## RESULTS AND DISCUSSION

The findings are divided into four parts relating to the study objectives. They are Part I: Data requirement pertaining water quality at Sub-district level, Part II: The participatory process in development of water quality database, Part III: Water quality database, and Part IV: Proposed participatory process and guideline.

### Part I: Data Requirement Pertaining Water Quality at Sub-district Level

Questionnaires were sent to 287 SAOs in the Northern part of Thailand. There were 177 questionnaires returned, approximately 61.7 % of total. The questionnaires from SAOs were classified geographically into urban and rural settings. There were 34 and 143 from urban and rural SAOs, respectively. The main purpose of the questionnaire was to study types of water quality data required by SAO management and what was acquainted and used by them. Table 2 and Table 3 summarize the result.

Table 2 Water quality data being used by SAOs management in urban and rural areas

(Unit: %)

| **Water quality indicators** | **Urban SAO management** (n=34) | **Rural SAO management** (n=143) | **Total SAO Management** (n=177) |
|---|---|---|---|
| Temperature | 20.60 | 20.30 | 20.34 |
| pH | 29.40 | 30.80 | 30.51 |
| DO | 17.60 | 16.13 | 16.38 |
| BOD | 23.50 | 23.10 | 23.16 |
| Bacteria | 8.80 | 11.90 | 11.30 |
| Nitrogen | 11.80 | 12.60 | 12.43 |
| Turbidity | 29.40 | 28.00 | 28.25 |
| Plants | 32.40 | 41.50 | 39.55 |
| Fishes | 52.90 | 53.80 | 53.67 |

From Table 2 the most data being used in SAO management were fishes from both urban and rural SAOs accounted for more than half of SAOs sample. The appearance and well being of fish such as its skin, death of fish in water body, abundances of certain species were indicators of water quality locally known and used for generations since it was easily observed. The least water quality data being used by both SAO setting was bacteria. The restraint for use of bacteria indicator at SAOs in northern region might go for the requirement of water sample analysis in the special laboratory with certain time limits. From the results, it also implied that at time of data collection SAOs did not used much of water quality data in their management. The data clearly showed less than 30 % of total SAO respondents used these water quality indicators in their management except for the fishes and plant indicators. During the participatory process at later stage, most participants from selected SAOs in Mae Taeng watershed explained that water quality data was not used much in their management because of the difficultly in obtaining the needed data and organizing them for decision making in SAO management. Also, indicators that were easy to understand and interpret can be more recognized and used in SAO management.

Table 3 Priority of needed information in SAOs management in urban and rural settings of Northern of Thailand

| Water quality indicators | Urban SAO management (n=34) 1/ | Rural SAO management (n=143) 1/ |
|---|---|---|
| Temperature | 5 | 7 |
| pH | 3 | 1 |
| DO | 2 | 5 |
| BOD | 1 | 2 |
| Bacteria | 6 | 6 |
| Nitrogen | 8 | 8 |
| Turbidity | 7 | 3 |
| Plants | 9 | 9 |
| Fishes | 4 | 4 |

1/ Ranking from 1 to 9 where 1 is the most needed data and 9 the least.

From Table 3 the most five needed water quality indicators by SAO management in urban settings were BOD, DO, pH, fishes, and temperature while the least needed indicators were plants, nitrogen, turbidity, and bacteria, respectively. For the SAO in rural setting, most five needed indicators were pH, BOD, turbidity, fishes and DO. The only difference between the SAO in urban and rural settings was the need of turbidity indicator found in rural SAOs but temperature in urban SAOs. It might result from different land use impacts found in urban and rural areas. Rural area was more impact from agricultural activities causing soil erosion that related to turbidity while urban area was received more impact on industrial activities related to water temperature.

Regarding to the watershed management issues, problem in water quantity was more prevail and highly recognized at sub-district level than problems in water quality or water pollution. Drought in dry season and flooding in rainy seasons were mentioned most in their issues identification. However, water pollution mentioned most in SAOs of northern region were those related to water turbidity, sedimentation, and chemicals from agricultural land.

The results from this part led to important activities in participatory process of water quality database development. It was anticipated to finalize what types of data and information would be needed in SAO management by giving the SAO participants to understand water quality issues within their watershed and neighboring watersheds and understand how to use water quality data or indicators in their management effectively though database system.

## Part II: The Participatory Process in WaterQquality Database Development

### 1. Analysis of Stakeholders

Mae Taeng watershed in Chiang Mai province composed of 15 SAOs. However, it was found that only 7 SAOs were relevant for involvement in water quality database development process (Figure 11). The other 8 SAOs were not relevant mainly because they were not involved with any water quality management activities in this watershed.

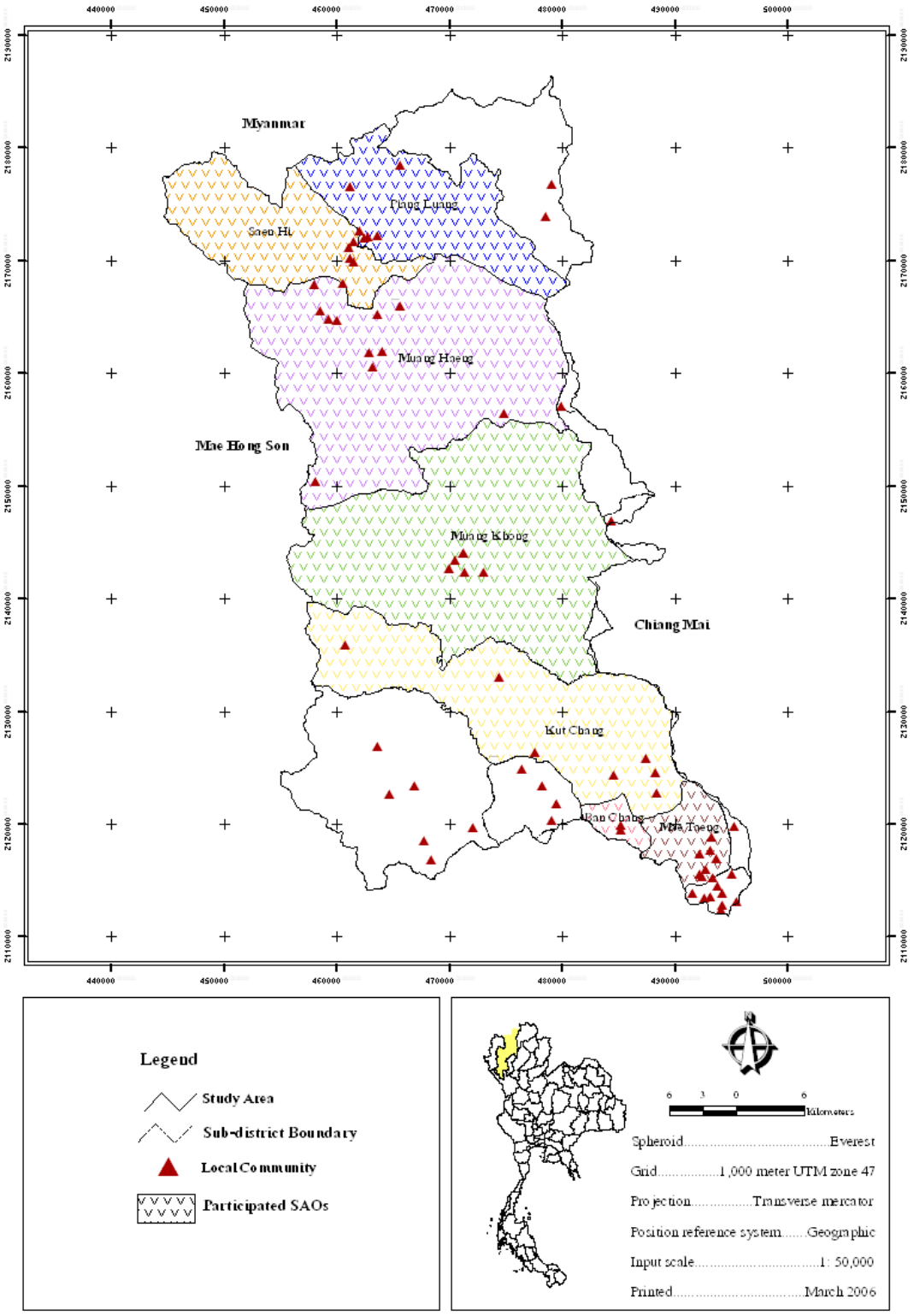


Figure 11 The SAOs participated in the research process of water quality database development in Mae Taeng watershed

In accordance with watershed management principle, the Mae Taeng watershed was divided into 3 parts namely: upper, middle, and lower sub-watersheds. The upper sub-watershed composed of 3 SAOs: Muang Haeng, Saen Hai and Piang Luang in Viang Hang. The middle sub-watershed had only one SAO, namely Muang Kong, in Chiang Down district. The lower sub-watershed composed of 3 SAOs: Mae Taeng, Baan Chang, and Kut Chang in Mae Taeng district.

The snowball sampling technique was employed to select the stakeholders who had been involved with planning, monitoring, and inspecting water quality in Mae Taeng watershed. There were 84 persons identified by this technique of which 28 were located in upper sub-watershed, 24 and 32 were in middle sub-watershed and lower sub-watershed, respectively. The general characteristics of stakeholders in participatory process of water quality database development of Mae Taeng watershed was shown in Table 4.

Table 4 General characteristics of stakeholders in participatory process of water quality database development in Mae Taeng watershed, Chiang Mai

(Unit %)

| **Characteristics** | **Mae Taeng Watershed** | | | **Whole Watershed** |
|---|---|---|---|---|
| | **Upper** (n=28) | **Middle** (n=24) | **Lower** (n=32) | (n=84) |
| Gender | | | | |
| Male | 71.0 | 69.0 | 82.0 | 74.0 |
| Female | 29.0 | 31.0 | 18.0 | 26.0 |
| Age | | | | |
| < 40 years | 21.0 | 29.9 | 15.4 | 22.1 |
| 41-50 years | 62.0 | 32.3 | 39.0 | 44.4 |
| > 50 years | 17.0 | 37.8 | 45.6 | 33.5 |
| Education | | | | |
| Elementary level | 62.0 | 45.6 | 63.2 | 56.9 |
| Higher than elementary | 38.0 | 54.4 | 36.8 | 43.1 |
| Main occupation | | | | |
| Non Agriculturalist | 72.8 | 48.9 | 63.0 | 61.6 |
| Agriculturalist | 27.2 | 51.1 | 37.0 | 38.4 |
| Monthly income | | | | |
| < 5,000 Baht/ month | 50.0 | 24.0 | 46.0 | 40.0 |
| 5,000-9,999 Baht/ month | 16.2 | 14.0 | 33.0 | 20.7 |
| > 9,999 Baht/ month | 33.8 | 62.0 | 22.0 | 39.3 |
| Duration of SAO committee | | | | |
| < 2 years | 43.0 | 57.0 | 28.0 | 42.7 |
| > 2 years | 57.0 | 43.0 | 72.0 | 57.3 |

The key characteristics of the stakeholders in Mae Taeng watershed can be summarized as follows:

Upper sub-watershed: Most of them were male aged between 41 - 50 years and more than 50 years. They had the elementary education and earned for a living in the form of non- agriculturalist. Their monthly income was less than 5,000 Baht and they were the members of SAOs for more than 2 years.

Middle sub-watershed: Most of them were male and not much different about ages, education level, membership period, and main occupation. Besides, most of them had their monthly incomes more than 9,999 Baht.

Lower sub-watershed: Most of them are male with age more than 50 years old. Most had elementary education and were non-agriculturalists. Their monthly incomes were between 5,000 - 9,999 Baht and have been the members of SAOs for more than 2 years.

This particular information about stakeholders characteristics were used in designing and planning of participatory techniques such as AIC and SLP for database development in the next stage. This key characteristics worth mentioned here are the followings:

Gender: The proportion of male and female found in our SAO participants was much different. Even though male usually dominated in decision making regarding water quality issues, in our research process male and female were treated equally. Female were given opportunity to learn about water quality and take part in data collection. It was anticipated that with more knowledge gained from the research process, women would be able to take more respobsobility on water qualiy management

Age: Most of the stakeholders were more than 40 years. As a result, the provision of knowledge or participatory activities were designed to be simple as step by step. Relatively high concern went for preparedness of the participatory process to make sure the older had ample time to learn and understand issues and knowledge offered during AIC process and SLP. However, the older tended to earned more experiences than young ones. Thus, the participatory process must take it as an advantage and prepare enough time for sharing such valuable experience among researcher and other.

Education: Most of them were educated at the elementary level, therefore the AIC process and SLP should be simple with clear explanation.

Main occupation: Most of them were non–agriculturalists, this resulted to be more flexible to design learning periods for them than agriculturalists.

Monthly income: this factor was not impediment for the involvement with AIC process and SLP due to the income level being higher than the minimum standard.

Duration of SAO membership: Most of then had been the members of SAO for more than 2 years. Thus, they had good knowledge and experiences on the duties and responsibilities of SAO. In this practice, it was appropriate for them to participate in the AIC process and SLP.

**2. Appreciation-Influence-Control (AIC)**

The AIC technique was employed here as a main method in a participatory action research to learn about Mae Taeng watershed management and its water quality issues. To be more specific, this technique was used in step 1 and step 2 (analysis of data requirement and identify database development objectives) mentioned as Figure 10.

The structure and component of AIC were designed for the member of 84 stakeholders in the following ways:

**2.1 Formulation of general objective of AIC**

The general objective of AIC was determined along the line with the main objectives of the research – that was, the participatory formulation of water quality database in Mae Taeng watershed, Chiang Mai province. Their behavioral objectives were stressed on the importance of awareness of the problems about water quality and their were understanding of the necessary information for water quality management as well as the participation in building up water quality database.

**2.2 Formulation of scope and content of AIC**

Scope and content of AIC were formulated by using various factors such as the needs of water quality information analyzed from the questionnaires and the objective stipulated in 2.1. The content for conversation under AIC process was composed of three issues: the water utilization of Mae Taeng watershed and the relevant problems, the factors related to water quality, and the factors associated with water quality management. The researcher acted as facilitator for the conversation session under AIC process.

**2.3 Logistics plan for AIC**

In order to achieve the determined objectives, the logistics plan for implementing AIC process prepared as follows:

1) Specific methods of AIC included group meeting, discussion, and brainstorming.

2) The implementation or action period was divided into two stages. At the first stage, researcher took a part in communication with the three sub-watershed for 3 weeks and did stakeholder analysis. The second stage was AIC process and took two days for each watershed. The researcher spent approximately 8 months to cover the whole process of AIC.

3) The researcher played a major role in facilitating the meeting. Co-researchers were assigned to play a supportive role of facilitator. The participants in each watershed were divided into three sub-groups.

4) Three places were selected for meetings Wieng Hang SAO office for upper watershed, Muang Kong SAO office for middle watershed, and Mae Taeng SAO office for lower watershed.

5) Materials, equipments, introductory document, pamphlet, and chart showing mind map were prepared to help participants on the "thinking" and opinion exchange process.

### 2.4 Activities under AIC process

The AIC process was composed of 3 stages: Stage 1-Appreciation (A), Stage 2-Influence (I) and Stage 3-Control (C). The implementation of each stage was details are as follows:

**Stage 1 Appreciation (A): Utilization of Mae Taeng watershed resources and associated problems**

***Duration*** 150 minutes (Day 1)

***Background and Justification***

This stage helped participants to understand issues and created positive attitude toward water quality. It was a good opportunity for the participants to present their opinions and experiences related to the activities benefited from Mae Taeng watershed and the problems associated with such activities. In this way, they analyzed the current situation of watershed. It could be said that this stage to awareness of the importance on water quality data.

***Objective***

To gain the necessary information for the joint development of water quality in Mae Taeng watershed, Chiang Mai province

***Behavioral objectives***

1. To identify activities related to Mae Taeng watershed
2. To identify water quality problems arising from the activities benefited from Mae Taeng watershed

***Conceptual Idea***

Land use activities in Mae Taeng watershed and problems of these activities related to Mae Taeng watershed which resulted to water quality

**Contents**

1. Importance and utilization of Mae Taeng watershed
2. Activities in from Mae Taeng watershed
3. Problems arising from land use activities in Mae Taeng watershed

**Activities**

1. Discussion and forum for idea exchange
2. Presentation

**Equipments**

1. Transparency/ overhead projector
2. Mind map
3. Flip chart

**Stage 2 Influence (I): Factor associated with water quality**

***Duration*** 150 minutes (Day 1)

***Background and Justification***

This stage was to provide opportunities for discussion among the participants. The researcher acted as facilitator, in particular issues concerning the factors related to water quality and relevant evidences. The participants also had the opportunities to share the ideas about the preliminary guideline of prioritization of water quality data and management.

***Objective***

To gain information and indicators of water quality for the database development in Mae Taeng watershed

***Behavioral objectives***

1. To gain knowledge about water quality and be able to identify proper factors as indicators for water quality
2. To identify causes and problems of water quality arised from the land use activities in Mae Taeng watershed

***Conceptual Idea***

Causes and problems of water quality in Mae Taeng watershed and relevant indicators of water quality

***Contents***

1. Causes of water quality problems in Mae Taeng watershed
2. Indicators of water quality which related to activities found in Mae Taeng watershed

***Activities***

1. Discussion and a forum for idea exchange opportunities to exchange ideas
2. Presentation

***Equipments***

1. Transparency/ overhead projector
2. Mind map
3. Flip chart

**Stage 3 Control (C): Factor associated with water quality management**
***Duration*** 180 minutes (Day 2)
***Background and Justification***
This stage brought the outcome of Stage 2 into action. The guideline for data collection and water quality data was developed for water quality inspecting and analyzing the results for water quality database. The facilitator induced participants to be aware of the database associated with water quality management in Mae Taeng watershed.
***Objective***
To prepare the water quality database of Mae Taeng watershed
***Behavioral objectives***
1. To understand and identify other factors related to water quality
2. To prioritize water quality data and present introductory guideline of water quality management
***Contents***
1. Factors involved with water quality management
2. Prioritization of water quality data and presentation of introductory guideline of water quality management.
***Activities***
1. Discuss and a forum for idea exchange opportunities to exchange ideas
2. Presentation
***Equipments***
1. Transparency/ overhead projector
2. Checklist sheet

### 2.5 Results from AIC process

The results gained from AIC process could be summarized into three aspects as follows:

**1) Water utilization from Mae Taeng watershed and relevant problems**

Participants could identify the usage of water from Mae Taeng watershed and the relevant problems as follows:

**Upper sub-watershed**

The activities regarding with usage of water from Mae Taeng watershed included horticulture plantation, paddy field and water use for household consumption. The arised problems were chemical use in horticulture plantation (pesticides), water shortage for paddy field, contaminated and algae blooming in water for general household consumption, and water turbidity for drinking water. The mind map from stakeholder brain storming activities during the AIC process were shown the Figure 12.

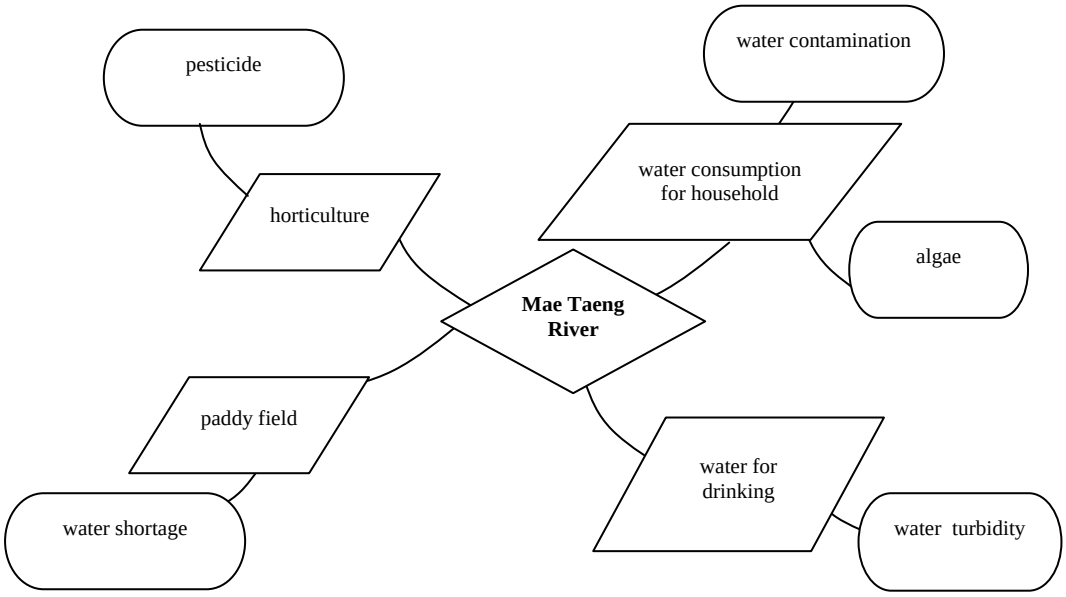


Figure 12 Mind map of water usages in the upper sub-watershed presented by stakeholders during the first stage of AIC process

**Middle sub-watershed**

The water usage activities in the middle Mae Taeng watershed comprised of paddy field, tour rafting, horticulture plantation, water use for drinking, and corn field. The arised problems were water turbidity in paddy field, garbage from rafting activity, water shortage for horticulture plantation and water for drinking and flooding in crop plantation areas. The mind map was shown in the Figure 13.

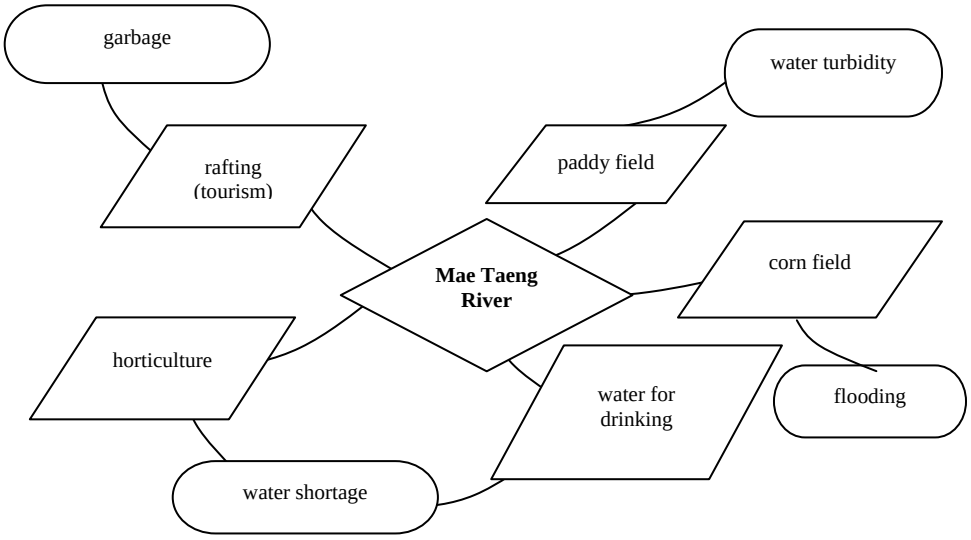


Figure 13 Mind map of water usage in the middle sub-watershed presented by stakeholders during the first stage of AIC process

**Lower sub-watershed**

The water usage activities in the lower Mae Taeng watershed comprised of corn plantation, water for consumption, elephant trekking and tour rafing, longan and tobacco plantations. The arised problems were flooding and water shortage in summer season for corn field and tobacco plantation, water contamination, water shortage for drinking, water degraded from tourism activities, and shallowing watershed. The mind map was shown in the Figure 14.

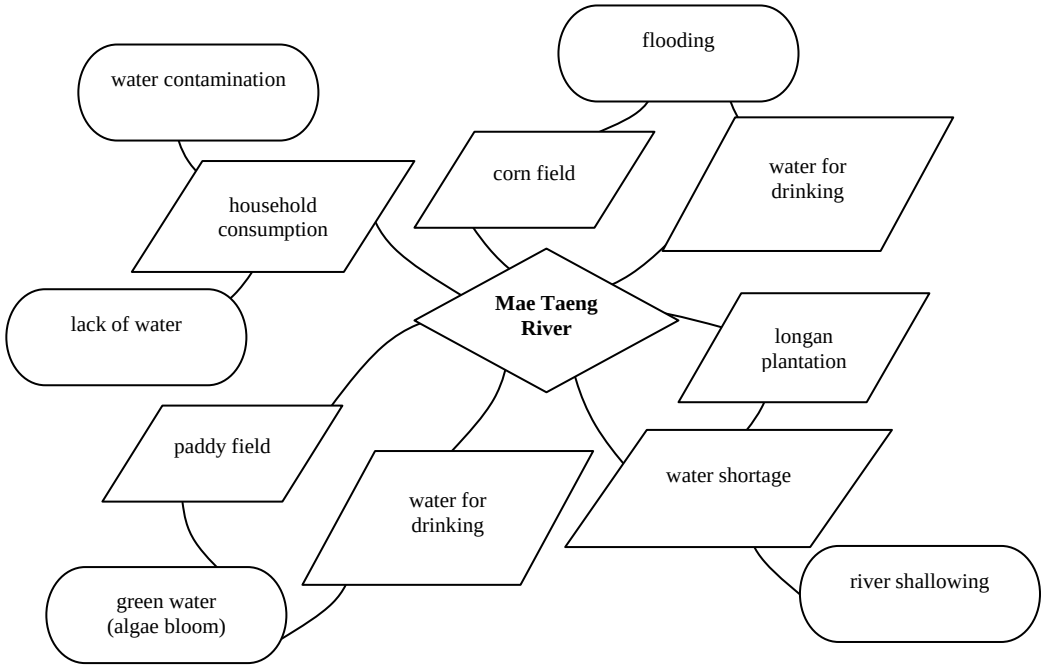


Figure 14 Mind map of water usage in the lower sub-watershed presented by stakeholders during the first stage of AIC process

For the whole watershed, agricultural activities were considered as the main activities in Mae Taeng watershed causing water quality problem. The problems were chemical use and fertilizers, in particular. The details was shown in Table 5.

Table 5 Checklist of problems related to water usage activities in Mae Taeng watershed

| Water usage from Mae Taeng watershed | Relevant problems | | | | | |
|---|---|---|---|---|---|---|
| | Water shortage | flooding | turbidity | water decaying | Green water from algae | Water contaminated with chemicals |
| **1) Paddy field** | | | | | | |
| Upper watershed | √ | | | | | |
| Middle watershed | | | √ | | | |
| Lower watershed | | | | | | |
| **2) Crop field** | | | | | | |
| Upper watershed | | | | | | |
| Middle watershed | | | | | | |
| Lower watershed | √ | √ | | | | |
| **3) Horticulture** | | | | | | |
| Upper watershed | | | | | | √ |
| Middle watershed | | | | | | |
| Lower watershed | | | | | | |
| **4) Tobacco** | | | | | | |
| Upper watershed | | | | | | |
| Middle watershed | | | | | | |
| Lower watershed | √ | √ | | | | |
| **5) Water consumption for household uses** | | | | | | |
| Upper watershed | | | | √ | √ | |
| Middle watershed | √ | | | | | |
| Lower watershed | √ | | | √ | | |
| **6) Water consumption for drinking** | | | | | | |
| Upper watershed | | | √ | | | |
| Middle watershed | | | √ | | | |
| Lower watershed | | | | | | |
| **7) Tourism** | | | | | | |
| Upper watershed | | | | | | |
| Middle watershed | | | | √ | | |
| Lower watershed | | | | | √ | |

**2) Factors associated with water quality**

The participants identified factors related to water quality in Mae Taeng watershed as follows:

**Upper sub-watershed**

The participants identified factors related to water quality such as fertilizers and pesticides contaminated in water, water temperature, water hardness, water volume, and climatic factor. The mind map was shown in the Figure 15.

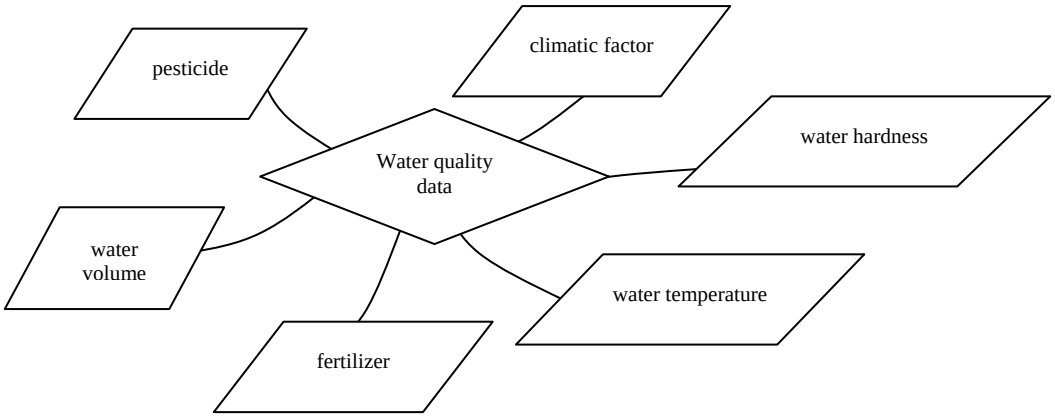


Figure 15 Mind map of water quality indicators identified for the upper sub-watershed

**Middle Mae Taeng watershed**

The participants could identify factors related to water quality such as fertilizer, water volume, water turbidity and color, aquatic plant, and climatic factor The mind map was shown in Figure 16.

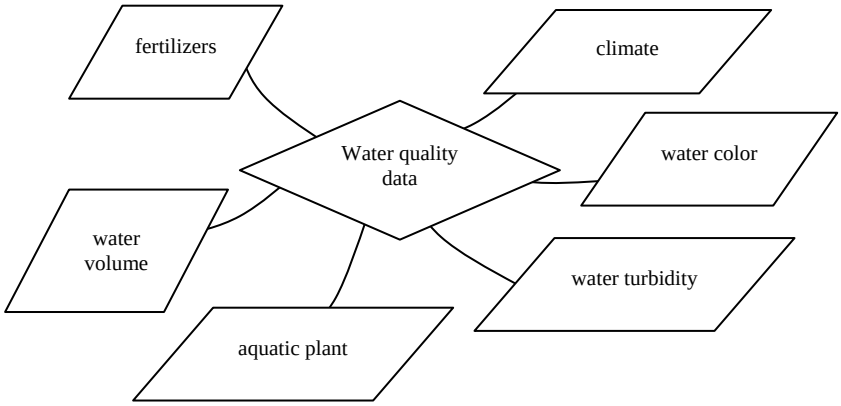


Figure 16 Mind map of water quality indicators identified for the middle sub-watershed

**Lower sub-watershed**

The participants identified factors related to water quality such as water volume, turbidity, color, water hardness, aquatic plants (algae), water odor and fertilizers. The mind map was shown in Figure 17.

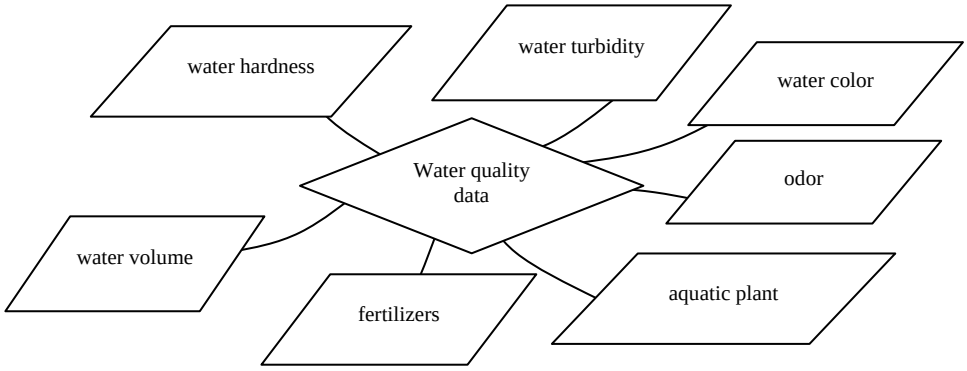


Figure 17 Mind map of water quality indicators identified for the lower sub-watershed

For the whole watershed, most factors related to water quality included physical aspects like hardness, turbidity, color, water temperature and toxic factors like fertilizers and pesticides compounded in water. The details were shown in Table 6.

Table 6 Checklist of factors related to water quality in Mae Taeng watershed

| **Problems relating to water quality** | **Mae Taeng Watershed** | | |
|---|---|---|---|
| | **Upper** | **Middle** | **Lower** |
| Fertilizers | √ | √ | |
| Pesticides | √ | | |
| Climate | √ | √ | |
| Water temperature | √ | | |
| Water volume | √ | √ | √ |
| Water turbidity | | √ | √ |
| Color | | √ | √ |
| Odor | | | √ |
| Aquatic plant | | √ | √ |
| Water hardness | | | √ |

**3) Factors associated with water quality management**

The participants also identified factors related to water quality management. The SAOs members and local stakeholders could learn and utilize as well as identify needed knowledge related to water quality and management through checklist method. The checklist included information on natural resources and environment, watershed, water quality indicators, water sampling, water quality management, and relevant agencies. It was found that the SAO participants preferred to have all information listed in Table 7 appeared in water quality database. The field practice or hands on experience was mentioned to be useful for learning about water quality indicators and water quality sampling. Additionally, the most preferred learning media suggested for inclusion in water quality database were simple text and pictures as well as video format (see Table 7).

From the result of AIC process, most participants still thought that each resource should be managed independently. There was few understanding about the relationships of soil, forest, and water resources as well as no apprehension about the relation components in of ecosystem or watershed system. For instances, the impacts of water quality crated from the upper watershed had not been realized that they could well affect the lower watershed. Subsequently it could create conflict between communities in upper and lower watersheds.

In this regard, results from the AIC process were carefully analyzed to produce the content and activities of SLP. The principles and concepts of watershed management, knowledge on water quality data and water quality management were emphasized.

Table 7 Checklist of information and activities needs identified by stakeholder in sub-watersheds of Mae Taeng

| Information and activities needs | Field Practice | Learning media | |
|---|---|---|---|
| | | Text and picture | VDO |
| Natural resources information | - | √ | √ |
| Environmental information | - | √ | √ |
| Environmental management | - | √ | - |
| Watershed information | - | √ | √ |
| Water quality indicators | √ | √ | √ |
| Water quality sampling | √ | √ | √ |
| Water quality management | - | √ | - |
| Water quality organization | - | √ | - |
| General data of Mae Teang watershed | - | √ | √ |

### 2.6 Lessons learned from AIC process

The lessons learned from the 3 stages of AIC process: Appreciation (A), Influence (I) and control (C) were presented:

**Stage 1: Water utilization from Mae Taeng watershed and the associated problems**

The lessons gained from AIC process could be explained as followings:

**Awareness of water quality problems**

In upper sub-watershed, at the linkages between the initial stage of conversation, participants did not have clear understanding on problems and causes of water quality arisen from activities done in Mae Taeng watershed. They first understood that their activities located at the upstream area did not affect or cause any problems to water quality. But when the exchange of ideas had made, they later understood and be aware of water quality problems which consequently affected to the environment and livelihood of communities located down stream.

In middle sub-watershed, participants were aware of water quality problems due to knowing that most of middle Mae Taeng watershed located inside the national park boundary. Besides, the knowledge about environmental conservation had been frequently given by the concerned agencies. As a result, the participants had good knowledge and information on natural resources and environmental management.

In lower sub-watershed, participants were highly aware of water quality problems since the lower Mae Taeng watershed had been affected by the tourism activities (like rafting and elephant riding) and resulted to negative impact on water

quality. Besides, since they lived not so far from Chiang Mai city, this easily made them receive adequate information on water quality.

**Conflicts of interest**

The conflicts of interest were found in the upper and lower areas of Mae Taeng watershed. At the upper area, the conflicts arised from agricultural activities at high elevation about chemical usage. This problem had caused some disputes for the participants at the beginning of conversation about the case of such problem. In this matter, the researcher acted as a mediator tried to provide the opportunities for them to express their opinions freely but in controlled situation. For the lower area, the conflicts came from tourism activities. The participants who lives at the downstream rather dissatisfied with the activities located at the upstream. Likewise, the researcher acted as a mediator and allowed them to discuss until common understanding emerged.

**Ethnics**

It was found that many participants from the lower watershed were Hmong hilltribe. For this reason, they did not dare to express their ideas since they could not speak Thai clearly. In this practice, the researcher encouraged them to speak out and communicate to the others and share their views with the group.

**Stage 2: Factors associated with water quality**

The lessons learned from this stage were presented as follows:

**Information and knowledge about water quality indicators**

At first, participants did not understand correctly about information and indicators of water quality. But they tried to join the discussion and share information and indicators of water quality. As a result, the researcher put this findings into action by including learning activity about water quality as part of SLP.

**Stage 3: Factors associated with water quality management**

The lessons gained from this stage were been summarized as follows.

**Role of stakeholders in managing local resources**

When participants from all sub-watersheds were able to understand and identify factors related to water quality management, they then prioritized the need of water quality information and suggested management guidelines of water quality. The lessons gained from this stage were valuable for sub-district development planning which most participants had played a key role in local development planning.

**Role of chief administrator of SAOs**

The result revealed that chief administrator of SAOs played important roles in participatory process of AIC. The good case was derived from the chief administrator of Muang Kong SAOs in middle sub-watershed. He encouraged other participants to actively participate in the AIC process so that the information obtained during the discussion was worthwhile. He also was a good coordinator as well as maintaining high interest in problems in his jurisdiction. This good quality of his brought about the better discussion and information exchanges then the other groups.

**3. Social Learning Process**

The workshop was introduced in the Social learning process (SLP). This workshop was a collaborative effort between a research team and SAO participants. The SLP was employed as a main effort in participatory action research step 3 and 4 (database design and evaluation) mentioned in Figure 10) The workshop was organized in each sub-watershed; upper, middle, and lower watershed. The participants were the same group with AIC process. The guidelines of implementation were listed as follows:

**3.1 Formulating of general and behavioral objectives**

The general objectives of SLP were formulated considering the main objective of the research–that was, development of water quality database based on participatory approach. It focused gaining knowledge and understanding on natural resources and environment, watershed management, water quality management, and water quality database. In this sense, the learning of fact-finding was essential for water quality managing at sub district level. This would help to create good attitude and participation in building up water quality database.

**3.2 Formulating of scope and content of SLP**

The scope and content of SLP were formulated based on the lessons learned from the AIC process. The scope and content of workshop could be divided into two parts. One was to provide knowledge on natural resources and environmental management, watershed management, water quality and management, database and maintenance. The other was to practice using handbook about water quality inspection. The researcher was responsible for compiling outputs from SLP.

**3.3 Preparing the workshop procedure and logistics**

In order to achieve the objective of SLP, the logistics was planned as follows:

1) Procedures of workshop divided into 2 parts. Part 1 was organized in the meeting room for providing knowledge and sharing experiences related to water

quality. Part 2 was held at Mae Taeng watershed for practicing about testing and simple analysis of water quality.

2) Duration: The workshop lasted for 2 days.

3) Facilitator was assigned a role to speak and listen to the local dialect and be ready to understand the objectives of the study very well. In addition, the environment of the meeting and the behavior of the participants' observation should be recorded. The number of staffs in charge for this part should be at least five people.

4) Lecturer took a role of providing knowledge on natural resources and environmental management, watershed management, water quality and management, database management, and water quality inspection in the filed. The researcher performed as a lecturer, in collaboration with the scientist from the Faculty of Environment and Resource Studies, Mahidol University who involved directly with water quality inspection.

5) There were three places selected for holding the meeting. At the upper watershed, it was Wieng Hang SAOs office. Muang Kong SAOs office was the place for middle watershed. At the lower watershed, it was Mae Taeng SAOs office and all the three parts of Mae Taeng watershed.

6) Equipment included document for introducing research, education document, VDO, and equipment for simple inspection of water quality.

### 3.4 Activities under SLP

For this study the SLP was composed of 5 stages as fellows:

Stage 1 was the introduction of workshop objectives and overall situation.

Stage 2 was to provide knowledge on natural resources and environmental management, water quality and watershed management, and database management.

Stage 3 was to provide awareness of the problems related to water quality and the access to water quality information.

Stage 4 was to explore alternatives to solve thee solution to water quality problems and information through hands - on training on the inspection of water quality in local areas.

Stage 5 was to summarize the water quality information guidelines and build up the database.

In this context, there were two activities: activities to be done in the meeting room and activities for field practice organized at the Mae Taeng watershed. The implementation of each stage were described below.

**Stage 1: Introduction to workshop objectives**
Activities done in the meeting room
***Duration*** 30 minutes (Day1)
***Principle and justification***
Facilitator introduced the objectives of the workshop in order to make preparedness for the participants in common understanding and agreement. It was the first stage of SLP and affected upon other stages. The implementation of this stage would run smoothly by the participants could understand the common objectives and expectation. They should firstly be familiar with each other aware of their roles in working for the group, and ready to comply with the required agreement or conditions.
***Objectives***
To make joint effects in water quality database in Mae Taeng watershed, Chiang Mai province
***Behavioral objectives***
1. To identify objectives and expected results gained from the workshop
2. To explain the expected the benefits from the workshop
3. To test the knowledge existing of the participants before the workshop.
***Contents***
1. Importance of the study and objectives of workshop.
2. Forms and conditions of activities under SLP
3. Testing of the knowledge existing before workshop.
***Activities***
1. Introduction of workshop objectives
2. Forms and conditions of workshop
3. Participants self-introduction
4. Testing of the knowledge existing before workshop
5. Floor opening floor for decision
***Equipments***
1. Document for introducing process
2. Testing Questionnaires

**Stage 2: Providing knowledge on natural resources and environment management, watershed management, water quality management**

Activities done in the meeting room

***Duration*** 240 minutes (Day 1)

***Principle and justification***

The lessons learned from AIC process was an input for this process so that knowledge could be properly provided for participants understanding and generating the positive attitude. In addition, they could adjust their basic knowledge of the participants in the ways of being aware of value and importance of natural resources and environment, watershed management, water quality management, and database management. In particular, they would have the opportunities to discuss and brainstorm in other issues too. These issues included acknowledgement of water quality information and information linkage, utilization of water quality information, and introducing for formation the guideline of water quality management.

***Objectives***

To identify any joint effects with water quality data in Mae Taeng watershed, Chiang Mai province

***Behavioral objectives***

1. To identify value importance, and principles of natural resources and environmental management and watershed management.
2. To identify water quality information, information use and collection, and water quality introductory management

***Contents***

1. Importance of the study and objectives of workshop.
2. Value, importance, and types of natural resources and environment
3. Definition, importance and factors related to water quality and introductory principle of water quality management
4. Indicators of water quality inspection, standard requirements, and data collection
5. Introductory principle and management of database

***Activities***

1. Lecture
2. Discussion

***Equipments***

1. Poster
2. Documents for education
3. Multi-media

**Stage 3: Awareness of problems relating to water quality and acquiring of water quality information**

Activities taken place in the meeting room

***Duration*** 180 minutes (Day 1)

***Principle and justification***

The utilization of natural resources together with environmental management in watershed was increased. This was particularly affected the water quality. This could be seen from knowledge requirements, problems arising from the use of water quality, and environmental quality. To solve such difficulty thorough understanding on water quality problems in watershed for the linkage among problems, causes, and impacts to build up database for water quality management was recommended. Beside the environmental situation in watershed could be seen clearly.

***Objectives***

To make joint effects in water quality database in Mae Taeng watershed, Chiang Mai province

***Behavioral objectives***

1. To identify problems, causes , and impacts of water quality in particular areas
2. To conclude the current situation and problems of water quality in watershed
3. To select and prioritize the importance of water quality problems
4. To identify key information for water quality management

***Contents***

1. Problems, causes, and impacts of water quality
2. Current situation of water quality in watershed
3. Key information on water quality for Mae Taeng watershed

***Activities***

1. To exchange ideas about causes and problems of water quality in Mae Taeng watershed
2. To discuss on key information of water quality for Mae Taeng watershed

***Equipments***

1. Paper (size A3)
3. Paper for Flip chart
3. Multi-media

**Stage 4: Alternatives to solve water quality problems**
Activities taken place in Mae Tang river
***Duration*** 380 minutes (Day 2)
***Principle and justification***
The purpose of this stage was to analyze problems, causes, information and accessibility to water quality data. In addition, it focused on data collection and management methodology alternatives to access appropriate data particularly for SAOs. Moreover, the participants could have hands–on training on water quality inspecting in local areas and some selected particular areas for inspection and analysis for water quality data management according to introductory handbook for water quality in watershed
***Objectives***
To create input into water quality database in Mae Taeng watershed, Chiang Mai province
Behavioral objectives
1. To identify problems and causes of water quality as well as data and accessibility to water quality data
2. To be able to inspect water quality through simple method
3. To analyze water quality and the linkage to water quality management guideline
***Contents***
1. Simple indicator of water quality
2. Collection of water quality data
3. Hands- on training on water inspiration
4. Comparison of water quality standard
5. Guidelines for water quality problem analyzing and managing
***Activities***
1. Lecture on inspection of water quality
2. Hands-on inspection and simple analysis of water quality
3. Discussion
***Equipments***
1. Introductory handbook for water quality in the watershed has been divided into two parts:
**Part I** to explore the nature of watershed. Before knowing the quality of watershed or water resource, the overall characteristic of the areas must be known first in order to design the geographical exploration of the areas and the forms of activities nearby the watershed properly. The objectives of the exploration of watershed are:
- To survey watershed and general biotic living in the watershed for better basic understanding about the nature
- To compare the seasonal changes and to build database for local areas In case of emergency, the situation could be understood and appropriate dealt with immediately
- To explore activities in the community and impacts to watershed in the past and present time.

**Part II** to explore water quality and to introduce principle and practical guidelines of sampling process for instances, equipment, target areas for sampling, preserving sampling nature, keeping sampling during transporting to the laboratory, simple inspection of water quality, and use of inspection tool to analyze water quality in the field. The objectives of water quality survey were:
- To explore water quality in the watershed so as to make understanding on the importance of water quality
- To keep the water sampling and send to the laboratory
- To compare the changes of water quality according to activities and seasons in order to build up database for that local areas. In case of emergency, the situation could be understood correctly and appropriate dealt with immediately

2. Water quality test kit

**Stage 5: Summary of water quality data to be included in database**
Activities to be done in the meeting room
***Duration*** 120 minutes (Day 2)
***Principle and justification***
The final stage of SLP was to form the guidelines for water quality data to be included in database. The willingness of the participants to brainstorm and make decision on such guidelines depended on their awareness, potential, experiences, knowledge, capability and preparedness of personnel in each watershed. The
guidelines for data collection to be included in the database were in the form of multi media
***Objectives***
To make joint effects in water quality database in Mae Taeng watershed, Chiang Mai province
***Behavioral objectives***
1. To analyze the component of database for watershed management
2. To identify needs and maintenance of water quality data
3. To test gained knowledge after workshop
***Contents***
1. Value and importance of data and database
2. Introductory principle of water quality database and maintenance
3. Data and database for watershed management required by local organizations
***Activities***
1. Discussion
2. Testing of gained knowledge after workshop
3. Performance assessment according to SLP
***Equipments***
1. Poster
2. Documents for education
3. Multimedia
4. Testing form
5. Program evaluation form

### 3.5 Lessons from SLP

The lessons gained from the SLP were the followings:

**Stage I: Presentation of the objectives of workshop and overall situation**

The lessons learned from this stage highlighted on persuasive technique for encouraging local people to get involved in this process.

The researcher learned that credits of outside moderators were very important in participation process. At the beginning the researcher performed as a graduate student, as the result, the participants did not pay much attention. To increase cooperation from participants, the researcher tried to perform as a lecturer from Faculty of Environment and Resource Studies afterward who could provide knowledge on environment which subsequently turned the negative attitude of the participants to the positive one. Besides, the researcher could speak dialects and perform as the person living in the community. Finally, the researcher could work with the community and the involvement participation could run more smoothly.

The researcher informed participants regularly of the next stage in order to motivate the participants to attend the next meeting as well as the hands-on training. In the meantime, the researcher also stressed the importance of Mae Taeng watershed in linking with the folkways and other resources in local areas.

**Stage II: Providing knowledge on natural resources and environmental management, watershed management, water quality management and database management**

The participants from sub-watershed were interested in the given lecture and document. The computer and Video from the Department of Environmental Quality Promotion were used to provide knowledge so the meeting atmosphere more interesting.

There were many questions about water quality because many participants misunderstood of water quality and quantity. Hence, the implementation of this stage provided technical knowledge for the community particularly in the issues of natural resources and environmental management, watershed management, water quality and management, database management and promote common learning between research team and participants.

The lessons learned during the knowledge and facts providing to local communities were as the followings:

1) The increase in knowledge and facts led local people to understand more and be able to link their thoughts and ideas to build wider or deeper concepts in watershed and water quality management, natural resource management and database management.

2) The knowledge provided by the outside resource persons interested local people well if the knowledge were important to their livelihood. Therefore, provision of knowledge must rely on local needs and capability of the local in absorbing and utilizing that knowledge in their lives.

3) Some comprehensive and complicated knowledge might be too difficult for local communities to understand it properly. As a result, they might refuse to extend their analysis if it was too complicated for them.

**Stage III: Building awareness of the problems related to water quality**

The participants were encouraged to freely discuss and analyze the problems related to water quality and the access to water quality data as specified in the main issues. At this stage, everyone had the opportunities to practice the skills of melting the behavior and managing the conflicts. The conclusion of the implementation were as follows:

**Upper sub-watershed**

The participants from three SAOs, namely Muang Hang, Saen Hai, and Piang Luang were much different in physical geography, agricultural practice, and race. Muang Hang SAO was a leading organization in Wieng Hang district. The plain area was cultivated rice and garlic. Most of people was Thai and spoke their own dialect. Saen Hai SAO was a mountainous area covered with orange and fruits plantation. Most of people wasThai living together with Chinese.

The problems related to water quality, water quality data were analyzed at the beginning, and some conflicts occurred because of the effects from the upper to the lower areas. The horticulture plantation especially orange orchard at Saen Hai sub district caused many fertilizer and pesticide residues down to the river. The affected areas were Piang Luang and Wieng Hang sub districts. The discussion on water quality inspection was made to find the preliminary indicators that SAO could implement by itself to identify the degraded Mae Taeng watershed.

**Middle sub-watershed**

The participants from Muang Kong SAO were hilltribes, Karen and Hmong but it was not impediment for brainstorming because all of them were close collaboration with both chief administrator of SAO and the chairperson of SAO. In addition, the chief administrator chief administrator of SAO has been also interested in natural resources and environment that was different from other SAOs that they were not interested to join this activity.

Chief administrator of Mae Taeng SAO was the one who induced people to join the activities about problem awareness. The problems related to water quality and water quality data of Mae Taeng watershed were accepted as the most important in rainy season because of many sediments resulted from the soil erosion from highland. In summer season, bamboo raft floating in the middle watershed for tourism activity has been carried out and then the rafts or bamboo were further used by the lower SAOs' people. In addition, there were many tourists entering into the area and resulted in garbage problems thrown away into the river. For the water quality data, it was a basic data inspect by themselves without any tools. Yet they needed to acknowledge standard or acceptable criteria for the water source.

**Lower sub-watershed**

This area covered three SAOs, namely Mae Taeng, Baan Chang, and Kit Chang. Most people were Thai. The area had many water quality problems because of various tourism activities at the upper part of this area. These activities included bamboo raft, boat floating and elephant trekking led to waste products-garbage and sewage water in the river and affected the lower sub-watershed. The water utility office of Mae Taeng district were the one that most affected by the water quality impact. As such, they had to spend high costs for water treatment while local people might not realize the direct impact from polluted water upon them.

The lessons learned from this stage were as follows:

**Conflicts arising from the participants**

The communication must be made as soon as there were problems in the group discussion. At least, it would help to prevent the widespread of conflicts. The awareness of the importance on the situation should be also made inducing even individual problem cooperate with the others for finding the appropriate solution. Dispute with the others should be avoided and change into working atmosphere. In this way, the potential of the community should be promoted to tackle and conflicts during the SLP. For example, the well-accepted people in the community should play their roles in giving advice and making understanding for those involved with some conflicts during working.

**Efficiency of moderator or lecturer**

The efficiency of the moderator was also important for the smooth implementation of the SLP. The moderator should provide the participants with knowledge and understanding in the systematic way and he/she should have a good skill on listening, observing, note taking, linking ideas and content, summarizing of concept, and adding up key points of the existing situation during the SLP carried on. Beside other personalities of the moderator were also important such as in knowledge capability, human relations, skills in transferring and linking ideas, summarizing of content, being alert, and being clever in coping with problems, determination, high responsibility, and self-merit as the moderator. This supported the actual learning of the participants and promoted the efficiency of SLP.

**Role of water quality problems and local management**

According to the role, duty, and responsibility as specified in the constitution, the stakeholders like SAOs played their roles on conserving and utilizing local natural resources and environment. The management was authorized for the SAOS, as identified in Item 46 of the SAO law.

At present, the role, duty, and responsibility on natural resources and environmental management of local community, local people and local organizations as stipulated in the constitution, had not yet put into practice because the SAOs were not much interested in these issues and there was no efforts on transforming the policies into practices. Moreover, it lacked of the proper participation process, even the local community like SAO had the potential to manage natural resources sustainable. This finding was from SLP. Accordingly, it was essential for the government sector to perform as a mentor in support data or technical knowledge to promote the local organizations to manage their natural resources and environment by themselves.

**Stage IV: Determination of the alternatives on the solution of water quality inspection in local areas**

Participants analyzed causes of water quality problems and water quality data to find the actual causes of data problems, alternatives of data, and various efficient and proper alternatives. For this stage, participants had to practice about the inspecting of water quality and selecting proper areas for inspection. During the meeting, participants practiced by using a handbook of the preliminary study on water quality in watershed developed by the researcher. The handbook was individually given.

The implementation of this stage could be written as the followings:

**Upper sub-watershed**

The participants were enthusiastic in exploring the nature of watershed and making record in their handbooks. Before the field surveying of water quality, the researcher team had introduces the inspection method, testing equipment was circulated particularly for the members of the group. They were interested in selecting sampling areas by themselves, with regard to possible areas that might cause water quality problems. In addition, they paid much attention to chemical problems that could be inspected by simple tool. For this matter, the research team gave advice that they should help the community to preserve water quality not to be contaminated rather than to inspect.

**Middle sub-watershed**

The participants discussed with each others to select the area for inspection and then inform. There were two selected areas for inspection. That was Mae Taeng watershed and sub-watershed passing through agricultural areas and the community. They wished to compare the water quality between these two areas. They did the inspection and analysis of water quality after getting the introduction of work. The analysis of the causes of water quality was made and found that it was high turbidity in Mae Taeng watershed. The members brainstormed their views about this matter and expressed their needs from government agencies concerned to provide assistance in case they could not solve problems by themselves.

**Lower sub-watershed**

Since the lower Mae Taeng watershed located not far from Muang district of Chiang Mai province only 60 kilometers, the participants could frequently receive data and information on environmental situations. This area is also a place where Mae Taeng water source flows down to Ping River- a main river in Chiang Mai province. Therefore, the participants were interested in exploring the nature of river and water quality in Mae Taeng water source as the basic information for inspecting the water quality change.

To sum up, this stage could be summarized as follows:

**Actions and transfer of experiences on participatory approach**

Without SLP, there was no action or practice, link with the problems, causes and solution, or even learning process and systematic experience to transfer a more researcher, lecturer, and participants. Therefore, SLP as a comprehensive learning process in this context was designed for the action and transfer of experiences on participatory approach and it was a valuable lesson to determine the process that leaded to the action and transfer of experiences on participatory approach as follows:

**Common understanding**

The researcher and participants should understand the objectives of action and participatory process. In doing so, the review of concept idea, education and existing information had made to understand the overall problems.

**Common thought**

The researcher and participants analyzed problems, causes and solution through group discussion. In this way, they analyze problem structure including methodology data collection and usages were analyzed. The expected outcome was to cope with the problems in their community by using gained knowledge related to such problem.

**Common practice**

The researcher and participants should comply with the action plan through transferring experience to tackle any obstacles and conflicts during working together. They were the action planning and management, solution to solve the conflicts, transfer of experiences, conditions to success and failures of action, and expected outcome. In doing so, they would certainly face with the success and failure solutions, gained knowledge regarding the solution, and learn how to get the practice solution.

**Stage V: Summarizing information of water quality to be included in the database**

The researcher provided opportunities to the members to exchange ideas among the others with regard to the needs of water quality data. Afterward the researcher presented the structure of database, which was required by SAOs for resource management in watershed and other information related to water quality. This database was partly analyzed by AIC. The researcher finally synthesized the database appropriate for the particular areas.

The database has been composed of three main parts as follows:

1) Part I is a basic data of natural resources and environment. It includes knowledge on natural resources and environment as well as management.

2) Part II is the information about water resource that includes water quality and characteristics

3) Part III is the information on water quality indicators that includes water quality indexes and water quality sampling collection.

The researcher formulated format for data presentation and presented to participants. The data were collected through brainstorming and learning process between participants and research team. It was found that the participants who located at sub-watershed were interested in the database, especially for providing knowledge and inspecting water quality. These two issues could be explained as follows:

**Providing knowledge**

The basic knowledge on natural resources and environment, watershed management, qualitative and quantitative resource of water, rules and regulations, and basic data of Mae Taeng watershed should be provided for the users and those interested, included SAO members who supervised database. The above data was developed and presented by the researcher to be added in video.

**Handbook for inspecting water quality**

The handbook distributed to the participants was tested at the sub-watershed and data was kept on computerized media and able to use for the next discussion.

The lessons learned from the SLP could be summarized as follows:

1) Network of watershed

At present, there are many watershed networks but only in large watershed. Therefore, SAOs should establish watershed networks in sub or small watershed of their jurisdiction. However, since the SAO members were to be their positions for only 4 years, the process of creating the network might not be done successfully within this period. As a result, the database should be set up to provide continuous data and in formation for management in the networks.

2) Transfer of experiences after completing SLP

The researcher, in cooperation with the participants, held the focus group discussion in order to make records, transfer experiences after completing SLP, and review issues and information on success and failure from each work. The analysis of experiences should be made in line with the issues as below:

1) Key factors contributing to the success included management. coordination, available resources, convenient working atmosphere, and others,

2) Conditions, conflicts and impediments confronted by those involved such as community. Group, institution, or agencies and other problems arose from powers and interests,

3) Process and proper management to achieve the objectives and cope with the difficulties,

4) Lessons from experiences indicating plans and methods to deal with any impediments and conflicts,

5) Records of all the experiences to be made,

6) Transfer of experiences to community networks and other plans eternally.

### 3.6 Evaluation of SLP

The evaluation of SLP for this study consisted of four methodologies. They were (1) testing of participants knowledge, (2) study on the relationship between knowledge and general information required for the participants, (3) observing the behavior of participants, and (4) satisfaction with SLP and benefits gained from SLP. The details were as follows:

#### Testing knowledge of participants

The pre-test and post-test evaluations of the participants about their perceptions of general knowledge of natural resources and environment, natural resources and environmental management, watershed management, water quality, and database perception were done. The results obtained were shown in Table 8.

Table 8 Pre-test and post-test evaluations of stakeholders' learning experience during the SLP

(Unit: %)

| Level of information perception | Mae Taeng Watershed | | | | | | Whole Watershed | |
|---|---|---|---|---|---|---|---|---|
| | Upper | | Middle | | Lower | | | |
| | Pre -test | Post -test | Pre -test | Post -test | Pre -test | Post -test | Pre -test | Post -test |
| **General knowledge of natural resources and environment** | | | | | | | | |
| Low (<3 score) | 30.2 | 9.2 | 27.9 | 8.8 | 29.6 | 8.1 | 29.2 | 8.7 |
| Medium (3-5 score) | 63.2 | 14.2 | 62.5 | 12.9 | 63.0 | 14.1 | 62.9 | 13.7 |
| High (>5 score) | 6.6 | 76.6 | 9.6 | 78.3 | 7.4 | 77.8 | 7.9 | 77.6 |
| **Knowledge of natural resources and environmental management** | | | | | | | | |
| Low (<3 score) | 53.7 | 7.1 | 57.6 | 1.4 | 61.9 | 9.7 | 57.73 | 6.1 |
| Medium (3-5 score) | 38.2 | 28.7 | 32.3 | 29.9 | 28.6 | 20.0 | 33.0 | 26.2 |
| High (>5 score) | 8.1 | 64.2 | 10.1 | 68.7 | 9.5 | 70.3 | 9.2 | 67.7 |
| **Knowledge of watershed management** | | | | | | | | |
| Low (<3 score) | 61.2 | 0.3 | 54.4 | 3.2 | 57.6 | 2.4 | 57.7 | 2.0 |
| Medium (3-5 score) | 30.0 | 15.1 | 33.5 | 7.8 | 34.0 | 8.9 | 32.5 | 10.6 |
| High (>5 score) | 8.8 | 84.6 | 12.1 | 89.0 | 8.4 | 88.7 | 9.8 | 87.4 |
| **Knowledge of water quality** | | | | | | | | |
| Low (<3 score) | 70.6 | 7.7 | 68.9 | 6.6 | 50.2 | 6.5 | 63.2 | 7.0 |
| Medium (3-5 score) | 26.7 | 19.7 | 28.3 | 19.9 | 44.5 | 11.2 | 33.2 | 16.9 |
| High (>5 score) | 2.7 | 72.6 | 2.8 | 73.5 | 5.3 | 82.3 | 3.6 | 76.1 |
| **Knowledge of database** | | | | | | | | |
| Low (<3 score) | 77.2 | 17.8 | 69.3 | 11.9 | 45.4 | 8.3 | 64.0 | 12.7 |
| Medium (3-5 score) | 21.7 | 20.0 | 28.9 | 22.6 | 50.9 | 26.8 | 38.8 | 23.1 |
| High (>5 score) | 1.1 | 62.2 | 1.8 | 65.5 | 3.7 | 64.9 | 2.2 | 64.2 |

According to Table 8, it was found that before SLP, most participants had the general knowledge of natural resources and environment at Medium level (62.9 %). Nevertheless, after SLP, most participants (about 77.5 %) had higher knowledge. It showed that the participants gained more knowledge after SLP.

It was found that before SLP, most participants have knowledge on natural resources and environmental management, watershed management, water quality, and database at the low level (about 57.7 %, 57.7 %, 63.2 %, and 64.0 % respectively). After SLP, most participants had higher knowledge in respective fields (see Table 8 ). It showed that after SLP, participants gained more knowledge.

The conclusion of the research could explain that the SLP, in the form of giving knowledge, question, practice, common learning through sharing views and discussion, helped inducing the participants to have more knowledge on natural resources and environment, natural resources and environmental management,

watershed management, water quality, and database. This subsequently resulted in the awareness of natural resources and environmental management in watershed.

**Observing behavior of the participants**

The monitoring of the participation in SLP was done through observing their behavior during conversation and discussion in Stages I, II, III and V and during workshop at Mae Taeng watershed in Stage IV. This result was shown in Table 9.

Table 9 Degree of stakeholders involvement during the participatory process in Mae Taeng watershed

unit (%)

| Degree of participation | Mae Taeng Watershed | | | |
|---|---|---|---|---|
| | **Upper** (n=28) | **Middle** (n=24) | **Lower** (n=32) | **Total** (n=84) |
| **Degree of involvement** (Group discussion) | | | | |
| Low (<2 score) | 13.0 | 14.7 | 13.4 | 13.7 |
| Medium (2-3 score) | 35.4 | 19.1 | 31.1 | 28.5 |
| High (>3 score) | 51.6 | 66.2 | 55.5 | 57.8 |
| **Degree of involvement** (Workshop) | | | | |
| Low (<2 score) | 10.1 | 8.1 | 9.5 | 9.2 |
| Medium (2-3 score) | 32.3 | 8.4 | 28.6 | 23.1 |
| High (>3 score) | 57.6 | 83.5 | 61.9 | 67.7 |

It was found that most of the participants from upper, middle, and lower watersheds were at high level of behavioral participation in conversation and discussion (57.8 %). The middle watershed group was at the highest level for group discussion (66.2 %). This was in accordance with AIC process of which the participants were aware of water quality problems, since most of the middle watershed located within the national park. Therefore, they often had the opportunities to gain knowledge on the environment from the relevant agencies. This has caused the participants having high level of behavioral participation in group discussion and workshop (Appendix A).

The result of the behavioral in participation in the workshop at Mae Taeng watershed (under the activities of Stage IV) found that most of the participants had high level of behavioral participation (61.9 %). Participants from the middle watershed were at the highest level of participation (83.5 %). This was in line with AIC process, sub-watershed that was under supervision of the government agency regarding natural resources and environment would provide people in the areas adequate knowledge, interest, and positive behavior toward natural resources and environmental management.

**Satisfaction and benefits from SLP**

The satisfaction and benefits on the SLP for the number of 84 participants were shown in Table 10.

Table 10 The participants' opinions on satisfaction and benefits of the participatory process

(Unit: %)

| Participants' opinions | Mae Taeng Watershed | | | |
|---|---|---|---|---|
| | **Upper** (n=28) | **Middle** (n=24) | **Lower** (n=32) | **Total** (n=84) |
| **Satisfaction in the participatory process** | | | | |
| Low | 6.6 | 8.8 | 7.2 | 7.5 |
| Medium | 27.8 | 19.1 | 25.3 | 24.1 |
| High | 65.6 | 72.1 | 67.5 | 68.4 |
| **Benefit on the participatory process** | | | | |
| Low | 2.0 | 3.0 | 2.5 | 2.5 |
| Medium | 25.4 | 14.6 | 23.3 | 21.1 |
| High | 72.6 | 82.4 | 74.2 | 76.4 |

According to Table 10, it was found that most participants were satisfied with the participatory process at high level (68.4 %). The participants from the middle watershed were found at the highest level of satisfaction (72.1 %).

For the benefits from SLP, it was found that most of participants got the high level of satisfaction (75.5 %). The participants from the middle watershed got the highest (82.4 %).

The result of the study showed that SLP would, principally, think, analyze, and find solution in systematic way and proceed on any actions to solve problems and mitigate conflicts. It could be said that SLP needed the accumulated experiences from the beginning of the process. In this concept, each stage of SLP requires simple preliminary data collection. Collected data was then be input for AIC process and it should be able to systematically analyze such accumulated data. The expected result would be in line with the evaluation guideline and be beneficial to local people. Moreover, the outcome could be applied for further development process in terms of policy, work plan and program.

However, the type of workshop (in the forms of education, training, brainstorming, and exchange of views) would be made for the people or the stakeholders involved with water quality in Mae Taeng watershed. This would help to promote the participants to take part in finding the solution for the natural resources management problems and the inspection of water quality in local area. Nevertheless, the result of workshop could be applied, it depended on the preparedness in various aspects such as the readiness of SAOs office in the future, those involved with water quality inspection, size of problems, duration, appropriate duration, and local support budget.