No.

THE KINGDOM OF THAILAND

THE PROJECT FOR IMPROVEMENT OF SEWAGE TREATMENT PLANT MANAGEMENT IN THAILAND

TERMINAL EVALUATION REPORT

August 2007

JAPAN INTERNATIONAL COOPERATION AGENCY
THAILAND OFFICE

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Focused STP

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Electric inflow Rate Meter

Coarse Screen

Pathumthani : OD (Oxidation Ditch) System

Focused STP

Automatic Timer Control Panel

1. Outline of the Project

Country： Kingdom of Thailand		Project Title： The Project for Improvement of Sewage Treatment Plant Management in Thailand
Issue/ Sector： Sewerage		
Division in Charge： JICA Thailand Office		Cooperation Scheme： Technical cooperation
Period of Cooperation	（R/D）： 26th May, 2004 – 25th November, 2007	Total Cost： 261,351 thousand Japanese yen
		Partner Country's Implementing Organization： Wastewater Management Authority (WMA)
		Supporting Organization in Japan： Ministry of Land Infrastructure and Transport, Japan Sewage Works Agency
		Related Cooperation： The Training Center for Sewage Works (TCSW) Project

1-1 Background of the Project

Thailand has faced various environmental problems due to the rapid economic growth and urbanization. The Department of Public Works of the Ministry of Interior and the former Ministry of Science, Technology and Environment actively promoted the development of sewage treatment facilities in all over Thailand in the 1990s in order to respond to the problem of water pollution. Since Thailand faced shortages in technical personnel who could operate and maintain these newly built facilities appropriately, the Training Center for Sewage Works (TCSW) Project was implemented from August 1995 until July 2000 in order to meet the urgent demands to foster technical personnel. Through the TCSW project, approximately 1,000 technical officers underwent training sessions. However, it became clear that inappropriate designing and insufficient operation and maintenance of sewage treatment plants (STPs) were root causes of malfunction of many STPs.

In order to improve the efficiency of sewage treatment plants (STPs) in Thailand, the Project for Improvement of Sewage Treatment Plant Management (hereinafter referred to as the "Project") was formulated for three and half years since May, 2004. Since the Project commencement, it has been implemented to improve the methods of operation and maintenance (O&M) through rehabilitating and improving insufficiently dysfunctional STPs focused by the Project. Furthermore, it has also produced reference materials for the operation and management of STPs and coordinated technical training programs to enable to apply skills and knowledge obtained through these processes for other STPs.

Besides, the mid-term evaluation study for the Project carried out in March 2006 and made several recommendations including "Enhancing the collaboration with the Pollution Control Department (PCD)" to the project activities. Now, considering those recommendations, the experts are making efforts. At this time of the terminal evaluation, evaluation team assesses "given the present status of implementation, the project purpose is expected to be achieved by the end of the Project".

1-2 Cooperation Overview

(1) Super Goal:
The water quality of public water bodies is improved.

(2) Overall Goal:
Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.

(3) Project Purpose:
Efficient and effective operation method of STPs is established.

(4) Project Outputs:
Output 1: Function of focused STPs is recovered.
Output 2: Reference materials for improvement of sewage treatment plant management are developed.
Output 3: Skilled personnel are assigned to operate and maintain the focused STPs appropriately.
Output 4: Information system is established to disseminate reference materials and to collect O&M data.

(5) Inputs (total since the Project commencement until the terminal evaluation)

Japanese side:

Long term experts: 6 persons — Equipment supply: approx. 8,517 thousand JPY
Short term experts: 7 persons — Local cost: 261,351 thousand JPY
Number of trainees received in Japan: 5 persons

Thai side:

Counterparts: 27 persons — Local cost: approx. 2,451 thousand JPY
Project office and equipment (627,870 Thai baht)

2. Evaluation Team and Period

Study Members	Team Leader:	Mr. Masazumi Ogawa, Deputy Resident Representative, JICA Thailand Office
	Wastewater Operational Management:	Mr. Nobuyuki Horie, Deputy Director General for Eastern Japan, Japan Sewage Works Agency
	Wastewater Planning Management:	Ms. Hiroko Kamata, Senior Advisor, Institute of International Cooperation, JICA
	Cooperation Plan:	Mr. Kazuya Maruo, Assistant Resident Representative, JICA Thailand Office
	Evaluation Control:	Ms. Athaneeporn Boonrad, Program Officer, JICA Thailand Office
	Evaluation Analysis:	Mr. Minoru Fujii, Consultant, RECS International Inc.

Period of Evaluation	Type of Evaluation
18th June – 20th July, 2007	Terminal Evaluation

3. Results of Evaluation

3-1 Summary of the Evaluation Results

(1) Output 1: Function of focused STPs is recovered.

Indicator
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.

- Unit costs have been totally reduced by 34% at Pathumthani focused STP and by 10% at Kamphaeng Phet focused STP respectively, however since stabilization pond has no machinery to use much electricity, there is a limited room of O&M cost reduction at Kamphaeng Phet focused STP. Based on the recommendation "reviewing the cost reduction impact for each factor" at the time of mid-term evaluation, as the result, 34% reduction was achieved in electricity cost portion.
- Treated wastewater has been increased by 25% at Pathumthani focused STP, but reduced by 20% at Kamphaeng Phet focused STP. Regarding this drop at Kamphaeng Phet, the averaged value in dry season is adopted as the reference value of treated wastewater. However the following reasons might still affect the reduction at Kamphaeng Phet.
  - The average precipitation in the dry season is higher than that of 2007, and there might be more seepage of groundwater into wastewater collection pipelines during the time of setting up base data than that of usual years. As a result, the base data might be set at higher than usual.
  - Troubles in the automatic screen might have caused the reduction of treated wastewater.

  Since the improvement of site operation and maintenance is not enough for increasing treated wastewater, the acceptance of wastewater from the hospital and paper mill factory was considered based on the mid-term evaluation, "technical recommendation for whole wastewater system".
- Effluent from all the focused STPs in 2007 meets the water quality requirements.

(2) Output 2: Reference materials for improvement of sewage treatment plant management are developed.

Indicator
2-1: All of the listed necessary reference materials are formulated.

- Based on the recommendation "Enhancing the collaboration with the Pollution Control Department (PCD)" at the time of mid-term evaluation, beneficial ideas and suggestions were exchanged by the members of the Reference Material Committee established by WMA, jointly organized by the Japanese and Thai sides, related central government organizations such as PCD and DOLA, local authorities and well-learned persons.
- By the time of the terminal evaluation, 9 reference materials were developed as planned.

(3) Output 3: Skilled personnel are assigned to operate and maintain the focused STPs appropriately.

Indicator
3-1: Skilled personnel are assigned to operate and maintain the focused STPs appropriately.
3-2: All of the focused STPs are managed by skilled personnel.

- Seminars for the oxidation ditch (OD) method applied to Pathumthani STP and stabilization pond (SP) method applied to Kamphaeng Phet have been held with many participants from the Thai side. 70% of them have been satisfied with the contents of the seminars.
- In addition to the seminars, monthly on-site trainings and OJTs have continuously been carried out for the counterparts of Thai side, as well as technical follow-ups at appropriate timings.
- Personnel in charge of the focused STPs who have joined the seminars think that they could reconfirm and expand their technical skills and knowledge, and they could also reflect their learning information

into their works.

(4) Output 4: Information system is established to disseminate reference materials and to collect O&M data.

Indicator
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 using information system.

- Three of totally nine reference materials are available on WMA's web site in English version, at the time of the terminal evaluation study.
- All the nine kinds of the reference materials in Thai are scheduled to be available on WMA's web site by the termination of the Project.
- The past O&M data from most STPs under WMA were submitted to WMA as digital data basis once a month, and 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.

3-2 Summary of Five Evaluation Criteria

(1) Relevance

Based on the revision of the Royal Decree in 2005 for the expansion of WMA's responsibilities and opportunities, WMA can provide technical support to local authorities for sufficient operation of STPs. In addition, wastewater treatment problem relates health and infectious diseases, and should be considered more closely and individually in new ODA Charter. Therefore, the relevance of the Project is assessed still high based on the consistency of Thai and Japanese policies.

Since fostering of skilled personnel of WMA is a matter of urgency for efficient and effective STP management, assisting WMA would boost the introduction of more strong measures upon Thai environmental policies with regard to the awareness of environmental condition and protection in urban areas of Thailand. This is also very helpful for the future sewage management in Thailand.

(2) Effectiveness

The result of assessment on one of indicators for Project purpose "STPs under WMA adopt the reference materials for their operation" suggests that the degree of their realization would be considerably high when the reference materials are disseminated through the seminars/ workshops conducted by the Project in September and October 2007. Besides, another indicator for Project purpose "Effluent from STPs under WMA meets the water quality standard in Thailand" has achieved at the time of terminal evaluation.

Regarding the relevance of the important assumption, it is confirmed as effective as before.

Based on PDM that the important assumption can be confirmed well, it is fair to conclude that the Project purpose would be achieved to a certain level by the time of the Project termination.

(3) Efficiency

It is confirmed that the contents of input were introduced as planned appropriately.

The terms, timings and technical quantities of dispatched Japanese experts could be evaluated quite

efficient by assessing the result of the questionnaire survey, of which most of respondents rated “very much” or “much” in questions concerned. The Thai side also arranged appropriate settings of counterparts and took the initiative in adequate coordination for the smooth implementation of the Project.

(4) Impact

Under the Rehabilitation Plan, totally 46 STPs are planed to be rehabilitated by 2009. Besides, PCD is now working on setting up the effluent standards of municipal wastewater. From now, if a number of STPs under WMA is increased based on the WMA’s 4-year plan, those STPs under local municipalities also will be operated and maintained properly and the treated wastewater will meet water quality standard. In these regards, indicators verifying the achievement of the project overall goal have emerged in some fields according to the result of the various evaluation surveys. However, it may be reasonable that the level of this achievement is assessed under the satisfactory level since the improvement of the conditions identified in the important assumption meets the expected level.

It is quite difficult to estimate the necessary time to achieve the project overall goal with satisfactory level, however, since technical advices on STP’s operation and maintenance for local municipalities outside of WMA are provided by WMA, it could firmly be confirmed that the movement toward the overall goal has already begun.

(5) Sustainability

From technical and financial aspects, the possibility to disseminate effective and efficient O&M method for STPs established in this project in the future is quite high for the following facts. Besides, the dissemination of the knowledge and experience in the reference materials, which is planned in the Project, is so important, and even after completion of the Project, the reference materials shall be maintained periodically.

- According to the statement from the representative from MONRE, DOLA and the Ministry of Finance (MOF) at the Seminar held on June 7, 2007, relative government organization will support for the WMA’s 4-year plan.
- 45 local municipalities have submitted request letters to WMA for technical support from WMA.

However, in order to promote the activities along with the WMA’s 4-year plan in the future, WMA shall focus on organizational issues including increasing business efficiency and the number of technical staff.

3-3 Factors that have promoted the Project

(1) Relate to planning

- To formulate the reference materials, WMA has actively carried out technical communication by the participation of other organizations such as PCD and DOLA in the Reference Committee meetings. It also contributes to expand their field of vision and knowledge, and the result of the Project.

(2) Relate to implementation

- The counterparts are positively creating technical events such as technical seminars and analyzing quality of water collected from the whole country of Thailand. And their high motivation to participate in this project is one of the reasons.

3-4 Factors that have inhibited the Project

(1) Relate to planning

None.

(2) Relate to implementation

In Thailand, wastewater collection system is controlled not under WMA but under local municipality operations. Therefore, it is difficult for WMA to deal with wastewater collection system directly. In the planning stage, it was not expected that the above-mentioned fact affected the indicator for Project outcome. The recommendation on technical proposal to local municipalities was made in the mid-term evaluation, but negative impacts to the indicator 1-2 could not be fully unavoidable.

3-5 Conclusion

The overall results of the Project are fairly good for the following reasons:

a) Two focused STPs have been recovered its function. In addition, many useful recommendations on maintenance and operation have maximized the efficiency of the focused STPs.
b) Nine reference materials were already developed, and these materials consist of not only theoretical knowledge but also practical know-how. In addition, the practical knowledge and experience, through the rehabilitation works and technical support for C/Ps, were also reflected on the reference materials.
c) By technical support to other STPs under WMA with C/Ps, the capability of C/Ps was enhanced and it is expected that the results of the Project will be disseminated the wider area in Thailand.

However, to sustain the project purpose, the enforcement of WMA capability in both quantity and quality, such as management efficiency and increase in the number of technicians, is strongly required. In addition, there are some hindering factors which have to be overcome for achieving the overall goal of the Project, such as willingness to pay sewage charge for O&M costs, problems on wastewater collecting system and institutional framework of legislation. To promote the utilization of the results of the Project in all over Thailand, it is quite significant to resolve these hindering factors as early as possible.

3-6 Recommendations

<u>Recommendations to be considered before the termination of the Project</u>

a) Active utilization of reference materials

It is recommended to disseminate the technical knowledge of 9 categories of reference materials through Seminar/Job-training in the STPs under WMA in the Project term. Furthermore, some practical ideas for efficient operation which came from the past experiences at focused sites, such as installation of a coarse screen and introduction of timer control to equipment shall be also spread through the above-mentioned activities continuously.

b) Establishment of information system

It is recommended that the information system shall be developed in accordance with the actual information technology (IT) situation in all municipalities. Therefore, currently the way of dissemination of

reference materials shall be selectable between CD-ROM and Download from WMA's web-site. In addition, the function of data processing on O&M data of STPs under WMA shall be installed in the WMA's server system and provide the summary of O&M data of each STP anytime. The 3 kinds of reference materials are available on WMA's web-site at the time of the evaluation. The remaining 6 kinds of reference materials should be available by the time of the Project termination.

Recommendations in the future

a) Update of reference materials

To maintain the efficient and high-quality operation at STPs, the accumulation of innovative ideas and practical troubleshooting cases, which come from the consultation activities by WMA, is very significant. Therefore, it is highly recommended the periodical update of reference materials in the reference material committee consisting of MONRE, PCD, DOLA, WMA and other external knowledgeable persons.

b) Sustainable technical knowledge dissemination by WMA

In the Project, the seminars on Oxidation Ditch method and Stabilization Pond method have been conducted. From the views of sustainability, it is preferable that WMA continuously conducts the seminars on various topics and develops the curricula and textbooks in the future. In addition, dissemination of practical technical knowledge by using WMA newsletter is also effective. We believe the above-mentioned efforts contribute to the sustainable development of WMA.

c) Human resource

To support local government widely and effectively, WMA shall secure the number of engineers in accordance with the number of STPs and continue the human resource development as well as business management development in WMA. In this regard, the continuous effort to collaborate with government agencies, such as Bangkok Metropolitan Administration (BMA), PCD, Office of Natural Resources and Environmental Policy and Planning (ONEP), Department of Environmental Quality Promotion (DEQP) and DOLA will be highly recommended in terms of the human resource development.

d) National policy

To make the WMA's activities toward the sewage treatment more effectively and efficiently, the establishment of sewage act/law and introduction of sewage charge system should be national policy as early as possible.

e) Financial support to local municipalities

Although the area of administration duty increased due to the decentralization policy, there was not enough financial support from central government. Therefore, reviewing the detail condition to utilize the environment fund or other financial resources is needed for municipalities in the near future.

3-7 Lesson Learned

a) Collection of baseline data

There were no base data for the verifiable indicators on unit operation cost and influent wastewater before the rehabilitation work. In addition, it is uncertain whether initial verifiable indicators are appropriate for

the project or not at the time of terminal evaluation. Avoiding this, original intention shall be noted as much as possible in the ex-ante evaluation report.

b) Collaboration with other partners

To make the project activities more effective, collaboration led by WMA with other authorities, such as the reference material committee consisting of relevant ministries and authorities, is working well. In this regard, such proactive way of communication with other authorities is very helpful.

3-8 Follow-up status

In the future, WMA will expand to support for local municipalities. However, in order to confirm the continuous activities utilizing reference materials and information system, the necessity of follow-up shall be discussed 1-year later after completion of the Project.

List of Abbreviations

AL	Aerated Lagoon
BMA	Bangkok Metropolitan Administration
C/P	Counterpart
DEQP	Department of Environmental Quality Promotion
DOLA	Department of Local Administration
JICA	Japan International Cooperation Agency
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
OD	Oxidation Ditch
ONEP	Office of Natural Resources and Environmental Policy and Planning
O&M	Operation and Maintenance
PCD	Pollution Control Department
PDM	Project Design Matrix
R/D	Record of Discussion
SP	Stabilization Pond
STP	Sewage Treatment Plant
TICA	Thailand International Development Cooperation Agency
TCSW (project)	Training Center for Sewage Works (project)
WMA	Wastewater Management Authority

1 Outline of the Terminal Evaluation Study

1.1 Background and Objectives of the Study

The terminal evaluation study (hereinafter referred to as the "Study" was conducted by the joint evaluation team consisted of JICA and Counterpart (C/P) organization with Thailand International Development Cooperation Agency (TICA) from18th June to 20th July, 2007, while focusing on the following points as the objectives of the Study;

1) To confirm the achievement of the Project purpose and outputs since the Project commencement until the present, and comprehensively evaluate them according to the five evaluation criteria (relevance, effectiveness, efficiency, impact and sustainability) jointly by the Thai and Japanese sides,
2) To discuss the activity plan of the Project in its terminal period, make necessary advices and modify its plan if necessary, and to report and advice its results to both of the Thai and Japanese sides concerned, and then,
3) On the basis of the result, to judge necessity of follow-ups such as appropriateness of the Project termination and extension of the Project period.

Since the Project is scheduled to be terminated at the end of November 2007, this terminal evaluation study is carried out.

1.2 Study Team and Study Period

The Study was carried out by the following Team members.

Table 1-1: Study Members

<Japanese side>

Name	Duty	Position/affiliation
Mr. Masazumi Ogawa	Leader	Deputy Resident Representative, JICA Thailand Office
Mr. Nobuyuki Horie	Wastewater Operational Management	Japan Sewage Works Agency Deputy Director General for Eastern Japan
Ms. Hiroko Kamata	Wastewater Planning Management	Senior Advisor, Institute of International Cooperation, JICA
Mr. Kazuya Maruo	Cooperation Plan	Assistant Resident Representative, JICA Thailand Office
Ms. Athaneeporn Boonrad	Evaluation Control	Program Officer, JICA Thailand Office
Mr. Minoru Fujii	Evaluation Analysis	Consultant, RECS International Inc.

<Thai Side>

Name	Position/affiliation
Mr. Somchai Sriavudh	Acting Director General, Wastewater Management Authority
Mr. Supparat Ittiphol	Director of Wastewater Management Department, Wastewater Management Authority
Ms. Hatairat Likitanupak	Director of Planning and Development Project, Wastewater Management Authority
Ms. Somsuan Howe	Program Officer, Thailand International Development Cooperation Agency
Ms. Suthanone Fungtammasan	Program Officer, Thailand International Development Cooperation Agency

1.3 Schedule of the Evaluation Study

The Schedule of the Evaluation Study was as follows.

Table 1-2: Schedule of the Evaluation Study

Date			Schedule	Remarks
6/18 ~7/1	—		Evaluation Grid, Interviews with C/P, etc	Consultant
7/2	Mon		TV Meeting with JICA HQ Interviews with DOLA	Consultant
7/3	Tue		Site Visit and Interviews with Pathumthani Municipality	Consultant
7/4	Wed		Compiling and analyzing collected information	Consultant
7/5	Thu		Interviews with PCD	Consultant
7/6	Fri		Compiling and analyzing collected information	Consultant
7/7	Sat		Compiling and analyzing collected information	Consultant
7/8	Sun		Compiling and analyzing collected information	Consultant
7/9	Mon	AM	Meeting with JICA Thailand Office	Japanese members
		PM	Kick-off Meeting with WMA Discussion(1): Confirming the way of Evaluation	All members
7/10	Tue	AM	Discussion(2): Confirming the Actual Results	Japanese members
		PM	Discussion(3): Confirming the Actual Results	All members
7/11	Wed	AM	Discussion(4): Confirming the Evaluation Results	All members
		PM	Interviews with MONRE	Japanese members
7/12	Thu	AM	Discussion(5): Confirming the Joint Evaluation Report	Japanese members
		PM	Discussion(6): Confirming the Joint Evaluation Report	All members
7/13	Fri	AM	Preparation for JCC/Discussion	Japanese members
		PM	JCC (Signing the Joint Evaluation Report)	All members
7/14 ~20	—		Related Survey, Drafting Final Evaluation Report	Ms. Kamata, Consultant

1.4 Background and Outline of the Project

Thailand has faced various environmental problems due to the rapid economic growth and urbanization. The Department of Public Works of the Ministry of Interior and the former Ministry of Science, Technology and Environment actively promoted the development of sewage treatment facilities in all over Thailand in the 1990s in order to respond to the problem of water pollution. Since Thailand faced shortages in technical personnel who could operate and maintain these newly built facilities appropriately, the Training Center for Sewage Works (TCSW) Project was implemented from August 1995 until July 2000 in order to meet the urgent demands to foster technical personnel. Through the TCSW project, approximately 1,000 technical officers underwent training sessions. However, it became clear that inappropriate designing and insufficient operation and maintenance of sewage treatment plants (STPs) were root causes of malfunction of many STPs.

In order to improve the efficiency of sewage treatment plants (STPs) in Thailand, the Project for Improvement of Sewage Treatment Plant Management (hereinafter referred to as the "Project") was formulated for three and half years since May, 2004, according to the Record of Discussion (R/D) signed on 25th May, 2004 between the Wastewater Management Authority (WMA) and the Japan International Cooperation Agency (JICA). Since the Project commencement, it has been implemented to improve the methods of operation and maintenance (O&M) through rehabilitating and improving insufficiently dysfunctional STPs focused by the Project, and Furthermore, it has also produced reference materials for the operation and management of STPs and coordinated technical training programs to enable to apply skills and knowledge obtained through these processes for other STPs.

At present, the number of long term experts dispatched from Japan is four persons (chief advisor/sanitary engineering, design/planning/construction on sewage, electric & machinery engineering and project coordinator/training), and their assisting fields are as follows;

1) Technical assistance of necessary matters concerned with O&M of STPs,
2) Assistance and advice concerned with improvement measures against issues on the focused STPs,
3) Necessary advices on O&M and suggestion on reconstruction of treatment system design,
4) Production of reference materials in the fields of mechanical and electrical equipment, and then,
5) Preparation of training materials necessary for O&M management, and training implementation.

Besides, the mid-term evaluation study for the Project carried out in March 2006 concluded "given the present status of implementation, the project purpose is expected to be achieved by the end of the Project", and at the same time, it also recommended the following points;

1) Enhancing the collaboration with the Pollution Control Department (PCD),
2) Redefining conditions for the objectively verifiable indicators of the Project output 1,
3) Technically complementing the indicator 1-2 "Treated wastewater is increased by 30% at focused STPs" of the Project output 1,
4) Developing reference materials which can serve many users,
5) Continuing the training activities, and then,
6) Enhancing the public relations activities

1.5 Contents of the Project

According to the PDM of the Project, the overall goal, purpose and outputs of the Project are as follows:

Super Goal:
The water quality of public water bodies is improved.

Overall Goal:
Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.

Project Purpose:
Efficient and effective operation method of STPs is established.

Project Outputs:
1) Function of focused STPs is recovered.
2) Reference materials for improvement of sewage treatment plant management are developed.
3) Skilled personnel are 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. 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. Skilled personnel are assigned to operate and maintain the focused STPs appropriately
3-1. Decide areas of necessary knowledge and skills for officers in charge.
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.

1.6 Focused STPs of the Project

There are twelve STPs under WMA and two focused STPs of the Project as follows;

No.	Location of STPs under WMA	Focused STPs (✓)	System
1	Baan Pae		OD
2	Panguan		Wetland
3	Chomseang		SP
4	Huakwang		SP
5	**Kamphaeng Phet**	✓	**SP***
6	Pak Panung		AL + Wetland
7	**Pathumthani**	✓	**OD****
8	Phayao		SP
9	Sakon Nakorn		SP + Wetland
10	Songkha		AL
11	Sri Racha		OD
12	Ta rae		Wetland

Note: SP=Stabilization Pond, OD=Oxidation Ditch

Source: WMA

Note:

** SP (stabilization pond) system is a wastewater treatment method which stabilizes wastewater with algae and microorganisms*

*** OD (oxidation ditch) is a wastewater treatment system ideally for use at small to medium-scale wastewater treatment plants, agitating wastewater by rotors, and circulating it along the ditch at level.*

2 Study Methods

2.1 Study Methods

For the objectives of the evaluation study, the following methods are mainly used for the Study.

1) Related information reviews,
2) Questionnaires, and
3) Interviews.

The Study Team has initially started the Study from the collection of information related to the Project. The collection of information on the Project activities and outputs has been based on a review of documents related to the Project, such as the PDM and PO, and R/D and reports of the Project activities and outputs. After confirming the Project achievement through the collected information, the Study Team has moved to the following works for the preparation of questionnaires to be distributed to 21 persons of the C/P personnel in WMA. Then, the questionnaires have been sent to 15 of them, who were available to answer in Bangkok, while focusing on the five evaluation criteria described below.

After collecting the questionnaires from them, then, the Study Team has carried out interview surveys to the personnel of the following organizations to question specified and detailed topics concerned with the Project.

Table 2-1: Organizations which have been invited to the interview survey

Central government organization	MONRE, DOLA, PCD
Local municipality	Kamphaeng Phet and Pathumthani Municipalities
Counterpart	WMA

In terms of the evaluation analysis for the Study, the five evaluation criteria described below is applied with the evaluation grid for the Study.

Table 2-2: Five Evaluation Criteria

Relevance	Relevance of the Project plan is reviewed by the validity of the Project purpose and the overall goal in connection with the development policy of the Government of Thailand and needs of the beneficiaries and also by the logicality of the plan.
Effectiveness	Effectiveness is assessed by evaluating to what extent the Project has achieved its purpose and clarifying the relationships between purpose and outputs.
Efficiency	Efficiency of the Project implementation is analyzed with emphasis on the relationships between outputs and inputs in terms of timing, quality, and quantity.
Impact	Impact of the Project is assessed by measuring either positive or negative influences made by the Project, which are not originally expected in the Project plan.
Sustainability	Sustainability of the Project is assessed in organizational, technical and financial aspects by extent to which the achievements of the Project are sustained or expanded after the Project is completed.

This evaluation study was conducted by using the five evaluation criteria, which is a basic evaluation method set by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) to evaluating project achievements. All of the JICA projects are today evaluated by means of this evaluation method. The five evaluation criteria described above is applied with the Evaluation Grid of the Project.

In addition to the methods above, the Study Team also visited the focused STPs in Kamphaeng Phet and Pathumthani Municipalities to support the Study with field surveys on their existing conditions.

3 Project Achievement

3.1 Inputs

3.1.1 Inputs from Japanese side

The Japanese side has input for the Project since its commencement until the present as follows;

1) Long term experts,
2) Short term experts,
3) Counterpart training in Japan,
4) Equipment

The detailed information above is as follows;

a. Long term experts

No.	Name of Expert	Period of Assignment		Title
		From	Until	
1	Mr. Shuji TANAKA	26 May, 04	31 Mar, 06	Chief advisor/sanitary engineering
2	Mr. Haruki TAKAHASHI	4 Apr, 06	25 Nov, 07	Chief advisor
3	Mr. Matsuo TANAKA	26 May, 04	26 May, 06	Design/planning/construction on sewage
4	Mr. Shu NISHI	21 May, 06	25 Nov, 07	Design/planning/construction on sewage
5	Mr. Nagahide NAKAMURA	4 Jul, 05	25 Nov, 07	Electric & machinery engineering
6	Mr. Tetsuro USUI	25 May, 05	25 Nov, 07	Project coordinator / training

b. Short term experts

No.	Name of Expert	Period of Assignment		Title
		From	Until	
1	Mr. Nobuyuki MATSUMOTO	23 Nov, 04	21 Jan, 05	O&M electric engineering
2	Mr. Akito KURAMOCHI	2 Jun, 05	31 Jul, 05	O&M electric engineering
3	Ms. Yuko FUJII	31 Oct, 05	29 Dec, 05	Training sewage works

No.	Name of Expert	Period of Assignment		Title
		From	Until	
4	Mr. Kazuhisa SAKAGUCHI	21 Nov, 05	14 Jan, 06	O&M mechanical engineering
5	Mr. Yutaka UCHIMURA	3 Jul, 06	15 Sep, 06	Training instructor for discharge to sewer pipe and public water body
6	Mr. Shigeo KANAI	27 Sep, 06	15 Dec, 06	Quality control by specification and inspection on rehabilitation works
7	Mr. Yutaka KOMURA	2 Oct, 06	30 Nov, 06	O&M preventive maintenance and management for equipment

c. Counterpart training in Japan

No.	Name of Counterpart	Period of Assignment		Title
		From	Until	
1	Mr. Akanit Ampawasiri	8 May, 05	21 May, 05	Management of Organization
2	Mr. Supparat Ittipol	8 May, 05	21 May, 05	Management of Organization
3	Mr. Phanthouch Chuncharoensook	30 Aug, 05	10 Dec, 05	Sewage works engineering & Storm water drainage technology
4	Mr. Atilak Bupachanto	30 Aug, 05	10 Dec, 05	Sewage works engineering & stormwater drainage technology
5	Ms. Duangjai Khankruer	29 Aug, 06	9 Dec, 06	Sewage works engineering & stormwater drainage technology

d. Equipment

The detailed list of the equipment is shown in Annex 7.

In addition, the Japanese side has allocated and appropriated necessary budget for the Project activities and management as shown in the following table.

Table 3-1: Budget Allocation from Japanese Side

Unit: Thousand Japanese yen

Japanese fiscal year	JFY2004	JFY2005	JFY2006	JFY2007
Total cost for the Project Implementation	42,887	81,405	92,350	44,709

Source: JICA

3.1.2 Inputs from the Thai side

The following inputs have been provided by the Thai side for the Project

a. Counterparts

Counterparts have been assigned from the Thai side for the Project as listed in Annex 9.

b. Project office and equipment

Sufficient spaces as the Project office and sufficient numbers of desks and tables have been prepared by the Thai side for the Project.

c. Others

Other costs for the Project have been allocated by the Thai side as shown in the following table.

Table 3-2: Budget Allocation from Thai Side

Unit: Thai baht

Year	2004	2005	2006	2007	Total
By WMA For training sessions	0	0	32,000	43,000*	75,000*
By TICA For utility and administration	56,760	158,060	132,880	205,170*	552,870*
Total	56,760	158,060	164,880	248,170*	627,870*

Source: 1) Mid-term evaluation study report
2) Information from the Project team
* Estimation

3.2 Outputs

3.2.1 Output 1: Function of focused STPs is recovered

Indicator 1-1: Unit cost (Baht/m^3) is reduced by 20% at focused STPs.

- As for the base data for the unit costs for the focused STPs.
  a) The focused STP in Pathumthani was out of operation completely before the completion of the rehabilitation in May 2005.
  b) There were no reliable flow rate data in Kamphaeng Phet, when the Project was started.

(Annex 26-7)

- Therefore, the mid-term evaluation team has recommended as the follows;
  a) "For STP in Pathumthani, the base data for the unit cost should be 10. 4 baht/m^3 of May 2005."
  (Base data should be data obtained before employing cost reduction suggestions by the Japanese experts.)
  b) "For STP in Kamphaeng Phet, the base data for the unit cost should be the average unit cost of January and February 2006".
  c) "Cost reduction effects by such elements as electricity, personnel and chemical expense should be also considered"

(Annex 26-5)

- Given the above, the reductions in unit costs are calculated as follows:

Pathumthani	Base Data (As of May, 2005)	Actual Data (Average of May, 2006 – May, 2007)	Cost Reduction	Indicator Required
Total Cost	10.4 Baht/ m^3	6.9 Baht/ m^3	34 %	20 %
(Electricity Cost)	(3.2 Baht/ m^3)	(1.2 Baht/ m^3)	62 %	

Source: O&M data from WMA (Annex 26-7)

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.

(Annex 26-7)

Kamphaeng Phet	Base Data (Average of March – April, 2006*)	Actual Data (Average of March – April, 2007)	Cost Reduction	Indicator Required
Total Cost	2.4 Baht/ m^3	2.2 Baht/ m^3	10 %	20 %
(Electricity Cost)	(0.54 Baht/ m^3)	(0.34 Baht/ m^3)	37 %	

*Monthly cost was not available in January and February in 2006
Source: O&M data from WMA (Annex 26-7)

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.

(Annex 26-7)

Constraint of cost reduction

- Since stabilization pond has no machinery to use much electricity, there is a limited room of O&M cost reduction.

(Annex 26-7)

Indicator 1-2: Treated wastewater is increased by 30% at focused STPs

- 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):
  a) The quality of the construction of the existing wastewater collection system
  b) The expansion of wastewater collection system.
  c) The maintenance of collection system

(Annex 26-6)

- The mid-term evaluation for the Project was considered as follows:
  "For the focused STPs where there is limited room to increase 30% of the volume of treated wastewater by O&M, technical suggestions and proposals related to improvement of wastewater collection system, etc., should be made to increase efficiency of the focused STPs."

(Annex 26-5)

* The following suggestions and proposals were made in the Project.
a) Acceptance of Business-based wastewater (two focused sites)
b) Sewage area expansion (Pathumthani municipality)
c) Survey for the acceptance sewage water from nearby municipalities (Kamphaeng Phet)

(Annex 26-6)

- Moreover, the mid-term evaluation team recommended the following point.
  "The volume of influent wastewater of December 2005, January and February 2006 on average should be applied as base data."

(Annex 26-5)

Pathumthani	Base data (Average of December 2005 – March 2006*)	Actual data (Average of February and March 2007**)	Increase in treated wastewater	Indicator required
Influent wastewater	22,001 (16,501)*** m^3/month	27,578 m^3/month	25 % (40 %)***	30 %

Source: O&M data from WMA (Annex 26-7)
* 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

Kamphaeng Phet	Base data (Average of December 2005 – March 2006*)	Actual data (Average of December 2006, February and March 2007**)	Increase in treated wastewater	Indicator required
Influent wastewater	90,473 m^3/month	72,037 m^3/month	-20 %	30 %

Source: O&M data from WMA (Annex 26-7)
* 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.

- 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.

(Annex 10 and 26-7)

Indicator 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℃	Maximum 20mg/l	(at least twice per week)
COD	Maximum 120mg/l	(daily)
SS	Maximum 30 mg/l	(daily)
pH	in the range of 5-9	(daily)
Temperature	Maximum 40℃	(daily)

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.

(Annex 11)

3.2.2 Output 2: Reference materials for improvement of sewage treatment plan management are developed

Indicator 2-1: All of the listed necessary reference materials are 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 planned 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;
  a) Analysis of Existing Wastewater Treatment Systems,
  b) Guide for Wastewater Collection to Sewer System,
  c) Guideline for Pumping Station Design and O&M,
  d) Wastewater Treatment System O&M
  e) 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
  f) Guideline for Evaluation of Rehabilitation Works,
  g) Cost Control for O&M of STPs,
  h) Troubleshooting Examples,
  i) Safety Manual.

- To exchange beneficial ideas and suggestions on the contents of reference materials, WMA set up Reference materials committee. Based on the recommendation "Enhancing the collaboration with the Pollution Control Department (PCD)" at the mid-term evaluation study, its members jointly organized by the Japanese and Thai sides, related central government organizations - such as PCD and DOLA - and local authorities.
- In this committee, beneficial ideas and suggestions were actively made.
- By the time of the terminal evaluation, 9 reference materials were developed as planned.

(Annex 12)

3.2.3 Output 3: Skilled personnel are assigned to operate and maintain the focused STPs appropriately

Indicator 3-1: Personnel assigned for the focused STPs undergo training organized by the Project.

- The numbers of seminar participants as follows;

Date	Contents		No. of Attendance								
			WMA	PCD/ ONEP	Kamphaeng Phet (SP)		Pathumthani (OD)		Other municipalities under WMA	Others municipality not under WMA	Total
					Muni-cipality	O&M contractor	Muni-cipality	O&M contractor			
30 Jan – 3 Feb, 2006	OD system	A	18	0			**0***	**2**	3	5	28
		B	18	0			**0***	**2**	3	5	28
29 – 31 Jan, 2007	SP system	A	17	2	**0**	**2**			9	60	90
		B	17	5	**1**	**3**			10	84	120

Source: Attendance lists from the Project
Note: A= No. of certified persons, B= No. of participants
* All engineers have joined the seminar as trainers

(Annex 13)

- According to hearing surveys, 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.

(Annex 14)

- The Project has carried out technical follow-ups to personnel of Pathumthani Municipality afterward.

(Annex 26-10 and 26-14)

- Monthly onsite trainings and OJTs at focused STPs have been conducted for appropriate operation and maintenance and the major contents are as follows;

(Annex 26-10)

  - 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

Besides, short term experts have also carried out the trainings and OJT with long term experts. Their contents have been as follows;

(Annex 26-14)

  - 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

Indicator 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. (Annex 15)

3.2.4 Output 4: Information system[1] is established to disseminate reference materials and to collect O&M data

Indicator 4-1: Reference materials are available through information system on WMA managing STPs
• The following 3 reference materials are available on WMA's web site (http://www.wma.or.th/jica_index.htm) in English version. - Analysis of existing wastewater systems - Guideline for wastewater collection to the sewer system - Pumping station design and O&M • According to hearing surveys to the Project experts, 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. (Annex 3)

Indicator 4-2: O&M data of all of the focused STPs is collected using information system.
According to hearing surveys to the Project experts and C/Ps; • 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. (Annex 3)

3.3 Project Purpose

Indicator 1-1: 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. • 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. (Annex 12 and 26-8)

[1] Since the internet access is not really available in some areas of Thailand, "information system" is defined generally as the distribution of digital data itself to organizations concerned.

Indicator 1-1: STPs under WMA adopt the reference materials for their operation
• It is confirmed that effluent from all STPs under WMA meets the WMA requirements. (Annex 11)

Based on the result of the detail assessment described in the section 4.2 “Effectiveness”, it was confirmed that the adequate generation of outputs contributes to the achievement of the project purpose to a certain extent. By the end of the Project, it is possible to achieve Project Purpose with more satisfactory level when the reference materials are fully developed and its contents are disseminated to all the STPs under WMA.

3.4 Overall goal

Indicator 1-1: 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. (Annex 11)

Indicator 1-2: 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. It may be possible that the quality of effluent from STPs other than those focused upon could also be improved through technical skills and knowledge of WMA personnel enhanced by the Project. (Annex 11) • Therefore, it is possible to expand the good quality area in Thailand with dissemination of reference materials through the seminars. (Annex 3 and 11)

The indicators potentially contributing to the achievement of the project overall goal have already been identified in the focused STPs through the evaluation study. However, it does not extend its influence widely enough to reach all the STPs in Thailand.

Therefore, it could be assessed that the overall goal of the project in future might be achieved if the conditions described in the important assumptions, such as people awareness to pay the sewage charge and the wastewater collection system owned by each municipality, are solved in the near future.

4 Results of Evaluation

4.1 Relevance

a. Focal Points

Focal Points	Results
Thai policies and approaches	• 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. This policy places great importance on water quality improvement and wastewater treatment. • Under the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand (hereinafter referred to as the "Rehabilitation Plan") formulated by the Pollution Control Department (PCD) under the Ministry of Natural Resources and Environment (MONRE) 2003-2007, 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. However, WMA has been operating for just 12 years, and its technical personnel as a whole is still new to the sewage field. So, by assisting WMA, the enhancement of sewage techniques in Thailand can be expected.
Selection of C/P organization	• 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 itself by processing to the Cabinet. Under these circumstances, fostering of skilled personnel of WMA is urgently needed.
Japan's ODA scheme and JICA programs	• 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. • 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.
Technical advantage of Japan	• In Japan, there is an organization called the Japan Sewage Works Agency (JSWA) which functions much like WMA. Through the technical activities of JSWA, the construction of sewage treatment

Focal Points	Results
	plants (STPs) and development of essential technical skills have been widely well-evaluated in Japan. • Furthermore, JSWA has accumulated sufficient technical skills and knowledge in the sewage field through its long experience in large Japanese cities such as Tokyo and Yokohama, and the skills and knowledge obtained from the experiences have been aggregated into various technical guidelines through the Sewage Works Association. • With the skills and knowledge from theory to practice, it is useful to improve Thai sewage technology by assisting WMA.

b. Conclusion

Based on the revision of the Royal Decree in 2005 for the expansion of WMA's responsibilities and opportunities, WMA can provide technical support to local authorities for sufficient operation of STPs. In addition, wastewater treatment problem relates health and infectious diseases, and should be considered more closely and individually in new ODA Charter. Therefore, the relevance of the Project is assessed still high based on the consistency of Thai and Japanese policies.

Since fostering of skilled personnel of WMA is a matter of urgency for efficient and effective STP management, assisting WMA would boost the introduction of more strong measures upon Thai environmental policies with regard to the awareness of environmental condition and protection in urban areas of Thailand. This is also very helpful for the future sewage management in Thailand.

4.2 Effectiveness

a. Focal Points

Focal Points	Results
Degree of achievement of the Project purpose	• By the time of the terminal evaluation, the formulation of 9 reference materials is completed. (Visual survey) • 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. (Annex 12) • 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. (Annex 11)

Focal Points	Results
Assessment of relation between the Project outputs and purpose	• The average budget of O&M in municipalities from 2005 to 2007 has no significant change according to the report of budget allocation for STP O&M by DOLA. (Annex 17) • All the contents of the English reference materials have been confirmed and approved by the JCC meeting. (Annex 12) • 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. (Annex 3) • After the seminars with the reference materials, they are predicted to be practically referred by central and local governments. (Annex 3) • Information system is not established enough for utilization by organization/ personnel concerned. • The reference materials will be available in digital forms by the end of the Project term. (Annex 3)

b. Conclusion

The result of assessment on one of indicators for Project purpose "STPs under WMA adopt the reference materials for their operation" suggests that the degree of their realization would be considerably high when the reference materials are disseminated through the seminars/ workshops conducted by the Project in September and October 2007. Besides, another indicator for Project purpose "Effluent from STPs under WMA meets the water quality standard in Thailand" has achieved at the time of terminal evaluation.

Regarding the relevance of the important assumption, it is confirmed as effective as before.

Based on PDM that the important assumption can be confirmed well, it is fair to conclude that the Project purpose would be achieved to a certain level by the time of the Project termination.

4.3 Efficiency

a. Focal Points

Focal Points	Results
Degree of achievement of inputs	(Japanese side) • A total of six long term experts and seven short term experts have been dispatched since the Project commencement until the present appropriately. (Annex 6) • Most answers to the questionnaire survey say that the number, timing, dispatch term and technical capacity of the Japanese experts have been appropriately. (Annex 18) • Equipment has been provided for the Project as originally planned. (Annex 7) • Totally 5 C/Ps have been in Japan for training programs. (Annex 8) (Thai side)

Focal Points	Results

- Full and part time C/Ps have been assigned appropriately.

(Annex 9)

- Space for the Project office has been provided.

(Visual survey)

- Equipment for STPs has been prepared.

(Visual survey)

- Necessary budgets for rehabilitation of STPs, training and O&M of STPs have been released.

(Annex 26-11 and 26-12)

- The following table shows the numbers of seminar participants as the Project inputs.

Date	Contents		No. of Attendance								
			WMA	PCD/ ONEP	Kamphaeng Phet		Pathumthani		Other municipalities under WMA	Others municipality not under WMA	Total
					Muni-cipality	O&M contractor	Muni-cipality	O&M contractor			
30 Jan – 3 Feb, 2006	OD system	A	18	0			**0***	**2**	3	5	28
		B	18	0			**0***	**2**	3	5	28
29 – 31 Jan, 2007	SP system	A	17	2	**0**	**2**			9	60	90
		B	17	5	**1**	**3**			10	84	120

Source: Attendance lists from the Project
Note: A= No. of certified persons, B= No. of participants
* All engineers have joined the seminar as trainers

(Annex 13)

- In addition to the seminars above, follow-up, OJT and short seminars/programs have been organized appropriately.

(Annex 26-8 and 26-10)

- C/P personnel in charge of WMA staffs have been appropriately trained and assigned for O&M of information system.

(Annex 26-5)

- 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

(Annex 26-10)

Besides, 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 appliance
- ✶ 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

(Annex 26-14)

Focal Points	Results
Assessment of relation between inputs and outputs	• Trained personnel in C/P organizations are still working continuously by the time of the Study. (Annex 9 and 16) • The O&M contractor of the focused STP in Pathumthani trained in the Project was replaced with other contractor in the mid of the Project which did not have training session in the Project. (Annex 15)
Degree of achievement of outputs	• Total cost at the focused STP in Pathumthani reduced to 34 % (Annex 26-7) • Total cost at the focused STP in Kamphaeng Phet reduced to 10% (Annex 26-7) • Influent wastewater at the focused STP in Pathumthani increased to 25% (Annex 26-7) • Influent wastewater at the focused STP in Kamphaeng Phet increased to -20% (Annex 26-7) • Effluent from all the focused STPs JFY2007 meets the requirement, although that of Kamphaeng Phet exceeded in August 2006 because of Algae outbreak. (Annex 11) • 9 reference materials were developed. (Visual survey) • Skilled personnel are assigned to operate and maintain the focused STPs appropriately. (Annex 13 and 26-4) • Information system will be established to disseminate the reference materials to collect O&M data by the time of the Project termination. (Annex 3)

b. Conclusion

It is confirmed that the contents of input were introduced as planned appropriately.

The terms, timings and technical quantities of dispatched Japanese experts could be evaluated quite efficient by assessing the result of the questionnaire survey, of which most of respondents rated “very much” or “much” in questions concerned. The Thai side also arranged appropriate settings of counterparts and took the initiative in adequate coordination for the smooth implementation of the Project.

4.4 Impact

a. Focal Points

Focal point	Result
Degree of achievement of overall Goal	• According to the “Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand” released by PCD, 46 units of STPs are planed to be rehabilitated by 2009. (Annex 19) • The 16 Regional Provincial Offices under MONRE have conducted routine monitoring of the quality of effluent from all STPs in Thailand and submitted the report to PCD 4 times/year. Due to the lacking of

Focal point	Result
	reference effluent standard of municipal wastewater, PCD has referred to the building effluent standard type A*. However, the process of setting up the effluent standard of municipal wastewater is now ongoing. * *Notification of the Ministry of Natural Resources and Environment: Building Effluent Standards dated November 7, B.E. 2548 (2005) published in the Royal Government Gazette, vol. 122 Part 125 D, dated December 29, B.E. 2548 (2005).* (Annex 16)
Assessment of relation between the Project purpose and overall goal	• According to the interview survey and document review on the current situation of conducting public opinion surveys for collection wastewater treatment fee of 11 STPs under WMA, it was indicated that: 2 focused STPs • Kamphaeng Phet Municipality: - 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. - 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. • Pathumthani Municipality: - 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. (Annex 26-2) 9 STPs under WMA • 1 municipality – Sri Racha – has already applied the fee collection system. • 3 municipalities – Baan Pae, Tarae, and Songkha - have been prepared for setting up fee collection system. The implementation will be done as soon as the related regulations are set and approved. • 5 municipalities – Sakonnakorn, Huakwang, Chomsang, Phayao, and Pha Ngun (Baan Tai) – are in the process of WMA implementation. (Annex 26-2) • 10 out of 15 persons answered in the questionnaire survey that all the STPs under WMA have been operated efficiently and effectively in the rate of “very much” and/or “much.” (Annex 18) • Referring to “the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for overall Thailand (2004-2009)” prepared by PCD; 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. (Annex 19) • Referring to the result of interview survey with PCD officers in charged, the priority area defined in the Rehabilitation Plan might be changed depending on budget and existing facilities in each area. (Annex 16)

Focal point	Result
Assessment of unexpected factors	• 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. (Annex 16)
Assessment of ripple effects from the Project	• Since wastewater management involves central and local governments, there have been opportunities to exchange beneficial ideas and opinions through the Project activities. (Annex 16 and 18) • Wastewater treatment management can be applied for other urban management such as water supply. Through the Project, C/Ps have also been interested in other urban management. (Annex 16 and 18)

b. Conclusion

Under the Rehabilitation Plan, totally 46 STPs are planed to be rehabilitated by 2009. Besides, PCD is now working on setting up the effluent standards of municipal wastewater. From now, if a number of STPs under WMA is increased based on the WMA's 4-year plan, those STPs under local municipalities also will be operated and maintained properly and the treated wastewater will meet water quality standard. In these regards, indicators verifying the achievement of the project overall goal have emerged in some fields according to the result of the various evaluation surveys. However, it may be reasonable that the level of this achievement is assessed under the satisfactory level since the improvement of the conditions identified in the important assumption meets the expected level.

It is quite difficult to estimate the necessary time to achieve the project overall goal with satisfactory level, however, since technical advices on STP's operation and maintenance for local municipalities outside of WMA are provided by WMA, it could firmly be confirmed that the movement toward the overall goal has already begun.

4.5 Sustainability

a. Focal Points

Focal point	Result
Technical aspect	• With technical skills and knowledge obtained from the Project, C/Ps have opportunities to share their positive ideas with others concerned with wastewater treatment. (Annex 16 and 18) • As a result, they have started creating technical events such as workshops and improving contents of their news letters to explain technical matters to ordinary people. (Annex 16) • 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. (Annex 3 and12) • As a result, it can be expected that the materials are authorized. (Annex 3 and 12) • It is confirmed that the project has identified many requests from the municipalities for the technical consultation. This proves that WMA consultation is reliable at the present. (Annex 21)

<table>
<tr><th>Focal point</th><th>Result</th></tr>
<tr><td>Organizational and institutional aspects</td><td>

- Although there have been personal charges in Thai side, the core members of C/Ps have not been changed since the Project commencement.

(Annex 9 and 16)

- According to interview surveys, WMA plans to increase the number of its employees constantly as follows;

Year	2006	2007	2008	2009	2010
Total No. of WMA's employees	104	108	118	128	138

No. of staff of Engineering Dept.	4	5	6	7	8
No. of staff of Wastewater Management Dept.	8	7	9	10	11
No. of staff Statistical Data Development Div.	5	5	6	7	8

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

(Annex 20)

- 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 as follows based on the request from the local governments;

	2007	2008	2009	2010	2011
No. of WTSs under WMA	12	28	38	48	58
Effluent (million m3)	7.78	27.66	43.25	50.59	87.59

Source: Draft of WMA's 4 year operation plan (2008-2011)

- This plan is supported by MONRE, DOLA and MOF in the WMA promotion seminar on 7th June, 2007.

(Annex 22)

- 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.

(Annex 18)

- 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.

(Existing reference and visual survey)

- Training works on sewerage targeting at personnel of local authorities is also examined to carry out continuously after the Project termination.

</td></tr>
<tr><td>Political aspect</td><td>

- 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.

(Existing reference)

- Since the revision, WMA has also redefined and expanded the wastewater management area by proposing to the cabinet.

(Existing reference)

</td></tr>
<tr><td>Financial aspect</td><td>

- The WMA's 4-year operational plan programs revising its budgets for an increase in the number of STPs under WMA.

(Annex 23)

</td></tr>
</table>

b. Conclusion

From technical and financial aspects, the possibility to disseminate effective and efficient O&M method for STPs established in this project in the future is quite high for the following facts. Besides, the dissemination of the knowledge and experience in the reference materials, which is planned in the Project, is so important, and even after completion of the Project, the reference materials shall be maintained periodically.

- According to the statement from the representative from MONRE, DOLA and the Ministry of Finance (MOF) at the Seminar held on June 7, 2007, relative government organization will support for the WMA's 4-year plan.

- 45 local municipalities have submitted request letters to WMA for technical support from WMA.

However, in order to promote the activities along with the WMA's 4-year plan in the future, WMA shall focus on organizational issues including increasing business efficiency and the number of technical staff.

5 Conclusion

The overall results of the Project are fairly good for the following reasons:

a) Two focused STPs have been recovered its function. In addition, many useful recommendations on maintenance and operation have maximized the efficiency of the focused STPs.

b) Nine reference materials were already developed, and these materials consist of not only theoretical knowledge but also practical know-how. In addition, the practical knowledge and experience, through the rehabilitation works and technical support for C/Ps, were also reflected on the reference materials.

c) By technical support to other STPs under WMA with C/Ps, the capability of C/Ps was enhanced and it is expected that the results of the Project will be disseminated the wider area in Thailand.

However, to sustain the project purpose, the enforcement of WMA capability in both quantity and quality, such as management efficiency and increase in the number of technicians, is strongly required. In addition, there are some hindering factors which have to be overcome for achieving the overall goal of the Project, such as willingness to pay sewage charge for O&M costs, problems on wastewater collecting system and institutional framework of legislation. To promote the utilization of the results of the Project in all over Thailand, it is quite significant to resolve these hindering factors as early as possible.

6 Recommendations and Lessons Learned

6.1 Recommendations

6.1.1 Recommendations to be considered before the termination of the Project

a. Active utilization of Reference materials

It is recommended to disseminate the technical knowledge of 9 categories of reference materials through Seminar/Job-training in the STPs under WMA in the Project term. Furthermore, some practical ideas for efficient operation which came from the past experiences at focused sites, such as installation of a coarse screen and introduction of timer control to equipment shall be also spread through the above-mentioned activities continuously.

b. Establishment of information system

It is recommended that the information system shall be developed in accordance with the actual information technology (IT) situation in all municipalities. Therefore, currently the way of dissemination of reference materials shall be selectable between CD-ROM and Download from WMA's web-site. In addition, the function of data processing on O&M data of STPs under WMA shall be installed in the WMA's server system and provide the summary of O&M data of each STP anytime. The 3 kinds of reference materials are available on WMA's web-site at the time of the evaluation. The remaining 6 kinds of reference materials should be available by the time of the Project termination.

6.1.2 Recommendations in the future

a. Update of reference materials

To maintain the efficient and high-quality operation at STPs, the accumulation of innovative ideas and practical troubleshooting cases, which come from the consultation activities by WMA, is very significant. Therefore, it is highly recommended the periodical update of reference materials in the reference material committee consisting of MONRE, PCD, DOLA, WMA and other external knowledgeable persons.

b. Sustainable technical knowledge dissemination by WMA

In the Project, the seminars on Oxidation Ditch method and Stabilization Pond method have been conducted. From the views of sustainability, it is preferable that WMA continuously conducts the seminars on various topics and develops the curricula and textbooks in the future. In addition, dissemination of practical technical knowledge by using WMA newsletter is also effective. We believe the above-mentioned efforts contribute to the sustainable development of WMA.

c. Human resource

To support local government widely and effectively, WMA shall secure the number of engineers in accordance with the number of STPs and continue the human resource development as well as business management development in WMA. In this regard, the continuous effort to collaborate with government agencies, such as Bangkok Metropolitan Administration (BMA), PCD, Office of Natural Resources and Environmental Policy and Planning (ONEP), Department of Environmental Quality Promotion (DEQP) and DOLA will be highly recommended in terms of the human resource development.

d. National policy

To make the WMA's activities toward the sewage treatment more effectively and efficiently, the establishment of sewage act/law and introduction of sewage charge system should be national policy as early as possible.

e. Financial support to local municipalities

Although the area of administration duty increased due to the decentralization policy, there was not enough financial support from central government. Therefore, reviewing the detail condition to utilize the environment fund or other financial resources is needed for municipalities in the near future..

6.2 Lesson Learned

a. Collection of baseline data

There were no base data for the verifiable indicators on unit operation cost and influent wastewater before the rehabilitation work. In addition, it is uncertain whether initial verifiable indicators are appropriate for the project or not at the time of terminal evaluation. Avoiding this, original intention shall be noted as much as possible in the ex-ante evaluation report.

b. Collaboration with other partners

To make the project activities more effective, collaboration led by WMA with other authorities, such as the reference material committee consisting of relevant ministries and authorities, is working well. In this regard, such proactive way of communication with other authorities is very helpful..

6.3 Follow-up status

In the future, WMA will expand to support for local municipalities. However, in order to confirm the continuous activities utilizing reference materials and information system, the necessity of follow-up shall be discussed 1-year later after completion of the Project.

LIST OF ANNEX

Annex 1: Minutes of Meeting
on the Joint Terminal Evaluation Study
(13 July, 2007)

MINUTES OF MEETING

BETWEEN
THE JAPANESE TERMINAL EVALUATION TEAM
AND
THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THAILAND
ON
THE JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR IMPROVEMENT OF SEWAGE TREATMENT PLANT MANAGEMENT IN THAILAND

The Japanese Terminal Evaluation Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. Masazumi Ogawa conducted an evaluation study from July 9th to July 13th, for the purpose of the joint terminal evaluation of the project for improvement of sewage treatment plant management in Thailand (hereinafter referred to as "the Project").

During the study, the Team had a series of discussion with the Thai authorities concerned, jointly evaluated the achievements of the Project, and exchanged views of the Project.

As a result of the study and discussions, both sides agreed to report to their respective Governments the matters referred to in the document attached hereto.

Bangkok, July 13th , 2007

Mr. Masazumi Ogawa	Mr. Somchai Sriavudh
Leader	Acting Director General
Japanese Terminal Evaluation Team,	Wastewater Management Authority
Japan International Cooperation Agency,	Ministry of Natural Resources and Environment
Japan	Kingdom of Thailand

CONTENTS

List of Abbreviations and Acronyms

General Terms

AL	Aerated Lagoon
AS	Activated Sludge
BMA	Bangkok Metropolitan Administration
C/Ps	Counterparts
DEQP	Department of Environmental Quality Promotion
DOLA	Department of Local Administration
JICA	Japan International Cooperation Agency
LAs	Local Authorities
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
OD	Oxidation Ditch
OEPP	Office of Environmental Policy and Planning
O&M	Operation and Maintenance
PCD	Pollution Control Department
PDM	Project Design Matrix
PS	Pumping Station
R/D	Record of Discussion
SP	Stabilization Pond
STP	Sewage Treatment Plant
TICA	Thailand International Development Cooperation Agency
TCSW (project)	Training Center for Sewage Works (project)
WMA	Wastewater Management Authority

1. Introduction

1.1 Background

Thailand has faced various environmental problems due to the rapid economic growth and urbanization. The Department of Public Works of the Ministry of Interior and the former Ministry of Science, Technology and Environment actively promoted the development of sewage treatment facilities of all over Thailand in the 1990s in order to respond to the problem of water pollution. Since Thailand faced shortages of technical personnel who could operate and maintain these newly built facilities appropriately, the Training Center for Sewage Works Project (hereinafter referred to as "the TCSW project") was implemented from August 1995 until July 2000 in order to meet the urgent demands to foster technical personnel. Through the TCSW project, approximately 1,000 technical officers underwent training sessions. However, it became clear that inappropriate designing and insufficient operation and maintenance of sewage treatment plants (hereinafter referred to as "STPs") were root causes of malfunction of many STPs.

In order to improve the efficiency of STPs in Thailand, the Project for Improvement of Sewage Treatment Plant Management (hereinafter referred to as "the Project") was formulated for three and half years since May, 2004, according to the Record of Discussion (R/D) signed on 25th May, 2004 between the Wastewater Management Authority (hereinafter referred to as "WMA") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"). Since the Project commencement, it has been implemented to improve the methods of operation and maintenance (O&M) through rehabilitating and improving insufficiently dysfunctional STPs focused by the Project, and furthermore, it has also produced reference materials for the operation and management of STPs and coordinated technical training programs to enable to apply skills and knowledge obtained through these processes for other STPs.

At present, the number of long term experts dispatched from Japan is four persons (chief advisor/sanitary engineering, design/planning/construction on sewage, electric & machinery engineering and project coordinator/training), and their assisting fields are as follows;

1) Technical assistance of necessary matters concerned with O&M of STPs,
2) Assistance and advice concerned with improvement measures against issues on the focused STPs,
3) Necessary advice on O&M and suggestions on reconstruction of treatment system design,
4) Production of reference materials in the fields of mechanical and electrical equipment, and then,
5) Preparation of training materials necessary for O&M management, and training implementation.

Besides, the mid-term evaluation study for the Project carried out in March 2006, the mid-term evaluation team concluded "given the present status of implementation, the project purpose is expected to be achieved by the end of the Project", and at the same time, it also recommended the following points;

1) Enhancing the collaboration with the Pollution Control Department (PCD),
2) Redefining conditions for the objectively verifiable indicators of the Project output 1,
3) Complementing the indicator 1-2 of the Project output 1,
4) Developing reference materials which can serve many users,
5) Continuing the training activities, and then,
6) Enhancing the public relations activities

Since the Project is scheduled to be terminated at the end of November 2007, this terminal evaluation study is carried out.

1.2 Objectives of the Study

The main objectives of the Study are as follows;

1) To confirm the achievement of the Project purpose and outputs since the Project commencement until the present, and comprehensively evaluate them according to the five evaluation criteria (relevance, effectiveness, efficiency, impact and sustainability) jointly by the Thai and Japanese sides,
2) To discuss the activity plan of the Project in its terminal period, make necessary advice and modify its plan if necessary, and to report and advise its results to both the Thai and Japanese sides concerned, and then,
3) On the basis of the result, to judge the necessity of follow-ups such as appropriateness of the Project termination and extension of the Project period.

1.3 Members of the Study

The Study was carried out by the following Team members.

<Japanese Side>

Name	Duty	Position/affiliation
Mr. Masazumi Ogawa	Leader	Deputy Resident Representative, JICA Thailand Office
Mr. Nobuyuki Horie	Wastewater Operational Management	Japan Sewage Works Agency Deputy Director General for Eastern Japan
Ms. Hiroko Kamata	Wastewater Planning Management	Senior Advisor, Institute of International Cooperation, JICA
Mr. Kazuya Maruo	Cooperation Plan	Assistant Resident Representative, JICA Thailand Office
Ms. Athaneeporn Boonrad	Evaluation Control	Program Officer, JICA Thailand Office
Mr. Minoru Fujii	Evaluation Analysis	Consultant, RECS International Inc.

<Thai Side>

Name	Position/affiliation
Mr. Somchai Sriavudh	Acting Director General, Wastewater Management Authority
Mr. Supparat Ittiphol	Director of Wastewater Management Department, Wastewater Management Authority
Ms. Hatairat Likitanupak	Director of Planning and Development Project, Wastewater Management Authority
Ms. Somsuan Howe	Programme Officer, Thailand International Development Cooperation Agency
Ms. Suthanone Fungtammasan	Programme Officer, Thailand International Development Cooperation Agency

1.4 Major Study Schedule

The major schedule of the Study Team was as follows;

Date			Survey Content	Remarks
July	8	Sun	Data analysis, Document review	Arrival of Ms. Kamata and Mr. Horie
July	9	Mon	Kickoff meeting, Briefing the result of survey Courtesy Call on JICA Thailand Office	
July	10	Tue	Discussion on the actual result of Project	
July	11	Wed	Discussion on the evaluation of Project Interview with responsible personnel of MONRE	
July	12	Thu	Discussion on the draft Joint Evaluation Minutes	
July	13	Fri	JCC Meeting, Discussion of the Joint Evaluation Minutes and Signing the Minutes Report to JICA	

1.5 Summary of the Project

According to the PDM (Annexes), the overall goal, purpose and outputs of the Project are as follows:

Super Goal:
The water quality of public water bodies is improved.

Overall Goal:
Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.

Project Purpose:
Efficient and effective operation method of STPs is established.

Project Outputs:
1) Function of focused STPs is recovered.
2) Reference materials for improvement of sewage treatment plant management are developed.
3) Skilled personnel are 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. 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. Skilled personnel are assigned to operate and maintain the focused STPs appropriately

3-1. Decide areas of necessary knowledge and skills for officers in charge.

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.

1.6 Focused STPs of the Project

There are twelve STPs under WMA and two focused STPs of the Project as follows;

No.	Location of STPs under WMA	Focused STPs (✓)	System
1	Baan Pae		OD
2	Panguan		Wetland
3	Chomseang		SP
4	Huakwang		SP
5	**Kamphaeng Phet**	✓	**SP**
6	Pak Panung		AL + Wetland
7	**Pathumthani**	✓	**OD**
8	Phayao		SP
9	Sakon Nakorn		SP + Wetland
10	Songkha		AL
11	Sri Racha		OD
12	Ta rae		Wetland

Note: OD=Oxidation Ditch, SP=Stabilization Pond Source: WMA

1.7 Methodology of Evaluation

For the objectives of the evaluation study noted before, the following methods are mainly used for the Study.

1) Related information reviews,

2) Questionnaires,

3) Interviews.

The Team has initially started the Study from the collection of information related to the Project. The collection of information on the Project activities and outputs has been based on a review of documents related to the Project, such as the PDM and PO, and R/D and reports of the Project activities and outputs. After confirming the Project achievement through the collected information, the Team has moved to the following works for the preparation of questionnaires to be distributed to

21 persons of the C/P personnel in WMA, while focusing on the five evaluation criteria described above.

After collecting the questionnaires from them, then, the Team has carried out interview surveys with the personnel of the following organizations to question specified and detailed topics concerned with the Project.

Organizations which have been invited to the interview survey

Central government organization	MONRE, DOLA, PCD
Local municipality	Kamphaeng Phet and Pathumthani Municipalities
Counterpart	WMA

In terms of the evaluation analysis for the Study, the five evaluation criteria described below are applied with the evaluation grid for the Study.

Five Evaluation Criteria

Relevance	Relevance of the Project plan is reviewed by the validity of the Project purpose and the overall goal in connection with the development policy of the Government of Thailand and needs of the beneficiaries and also by the logicality of the plan.
Effectiveness	Effectiveness is assessed by evaluating to what extent the Project has achieved its purpose and clarifying the relationships between purpose and outputs.
Efficiency	Efficiency of the Project implementation is analyzed with emphasis on the relationships between outputs and inputs in terms of timing, quality, and quantity.
Impact	Impact of the Project is assessed by measuring either positive or negative influences made by the Project, which are not originally expected in the Project plan.
Sustainability	Sustainability of the Project is assessed in organizational, technical and financial aspects, by the extent to which the achievements of the Project are sustained or expanded after the Project is completed.

The five evaluation criteria are a basic evaluation method set by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) for evaluating project achievements. All JICA projects are today evaluated by means of this evaluation method.

In addition to the methods above, the Study Team also visited the focused STPs in Kamphaeng Phet and Pathumthani Municipalities to support the Study with field surveys on their existing conditions.

2. Project Achievement

2.1 Inputs

2.1.1 Inputs from Japanese side

The Japanese side has input for the Project since its commencement until the present as follows;

1) Long term experts,
2) Short term experts,
3) Counterpart training in Japan, and then,
4) Equipment

The detailed information above is attached in Annexes.

In addition, the Japanese side has allocated and appropriated necessary budget for the Project activities and management as shown in the following table.

Unit: Thousand Japanese yen

Japanese fiscal year	JFY2004	JFY2005	JFY2006	JFY2007
Total cost for the Project Implementation	42,887	81,405	92,350	44,709

Source: JICA

2.1.2 Inputs from the Thai side

The following inputs have been provided by the Thai side for the Project

1) Counterparts

Counterparts have been assigned from the Thai side for the Project.

2) Project office and equipment

Sufficient space for the Project office and sufficient numbers of desks and tables have been prepared by the Thai side for the Project.

3) Others

Other costs for the Project have been allocated by the Thai side as shown in the following table.

Unit: Thai baht

Year	2004	2005	2006	2007	Total
By WMA For training sessions			32,000	43,000*	75,000*
By TICA For utility and administration	56,760	158,060	132,880	205,170*	552,870*
Total	56,760	158,060	164,880	248,170*	627,870*

Source: 1) Mid-term evaluation study report
2) Information from the Project team
*: Estimation

2.2 Outputs

Output 1: Function of focused STPs is recovered.

Indicator 1-1: Unit cost (Baht/m^3) is reduced by 20% at focused STPs.

- As for the base data for the unit costs for the focused STPs.

a) The focused STP in Pathumthani was out of operation completely before the completion of the rehabilitation in May 2005.

b) There were no reliable flow rate data in Kamphaeng Phet, when the Project was started.

- Therefore, the mid-term evaluation team has recommended as the follows;

a) "For STP in Pathumthani, the base data for the unit cost should be 10. 4 baht/m^3 of May 2005." (Base data should be data obtained before employing cost reduction suggestions by the Japanese experts.)

b) "For STP in Kamphaeng Phet, the base data for the unit cost should be the average unit cost of January and February 2006".

c) "Cost reduction effects by such elements as electricity, personnel and chemical expense should be also considered"

- Given the above, the reductions in unit costs are calculated as follows:

Pathumthani

	Base data (as of May, 2005)	Actual data (Average of May, 2006 – May, 2007)	Cost reduction	Indicator required
Total cost	10.4 baht/m^3	6.9 baht/m^3	34%	20 %
(Electricity cost)	(3.2 bath/m^3)	(1.2 baht/m^3)	(62 %)	

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

	Base data (Average of March – April, 2006*)	Actual data (Average of March – April, 2007)	Cost reduction	Indicator required
Total cost	2.4 baht/m^3	2.2 baht/m^3	10 %	20 %
(Electricity cost)	(0.54 bath/m^3)	(0.34 baht/m^3)	37 %	

*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.

Indicator 1-2: Treated wastewater is increased by 30% at focused STPs

- 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

- The mid-term evaluation for the Project was considered as follows:

"For the focused STPs where there is limited room to increase 30% of the volume of treated wastewater by O&M, technical suggestions and proposals related to improvement of wastewater collection system, etc., should be made to increase efficiency of the focused STPs."

* The following suggestions and proposals were made in the Project.

a) Acceptance of Business-based wastewater (two focused sites)

b) Sewage area expansion (Pathumthani municipality)

c) Survey for the acceptance sewage water from nearby municipalities (Kamphaeng Phet)

- Moreover, the mid-term evaluation team recommended the following point.

"The volume of influent wastewater of December 2005, January and February 2006 on average should be applied as base data."

a) Pathumthani

	Base data (Average of December 2005 – March 2006*)	Actual data (Average of February and March 2007**)	Increase in treated wastewater	Indicator required
Influent wastewater	22,001 (16,501)*** m^3/month	27,578 m^3/month	25 % (40 %)***	30 %

* 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) Kamphaeng Phet

	Base data (Average of December 2005 – March 2006*)	Actual data (Average of December 2006, February and March 2007**)	Increase in treated wastewater	Indicator required
Influent wastewater	90,473 m^3/month	72,037 m^3/month	-20 %	30 %

* 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

- 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.

Indicator 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.

Output 2: Reference materials for improvement of sewage treatment plan management are developed.

Indicator 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;
   * 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.

Output 3: Skilled personnel are assigned to operate and maintain the focused STPs appropriately.

Indicator 3-1: Personnel assigned for the focused STPs undergo training organized by the Project.

- The numbers of seminar participants as follows;

Date	Contents		No. of Attendance								
			WMA	PCD/ ONEP	Kamphaeng Phet (SP)		Pathumthani (OD)		Other municipalities under WMA	Others municipality not under WMA	Total
					Muni-cipality	O&M contractor	Muni-cipality	O&M contractor			
30 Jan – 3 Feb, 2006	OD system	A	18	0			0*	2	3	5	28
		B	18	0			0*	2	3	5	28
29 – 31 Jan, 2007	SP system	A	17	2	0	2			9	60	90
		B	17	5	1	3			10	84	120

Note: A= No. of certified persons, B= No. of participants
* All engineers have joined the seminar as trainers
Source: Attendance lists from the Project

- 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

Besides, 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

Indicator 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.

Output 4: Information system is established to disseminate reference materials and to collect O&M data.

Indicator 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.

Indicator 4-2: O&M data of all of the focused STPs is collected 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.

2.3 Project Purpose

Indicator 1-1: 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.

Indicator 1-2: 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.

Based on the result of the detail assessment described in the section 3.2 "Effectiveness", it was confirmed that the adequate generation of outputs contributes to the achievement of the project purpose to a certain extent. By the end of the Project, it is possible to achieve Project Purpose with more satisfactory level when the reference materials are fully developed and its contents are disseminated to all the STPs under WMA.

2.4 Overall goal

Indicator 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.

Indicator 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.

The indicators potentially contributing to the achievement of the project overall goal have already been identified in the focused STPs through the evaluation study. However, it does not extend its influence widely enough to reach all the STPs in Thailand. Therefore, it could be assessed that the overall goal of the project in future might be achieved if the conditions described in the important assumptions, such as people awareness to pay the sewage charge and the wastewater collection system owned by each municipality, are solved in the near future.

3. Evaluation by Five Criteria

3.1 Relevance

a. Facts and Findings

Focal point	Result
Thai policies and approaches	• 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. This policy places great importance on water quality improvement and wastewater treatment. • Under the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand (hereinafter referred to as the "Rehabilitation Plan") formulated by the Pollution Control Department (PCD) under the Ministry of Natural Resources and Environment (MONRE) 2003-2007, 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. However, WMA has been operating for just 12 years, and its technical personnel as a whole is still new to the sewage field. So, by assisting WMA, the enhancement of sewage techniques in Thailand can be expected.
Selection of C/P organization	• 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 itself by processing to the Cabinet. Under these circumstances, fostering of skilled personnel of WMA is urgently needed.
Japan's ODA scheme and JICA programs	• 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. • 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.
Technical advantage of Japan	• In Japan, there is an organization called the Japan Sewage Works Agency (JSWA) which functions much like WMA. Through the technical activities of JSWA, the construction of sewage treatment plants (STPs) and development of essential technical skills have been widely well-evaluated in

Focal point	Result
	Japan. • Furthermore, JSWA has accumulated sufficient technical skills and knowledge in the sewage field through its long experience in large Japanese cities such as Tokyo and Yokohama, and the skills and knowledge obtained from the experiences have been aggregated into various technical guidelines through the Sewage Works Association. • With the skills and knowledge from theory to practice, it is useful to improve Thai sewage technology by assisting WMA.

b. Conclusion

The relevance of the Project is assessed still high based on the consistency of Thai and Japanese policies. Moreover, the awareness of environmental condition and protection in urban areas of Thailand would boost the introduction of more strong measures upon Thai environmental policies.

3.2 Effectiveness

a. Facts and Findings

Focal point	Result
Degree of achievement of the Project purpose	• 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. • 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.
Assessment of relation between the Project outputs and purpose	• The average budget of O&M in municipalities from 2005 to 2007 has no significant change according to the report of budget allocation for STP O&M by DOLA. • All the contents of the English reference materials have been confirmed and approved by the JCC meeting. • 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. • Information system is not established enough for utilization by organization/ personnel concerned. • The reference materials will be available in digital forms by the end of the Project term.

b. Conclusion

The result of assessment on indicators above 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, it is fair to conclude that the Project purpose would be achieved to a certain level by the time of the Project termination.

3.3 Efficiency

a. Facts and Findings

Focal point	Result
Degree of achievement of inputs	(Japanese side) • A total of six long-term experts and seven short-term experts have been dispatched since the Project commencement until the present appropriately. • Most answers to the questionnaire survey says that the number, timing, dispatch term and technical capacity of the Japanese experts have been appropriately. • Equipment has been provided for the Project as originally planned. • Totally 5 C/Ps have been in Japan for training programs. (Thai side) • Full and part time C/Ps have been assigned appropriately. • Space for the Project office has been provided. • Equipment for STPs has been prepared. • Necessary budgets for rehabilitation of STPs, training and O&M of STPs have been released. • The following table shows the numbers of seminar participants as the Project inputs.

Date	Contents		No. of Attendance								
			WMA	PCD/ ONEP	Kamphaeng Phet		Pathumthani		Other municipalities under WMA	Others municipality not under WMA	Total
					Muni-cipality	O&M contractor	Muni-cipality	O&M contractor			
30 Jan – 3 Feb, 2006	OD system	A	18	0			0*	2	3	5	28
		B	18	0			0*	2	3	5	28
29 – 31 Jan, 2007	SP system	A	17	2	0	2			9	60	90
		B	17	5	1	3			10	84	120

Note: A= No. of certified persons, B= No. of participants
* All engineers have joined the seminar as trainers
Source: Attendance lists from the Project

- In addition to the seminars above, follow-up, OJT and short seminars/programs have been organized appropriately.
- C/P personnel in charge of WMA staffs have been appropriately trained and assigned for O&M of information system.
- 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

  Besides, 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 appliance
  - ✶ 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

Assessment of relation between inputs and outputs	• Trained personnel in C/P organizations are still working continuously by the time of the Study. • The O&M contractor of the focused STP in Pathumthani trained in the Project was replaced with other contractor in the mid of the Project which did not have training session in the Project.

Focal point	Result
Degree of achievement of outputs	• Total cost at the focused STP in Pathumuthani reduced to 34 % • Total cost at the focused STP in Kamphaneg Phet reduced to 10% • Influent wastewater at the focused STP in Pathumthani increased to 25% • Influene 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. • 9 reference materials were developed. • Skilled personnel are assigned to operate and maintain the focused STPs appropriately. • Information system will be established to disseminate the reference materials to collect O&M data by the time of the Project termination.

b. Conclusion

It is confirmed that the contents of input were introduced as planned based on the result of document review and hearing from the experts.

The timing and quantity of input could be evaluated quite efficient by assessing the result of the questionnaire survey, of which most of respondents rated "very much" or "much" in questions concerned.

However, it could be assessed that the earlier preparation of reference materials would enhance more the degree of output generation by the result of the interview survey conducted at the focused STPs, which could eventually support the achievement of overall goal of the Project.

3.4 Impact

a. Facts and Findings

Focal point	Result
Degree of achievement of overall Goal	• According to the "Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand" released by PCD, 46 units of STPs are planed to be rehabilitated by 2009. (Indicator 1: Overall Goal) • The 16 Regional Provincial Offices under MONRE have conducted routine monitoring of the quality of effluent from all STPs in Thailand and submitted the report to PCD 4 times/year. Due to the lacking of reference effluent standard of municipal wastewater, PCD has referred to the building effluent standard type A*. However, the process of setting up the effluent standard of municipal wastewater is now ongoing. (Indicator 2: Overall Goal) * Notification of the Ministry of Natural Resources and Environment: Building Effluent Standards dated November 7, B.E. 2548 (2005) published in the Royal Government Gazette, vol. 122 Part 125 D, dated December 29, B.E. 2548 (2005).
Assessment of relation between the Project purpose and overall goal	• According to the interview survey and document review on the current situation of conducting public opinion surveys for collection wastewater treatment fee of 11 STPs under WMA, it was indicated that: 2 focused STPs • Kamphaeng Phet Municipality: - 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. - 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. • Pathumthani Municipality: - There is no plan to conduct public opinion survey on this matter

Focal point	Result
	since the municipality considers that the central government should take responsibility to raise people awareness and persuade them to pay the sewage charge. 9 STPs under WMA • 1 municipality – Sri Racha – has already applied the fee collection system. • 3 municipalities – Baan Pae, Tarae, and Songkha - have been prepared for setting up fee collection system. The implementation will be done as soon as the related regulations are set and approved. • 5 municipalities – Sakonnakorn, Huakwang, Chomsang, Phayao, and Pha Ngun (Baan Tai) – are in the process of WMA implementation. (Important assumption 1: Project purpose) • 10 out of 15 persons answered in the Questionnaire that all the STPs under WMA have been operated efficiently and effectively in the rate of "very much" and/or "much." (Important assumption 2: Project purpose) • Referring to "the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for overall Thailand (2004-2009)" prepared by PCD; 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. (Important assumption 2: Project purpose) • Referring to the result of interview survey with PCD officers in charged, the priority area defined in the Rehabilitation Plan might be changed depending on budget and existing facilities in each area. (Important assumption 2: Project purpose)
Assessment of unexpected factors	• 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.
Assessment of ripple effects from the Project	• Since wastewater management involves central and local governments, there have been opportunities to exchange beneficial ideas and opinions through the Project activities. • Wastewater treatment management can be applied for other urban management such as water supply. Through the Project, C/Ps have also been interested in other urban management.

b. Conclusion

Indicators verifying the achievement of the project overall goal have emerged in some fields according to the result of the various evaluation surveys. However, it may be reasonable that the level of this achievement is assessed under the satisfactory level since the improvement of the conditions identified in the important assumption meets the expected level.

It is quite difficult to estimate the necessary time to achieve the project overall goal with satisfactory level but firmly confirmed that the movement toward the overall goal has already begun.

3.5 Sustainability

<table>
<tr><th>Focal point</th><th>Result</th></tr>
<tr><td>Technical aspect</td><td>

With technical skills and knowledge obtained from the Project, C/Ps have opportunities to share their positive ideas with others concerned with wastewater treatment.
As a result, they have started creating technical events such as workshops and improving contents of their news letters to explain technical matters to ordinary people.
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.
As a result, it can be expected that the materials are authorized.
It is confirmed that the project has identified many requests from the municipalities for the technical consultation. This proves that WMA consultation is reliable at the present.

</td></tr>
<tr><td>Organizational and institutional aspects</td><td>

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 as follows;

<table>
<tr><th>Year</th><th>2006</th><th>2007</th><th>2008</th><th>2009</th><th>2010</th></tr>
<tr><td>Total No. of WMA's employees</td><td>104</td><td>108</td><td>118</td><td>128</td><td>138</td></tr>
</table>
<table>
<tr><td>No. of staff of Engineering Dept.</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>No. of staff of Wastewater Management Dept.</td><td>8</td><td>7</td><td>9</td><td>10</td><td>11</td></tr>
<tr><td>No. of staff Statistical Data Development Div.</td><td>5</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
</table>
Source: 1) Mid-term evaluation study report
2) Interview survey to WMA

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 as follows based on the request from the local governments;

<table>
<tr><th></th><th>2007</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr>
<tr><td>No. of STPs under WMA</td><td>12</td><td>28</td><td>38</td><td>48</td><td>58</td></tr>
<tr><td>Effluent (million m^3)</td><td>7.78</td><td>27.66</td><td>43.25</td><td>50.59</td><td>87.59</td></tr>
</table>
Source: WMA's 4 year operation plan (2008-2011)

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.
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.
Training works on sewerage targeting at personnel of local authorities is also examined to carry out continuously after the Project termination.

</td></tr>
<tr><td>Political aspect</td><td>

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.

</td></tr>
<tr><td>Financial aspect</td><td>

The WMA's 4-year operational plan programs revising its budgets for an increase in the number of STPs under WMA.

</td></tr>
</table>

b. Conclusion

Assessing comprehensively the facts and findings above, it could be concluded that the sustainability of the Project would be secured by the active utilization of reference materials by the target groups or related organizations. In this regard, the dissemination activities planned in the Project will be important and expected to be conducted effectively.

Once the reference materials prepared by the Project become reputed among the Thai society of this field, the impact generated by the Project may be sustained or even improved continuously.

According to the statement from the representative from MONRE, MOF and DOLA at the Seminar held on June 7, 2007, relative government organization will support for the WMA's 4-year plan. In addition, it was recognized by result of questionnaire survey, etc., that 45 local municipalities submitted request letters for the support from WMA. Therefore, in this aspect the WMA's 4-year plan would be feasible planning.

4. Conclusion

The overall results of the Project are fairly good for the following reasons:

a) Two focused STPs have been recovered its function. In addition, many useful recommendations on maintenance and operation have maximized the efficiency of the focused STPs.

b) 9 reference materials were already developed, and these materials consist of not only theoretical knowledge but also practical know-how. In addition, the practical knowledge and experience, through the rehabilitation works and technical support for C/Ps, were also reflected on the reference materials.

c) By technical support to other STPs under WMA with C/Ps, the capability of C/Ps was enhanced and it is expected that the results of the Project will be disseminated the wider area in Thailand.

However, to sustain the project purpose, the enforcement of WMA capability in both quantity and quality is strongly required.

In addition, there are some hindering factors to achieve the overall goal of the Project, such as willingness to pay sewage charge for O&M costs, problems on wastewater collecting system and institutional framework of legislation to overcome them. To promote the utilization of the results of the Project in all over Thailand, it is quite significant to resolve these hindering factors as early as possible.

5. Recommendations and Lessons Learned

5.1 Recommendations

5.1.1 Recommendation to be considered before termination of the Project

a) Active utilization of Reference materials

It is recommended to disseminate the technical knowledge of 9 categories of reference materials through Seminar/Job-training in the STPs under WMA in the Project term. Furthermore, some practical ideas for efficient operation which came from the past experience at focused sites, such as installation of a coarse screen and introduction of timer control to equipment shall be also spread through the above-mentioned activities continuously.

b) Establishment of information system

It is recommended that the information system shall be developed in accordance with the IT situation in all municipalities. Therefore, currently the way of dissemination of reference materials shall be selectable between CD-ROM and Download from WMA's web-site. In addition, the function of data processing on O&M data of STPs under WMA shall be installed in the WMA's server system and provide the summary of O&M data of each STP anytime.

The 3 reference materials are available on WMA at the time of the evaluation. The remaining 6 reference materials should be available by the time of the Project termination.

5.1.2 Recommendation in the future

a) Update of Reference materials

To maintain the efficient and high-quality operation at STPs, the accumulation of innovative ideas and practical troubleshooting case, which come from the consultation activities by WMA, is very significant. Therefore, it is highly recommended the periodical update of reference materials in the Reference material committee consisting of MONRE, PCD, DOLA, WMA and other external knowledgeable persons.

b) Sustainable technical knowledge dissemination by WMA

In the Project, the seminars on Oxidation Ditch method and Stabilization Pond method have been conducted. From the views of sustainability, it is preferable that WMA continuously conducts the seminars on various topics and develops the curricula and textbooks in the future. In addition, dissemination of practical technical knowledge by using WMA newsletter is also effective. We believe the above-mentioned efforts contribute to the sustainable development of WMA.

c) **Human Resource**

To support local government widely and effectively, WMA shall secure the number of engineers in accordance with the number of STPs and continue the human resource development as well as business management development in WMA. In this regards, the continuous effort to collaborate with government agencies, such as BMA, PCD, ONEP, DEQP and DOLA will be highly recommended in terms of the human resource development.

d) **National Policy**

To make the WMA's activities toward the sewage treatment more effectively and efficiently, the establishment of sewage act/law and introduction of sewage charge system should be national policy as early as possible.

e) **Financial Support to local municipalities**

Although the area of administration duty increased due to the decentralization policy, there was not enough financial support from central government. Therefore, reviewing the detail condition to utilize the environment fund or other financial resources is needed for municipalities in the near future.

5.2 Lessons Learned

a) **Setting indicators of Project Design Matrix**

There were no base data for the verifiable indicators on unit operation cost and influent wastewater before the rehabilitation work. In addition, it is uncertain whether initial verifiable indicators are appropriate for the project or not at the time of terminal evaluation. Avoiding this, original intention shall be noted as much as possible in the ex-ante evaluation report.

b) **Collaboration with other organizations**

To make the project activities more effective, collaboration led by WMA with other authorities, such as the reference material committee consisting of relevant ministries and authorities, is working well. In this regards, such proactive way of communication with other authorities is very helpful.

Annex 2: Project Design Matrix (PDM)

Annex 2: Project Design Matrix (PDM) (1/2)

Version: 2 Date of revision: March 8, 2006

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. ● The problems relating to the wastewater collection system are solved.
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. Operation report of each STP 1-2. Operation report of each STP 1-3. 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. Skilled personnel are assigned to operate and maintain the focused STPs appropriately.	3-1. Personnel assigned for the focused STPs undergo trainings organized by the project. 3-2. All of the focused STPs are managed by skilled 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.	

Annex 2: Project Design Matrix (PDM) (2/2)

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. Skilled personnel are assigned to operate and maintain the focused STPs appropriately 3-1. Decide areas of necessary knowledge and skills for officers in charge. 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 3: Plan of Operation (P/O)

Annex 3: PLAN OF OPERATION (Plan & Progress)

Schedule of Activities

Red Line: progress BlueLine: plan Note: (*)Jun. including from 25 to 31 May 04.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
	(*)Jun. 04	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 05	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 06	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 07	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	24 Nov. 07
1. Function of focused STPs is recovered.																																										
1-1. Review rehabilitation plan of existing 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 sewerage treatment plant management																																										
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. Skilled personnel are assigned to operate and maintain STPs appropriately.																																										
3-1 Decide areas of necessary knowledge and skills for officers in charge.																																										
3-2 Prepare training materials.																																										
3-3 Execute training.																																										
4. Information system is established to disseminate reference materials.																																										
4-1 Prepare reference materials for dissemination.																																										
4-2 Collect operation and maintenance data report.																																										
4-3 Collect completion document (construction drawings, etc.)																																										
4-4 Investigate existing information systems.																																										
4-5 Develop information system modifying existing ones.																																										
Midterm and Final evaluation, Closing seminar																																										

Schedule of Personnel

Personnel/Months

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	Total
Long-Term Experts																																											
Chief Advisor/sanitary engineering																																											42MM
Advisor for planning/designing/construction																																											36MM
Advisor for mechanical/electrical equipment																																											29MM
Coordinator/training																																											31MM
Short-Term Experts																																											
Expert in charge of mechanical/electrical equipment																																											4 MM
Expert in charge of O&M																																											5 MM
Expert in charge of management for construction works and inspection																																											3 MM
Expert in charge of training																																											6 MM

Work plan for the output "1. Function of focused STPs is recovered."

1. Function of focused STPs is recovered.	23 Apr. 06	24 May	25 Jun.	26 Jul.	27 Aug.	28 Sep.	29 Oct.	30 Nov.	31 Dec.	32 Jan. 07	33 Feb.	34 Mar.	35 Apr.	36 May	37 Jun.	38 Jul.	39 Aug.	40 Sep.	41 Oct.	42 Nov.
1-1. Review rehabilitation plan of existing STPs.																				
Pathumthani rehabilitation and O&M works																				
Kampheng Phet rehabilitation works																				
1-2. Support implementation of rehabilitation focused STPs.																				
Kampheng Phet rehabilitation works																				
Oversee of Progress																				
Proposal for improvement of rehabilitation works																				
1-3. Inspect rehabilitation works.																				
Pathumthani rehabilitation works																				
Kampheng Phet rehabilitation works																				
1-4. Operate and maintain rehabilitated STPs.																				
Pathumthani O&M works																				
O&M check-point																				
Evaluation																				
Kampeng Phet O&M works																				
O&M check-point																				
Evaluation																				

Work plan for the output "2. Reference materials for improvement of sewerage treatment plant management are developed."

2. Reference materials for improvement of sewerage treatment plant management	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
	Apr. 06	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 07	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
2-1 List necessary reference materials.																				
List necessary reference materials.																				
2-2 Examine methodology to develop reference materials.																				
Examine methodology to develop reference materials.																				
2-3 Conduct research works for development																				
Pathumthani wastewater system document collection and house connecting condition																				
Water quality analysis of nine treatment plants																				
Existing standard for construction quality																				
Pumping station data collection																				
Sewage treatment plant data collection																				
2-4 Develop reference materials.																				
1.Analysis of existing wastewater systems																				
2.Guideline 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.Guideline 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																				
Revise and update																				

Work plan for the output "3. Skilled personnel are assigned to operate and maintain STPs appropriately."

3. Skilled personnel are assigned to operate and maintain STPs appropriately.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
	Apr. 06	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 07	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
3-1 Decide areas of necessary knowledge and skills for officers in charge.																				
Decide areas of necessary knowledge and skills for officers in charge																				
3-2 Prepare training materials.																				
Text compiling																				
Reviewing of available existing text book																				
Writing and compiling of new text book																				
3-3 Execute training.																				
Selection of lecturer																				
Preparation of program																				
Training																				

Work plan for the output "4. Information system is established to disseminate reference materials."

4. Information system is established to disseminate reference materials.	23 Apr. 06	24 May	25 Jun.	26 Jul.	27 Aug.	28 Sep.	29 Oct.	30 Nov.	31 Dec.	32 Jan. 07	33 Feb.	34 Mar.	35 Apr.	36 May	37 Jun.	38 Jul.	39 Aug.	40 Sep.	41 Oct.	42 Nov.
4-1 Prepare reference materials for dissemination.																				
Prepare reference materials for dissemination.																				
4-2 Collect operation and maintenance data report.																				
Prathumthani operation and maintenance data collection																				
Kanpeng Phet operation and maintenance data collection																				
4-3 Collect completion document																				
Collect completion document (construction drawings, etc.)																				
4-4 Investigate existing information systems.																				
Investigate existing information systems.																				
4-5 Develop information system modifying existing ones.																				
Develop information system modifying existing ones.																				

Annex 4-1: Record of Discussion on May 25, 2004

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

With reference to the technical cooperation project concerning the Project for Improvement of Sewage Treatment Plants Management in Thailand (hereinafter referred to as "the Project"), the Resident Representative of Japan International Cooperation Agency (hereinafter referred to as "JICA") in Thailand exchanged views and had series of discussion with Wastewater Management Authority (hereinafter referred to as WMA) with respect to desirable measures to be taken by JICA and Thai Government for the successful implementation of the above-mentioned Project.

As a result of discussions, it has been decided that the Project is implemented in accordance with the 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") and the Embassy of Japan's Note No. 88/16 and No. 127/16 dated March 26, 2004 and April 22, 2004 respectively, and by the Department of Technical and Economic Cooperation, Ministry of Foreign Affairs Note No. 0607/4882 dated May 3, 2004.

JICA and WMA agreed on the matters referred to in the document attached hereto.

Bangkok, May 25, 2004

Mr. Shinya Nakai	Mr. Akanit Ampawasiri
Resident Representative,	Acting Director General
Japan International Cooperation Agency	Wastewater Management Authority
Thailand Office	Ministry of Natural Resources and Environment
Japan	Kingdom of Thailand

ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH COUNTRIES

1. WMA will implement the "Project for Improvement of Sewage Treatment Plants Management in Thailand" (hereinafter referred to as "the Project") in cooperation with JICA.

2. The Project will be implemented in accordance with the Master Plan, which is given in Annex-I. Both sides agreed that the Master Plan will be modified following the result of a study mission (hereinafter referred to as "the Mission"), which will be dispatched at the initial stage of the Project.

II. MEASURES TO BE TAKEN BY JAPANESE SIDE

In accordance with the laws and regulations in force in Japan and the provisions of Article III of the Agreement, JICA will take, at its own expense, the following measures which will be modified according to the Master Plan of I.2 under the technical cooperation scheme of Japan. Such privileges and benefits will be provided for the actual implementation in Thailand.

1. DISPATCH OF JAPANESE EXPERTS

   JICA will provide the services of the Japanese experts listed in Annex-II. The provisions of Article IV of the Agreement will be applied to the above-mentioned experts.

2. PROVISION OF MACHINERY AND EQUIPMENT

   JICA will provide such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex-III. The provisions of Article VIII-1 of the Agreement will be applied to the Equipment.

3. TRAINING OF THAI PERSONNEL IN JAPAN

   JICA will receive Thai counterpart personnel connected with the Project for technical training in Japan when necessity arises based on the advise of the Japanese experts in consultation with the Thai authorities concerned.

III. MEASURES TO BE TAKEN BY THAI SIDE

1. WMA will take necessary measures to ensure that the self-reliant operation of the Project will be sustained during and after the period of Japanese technical cooperation through the full and active involvement in the Project of all related authorities, beneficiary groups and institutions.

2. WMA will ensure that the technologies and knowledge acquired by Thai nationals as a result of Japanese technical cooperation will contribute to the economic and social development of the Kingdom of Thailand.

3. Specific privileges and other benefit necessary for the conduct of the Project will be provided in accordance with the Agreement.

4. WMA will take necessary measures to ensure that the knowledge and experience acquired by Thai counterpart personnel from technical training in Japan will be utilized effectively in the implementation of the Project.

5. In accordance with the provisions of Article IV- (b) of the Agreement, WMA will provide the services of Thai counterpart personnel and administrative personnel as listed in Annex-IV.

6. In accordance with the provisions of Article IV- (a) of the Agreement, WMA will provide the buildings and facilities listed in Annex-V.

7. In accordance with the laws and regulations in force in the Kingdom of Thailand, WMA will take necessary measures to supply or replace at its own expense machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the Equipment provided through JICA under II-2 above.

8. In accordance with the laws and regulations in force in the Kingdom of Thailand, WMA will take necessary measures to meet the running expenses necessary for the implementation of the Project.

IV. ADMINISTRATION OF THE PROJECT

1. Director General of WMA, as the Project Director, will bear overall responsibility for the administration and implementation of the Project.

2. Mr. Suchai Janepojanat, Director of Survey Department of WMA, as the Project Manager, will be responsible for the managerial and technical matters of the Project.

3. The Japanese Chief Advisor will provide necessary recommendations and advice to the Project Director and the Project Manager on any matters pertaining to the implementation of the Project.

4. The Japanese experts will give necessary technical guidance and advice to Thai counterpart personnel on technical matters pertaining to the implementation of the Project.

5. The Project Office will be set up in WMA and will act as the center for Project coordination of administrative and technical matters. The Project organization chart is described in Annex-VI.

6. For the effective and successful implementation of technical cooperation for the Project, a Joint Coordinating Committee will be established whose functions and composition are described in Annex-VII.

V. TERM OF COOPERATION

The duration of technical cooperation for the Project under this Attached Document will be tentatively three and a half (3.5) years starting from the May 25, 2004. Both sides agreed that the duration of the Project will be fixed based on the result of the Mission.

VI. JOINT EVALUATION

Evaluation of the Project will be conducted jointly by the two Governments through JICA, and Thai authorities concerned during the last six months of the cooperation term in order to examine the level of achievement.

VII. MUTUAL CONSULTATION

There will be mutual consultation between JICA and WMA on any major issues arising from, or in connection with, this Attached Document.

VIII. MEASURES TO PROMOTE UNDERSTANDING AND SUPPORT FOR THE PROJECT

For the purpose of promoting support for the Project among the people of the Kingdom of Thailand, WMA will take appropriate measures to make the Project widely known to the people of the Kingdom of Thailand.

IX. CLAIMS AGAINST JAPANESE EXPERTS

In accordance with the provisions of article-VII of the Agreement, the Government of Thailand undertakes to bear claims, if any arises, against the Japanese experts engaged in technical cooperation for the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the Kingdom of Thailand except for those arising from the willful misconduct or gross negligence of the Japanese experts.

X. OTHER

The Mission mentioned in 1.- 2. above aims at grasping baseline/detailed situation of WMA and relevant sewage treatment plants, and future plan on extension of WMA operation toward other STPs, and at formulating detailed technical cooperation plan including scope of the Project, schedule, input and its terms of reference.

LIST OF ANNEX

R G.

ANNEX-I MASTER PLAN

1. Overall Goal

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

2. Project Purpose

Efficient and effective operation method of STPs is established.

3. Output of the Project

1) Guidelines (O&M, P&D) at sewage system appropriate for Thailand (tropical area) are developed.
2) Awareness of decision-makers of local governments and general public for sewage works is improved, for collection of sewage charge.
3) Managers of target STPs will be able to manage the plant appropriately.
4) Chief operators of target STPs will be able to operate the plant appropriately.
5) Operation and maintenance information is exchanged among target local governments and target STPs in order to disseminate the guidelines and successful examples.

4. Activities of the Project

1-1) Collect data/analyze problems affecting the operation of plant.
1-2) Clarify factors contributing to each problem.
1-3) Set the target of operation and maintenance (e.g. BOD, sludge, equipment).
1-4) Improve the target treatment plants.
1-5) Test/run the improved system and evaluate data.
1-6) Set the guideline for operation and maintenance.
1-7) Set strategies to disseminate the guidelines.

2-1) Conduct awareness survey on sewage works to the local governments and general public.
2-2) Study the socio-economic background and attitude of the target community.
2-3) Plan the strategy to increase awareness of local governments and general public.
2-4) Develop material for local governments and public on sewage works.
2-5) Prepare draft guideline and methodology.
2-6) Implement public relation on sewage works.
2-7) Implement awareness campaign of Polluter-Pay Principle to the target population and local governments.
2-8) Conduct workshop/seminar for councilors and executives to pay much attention on sewage works.

2-9) Evaluate the result of the activities implementation.

3-1) Set the qualification standards of managers that should be achieved by the training.

3-2) Develop training guideline for STP managers.

3-3) Develop materials for manager training.(For trainers and trainee)

3-4) Train trainers for OJT (On The Job Training) and training course.

3-5) Conduct OJT and training course.

3-6) Evaluate the training effect and improve the training guideline.

4-1) Set the qualification standards of chief operators that should be achieved by the training.

4-2) Develop training guideline for STP chief operators.

4-3) Develop materials for chief operator training.(For trainers and trainee)

4-4) Train trainers for OJT (On The Job Training) and training course.

4-5) Conduct OJT and training course.

4-6) Evaluate the training effect and improve the training guideline.

5-1) Collect operation and maintenance data report.(daily weekly monthly yearly report)

5-2) Collect completed document.(Construction drawings, plants specifications, As-built drawings)

5-3) Develop an information exchange system (e.g. Stand -alone, Local LAN, The Internet)

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 for the first year:

1) Chief Advisor/ Civil Engineering
2) Sewerage System Administration

The number and the field of the long-term experts will be modified according to the modification of PDM, following the result of the Mission.

1) **Chief Advisor/ Civil Engineering** (Terms of Reference)

Assignment title	Chief Advisor/ Civil Engineering
Period of Assignment	Approximately one year from the end of May 2004
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) Work out 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.
e) Give necessary guidance and advice to the Mission on the technical matters.

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) **Sewerage System Administration** (Terms of Reference)

Assignment title	Sewerage System Administration
Period of Assignment	Approximately one year from the end of May 2004
Duty station	WMA

Duties

a) Give necessary guidance and advice to counterpart personnel on technical matters concerning the sewerage system administration.

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

c) Give necessary guidance and advice to counterpart personnel for the training of chief operators and managers of target STPs.

d) Give necessary guidance and advice to the Mission on the technical matters.

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 management
d) Language	Fluent in English

2. Short-term experts

The number and the 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.

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 target STPs
   (2) Equipment for information exchange system
   (3) Equipment for training

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-IV LIST OF THAI COUNTERPART AND ADMINISTRATIVE PERSONNEL

1. Project Director : Director General of WMA

2. Project Manager : Director of Survey Department

3. Counterpart Personnel

   Suitably qualified personnel assigned continuously to work with Japanese experts as below;

   1) Director of Survey Department
   2) Director of Planning & Development Project Department
   3) Chief of Project Development and Planning Division
   4) Chief of Wastewater Management Department
   5) Chief of Technology and General Information Division

4. Administrative Personnel

   1) Director of Office Director
   2) Acting Chief of Coordination Division
   3) Researcher of Technology and General Information Division
   4) Analyst of Coordination Division

5. Other personnel mutually agreed upon as necessary

5. ANNEX-V LIST OF BUILDINGS AND FACILITIES

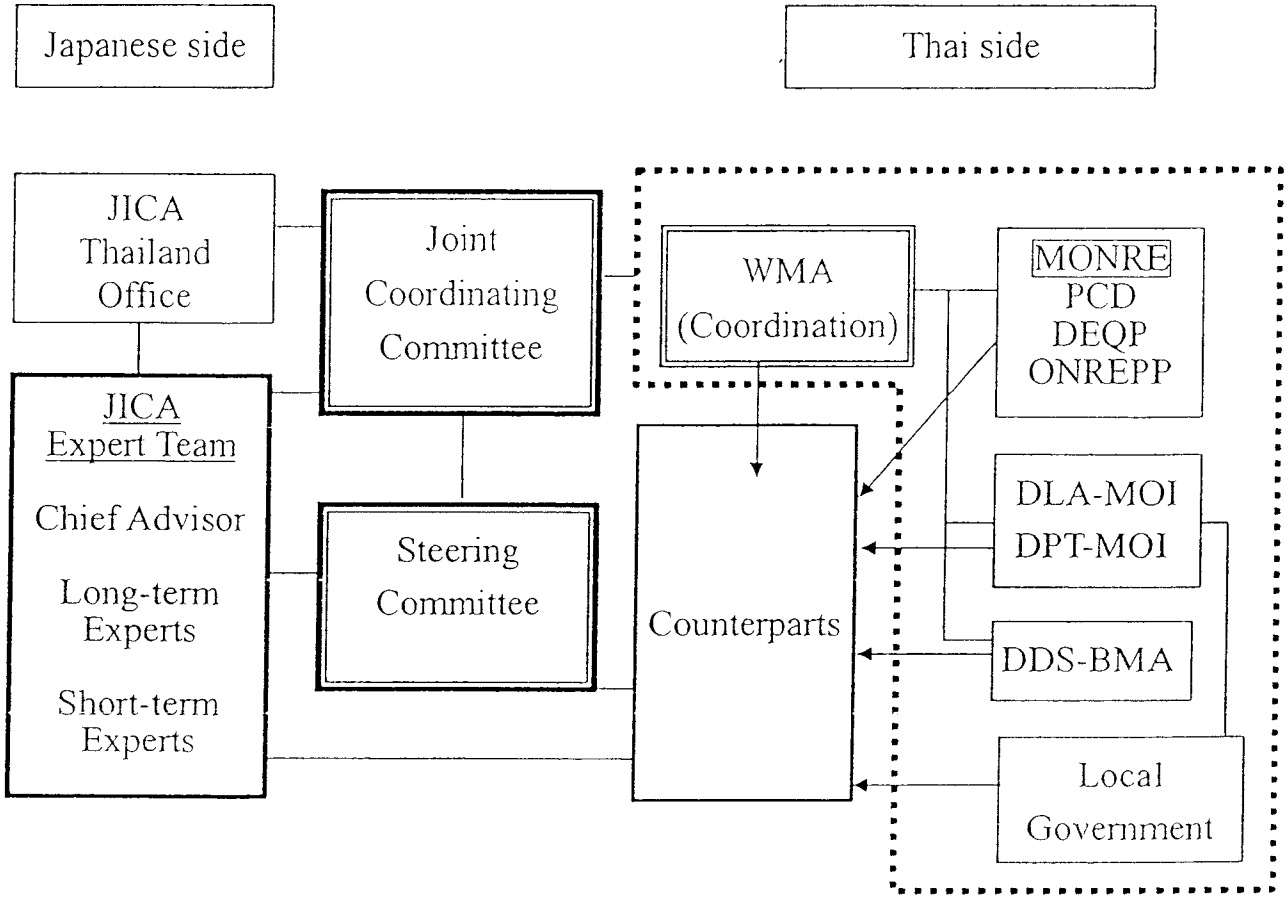
The following will be prepared by the Government of Thailand for the implementation of the Project.

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.

ANNEX-VI PROJECT ORGANIZATION CHART



WMA: Wastewater Management Authority

PCD: Pollution Control Department

MONRE: Ministry of Natural Resources and Environment

DEQP: Department of Environmental Quality Promotion

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

MOI: Ministry of Interior

DLD: Department of Local Administration

DPT: Department of Public Works and Town & Country Planning

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 proposed by the Thai side

(1) Thai side:

(a) Project Director of WMA will be the Chairperson.
(b) Director of Survey Department
(c) Director of Planning & Development Project Department
(d) Director of Office of Director
(e) Representative of Department of Technical and Economic Cooperation (DTEC)
(f) Representative of Bangkok Metropolitan Administration (BMA)
(g) Representative of Pollution Control Department (PCD)
(h) Representative of Office of the Natural Resources and Environmental Policy and Planning (OEPP)

(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).