตเทพ สถาบันเทคโนโลยีแห่งเอเชีย

ผู้แทนจากวิศวกรรมสถานแห่งประเทศไทย

ผู้แทนจากกรมส่งเสริมการปกครองท้องถิ่น

ผู้แทนกรมส่งเสริมคุณภาพสิ่งแวดล้อม

ผู้แทนสำนักนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม

ผู้แทนสำนักงานความร่วมมือเพื่อการพัฒนาระหว่างประเทศ

ผู้แทนสำนักการระบายน้ำ กรุงเทพมหานคร

ผู้แทนกรมควบคุมมลพิษ

ผู้แทนเทศบาลเมืองกำแพงเพชร

ผู้แทนสมาคมสันนิบาตแห่งประเทศไทย

2. วาระการประชุม

<u>วาระที่ 1 เรื่องประธานฯ แจ้งให้ที่ประชุมทราบ</u>

1.1 แนะนำโครงการ IST

- ประธานฯ แจ้งให้ที่ประชุมทราบว่า โครงการ Improvement of Sewage Treatment Plant Management in Thailand ได้ก่อตั้งขึ้นมาเพื่อแก้ปัญหาเกี่ยวกับการจัดการน้ำเสียในประเทศไทย โดยการสนับสนุนจากองค์การร่วมมือระหว่างประเทศของญี่ปุ่น (JICA) โครงการนี้มุ่งเน้นแนวทางแก้ปัญหาทางด้านเทคนิค เรื่องการฟื้นฟูโรงบำบัดน้ำเสียที่ระบบการทำงานไม่สามารถทำได้เต็มประสิทธิภาพ การปรับปรุงวิธีการจัดการ การบำรุงรักษาเผยแพร่ความรู้ต่างๆ ในการปรับปรุงโรงบำบัดน้ำเสียให้ดีขึ้น รวมทั้งการพัฒนาประสิทธิภาพการบำบัดน้ำเสียและเจ้าหน้าที่บุคลากรให้ดียิ่งขึ้น โดยได้ลงนามในข้อตกลงความร่วมมือในวันที่ 25 พฤษภาคม 2547 มีระยะเวลาการดำเนินงานตั้งแต่วันที่ 26 พฤษภาคม 2549 ถึงวันที่ 25 พฤศจิกายน 2550
- เป้าหมายการดำเนินงานโครงการ
  1. ระบบบำบัดน้ำเสียในพื้นที่เป้าหมายได้รับการบำรุงฟื้นฟูให้สามารถทำงานได้อย่างมีประสิทธิภาพ
  2. มีเอกสารอ้างอิงทางวิชาการสำหรับการพัฒนาการจัดการระบบบำบัดน้ำเสีย
  3. มีเจ้าหน้าที่ที่มีความสามารถทำการควบคุมและบำรุงรักษาระบบบำบัดน้ำเสียในพื้นที่เป้าหมายที่ทำการฟื้นฟูอย่างเหมาะสม
  4. มีระบบฐานข้อมูลที่จัดสร้างขึ้น เพื่อการเผยแพร่เอกสารอ้างอิง และเก็บรวบรวมข้อมูลการเดินระบบและบำรุงรักษาระบบบำบัดน้ำเสีย
- กิจกรรมการดำเนินงานของโครงการนี้มี 4 ด้านได้แก่
  1. กิจกรรมการปรับปรุงฟื้นฟูระบบบำบัดน้ำเสีย 2 แห่ง ได้แก่ โรงบำบัดน้ำเสียเทศบาลเมืองปทุมธานี และโรงบำบัดน้ำเสียเทศบาลเมืองกำแพงเพชร
  2. กิจกรรมงานจัดทำเอกสารอ้างอิงทางวิชาการ เพื่อการปรับปรุงการบริหารจัดการโรงบำบัดน้ำเสีย
  3. กิจกรรมการฝึกอบรมบุคลากรให้มีคุณสมบัติเหมาะสม ในการควบคุมดูแลโรงบำบัดน้ำเสีย
  4. กิจกรรมจัดทำระบบข้อมูลข่าวสาร เพื่อการเผยแพร่เอกสารอ้างอิงทางวิชาการและจัดเก็บข้อมูลด้านการเดินระบบและบำรุงรักษาระบบ
  5. กิจกรรมปรับปรุงห้องปฏิบัติการวิเคราะห์น้ำ

1.2 การจัดทำเอกสารอ้างอิงทางวิชาการด้านการจัดการน้ำเสีย

- ผอ.หทัยรัตน์ กล่าวถึงการจัดทำเอกสารอ้างอิงทางวิชาการ เพื่อปรับปรุงการบริหารจัดการโรงบำบัดน้ำเสีย ซึ่งประกอบด้วยคู่มือต่างๆ จำนวน 9 ฉบับดังนี้
  1. การวิเคราะห์ระบบบำบัดน้ำเสียในประเทศไทยที่มีอยู่ในปัจจุบัน
  2. คู่มือการดูแลรวบรวมน้ำเสีย
  3. แนวทางการออกแบบและดูแลรักษาสถานีสูบน้ำ
  4. คู่มือการบำรุงรักษาระบบบำบัดน้ำเสีย
  5. แนวทางการควบคุมคุณภาพสำหรับการก่อสร้างระบบบำบัดน้ำเสีย
  6. คู่มือการประเมินงานปรับปรุง ซ่อมแซมระบบบำบัดน้ำเสีย
  7. แนวทางการควบคุมค่าใช้จ่ายสำหรับการบริหารจัดการระบบบำบัดน้ำเสีย
  8. ปัญหาที่เกิดขึ้นพร้อมแนวทางแก้ไข
  9. คู่มือความปลอดภัยของแรงงาน สำหรับงานก่อสร้าง เดินระบบ และบำรุงรักษาระบบบำบัดน้ำเสีย

มติที่ประชุม รับทราบ

วาระที่ 2 *เรื่องเพื่อพิจารณา (การแต่งตั้งคณะกรรมการพิจารณาการจัดทำเอกสารอ้างอิงทางวิชาการด้านการจัดการน้ำเสีย*

2.1 วัตถุประสงค์

- ผอ.หทัยรัตน์ แจ้งให้ที่ประชุมทราบถึงวัตถุประสงค์ในการแต่งตั้งคณะกรรมการเพื่อพิจารณาการจัดทำเอกสารอ้างอิงทางวิชาการว่า เพื่อให้หน่วยงานที่เกี่ยวข้องและนักวิชาการได้มีส่วนร่วมในการพิจารณา และให้ความเห็นในการจัดทำเอกสารดังกล่าว ซึ่งอจน. จะได้พิมพ์และเผยแพร่ให้กับหน่วยงานที่เกี่ยวข้องใช้ประโยชน์ต่อไป

2.2 เอกสารอ้างอิงทางวิชาการด้านการจัดการน้ำเสีย ที่จะนำเข้าสู่การพิจารณา มี 3 ฉบับคือ

- ฉบับที่ 3 แนวทางการออกแบบและดูแลรักษาสถานีสูบน้ำ
- ฉบับที่ 5 แนวทางการควบคุมคุณภาพสำหรับการก่อสร้างระบบบำบัดน้ำเสีย
- ฉบับที่ 9 คู่มือความปลอดภัยของแรงงาน สำหรับงานก่อสร้าง เดินระบบ และบำรุงรักษาระบบบำบัดน้ำเสีย

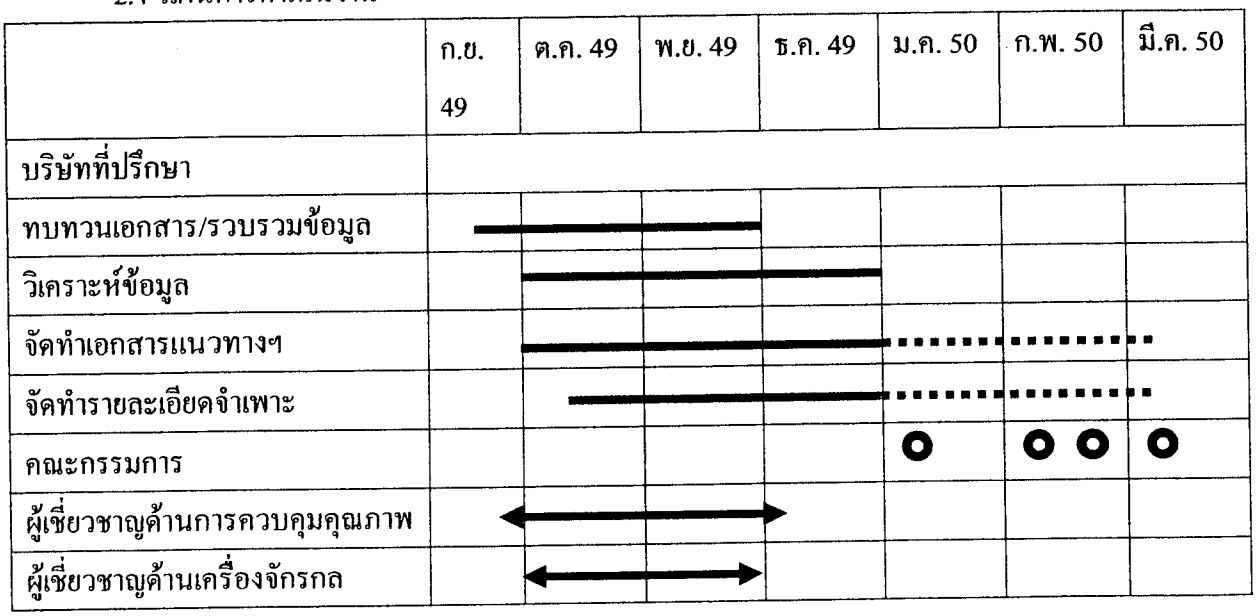
2.3 คณะกรรมการ

- ผอ.หทัยรัตน์ แจ้งให้ที่ประชุมทราบว่า คณะกรรมการในการพิจารณาเอกสารอ้างอิงทางวิชาการที่จะจัดทำขึ้น จะประกอบด้วยสมาชิกเดิมของ Joint

Coordinating Committee (JCC) ผู้แทนจากหน่วยงานที่เกี่ยวข้อง และสถาบันการศึกษา สถาบันทางด้านวิชาการ ดังต่อไปนี้

1. ผู้แทนจากกรมส่งเสริมการปกครองส่วนท้องถิ่น
2. ผู้แทนจากกรมส่งเสริมคุณภาพสิ่งแวดล้อม
3. ผู้แทนจากสำนักนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม
4. ผู้แทนจากสำนักงานความร่วมมือเพื่อการพัฒนาระหว่างประเทศ
5. ผู้แทนจากสำนักการระบายน้ำ กรุงเทพมหานคร
6. ผู้แทนจากกรมควบคุมมลพิษ
7. ผู้แทนจากเทศบาลเมืองกำแพงเพชร
8. ผู้แทนจากเทศบาลเมืองปทุมธานี
9. ดร. ธรรมรัตน์ คุฑตเทพ จากสถาบันเทคโนโลยีแห่งเอเชีย
10. อ.ยุทธนา ผู้แทนจากภาควิชาสาขาวิศวกรรมสิ่งแวดล้อม วิศวกรรมสถานแห่งประเทศไทย
11. นายกหรือผู้แทนสมาคมสันนิบาตเทศบาลแห่งประเทศไทย

2.4 แผนการดำเนินงาน



ข้อพิจารณา

1. ผู้แทนจากกรมส่งเสริมการปกครองส่วนท้องถิ่น ให้ข้อคิดเห็นในส่วนของคู่มือที่จะนำเข้าสู่การพิจารณาว่า เห็นควรเพิ่มฉบับที่ 2 เกี่ยวกับคู่มือการดูแลรวบรวมน้ำเสียด้วย ซึ่ง ผอ. หทัยรัตน์ชี้แจงว่าเอกสารฉบับที่ 2 เป็นเพียงรายงานผลการสำรวจ ไม่จำเป็นต้องมีการพิจารณาให้ข้อคิดเห็น

2. ผู้แทนจากกรมส่งเสริมการปกครองส่วนท้องถิ่น และจากสถาบันเทคโนโลยีแห่งเอเชีย ให้ข้อคิดเห็นว่าควรเพิ่มผู้แทนจากกระทรวงวิทยาศาสตร์และพลังงาน และ JICA Experts เป็น Authorizing Committee ด้วย
3. ผู้แทนจากกรมควบคุมมลพิษ ให้ข้อคิดเห็นในส่วนของกิจกรรมการปรับปรุงฟื้นฟูระบบบำบัดน้ำเสีย ที่มีการปรับปรุงเพียง 2 แห่ง คือ โรงบำบัดน้ำเสียเทศบาลเมืองปทุมธานี ที่มีระบบบำบัดน้ำเสีย แบบคลองวนเวียน (Oxidation Ditch) และเทศบาลเมืองกำแพงเพชร ที่มีระบบบำบัดน้ำเสียแบบบ่อผึ่ง (Stabilization Pond) อาจไม่ครอบคลุมโรงบำบัดน้ำเสียที่ใช้ระบบบำบัดแบบอื่น
4. ผู้แทนจากกรมส่งเสริมการปกครองส่วนท้องถิ่น ให้ข้อคิดเห็นว่าควรคำนึงถึงบุคลากรเป้าหมายที่จะใช้คู่มืออ้างอิงทางวิชาการที่จัดทำขึ้นดังกล่าว รวมทั้งควรกำหนดขอบเขตของระบบบำบัดน้ำเสียในประเทศไทยให้ครอบคลุมและชัดเจน

<u>วาระที่ 3 เรื่องเพื่อทราบ</u>

3.1 การนำเสนองานของผู้เชี่ยวชาญชาวญี่ปุ่น Mr.Shigeo Kanai เรื่อง "General Specification and Supervision Inspection Manual"

- Mr.Kanai นำเสนอวัตถุประสงค์ในการทำงานครั้งนี้ สิ่งที่ได้ทำไปแล้ว เช่น การตรวจเยี่ยมโรงบำบัดน้ำเสีย ที่นครปฐม บ้านเพ กรุงเทพมหานคร และกำแพงเพชร ซึ่งผลการตรวจเยี่ยมพบว่าคุณภาพการก่อสร้างของโรงบำบัดเหล่านี้ยังไม่ดีเท่าที่ควร ต้องมีการฟื้นฟูปรับปรุง
- Mr.Kanai ได้นำเสนอวิธีการทำ GS และ Supervision Inspection ต่อที่ประชุม พร้อมทั้งนำเสนอสารบัญของเอกสารทั้งสองเล่มด้วย นอกจากนี้ยังกล่าวถึงสิ่งที่จำเป็นสำหรับการปรับปรุงคู่มือดังกล่าวให้ดียิ่งขึ้น

3.2 การนำเสนอความก้าวหน้าการดำเนินงานของ TEAM Consulting Engineering and Management เรื่อง "Study for Authorizing of Technical Guidelines for Quality in Sewage Works in Thailand"

- ดร.สำราญ ผู้จัดการโครงการของที่ปรึกษา ได้นำเสนอรายละเอียดและความก้าวหน้าการดำเนินงานของการจัดทำคู่มือแนวทางการควบคุมคุณภาพสำหรับการก่อสร้างระบบบำบัดน้ำเสียโดยสังเขป
- ความก้าวหน้างานโดยสังเขปเป็นดังนี้
  - Investigation work 100%
  - Creation of the GS 100% (Draft)
  - Creation of the TG & TD 50%

- งานที่ที่ปรึกษายังต้องดำเนินการ
  - Progress Report & GS ส่ง 21 ธ.ค. 49 (สำหรับ Authorizing Committee วันที่ 26 ธ.ค. 49)
  - Draft of TG, TD & Refine GS ส่ง 5 ม.ค. 50 (สำหรับ Authorizing Committee วันที่ 15 ม.ค. 50)
  - Draft Final report & Refine TG & TD ส่ง 29 ม.ค. 50 (สำหรับ Authorizing Committee วันที่ 8 ก.พ. 50)
  - Draft outputs GS, TG & TD ส่ง 19 ก.พ. 50 (สำหรับ Authorizing Committee วันที่ 28 ก.พ. 50)
  - Final Report ส่ง 9 มี.ค. 50

<u>วาระที่ 4 เรื่องอื่นๆ</u>

4.1 การนำเสนอในที่ประชุม

- ผู้แทนผู้เข้าร่วมประชุมต้องการให้ใช้ภาษาไทยในการประชุม Authorizing Committee และให้มีล่ามแปลเป็นภาษาอังกฤษ สำหรับผู้เชี่ยวชาญชาวญี่ปุ่น

เลิกประชุม เวลา 12.30 น.

ระเบียบวาระการประชุม
คณะกรรมการพิจารณาการจัดทำเอกสารอ้างอิงทาง
วิชาการด้านการจัดการน้ำเสีย

โครงการ The Improvement of Sewage Treatment Plant Management in Thailand

ครั้งที่ 1/2550

วันศุกร์ที่ 16 กุมภาพันธ์ 2550

เวลา 09.30 น.

ณ. ห้องประชุมองค์การจัดการน้ำเสีย

ระเบียบวาระการประชุม

คณะกรรมการพิจารณาการจัดทำเอกสารอ้างอิงทางวิชาการด้านการจัดการน้ำเสีย

โครงการ The Improvement of Sewage Treatment Plant Management in Thailand

ครั้งที่ 1/2550

วันศุกร์ที่ 16 กุมภาพันธ์ 2550 เวลา 09.30 น.

ณ. ห้องประชุมองค์การจัดการน้ำเสีย

ระเบียบวาระที่ 1 เรื่องที่ประธานแจ้งให้ที่ประชุมทราบ

ระเบียบวาระที่ 2 เรื่องเพื่อพิจารณา

วาระที่ 2.1 General Specification (TEAM)

วาระที่ 2.2 Management/Inspection Manual (JICA)

วาระที่ 2.3 Pumping station designing and O&M (JICA/TEAM)

วาระที่ 2.4 Safety manual for construction and O&M (JICA)

วาระที่ 2.5 Technical Guideline (TEAM)

ระเบียบวาระที่ 3 เรื่องอื่นๆ (ถ้ามี)

ระเบียบวาระที่ 1 เรื่องที่ประธานแจ้งให้ที่ประชุมทราบ

ระเบียบวาระที่ 2 เรื่องเพื่อพิจารณา

วาระที่ 2.1 General Specification

วาระที่ 2.2 Management/Inspection Manual

วาระที่ 2.3 Pumping station designing and O&M

วาระที่ 2.4 Safety manual for construction and O&M

วาระที่ 2.5 Technical Guideline

วาระที่ 2.1 General Specification

วาระที่ 2.2 Management/Inspection Manual

วาระที่ 2.3 Pumping station designing and O&M

วาระที่ 2.4 Safety manual for construction and O&M

วาระที่ 2.5 Technical Guideline

ระเบียบวาระที่ 3 เรื่องอื่นๆ (ถ้ามี)

Advisory Committee Meeting No. 1

Study for Authorization of Technical Guidelines for Quality Control In Sewage Works in Thailand

Held on 16 February 2007, at 09:45 a.m.
At the JICA's Meeting Room, Fl.23 LPN Building

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1. PARTICIPANT

1.1 JICA Expert's team

Mr. Haruki	Takahashi	Chief Advisor
Mr. Nagahide	Nagamura	Expert
Mr. Shu	Nishi	Expert and Project Secretary
Mr. Tetshro	Usui	Coordinator

1.2 WMA Staff

Mr. Supparat	Ittiphol	Director of Wastewater Management Dept-WMA
Ms. Hatairat	Likitanupak	Director, Department of Planning and Project Development
Mr. Kitti	Teerasoradech	Section Chief

1.3 Consultant

Dr. Samran	Chooduangngern	Project Manager
Mr. Jadenarong	Chaochudetch	Document and Specification Expert
Dr. Sompong	Hirunmasuwan	Environmental Expert
Mr. Akachat	Saisuwan	Mechanical Engineer
Mr. Somsak	Rittiboon	Electrical Engineer
Ms. Pitukarn	Charoensombut	Environmental Engineer

Dr.Yuttana presided over the meeting.

2. OUTCOME

1. Introduction

- Dir.Supparat, Director of Wastewater Manager Dept-WMA said about the background this project.
- The outputs of this project are following:
  - i. Improvement of Sewage Treatment Plant in Thailand such as Pathumthanee and Kumpangpetch
  - ii. Documentary paper preparation
  - iii. Human training
  - iv. Information technology
- There are 5 documents/topics being purposed for review and comments by advisory committee :
  - i. The General Specification : present by the Consultant
  - ii. Supervision and Inspection Manual for Construction Works (Thai Version) : present by the Consultant

iii. The Guideline for Pumping Station : present by the Consultant
iv. Safety in Sewage work : present by JICA Expert
v. The Technical Guideline : present by the Consultant

2. Questions and Comments

The meetings have a several comments following:

Q1: Can the General Specification apply for improvement sewage plant (the existing plant)?

A1:

C1: The representative of PCD would like to know the real objective of this meeting

Q2: How could the end user (local government) use each document?

A2:

C2: The consultant should add more details about "personal" and "financial" in the documents and WMA wants to discuss with JICA and the Consultant before doing so.

C3: There should be some figure and strongly focus on contents in the "Safety for sewage work"

C4: Each document must consist of introduction and abstract so that the end user can understand the objective of its.

C5: The Consultant should identify the reference by separating in each chapter.

C6: The advisory committee would like the Consultant add "Flap gate" that has a problem for the wastewater treatment plant in the coast about the installation guideline, operation and maintenance.

C7: For improvement the sewage plant, the advisory committee would like to add "Problem and solution" in the documents.

The chairman of the meeting would like the advisory committee send the comments to WMA (Mr.Kitti Teerasoradetch) within 23 February 2007.

The next meeting will be held on 2 March 2007.

ระเบียบวาระการประชุม

คณะกรรมการพิจารณาการจัดทำเอกสารอ้างอิงทาง

วิชาการด้านการจัดการน้ำเสีย

โครงการ The Improvement of Sewage Treatment Plant Management in Thailand

ครั้งที่ 2/2550

วันศุกร์ที่ 9 มีนาคม 2550

เวลา 09.30 น.

ณ ห้องประชุมองค์การจัดการน้ำเสีย

คณะกรรมการพิจารณาการจัดทำเอกสารอ้างอิงทาง

วิชาการด้านการจัดการน้ำเสีย

โครงการ The Improvement of Sewage Treatment Plant Management in Thailand

ครั้งที่ 2/2550

วันศุกร์ที่ 9 มีนาคม 2550 เวลา 09.30 น.

ณ ห้องประชุมองค์การจัดการน้ำเสีย

ระเบียบวาระที่ 1 เรื่องที่ประธานแจ้งที่ประชุมทราบ

ระเบียบวาระที่ 2 เรื่องสืบเนื่องเพื่อพิจารณา

ระเบียบวาระที่ 3 เรื่องอื่นๆ

Annex 13: List of Attendance to Technical Seminars

Annex 13: List of Attendance to Technical Seminars

North Region

Location	Type	Training	Name	Position
Payao Municipality	SP	SP	Mr. Sanee Chanfai	Director of Technical Works
		SP	Mr. Sanguan Matnok	Sanitary Engineer
Cheangmai Municipality	AL			
Tak Municipality	SP	SP	Mr. Sanee Naknawdee	Director of Water Quality Analysis
		SP	Mr. Kajornsuk Saijai	Sanitary Engineer
Pichit Municipality	AL	SP	Mr. Surapon Teytakul	Machanician
		SP	Mr. Chompol Sadao	Sanitary Engineer
Khampangphet Municipality	SP	SP	Mr. Chosub Saisang	Director of Sanitary Works
Salokbaht Municipality	SP	SP	Mr. Prawit Hunteang	Public Health 6
		SP	Ms. Siriporn Kumkram	Sanitary 2
Nan Municipality	SP			
Mae Sod, Tak Municipality	SP			
Cheangrai Municipality	AL	SP	Mr. Sanong Neamsakul	Acting Chief of Sanitary Works
		SP	Mr. Chawalit Chantharot	Civil Engineer
Lumpon Municipality	AS			
Sukhothaithani Municipality	SP	SP	Mr. Chawarit Srimung	Sanitary Academician
		SP	Mr. Sophon Chommanee	Machanician
Phitsanulok Municipality	SP			
Lumpang Municipality	SP	SP	Mr. Surachat Paisarn	Mechanician 7
		SP	Mr. Sawage Chanthawong	Civil Technician 4
Chumsang Municipality	SP	SP	Mr. Saroj Luttisophon	Engine Technician 6
Uthaithani Municipality	SP	SP	Mr. Bunnatorn Tonglor	Director of Public Health and Environment Division
	SP	SP	Mr. Nikorn Krawitnit	Vice Mayor

Middle Region

Location	Type	Training	Name	Position
Chainart Municipality	SP	SP	Ms. Kasara Sungkapand	Director of Public Health and Environment Division
Baan Mee Municipality	SP	SP	Ms. Saiphet Maksuthat	Director of Sanitary and Environment Division
Angtong Municipality	AL	SP	Mr. Suwatchai Tanaseaneewat	Civil Mechanician 5
Bangkok Sipraya	AS	SP	Mr. Kretha Soysiri	Civil Engineer 7
Yannava	AS	SP	Mr. Chalom Mepong	Electrical Engineer
Ratthanakosin	AS			
Ratburana	AS			
Nongkham – Pasricharoen	AS			
Combine WTP, phase 1	AS			
Combine WTP, phase 4	AS			
Nakornpathom Municipality	SP	SP	Mr. Sonthaikarn Sangsawang	Acting Chief of Maintenance
	SP	SP	Mr. Chanont Kammanee	Acting Chief of Maintenance
Baanpong Municipality	SP	SP	Mr. Surut Tanasupanuwet	Civil Technician 5
Photharam Municipality	OD			
Phetburi Municipality	SP	SP	Mr. Kiertsak Suksadee	Civil Mechanician 6
Huahin, phase 1	RBC	SP	Mr. Nirun Nimittawin	Electrical Techinician 6
Huahin, phase 2	OD	SP	Ms. Madee Ruksa	Director of Technical Works
Prachubkirikhan Municipality	AL	SP	Mr. Narong Tavornbunjob	Mr. Narong Tavornbunjob
Authong Municipality	SP	SP	Mr. Chaowchai Kitipun	Technician Administrator 7
		SP	Mr. Chalermchai Pisitpan	Civil Mechanician 5
Suphanburi Municipality	SP	SP	Mr. Suvit Panacha	Chief of Public Health Division
Pathumthani Municipality	OD			
Nonthaburi Municipality	AS	SP	Mr. Siwawut Neamwutthana	Machanical Engineer
Prainnracha Municipality	AS	SP	Mr. Veeraphon Atthajinda	Electrical Technician 5
Cha-um Municipality	AL			

Location	Type	Training	Name	Position
Rachaburi Municipality	SP	SP	Mr. Teerapong Kahabadee	Acting Diriector of Sanitary Works
		SP	Mr. Permyut Tiwwoharn	Electrical Technician 7
Singburi Municipality	SP	SP	Mr. Nutthayut Pusuwan	Electrical Technician 2
Khanchanaburi Municipality	OD			
On process of Construction				
Samutprakarn Minicipality	AS			

North East Region

Location	Type	Training	Name	Position
Sakonnakorn Municipality	SP + Wetland	SP	Mr. Apiwut Pudjaiko	Engine Technician
		SF/SP	Mr. Rungroj Kotprom	Sanitary Acdamician
Ta Rae Municipality	SP	SP	Mr. Sayun Sanpak	Vice Mayor
		SP	Mr. Teerawut Sarathiyakul	Chief of Public Health Division
Khonkhan Municipality	AL	SP	Mr. Thotsaphon Wongarsa	Chief of Natural Resourdes Management
		SP	Mr. Chawalit Hongyont	Sanitary Academician 6
Huakwang Municipality	SP	SP	Mr. Thanatip Amornpun	Director of Mechanician Division
		SP	Ms. Siriwan Chaithani	Director of Public Health Division
Chaiyaphom Municipality	SP	SP	Ms. Suthida Ngorpilai	Sanitary Academician 6
		SP	Ms. Nalinee Arjarun	Sanitary 2
Bau Yai Municipality	SP	SP	Mr. Vitthaya Muanmai	Vice assistant district officer
		SP	Mr. Uthaisin Kumsiri	Public Health 6
Nakornratchasrima Municipality	SP	SP	Mr. Rachan Teeraphitthayatrakul	Sanitary Acadamician 6
Ubonrachathani Municipality	AL	SP	Mr. Jongka Boonrung	Sanitary Acadamician 4
Bureerum Municipality	AL	SP	Mr. Pairat Chaisoomboon	Technician 6
Pakchong Municipality	SP	SP	Mr. Chakkre Dokmanee	Civil Engineer 5
		SP	Mr. Rojrut Muangnak	Electrical Technician 1
Varinchumrab Municipality	SP			
Mookdaharn Municipality	SP			
On process of Construction				
Yasothorn Municipality	SP	SP	Mr. Aram Nijphanit	Director of Technical Works
		SP	Mr. Atjiphon Nontree	Civil Engineer 6
Aumnartcharoen Municipality	SP	SP	Mr. Prasarn Pungpan	Vice assistant district officer
		SP	Mr. Jarutchai Chantongsurawee	Vice Mayor
		SP	Mr. Sungworn Bonsod	Civil Engineer 8
		SP	Mr. Vichean Yoyala	Sanitary Acdamician 5
		SP	Mr. Tawee Pannawong	Sanitary Acdamician 5
Nakornpanom Municipality	SP			
Mahasarakham Municipality	SP			
Karasin Municipality	AL			
Surin Municipality	SP			

East Region

Location	Type	Training	Name	Position
Chachensao Municipality	OD	SP	Ms. Pichittra Ngenpatt	Environment Academician 7
		SP	Ms. Chatvadee Khamchai	Assistant Environment Academician
Panasnikhom Municipality	SP	SP	Mr. Somchai Pinpiroom	Electrical Technician 5
Sansook Municipality		SP	Mr. Pakorn Kitinunthawat	Engine Technician
North Area	SP	SP	Mr. Chanachai Sansooksakolchon	Electrical Technician
South Area	OD	SP	Mr. Somsak Sompand	Electrical Engineer
	OD	OD	Ms. Kwankanung Srihawong	Sanitary Works
		OD	Mr. Pakorn Kitinuntawat	Technician
Sriracha Municipality	OD	OD	Ms. Nisakorn Wiwagwin	Sanitary Works
Lamchabung Municipality	OD	SP	Ms. Kavarin Akradechrungsri	Sanitary Acdamician 8
		SP	Mr. Yongyut Suwansin	Engine Technician 5

Location	Type	Training	Name	Position
Phattaya Municipality				
Soi watbunkunchanaram	AS	SP	Mr. Vorayut Krompalod	Sanitary Engineer 3
Na kreu	AS	SP	Mr. Sadjapad Tawatphaiboon	Civil Technician 2
Baan Pae Municipality	OD	SP	Mr. Noppadon Viyaporn	Electrical Techinician 4
		OD	Mr. Kornpob Shotipong	Sanitary Works
		OD	Mr. Buntoon Buatong	Civil Engineer
Chantaburi Municipality	SP	SP	Mr. Chatchai Wutthanaaungkul	Civil Technician 2
Tachang Municipality		SP	Ms. Sasina Jirapruk	Public Health 3
Rayong Municipality	AL	SP	Mr. Attawit Tiptayawut	Technical Admintration 6
		SP	Mr. Dusit Tummasiriruk	Public Health Administration 6
Chonburi Municipality	OD			
Kalong Municipality	SP	SP	Mr. Rathasak Sunthanon	Sanitary Academician 4
		SP	Mr. Rawat Chalermpong	Electrical Technician 6
Mabthaphut Municipality	AL			
On process of Construction				
Bang Kra, Chachengsao	SP			

South Region

Location	Type	Training	Name	Position
Panguan Local Administration	Wetland			
Pa Tong Municipality	OD	SP	Mr. Supanut Mirint	Civil Mechanician 6
Phuket Municipality	OD	SP	Ms. Sitharat Srikat	Assistant Environment Academician
		SP	Ms. Anuttha Sakeaw	Assistant Civil Engineer
Aow Nang Municipality	SP			
Trang Municipality	AL	SP	Ms. Jarunee Fongngam	Sanitary Acadamician 3
		SP	Mr. Surana Suthinint	Civil Technician 5
Hadyai Municipality	SP +			
Songkra Municipality	AL			
Koh Sa mui Municipality				
Had Na Thon	OD	SP	Mr. Sombat Somwang	Chief of Sanitary Works
Cha Wang	OD	SP	Mr. Paiboon Phetthong	Sanitary Engineer 5
La mai	OD	OD	Mr. Sombat Somwang	Sanitary Works
Krabi Municipality	AL	SP	Mr. Sompob Kuwanichkul	Director of Techical Works
		SP	Mr. Bunjob Kasumrit	Civil Technician 6
Karon Municipality	AS	SP	Mr. Chatporn Charoenvat	Electrical Technician
		SP	Mr. Sin Sirinuntasak	Machanician
Pak Panung Municipality	AL + Wetland			
On process of Construction				
Chompon Municipality	SP	SP	Ms. Jongjai Kuyukhom	Chief of Public Health Administration
		SP	Ms. Thitiya Jarukitpiphat	General Staffs
Phatthani Municipality	SP	SP	Mr. Manit Aebsakul	Director of Civil Works
Nakornsrithummarat Municipality	SP + Wetland			
Krato Municipality	OD			
Yala Municipality	Decentralized AL &SP			

Other Organizations

Organizations		Training	Name	Position
WOMC		SP	Mr. Nattaphat Saiwan	Manager
WOMC		SP	Ms. Jiratha Phatkanoksiri	Chemist
WOMC		OD	Ms. Sukanya krinkrob	Sriracha, Baan Pae, Chemsang, Khampangpet
WOMC		OD/SP	Mr. Nirut Tongpromrat	Sakonnakorn, Ta Rae, Hua Kwang
EEI		OD	Mr. Akarat Sriyuyung	Officer
EEI		OD	Mr. Chalermpon Chareontao	Middle Region
EEI		SP	Mr. Jiraphat Nonthapraphet	Environment Engineer
EEI		SP	Mr. Alongkorn Auttarapinyo	Environment Engineer

Organizations		Training	Name	Position
PCD		SP	Mr. Bunphot Yamkrinphot	Civil Techinicain 6
PCD		SP	Mr. Suriya Morsin	Environment Acdamician
ONEP		SP	Mr. Paisarn Padungsirikul	Director of Analysis and coordination
ONEP		SP	Ms. Nareerat Punmanee	Environment Academician 6
ONEP		SP	Mr. Pisanuphon Sanguanaon	Envirinment Acdamician
WMA		OD/SP	Mr. Supparat Ittipol Participated as a lecturer	Director of Wastewater Management Lecture for cost and energy saving
WMA		OD/SP	Ms. Hatairat Likitanupak Participated as a lecturer	Director of Planing and Development Project Lecture for Wastewater Treatment om OD method
WMA		OD/SP	Mr. Chumpol Musiganont Participated as a lecturer	Director of The Office of Internal Audit Law & Regulation, Wastewater Treatment System
WMA		OD/SF/SP	Mr. Phanthat Chancharoensook	Special Project Lecture for Safety Control for Workers in Wastewater & Safety
WMA		OD	Mr. Anupand Taipairuchkulkit	Special Project
WMA		OD/SP	Mr. Kumpanart Tanasatakorn	Project Engineer for Central & East
WMA		OD/SP	Ms. Photjamarn Tuntip	Project Secretary for Central & East Lecturer for water analysis
WMA		SP	Mr. Somkiet Sangchaisukonkit	Special Project Lecturer for Pumping Station Mechanical and Electrical facilities
WMA		SP	Ms. Phatcharin Nuntiwawat	Project Engineer for Central & East Lecturer for Periodical and daily inspection in SP treatment system
WMA		OD/SP	Mr. Atirak Buphajantao	Deputy Project Manager for North
WMA		OD/SP	Ms. Rosita Laosakol	Project Engineer for North
WMA		SP	Ms. Woranun Chandanu	Budgeting Division
WMA		OD	Mr. Sombat Paneiam	EX Project Manager for North
WMA		OD/SP	Mr. Amornchai Hiranrat	Special Project
WMA		SP	Ms. Sukanda Taweepon	ISO Research Project
WMA		OD/SP	Ms. Duangjai Khunkruer	Project Secretary for Northeast Lecturer for wastewater treatment of SP method
WMA		OD	Mr. Supamit Yuwattana	Deputy Project Manager for Northeast
WMA		OD	Ms. Orawan Chantra	Research Project
WMA		SF/SP	Mr. Kitti Teerasoradeck	Special and Research Project Lecture for Safety
WMA		OD/SP	Mr. Paisarn Taitama	Deputy Project Manager for South
WMA		OD/SP	Mr. Nawin Jitkeaw	Project Engineer for South
WMA		SP	Ms. Vipa Matamoo	Public Relation
WMA		OD	Mr. Puwanart Kreangmeesri	Project Secretary for South
WMA		OD	Mr. Manut Kumkul	Special Project
WMA		OD	Mr. Sompong Pusub	Special Project
WMA		OD/SP	Ms. Panadda Kongcharoen	Laboratory Staff Lecturer for water analysis
WMA		SP	Ms. Rattiya Saingam	Laboratory Staff, Chemist
WMA		OD	Mr. Norasing Karnchanaprakorn	Procurement

Training: OD: Oxidation Ditch
SP: Stabilization Pond
SF: Safety

STP under the WMA

STP under the WMA from 2008

STP completed contract

A person who are certified of SP

A person who are certified of OD

Annex 14-1: Report on Trainings of SP Management

Evaluation Report
Training Program – The Management of Stabilization Pond System
Bangkok – Nakornpathom, 29 – 31 January 2007

Evaluation Meeting on 6 February 2007 at WMA Meeting Room

Participants

WMA

1. Mr. Supparat Ittipol	Project Manager
2. Ms. Hatairat Likitanupak	Assistance Project Manager
3. Mr. Phanthat Chuncharoensook	Head of Training
4. Mr. Kitti Teerasoradej	Team Member
5. Ms. Phatcharin Nuntiwawat	Lecturer
6. Mr. Somkiert Sangchaisukonkit	Lecturer

JICA

1. Mr. TAKAHASHI Haruki	Chief Advisor
2. Mr. USUI Testuro	Project Coordinator
3. Mr. NAKAMURA Nagahide	Long Term Expert
4. Mr. NISHI Shu	Long Term Expert
5. Ms. Parawee Bailee	Secretary

Meeting Began 9.30 AM.
Mr. USUI Tetsuro informed Agenda and the purpose of evaluation meeting is to exchange the ideas among team member in order to improvement for organizing training program in next time.

The topics of evaluation as follows

- **The title of training program** is "The management of Stabilization Pond System". The title was appropriate, by evaluating from the number of participants that was more than the expectation.
- **Duration of Training** is 3 days divided into lecture 2 days and practical training on the last day, that was appropriate. From the experience of the previous training program last year which was 5 days training, team member found that 5 days was too long.
- **Place of Training** is Princeton Park Suite Hotel and Nakorn Pathom Wastewater Treatment Plant and Pumping Station.
    - ♦ Princeton Park Suite Hotel – the training room was not appropriate for more than 100 persons, because the columns of the room cover up the participant at the back of the room, so the participants could not pay attention to the lecture.
    - ♦ Nakornpathom Wastewater Treatment System was appropriate, because Wastewater Treatment System is Stabilization Pond System and close to Bangkok. It was only one choice to select Nakornpathom as the practical training site. The distance from Pumping Station to Wastewater Treatment Plant is long, so it spend much time to rotate the participant from one place to another place.

- Nakornphathom Municipality contributed to this training very much.

- **Number of Trainees** is satisfactory and more than expectation. Total participants are 120 persons from 54 Municipalities, BMA, ONEP, PCD, DLP, WOMC, EEI and WMA. The rank and level of participants were wide and varied, so the view points of participants were different. For example, the participant who has high qualification might gain the knowledge less than the expectation, but the participant who has less qualification might not understand some topics that cover the basic knowledge. The invitation letter had mentioned clearly about the target of participants and asked the organization to select the participant to meet our criteria. Finally 90 persons got certification as skilled personnel.
- **Curriculum and Content of Training Program**
    - Curriculum of this training was appropriate.
    - Lecturers contributed to the training lecture with preparing text book. Text book is valuable.
    - Power point for presenting should be visual to attract the participants. Slide should put only keywords and visual things, because all the contents are already provided in text book.
    - The rehearsal for junior lecturer should be held before the lecture in order to practice presentation skill and how to make the question and answer.
- **On site training**
    - The transportation from treatment plant to pumping station was inconvenience because the size of the bus was too large and the weight of the bus made the bank of the pond damage.
    - We could not control all the participants at the site and let them rotate to each section of training because of large number participants.
    - The instruction or direction board should be prepared in front of the entrance in order to guide the participants.
- **Group Discussion**

Group Discussion was organized by dividing participants into 4 groups which follow the type of treatment system and had the leader from WMA to guide and lead the question in each group. After that, the representative from each group presented the ideas, and the discussion was concluded by Mr. Supparat and Ms. Hatairat. The purpose of group discussion is to share the experience, problems and get the appropriate solution. WMA staff learned from them and they learned from each other so this training achieved the purpose of group discussion.

Group Discussion divided participant into group by following the wastewater treatment system of participants such as Stabilization Pond, Oxidation Ditch, and Aerated Lagoon. The

activities of group discussion was shared the experience of operation system and circumstance also the problems. The point of group discussion could summarize into 8 point are as follows:

1. **Treated Wastewater Quality:** The effluence from STP could not reach the standard of effluence and staff could not operate and make the effluence meet standard so participants mention that they need knowledge to improve the wastewater treatment system in order to solve the problem of treated wastewater quality.

2. **Lack of Staffs (Skilled Person/Total Staffs):** The staffs working in the function of STP lack of knowledge, the proportion about skilled person per total staffs is quite difference so skilled person could not control and manage cover all functions then they need more training both lecture and practical training.

3. **Lack of knowledge and budgets in mechanical Facilities:** Need budget in maintenance facilities, Need knowledge in maintenance facilities.

4. **Citizen unconcern about the management of wastewater:** From the discussion, participants share the opinion and the opinion goes the same direction which is citizens unconcern and not realize about the management of wastewater so participants agree that they need the method to make citizens are conscious about the valuable of water, wastewater treatment system and environment. They expect that if citizen concern about the management of wastewater other problems could solve easier.

5. **Executives unconcern about the management of wastewater:** The management of wastewater is depend on the executives policy, the problem might occur when municipality change the executives. If the executive unconcern about the management of wastewater so during that period will not have any budgets or workflow about wastewater then they need to know clarify about the management of executives.

6. **Inappropriate Design:** Since the construction period in the past, the design is inappropriate with the location such as over capacity, the design of pumping stations and specification of facilities are not the same so they need the appropriate design and facilities as pump and pipe should be the same type. For example, when pump NO. 1 got damage, we could switch another pump to work.

7. **Problem of influence (Damage of pipe/ sewer not cover):** The design of STP could support more than the actual influence so they would like to increase number of pipe and connection of pipe to increase the influence, need to examine the damage of pipe in order to get the real volume of influence. Municipalities do not have the ability to examine the damage of the pipe and does not have the budgets to expand the line of sewer to collect influence.

8. **Lack of budgets and could not collect wastewater treatment fee:** Need constant budget in order to operate system continuously. Citizens are not conscious for fee collection and the executives don't propose it and the budgets in management of wastewater are depending on the executive level also.

- **Evaluation from participants**
  Only 72 evaluation sheets has submitted among 120 participants, and summary of result as below,
  1. Content of training [very good: 7.41%, good: 48.84%, fairly: 39.81%, poor: 3.94%]
  2. Practical training [very good: 8.10%, good 57.87%, fairly 33.33%, poor: 0.70%]
  3. Satisfaction [very good: 15.28%, good: 51.04%, fairly: 29.86%, poor: 3.13%, very poor: 0.69%]

- **Cost Management**
  The brief total cost of organizing this training program is 250,000 THB. The detail of expenses is enclosed in the meeting documents. This number could be used as the reference data when WMA will organize training program next time and also be necessary for the program to set up with training fee per person. So it is very important how much program itself will be beneficial and attractive for their demands.
- **Next Training Plan**
  WMA plan to organize training program once a year and safety training 4 places per year.

- **Others**

1. Revises text book and materials for demands of participants.

2. Editing video record and produce as training kits with revises text book and materials, it will be one of the tools to promote WMA activities.

3. Analysis of data of evaluation paper and questionnaire to meet their demands for WMA activities and next training program.

Meeting Closed 11.30 AM.

Annex 14-2: Report on Trainings of OD Management

1, Title
Training of wastewater treatment plant management on oxidation ditch with cost and energy saving guideline

2, Duration
30 January to 3 February, 2006

3, Location
Princeton Park Suites Hotel

4, Target group and no of participants
Participants no. is 30 but only 24 of them has completed the training course.

5, Content of curriculum
There are 4 days for 8 topics of lecture with 1 day for practical training in oxidation ditch treatment plant and pumping station

6, Recommendation
As the result of evaluation, very good and good in level of satisfaction occupied over 70% however there are some points to develop training program with more effective and practical approach. And we would like to mention ideas to concern this point as recommendation as below.

1, Information of training program should be delivered at least before two months as advance.

2, The content of each topics is necessary to consider with lecturers and related staffs more as well as content of hand out materials.

3, There were not much time to report current condition of each of them and idea, it is more better if program has more time to exchange idea to improve management with their own experiences and practical suggestion of WMA.

4, The training schedule of the last day should be flexible to finish earlier than the appointed time.

5, There are some problems for lecturer from WMA to synchronize the explanation data with the time they have.

Training Schedule

Day	9:00 - 10:15		10:30 - 12:00		13:00 - 14:30		14:45 - 16:30
1	**Laws and regulation about wastewater systems** Mr. Chumpol Musiganont WMA	COFFEE BREAK	**Laws and regulation about wastewater systems** Mr. ChumpolMusiganont WMA	LUNCH	**Wastewater Treatment of OD method** Ms. Hatairat Likit Anupak WMA	COFFEE BREAK	**Wastewater Treatment of OD method** Ms. Hatairat Likit Anupak WMA
2	**Sewer and pumping stations** Mr. Jane BMA		**Sewer and pumping stations** Mr. Jane BMA		**Mechanical and electrical facilities System in Wastewater Treatment Plant** Mr. Chatchawan Supa Thai Medan CO.,LTD		**System and Machinery of Wastewater Treatment System** Mr. Reakchai A. MRM CO.,LTD
3	**Periodical and daily inspections for wastewater systems** Mr. Kitti Teerasoradech WMA		**Periodical and daily inspections for wastewater systems** Mr. Kitti Teerasoradech WMA		**Safety control for workers in wastewater system** Asst.Pro. Somchai / Mr. Anupand KMITNB/WMA		**Safety control for workers in wastewater system** Asst.Pro. Somchai / Mr. Anupand KMITNB/WMA
4	**Practical training for operation in OD treatment plant and Pumping Station** Mr. Phanthat Chancharoensook WMA		**Practical training for operation in OD treatment plant and Pumping Station** Mr. Phanthat Chancharoensook WMA		**Practical training for operation in OD treatment plant and Pumping Station** Mr. Phanthat Chancharoensook WMA		**Practical training for operation in OD treatment plant and Pumping Station** Mr. Phanthat Chancharoensook WMA
5	**Cost and Energy Saving** Mr. Supparat Ittipol		**Cost and Energy Saving** Mr. Supparat Ittipol		**Brainstorm, Sharing Experience and Knowledge**		**Certificate Ceremony**

Training Certificate

Name	Organization	Signature
1. Ms. Kwankanung Srihawong	Sansook Municipality	
2. Mr. Pakorn Kitinuntawat	Sansook Municipality	
3. Mr. Sombat Somwang	Samui Municipality	
4. Mr. Buntoon Buatong	Baan Pae Municipality	
5.Ms. Nisakorn Wiwagwin	Sriracha Municipality	
6. Ms. Sukanya krinsamui	WOMC	
7. Mr. Nirut Tongpromrat	WOMC	
8. Mr. Chalermpon Jareontao	EEI	
9. Mr. Norasing Karnchanaprakorn	Wastewater Management Authority	
10. Mr. Sombat Paneiam	Wastewater Management Authority	
11. Ms. Panadda Kongcharoen	Wastewater Management Authority	
12. Mr. Amornchai Hiranrat	Wastewater Management Authority	
13. Ms. Duangjai Kunkrau	Wastewater Management Authority	
14. Ms. Rosita Laosakol	Wastewater Management Authority	
15. Mr. Anupand Taipairuchkulkit	Wastewater Management Authority	
16. Mr. Puwanart Kreangmeesri	Wastewater Management Authority	
17. Mr. Kumpanart Tanasatakorn	Wastewater Management Authority	
18. Mr. Manut Kumkul	Wastewater Management Authority	
19. Mr. Sompong Pusub	Wastewater Management Authority	
20. Ms. Photjamarn Tuntip	Wastewater Management Authority	
21. Mr. Nawin Jitkeaw	Wastewater Management Authority	
22. Mr. Supamit Yuwattana	Wastewater Management Authority	
23. Mr. Atirak Buphajantao	Wastewater Management Authority	
24. Mr. Paisarn Taitama	Wastewater Management Authority	

Evaluation Results

On "Management of Wastewater Treatment Plant:

Oxidation Ditch System

And guidelines to reduce cost and conserve energy

30 Jan. – 3 Feb. 2006

	Level of Judgment					
Understanding/Satisfaction	**Very Good**	**Good**	**Fair**	**Poor**	**Very Poor**	**Total%**
1. How much knowledge/ understanding do you have on the training contents: 1) Laws and Regulation on Wastewater Treatment System	-	36.36%	59.09%	-	4.55%	100%
2) Methods to treat wastewater in OD system	14.28%	66.67%	14.29%	4.76%	-	100%
3) Sewer System and wastewater pumping system	4.54%	72.75%	18.18%	4.54%	-	100%
4) Electric equipment system in wastewater treatment system	-	50.00%	45.54%	-	4.54%	100%
5) Mechanical equipment system in wastewater treatment system	-	63.64%	31.82%	4.54%	-	100%
6) Scheduling to monitor wastewater treatment system	9.09%	72.73%	18.18%	-	-	100%
7) Safety for Operators in wastewater treatment system	23.81%	61.90%	14.29%	-	-	100%
8) Guidelines to reduce cost and conserve energy	4.54%	68.18%	22.73%	4.55%	-	100%
9) Operation Training in OD system	36.36%	45.45%	13.64%	4.55%	-	100%

(Conti)

Understanding/Satisfaction	Level of Judgment					Total %
	Very Good	Good	Fair	Poor	Very Poor	
2. Were you satisfied with the training activities 1)Knowledge and performance of lecturer	31.82%	54.54%	13.64%	-	-	100%
2)Transfer of knowledge	19.05%	71.43%	9.54%	-	-	100%
3) Supervision of lecturer	33.33%	52.38%	14.28%	-	-	100%
4) Answering of Questions	19.05%	47.62%	33.33%	-	-	100%
5) Level of Participation during training	28.57%	47.62%	19.05%	4.76%	-	100%
6) Suitable Medias used for training	15.00%	65.00%	20.00%	-	-	100%
3. What is your level of satisfaction 1) On the contents of the training	23.81%	66.67%	9.52%	-	-	100%
2) The training can be used in actual practice.	23.81%	66.67%	9.52%	-	-	100%
3) Training Period (5 days)	19.05%	52.38%	19.05%	9.52%	-	100%
4) Place, Food, and beverage suitable for the training	33.33%	42.86%	19.05%	4.76%	-	100%

Annex 15: Summary of Interview with Agencies/Organization Concerned

Annex 15: Summary of Interview with Agencies/Organization Concerned

Organization	Date of Interview
1. Wastewater Management Authority (WMA)	21/06/07
2. Wastewater Management Authority (WMA)	21/06/07
3. Wastewater Management Authority (WMA)	22/06/07
4. Wastewater Management Authority (WMA)	25/06/07
5. Wastewater Management Authority (WMA)	25/06/07
6. Wastewater Management Authority (WMA)	26/06/07
7. Wastewater Management Authority (WMA)	26/06/07
8. Wastewater Management Authority (WMA)	26/06/07
9. Wastewater Management Authority (WMA)	27/06/07
10. Wastewater Management Authority (WMA)	27/06/07
11. Wastewater Management Authority (WMA)	27/06/07
12. Kamphaeng Phet Municipality	28/06/07
13. Kamphaeng Phet Municipality	28/06/07
14. Kamphaeng Phet Municipality	28/06/07
15. Wastewater Management Authority (WMA)	29/06/07
16. Pathumthani Municipality	03/07/07
17. Department of Local Administration (DOLA)	02/07/07
18. Pollution Control Department, MONRE	05/07/07
19. The Office of Permanent Secretary, MONRE	11/07/07
20. Summary of Interview with Focused STPs	10/07/07

1. Wastewater Management Authority (WMA)

1. Present issues on sewage policies and WMA functions.

- The problems of wastewater management in Thailand still exist; 80% of those are related to O&M of the system.
- WMA expects to construct new sewage treatment plants (STP) in potential areas, but it is difficult to do because of the financial burden and lessons learned from unsuccessful projects in the past - such as the STP at Klong Dan, Samut Prakarn. In this regard, MONRE has solved the problems by providing some budget allocations to Local Authorities (LA) to manage the system by themselves, but it did not work well in practice.
- MONRE plans to improve the operation of existing sewage treatment plants by appointing WMA to a role to support LAs to perform this function. Under this directive, WMA shall conduct certain activities, as follows:
    - O&M
    - Study wastewater treatment system structure
    - Set up wastewater treatment fee
    - Public Participation Promotion
- The current policy of WMA does not support these roles it plays, mentioned above, because:
    - Wastewater management policy is still unclear and the operation of STPs belongs to LAs that have not allowed WMA to perform much in practical terms.

- The influence of local politics on wastewater management can be intrusive at times. For example, some local authorities consider that the concept of a "Polluters Pay Principle" might affect their local votes.
- The changes on local executive boards are considered to be an obstacle for cooperation with the WMA.

2. **What expectations, desires and necessities do you think local authorities and other organizations concerned requires from WMA?**
   - Cooperation with local authorities in 3 areas:
     1) Technical transfer
     2) Collect wastewater treatment fee
     3) Public relations

3. **To what extent can WMA deal with these expectations, desires and necessities?**
   - WMA should discuss with the mayor of the municipality about the direction of cooperation on wastewater management and follow-up on its performance regularly.

4. **Does WMA have specified ideas and views about its own future possibilities and the required activities, especially in the next five years?**
   - At present, the cabinet is in the process of approving the policy itself. In the next five years, WMA will play a roll as a consultant for local authorities on wastewater management.
5. **Remarks on the position and future activities of the water quality analysis team**
   - The existing structure of WMA does not feature a water quality analysis team, so we plan to reconsider a new structure.
   - Now WMA has one chemist working for water quality analysis. In the future, WMA will recruit an additional chemist.
   - WMA will apply for ISO 17025 using the budget from government and JICA in order to improve the quality of the laboratory.

6. **To ensure project sustainability and achieve the overall project goals and super goals after project termination, what are the important points on the training programs?**
   - One important point is that all technical knowledge from the Project must be transferred to the new engineers.
   - Another point is setting up "on the job training" for staff in the engineering division to enhance their knowledge.
   - Self-effort on technical sustainability is important. In the Project, there are some remarkable points such as self-arrangement of technical seminars and improvement of contents of newsletter to inform WMA activities to the public.

7. **What kinds of problems and concerns are there in terms of capacity building and development through the use of reference materials?**
   - Due to the fact that reference materials are prepared in English, it is difficult for the relevant staff to understand. In response, WMA assigned a local consultant to translate the materials into Thai, though the translations are not yet complete.
   - After the translation process is finished, a committee consisting of related agencies - for example, academic institutes, ONEP, PCD, DEQP - will be invited to share their ideas and suggestions on the reference materials. In addition, WMA will set up 4

workshops to disseminate the reference materials in 4 regional areas including North, North East, Central, and South.

8. Others

- CP personnel who have joined training programs in Japan have not left their jobs and works, meaning they still continue their works.

2. Wastewater Management Authority

1. How does WMA need to sustain and develop technical skills and knowledge for facility rehabilitation and O&M obtained from the project activities?

- Since the number of WMA experts is small, we plan to transfer the technical skills obtained from the Project to new engineers in order to sustain the knowledge over the long run.

2. How have technical skills and knowledge obtained from training programs in Japan been applied for project sustainability? And how will they have to be developed in the future?

- The knowledge obtained from the training programs in Japan can be applied to the work in terms of equipment maintenance, algae control and utilization of effluent water for agriculture activities.

3. Wastewater Management Authority

1. What and how has the project affected the activities of the training Laboratory?

- JICA provided 3 items of equipment for the training laboratory (DO meter, pH meter and spectrophotometer), so training was provided for water analysis in 5 parameters:
    1) Suspended Solids (SS)
    2) Total dissolved solids (TDS)
    3) Dissolved Oxygen (DO)
    4) Biochemical Oxygen Demand (BOD)
    5) Chemical Oxygen Demand (COD)
- All equipment procured by the Project is still well utilized, while the equipment that was transferred from the Department of Public Works and Town & Country Planning (DPT) are out of order and in need of repair.
- The present activities of the laboratory include the following:
    1) Collect and analyze wastewater samples from wastewater treatment plants under WMA twice a year.
    2) Demonstrate the equipment for technical training
- Future plans for the laboratory:
    1) Recruitment of environmental scientist to operate laboratory.
    2) Strengthen capabilities to analyze all necessary parameters under wastewater standards such as TKN, Oil & Grease, etc.
    3) Apply for ISO certification

4. Wastewater Management Authority

1. **Present issues on sewage policies and WMA's functions.**
2. **What expectations, desires and necessities do you think WMA are required from local authorities and other organizations concerned?**
3. **To what extent can WMA deal with these expectations, desires and necessities?**
4. **Do you think that WMA will also have sufficient possibilities (organizational power and ability) in the future?**
5. **Does WMA have specified ideas and views about its own future possibilities and the required activities, especially in the next five years?**

- The important policy is related to the Decentralization Act B.E. 2542 (1999); this is because the Department of Public Works constructed STPs all over Thailand and transferred the responsibility of system operation to local authorities. As a matter of fact, most LAs do not have the capability - in particular human resources - to operate the system, so that the system cannot work properly.
- WMA initiated the rehabilitation program and provided supervision for the local authority on O&M of the existing wastewater treatment system as a pilot project at Saen Suk Municipality, Chonburi Province.
- Starting in fiscal year 2004, WMA conducted similar projects in other areas:
    - Sri Racha Municipality, Chonburi
    - Baan Pae Municipality, Rayong
    - Petchaburi Municipality, Petchaburi
    - Sakon Nakon Municipality, Sakon Nakon
    - Pathum Thani Municipality, Pathum Thani
- In fiscal 2005, the project was expanded to another 5 areas:
    - Tharae Municipality, Sakon Nakon
    - Huakhwang Municipality, Maha Sarakam
    - Kampaengpetch Municipality, Kampaengpetch
    - Pa-Ngan (Baan Tai Tambol Administrative Organization), Surat Thani
- The policy given by the previous government on the role of WMA is unclear as it expects WMA to provide social services on wastewater management while, at the same time, WMA has to raise its income without support from the government.
- WMA is a state enterprise organization that collaborates with the local authorities to conduct public opinion surveys on the collection of the wastewater treatment fee and set up appropriate wastewater treatment charges in each responsible area.
- According to the 4-year plan of WMA, it is impossible to achieve the target defined in the plan due to the overwhelming number of STPs in relation to the limited budget and human resources of WMA.
- WMA finds suitable technology for each local area. In addition, for project sustainability, WMA wants to increase capacity building of human resources, technical skill and management.
- The IST project supported by JICA is appropriate and beneficial to WMA to obtain new technical skills and knowledge on wastewater treatment systems that can

enhance the capability of WMA staff to expand their knowledge to the local authorities in order to support them to operate the wastewater treatment system efficiently and effectively. Moreover, the reference materials and Information System developed by the Project also supports WMA to disseminate useful information to the public.

- To sustain the Project, the capability building of WMA staff is required to strengthen their knowledge and explore suitable wastewater treatment technology that can then be applied to each area.

5. Wastewater Management Authority

- Participation in training in Japan improved my knowledge which I am able to transfer to the staff of local authorities. Although, most STPs in Japan are activated sludge, and the major system used in Thailand is the stabilization pond, somehow, some part of the knowledge obtained from the Project is still applicable.
- New Japanese technology, such as nitrogen and phosphorus removal, and algae removal by ultrasonic sound, can apply to STP operation in Thailand; for example, algae removal by ozone, but the cost is high and requires more research.
- The establishment of a WMA Research Center should be taken into consideration.

6. Wastewater Management Authority

1. **Current situation of STPs in Thailand**
   - The number of STPs is inadequate and does not cover all of Thailand.
   - The operation of existing STPs has not reached full capacity.
   - The technical skills of personnel are insufficient to solve the wastewater problem.
   - The budget from the central government is inadequate.
   - The awareness and willingness of people to pay the wastewater treatment charge is still low. The influence of local politicians can be an obstacle to the achievement of wastewater treatment fee collection.

2. **Local Authorities require WMA support to:**
   - Implement technical transfer for O&M of the system
   - Enhance capacity building of their staff
   - Provide recommendation on how to secure the budget from the central government to be used for STP operation

3. **WMA requires local authorities' cooperation:**
   - To raise people's awareness of the wastewater treatment charge
   - To allocate some of their own budget for wastewater management
   - To assign appropriate staff for O&M of the system

4. **To Sustain the Project, these activities should be performed:**
   - Follow the 4-year plan of WMA
   - Continue the technical training program
   - Set up the information system to disseminate data to the public
   - Distribute reference material in Thai to the related agencies

7. Wastewater Management Authority

1. **What are the important points in the training programs to ensure project sustainability and achieve the overall project goals and super goals after project termination?**
2. **What kinds of problems and/or concerns are there in terms of capacity building and development using reference materials?**

- The important points are to strengthen technical skills and increase the number of WMA staff for technical transfer to the LAs.
- The qualification of personnel to be trained should be taken into consideration by the LAs in order to utilize and maintain the knowledge effectively.
- The knowledge obtained from the training program in Japan has not yet been transferred to other staff of WMA since the responsible person is very busy.

8. Wastewater Management Authority

1. **What are the important points in the training programs to ensure project sustainability and achieve the overall project goals and super goals after project termination,?**
2. **What kinds of problems and/or concerns are there in terms of the capacity building and development using reference materials?**

- The important point is capacity building of WMA staff.
- WMA expected target personnel from LAs to be trained in the training program, but LAs managed the selection of trainees.
- Since the reference materials are prepared by WMA and JICA experts, after the process is completed, concerned agencies should be invited to share their comments and recommendations before the materials are disseminated to the public.
- Now training programs schedule for wastewater treatment system are keep on going.
- In my opinion, more technical abilities need to be strengthened with support from JICA. The training programs should be conducted in Thailand rather than Japan in order to reduce costs.

9. Wastewater Management Authority

1. **Current situation on wastewater policies and WMA functions.**
   - There have been 4 policies related to wastewater management:
     1) Decentralization Act: This provides authority to Local Administrative Organization (LAO) to manage wastewater treatment systems by themselves.
     2) Laws and regulations related to pollution control policy: LAs must comply; for instance, setting up environmental standards for pollution control.
     3) Privatization policy: In cases where LAs lack potential to solve pollution problems such as wastewater and solid waste, they are allowed to utilize the private sector to do so.
     4) Polluters Pay Principle: This policy aims to raise the awareness of people responsible for the wastewater treatment fee.

     Based on these 4 policies, WMA is the direct agency responsible for managing wastewater. However, from my point of view, WMA does not have full authority to manage the wastewater treatment system since it is the responsibility of local authorities.

2. **What expectations, desires and necessities do you think WMA are required from local authorities and other organizations concerned?**
3. **To what extent can WMA deal with these expectations, desires and necessities?**
   - Executive board of LAs should pay more attention to wastewater management.
   - The facilities of the wastewater treatment system, such as the collection system, have to be completed and function well for their operation.
4. **Do you think that WMA will also have sufficient possibilities (organizational power and ability) in the future?**
5. **Does WMA have specified ideas and views about their own future possibilities and the required activities, especially in the next five years?**
   - WMA will have sufficient capability in the future because WMA is the only agency responsible for managing wastewater. In addition, the regulation allowed WMA to collect a wastewater treatment fee, whereas the government cannot.
   - Due to the fact that most LAs do not pay much attention to wastewater management, the government should enforce them to take applicable actions, which are:
     - Manage the wastewater treatment system by themselves
     - Assign a private company to manage the system
     - Assign WMA to manage the system
   - According to the WMA 4-year plan, ten more engineers will be recruited.

10. Wastewater Management Authority

1. **How does WMA need to sustain and develop technical skills and knowledge for facility rehabilitation and O&M obtained from the project activities?**
   - More technical training programs (laboratory, mechanical technique and O&M) still need to be strengthened for WMA staff.
   - Japanese experts shall be requested to transfer technical knowledge in this regard.

11. Wastewater Management Authority

1. **What expectations and abilities does WMA receive from Pathumthani Municipality for future activities?**
2. **To deal with those expectations and abilities, what does WMA have to do?**
3. **How does Pathumthani STP need to sustain and develop technical skills and knowledge for rehabilitation and O&M?**

   - People in high ranking positions assigned for STP operation rarely deal with LAs.
   - The municipality is willing to support WMA's activities, but the problem is that they lack the human resources to do so.
   - In the past, the contractor assigned by WMA to take care of the STP did not operate the system properly; for example, sometimes turning off the aerator.
   - The government should build up public relations in the area, because local people still do not know much about the project and the wastewater treatment charge.

12. Kamphaeng Phet Municipality

1. **The priority of the wastewater treatment situation in Kamphaeng Phet Municipality.**
   - Current situation:
     - The wastewater collection system is a combination of wastewater and rainfall. When the amount of rainfall is higher than wastewater, the system does not work at its full capacity.
     - Lack of skilled personnel to operate the system efficiently and effectively.
2. **Is the wastewater treatment policy appropriate for the municipality to manage the STP?**
   - The wastewater treatment policy is not appropriate to solve water pollution across the country.
3. **Does the municipality have its own policy for wastewater treatment?**
   - Kamphaeng Phet municipality does not have a special policy for wastewater treatment. Overall, the policy covers both wastewater and solid waste to protect environmental quality.

4. **Does the municipality have plans to collect a wastewater treatment fee?**
   - Currently, the regulations related to the wastewater treatment charge from the business sector have been prepared and are awaiting the approval by the municipality executive board.

13. Kamphaeng Phet Municipality

1. **Is the wastewater treatment policy appropriate for the municipality to manage STP?**
   - Thai wastewater treatment policy is still unclear. The policy should concentrate on capacity building of the municipality and raise environmental awareness of leaders and the public.
   - The budget supported by the government is insufficient for wastewater management.

2. **Does the municipality have its own policy for wastewater treatment?**
   - No, but it cooperates with WMA in this regard.

3. **Does the municipality have plans to collect a wastewater treatment fee?**
   - Currently, the regulations related to the wastewater treatment charge from the business sector have been prepared and are awaiting approval by the municipality executive board.

4. **From your point of view, how do you evaluate the performance of WMA in terms of STP management?**
   - The STP management by WMA is appropriate. The problem is that WMA staff cannot work full time at the plant so that when the municipality faces problems with O&M, they cannot be solved promptly.

5. **What is your expectation on the roles played by WMA?**
   - We expect WMA to support local authorities and provide technical assistance and the budget for us to operate the system properly.
   - However, we also fear whether WMA can ensure sufficient number of technicians for O&M of STPs with regard to the present management conditions of WMA.

6. **What kinds of media are used for the public relations campaign on wastewater management?**
   - Local TV Cable and brochures.

14. Kamphaeng Phet Municipality

1. **The priority of the wastewater treatment situation in the municipality.**
   - Once we have STP and collect wastewater from commercial areas to be treated, we have been trying to improve the wastewater collection system using the municipal budget.

2. **Does wastewater treatment policy appropriate for the municipality to manage the STP?**
   - The policy itself is appropriate. The problem is that the budget of the municipality is not enough to cover O&M costs (electricity, chemical substance (Cl_2) and human resources).

3. **Does the municipality have its own policy for wastewater treatment?**
   - Kamphaeng Phet municipality does not have a particular policy for wastewater treatment. Overall, the policy covers both wastewater and solid waste to protect environmental quality.

4. **From your point of view, how do you evaluate the performance of WMA in terms of STP management?**
   - From my point of view, WMA manages the STP very well and can respond to our requests promptly. Plus, we have learned about O&M of the STP from them.

5. **What is your expectation on the roles of WMA?**
   - We expect WMA to support us in terms of budget for the improvement of the drainage system in order to change the route of effluent pipes.

15. Wastewater Management Authority

1. **How do you wish to produce the contents of public relations to ensure project sustainability and achieve the overall project goals and super goals in the future after project termination,?**
   - Currently, the data of WMA is prepared in simple format, such as location, wastewater treatment plant capacity, and water quality, which is updated once a month.
   - We also disseminate reference materials provided by the Project on the website (only English version)

2. **How do you wish to apply the information network to promote project sustainability after project termination,?**
   - Same as before, but we want to develop the reference materials to be more interesting and easy for users to download.

16. Pathumthani Municipality

1. Priority of wastewater treatment issue including wastewater fee collection system

- Priority of wastewater treatment issue in Pathumthani municipality is quite high.
- However, municipality budget is still not enough to cover wastewater treatment plant operation or maintenance cost because municipality has many functions which need to use a lot of budget, such as taking care of flood control, solving electric problems etc.
- Therefore, to manage wastewater treatment plant, municipality thinks that it is necessary to collect fee from residents in the future.

2. How does Pathumthani Municipality evaluate the performance of WMA?

- Nowadays, Pathumthani municipality has asked WMA to rehabilitate the plant for them.
- However, as WMA has hired another local consultant company to run the plant, there is no need for the consultant company to transfer any maintenance technology or report collected data to municipality staffs, the company only needs to response to WMA.
- Besides, WMA hardly sent the report to municipality. Therefore, municipality feels that it is unfair and has no idea how much budget is really needed in plant O&M.
- Pathumthani municipality prefers the central government to support budget to municipality directly that supports to WMA.
- If Pathumthani municipality can have sufficient budgets to hire a consultant company by themselves, the company will be more responsible to municipality and it will be easier for the municipality to control, monitor the consultant company and municipality staffs can also have opportunities to learn the O&M from hired consultant company.

3. Overall comments

- From these reasons, Pathumthani municipality is not willing to use WMA service after finishing 5 year of rehabilitation support anymore.
- As WMA does not have enough manpower to maintain the STPs in overall Thailand, what WMA should do is 1) making O&M standard, 2) making manuals and 3) conducting training courses for municipality staffs
- To tackle with local environmental problems, central government should think about wastewater treatment fee as part of social services, support budget to municipalities, promote and make people understand why fee collection is important.
- Let people know more about wastewater system and their responsibilities on the environment, not only trying formulating regulations. Then, it would be possible to collect treatment fee from the residents.

4. Others

- After the rehabilitation of the STP, the operation of the aeration tank has been improved, which has led to more energy saving.
- The service area for wastewater treatment is the same as before because of the limitations of the wastewater collection system.
- The flow rate is higher (from 2,000 m^3/day up to 3,000 m^3/day)

17. Department of Local Administration (DOLA)

1. Wastewater management policy

Relationship between Decentralization policy and Wastewater management policy

- Decentralization began in 1999. Since then, 50 sewage treatment plants in 32 areas constructed by PWD have been transferred to local government management. Because of the lack of budget and personnel in local government, PWD tried to negotiate with the government to prepare an O&M budget for local government. Therefore, MOI started a 5-year plan to support O&M costs.

- DOLA budget in the 5-year plan is as follows:
  - In 2006, 298 million baht was allocated for 48 project sites.
  - In 2007, 150 million baht has been allocated for 42 project sites.
  - In 2008, 28 million baht will be allocated for 14 project sites.
  - In 2009, provisions will be given for only 8 project sites.

- After these allocations are used, each municipality needs to seek new grants from WMA or use their own budget. However, DOLA will try to consider, with ONEP and PCD, a new program on wastewater treatment.

Policy on the reinforcement of local government for municipal sewerage system management

- The only policy is that of the Environmental Act in 1992, Article 39, which indicated that local authorities should collect treatment fee by themselves. However, there was no regulation or Ministry declaration to support local authorities to force people to pay the treatment fee at that time.

- Mr. Chipat believes that, in order to collect a wastewater treatment fee, first of all, the treatment system should be fully operational, then it will be necessary to revise the law and clarify policy about how people should pay, and at the same time, convince people of the benefits of paying the treatment fee.

- Initially, the government should provide full support for the treatment fee, while trying to convince people to pay. In the second step, ask people to pay half the cost, and finally ask them to pay full price when everything is sufficiently prepared. The most important thing is that the central government should not fail to ask for public opinion before they make any decisions or formulate any new rules/ regulations for local people.

2. Expectation and needs for WMA

- DOLA expects WMA to provide grants to municipalities who apply for WMA service, transfer technology and be a consultant for those municipalities who cannot operate treatment plants by themselves.

- There are 4 more municipalities who applied for WMA service after the WMA Seminar on June 7, 2007. Therefore, if WMA continues their promotion, more municipalities may want to use WMA services.

3. Financial allocation and resources

- DOLA supports the O&M budget to municipalities in the 5-year plan as mentioned above. However, after 5 years, support from DOLA will end and they will need to look for new grants from WMA, environmental funds, the private sector or utilize their own budgets.

- Concerning the utilization of Environmental funds, Mr. Chaipat mentioned that ONEP needs to change many commercial oriented criteria which are not fit for Local administration to become public service oriented. If it does not, it will be difficult for local administrations to make use of this fund.

4. Other comments

- BMA should start a collection system to set an example for other small municipalities.

- A public opinion survey should be conducted before the construction of any new treatment plant. Without an opinion survey, it would likely end up like cases in Rayong, Pitsanulok and Saraburi where the central government built treatment plant on too big a scale for which the municipalities could not afford O&M costs and refused to take any responsibility for the plants. The municipalities who would like to construct plants should study the Royal Project in Laem Pak Bia, Petchaburi province which uses a Wetland system for wastewater treatment.

- DOLA also expects DEQP to play an important part in raising public awareness on the necessity of wastewater treatment collection.

- As the treatment plants are difficult for local authorities to manage, the central government started to ask local people to install grease traps for household wastewater treatment instead. This made people think they have to pay for both grease trap installation and wastewater treatment fees, and consequently are unwilling to pay for the treatment fee.

18. Pollution Control Department, MONRE

1. **Policy on water pollution control/water environment conservation in Thailand, with development/rehabilitation of the wastewater system and coordination between MONRE and MOI on water pollution control.**

    - In the past, the government policy required the local authorities (municipalities) to manage wastewater treatment system by itself. However, most municipalities faced the same problems, which are a lack of budget, human resources and technical knowledge to manage the system.

    - Two years ago, the government changed its policy by supporting small-scale wastewater sources to use Onsite Treatment System – Oil & Grease Trap and Septic Tank. In the meantime, for large-scale wastewater sources, cluster wastewater management will be introduced (approximately 10 households/groups) in some potential areas. The implementation of this policy has been announced by PCD to related agencies, including the Department of Local Administration (DOLA) which is responsible for budget allocations to local organizations.

2. **Is the policy on wastewater management of MONRE in line with the Decentralization Act?**

    - Yes, very much so, since the management of Onsite Treatment System requires the local authorities to implement it. They have to set the priority areas and install the system. PCD plays a role as policy maker and technical assistant. However, this policy has been implemented for only 2 years so it will take some times to evaluate the degree of achievement.

3. **Does PCD have any criteria to select the priority areas for installing Onsite Treatment System?**

    - For small-scale wastewater sources, we give priority to the areas that wastewater treatment and collection system are not available. For cluster management, we consider the areas based on the potential areas that already have a wastewater treatment system by constructing additional pipe connected to the existing collection system to collect wastewater from the cluster groups to be treated.

4. **How far of the success of "Municipal Wastewater Management Plan (2003-2007)" (PCD, 2002)?**

    - This plan was approved by the cabinet in 2004. However, the priority area defined in the plan could be changed depending on the budget and existing facilities in each area. After the termination of this plan, municipalities have to manage the wastewater treatment systems by themselves. In this regard, PCD is working on this matter by conducting discussions with concerned agencies – for example DOLA and the Decentralization Committee in order to support municipalities to be prepared. As the result of discussion, the government shall allocate a budget amount

to DOLA to support O&M expenditure for wastewater treatment systems, which is a financial burden for most municipalities.

- In addition, PCD has collaborated with other agencies about how to raise people's awareness on the importance of wastewater treatment systems. Once people realize this point, they will ultimately be willing to pay the treatment fee.

5. Has PCD prepared a guideline or criteria to calculate a suitable figure for wastewater treatment fee? And does PCD have any policy to enforce people to pay the fee in the future?

- The study on this matter has already been done and disseminated to concerned agencies, particularly the local authorities. However, the implementation of this study is dependant on voluntary action. So far, there is no plan to enforce every household to pay the fee. But PCD selected 5 municipalities as a pilot area to set up and collect the wastewater treatment fee from their people. The result from this study will be analyzed and applied to other areas in the future.

- Nonetheless, local authorities that obtained governmental loans for wastewater treatment system construction have to collect the fee from their residents as part of the loan regulations. However, the implementation of this regulation does not work in practical terms.

6. What is the direction of the collaboration between PCD and WMA on wastewater management in Thailand?

- Nowadays, PCD plays the role of policy maker and setting up or prioritizing areas to be managed; while DOLA is responsible for budget allocations to local authorities. In the meantime, WMA can participate in the process as a consultant for local authorities. In the future, if the capacity of WMA is increased, WMA will be able to play the role of supervisor for detailed design and construction for municipalities whose wastewater treatment system has not yet been constructed (1,146 areas approximately). Moreover, WMA can work together with PCD to provide technical training courses to municipality staff.

- In terms of WMA capacity building, PCD has nothing to do with this matter. WMA has to consider the possibility of injecting more capital in order to manage their organization efficiently.

7. Which agency conducts routine monitoring of the effluent of the municipality wastewater treatment plant?

- Nowadays, 16 Provincial Environment Offices under MONRE have conducted routine monitoring of the effluent of MWTS 4 times/year covering the parameter of pH, BOD, SS, TDS, TKN, TP and FoG. The report of effluent wastewater quality will be submitted to both municipalities and PCD.

19. The Office of Permanent Secretary, MONRE

1. Wastewater management policy

- Water quality in Thailand is getting 3-5% worse because of wastewater discharge. MONRE has formulated a Master Plan on wastewater management and prepared a budget of 26,000 million baht for 40 cities over the next 4 years for treatment plant construction. These 40 cities have completed feasibility studies and were selected by criteria such as its status as a tourist spot or the seriousness of wastewater discharge wastewater.

- The wastewater management policy at present is already clear enough that it is the local authorities' duty to solve environmental problems in their area. MONRE plans to decrease the budget for local authorities because MONRE want to stimulate local authorities to really think about ways to solve the wastewater problem. If they really want to solve the problem, they must find a way by themselves, such as selling bonds, etc.

  - Due to this policy, many local authorities might complain that they do not have sufficient budget or personnel. However, for the budget, it depends on how local governors allocate the budget to tackle environmental problems, and for personnel problems, at first local authorities can hire WMA or consultants to operate the plants for them, so there is no need to have their own engineers or technicians. For the fee collection, local authorities should not expect the central government to provide any subsidy because wastewater problems are the problem of each local area, so people in those areas should take responsibility upon themselves. Moreover, the National Environmental Board already approved that local governments can set up their own regulation to collect wastewater treatment fees,
  so there is no need for the central government to set up any other new regulation to force people to pay again.

- About raising awareness, governors should tell their residents the truth about why wastewater treatment is important, why treatment plant construction is necessary and why fee collection is necessary. There are a few different types of treatment plants, so governors should explain to people which type would be suitable for their area and not cost much for the local people.

2. Enhancement of WMA capability

- MONRE would like to support WMA. However, according to the law, when WMA became an agency they gained the option to join business with the private sector. WMA can offer technical support, be a consultant or operate treatment plants for local authorities. Besides, WMA already has an advantage by the budget support they receive from the central government. Therefore, WMA should have enough capability to compete in the private sector.

they would like to use this methodology or not. Local governments can collect lower fees than that which was set as the standard if they generate their own subsidies.

4. Cooperation with Water supply authority

- There are many Water/Wastewater related organizations in Thailand and the relationship between organizations is quite complicated. MONRE used to ask for cooperation from the water supply authority on wastewater treatment fee collection, but as the water supply authority is under the Ministry of Interior, cooperation was quite difficult. Moreover, as the water supply fee is already high, if they add the wastewater treatment fee to the water supply fee, people will not be satisfied.

20. Summary of Interview with Focused STPs

In you opinion, are there any changes on the technical consciousness compared with "before" and "after" joining the techincial seminar and/or special lecture?

Directors of Sanitation Department

- Since I have a certain background of wastewater treatment process so that the technical trainings provided by the Project did not increase much new knowledge but it could remind of and strengthen my existing knowledge to be more utilized at present. Moreover, it would be appriciated if the central government provide this kind of trainings to local staff periodically.

Operators of STPs (subcontractors of WMA)

- Some useful experiences and information from the Japanese experts for O&M of STP were shared and applied to my works. Even I have quited and been transferred to work at other plants but the knowledge obtained from the Project was still useful.

Annex 16: Budget allocation concerned with STP O&M From DOLA to local authorities 2005-2007

Annex 17: Budget allocation concerned with STP O&M from DOLA to local authorities 2005-2007

(Unit: thousand Thai baht)

Thai fiscal year	2005	2006	2007
a. Total budget	107,956	105,461	102,340
b. No. of municipalities with O&M implementations	36	35	34
Simple average (a/b)	2,999	3,013	3,010

Source: DOLA

* The additional information on the table above is as follows;

Background

Ministry of Natural Resources and Environment (MONRE) has concluded preparation of “Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand” (Rehabilitation Plan) in May 2003. Under the Rehabilitation Plan, Pollution Control Department of MONRE is designated as the main organization in preparing the rehabilitation plan, which is part of the National Wastewater Management Plan 2003-2007.

Objectives

The objectives of the Rehabilitation Plan are to accelerate the proceeding on rehabilitation of municipal wastewater treatment systems, which have problems on performance efficiency to be more efficient as soon as possible together with capacitive building for local authorities in wastewater management, operation and maintenance to be able to efficiently and continuously operate the wastewater treatment system. Moreover, local authorities have to take responsible in the system management as well as operation expenses.

Evaluation Criteria

The Investigation Team established by MONRE has investigated and evaluated 77 municipal wastewater systems by using evaluation criteria on system operation, readiness of the staffs and budget.

MONRE by PCD has analyzed and evaluated to determine the method for solving problems on municipal wastewater treatment system in consideration of concrete management by appointing local authorities to be the main practical organization. Analyses have been in overall pictures

of system operation status, problems in grouping of performance level, budgetary support in O&M and efficiency in wastewater management with regarding in capacity building to local authority. The method in wastewater treatment system rehabilitation can be summarized into three activities as follows;

1) The acceleration of rehabilitation for municipal wastewater treatment systems that have been finished construction but with problems so that the system cannot be efficiently and continuously operated.
2) Supporting of operation budget to local authorities in the first phase to strengthen the local potential during the preparation stage for self-support.
3) Capacity building for local authorities in wastewater management.

Condition of the Supporting Budget

For the implementation of rehabilitation and improvement of wastewater collection system, and wastewater treatment plant, it must be confident that the wastewater treatment system had already been rehabilitated and the readiness of management for the responsible authorities had been built. The local authorities will have to operate the system continuously and effectively by themselves. Further, all the implementations must be evaluated. Therefore, the guarantee criteria should be built for the system, receiving budget for rehabilitation and improvement, that these system will effectively operate and cover the investment cost. PCD proposes condition for supporting budget to the Department of Local Authority (DOLA) to be allocated to local authorities under the condition mentioned in the Rehabilitation Plan.

Annex 17: Questionnaire and Summary of Results

Annex 17: Questionnaire and Summary of Result

List of Recipients for Questionnaire Survey

No.	Name	Position	Response
1.	Ms. Hatarirat Likitanupark	Director of Business Development; Assistant Project Manager	O
2.	Mr. Atirak Bupachanto	Mechanical Engineer at Kamphaeng Phet STP	O
3.	Ms. Rattiya Saingam	Training Laboratory staff	O
4.	Ms. Panadda Kongsricharoen	Training Laboratory staff	O
5.	Ms. Pojjaman Tanthip	Training Laboratory staff	O
6.	Ms. Duangjai Khankruer	Technician, Engineering Division	O
7.	Mr. Supparat Ittipol	Office Director for Wastewater Treatment	O
8.	Mr. Phanthat Chancharoensook	Head of Training Program	O
9.	Mr. Kitti Teerasoradech	Staff of Training Program, technical and safety training programs	O
10.	Ms. Valailak Komolrit	Staff of Information System	O
11.	Mr. Somkiet Sangchaisukonkit	Mechanical Engineer, Wastewater Management Division,	O
12.	Mr. Khampanart Thanasadtakorn	Former responsible person for STP, Pathumthani	O
13.	Ms. Rosita Laosakul	Technician, Engineering Department	O
14.	Mr. Paisarn Taetama	Technician, Engineering Department	O
15.	Mr. Puwanart Kreangmesri	Technician, Wastewater Treatment Division	O

Japan International Cooperation Agency

Terminal Evaluation Study on the Project for Improvement of Sewage Treatment Plant Management in Thailand

Questionnaire

Name of correspondent: _____

Division/Section: _____

Position: _____ **Contact Tel No.:** _____

Period involved in the Project: _____

Share of approximately working hours for the Project activities: _____ **%**

This questionnaire is prepared for the Terminal Evaluation Study on the project mentioned above. Your answers would help analyze whether or not the Project has been carried out properly as it was planned and generated a certain achievement.

This questionnaire is also prepared to analyze **"Relevance", "Effectiveness", "Efficiency", "Impact", and "Sustainability"** of the Project.

Besides, if you cannot fulfill your additional comments, ideas and/or suggestions onto this paper, please prepare additional papers and write down onto them.

Finally, after fulfilling this questionnaire, please send back to 'Mr. Minoru FUJII of the JICA Terminal Evaluation Study Team not later than 12pm on Friday, 22nd June, 2007 with the following way;

By fax: 02-937-0704 or

By e-mail: fujiim@tkh.att.ne.jp

We should be glad if you would share your time for this work.

Thank you for your cooperation in advance.

I. Relevance

1. Does the overall project goal coincide with the Thai national policies?

Overall Goal of the Project:

"Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand"

❍Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not at all

Please provide your comment what type of performance is particularly coincide with.

Comment: ……

……..

……..

2. Is the project in line with the needs of the central and local government officials for wastewater plant management?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not at all

Please provide your comment on the reason for your answer.

Comment: ……

……..

……..

3. Is the project purpose in line with the policy of WMA?

Project Purpose:

"Efficient and effective operation method of STPs is established".

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not at all

If "No", please provide your comment what point is NOT in line with the policy of WMA.

Comment: ……

……..

……..

4. Is the project purpose in line with the policy of local authorities?

Project Purpose:

"Efficient and effective operation method of STPs is established".

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not at all

If "No", please provide your comment what point is NOT in line with the policy of local authorities.

Comment: ……

……..

……..

5. Are there any other institutes/ organizations which should correspond to domestic wastewater management in Thailand?

❍ Yes, very much ❍ Yes, much ❍ Yes, but just few ❍ No ❍ Not sure

Please list the names of institutes/ organizations if you answer "Yes" above.

Comment: ……

……..

……..

6. Are there any other institutes/ organizations/ committees involved consequently in the project?

❍ Yes, very much ❍ Yes, much ❍ Yes, but just few ❍ No ❍ Not sure

Please list the names of institutes/ organizations if you answer "Yes" above.

List: ……..……

……..

……..

7. Have you ever participated in this kind of the project encompassing technology transfer; training; reference materials and information system development by other cooperating agencies?

❍ Yes ❍ No ❍ Not sure

If "Yes", please describe respectively the names of cooperating agency, and contents of activities.

Comment: …..……..……

……..

……..

And, how has this experience above been ever supporting your career?

Comment: ……..……

……..

……..

8. Have there been any positive changes in the environment of the project (politics, economy, society, etc.) since the mid-term evaluation?

❍ Yes ❍ No ❍ Not sure

If "Yes", please comment what type of changes there have been.

Comment: ……

……..

……..

II. Effectiveness

1. Is the setting up of the project purpose appropriate in accordance with the nature of WMA and local authorities?

Project Purpose:

"Efficient and effective operation method of STPs is established".

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not at all

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

2. To what extent has the project purpose been achieved?

Project Purpose:

"Efficient and effective operation method of STPs is established."

❍ Completely achieved ❍ Almost achieved

❍ Halfway or in part, but can be achieved by the project termination

❍ Not so, cannot be achieved by the project termination ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

3. Have the STPs under WMA's control adapted the reference materials provided by the project for their operation?

❍ Yes ❍ No ❍ Not sure

If "Yes", please provide your comment how the materials have ever been supporting your operational work.

Comment: ……

……..

……..

4. Have the reference materials provided by the project ever been used widely for STP operators all over Thailand?

❍ Yes ❍ No ❍ Not sure

If "No", please provide your comment on its reasons.

Comment: ……

……..

……..

5. Do you think that effluent from STPs under WMA has met the water quality standard in Thailand?

❍ Yes ❍ No ❍ Not sure

Please provide your comment supporting the answer above:

Comment: ……..…….

……..……..……

……..

6. Are there any policies/regulation to collect the sewage treatment fee from residents?

❍ Yes ❍ No ❍ Not sure

If "Yes", please provide your comment when it will be or was implemented.

Comment: ……..……

……..

……..

6. Are sewage users willing to pay the sewage charge?

❍ Yes ❍ No ❍ Not sure

If "No", please provide your comment on its reasons.

Comment: ……..……

……..

……..

III. Efficiency

1. Has the number of dispatched Japanese experts been appropriate for the activities of the project?

❍ Yes, very much ❍ Yes, much ❍ Fair ❍Not so ❍ Not at all

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

2. Has the capacity of dispatched Japanese experts been appropriate for the activities of the project?

❍ Yes, very much ❍ Yes, much ❍ Fair ❍Not so ❍ Not at all

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

3. Has the length of dispatch of Japanese experts been appropriate for the activities of the project?

❍ Yes, very much ❍ Yes, much ❍ Fair ❍Not so ❍ Not at all

Please provide your comment supporting the answer above.

Comment: ……..……

……..

……..

4. Has the timing of each activity been appropriate for the activities of the project?

❍ Yes, very much ❍ Yes, much ❍ Fair ❍Not so ❍ Not at all

Please provide your comment supporting the answer above.

Comment: ……..……

……..……..

……..……..

5. Has the number of counterpart trainees for the training in Japan been appropriate?

❍ Yes, very much ❍ Yes, much ❍ Fair ❍Not so ❍ Not at all

Please provide your comment supporting the answer above.

Comment: ……..……

……..……..

……..……..

(* For those who have joined technical training in Japan only)

6. Have the quantity and quality of training contents in the training in Japan been appropriate?

❍ Yes, very much ❍ Yes, much ❍ Fair ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……..……

……..……..

……..……..

(* For those who have joined technical training in Japan only)

7. Has knowledge gained from the training in Japan benefited you for a better understanding of transferring knowledge and organizing the training sessions by yourself later on?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

8. Has the number of skilled personnel assigned to operate and maintain the focused STPs been appropriate?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

9. Has the information system established to disseminate reference materials and to collect O&M data been appropriate?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

10. Are reference materials for technical dissemination still appropriate and available through information system on WMA managing STPs?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above. For example, which materials are practically still appropriate and available?

Comment: ……

……..

……..

IV. Impact

1. Has/will the new wastewater system construction plan for overall Thailand been/be formulated?

❍ Yes ❍ No ❍ Not sure

If "Yes", when will it be / was it formulated?:……...
…….

…….

If "No", please provide your comment on its reason.

Comment: ……
……..

2. How far have all the STPs in Thailand been operated efficiently and effectively?

❍ Very much ❍ Much ❍ Fairly ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……
……..

……..

3. How far have all the STPs under WMA been operated efficiently and effectively?

❍ Very much ❍ Much ❍ Fairly ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……
……..

……..

4. Has the improvement of WMA performance influenced the formation of related policies, regulations, or legal systems on wastewater management in Thailand?

❍ Yes, very much ❍ Yes, much ❍ Fair ❍ Not so ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……
……..

……..

5. Has there been any influence on raising environmental awareness from the public by the achievement of the project?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Not so ❍ Not sure

If "Yes", please provide your comment what influence has risen.

Comment: ……

……..

……..

6. Have there been any visual publications (such as newsletters, booklets, etc.) produced by the project organization to show its presence to the general public?

❍ Yes ❍ No ❍ Not sure

If "Yes", please provide your comment what publications there have been.

Comment: ……

……..

……..

7. How has the trend been in complaints and/or opinions from sewage users (residents) to sewage treatment operation?

❍ Increasing very much ❍ Increasing slightly ❍ Just same as before
❍ Decreasing slightly ❍ Decreasing very much

Please provide your comment supporting the answer above.

Comment: ……

……..

……..

8. Have there newly been any negative events (problems, troubles or confusions) occurred by knowledge and technologies transferred by the project?

❍ Yes ❍ No ❍ Not sure

If Yes, please provide your comment what negative kinds of events have been occurred.

Comment: ……

……..

……..

9. Have there been any specific impacts observed, either positive or negative changes by the project?

❍ Yes ❍ No ❍ Not sure

If yes, please provide your comment what specific impacts you have observed.

Comment: ……

……..

……..

V. Sustainability

1. Do you think that the achievement of the project purposes will be able to be sustained after the termination of the project?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Less ❍ Not at all

If "No", please provide your comment on the reason for why "No".

Comment: ……..……
……..

2. What kinds of capacity development has WMA obtained sufficiently in order to carry out your activities after the termination of the project? (Multiple answered allowable)

❍ Human resource ❍ Technical skills and knowledge ❍ Financial stability

❍ Institutional framework ❍ Socio-environmental concerns ❍ Others ❍ None of them

Please provide your comment supporting the answer(s) above.

Comment: ……...…….……
……..

3. Does WMA cooperate with other agencies concerned with domestic wastewater management for the wide spread of the project outputs?

❍ Yes ❍ No ❍ Not sure

If yes, please provide your comment on the name(s) of cooperating agency/ies, and content(s) of activity/ies.

Comment: ……..……...……
……..

4. Have all the techniques developed by the project still been effective/ conducted/ progressed since their technical transfers during the project implementation?

❍ Yes, very much ❍ Yes, much ❍ Fairly ❍ Less ❍ Not at all

Please provide your comment supporting the answer above.

Comment: ……..……
……...……..

5. Are there any continuous training sessions by using reference materials provided by the project?

❍ Yes ❍ No ❍ Not sure

If yes, please describe what kinds of session are there.

Comment: ……..……...……
……..

6. Have the skills of counterparts and assigned persons involved in wastewater management and operation been rising through the project implementation?

❍ Yes, very much ❍ Yes. much ❍ Fairly ❍ Less ❍ Not at all

If yes, please provide your comment what skills have been rising in particular.

Comment: ……..……..……
……..

7. Are equipment/materials procured by the project still utilized well since their operational commencements in the project?

❍ Yes ❍ No ❍ Not sure

If "No", please describe what equipment/materials are not utilized well and why they are not.

Comment: ……..……..……
……..

8. Are equipment/materials for the water quality measurement transferred from the Training Center for Sewage Works (TCSW) Project still well utilized for the project?

❍ Yes ❍ No ❍ Not sure

If "Yes", please describe what equipment/materials are still utilized well.

Comment: ……..……..……
……..

9. Is the information system established by the project still utilized well ?

❍ Yes ❍ No ❍ Not sure

Please provide your comment supporting the answer above.

Comment: ……..……..……
……..

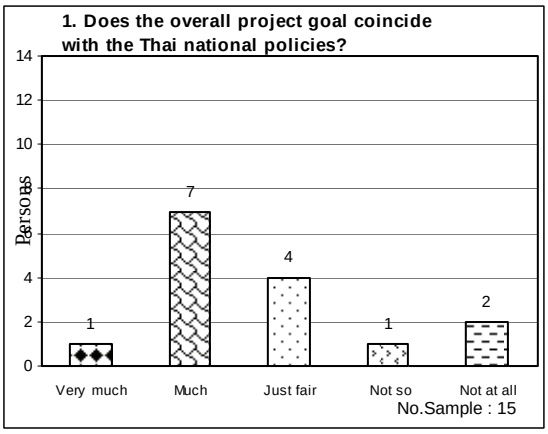
Thank you indeed again for your cooperation. If you have other suggestions and/or comments useful for the terminal evaluation of the project, please feel free to state below. Any comments (especially, comments on how the JICA technical cooperation projects should be operated in the future) are welcome.

Suggestions and/or comments:

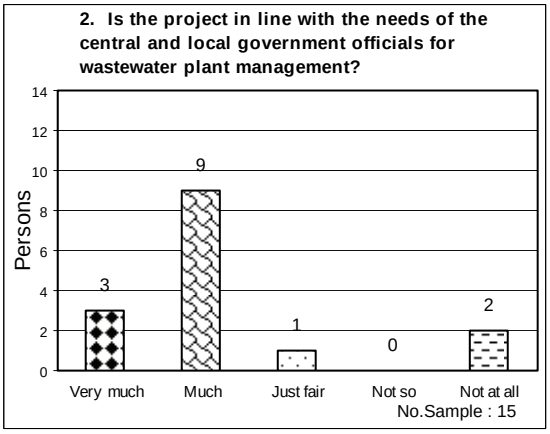
--- End ---

Summary Results

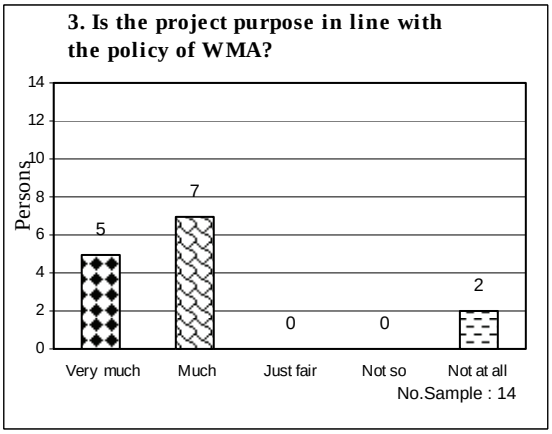
I. Relevance



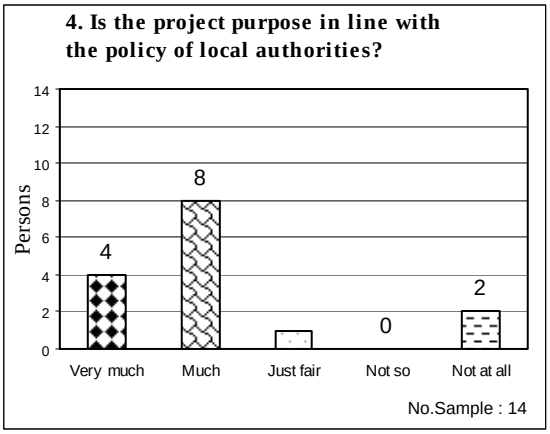
Comment:
- Assistance from this project was technology transferring in terms of enhancing technique, improving and operating wastewaster treatment system including making reference documents and training for the staff of WMA and local authorities.
- Reduction, Protection and Control of Pollutions
- The Sewage Treatment Plant can be effective that mean the water quality meet the standard. And the Sewage Treatment Plant can work sustainable without budget from central Government.
- It coincides with water environmental quality conservation policy
- The Thai government will emphasize integrated water management to deal with water-related issues.



Comment:
- 1) Central government is still need for capacity building to local authorities; 2) Local authorities are not ready in term of technique to do it by themselves.
- Central government and local authorities are lacking of technical skills and knowledge.
- Because the knowledge on wastewater treatment system is required.
- Local administration has been received assistance and knowledge for waste water treatment system
- Local Government lacks of expert staff.
- Local government agencies have obtained more knowledge of waste water treatment.
- The project supports the central and local governments to acquire knowledge on wastewater treatment and plant management.

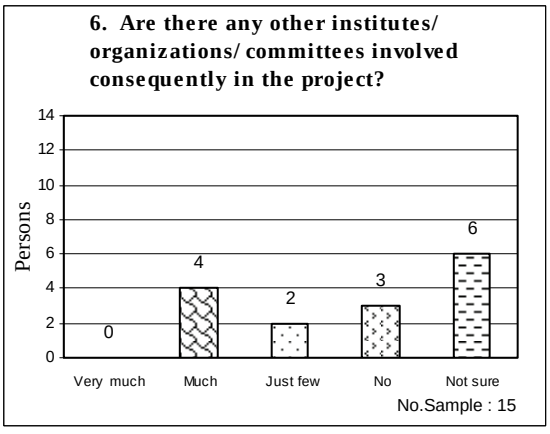


Comment:
- Staffs of WMA are still need to capacity building in terms of technical knowledge.
- The operation has gone to difference way.

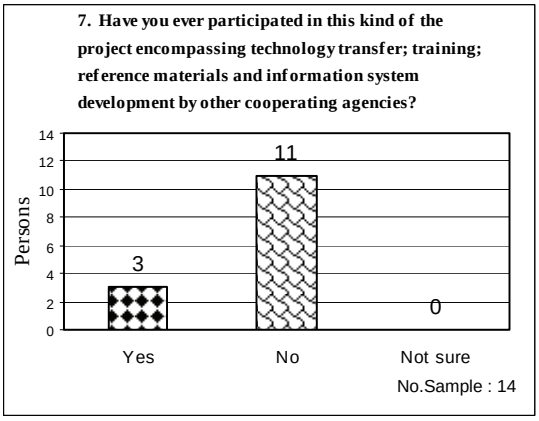


Comment:
- Local authorities have policy to operate its STP efficiency and effectively.
- Local authorities need the plant to operate effectively but they need skill staff.
- It is difficult to get cooperation from them.
- Local authorities want wastewater treatment system work efficienctly and effectively but they lack of skill personnel and techniques.

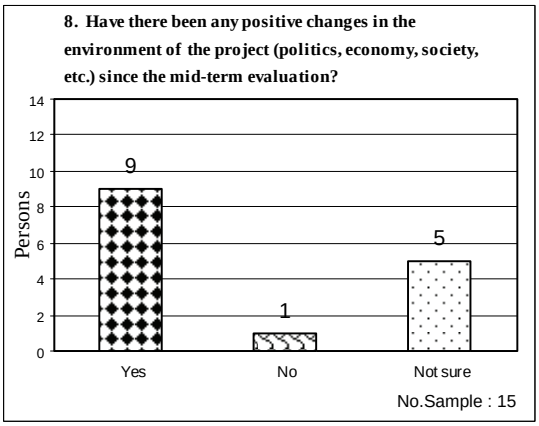
Comment:
- The decentralization act define that the agency responsible for waste water treatment is local authorities while the duty of WMA is the same as defined in WMA's regulations. In this regard, local authorities should allow WMA play its role and share responsibility in the area.
- BMA, local authorities
- PCD, ONEP, Regional Environmental Office of MONRE
- NHA
- All agencies working as the Joint Committee of the project such as PCD, DEQP, DOLA, Local government



Comment:
- Patumthani and Kampaeng Petch Municipality
- MONRE, local authorities.

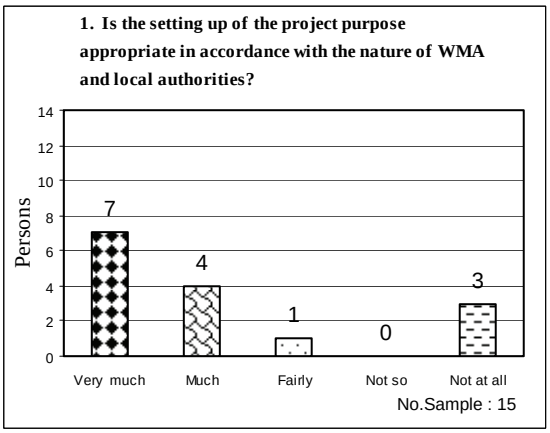


Comment:
- BMA, Department of Public Works and Town & Country Planning (DPT)
- DANIDA (construction of wetland and wastewater feasibility studies

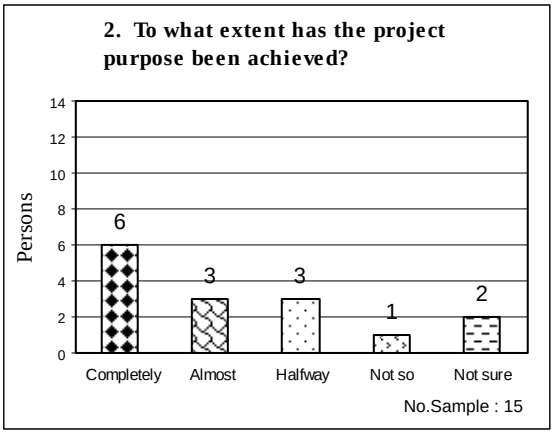


Comment:
- There is coordination among related agencies - ONEP, PCD, local authorities - to participate in the process of preparing reference materials. This could lead to other kinds of cooperation in the future.
- Using knowledge to apply with real work.
- The suggestion on various types of STP could build up more knowledge for actual operation.
- More clear policy.
- Local authorities concern about the management of wastewater as Kamphengpet and Phathumthani.
- WMA has clearer policy to assist local authorities.
- If we can operate wastewater treatment system as efficiency and received good cooperation from municipality. Quality of life in community to be better.

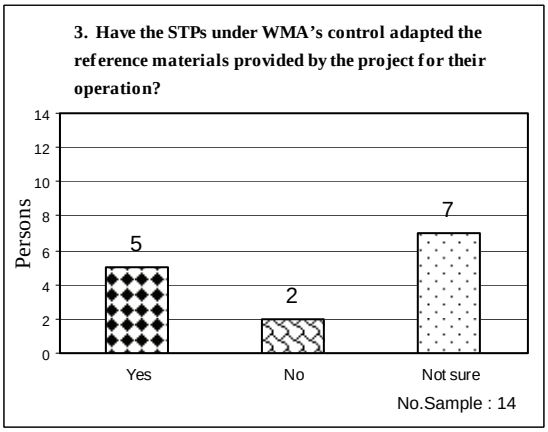
II. Effectiveness



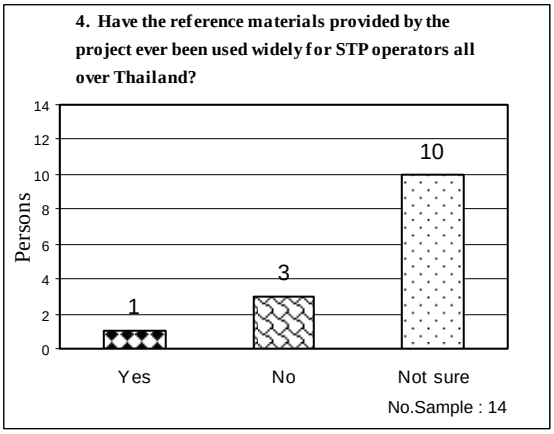
Comment:
- The capacity of WMA's staffs is increased in term of technique such as analysis, survey, inspection, electrical system and analysis in problems of operation and maintenance of waste water treatment system including energy saving idea.
- WMA is the main agency for operation and disseminating knowledge on waste water treatment.
- The purpose of project same as WMA purpose.
- WMA has duty to support operation of waste water treatment plant to run efficiency and effectively.
- Effective operation methods of STPs as recommended by the Japanese experts were difficult to implement because STPs operational staff do not follow it.



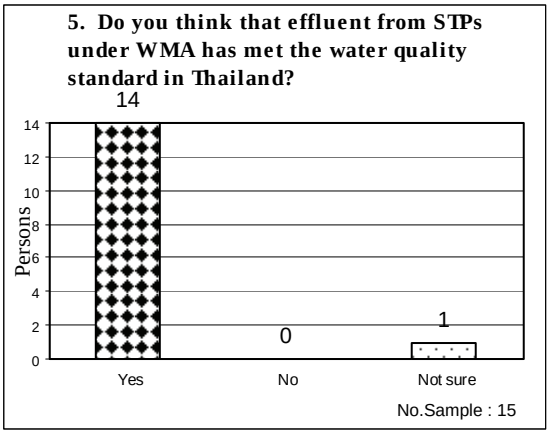
Comment:
- It has not yet been achieved in terms of dissemination/training. However, the preparation of reference materials has been completed but WMA has plan to arrange the workshops for dissemination them to related agencies in the future.
- STPs have been operated efficiently and effectively and make the effluent meet the water quality standard.
- System has been run effectively.
- Some areas have not yet cooperated.
- Local authorities can run the system efficiency and effectively.
- Overall operation method of STP has been improved.



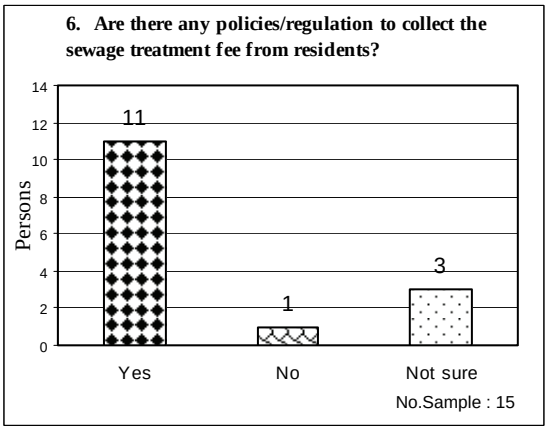
Comment:
- Further study on pumping operation and saving energy
- The reference materials have not yet been distributed.
- It will be distributed in the future.
- Some reference materials have been disseminated via website of WMA.



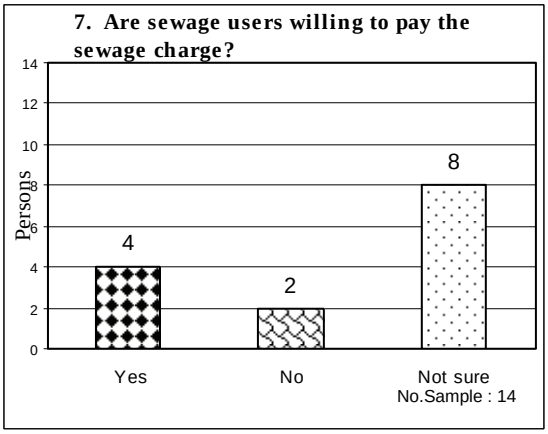
Comment:
- It has been used by the STP operators under WMA but the adaptation of these materials in other areas has not been confirmed.
- Currently, the reference materials have been used for STP under WMA only.
- The reference materials can be applied in some certain areas only.
- There is the standard for waste water discharge and operation of WMA.
  It is mentioned in contract and TOR.
- The Thai version of reference materials have not yet be completed.



Comment:
- The analysis of effluent quality from STPs under WMA has been conducted many times and the results have met the water quality standard.
- Because the water quality control is managed efficiently by WMA.
- The quality of effluent meets the standard.
- Regular water quality analysis has been conducted.
- There has been the standard for waste water discharge and operation of WMA. It is mentioned in the contract and TOR.

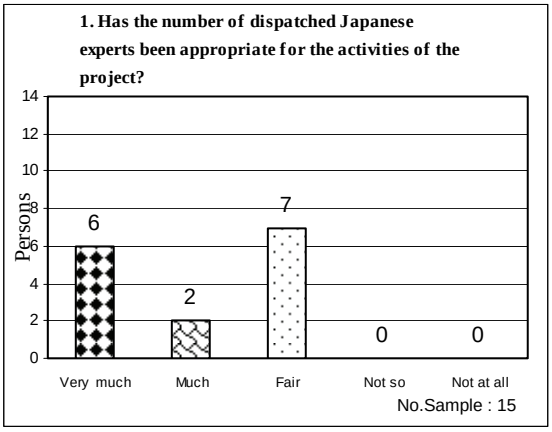


Comment:
- Due to the duty of wastewater management is under local authorities, so
  it depends on the policy of each local authority. In some areas the fee has been collected from residents while some areas collect from business sector only or do not collect at all.
- WMA is working on sewage charge collection.
- Some local authorities have a policy to collect the fee.
- Some local authorities have issued municipal regulation on this matter.
- Policies/regulations are implemented by local authorities.

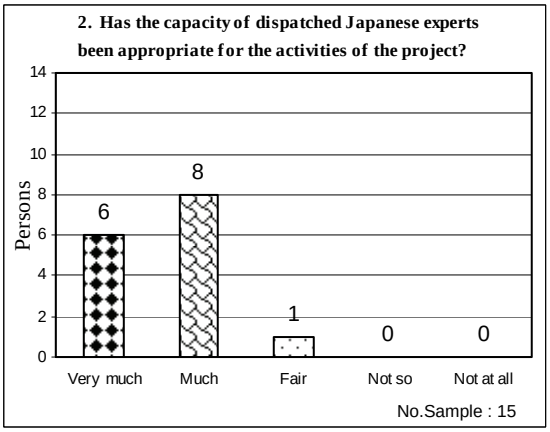


Comment:
- It depends on the awareness of people in each area.
- Most Thai people are unconcern on wastewater management and the collection of wastewater treatment fee had not been done before.

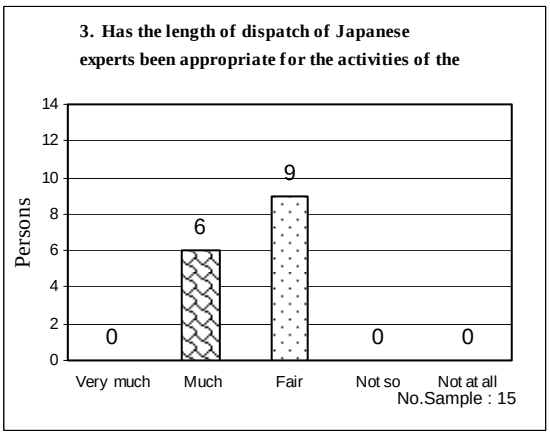
III. Efficiency



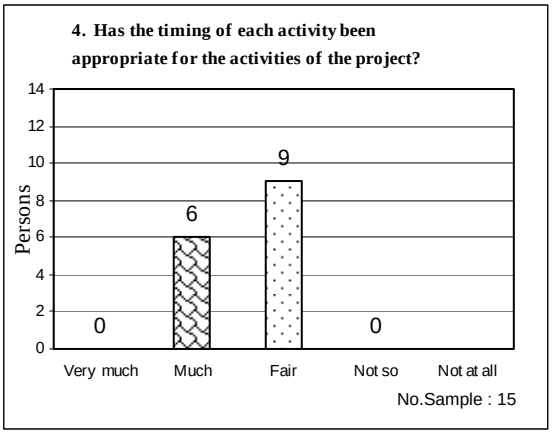
Comment:
- It was appropriated. They could transfer their knowledge without any delay.
- Number is appropriate for STP rehabilitation under WMA
- The dispatch of the experts should be longer-stay.



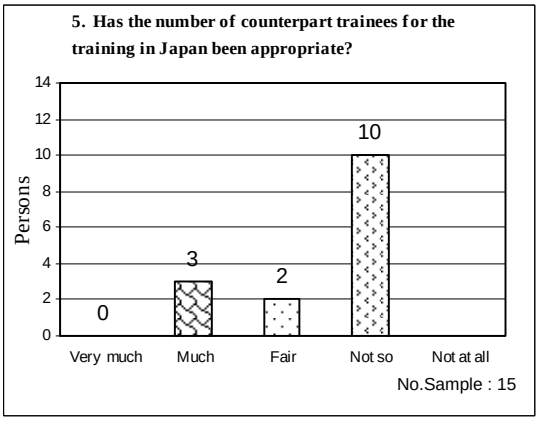
Comment:
- When facing some problems during the period of technical transfer, the experts could provide useful recommendation to over come those problems properly.
- They are technical experts in several fields.
- They have experiences and skillful.
- They were appropriate and have knowledge
- Their expertise and recommendations are very useful.



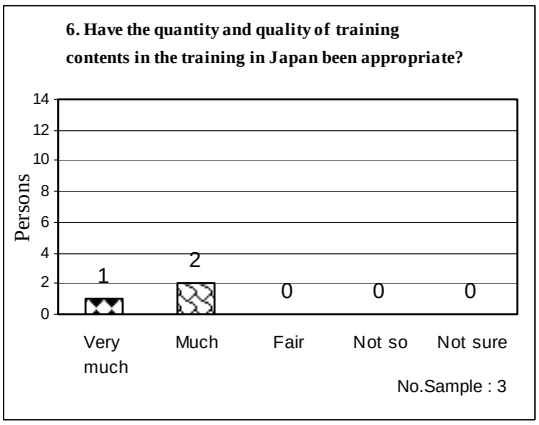
Comment:
- The dispatch of some short term experts was too short so they could not finished their assignment because running out of time.
- Very short period
- The time period should be extended.
- Long-term and short-term experts should get involved throughout the project.



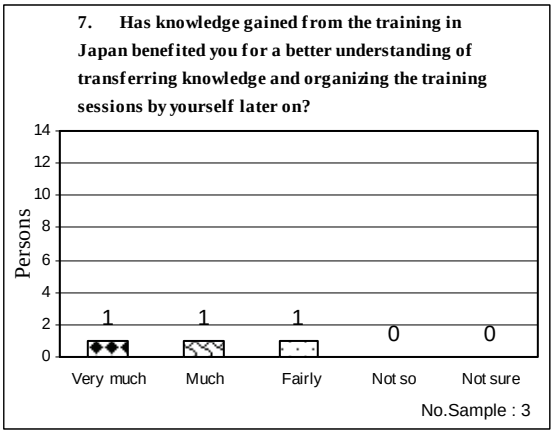
Comment:
- It could be done in accordance with the plan.
- Very short period
- The time suited for each activity.
- It should provide more activities to concentrate on operation/take caring of the routine system
- The target for each activity has been achieved.



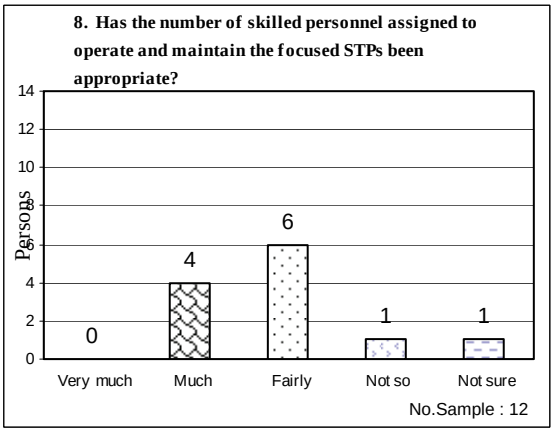
Comment:
- The number of trainees was not adequate and less than expectation as discussed at the initial stage of the Project.
- The number should be increased more widely
- Many trainees are interested.
- Some problem on JICA budget
- The number of trainee from WMA and local authorities should be increased.
- It number of trainees should be increased and domestic training should be considered in order to save cost.
- Counterpart training depends on the budget available.



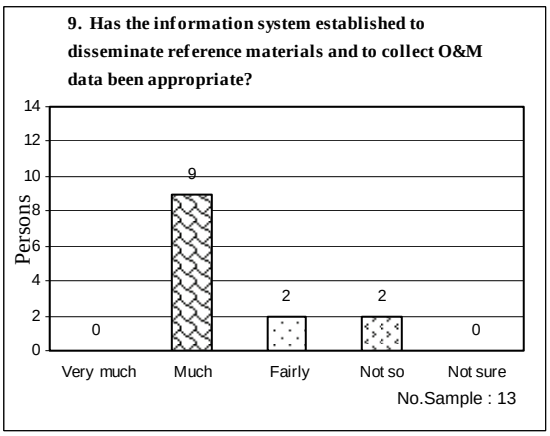
Comment:
- The training contents cover all necessary fields in the period of time.
- It covered the system that Japan uses for Sewage work but for Thailand whose budget is limited should concentrate on pond system.



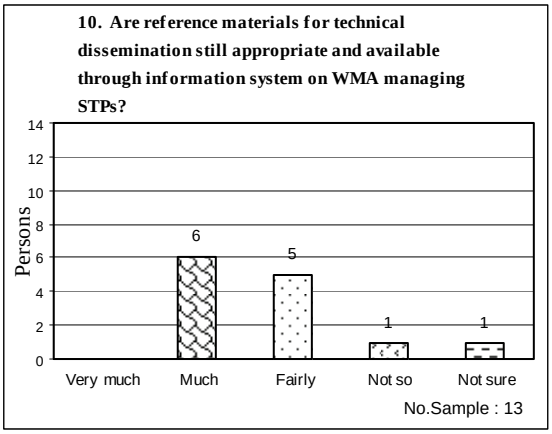
Comment:
- The new knowledge can distribute to other staff and concerned officers.



Comment:
- It is small compared to the number of existing STPs across Thailand. And comparing to the 4-year-plan of WMA, this number is also small.
- The number of skilled personnel is small in practical.
- It should be more than now because area of STP is quite large.
- The employee have never been determined on their skills.

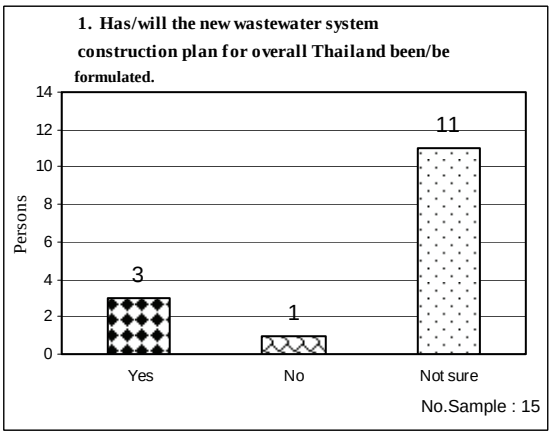


Comment:
- It has been well established.
- The reference materials cover various sections widely used for O&M of STPs.
- Because it has to use as manual for solving problem and improvement of the treatment system.
- The search engine should be applied.

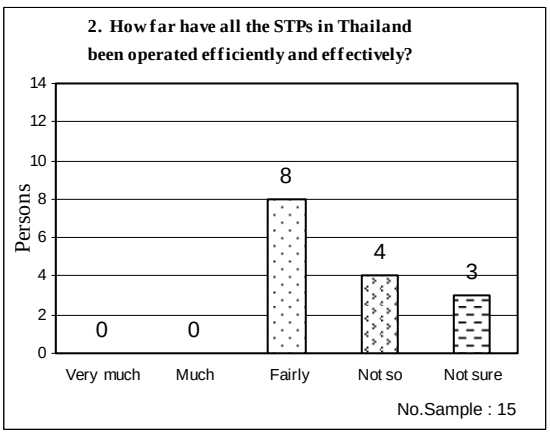


Comment:
- Some reference materials is still in the process of translation. After the completion, it will be disseminated thoroughly.
- It can be used as guideline.
- The search engine will help tremendously in this regard.

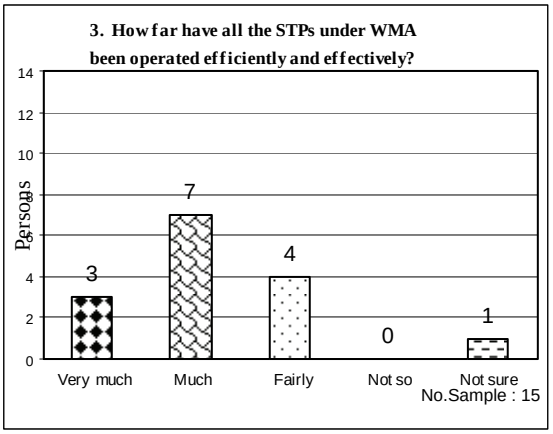
IV. Impact



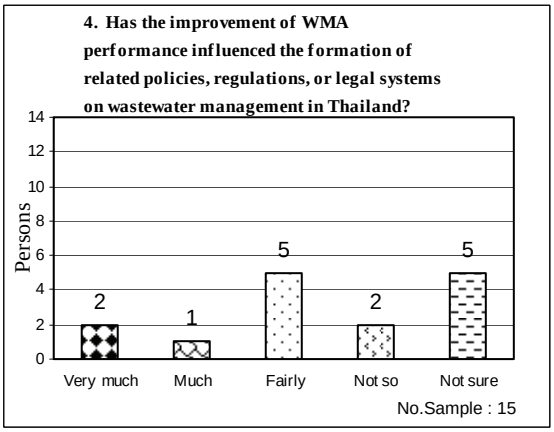
Comment:
- It is planned by PCD.
- It depends on policy of MONRE in the future.
- Problem about policy and budget.



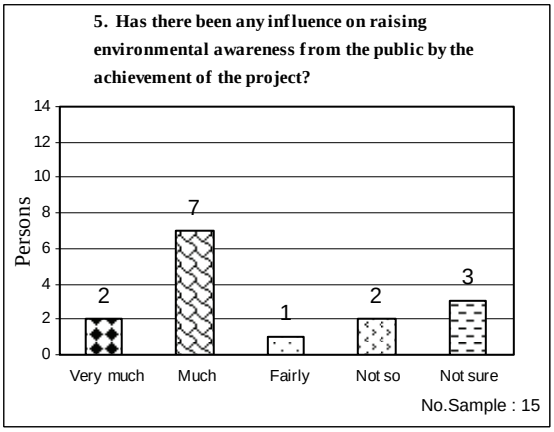
Comment:
- Many STPs are still lacking of budget for O&M and lacking of staff in both quantity and quality.
- Actually, not so. This is because some existing STPs are controlled by local authorities.
- Some area need to operate and maintenance.
- Suitable wastewater treatment and management system need to be conducted and more wetland construction should be considered.



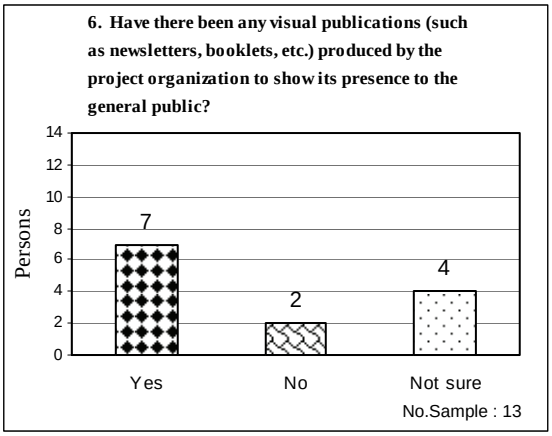
Comment:
- Because WMA has good administration and management system and enough qualified staff and budget supported by the government.
- Effluent quality has met water quality standard in Thailand
- I recognized only Pathum Thani STP which has been operated efficiently.
- Some STPs have been operated with high cost, thus they might be considered effective but not efficient.



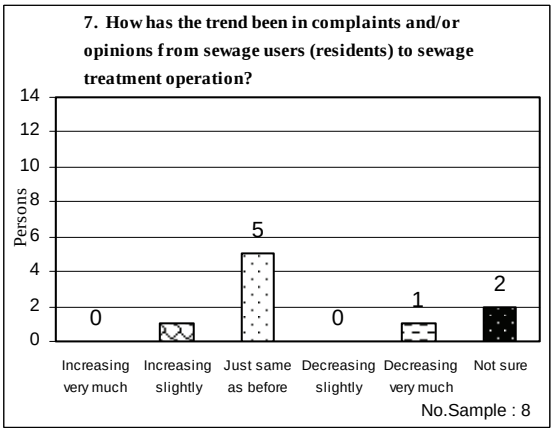
Comment:
- Although the government expect WMA to responsible for STPs operation in Thailand, but the capability of WMA is still doubtful in some certain extents.
- Creating new policies.
- Local authorities are aware of wastewater problems and set up policies and regulations for wastewater management.



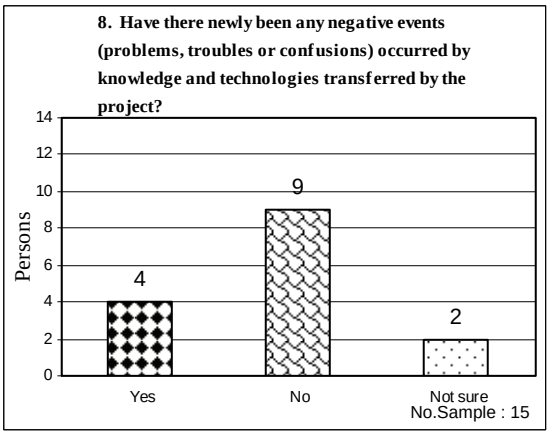
Comment:
- Because the project has not concerned with the raising of environment awareness to the people.
- Awareness in field of water environmental quality conservation and willingness to pay sewage treatment charge.
- Environment awareness is increased through local participation.



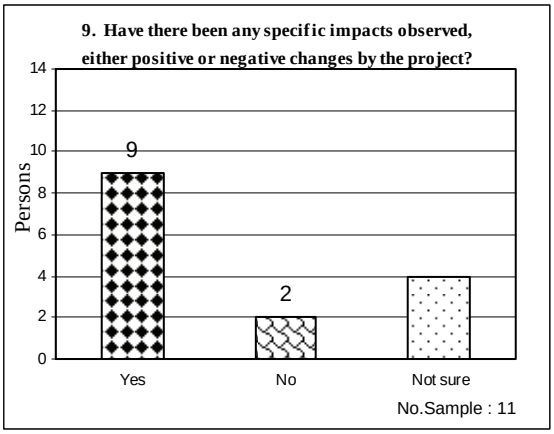
Comment:
- WMA newsletters
- Newsletters of JICA/IST project are issued periodically.



Comment:
- Residents are aware of how wastewater caused environmental problems.

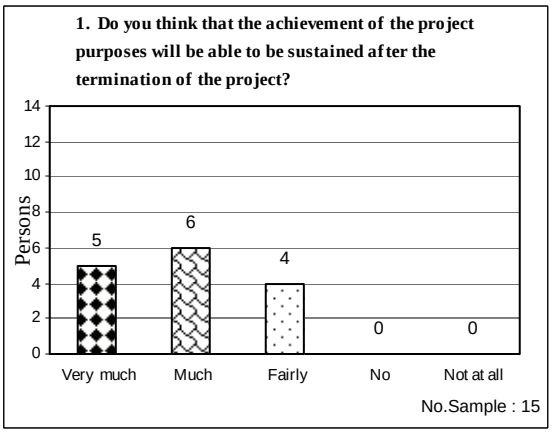


Comment:
- We have faced language translating problems on specified technical terms between English and Thai.
- Some equipment have never be used.
- Some WMA staff have no much time for this project because of their routine work..
- The use of many electrical equipment and machineries is a problem during flooding period.

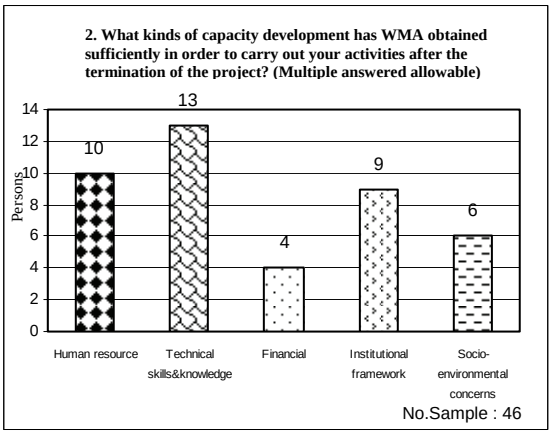


Comment:
- WMA staff obtained more knowledge and skills to improve their operation.
- Environmental Quality is getting better.
- It's positive impact such as local administrations can run waste water treatment system more effectively.
- Local operators have increased their knowledge and skill from the project.

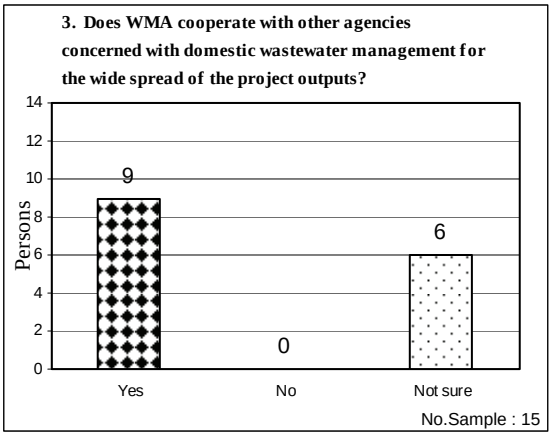
V. Sustainability



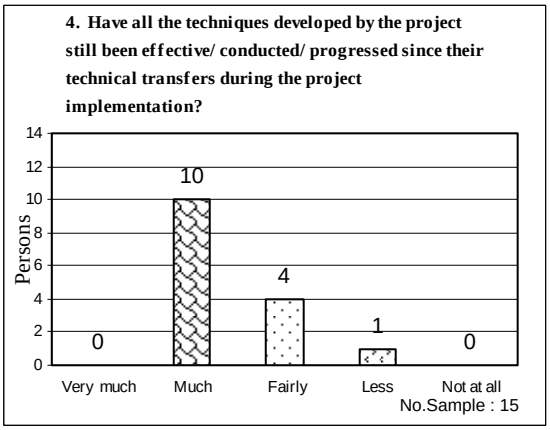
Comment:
- We have to continue technical training for our new staff.



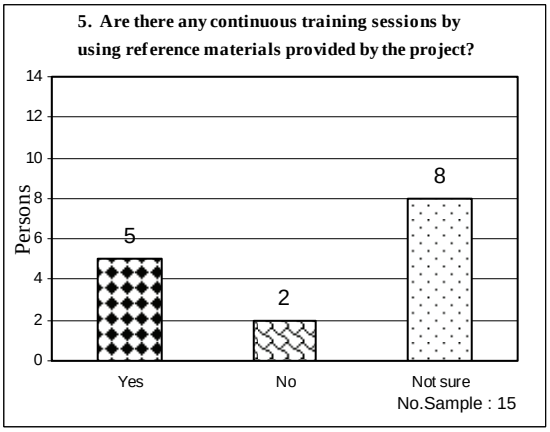
Comment:
- Continuous training on technical skills/knowledge and socio-environmental concerns are very important for WMA capacity development.
- The knowledge and techniques obtained during the project should be applied and developed for the work.
- My knowledge and skill in computer network and programming have increased through the computer training supported by the project.



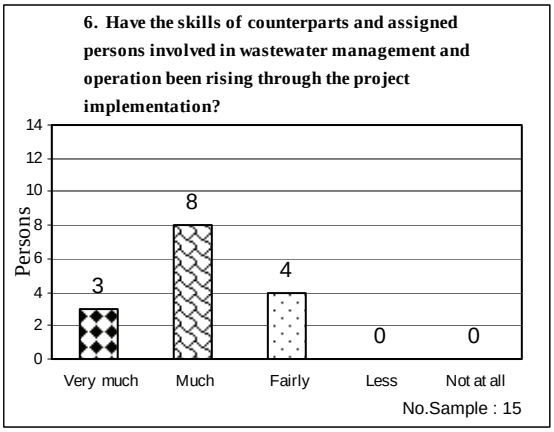
Comment:
- PCD, ONEP, DOLA
- Local administration/Knowledge Transfer
- PCD, ONEP, BMA, DOLA, Local authorities
- Local authorities



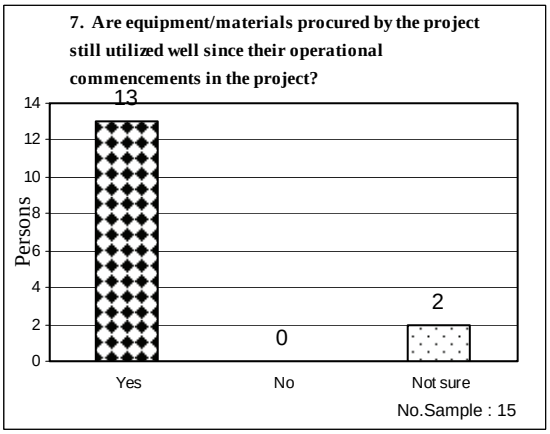
Comment:
- Training for staff working in Wastewater Treatment Plant.
- The search engine was not put in use.



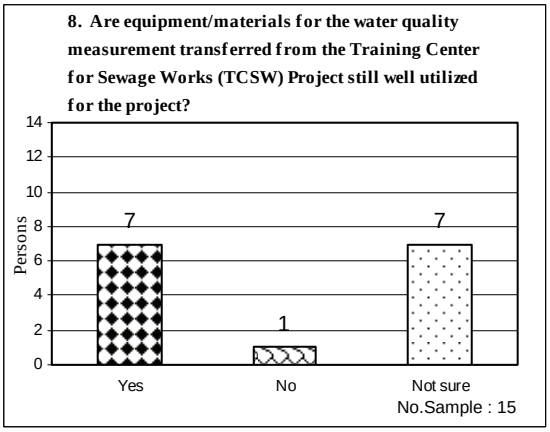
Comment:
- Currently, the preparation of training plan is ongoing before the completion of the project.



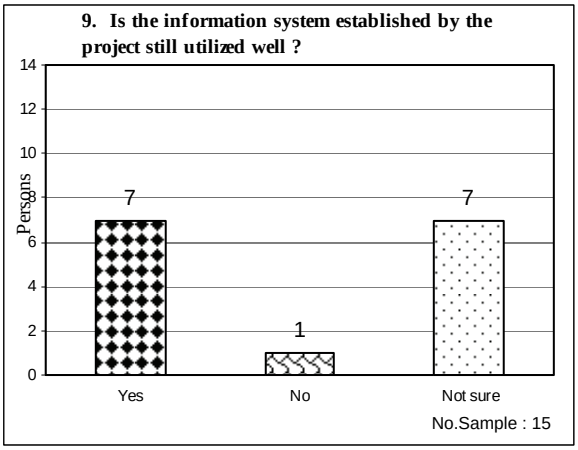
Comment:
- Knowledge in waste water treatment technique; survey; problem analysis on wastewater treatment system; IT for data dissemination
- Technical skills and knowledge in particular areas.
- Experiences, techniques gained from the experts
- Obtained more knowledge and techniques.
- Knowledge on operation and maintenance
- Capability on operating STA and heavy equipment inspection



Comment:
- Some parts can be used.



Comment:
- Basic equipment for water quality analysis is in good condition and be utilized well. But some equipment could not be used such as Nitrogen Analysis Equipment, Heavy Metal Detector (AAS) so WMA has to use the laboratory of Department of Fisheries in stead.
- All equipment used in the field is still utilized well.
- The equipment that are still utilized well including pH Meter, DO meter, oven, incubator, waterbath, Spectophoto meter
- The equipment that are still utilized well including BOD, DO meter, SS, TDS, pH, Spectro photometer
- Some equipment was damaged and some are still in good condition.



Comment:
- The search engine needs to be link into the system.

Suggestions and/or comments:

- WMA are still need capacity building for its staff in the area of survey and design techniques. In addition, public education on wastewater treatment system in Thailand is also required. Since WMA tend to develop its policy and plays its role to be the same as Japan Sewage Work Agency, so the assistance from JICA is required in order to develop our human resources and working system to achieve the target.

- All training from the project contributes greatly to the successful dissemination of reference materials through the Internet by using the search engine and building web pages to be user-friendly.

Annex 18: Rehabilitation and Improvement Plan For Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand

Rehabilitation and Improvement Plan
For
Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand

By

Pollution Control Department
and
Investigation & Rehabilitation Survey Team

Ministry of Natural Resources and Environment

Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand

By: Pollution Control Department and Investigation & Rehabilitation Team, MONRE

Table of Contents:

4.3.1 Implementation Activity and Budgetary under Rehabilitation and Improvement Plan on Municipal Wastewater Treatment System

(1) Improvement and Repair of the Wastewater Treatment Plant

(2) Supporting on Operation and Maintenance

(3) Operation after Rehabilitation Plan

4.3.2 Conditions for Supporting Budget

4.3.3 Suggestions

Summary of Important Points

1. Introduction

MONRE has finished preparation of Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand in May 2003. The objective of this plan is to accelerate the proceeding on rehabilitation of municipal wastewater treatment systems, which have problems on performance efficiency to be more efficient as soon as possible together with capacitive building for Local Authority in wastewater management, operation and maintenance to be able to efficiently and continuously operate the wastewater treatment system. Moreover; local authority has to take responsible in the system management as well as operation expenses.

MONRE has established an Investigation & Rehabilitation Team to investigate, evaluate and analysis for rehabilitation model as well as cost estimation of the municipal wastewater treatment system for the whole country in March 2003. The establishment is the cooperation among Provincial Natural Resource and Environment, Regional Environmental Office, ONEP, WMA and PCD, whereas PCD is the main organization in preparing the rehabilitation plan which is part of the National Wastewater Management Plan. The objectives and goals of the rehabilitation plan are as follows:

Objectives

(1) To rehabilitate and improve of municipal wastewater collection and treatment system to perform efficiently.

(2) To strengthen the local authorities in wastewater management and responsibility in continuous plant operation by their own.

Goals

Total 77 sites of the municipal wastewater treatment system should be efficiently operated by the responsibility of the local authorities with readiness in management and continuous maintenance by the year 2006.

2. Status of Centralized Municipal Wastewater Treatment System

For the past 20 years, Central Government had provided budgetary of 67,290 million baht for construction of wastewater collection and treatment plant to local authorities. The provision of budget was through MOSTE (previously) to OEPP (previously) and MOI to PWD (previously). Up to now there are total 87 municipal wastewater treatment plants which can handle total 2.8 million cubic meters per day of domestic wastewater. 50 plants were from the PWD construction, 22 plants were from local authority construction from MOSTE budget, 7 plants were from BMA construction and 8 plants from other organizations. However there are 3 wastewater treatment plants that cannot be constructed according to the plan, which are Wastewater Treatment Plant for Saraburi Town Municipality from some conflicts and the municipality has not handed over the site to the contractor, Wastewater Treatment Plant for Tambon Pakprak Municipality - Nakorn Sri Tammarat Province where NEB has resolution to cancel the Project on 10 April 2003 and the Wastewater Treatment Plant in Samutprakarn Province where PCD has ordered to postpone the Project on 28 February 2003.

The Investigation Team established by MONRE has investigated and evaluated 77 municipal wastewater systems by using evaluation criteria on system operation, readiness of

the staffs and budget and found out that no sites are performed in very good standard, with 13 sites in good standard, 11 sites in low standard and the rest 14 sites are under construction. Details of the standard grouping for sites can be shown in Table 1 and Figure 1.

Main reasons for the inefficient performance of the municipal wastewater treatment system can be summarized below:

(1) Lack of staffs that have skills or experiences in operation and maintenance. Most of local authorities have problems in lacking of staffs who are directly responsible in operation and maintenance of wastewater treatment systems. Moreover; the assigned staffs always have not much knowledge or experience in wastewater management as well as wastewater treatment operation and maintenance.

(2) Lack of clear understanding in related law enforcement especially enforcement in wastewater collection fee which should be clear policy from central government for local authority to follow according to the polluters pay principle.

(3) Lack of public relation to give knowledge and facts to community and people as well as public hearing to let them participate in wastewater management. Participation among government sector, private sector and people should be promoted.

(4) Lack of budgetary to be used as expenses in wastewater treatment system operation caused by not ready in management and local authorities do not concentrate in system operation.

MONRE by PCD has analyzed and evaluated to determine the method for solving problems in consideration of concrete management by appointing local authority to be the main practical organization. Analysis were in overall pictures of system operation status, problems in grouping of performance level, budgetary support in operation and maintenance and efficiency in wastewater management with regarding in capacity building to local authority. The method in wastewater treatment system rehabilitation can be summarized into 3 activities, i.e.

(1) The acceleration of rehabilitation for municipal wastewater treatment systems that have been finished construction but with problems so that the system cannot be efficiently and continuously operated.

(2) Supporting of operation budget to local authority in the first phase to strengthen the local potential during the preparation stage for self support.

(3) Capacitive building for local authority in wastewater management.

3. Summary of the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System

The rehabilitation and improvement plan is part of the National Municipal Wastewater Management Plan which has to be consistent and link together in each activity. Central and regional government shall perform supporting and assisting roles to the local government for clear and not duplicating works for all agencies which will create integration with more efficient implementation, according to the environmental policy and strategy of the government and MONRE.

The budget for rehabilitation and improvement plan is approx. 1,138.00 million baht (342.6 million baht from supporting budget of local government and 795.4 million baht from the central government budget.) with following details:

(1) Rehabilitation, improvement and repair of the wastewater collection and wastewater treatment plant including machines and equipment in the system is approximately 185.00 million baht.

(2) Supporting budget for operation and maintenance of the 46 plants which have been constructed (not including the plants that have been cancelled or postponed, BMA plants, under construction plants plants, plants that already have fee collection for cost recovery, plants in WMA responsibility or hire private company to operate). The estimation for operation expenses during year 2004 – 2009 is approximately 914.00 million baht. But in case the supporting budget for operation will be on decreasing basis to each local authority within 4 years (reduce 25% per year) for preparation of long run operation to the local authority, the budget will be 342.60 million baht from the local authority and 571.40 million baht from the supporting budget. Local authority can provide this expense from the direct wastewater fee collection or local budget or supporting budget under the action plan step for the decentralization administration or from other sources. This budget will include only electrical cost, operating staffs, chemical costs and laboratory cost. The 4 tear operating budget will not include the maintenance and repair cost for equipment in the system in which the local authority will have to provide budget separately.

(3) The operation after system rehabilitation and capacitive building to local authorities for the 77 sites for the year 2004 – 2006 for both completely constructed and under construction will be in monitoring and evaluation on the rehabilitation results of the local authority. This capacitive building to local authority on management, public relation, public awareness and public participation from community and people in wastewater management will require approx. budget of 39 million baht.

The details according to the rehabilitation plan are as follows:

1. System improvement and repair to 36 sites for 185.00 million baht budget with local authority as main responsible authority, including

1.1 System improvement and repair of 25 sites for 170.00 million baht budget in year 2004.

1.2 Detail survey and planning for improvement and repair of 11 sites for 15.00 million baht in year 2004 before actual improvement in next year.

2. Supporting for plant operation within 571.40 million baht budget with local authority and/or WMA as main responsible authority, including

2.1 Supporting budget in decreasing basis, starting from year 2004 – 2007 for 17 wastewater treatment plants with total budget of 259.00 million baht categorized in 3 good performances, 14 fair performances which are the ones without request in repair and can be implemented in year 2004.

2.2 Supporting budget in decreasing basis, starting from year 2005 – 2008 for 18 wastewater treatment plants with total budget of 180.40 million baht categorized in 2 good performances and 16 fair performances which are the ones with requests in repair for rehabilitation therefore the implementation can start after rehabilitation in year 2005.

2.3 Supporting budget in decreasing basis, starting from year 2006 – 2009 for 11 low performances wastewater treatment plants with total budget of 132.00 million baht.

(Details are illustrated in Figure 2 and 3)

3. Implementation after rehabilitation of the system for 39.00 million baht budget, including:

3.1 Monitoring, inspection and evaluation of the rehabilitation result for 9.0 million baht budget with Regional Environmental Office, ONEP, PCD and WMA as main responsible authorities.

3.2 Capacitive building for local authority in wastewater management for sustainable operation with efficiency and continuously for 10.0 million baht budget with Regional Environmental Office, DEQP and WMA as main responsible authorities. The works will cover preparation of wastewater fee structure and collection method as well as creation of public understanding in wastewater management, operation and maintenance.

3.3 Public relation, public awareness and public participation in wastewater management as well as work cooperation and payment in wastewater fee for 20.0 million baht budget with Regional Environmental Office, Provincial Natural Resource and Environmental Office and DEQP as main responsible authorities.

Table 2: Summary of plans for improvement, rehabilitation and repair for 36 sites of wastewater treatment plant

Plans for rehabilitation and repair of wastewater treatment plant	Operation cost (Million Bath)	Operation year	Financial source	Responsible authority
Total budget for the 36 sites of wastewater treatment systems	185.00			Main responsible authority Local authority
(1) Improve and repair of 25 sites	170.00	2004	Government budget	Supporting authorities
(2) Detail study and plan for the improvement and repair of 11 sites	15.00	2004	Government budget	PCD, OEPP, DEQP, REO, PNREO

Remarks:

PCD = Pollution Control Department
OEPP = Office of Environmental Policy and Planning
DEQP = Department of Environmental Quality Promotion
REO = Regional Environmental Office
PNREO = Provincial Natural Resource and Environment Office

Table 3: Summary of supporting plans for operation and maintenance for 46 units of wastewater treatment plant

Supporting plans for operation and maintenance	Budget (Million Baht)	4 years supporting budget in decreasing basis						Financial Source	Responsible authority
		2004	2005	2006	2007	2008	2009		
Total operation budget for wastewater treatment plant of 46 units (reduce supporting budget)	571.4							Budget flows through steps of action plan of the distribution of authority to local government	Main responsible authority Local authority or WMA
(1) Operation for 17 units	259.0	←	—	—	→				Supporting authority
(2) Operation for 18 units	180.4		←	—	—	→			PCD, OEPP, DEQP, REO, and PNREO
(3) Operation for 11 units	132.0			←	—	—	→		

Table 4 Summary of operation plans after rehabilitation for 77 units of wastewater treatment plant

Operation plan after rehabilitation	Budget (Million Baht)	Operation year (B.E)	Financial source	Responsible authority
Total operation budget	39.0			
(1) Monitoring and evaluation of the system rehabilitation project	9.0	2547-2549	Government budget	Main responsible authorities are REO, OEPP, WMA, and PCD. Supporting authority is PNREO.
(2) Building the readiness of the local authority for management of wastewater treatment plant	10.0	2547-2549	Government budget	Main responsible authorities are REO, DEQP, and WMA. Supporting authorities are PCD, OEPP, and PNREO.
(3) Conduct public relation, public awareness and public participation	20.0	2547-2549	Government budget	Main responsible authorities are REO, PNREO, and DEQP. Supporting authorities are PCD, and WMA

Remarks:
PCD = Pollution Control Department
OEPP = Office of Environmental Policy and Planning
DEQP = Department of Environmental Quality Promotion
REO = Regional Environmental Office
PNREO = Provincial Natural Resource and Environment Office
WMA = Wastewater Management Authority

4. Condition of the supporting budget

For the implementation of rehabilitation and improvement of wastewater collection system and wastewater treatment plant, it must be confident that after the wastewater treatment system had been rehabilitated and the readiness of management for the responsible authority had been built. The local government authority will operate the system by itself with continuity, and effective. Further, all implementations must be evaluated. Therefore, the guarantee criteria should be built for the system, receiving budget for rehabilitation and improvement, that these system will effective operate and cover the investment cost. The Pollution Control Department proposes condition for supporting budget to the Department of Local Authority as follow:

1. Budget Management

1.1 PCD will support only the operation cost. The local authority must take responsibility for maintenance and machine cost. The operation cost budget will support for 4 consecutive years, with the reduction of 25% per year, to the local authority that has no

money. The supporting operation cost will not give to the sites that collect the wastewater treatment fee, the sites for which the Wastewater Management Authority take responsibility or the sites that privatize to private sector. For the 4 consecutive years supporting budget, with the reduction of 25% per year, PCD has to find source of money. Source of supporting budget will be government budget from the Department of Local Authority Promotion or budget from action plan of the provincial environmental management. The Ministry of Natural Resource and Environment will cooperate for these supporting budgets to reduce the redundant of the supporting expense of the wastewater treatment plant operation, creating the integrated of the wastewater treatment system.

1.2 PCD will support budget for building the readiness of the local authority for management of wastewater treatment system by itself. Monitoring, evaluation, building the readiness for management, public relation, public awareness and public participation will be conducted for 3 years (2547-2549) by using the central financial support. Further, for the ultimate objectives, from year 2550 and so on, the 77 Local Authorities, who own the treatment system will take the total responsibility (both operation and maintenance cost) by itself using the local budget, which will came from the wastewater treatment fee of others income.

2. Local Authorities (Local Authority Board/Provincial Management Board/City Management Board) have to follow the conditions as follow:

2.1 Prepare the suitable budget that cover all expense of the operation and maintenance cost of the treatment system by using the local budget, the supporting budget from the distribution of authority plan, and/or income form the wastewater treatment fee. Prepare budget to support the reduction of budget for operation cost according to supporting budget plan for 4 consecutive years. And, prepare financial support for the treatment system operation and maintenance after the 4 consecutive years supporting budget ended.

2.2 Collection of wastewater treatment fee within 1 year after the rehabilitation of the system completed or after 1 year receiving supporting budget for system operation. The wastewater treatment fee must be in the range of the initial proposed minimum-maximum rate. The local authority has to collect the fee that covers all the expense (all expense plus supporting budget from central authority.

2.3 Responsible for the financial budget and management plan of wastewater collection and wastewater treatment that can be evaluated. All these responsibility must be proposed to the Ministry of Natural Resource and Environment through the Pollution Control Department.

2.4 Report results of wastewater treatment plant operation to the Ministry of Natural Resource and Environment through the Pollution Control Department every 4 months.

2.5 Prepare organization, personal or privatize to private sector or Wastewater Management Authority to conduct the rehabilitation and improvement of the treatment system and/or operate wastewater treatment plant, maintenance and/or collect the wastewater treatment fee for the local authority.

3. In case of the local authority can not operate the wastewater treatment plant with the effectiveness according to the supporting budget for 4 years such as can not collect the wastewater treatment fee, low inflow of wastewater to the treatment plant, the effluent can not

meet the effluent standard, the local authority have to follow the Wastewater Management Authority, which will take responsibility instead of the local authority and the local authority have to send the received budget to Wastewater Management Authority.

4. In case of the local authority can not operate the wastewater treatment plant with the effectiveness after the end of the 4 years supporting budget, such as can not collect the wastewater treatment fee, low inflow of wastewater to the treatment plant, the effluent can not meet the effluent standard, the local authority have to follow the Ministry of Natural Resource and Environment or other responsible authority such as the Wastewater Management Authority or the authorized private sector, which will take responsibility instead of the local authority to manage the treatment system and the local authority has to pay for all expense from the operation and maintenance of the treatment system.

5. The local authority, receiving the supporting budget according to rehabilitation and improvement plan, which can not operate the wastewater treatment system with continuity and effective for the total life cycle of the plant, will not be supported for the construction cost to increase the capacity of the treatment plant for the next phase.

6. PCD suggest to the Ministry of Natural Resource and Environment to bring the polluter pay principal, under the consideration process of the polluter pay principal committee, to identify the rate of charge and the method of the fee collection throughout the country before the ended of the 4 consecutive years supporting budget to solve the problem and can be implemented. Results of the wastewater treatment plant operation form the 4 consecutive years supporting budget should be considered to identify the rate of charge as well.

MONRE has brought the wastewater treatment fee collection method in according to the polluters pay principal proposed to the Nation Environmental Board during the 7/2546 meeting on December 4, 2003. The Nation Environmental Board has resolution in acceptance the concept of the wastewater treatment fee collection in according to the polluters pay principal proposed by the MONRE with details are as follows:

1. Objective of the wastewater treatment fee: Bring income to the local authority the effective manage of the wastewater treatment plant and invest the new treatment units in the future.

2. Target: Collect the wastewater treatment fee within the rate of total cost.

3. Concept of the charge rate for the wastewater treatment fee and strategy to identify the rate of charge.

3.1 Wastewater treatment fee collected in the form of “Treatment Fee”, people living in the area have to responsible for.

3.2 The initial rate of charge for the wastewater treatment fee is charged only for the operation and maintenance for the operation unit as follow:

1.) Stabilization Pond 2-4 Baht per cubic meter
2.) Aerated lagoon 3-5 Baht per cubic meter
3.) Activated Sludge System 3-8 Baht per cubic meter
4.) Rotating Biological Contact (RBC), Bio-filter, Constructed wetlands, charge rate consider from operation and maintenance cost of each site.

4. Rate of charge: Fix rate of charge within the range of minimum-maximum. For the first stage of the collection, the minimum rate will be charge after that the rate of charge will be increased to the fixed maximum rate. Concept and method for the rate of charge will be intermittently considered.

5. Collection and management of income

5.1 Collection: For the first stage, collection in the form of wastewater treatment fee only in the area that has the wastewater treatment plant and had water supply system. The local authority will be collected because the local government has legal authority that can be implemented immediately.

5.2 Management of income: Money collected from wastewater treatment fee of the local authority will be the income of the local government, which can be used for the management and expansion of the wastewater treatment system.

6. Local authority will have to implement and consider in the following details:

6.1 From the regulation of the distribution of authority to the local government section 16 (8), 17 (10) and section 23(19), 24(12), the local authority has authority and duty to manage the wastewater treatment system and the central waste treatment system within the responsible area and the local authority had authorize to collect the fee for the wastewater treatment or central waste treatment system.

6.2 Identify the initial rate of the wastewater treatment fee according to the proposed charged rate or according to the operation and maintenance cost. Activity or type of the water usage or other collection method that consider being suitable will be investigated and the charged rate will be intermittently reconsidered.

6.3 Consider for waving of the wastewater treatment fee for the household.

6.4 Consider for the reimbursement or waving of the wastewater treatment fee for the sources of wastewater that have wastewater treatment plants, which can be proved that the effluent meet the effluent standard.

6.5 Consider for the collection of the service fee or the other fee that related to the wastewater treatment system such as water discharge fee or the fee for connecting of wastewater to treatment system.

7. In case of the local authority that has the charged rate and collected of the wastewater treatment fee, the local authority should consider for further implementation or should reconsider for the suitable proposed outlines.

Moreover, the Ministry of Natural Resource and Environment will be the main responsible organization for the consideration and cooperation with the related organization regarding law, regulation, and practice outlines according to the polluter pay principle. The Ministry of Natural Resource and Environment will assign the government authority or private sector that has the authority to conduct the implementation plan to solve problems in case of the local authority can not operate or can not take responsibility for the effective operation of the wastewater treatment plant. Law and regulation that will be considered would be the National Environmental law, 2535 B.E., the Wastewater Management Authority law and regulation, the distribution of authority to the local government law and regulation, 2542 B.E. Other laws that give authorize to the organization relating to the management such as water supply, electrical supply.

5. Suggestion

1. Management of wastewater should be opened to the public society and people in the local community should be involved and make decision to make the public participation and reduce the problems that will emerge.

2. The budget management of the local authority through the action plan of the distribution of authority to the local government should clearly consider the responsibility and budget of the local government that has to manage for the environment and wastewater.

3. Bring the polluter pay principle and put the wastewater treatment fee collection to the action. The wastewater treatment fee may collect plus the water supply fee, which law and regulation should be indicated. Organization such as the water supply section and wastewater treatment section should be reorganized to be the new one organization. These will give the effective management.

4. Local government, who do not want to operate and maintenance of the wastewater treatment system, can privatize these responsibility to private sector or consulting company or the Wastewater Management Authority.

5. Building capacity and develop the local government personal to manage and maintenance of the wastewater treatment system.

6. Expected outcome

1. Community and people have an increase in the water quality and environmental quality, and accordingly the increase in the quality of life.

2. People have knowledge, understanding and receiving information regarding the wastewater management and pollution form wastewater. Further, people have the change to participate and involve in the decision making regarding wastewater treatment.

3. Community and people have the effective and capable local authority to the effective environmental management.

Table 1: Status and standard of the operation performance for municipal wastewater treatment plants

Criteria		Site and location	Plant type	Operation capacity (m^3/d^{-1})	Construction cost (Milion Bath)	Financial Source	Construction control authority	Remarks
Good performance	1	Had Yai City municipality, Songkhla	SP	69,000	1,784.38	MOSTE + Local Authority	Had Yai City municipality	
	2	Phuket Town municipality, phase 1	AS	36,000	912	PWD	PWD	
	3,4	Sansouk Town, north-south municipality	AS	14,000	800	PWD	PWD, WMA	WMA has plan
	5	Pattaya Town municipality	AS	65,000	1,786.88	MOSTE	Pattaya Town municipality	
	6	Songkhla City municipality	AL	24,000	298.7	PWD	PWD	
	7	Cholburi Provincial Administrative Organization	AS	22,500	565	PWD	PWD	
	8	Khonkaen City municipality	AL	50,000	533	PWD + MOSTE	PWD, Khonkaen City municipality	
	9	Nakorn Ratchasima City municipality	SP	32,000	655	PWD	PWD	
	10	Tambon Klung municipality, Chantaburi	SP	5,400	128.24	PWD	PWD	
	11	Nonthaburi City municipality (Prachanivet)	AS	38,500	616.5	PWD	PWD	
	12	Kampaengphet Town municipality	SP	13,500	230	MOSTE	MOSTE	
	13	Petchaburi Town municipality	SP	10,000	117.6	DOLA	Petchaburi Town municipality	WMA has plan
Fair performance	1	Chiangmai City municipalit (West site)	AL	55,000	760.09	PWD + MOSTE	PWD, Chiangmai City municipalit	
	2	Phayao Town municipality	SP	9,700	200	PWD	PWD	
	3	Pichit Town municipality	AL	12,000	180	PWD	PWD	
	4	Chumsaeng Town municipality, Nakornsawan	SP	1,650	52.42	MOSTE	Chumsaeng Town municipality	WMA has plan
	5	Tak Town municipality	SP	5,400	66.49	MOSTE	Tak Town municipality	
	6	Nakorn Pathom City municipality	SP	60,000	219.16	PWD	PWD	
	7	Chainat Town municipality	SP	3,469	203.8	PWD	PWD	
	8	Tambon U-Thong municipality	SP	5,500	135.51	PWD	PWD	

Table 1: Status and standard of the operation performance for municipal wastewater treatment plants

Criteria	Site and location	Plant type	Operation capacity (m^3/d^{-1})	Construction cost (Milion Bath)	Financial Source	Construction control authority	Remarks
	9 Supanburi Town municipality	SP	11,400	363.21	PWD	PWD	
	10 Ang-Thong Town municipality	AL	8,200	179	PWD	PWD	
	11 Ayudhaya City municipality	AS	25,000	496.92	PWD + Ayudhaya City municipality	PWD, Ayudhaya City municipality	
	12 Tambon Praintaracha municipality, Ayudhaya	AS	4,500	148.3	MOSTE	Tambon Praintaracha municipality	
	13 Ban Mee Town municipality, Lopburi	SP	1,000	4.68	PWD	Ban Mee Town municipality	
	14 Ratchaburi Town municipality	SP	20,000	359	PWD	PWD	
	15 Ban Pong Town municipality, Ratchaburi	SP	5,000	82.74	PWD	PWD	
	16 Potharam Town municipality, Ratchaburi	AS	5,000	55.92	PWD	PWD	
	17 Kanchanaburi Town municipality	AS	24,000	574.25	PWD + MOSTE	PWD, Kanchanaburi Town municipality	
	18 Tambon Cha-am municipality, Petchaburi	AL	17,000	359.5	PWD	PWD	
	19 Prachuab Kirikan Town municipality	AL	8,000	200	PWD	PWD	WMA has plan
	20 Tambon Hua-Hin municipality (Phase 1), Prachuab Kirikan	RBC	8,000	53	PWD	PWD	WMA has plan
	21 Tambon Hua-Hin municipality (Phase 2), Prachuab Kirikan	AS	8,500	310	PWD	PWD	WMA has plan
	22, 23 Kumarksue Nongsanom Sakolnakorn Town municipality, Sakolnakorn	SP	16,000	630	PWD + DOF+ RID	PWD, DOF, RID	WMA has plan
	24 Tambon Tarae municipality, Sakolnakorn	SP	2,054	60.76	MOSTE	Tambon Tarae municipality, Sakolnakorn	
	25 Tambon Hua Kwang municipality, Mahasarakam	SP	1,500	21.39	MOSTE	Tambon Hua Kwang	
	26 Tambon Pakchong municipality	SP	12,000	255.66	MOSTE	Tambon Pakchong municipality	
	27 Bureerum Town municipality	AL	13,000	249.3	PWD	PWD	
	28 Ubonrachathani City municipality	AL	22,000	370	PWD	PWD	

Table 1: Status and standard of the operation performance for municipal wastewater treatment plants

Criteria	Site and location	Plant type	Operation capacity (m^3/d^{-1})	Construction cost (Milion Bath)	Financial Source	Construction control authority	Remarks
	29 Tambon Warinchamrab municipality, Ubonrachathani	SP	22,200	309	MOSTE	Tambon Warinchamrab municipality	
	30 Panusnikom Town municipality, Cholburi	SP	5,000	30	PWD	PWD	
	31 Sri Racha Town municipality, Cholburi	AS	18,000	115.52	PWD	PWD	WMA has plan
	32 Soi Watbun Kanchanaram, Pattaya, Cholburi	AS	20,000	359.11	PWD	PWD	
	33 Tambon Ban Pae municipality, Rayong	AS	8,000	230	PWD	PWD	WMA has plan
	34 Map Tapud municipality, Rayong	AL	15,000	286.7	PWD	PWD	
	35 Chantaburi Town municipality	SP	17,000	300	PWD	PWD	
	36 Cha-Cheng-Sao Town municipality	AS	24,000	240	PWD + MOSTE	PWD, Cha-Cheng-Sao Town municipality	
	37 Bantai-Koh Pangan Tambon Administrative Organization, Surat Thani	Biofilter	200	10	TAT	TAT	
	38 Patong Town municipality, Phuket	AS	14,250	360.19	PWD + MOSTE	PWD, Patong Town municipality	WMA has plan
	39 Trang City municipality	AL	17,700	480.8	PWD + MOSTE	PWD, Trang City municipality	
Low performance	1 Singhaburi Town municipality	SP	4,500	249.5	PWD	PWD	
	2 Patumthani Town municipality	AS	11,000	340	PWD	PWD	
	3 Mae Sod Town municipality, Tak	SP	40,000	305	MOSTE	Mae Sod Town municipality	
	4 Tambon Laemchabang municipality, Cholburi	AS	25,000	179.6	PWD	PWD	
	5 Nan Town municipality	SP	8,259	475	MOSTE	Nan Town municipality	
	6 Rayong Town municipality	AL	41,000	318	PWD	PWD	
	7 Tambon Buayai municipality, Nakorn Ratchasima	SP	1,500	1.54	DOLA		
	8 Chaiyaphom Town municipality	SP	2,000	0.1	Local source	Chaiyaphom Town municipality	
	9 Pee Pee Island, Krabi	SP	400	15.95	MOSTE		

Table 1: Status and standard of the operation performance for municipal wastewater treatment plants

Criteria	Site and location	Plant type	Operation capacity (m^3/d^{-1})	Construction cost (Milion Bath)	Financial Source	Construction control authority	Remarks
	10 Uthai Thani Town municipality	SP	2,590	15.9	Rigional and local source	Uthai Thani Town municipality	
	11 Tambon Salokbart municipality, Kampaengphet	SP	500	230	PWD	PWD	
Remarks 1. PWD = Public Work authority 2. MOSTE = Ministry of Science, Technology and Environment 3. TAT = Tourism Authority of Thailand 4. DOLA = Department of Local Authority 5. WMA = Wastewater Management Authority 6. DOF = Department of Fisheries 7. RID = Royal Irrigation Department 8. PWD + MOSTE means financial source of phase 1 came from PWD and financial source of phase 2 (expansion of the system) came from MOSTE							

Figure 2: Summary of the process under the rehabilitation plan for the municipal wastewater collection and treatment system

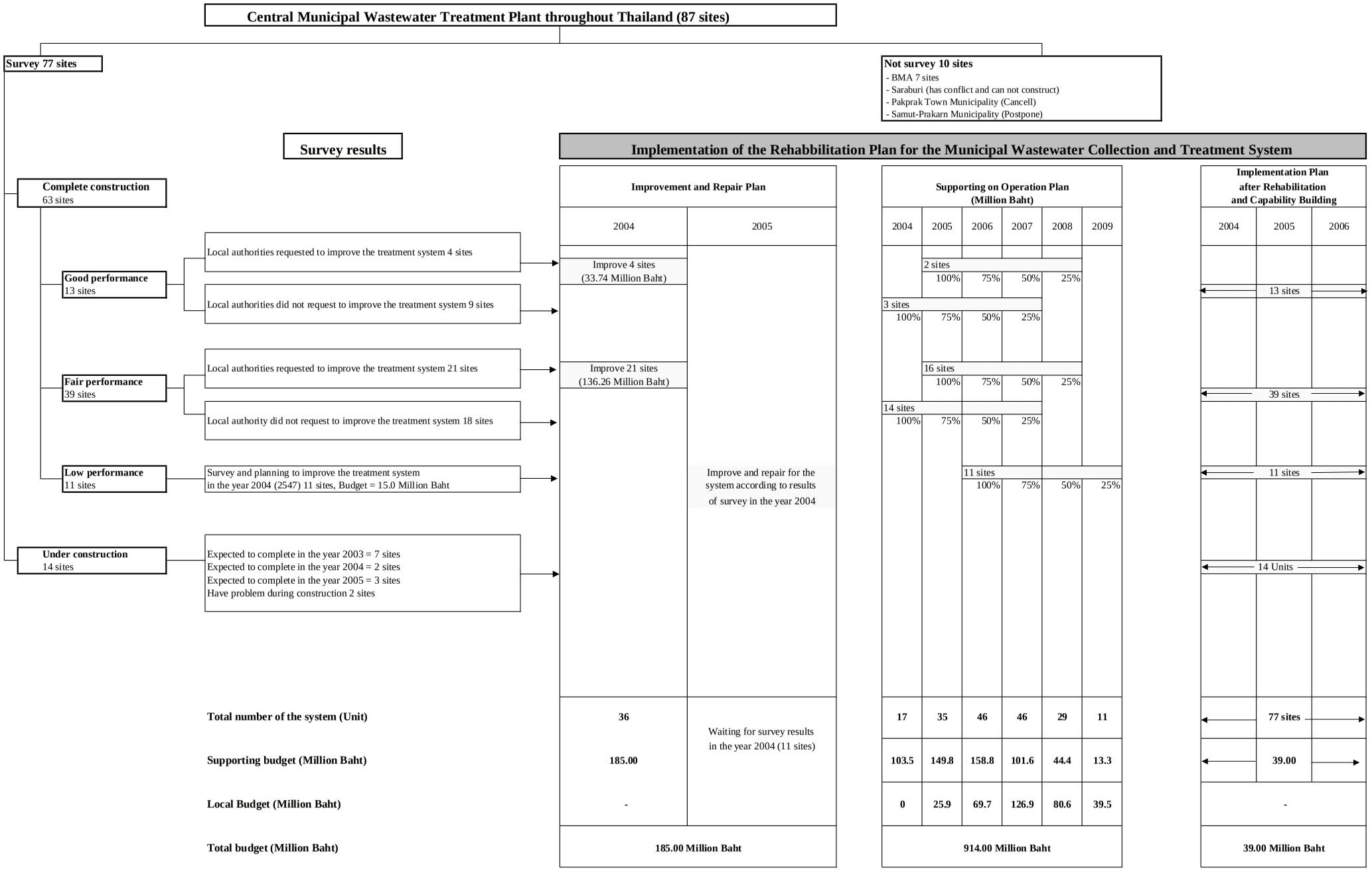
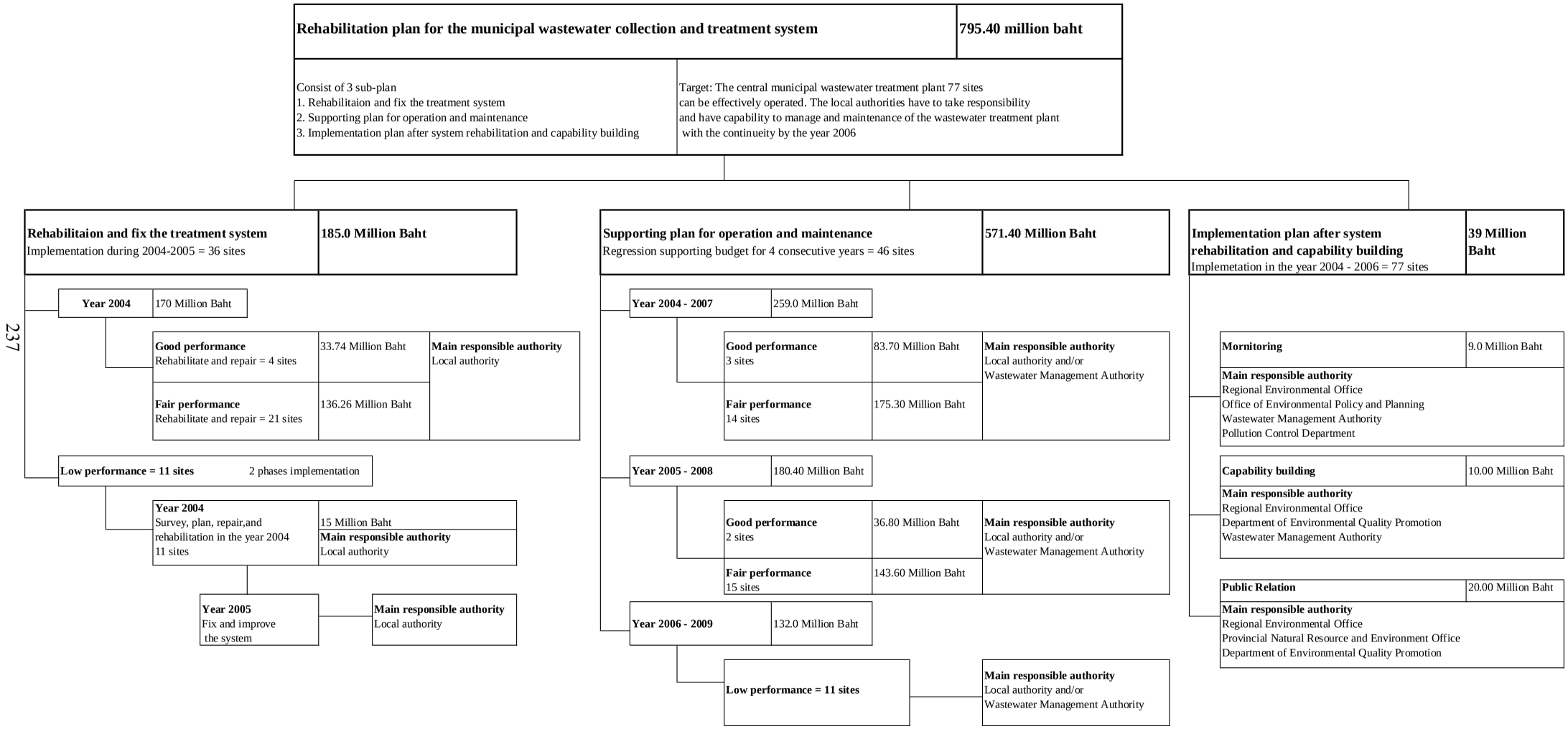


Figure 3: Summary of budget for the implementation of the rehabilitation plan for the municipal wastewater collection and treatment system throughout Thailand



Annex 19: Total number of WMA employees 2004-2010
The number of WMA’s technical personnel 2004-2010

Annex 19: Total number of WMA employees 2004-2010
The Number of WMA's technical personnel 2004-2010

Year	2004	2005	2006	2007	2008	2009	2010
Total number of WMA employees							
Total No. of WMA's employees	88	92	104	108	118	128	138
Number of WMA's technical personnel							
No. of staff of Engineering Dept.	2	4	4	5	6	7	8
No. of staff of Wastewater Management Dept.	7	12	8	7	9	10	11
No. of staff Statistical Data Development Div.	0	3	5	5	6	7	8

Source: 1) Mid-term evaluation study report
2) Interview survey to WMA

Annex 20: List of Requests from Local Authorities to WMA

Annex 20: List of Requests from Local Authorities to WMA

Content of Request	Municipality	Year	Detail
For existing STPs Rehabilitation, O/M and consuiting (33 municipalities)	Had Yai , Songkhla	2003	Prepare Plan of Manangement and Rehabilitation, Request for Operation
	Mab Ta Put, Rayong		Survey System, Estimate the problem, and Operation system
	Pakert , Non thaburi	2004	Request to speed up the Construction
	Nakorn Rachasima	2003	Prepare Plan of Manangement and Rehabilitation, Request for Operation
	Burirum	2003	Prepare Plan of Manangement and Rehabilitation, Request for Operation
	Koi Sa Mui, Surat Thanee	2003	Prepare Plan of Manangement and Rehabilitation, Request for Operation
	Ao Nang, Kra Bi	2003	Prepare Plan of Manangement and Rehabilitation, Request for Operation
	Kanjana Buri	2003	Prepare Plan of Manangement and Rehabilitation, Request for Operation
	Chai Nat	2003	Prepare Plan of Manangement and Rehabilitation, Request for Operation
	Tak	2002	Joint Management, Rehabilitation and O&M of STP : 4 Years
	Pakchong , Ratcha Sima	2006	Joint Management, Rehabilitation and O&M of STP : 4 Years
	Cha Am, Petcha Buri	2002	Study and Prepare plan of Rehabilitation
	Lam Pang		Survey system, Estimate the problem, and operation system
	Leam Chabang, Rayong		Survey system, Estimate the problem, and operation system
	Pra In Tharacha, Ayuddhaya		Study and Prepare plan of Rehabilitation
	Pra Nakon Sri Ayuddhaya	2002	Study and Prepare plan of Rehabilitation
	Patong, Phuhet	2002	Study and Prepare plan of Rehabilitation / constrnetedsult the constructed wetland
	Ka Ron, Phuket	2002	Study and Prepare plan of Rehabilitation
	Pattaya, Chon Buri	2001	Rehabilitation, management
	Ban Pong, Ratcha Buri	2003	Prepare Plan of manangement and rehabilitation, Request for operation
	Hua Hin, Prachuap Kiri Kan	2001	Joint Management, Rehabilitation and O&M of STP : 4 Years
	Ban Mee, Lop Buri	2001	Joint Management, Rehabilitation and O&M of STP : 4 Years
	Chaiyapum	2002	Study and Prepare plan of Rehabilitation
	Bua Yai, Nakon Ratcha Srima	2002	Study and Prepare plan of Rehabilitation
	Prachuap Kiri Kan	2002	Joint Management, Rehabilitation and O&M of STP : 4 Years
	Chan Thaburi	2002	Refuse to join / in 2007 Request by phone for help for Rehabilitation and O&M of STP
	Khon Khan		Study and Prepare plan of Rehabilitation
	Luang Suen, Chum Porn	2007	Expert in wastwater management to be consultant in planning wastewater treatment system
	Chon Buri		Study and Prepare plan of Rehabilitation
	U Thong, Suphan Buri		Study and Prepare plan of Rehabilitation
	Suphan Buri	2002	Study and Prepare plan of Rehabilitation
	Chaing Rai		Study and Prepare plan of Rehabilitation
	Pi Jit	2002	Study and Prepare plan of Rehabilitation
For underconstructing STPs Technical assistance and suggestion on planing, FS and survey by dispatching WMA staff (12 municipalities)	Rayong**	2002	Survey System, Estimate the problem, and Operation system
	Surat Thanee	2002	Study and Prepare Plan for Wastewater Management
	Koi Lanta, Kra Bi		Study and Prepare Plan for Wastewater Management
	Phisanulok**		Survey System, Estimate the problem, and Operation system
	Phuket		Study and Prepare plan of Rehabilitation
	Pattanee		to support expert on wastewater treatment/to plan and manage STP to be efficiency
	Rachaburi**		Survey System, Estimate the problem, and Operation system
re) * don't finish construction	Sra Buri*		Survey System, Estimate the problem, and Operation system
** don't accept STP from PWD	Plu Taew Village, Ta Kao Pa		WMA(DANIDA Budget) constructed the STP (Constructed Wetland)
	Nam Kam, Ta Kao Pa		Constructed the Onsite Treatment System
	Chum Porn*	Feb-07	Survey System, Estimate the problem, and Operation system
	Luang Suen, Chum Porn	Feb-07	to support expert on wastewater treatment/to plan and manage STP to be efficiency

Annex 21: Seminar Report No.1

"Trend for Supporting Local Administrations in Community Wastewater Management of Wastewater Management Authority"

Management Solutions International Co., Ltd.
Asdecon Corporation Co., Ltd.

June 2007

Seminar
On Topic of "The guidance in supporting Local Administration about domestic wastewater management of Wastewater Management Authority"

1. Principle and Reason

The growth and expansion of communities is continuously so the quantity of wastewater is increase especially big city area. The quantity of wastewater might be effect to environment, water quality, and quality of life of citizen in community. Government and related organization both central and local are implementing about domestic wastewater management. From the past, total project of construction domestic wastewater treatment system is 87 projects, total cost is 68,295 million baht by dividing into project of local administration and outside Bangkok 79 projects with the cost of investment is 25,524 Million Baht.

Moreover, the operation of wastewater treatment system in several areas faces with the problems such as budget, readiness of staffs, management, and etc. Some wastewater treatment system are not operate, get damage, and lose the cost of investment so the investment of construction, rehabilitation, and management of wastewater treatment system in order to operate efficiency and sustainable, the cooperation of local administration and the support of related organization both government and private are necessary include capacity development of local organization to have enough capacity.

The guideline of good operation and success in domestic wastewater management in other countries such as Unite State of America, Japan, and Korea, the related organization of government must support local administration in management of domestic wastewater treatment system in various fields such as finance, staffs and technical, collecting environment fee, Law and regulation, and etc. At present, Wastewater Management Authority (WMA) is the one of government organization has the role with other main related organization such as Ministry of Natural Resources and Environment, Office of the Natural Resources and Environmental Policy and Planning, Pollution Control Department, and etc. In order to support local administration and development and rehabilitation efficiency of wastewater treatment system to reach the highest effectiveness and government need to operate wastewater treatment system with the purpose of construction, these projects necessary to use the investment and rehabilitation cost and has appropriate management method.

Wastewater Management Authority Board Member has meeting session 3/2007 on 19 March 2007 and agree about the development method of Wastewater Management Authority by agreeing to implementation, rehabilitation of domestic wastewater treatment system, and support local administration in management of domestic wastewater treatment system by cooperating with related organization both Ministry level (Ministry of Natural Resources and Environment and Ministry of Interior) and Operation Level (Wastewater Management Authority and Department of Local Administration)

The purpose of this seminar is to explain and make clarify in this matter and create the cooperation and define the method of operation in domestic wastewater management between Local Administration and Wastewater Management authority. This is one of strategy of operation to support the success and sustain operation.

2. Objectives

2.1 To create understanding to Local Administration in wastewater operation of Wastewater Management Authority

2.2 To find out the appropriate method in operating wastewater management between Wastewater Management Authority and Local Administration.

3. Target Group

1. Representative from Local Administration 75 places	1 Person/Place
2. Committee of Wastewater Management Authority	12 Persons
3. Representative from Department of Local Administration	4 Persons
4. Representative from Bureau of Budget	2 Persons
5. Representative from State Enterprise Policy Office	2 Persons
6. Representative from Office of the Natural Resources and Environmental Policy and Planning	2 Persons
7. Representative from Pollution Control Department	2 Persons
8. Representative from Department of Environmental Quality Promotion	2 Persons
9. Representative from Regional Environmental Office 16 places	16 Persons
10. Representative from Office of Natural resources and Environment Provincial	44 Persons
11. Wastewater Management Authority Staffs	40 Persons
Total	**201 Persons**

4. Implementation Method

Implement in presentation, sharing ideas and experience, and panel discussion and divide into 2 parts which are

4.1 Presentation and sharing ideas in sustainable domestic wastewater management by cooperating with Local Administration and Wastewater Management Authority

4.2 Transforming Experience and Panel Discussion in several issues that related with the ideas and method in morning session in order to find out the appropriate method in cooperation between Local Administration and Wastewater Management Authority.

5. Time of Implementation

Thursday 7 June 2007, 8.15 – 16.30 (Agenda Attached)

6. Place

Miracle Grand Hotel

7. Organizer

Business Development Section, Wastewater Management Authority

8. Expect Output

8.1 To promote organization and increase level of understanding about organization role of Wastewater Management Authority to Local Administration

8.2 Acknowledgement about the attitude of Local Administration to Wastewater Management Authority

8.3 Acknowledgement about total of Local Administration that supports the operation of Wastewater Management Authority and could attend in the beginning.

AGENDA
The guidance in supporting Local Administration about domestic wastewater management of Wastewater Management Authority
Thursday 7 June 2007
Magic 2, 2nd Floor, Miracle Grand Hotel, Bangkok

08.15 – 09.00	Registration
09.00 – 09.10	Welcome Speech By Mr. Reab Naradisorn Chairman of Wastewater Management Authority
09.10 – 09.20	Reporting Speech By Mr. Akanit Ampawasiri Acting Director General Wastewater Management Authority
09.20 – 09.50	Opening Speech and Special Speech By Mr. Pitipong Pungboon Na Ayutdaya Permanent Secretary Ministry of Natural Resources and Environment
09.50 – 10.35	Presentation in topic of "Wastewater Management of Local Administration in Thailand" By Mr. Somporn Chaibangyang Director General – The department of Local Administration
10.35 – 10.50	Coffee Break
10.50 – 12.00	Panel Discussion on "Guideline for operating between Local Administration and Wastewater Management Authority in improvement and management of wastewater" By 1. Mr. Chatri Chuyprasith Deputy Permanent Secretary Ministry of Natural resources and Environment 2. Ms. Jiraporn Meeleesawad Representative from Bureau of the budget, committee of Wastewater Management Authority 3. Mr. Akanit Ampawasiri Acting Director Wastewater Management Authority Moderator By Mr. Kitti Singhapat
12.00 – 13.00	Lunch
13.00 – 14.00	Panel Discussion on "The experience in wastewater management between Local Administration and Wastewater Management Authority" By Mr. Komut Teekatananont Mayor of Sakonnakorn Municipality Ms. Rattana Lertwichakul

	Vice Mayor of Hua Kwang Municipality, Mahasarakham Mr. Nartpong Wicheanchuy Mayor of Baan Tai Local Administration Moderator By Mr. Sarawut Srisakul Director of Director Office Wastewater Management Authority
14.00 – 14.30	Presentation on "Japan Sewage Works Agency and wastewater management in Thailand" By Mr. TAKAHASHI Haruki Chief Advisor The Project of The improvement of Sewage Treatment Plant Management in Thailand
14.30 – 16.00	Panel Discussion on Exchange the ideas in any issues that related with Policy and Guideline for managing domestic wastewater such as • The budget in investment ** • Wastewater Treatment Fee • Law in wastewater treatment management • Possibility in collecting Environment Tax by Local Administration
	(Coffee Break in Seminar Room)
16.00 – 16.10	Seminar Conclusion

Seminar Summary Report No. 1
on
"The Guidance in Supporting Local Administrations on Domestic Wastewater Management of Wastewater Management Authority"

1. Principle and Reason

Wastewater Management Authority (WMA) Board Member has a meeting session 3/2007 on 19 March 2007 and agreed about the development method of WMA by agreeing to implementation, rehabilitation of domestic wastewater treatment system, and support local administration in management of domestic wastewater treatment system by cooperating with related organization both Ministry level (MNRE and Ministry of Interior) and operation level (WMA and DOLA). Therefore, WMA has intention to organize a seminar in order to make understanding with local administrations in WMA's work and finding suitable solution for cooperation in wastewater management for WMA and local administration.

The consultant and WMA organized a seminar no. 1 on 7 June 2007 at Magic 2 Room, Miracle Grand Hotel, Bangkok, for this matter.

2. Objectives

2.1 To survey opinions of all related agencies and local administrations to WMA's work including domestic wastewater management in whole picture.

2.2 To bring opinions to reflect in formulation of detail reform plan.

3. Participants and Topics

3.1 Participants

Participants come from all concerned agencies with wastewater management in central government, local agencies and private, totally 215 persons. It can be summarized as follows;

1) Representative from government agencies	215	persons
- central government	59	persons
- provincial administration	46	persons
- local administration	80	persons
2) Representative from private and other	30	persons

Annex A is shown name list of all participants.

3.2 Topics

The seminar is divided into 2 parts as follows;

Part 1 is lecture and present idea of MNRE, Budget Bureau and DOPA. The topics are as follows;

- Wastewater Management of Local Administration in Thailand
- Trend of Cooperation between Local Administration and WMA for rehabilitate and wastewater management

Part 2 is experience transfer in wastewater management and operation both in Thailand and foreign countries including exchanging of opinions in various topics which related to community wastewater management. The topics are as follows;

- Experience in cooperation of wastewater management between local administration and WMA in Sakhon Nakhon municipality in Sakhon Nakhon province, Hua Kwang municipality in Maha Sarakham province and Ban Tai TAO in Surat Thani province
- Japan Sewage Works Agency and wastewater management in Japan
- Panel discussion regarding policy and operation guidance for domestic wastewater such as
  - Budget supporting from central government for investment in construction of wastewater management and operation
  - Opportunity in central wastewater treatment for local administration more than 1 place
  - Sewage treatment charge collection
  - Law measurement to support wastewater treatment of local administration
  - Supporting from central government that local administration needs for efficiency, effectively and sustainable of wastewater treatment management
  - Appropriateness of local environmental tax collection

  Detail is shown in seminar's schedule of Annex B.

4. Summary of Important Topics from Seminar

4.1 Opinion of related agencies to WMA

4.1.1 Opinion of MNRE to WMA

- Guidance of operation and assistance to local administration of WMA is not clear.
- WMA has to develop, modify its task and organization structure in order to response to the needs of local administration efficiency and effectively.
- WMA should have capacity building especially in field of technique including project analysis, design, construction, research, etc. in order to fully assist local administration.
- MNRE pleased to fully support to WMA if WMA has a clear in policy and work plan.
- Funding source for wastewater management come from 3 source as follows;
  - Central government budget through Ministry of Interior. However, this budget requires advanced plan for at least 1 year. Therefore, this budget is not suitable with wastewater problem which is critical now.
  - Source from Environmental Fund about 4,000 million Baht which is suitable for solving environmental problem in urgent case. However, using this fund requires many processes, difficult and high cost. MNRE would like to get opinion from local administration in order to improve the regulation of Environmental Fund for more appropriateness.
  - Income of local administration for sewage treatment charge but it is unpopular among local administration.

- MNRE pleased to support WMA for sewage treatment collection. MNRE may issue Ministry Act in order to pave the way for local administration to collect the charge.
- The problem occurred to large scale wastewater treatment is mostly collection pipe system. This makes MNRE changing idea to construct of smaller scale of wastewater treatment including treatment at wastewater generation point. MNRE thinks that WMA at present is suitable for improvement of existing wastewater treatment including medium scale of wastewater treatment like cluster.
- MNRE pleased to support local administration in various fields such as duty, law concerned, etc. in order to achieve more efficiency and effectively of wastewater management.
- WMA should conduct capacity building for local administration in order to strengthen local administration to fulfill its duty in accordance with Decentralization Act Year 1999. WMA should do in the 5 following fields.
  - Giving knowledge and understanding for wastewater management to local administration
  - WMA should participate in wastewater treatment operation in control area for 10 places by cooperating with local administration for analysis and construction of wastewater treatment system
  - WMA should increase its capacity especially in field of design, construction in order to assist local administration
  - At present, wastewater treatment system has run much lower than its capacity (40%), therefore, WMA should assist local administration to rehabilitate and manage the wastewater treatment system
  - WMA should concentrate to wastewater treatment for cluster or on-site treatment including specific wastewater treatment

4.1.2 Opinions of DOLA to WMA

- Due to limited budget, investment for wastewater treatment should have work plan and clear target. Prioritize of the project must be suited with water pollution problems and investment plan on domestic wastewater
- WMA could not run wastewater treatment alone. WMA should be the organization to take care the system in whole picture.
- DOLA pleased to promote cooperation between WMA and local administration. WMA should participate in construction plan and operation plan of wastewater treatment system of local administration
- WMA should do the work aggressive by preparing plan and awareness of people in wastewater treatment

4.1.3 Opinion of Budget Bureau to WMA

- Budget Bureau pleased to support WMA in field of budget. In year 2008, the Budget Bureau has allocated budget to WMA to operate the system for 18 places (increase from 12 places at present)

- If WMA has a clear work plan, the Budget Bureau pleased to support.
- However, as state enterprise, WMA should get income at most.

4.2 Opinion of Participants

4.2.1 Support of central government to project of wastewater treatment and operation

- Proportion of investment between central government and local administration is highly depended on necessity of each area. However, it should be the proportion that local administration can stand on.
- Borrowing money from Environmental Fund is difficult and high cost. MNRE should reduce regulations and interest including possibility to give grant to local administration
- Project analysis of local administration is still lower than standard. It makes Environmental Fund and central agencies (MNRE, Ministry of Interior and The Budget Bureau) do not believe the possibility of the project. Therefore, they do not allocate the budget.
- Changing type of budget from general support to specific support makes local administration facing difficulties in operation

4.2.2 Opportunity of Cluster Wastewater Treatment for local administration more than 1 place

- Cluster Wastewater Treatment is depended on each local administration. If local administration operate by itself, the cluster system will be more difficult.

4.2.3 Sewage Treatment Charge Collection

- Some local administration thinks it should be collected together with water supply but it may difficult to do and need strong cooperation from Provincial Water Authority. Even in Bangkok Metropolitan, there is no wastewater treatment collection
- In case that wastewater treatment system constructed by Public Works Department, it could not collect the sewage treatment charge because according to Article 88 allows to collect fee only if the project cost come from Environmental Fund.
- MNRE should consider to issue Ministry Act for sewage treatment charge collection in order to pave the way for local administration to collect the fee
- Campaign for people to aware and willing to pay is necessary.

4.2.4 Law Measurement to support Wastewater Treatment of Local Administration

- National Environmental Quality Promotion Act allows local administration that use budget or Environmental fund to set rate and collect sewage treatment charge. However, in case that Public Works Department constructed the system, it is not clear that the sewage treatment charge could be collect or not.

4.2.5 Support of Central Government that Local Administration needs for management of wastewater treatment efficiency and effectively

- WMA has to study and analysis that the project which WMA participate for 5 years, after that local administration can run by itself or not
- Many local administrations need WMA for analysis of the wastewater treatment project due to can not do by themselves. Analysis of the project is also to consider the intention of local administration to have wastewater treatment system.
- Central government is still lack of clear policy for wastewater management due to many agencies concerned and each agency go into difference way. It should be propose to national agenda or have only one agency to responsible for.
- Budget on wastewater management should be continued.

4.2.6 Others

- If local administrations do the system by itself, the cost will be cheaper than WMA. WMA will get benefit in case of compiling many contracts together.
- How WMA has clear policy for local administration to participate in setting up it requirement and wastewater management operation

5. Summary of Questionnaire

Summary of Questionnaire to survey opinion of participants on topic of domestic wastewater management in Thailand has 65 replies. The detail is shown in Annex C.

6. Results of Panel Discussion that WMA could proceed further

The consultant has summarized the results of seminar for WMA to proceed further as follows;

Issues from Seminar	Problem	The thing that WMA should do
1. Guidance of Operation and Assistance to local administration of WMA is not clear	1. Due to WMA is state enterprise, therefore, WMA has to consider the profit at most	1. WMA's business is service for social. It's difficult to get profit. For example, Provincial Water Authority (PWA) is a state enterprise. It has to get some funding support from the central government. Therefore, the business of WMA has to do for social service. 2. WMA has to push all concerned agencies to acknowledge that WMA could not think only profit because the service is served social. The thing that WMA can do only to find the most income in order to reduce the burden of central government budget.

		3. WMA may have to reorganize its structure such as to be public organization for clearer task of WMA.
	2. Task and structure of WMA may not suitable and may not response to the need of local administration	1. Propose the structure of new organization that response to the need of local administration and all concerned agencies 2. Analysis and design of the new guidance which concentrate for technical support to local administration for operating of domestic wastewater management. It should have a opinion survey and seminar to obtain all idea of related agencies.
2. WMA should have capacity building especially in field of technique including project analysis, design, construction, research, etc. for fully assist to local administration	1. Most of outsider agencies are still lack of confidence to WMA 2. WMA is still lack of expert in field of project analysis, wastewater treatment system design and wastewater treatment 3. When they talk about wastewater management they don't think about WMA.	1. WMA has to change organization structure and recruit more staff especially in field of engineering and science 2. WMA must have training for its staff in field of technique and wastewater treatment method 3. WMA should have research project to develop technology of domestic wastewater treatment that suitable for Thailand and local communities. 4. WMA has to upgrade itself to be the main national agency in field of domestic wastewater management
3. WMA has to do capacity building for local administration in order to achieve assigned tasks of Decentralization Act Year 1999	1. Main tasks of local administration is not wastewater management. Therefore, many local administration especially the small one is lack of human resources and capacity for wastewater management	1. WMA has to adjust itself to have more capability especially in field of technique and wastewater management in order to transfer technology to local administration 2. WMA should develop itself to be strategic partner of local administration. This will be guarantee for local administration that WMA will not compete with local administration for wastewater management

4. Due to limited budget, investment for wastewater treatment should have work plan and clear target. Prioritize of the project must be suited with water pollution problems and investment plan on domestic wastewater	1. Central government budget to local administration for wastewater management is limited. Therefore, it must have good criteria for budget allocation in order to use it at the most efficiency.	1. In project planning of WMA and local administration, it should be considered pollution problems of water source and investment plan of PCD for domestic wastewater management
5. MNRE has changed idea to construct smaller scale of wastewater treatment system including treatment at wastewater generation source	1. Main problem of large scale wastewater treatment system is collection pipe system. The expense for installation of collection pipe system is much higher than construction of wastewater treatment system	1. In the near future, the central wastewater treatment system in large scale like Klong Dan will be quite difficult to happen. WMA should consider medium size of wastewater treatment system 2. Cluster idea for local administrations which have close border may possible but it must operate by WMA 3. Task to rehabilitate existing wastewater treatment system must be continued
6. Assistance to local administration to operate the wastewater treatment system for 5 years, after that whether local administration can operate by itself or not	1. There is no study to analyze that what should be done for local administration to stand on by itself in term of finance. Because model of WMA uses for local administration is for 20 years. If the time is reduced to 5 years, the opportunity of local administration to stand on in term of financial may be very low	1. WMA has to study and analyze the project that WMA assist for 5 years, after that what local administration can do by itself. 2. The possible case is local administration could not stand on by itself. WMA should provide plan for local administration and coordinate with related agencies for getting financial support for local administration after 5 years.
7. Local administration thinks that expenses for running wastewater treatment by itself are cheaper than WMA. Therefore, local administration would like to operate by itself, not contract to WMA.	1. Labor fee of local administration is cheaper than WMA. Therefore, WMA must show the benefit that local administration could receive if WMA participate in wastewater treatment system.	1. WMA will get advantage when compiling many contracts of local administrations. WMA could negotiate with contractor. It can be reduced the cost due to economies of scales.

8. How WMA has clear guidance for participation of local administration in term of requirement and wastewater management for new project	1. Local administration is not participated in process of establishment of wastewater treatment system in the area	1. Giving change to local administration to participate in all process from survey, design, construction until operation 2. WMA should work with people and volunteer for awareness and necessity of wastewater treatment system
9. Proportion of investment between central government and local administration	1. Construction and operation of wastewater treatment system require high investment. With limited budget of local administration, they could not bear on this cost alone. The central government has to assist in term of finance.	1. Coordinate with related agencies to have seminar for setting proportion of investment between central government and local administration
10. In case of wastewater treatment system constructed by Public Works Department, how to collect the sewage treatment charge because the article 88 allows only collect the charge in case of use financial from Environmental Fund	1. Article 88 mentioned that wastewater treatment system that constructed from budget and Environmental Fund can collect sewage treatment charge. But in case doesn't use Environmental Fund, many local administrations think that could not get the charge.	1. Pushing up to modify Article 88 in order to collect the sewage treatment charge in all case. 2. Issuing Ministry Act for local administration can collect sewage treatment charge
11. Central government is still lacking of clear policy for wastewater management due to there are many agencies to responsible for wastewater management. Therefore, it should put wastewater topic to be national topic and it should have only one organization to take care.	1. There is no main agency for wastewater management	1. Trying to have only one main agency and it should be WMA for wastewater management.

ANNEX C Summary of Questionnaire from Seminar's Participants
National Community's Waste Water Treatment Management
Thursday 7 June 2007

Part 1: Replier is divided into 2 groups as follows;

1. Representatives from municipalities, there are 33 repliers.
2. Representatives from Regional Office of Natural Resources and Environment and Provincial Office of Natural Resources and Environment including other agencies, there are 32 repliers.

Part 2: Opinion to environmental tax and central waste water treatment development of Thailand

2.1 Acknowledgement about idea of Ministry of Finance for environmental tax collection

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Knew and well understand	3	4	7	11
2. Heard but it's not clear	26	26	52	81
3. Never heard	3	2	5	8
Total	32	32	64	100

Most of 2 groups have already known about idea of Ministry of Finance to collect environmental tax but is not clear (81%). This due to the actual situation because the environmental tax is under study, therefore, it has not clear yet.

2.2 Agreement with idea of Ministry of Finance for environmental tax collection

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Agree	31	30	61	94
2. Do now agree	2	1	3	5
3. No idea	-	1	1	1
Total	33	32	65	100

Most of 2 groups agree with idea of Ministry of Finance to collect environmental tax up to 94%. The persons who agree with this idea have given idea and suggestions as follows;

- The environmental management has to use a lot of money, therefore, collection of environmental tax for solving problem and expand management system for waste water, solid waste and others can be covered whole country.
- Population is the main factor to destroy environment, therefore, it should be take responsible together in accordance with PPP. Furthermore, giving knowledge and creating environmental awareness to people should be done.
- Issuing a law has to be considered for enforcement and collection structure that must be justice and capability to pay of payer.
- It should be considered tax collection to a target group especially industry and commercial including service before the household, community or small enterprises.

- Data dissemination should be widening and tax payer should be understand and accepted.
- Tax collection can be added to VAT. It should have trial period for 5 years before revision.
- Sewage charge comes from tax and water supply charge, therefore, the suggest formula is sewage charge = tax + K (factor from water supply)

For the disagree group, they gave reasons as follows;
- Waste water treatment by government is not good enough (Pakchong City Municipality)
- Waste water treatment is service to people as same as road. Furthermore, most of waste water doesn't come from household (Laem Chabang Sub-district Municipality)

For the person who doesn't have any idea gives reason that they don't know the data and structure of environmental tax collection.

2.3 Possibility for environmental tax added with sewage charge of WMA

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Possible	25	22	47	72
2. Not sure	7	9	16	25
3. Impossible	1	1	2	3
Total	33	32	65	100

Most of 2 groups has opinion that there is possibility for environmental tax to be collected for sewage charge 72%. However, there are repliers about 25% are not sure on this matter. The persons who think it is possible have the following comments;

- Public relations through mass media should be done often and continuously in order to make everybody understand and agree to cooperate.
- Tax collection should be issued by law.
- It should be entrusted the central government agencies to be responsible on this matter such as WMA, PCD and ONEP.
- Tax and service should be collected and done by local administrations.
- It should be started from large community such as town municipality, city municipality in order to be pilot before down to sub-district level.

The persons who are not sure on this matter give reason regarding local political vote and think that local administrations are not well understand.

2.4 Agreement with Central Waste Water Treatment

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Agree	30	23	53	83
2. Do not agree	3	7	10	16
3. No idea	-	1	1	1

Total	33	31	64	100

Most of representatives from 2 groups agree with central waste water treatment 83%. However, there is disagree group up to 16%. The persons who agree with central waste water treatment have the following instructions as follows;

- Suitable is depended on density of community for amount of waste water and limited conditions of each area
- Central waste water treatment is easily to control, operate and high capability. However, it also should have separated waste water treatment due to each community has different geography and physical.
- Central waste water treatment is not suitable with large community or far from each other or scattering communities.
- Urban community is very high density of household. Therefore, the area should be divided into cluster which not too big. It should not be concentrated only mega project but mid-size system should be introduced and scattered to whole area.
- Central waste water treatment can control waste water treatment is better in large city which waste water mostly drain to river or canal.
- It's better to use simple waste water treatment system that not required heavy equipment such as pond.
- Central waste water treatment can operate in case city structure is suitable in term of justice and fairness.

The persons who disagreed have the following reasons:

- It may not be settle for the dividing of responsibility.
- Management is difficulty, high cost and need large area.
- Waste water in rural area is not much dirty, therefore, it should be done by on-site method.
- At present, more than 60% of central waste water treatments were failed. Therefore, it should be changed to small system which concentrates to quality. Furthermore, it should be encouraged to enterprises that have their own waste water treatment system and monthly water quality analysis for tax reduction.

For the persons who don't have idea said it's depended on suitable of each area. Therefore, it's no answer.

2.5 Complaints from people related to waste water

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. No complaints	4	1	5	8
2. Some complaints	27	19	46	73
3. Many complaints	2	10	12	19
Total	33	30	63	100

It found that most of area of local administrations that have waste water treatment system are still facing complaints from people up to 91%. Among these amount, 19% are many complaints and 73% are some complaints.

2.6 Level of Local Administrations that ready to construct central waste water treatment system

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Provincial Administration Office (PAO)	11	15	26	32
2. Municipality	27	27	54	67
3. Tambol Administration Office (TAO)	1	-	1	1
Total	39	42	81	100

Remark: This question can reply more than 1 answer.

It found that local administration in municipality level is ready to construct central waste water treatment system 67% while PAO is 32%.

2.7 Readiness of Local Administration for construction of Central Waste Water Treatment System

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Ready	27	12	39	63
2. Not sure	4	14	18	29
3. Not ready	1	4	5	8
Total	32	30	62	100

It found that 63% of replies think that their area are ready to construct central waste water treatment system.

2.8 Which agency should initiate for construction of central waste water treatment system

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Local administration	17	15	32	48
2. Central government agency	5	8	13	20
3. WMA	11	10	21	32
Total	33	33	66	100

It found that 48% of replies think that local administration should initiate. The next agency is WMA.

2.9 Expectation to have organization or agency to assist in field of technique, operation and maintenance

Amount	No. of Municipality's Representative	No. of Representative of Regional Office and others	Total	Percentage (%)
1. Expect	27	28	55	87
2. Do not expect	4	4	8	13
Total	31	32	63	100

It found that 87% of replies expects to have organization or agency to assist.

Representatives from local administrations expect to have agency to support in the following fields;

Agency	Supporting for
• Ministry of Interior	Budget
• Dept. of Provincial Administration	Budget/construction, expansion, improvement/human resources management
• Dept. of Public Works	Operation and maintenance
• PAO or Province	Budget
• Budget Bureau	Budget
• MNRE	Technique
• ONEP	Construction, expansion and system improvement
• WMA	Technique/operation & maintenance/sewage fee collection/public relations/training/meeting
• Provincial office and Regional office of Natural Resources and Environment	Technique
• PCD	Policy and standard/budget/operation and maintenance/law/regulation/feasibility study
• DEQP	Awareness/Public relations
• Educational Institute (University	Knowledge and experience
• Government	Law and regulation

Representatives from MNRE and others expect to have agency to support in the following fields;

Agency	Supporting for
• WMA	Technique/study design/construction supervision/operation and maintenance/budget/training for local administration in field of waste water treatment system/national policy of waste water treatment
• PCD	Technique/waste water treatment method/national policy of waste water treatment
• ONEP	Formulate environmental plan and fund source
• Provincial office and Regional office of Natural Resources and Environment	Coordination with central government agencies/advisor
• Environmental Fund	Loan support and grant to local administration

• PAO or Province	Operation
• Educational Institute (University	Technique/Lab
• Private Company	Technique/investment

13% doesn't expect with the reasons such as from his experience of coordination for support it found that very difficult and have conditions.

Part 3: Present Situation of Waste Water Treatment from Opinions of Representative of Local Administrations

3.1 Type of investment and management of waste water treatment system of local administration

Type of Investment and Management of Waste Water Treatment	Amount of Reply
1. Local administration invest and operate by itself	12
2. Local administration invest and hire private to operate	6
3. Local administration contracted with private for investment and operate in time period	-
4. Operate with WMA	6
5. Other	7
Total	31

3.2 Budget Source for operation and maintenance

Type of Investment and Management of Waste Water Treatment	Amount of Reply
1. Budget from central government	17
2. Budget from local	31
3. Collect from people	7
4. Budget from WMA	6
5. Other	3
Total	64

Remark: This question can be replied more than 1 answer.

3.3 Opinion to budget source for management of waste water treatment system

Type of Investment and Management of Waste Water Treatment	Amount of Reply
1. Budget from central government	15
2. Budget from local administration	18
3. Collect from people	15
4. Other	4
Total	52

Remark: This question can be replied more than 1 answer.

3.4 Operation and water quality after treatment

Operation	Number (case)	Water Quality	Number (case)
1. Operate normally	24	1. Meet standard	23
2. Some operation and some stop	5	2. Sometimes standard sometimes not	7
3. Stop operation	1	3. Not standard	1
Total	30	Total	31

3.5 Necessity/Assistance Requirement in term of technique and Assistance in Operation and Maintenance

Necessity/Requirement	Technical Assistance	Percent (%)	Assistance in Operation and Maintenance	Percent (%)
1. Very necessary	9	31	17	56
2. Necessary	20	63	11	34
3. Not necessary	2	6	3	10
Total	31	100	31	100

Local administration up to 94% needs technical assistance. Among these, 31% needs very much and 63% needs in medium level. At the same time, 90% needs assistance for operation and maintenance. In this amount, 56% needs very much and 34% needs in medium level.

3.6 Opinion to Human Resources of Local Administration to take care waste water treatment

Number of Human Resources	Amount (Case)	Percent (%)
1. Enough	12	40
2. Not enough	18	60
Total	30	100

Local administration about 60% thinks that number of human resources to take care waste water treatment is not enough.

3.7 Necessity/Requirement in Training for waste water treatment

Necessity/Requirement	Amount (Case)	Percent (%)
1. Very necessary	19	63
2. Necessary	11	37
3. Not necessary	-	-
Total	30	100

All local administration (100%) would like their staffs to be trained in field of waste water treatment. 63% thinks that it is quite necessary.

3.8 Opinion to Principle

Principle	Amount (Case)	Percent (%)

1. Polluter Pay Principle	15	48
2. Who gets benefit from waste water treatment should be responsible for the charge	2	7
3. Agree with 2 above principles	14	45
Total	31	100

3.9 Sewage charge collection from people

Collection	Amount (Case)	Percent (%)
1. Full collection	4	13
2. Collection in some	1	3
3. No Collection	25	84
Total	30	100

Most of local administration (84) does not collect sewage charge from people. There are only 4 places collect the charge (Pattaya city, Tha Rae Municipality, Nakhon Ratchasima Municipality and Hadyai Municipality)

The more details on this matter is in Table 3.10.

3.10 Reasons that Local administration doesn't collect sewage charge

Reason	Amount (Case)	Percent (%)
1. No policy from executives of local administration	13	35
2. Worry to people protest	7	22
3. People could not pay	3	8
4. Other	13	35
Total	36	100

Remark: This question can be replied more than 1 answer.

Other reasons that local administration doesn't collect sewage charge such as

- Service is not fully covered the responsible area and the waste water treatment system is not good enough.
- Lack of law on this matter
- Lack of human resources to do collection due to it needs a lot of human resources for survey, data base, collection, finance and accounting.
- People don't understand clear benefit of waste water treatment.
- Sewage charge must be justice and collect according to capability to pay of payer with most convenience to pay and have a willing to pay.
- It could not be collected now due to Pollution Control Dept. has not announced in the law yet. If collection is done before it may make a problem.
- Idea of sewage charge is not well known in local administration and they are waiting more clear policy from central government
- Sewage charge collection is the duty of local administration. If there are good public relations to people it may be possible to collect the charge.
- They would like to see more clear policy, clear law and more fairness for waste water treatment system

3.11 Additional Opinion

- WMA should give instruction in term of technique, operation and maintenance to all local administration although the contract was expired or no contract.
- WMA should assist local administration in initial period until they have human resources for operation and maintenance by themselves.
- When the contract is expired, WMA should organize training for local administration in order to guarantee that they can operation the system individually.
- Training should be organized together with operation and specifies in specific field such as management, operation, water quality, etc.
- Human resources of local administration are still lacking of knowledge such as laboratory, sanitary engineering (in mechanical maintenance)
- WMA should be a service agency to serve local administration, giving knowledge and budget. It should not be contractor of local administration because nowadays local administration can do by itself.
- Data on budget should propose with good consideration for budget allocation.
- Sewage charge should be collected in low rate. Or it can be collected from factory, hotel, resort, restaurant in higher rate from household.
- Central government should understand problem and cooperate to solve a problem
- Small municipality has not enough budget.
- Waste water treatment system is good but lack of budget, human resources and management method
- It should have public relations to people to know that at present problem of water environment is increasing and has much negative impact to environment and human being.
- Public hearing from people required supporting from executives to provide budget.

Annex 22: WMA’s 4 year Operational Plan

Annex 22: 4 Years Operation Plan (2008 – 2011)

Wastewater Management Authority

Wastewater Management Authority was found by Wastewater Management Authority Royal Decree in 1995 and announces in government gazette on 14 August 1995, the status is state enterprise under Ministry of Natural Resources and Environment. The authority and obligation of WMA in Royal Decree is to connect with central government and local administration in managing wastewater within country. The objective is "Provide combined wastewater treatment system for treating wastewater in wastewater management area and services or managing wastewater treatment system both inside and outside wastewater management area including services or sequence activity about efficiency of wastewater management in economical"

Wastewater Management Area in Royal Decree (Section 3, space 2) is Bangkok, perimeter and other areas that cabinet announce in government gazette.

In Fiscal Year 2007, WMA has plan to management wastewater treatment system total 12 places

In Fiscal Year 2008, WMA has plan to management wastewater treatment system total 28 places

In Fiscal Year 2009, WMA has plan to management wastewater treatment system total 38 places

In Fiscal Year 2010, WMA has plan to management wastewater treatment system total 48 places

In Fiscal Year 2011, WMA has plan to management wastewater treatment system total 58 places

(The details of wastewater management area in fiscal year 2008 – 2011in document attached)

The connectivity with Policy and Nation Plan

National Economic and Social Plan, Issue 10 (2007-2010)

- Goal
  No. (4) The creation of stable resources base
  - Maintain waster quality to meet at least moderate level and more than 85%
- Strategies
  No. 4.4 The development on several of biological and the creation the stable of resource and environment base
  (2) The creation of good environment for enhancing life quality and sustainable development
- Investment Guideline
  Investment in construction, expansion, and improvement of combine wastewater treatment system

Environment Quality Management Plan 2007 - 2010

- Goal
  No. 4.2.2 maintains environment quality to meet the appropriate level in order to increase citizen quality of life.
  (1) Maintain quality of ground water at least 85% and source of sea water coast at least 97% to meet the moderate level.
- Strategy
  Strategy 6th, control, take care, and improvement environmental quality to be balance and sustainable

Government Policy announce to The National Legislative Assembly, Thailand on November 3, 2006

No. 2 Economic Policy

2.2.8 The management of Natural resources and environment create the balance between the conservation and sustainable usage of natural resources especially biological resource in order to create good quality of environment and conform to nation economic status. By using economic policy and integrate with principal of environment management in order to make participation and fairly in every parties.

Wastewater Management Authority

Vision

“To be an organization that social trust in wastewater management”

Mission

Provide Combine wastewater treatment system, rehabilitate domestic wastewater treatment system, and sharing management with social services and efficiency commercialization

Strategic Issue

“Improve and reduction of water pollution”

Goal

“Domestic wastewater has treatment with the standard of government”

Services Purpose

The management of combine wastewater and wastewater management of organization under government and enterprise are enhance efficiency

Indicators	Target 2008 - 2011
Indicator 1 Number of management wastewater treatment system	**58 Places**
Indicator 2 Number of construction new wastewater treatment system	**2 Places**
Indicator 3 Quantity of effluent	**209.36 Million m^3**
Indicator 4 Quantity of effluent and meet standard, the average not less than %	**80**
Indicator 5 Plan of development employee evaluation system by the method of Performance based Management	**Completed**
Indicator 6 Percentage of the improvement of Business Process Development	**100**
Indicator 7 Percentage of the achievement in the development quality management system (ISO 9001 Version 2000)	**100**
Indicator 8 The satisfaction of Local Administration in the operation of WMA, not less than%	**80**

4 Years Operation Plan (2008 – 2011)

Ministry/Group of Obligation/ Organization Wastewater Management Authority

Vision

To be trust organization in wastewater management

Mission

Provide Combine wastewater treatment system, rehabilitate domestic wastewater treatment system, and sharing management with social services and efficiency commercialization

Strategic Issues	Objective	Indicators	2007	Target Value					Strategy	Undertaker
				2008	2009	2010	2011	08-11		
Rehabilitation and reduce water pollution	Domestic wastewater has treat with the standard of government	(1) Number of management wastewater treatment system (Place)	12	28	38	48	58	58**	Increase capacity organization and efficiency of wastewater management	-Business Development Section -Operation Section
		(2) Number of New construction if wastewater treatment system (Place)	-	-	←	2	→	2		
		(3) Effluent (Million m^3)	7.78	27.66	43.25	50.59	87.59	209.36		

** Condition
(1) Policy Cooperation in 2 levels are Minister of MONRE, Minister of MOI and Director of WMA with
(2) Allocate budgets and set up the budgets at WMA in recession 20% in 5 Years
(3) To appoint WMA staffs (Append) for supporting the increasing of work

F: Earn แผนปฏิบัติการ 4 ปี (2551-2554) ปรับปรุงเมื่อ 20 มีนาคม 2550

Strategic Issues	Objective	Indicators	2007	Target Value					Strategy	Undertaker
				2008	2009	2010	2011	08-11		
		(4) Quantity of effluent and meet standard, the average not less than %	80	80	80	80	80	80		
		(5) Plan of development employee evaluation system by the method of Performance based Management	-	Completed	-	-	-	Completed		Administration Section (กบก.)

Strategic Issues	Objective	Indicators	2007	Target Value					Strategy	Undertaker
				2008	2009	2010	2011	08-11		
		(6) Percentage of the improvement of Business Process Development	-	10%	50%	100%	-	100%		Administration Section (ฝบท.)
		(7) Percentage of the achievement in the development quality management system (ISO 9001 Version 2000)	-	100%	100%	100%	100 %	100%		
		(8) The satisfaction of Local Administration in the operation of WMA, not less than%	80%	80%	80%	80%	80%	80%		

Activities, Indicators, Budget follow Strategies

Strategic Issue

Rehabilitation and reduce water pollution

Strategy

Enhance capacity and efficiency in wastewater management

Activity	Undertaker	Indicators	Year 50	Target Value					Year 50	Budgets (Million Baht)				
				51	52	53	54	51-54		51	52	53	54	51-54
1. Project from Royal ideas														
1.1 Project of development Pak pa nung basin														
- Construction wastewater treatment system (specific point)	Engineering Section	1. Number of new construction Specific WWTP (Place)	-	1	1	1	-	3	-	**3.75**	**7.00**	**7.00**	**-**	**17.75**
- O&M		2. Number of management specific WWTP (Place)	-	4	5	6	6	6	-	**1.68**	**2.70**	**3.00**	**3.56**	**10.94**
1.2 Sirindhorn International Environmental park Project														
- Construction wastewater	Engineering Section	1. Number of new construction Specific	-	1	-	-	-	1	-	**14.80**	**-**	**-**	**-**	**14.80**

Activity	Undertaker	Indicators	Year 50	Target Value 51	52	53	54	51-54	Year 50	Budgets (Million Baht) 51	52	53	54	51-54
treatment system (specific point) - O&M		WWTP (Place) 2. Number of management specific WWTP (Place)	-	1	-	-	-	1		**0.40**	**0.80**	**0.80**	**0.80**	**2.80**
Main Activity **2. Rehabilitation Maintenance and management wastewater treatment system**	Operation Section	1. Number of management wastewater treatment system (Place)	12	28	38	48	58	58**	**62.00**	**105.95**	**166.00**	**130.02**	**218.80**	**620.77**
		2. Effluent (Million m3)	7.78	27.66	43.25	50.59	87.59	209.36						
		3. Effluent that meet standard, average not less than (%)	80	8 0	80	80	80	80						
3. Construction new wastewater treatment system	Business Development Section	- Number of new construction Specific WWTP (Place)	-	-	←	2	→	2	**-**	**-**	**537.77**	**956.71**	**958.11**	**2,452.59**

** Condition
(1) Policy Cooperation in 2 levels are Minister of MONRE, Minister of MOI and Director of WMA with
(2) Allocate budgets and set up the budgets at WMA in recession 20% in 5 Years
(3) To appoint WMA staffs (Append) for supporting the increasing of work

Activity	Undertaker	Indicators	Year 50	Target Value					Year 50	Budgets (Million Baht)				
				51	52	53	54	51-54		51	52	53	54	51-54
4.Support Activity 4.1 General Operation	Administration Section (กงป.)			-	-	-	-	-	**64.87**	**71.39**	**73.93**	**78.83**	**84.12**	**308.27**
4.2 The Project for improvement of sewage treatment plant management in Thailand	Operation Section (ผอ.ฝจน.)	- Reference Material 9 Topics - Training for Local administration, at least 2 time per year - Set up Information Center in wastewater treatment system	9 topics 2 times Completed	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
4.3 Creation revealing of operation wastewater treatment system.	Administration Section (กจบ.)	- Percentage of using manual for standard in hiring contractor in operation and maintenance wastewater treatment system	50%	100%	100%	100%	100%	100%	1.71 (income)	**-**	**-**	**-**	**-**	**-**
4.4Hiring consultant in development organization continue from the reengineering organization	Administration Section (กบก.)		-	-	-	-	-	-	**-**	**7.90**	**11.00**	**1.00**	**1.00**	**20.90**

Activity	Undertaker	Indicators	Year 50	Target Value 51	52	53	54	51-54	Year 50	Budgets (Million Baht) 51	52	53	54	51-54
4.4.1. System Development in employee evaluation (Performance based Management)	Administration Section (กบก.)	- Has Development Plan in management system (PBM)	-	Completed	-	-	-	Completed	-	**3.40**	-	-	-	**3.40**
- Job Analysis	Administration Section (กบก.)	- Completed Job Description	-	Completed	-	-	-	Completed	-	0.40	-	-	-	0.40
- Manpower Planning	Administration Section (กบก.)	- Man Power	-	Completed	Operation with Plan 100 %	100 %	100 %	Completed	-	0.50	-	-	-	0.50
- Compensation Structure	Administration Section (กบก.)	- Percentage of Total Evaluation Positions	-	100 %	100% Announcement	-	-	100% Announcement	-	1.00	-	-	-	1.00
- Performance Management	Administration Section (กบก.)	- Percentage of Total Indicators of work achievement position	-	100 %	100% Announcement	-	-	100% Announcement	-	1.00	-	-	-	1.00
- Career Path	Administration Section (กบก.)	- Percentage of achievement in prepare career path	-	100 %	100% Announcement	-	-	100% Announcement	-	0.50	-	-	-	0.50

Activity	Undertaker	Indicators	Year	Target Value					Year	Budgets (Million Baht)				
			50	51	52	53	54	51-54	50	51	52	53	54	51-54
4.4.2 Competency Based Management	Administration Section (กบก.)	- Plan of development human resource management in CBM	-	Completed	-	-	-	Complete in 51	-	**3.00**	**1.00**	**1.00**	**1.00**	**6.00**
- Competency System	Administration Section (กบก.)	- Percentage of Total Position that specific main performance and performance position	-	100 %	-	-	-	100 %	-	0.50	-	-	-	0.50
-Recruitment and Selection Development	Administration Section (กบก.)	- Start using recruitment system	-	Started	-	-	-	Started	-	0.50	-	-	-	0.50
- Training and Development Planning	Administration Section (กบก.)	1. Training Road Map 2. No. of curriculum /Person	- -	Completed 1	- 1	- 1	- 2	Completed 2	-	2.00	1.00	1.00	1.00	5.00
4.4.3 Project of Skill Center	Administration Section (กบก.)	- development of Employee skill	-	Start Operation	-	-	-	Start Operation	-	**0.50**	**-**	**-**	**-**	**0.50**

Activity	Undertaker	Indicators	Year	Target Value					Year	Budgets (Million Baht)				
			50	51	52	53	54	51-54	50	51	52	53	54	51-54
- Create knowledge and understand in administration and human resource management system	Administration Section (กบก.)	- Percentage of Evaluation in knowledge and understand toward Administration and human resource development system	-	50 %	80 %	90 %	100 %	100 %	-	0.50	-	-	-	0.50
4.4.4 Business Process Development	Administration Section (ฝบท.)	- Percentage of improvement in work flow	-	10 %	50 %	100 %	-	100 %	-	-	**10.00**	-	-	**10.00**
4.4.5 The improvement of foundation law and related law.	Office of Internal Audit	- Percentage of the improvement in foundation law and related law.	-	100 %	-	-	-	100 %	-	**1.00**	-	-	-	**1.00**
4.5 Employee Development	Administration Section (กบก.)	- Percentage of personal that got training in specific course - Percentage of curriculum that can train in specific period	80 %	80 %	80 %	80 %	80 %	80 %	-	**2.00**	**2.00**	**2.50**	**2.50**	**9.00**

Activity	Undertaker	Indicators	Year	Target Value					Year	Budgets (Million Baht)				
			50	51	52	53	54	51-54	50	51	52	53	54	51-54
4.6 Approach Strategy in Public Relation	Office of Director (ปชส.)	- Satisfaction Surveys of Local Administration toward the operation of WMA - Acknowledgement of citizen about operation area of WMA	- -	80% 70 %	80% 70 %	80% 70 %	80% 70 %	80% 70 %	-	**12.00**	**12.90**	**14.80**	**15.40**	**55.10**
4.7 ISO Development for improving services quality	Office of Internal Audit	- Get ISO 9001 version 2000	-	-	Compl eted	-	-	Complet ed	-	**0.80**	**0.50**	**0.10**	**0.10**	**1.50**
4.8 Research	Business Development Section (กวจ.)	- Research achieve the objectives	-	Comple ted	-	-	-	Complet ed	-	**0.90**	**1.00**	**1.00**	**1.00**	**3.90**
4.8.1 Research in troubleshoot about algae bloom in wastewater treatment system, Sakonnakorn	Business Development Section (กวจ.)	- reduction of Algae Bloom in wastewater treatment pond at Sakonnakorn		Comple ted	-	-	-	Complet ed	-	0.40	-	-	-	-
4.8.2 research in wastewater treatment collection	Business Development Section (กวจ.)	- Ability to collection wastewater treatment fee in Thailand		Comple ted	-	-	-	Complet ed	-	0.50	-	-	-	-
4.9 Risk Management	Administratio n Section (ฝบท.)	- Percentage of topic in Risk management that define in each year	-	75 %	80 %	85 %	95 %	95 %	-	**0.20**	**0.20**	**0.30**	**0.40**	**1.10**

Activity	Undertaker	Indicators	Year	Target Value					Year	Budgets (Million Baht)				
			50	51	52	53	54	51-54	50	51	52	53	54	51-54
4.10 Preparing database of source of pollution	Operation Section (กปก.)	- Number of completed area	-	6	5	5	5	21	-	**2.40**	**2.88**	**2.40**	**2.40**	**10.48**
4.11Enhancement capacity in acquiring income of WMA 4.11.1 Analysis water quality	Operation Section (ฝสร.)	- Analysis water quality in basic parameter are BOD5,COD, SS,TDS,Settleable solids, DO, pH, Temperature, Conductivity	-	56 Sample / Month	76 Sample / Month	96 Sample / Month	116 Sample / Month	116 Sample/ Month	-	**4.23**	**4.56**	**5.47**	**6.57**	**20.82**
4.12 Training in water quality analysis	Operation Section (ฝจน.)	- Percentage of increasing knowledge	-	80 %	80 %	80 %	80 %	80 %	-	**0.67**	**1.10**	**1.10**	**1.10**	**3.97**
Total									**126.87**	**229.07**	**824.34**	**1,205.03**	**1,295.86**	**3,554.30**

Conclusion of Activities in Fiscal Year 2551-2554

Main Activities

1. Improvement, Rehabilitation, Maintenance, and Management Wastewater Treatment System Project include fiscal year 2551-2554 Total 58 Places
2. The Project from Royal ideas
    2.1 Project of Development Pak pa nung basin
    2.2 Sirindhorn International Environmental park Project
3. Construction new wastewater treatment plant
4. **Support Activities** compose of sub activities are
    4.1 General Administration
    4.2 The Project for Improvement of Sewage Treatment Plant Management in Thailand (IST Project)
    4.3 Creation revealing in operation wastewater treatment system
    4.4 Hiring consultant in development organization continue from the reengineering organization
        4.4.1 System Development in Employee Evaluation with Performance based Management Method
            - Job Analysis
            - Manpower Planning
            - Compensation Structure
            - Performance Management
            - Career Path

4.4.2 Competency Based Management

- Competency System
- Recruit and Selection Development
- Training and Development Planning

4.4.3 Skill Development Project (Skill Center) of current employees

- Creation of Knowledge and understanding of management and development human resources system

4.4.4 Improvement of Business Process Development

4.4.5 Improvement of funding regulation and related law

4.5 General Training

4.6 Public Relation in approach strategy

4.7 Use ISO 9001 Version 2000 apply in organization

4.8 Research

4.8.1 Research in Algae Bloom

4.8.2 Research in collecting wastewater fee

4.9 Risk Management

4.10 Database of Source of Pollution

4.11 Enhancement Capacity in recruit income of WMA

4.11.1 Water Quality Analysis

4.12 Training in Water Quality Analysis

Analysis Report of

(Opportunities- Threats -Strength-Weakness)

Strength

- WMA Foundation Regulation allow private section in join investment
- WMA is only one organization of state enterprise in wastewater management
- WMA has experience in wastewater management
- Funding Regulation of WMA is Holding Company and reduces process in join investment of state enterprise.

Weakness

- Management Information System (MIS) is not complete
- No Director General
- Lack of basic human resource management
- Structure and number of employees not suitable with current tasks
- Internal Regulation not support in commercialization operation

Opportunities

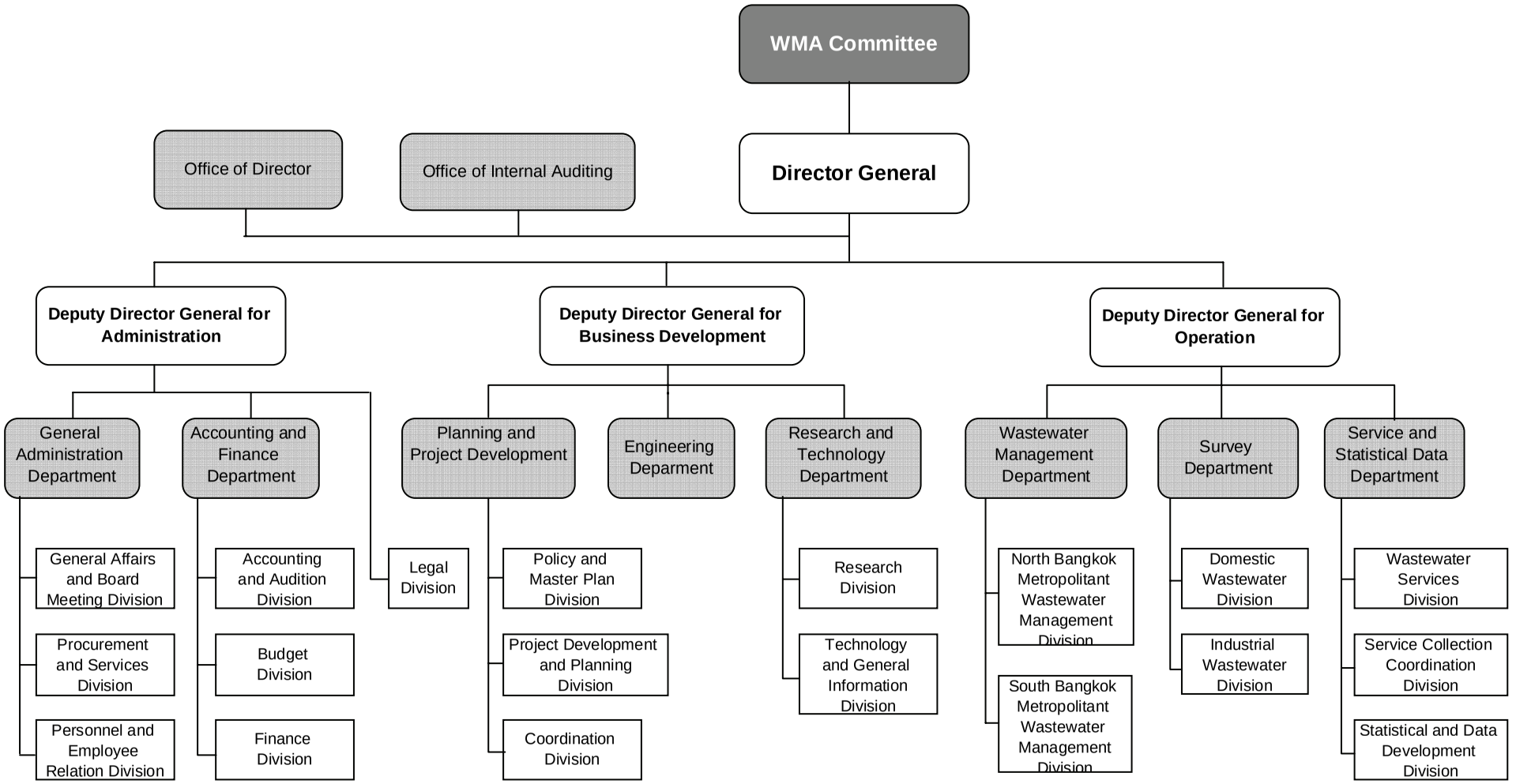
- National Development Plan NO. 9, NO. 10 and Government Policy has the plan about natural resources and environment, details and guidelines of operation support of working.
- Alert and movement of wastewater management in social but not ready to manage by own so it is an opportunities of WMA to services to local administration in correction and rehabilitation of wastewater treatment system.
- WMA has alliance with international organization that expertise in wastewater treatment
- WMA could create network in wastewater management between Stakeholder and WMA
- The market in management wastewater still has the more gaps.

Threats

- Previous High level policy of Ministry is not clear about WMA role in finding income and commercial service
- Policy of Local Political has effect to Wastewater Management Authority because Local Administration believes that Pollution Procedure is a payer then it will effect to the election.
- Act of Planning and step of distribute authority BE. 2542 defined to transform the duties of wastewater management to Local Administration so WMA could not operate in local administration area except WMA get the approval and make agreement before.
- Status of organization is state enterprise that conflict with the environment policy
- Most of customers do not want to pay wastewater fee
- The budgets is not enough

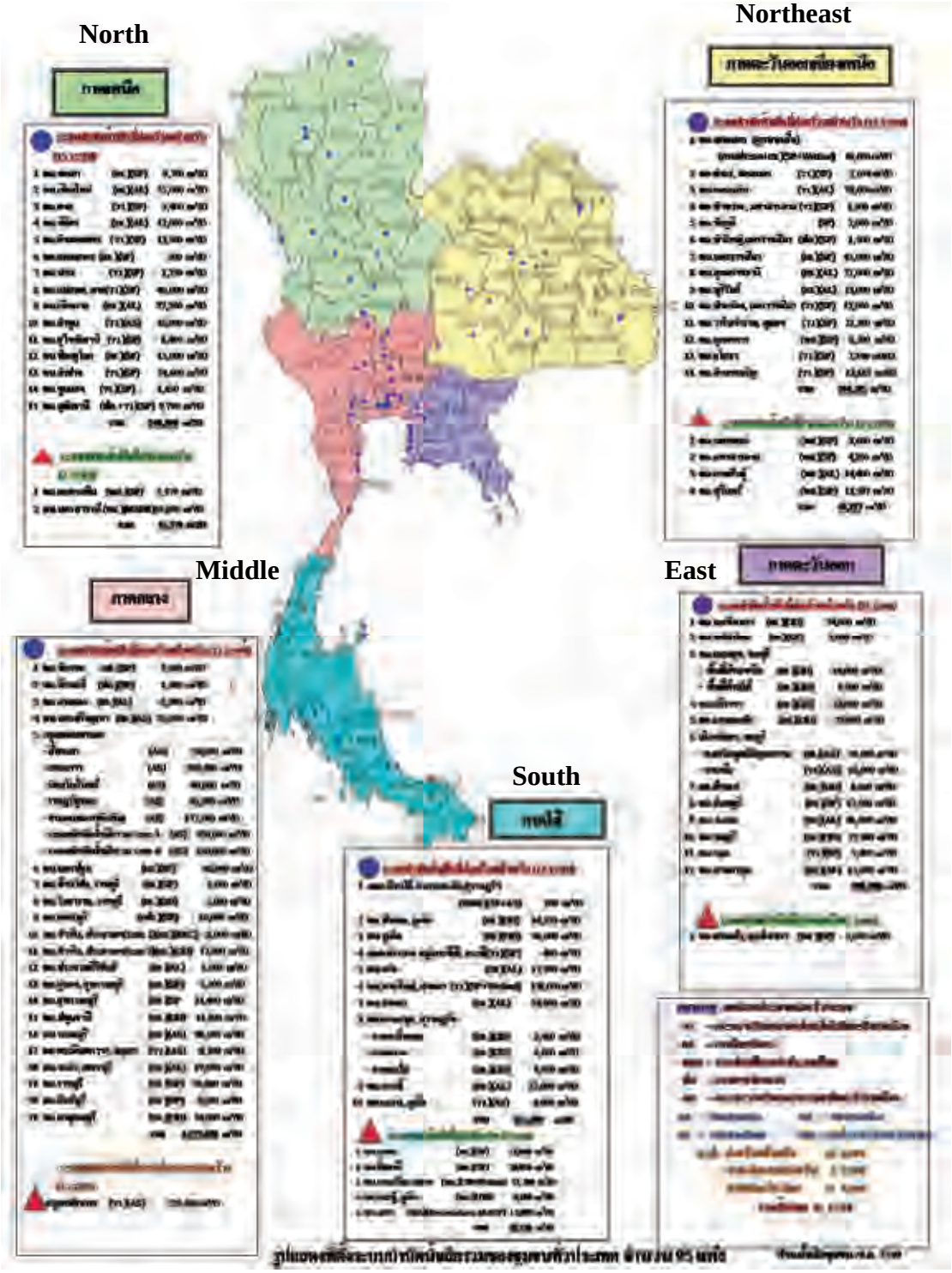
Annex 23: Organization Chart of WMA

Annex 23: Organization Chart of WMA



Annex 24: Location of Wastewater Treatment System in Thailand Total 95 places

Annex 24: Location of Wastewater Treatment System in Thailand Total 95 places



* Information in English is attached following this page

North Region

No.	Location	Type	Capacity
1.	Payao Municipality	SP	9,700 m^3/D
2.	Cheangmai Municipality	AL	55,000 m^3/D
3.	Tak Municipality	SP	5,400 m^3/D
4.	Pichit Municipality	AL	12,000 m^3/D
5.	Khampangphet Municipality	SP	13,500 m^3/D
6.	Salokbaht Municipality	SP	500 m^3/D
7.	Nan Municipality	SP	8,259 m^3/D
8.	Mae Sod, Tak Municipality	SP	40,000 m^3/D
9.	Cheangrai Municipality	AL	27,200 m^3/D
10.	Lumpon Municipality	AS	10,000 m^3/D
11.	Sukhothaithani Municipality	SP	8,400 m^3/D
12.	Phitsanulok Municipality	SP	15,000 m^3/D
13.	Lumpang Municipality	SP	24,600 m^3/D
14.	Chumsang Municipality	SP	1,650 m^3/D
15.	Uthaithani Municipality	SP	9,790 m^3/D
Total			240,999 m^3/D
On process of Construction			
No.	**Location**	**Type**	**Capacity**
1.	Tapanhin Municipality	SP	5,379 m^3/D
2.	Nakornsawan Municipality	MSBR	10,000 m^3/D
Total			15,379 m^3/D

Middle Region

No.	Location	Type	Capacity
1.	Chainart Municipality	SP	3,500 m^3/D
2.	Baan Mee Municipality	SP	1,000 m^3/D
3.	Angtong Municipality	AL	8,200 m^3/D
4.	Nakornsriadyuthaya Municipality	AS	25,000 m^3/D
5.	Bangkok		
	• Sipraya	AS	30,000 m^3/D
	• Yannava	AS	200,000 m^3/D
	• Ratthanakosin	AS	40,000 m^3/D
	• Ratburana	AS	65,000 m^3/D
	• Nongkham – Pasricharoen	AS	157,000 m^3/D
	• Combine WTP, phase 1	AS	350,000 m^3/D
	• Combine WTP, phase 4	AS	150,000 m^3/D
6.	Nakornpathom Municipality	SP	60,000 m^3/D
7.	Baanpong Municipality	SP	5,000 m^3/D
8.	Photharam Municipality	OD	5,000 m^3/D
9.	Phetburi Municipality	SP	10,000 m^3/D
10.	Huahin, phase 1	RBC	10,000 m^3/D
11.	Huahin, phase 2	OD	17,000 m^3/D
12.	Prachubkirikhan Municipality	AL	8,000 m^3/D

13.	Authong Municipality	SP	5,500 m^3/D
14.	Suphanburi Municipality	SP	11,400 m^3/D
15.	Pathumthani Municipality	OD	11,000 m^3/D
16.	Nonthaburi Municipality	AS	38,500 m^3/D
17.	Prainnracha Municipality	AS	4,500 m^3/D
18.	Cha-um Municipality	AL	17,000 m^3/D
19.	Rachaburi Municipality	SP	20,000 m^3/D
20.	Singburi Municipality	SP	4,500 m^3/D
21.	Khanchanaburi Municipality	OD	24,000 m^3/D
Total			1,279,100 m^3/D
On process of Construction			
No.	**Location**	**Type**	**Capacity**
1.	Samutprakarn Municipality	AS	525,000 m^3/D

North East Region

No.	**Location**	**Type**	**Capacity**
1.	Sakonnakorn Municipality	SP + Wetland	16,000 m^3/D
2.	Ta Rae Municipality	SP	2,054 m^3/D
3.	Khonkhan Municipality	AL	78,000 m^3/D
4.	Huakwang Municipality	SP	1,500 m^3/D
5.	Chaiyaphom Municipality	SP	2,000 m^3/D
6.	Bau Yai Municipality	SP	1,500 m^3/D
7.	Nakornratchasrima Municipality	SP	45,000 m^3/D
8.	Ubonrachathani Municipality	AL	22,000 m^3/D
9.	Bureerum Municipality	AL	13,000 m^3/D
10.	Pakchong Municipality	SP	12,000 m^3/D
11.	Varinchumrab Municipality	SP	22,300 m^3/D
12.	Mookdaharn Municipality	SP	8,500 m^3/D
Total			223,854 m^3/D
On process of Construction			
No.	**Location**	**Type**	**Capacity**
1.	Yasothorn Municipality	SP	7,246 m^3/D
2.	Aumnartcharoen Municipality	SP	13,185 m^3/D
3.	Nakornpanom Municipality	SP	8,600 m^3/D
4.	Mahasarakham Municipality	SP	4,200 m^3/D
5.	Karasin Municipality	AL	14,400 m^3/D
6.	Surin Municipality	SP	13,597 m^3/D
Total			61,228 m^3/D

East Region

No.	**Location**	**Type**	**Capacity**
1.	Chachensao Municipality	OD	24,000 m^3/D
2.	Panasnikhom Municipality	SP	5,000 m^3/D
3.	Sansook Municipality		
	• North Area	OD	14,000 m^3/D
	• South Area	OD	9,000 m^3/D

4.	Sriracha Municipality	OD	18,000 m^3/D
5.	Lamchabung Municipality	OD	25,000 m^3/D
6.	Phattaya Municipality		
	• Soi watbunkunchanaram	AS	20,000 m^3/D
	• Na kreu	AS	65,000 m^3/D
7.	Baan Pae Municipality	OD	8,000 m^3/D
8.	Chantaburi Municipality	SP	17,000 m^3/D
9.	Rayong Municipality	AL	41,000 m^3/D
10.	Chonburi Municipality	OD	22,500 m^3/D
11.	Kalong Municipality	SP	5,400 m^3/D
12.	Mabthaphut Municipality	AL	15,000 m^3/D
Total			288,900 m^3/D
On process of Construction			
No.	**Location**	**Type**	**Capacity**
1.	Bang Kra, Chachengsao	SP	5,000 m^3/D

South Region

No.	**Location**	**Type**	**Capacity**
1.	Baan Tai Municipality	AF + AS	200 m^3/D
2.	Pa Tong Municipality	OD	14,250 m^3/D
3.	Phuket Municipality	OD	36,000 m^3/D
4.	Aow Nang Municipality	SP	400 m^3/D
5.	Trang Municipality	AL	17,700 m^3/D
6.	Hadyai Municipality	SP + Wetland	138,000 m^3/D
7.	Songkra Municipality	AL	24,000 m^3/D
8.	Koh Sa mui Municipality		
	• Had Na Thon	OD	2,400 m^3/D
	• Cha Wang	OD	6,000 m^3/D
	• La mai	OD	8,650 m^3/D
9.	Krabi Municipality	AL	12,000 m^3/D
10.	Karon Municipality	AS	6,000 m^3/D
Total			265,600 m^3/D
On process of Construction			
No.	**Location**	**Type**	**Capacity**
1.	Chompon Municipality	SP	12,000 m^3/D
2.	Phatthani Municipality	SP	28,920 m^3/D
3.	Nakornsrithummarat Municipality	SP + Wetland	33,700 m^3/D
4.	Krato Municipality	OD	6,100 m^3/D
5.	Yala Municipality	Decentralized AL &SP	12,000 m^3/D
Total			92,720 m^3/D

Summary of Wastewater Treatment Plant

- **Stabilization Pond 44 Plants**
- **Activated Sludge 16 Plants**
- **Aerated Lagoon 15 Plants**
- **Oxidation Ditch 17 Plants**
- **Wetland 3 Plants**

Wastewater Treatment Plant under the management of WMA

NO.	Location	System
1.	Sriracha Municipality	OD
2.	Baan Pae Municipality	OD
3.	Phathumthani Municipality	OD
4.	Sakonnakorn Municipality	SP + Wetland
5.	Tarae Municipality	SP
6.	Huakwang Municipality	SP
7.	Chomsang Municipality	SP
8.	Khampangphet Municipality	SP
9.	Phayao Municipality	SP
10.	Songkha Municipality	AL
11.	Pha Ngun Municipality	Wetland

Annex 25: List of Materials Cited for the Study

Annex 25: List of Materials Cited for the Evaluation

No.	Name of references (or contents)	Language	Remarks
26-1	Annual budgetary information in Kamphaeng Phet and Pathumthani Municipalities 2003 – 2007	E	• Document Review and Clarification of Detail Information by telephone
26-2	Information concerned with people's willingness to pay charges of wastewater collection and current statuses of local municipalities under WMA	E	• Tel Interview Surveys to Kamphaeng Phet and Pathumthani Municipalities, and information from the Project.
26-3	Other Information of Reference Materials	J/E	• Including; - Progress summary (Japanese language only), - Member list of the Reference Material Committee
26-4	Observation Report of Field Survey in Kamphaeng Phet and Pathumthani Municipalities	E	• Including the personnel lists of O&M of the focused STPs • Field Trip(Consultant and Experts) - Kamphaeng Phet: 28th June, 2007/07/20 - Pathumthani: 3rd July, 2007
26-5	Mid Term Evaluation Report on the Project for Improvement of Sewage Treatment Plant Management in Thailand	E	• March, 2006
26-6	Semi-Annual Project Activity Reports from the Project chief advisor to JICA Thailand office	J/E	• 5th and 6th Reports • Japanese language only
26-7	Technical Reports on Achievement of Cost Reductions and Treated Wastewater at STPs in Kamphaeng Phet and Pathumthani Municipalities	J	• June, 2007 • Japanese Experts • Japanese language only
26-8	Technical Training Reports (Safety training)	J/E	• Mostly in Japanese language
26-9	Revenue and Expenditure in WMA's Annual Report	E	• Actual data is available from 2004 to 2005 (Thai fiscal year)
26-10	Minutes of Counterpart Meetings	E	• 25 April 2006 – 29 May 2007
26-11	WMA's Expenses for O&M 2004-2007	E	• From 2004 to 2005 is available from WMA anural report • 2006 is according to interview survey to WMA • 2007 is estimated by WMA
26-12	Budget Allocation for the Project from Thai side	E	• From 2004 to 2005 is available from Mid-term evaluation study report • From 2006 to 2007 is available from the Project.
26-13	Contract Concerned with O&M of STPs under WMA made between WMA and Contractor	E/T	• Only pages concerned with O&M of STPs is attached
26-14	Completion Reports of Short Term Experts	J/E	1. Nobuyuki Matsumoto (Nov. 2004-Jan. 2005) 2. Akito Kuramochi (Jun.2005-Jul.2005) 3. Yuko Fujii (Oct.2005-Dec.2005)

No.	Name of references (or contents)	Language	Remarks
			4. Kazuhisa Sakaguchi (Nov.2005-Jan2006) 5. Yutaka Uchimura (Jul.2006-Sep.2006) 6. Sigeo Kanai (Sep.2006-Dec.2006) 7. Yutaka Komura (Oct.2006-Nov.2006) (All of their reports above are partly written in Japanese language)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