Assessment of Laem Phak Bia Environmental Research and Development Project's Outreach Program

Chulalongkorn University
Worcester Polytechnic Institute

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SSP Team 5:
Jittisa Ketkaew
Patompong Leksomboon
Tapakorn Luangaramvej
Tuptim Jarusreni

IQP Team 5:
Adam Hoyt
James Loy
Michelle Ly
Silvia Zamora-Palacios

Abstract

The Laem Phak Bia Environmental Research and Development Project (LERD), a Royal initiative of the Chaipattana Foundation, aims to provide communities and organizations in Thailand with the environmental knowledge necessary to implement natural waste and wastewater treatment techniques. Our goal was to assess LERD's outreach program and recommend improvements. Through archival research, site assessments, interviews with staff, and visitor surveys, we performed a summative analysis of LERD's outreach strategy. After critical analysis, suitable recommendations were made to improve the program. These recommendations seek to improve LERD's interactions with the public, visitors, and clients as well as on-site presentation.

Executive Summary

Laem Phak Bia Environmental Research and Development Project (LERD) is a Royal initiative of the Chaipattana Foundation. The organization researches and develops natural wastewater and waste treatment methods. While continuing to research environmental waste treatment techniques, LERD has begun raising awareness and providing communities and businesses with the environmental knowledge necessary to implement LERD's methods throughout Thailand.

Background

The Chaipattana Foundation established LERD according to the decree of His Majesty King Bhumibol Adulyadej. The project has built wastewater and waste treatment models ideal for Thai communities, which are simple, natural, and low cost.

One of Five Wastewater Oxidation Ponds

Wastewater treatment models developed by LERD include: oxidation pond treatment systems, grass filtration systems, artificially constructed wetland systems, and mangrove ecosystems. Solid waste treatment includes "concrete box" composting. These treatments are purely natural means that involve aerobic organic matter decomposition, and can be effective from 90 days to 15 years, depending on the technique.

The researched environmental methods have been adapted for wide implementation throughout Thai communities and industries. To increase the implementation of the environmental methods in Thailand, the outreach efforts of LERD need to be optimized to more widely disseminate these commendable activities to a wider audience. In order to achieve an effective outreach program, it is essential to assess the strategy of outreach programs, to provide a firm basis for growth. Our team researched on useful outreach strategies including effective learning centers, evaluation models, and educational media that have been successfully used in previous outreach programs from different organizations around the world.

Methodology

Our objectives for meeting our project goal involved first determining LERD's plans for meeting their outreach goals and assessing how effective these plans were. We provided recommendations for improving LERD's outreach plans based on this analysis. In terms of investigative strategies, we conducted site assessments, archival research, staff interviews, and

surveyed visitors. We conducted a site assessment of the LERD experimental site to analyze the infrastructure and the services provided to visitors.

Conducted Interviews at LERD Facilities

We visited LERD's office at the College of Environment, in Kasetsart University to conduct interviews with the staff. Our questions focused on determining the outreach plans of LERD and how LERD executed those plans. While there, we also collected annual evaluation reports from LERD's archives.

When we visited LERD's experimental site, we interviewed LERD's clients about their relationship with LERD before and after the implementation of the environmental technique. We also conducted additional staff interviews and distributed surveys at the experimental site to be filled out by visitors. The questions on the survey related to the visitors experience at LERD and asked them to rate certain aspects of LERD's programs on site.

On our second visit to Kasetsart University, we collected internal reports and compiled our findings on the evaluation methods used in these reports. We also conducted interviews specifically on how records, if any, were kept. Moreover, we collected the surveys that had been completed by LERD's visitors and compiled the results for further data analysis.

Findings & Analysis

From the site assessment conducted at the two LERD facilities, we determined LERD's plans and examined educational materials created to accomplish their outreach goals. LERD's two locations are an operating office located at the College of Environment, Kasetsart University in Bangkok and an experimental site located in Laem Phak Bia, Phetchaburi province. LERD's operating office is where the library and most of the organization's paperwork, meetings and research presentations are held. The experimental site is where the wastewater and waste treatment techniques were developed and educational tours are given to interested visitors. The facilities at the experimental site include an office building, a souvenir shop, and the experimental plant where LERD's environmental treatment techniques are researched, developed and maintained. In our visits to the experimental site, we were able to observe and evaluate the amenities developed for visitors. This included tour buses, informational posters, and a map of

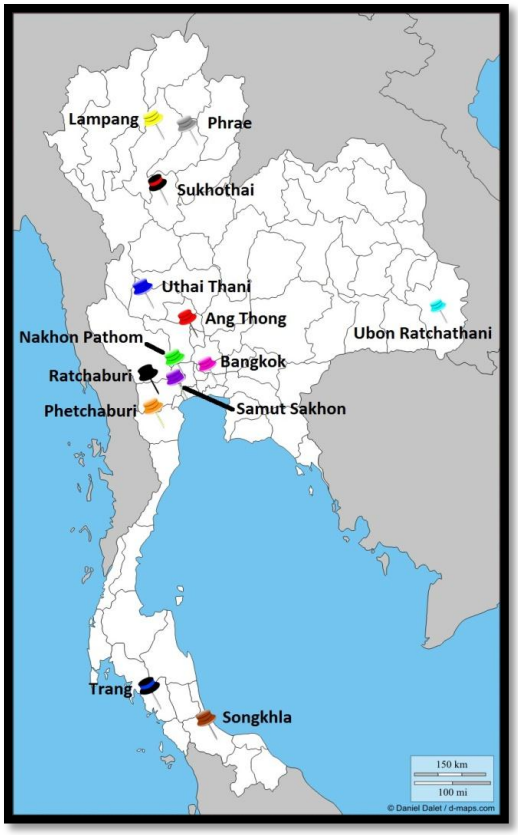
the area. We noticed that the majority of the informational posters were written in Thai and did not provide simple explanations for visitors with a non-scientific background to understand.

From our interviews with LERD staff, we learned that the staff was not in consensus on several important topics related to LERD's overall focus. We noticed the staff shares a similar overall mission, however, when addressing more specific details, their answers differed from one another according to their field of work. Also, we noticed the staff does not agree and focus on a single target audience for LERD's programs. These findings demonstrated to us the need for clarification of LERD's mission and target audience for the staff.

Interviews with current clients of LERD provided views from the receiving end of LERD's outreach initiatives. We determined that the majority of the clients were informed about LERD's environmental techniques by former Kasetsart University students who were previously involved with LERD. This was an interesting finding because it did not reflect the core outreach strategies that LERD staff had identified, but a new outreach channel to consider. In addition, all clients reported that site assessments and implementation support were provided by LERD once clients expressed interest and began constructing LERD's waste treatment systems. Also, with regard to the educational handouts developed by LERD, the clients requested new handouts with simpler explanations of LERD's wastewater and waste treatment techniques to appeal to audiences less familiar with scientific terminology.

After conducting archival research, we found that the official mission statement of LERD is to focus on researching and developing waste and wastewater management technologies, as well as providing academic service and transfer the knowledge to others. Comparing this statement with answers from LERD staff members, we noticed similarities between LERD's official mission and the staff's interpretation. We compared the demographic data with the stated target audience, and found an increasing number of visitors for the past several years. However, we noticed that unscheduled visits to LERD were not recorded in their visitors' records, thus affecting the actual total visitor count.

Additionally our team provided surveys to visitors and found useful data to draw conclusions about LERD's current presentations. From our survey data, we found specific visitor demographic information such as where visitors came from and the group type they identified with. The majority of the visitors were identified as students and teachers (41%) and also the majority of visitors are from Bangkok. We also gathered data on visitors' ratings of the informational content and the presentation quality of the programs at LERD. The majority of respondents rated each category with a score of 5 or 4, which were the two highest scores. This positive feedback shows that LERD is performing well in terms of media presentation and informational content in the programs at LERD. Additionally, our comparative analysis found trends and correlations between several of our survey questions.



Map of the Demographics Where the Visitors Are from

We evaluated various outreach materials and educational tools developed by LERD that is used to transfer knowledge of the center's techniques and increase the rate of implementation of their projects. Currently, the outreach materials include informative videos, pamphlets and brochures. These promotional materials are both in English and Thai, however, they have different designs, presentation and informational content.

Additionally, LERD also maintains a website, which includes content such as the history of the project and information regarding LERD's environmental techniques, as well as a list of activities occurring at the site. These activities include seminars, workshops, and video records of documentaries and TV programs. Many of the sections of the website contained a heading without any informational content. Also, there was no information about LERD's seven other learning centers in different areas of Thailand. It was found that the website is exclusively presented in Thai, but in an attempt to appeal to international audiences a Google translate application is included to translate the website. By using Google translate we determined that the quality of translation is inadequate.

After carefully analyzing the collected data from the site assessment, archival research, interviews and surveys, we determined the major trends in LERD's organization from which to draw conclusions. The first trend found was the inconsistency with the LERD staff members' goals and focus. Although there was some overlap, there were different opinions between the perceived mission and target audience of LERD. Without this greater strategic unity, it is difficult to design an optimal outreach strategy. Unity in this aspect can strengthen an

organization as it points all members in the correct direction as opposed to multiple scattered ones.

LERD's attempts to utilize the Internet for its outreach efforts can be improved. Many of the inconsistencies and lack of information hinder and confuse potential viewers. LERD can meet their outreach potential on the internet by updating the current website and Facebook fan page.

Another trend found was the lack of simple and easy-to-understand informational materials provided to the visitors and clients. Also, the lack of informational posters available onsite does not facilitate an understanding of the environmental techniques for the visitors. Similarly, all the information onsite and most of the materials provided to visitors are in Thai, which are not suitable currently for international visitors to LERD. Moreover, there are no lecturers fluent in other language besides Thai. Therefore, informational posters and media in English and other languages commonly noted in the visitor record need to be developed in order to promote what LERD has to offer to foreign visitors.

Lastly, LERD has an inefficient system of archiving visitor and client information. Data found in the archives was not always easily found and not all visitors are kept on record. Without an organized archive and complete records with relevant information, it is difficult for LERD to monitor its progress of accomplishing its goal and mission.

Recommendations

The potential of this environmental research completed at LERD can be furthered by its outreach efforts to create a greater impact. Through a combination of site assessments, interviews, surveys, and archival research, our team found and analyzed the following areas in LERD's outreach system that can benefit from improvements:

1. Clear communication among LERD staff
2. Methods for maintaining visitor and client records
3. Clear communication between LERD and its clients
4. Continued staff training
5. Advertisement and educational media

After analyzing these deficiencies we make the following recommendation for our sponsor:

1. The improvement of LERD's administrative procedures.
2. The creation a systematic follow-up process to improve LERD's interaction with clients
3. The provision of LERD's staff members with additional outreach training.
4. The improvement educational materials and programs for the LERD experimental site.
5. A reassessment of LERD's online interaction with visitors to their websites

With our recommendations, we hope to contribute to the improvement of the LERD outreach program. These recommendations have been presented to LERD and the Chaipattana Foundation for the promotion of their collaborative effort. Working as an international team in an interdisciplinary setting, it has been a great pleasure to have the opportunity to work with an organization with civic duties and it is our hope that through this project, we can contribute to the improvement of LERD's outreach program.

Acknowledgements

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Authorship

This report is the composition of all eight author's work and ideas. Each team member played a crucial role in the successful completion of this project, which includes but is not limited to: translation, data collection, statistical analysis, writing, editing, and the formation of recommendations.

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Glossary

Clients – Visitors who are interested in implementing LERD's techniques and contacted LERD for help. The word "clients" is not used to refer to a business transaction; no money was paid to LERD. Clients also include people who have already implemented the environmental techniques.

Facebook fan page - A Facebook fan page is a public profile that enables you to share your business and products with Facebook users.

Facebook "Welcome page" - A welcome page is a specially-designed page that visitors land on initially when they find the Facebook fan page of a business or product.

Field workers – Defined as the employees at LERD who work on the physical maintenance and construction of the wastewater and waste treatment systems.

Follow-up program – Defined as the various methods LERD can use to keep in contact with clients who have implemented LERD's wastewater and waste treatment techniques.

LERD – Acronym for: **L**aem Phak Bia **E**nvironmental **R**esearch and **D**evelopment Project, a Royal Project of the Chaipattana Foundation.

Outreach Programs/Plans – Services, presentations, or media that LERD utilizes to encourage the transfer of knowledge about their wastewater and waste treatment techniques. This can include any services and plans that are not directly related to researching wastewater treatment itself.

Staff – Employees of LERD including: officers, librarians, researchers, and graduate students who contribute to LERD's works.

Upper management staff – LERD's high ranking staff members involved in the key decision making and direction of LERD's mission as a whole. This includes: board of directors, founders, and department heads.

Waste – Solid material that no longer has useful value.

Wastewater – Water contaminated with pollutants such as excessive organic matter, municipal industrial waste, chemicals, and trace metal contaminants

Chapter 1: Introduction

Pollution and environmental destruction are problems that affect all residents throughout Thailand. Organizations such as the Chaipattana Foundation have conducted research to develop potential solutions that are simple, natural, and low-cost. These programs include wastewater treatment, waste disposal in sanitary landfills, and mangrove ecosystem protection (Chaipattana Foundation, 2007). The research completed by the Chaipattana Foundation through Laem Phak Bia Environmental Research and Development Project (LERD) reduces the efforts needed by small communities and businesses to research solutions for individual problems.

LERD aims to raise awareness to environmental protection and provide services for underprivileged communities and industries that lack financial and technical support to have access to clean water and sustainable waste treatment. This aim can be attained through greater outreach. LERD currently has outreach strategies for their aims, and as a team, our goal is to assess these outreach strategies.

We conducted site assessments, interviews, archival research, and surveys with LERD staff and clients to gain insight of what could be added to the outreach program. Outreach is vital to the implementation of LERD's environmental methods into other regions of Thailand and other countries. It is also crucial to raise awareness on the concept of low-cost, simple and natural solutions to environmental problems.

Finally, after studying the programs and activities available at LERD for visiting researchers, we evaluated possible media used for outreach. These outreach media recommendations are improvements that can enhance the outreach program of LERD. With more vigorous outreach initiatives, the Chaipattana Foundation can increase the utilization of environmental knowledge developed by the King's initiatives to better the lives of the people of Thailand.

Chapter 2: Literature Review

This chapter presents a review of recent research relevant to our project. First, we give a brief overview of Thailand, Thai culture, and our sponsor, the Chaipattana Foundation. Later we describe the Laem Phak Bia Environmental Research and Development Project (LERD) in Phetchaburi province. We explore further research into the outreach initiatives appropriate for environmental learning centers similar to LERD. This is followed by information regarding different educational approaches for visitors of learning centers, such as LERD. Finally we present two case studies as examples and guidelines for successful outreach initiatives.

2.1 Thailand & the Chaipattana Foundation

Thailand is a nation with an area of 198,000 square miles and has a population of 64 million people. Due to the rapidly growing population, families are increasingly forced to occupy all available space and take advantage of natural resources in the surrounding area. This continuous strain on resources has caused environmental problems across the country over several decades, including the extinction of many species of animals and plants. The Gulf of Thailand, a main marine resource of the country, has also seen an increase in pollution (Cheevaporn & Menasveta, 2003). Wastewater and debris thrown into the Gulf daily, have significantly contributed to the degradation of this important natural resource. To mitigate this trend, His Majesty the King ordered the development of suitable technology that was natural, simple, and low cost to help combat these issues. Thusly, His Majesty the King established the Chaipattana Foundation on June 14, 1988.

The goals of the Chaipattana Foundation include supporting Royal development projects, promoting increased social welfare, enabling self-reliance, improving quality of life, and carrying out plans or projects that are beneficial to local residents and the country as a whole. Royal development projects are projects carried out by foundations affiliated with the Thai Royal Family for the improvement of Thailand (Chaipattana Foundation, 2007).

In an effort to research solutions to the environmental issues faced by the country, the Chaipattana Foundation created LERD. The environmental methods developed at LERD include wastewater treatment, solid waste disposal, waste decomposition into fertilizer, and mangrove ecosystem protection (Chaipattana Foundation, 2007). Research completed at LERD reduces the efforts needed by small communities to research for solutions for their individual problems. This

is very beneficial for these communities as they lack the resources for higher level waste treatment technology that larger cities, such as Bangkok, have access to.

2.2 Laem Phak Bia Environmental Research & Development Project in Phetchaburi Province

Providing an excellent setting for the King's work, Phetchaburi, also called Mueang Petch, is a city in Thailand located in the province of the same name. This province is situated on the western shore of the Gulf of Thailand with an approximate area of 6,225 square kilometers. The province contains rainforests in the mountains along the border with Burma. There is also an 80-kilometer long coastline with the Gulf of Thailand where mangrove forests and nice beaches can be found (Department of Information and Communication, 2012).

The environmental research center of the Chaipattana Foundation, LERD, is in Ban Laem, which is in close proximity to the coast (see Figure 1, below). The organization chose to locate in this area because of the large amount of wastewater available for treatment in Phetchaburi. Not only is Phetchaburi a famous place for tourists, it is also a prevalent area for industrial businesses. Therefore, Phetchaburi faces many challenges with wastewater and garbage disposal.

Figure 1: Map of LERD (Upton, 2008)

In addition, LERD's location is in close proximity to a natural mangrove ecosystem to use for research in relation to LERD's waste and wastewater treatment methods. As Phetchaburi develops, pressure is put on the ecosystem by the growing population and the development of the area for tourism.

2.3 Alternative Solutions Developed by LERD

As a team assessing LERD's outreach program, we are not only required to learn the current activities and strategy of LERD's outreach program. It is also important for us to learn what LERD has developed and the techniques they are encouraging others to adopt. Therefore, we researched the five environmental techniques developed at LERD to fulfill this need and help us to excel in the assessment and recommendations to strengthen the outreach program.

LERD has developed several natural and simple options for tackling wastewater management and solid waste disposal. These projects include the use of oxidation pond treatment, artificially constructed wetlands, grass filtration, mangrove forest filtration, and "concrete box" composting. These different options all require different maintenance plans, land area, and resources to carry out. This is beneficial because the most suitable waste treatment method can then be chosen for each area and client. Here we describe the systems in greater depth.

2.3.1 Oxidation Pond Treatment System

The oxidation pond treatment system, also called a lagoon treatment system, is a process that the foundation has developed to treat waste using oxidation ponds. It involves 5 separate shallow ponds that can contain a flow of 20,000 cubic meters of wastewater a day. This system is effective over a long period of time, with the life cycle of the ponds typically lasting 10 to 15 years.

The process works in three main steps. The wastewater first enters a sedimentation pond. In this first pond the majority of the mechanical treatment is done as settled solids are removed from the wastewater. Next the wastewater is sent to the three oxidation ponds. The main purpose of these three ponds is the digestion of organic matter through the use of microorganisms. The conditions under which the microorganisms work are a combination of aerobic, facultative, and anaerobic. The final pond is the stabilization pond where the water is given a final polish as the algae in it die off due to lack of sufficient resources. This full cycle occurs over a 21 day period with the wastewater spending 7 days in each type of pond (Petchpoom Printing, 2008).

Lagoon systems are effective methods to treat sewage in rural areas because of their high purification rates. The main disadvantage of using lagoon systems is the risk of secondary pollution from algae blooms within or around the lagoon. If algae escape from the lagoon into other waterways, they can pollute waterways and damage the natural ecosystems. Therefore, it is important to keep populations of phytoplankton and algae under control. Nevertheless, lagoon systems are the most common treatments in low-economic areas (Steinmann, Weinhart, & Melzer, 2003).

2.3.2 Grass Filtration System

The next natural wastewater treatment method modeled onsite is the grass filtration system used to treat wastewater. In this method municipal wastewater is run through grass, where, like other filters, contaminants are trapped, while allowing water to continue traveling through the grass to be collected. After the grass has been allowed to grow for 90 days, it is cut down to prevent the grass from decomposing and introducing the absorbed toxins back into the system. Grasses identified as ideal for this treatment option include *Sporobolus virginicus,* and C*yperus corymbosus.* Photographs of these two plant types are included in the Figures 2 and 3 below.

Figure 2: Sporobolus Virginicus (Geographe, 2012)

Figure 3: Cyperus Corymbosus (Gold, 2012)

2.3.3 Artificially Constructed Wetland System

Although similar in method to the grass filtration system, the artificial wetlands system is slightly larger and has a different method of operation. The ideal water plants determined to grow in the artificial wetland are types of emergent macrophytes, *Cyperus corymbosus* Rottb. and *Typha angustifolia* Linn. The desired water flow to the wetland is 37.5 cubic meters of wastewater daily, which is the ideal amount for a small community. This system can be operated in two different ways; it can either be filled then drained at the same rate or at a rate equal to the evaporation rate.

2.3.4 Mangrove Systems

Among the many natural environmental management programs developed and implemented by LERD, is the practice of utilizing mangrove ecosystems for pollution control. Mangrove ecosystems are commonly found along tropical and subtropical coastlines. The mangroves can assist in natural pollution control as their roots help to create aerobic zones for organic matter decomposition. Mangrove roots also help purify water by absorbing nutrients such as nitrogen, and phosphorus from settled municipal wastewater (Wu, Chung, Tam, Pi, & Wong, 2008). The preservation of these mangrove ecosystems is important to the natural treatment of waterways and in turn, it is important to human health.

2.3.5 Concrete Box Composting

In addition to the primary focus on wastewater treatment, LERD has developed natural methods for disposing organic solid waste materials. The natural method that was developed involves the use of a large concrete box to hold waste, where waste is slowly broken down over time into compost. Each concrete box holds a total of two metric tons of waste and fertile soil that are layered throughout. This decomposing process takes approximately 60 days and in that time the volume of waste is reduced by 60%. An advantage of this compost system is that it does not require the periodical turning and mixing of the waste as it decomposes (Petchpoom Printing, 2008).

For proper use of the concrete box, a layer of fine sand is first put on the bottom of the box. This layer is followed by alternate layers of 660 kg of solid waste, preferably vegetable and fruit matter, and 210 kg of fertile soil or animal manure. After these layers a final layer of 630 kg of fertile soil is put on top to minimize the odors that are emitted by the compost. After all the material has been added to the box, 100 liters of water are added and an additional 30 liters are added to the pile every 7 days. This water helps to regulate the temperature of the box and encourages the growth of microorganisms that break down the waste. At the end of the 60 days any material not decomposed is removed through the use of a screen and the compost is exposed to the sun for 7 days to kill unwanted microorganisms (Petchpoom Printing, 2008).

2.4 Designing Effective Learning Centers

LERD facility located at Laem Phak Bia is not only a research center, it is also a learning center focused on educating visitors regarding environmental awareness and the developed environmental techniques. Therefore, in order to understand how learning centers operate and to conduct a proper assessment on the learning center's outreach program, as a team, we researched further into what a learning center is and how it functions.

An important aspect of designing an effective outreach strategy is making sure that the site is also an effective learning center, because outreach alone will not make a program successful. Once the audience is interested in learning more about the environmental methods available at LERD, information must be available to transfer the environmental knowledge to the visitors. This can be done through careful design of facilities and infrastructure at the learning center.

LERD has successfully developed wastewater treatment systems to an effective and satisfying level. Most of the current work at LERD is focused on applying the treatment techniques to other areas of Thailand. In this effort, the LERD experimental site provides some educational media. The site currently has great potential to expand as a learning center to raise awareness of environmental preservation and provide simple, natural, and low-cost solutions for waste treatment.

Learning centers are independent stations that allow visitors to explore the ideas of a certain program in a hands-on or interactive manner. Visitors are actually engaged in the learning process to help them gain knowledge in greater depth and stimulate more interest in the subject. Environmental parks, museums, zoos, botanical gardens, and other informal educational institution are some examples of learning centers (Diamond, 1999). With a high-quality structure and an organized system, informal learning centers allow visitors to easily understand material ranging from simple knowledge to complicated science techniques successfully.

2.4.1 Using Media Effectively in Learning Centers

It is important to discuss methods by which to evaluate media quality, because it is a means to indicate the success of the information transfer process. Tools to measure the success of media are a challenging topic for people within the media and advertising field.

In a recent study, "Comparing the effectiveness of the website with traditional media in tourism industry marketing", the authors compared the effectiveness of a website with traditional media in tourism industry marketing. The authors of the study state that:

> *Though mail, telephone and personal selling have been in existence for many years, the Internet however offers high-speed information transmission and retrieval at a low cost. The addressability of the web provides the ability to customize and tailor the product and/or the marketing effort to one consumer at a time* (Ramona, Gheorge, & Roxana, 2008).

It was concluded that promotion via the Internet satisfies the customers with convenient access to the information and allows them to compare choices. Visitors of the site are able to understand complex information on the webpage. Webpages are constantly available to users and are a low cost option to disseminate information.

The method used to evaluate the effectiveness of a website is useful to study and can be applied to evaluate LERD's website. One good example of the method used to study the efficient and effective media strategy is shown in a paper written by David F. Poltrack and Kevin Bowen called "The Future is Now: In Pursuit of a More Efficient and Effective Media Strategy". This paper aimed to study which media are most popular and the reason for their popularity. The paper specifically looked at demographics of consumers. As an evaluation tool, the Cambridge Group and CBS corp. conducted an online-survey with 7,000-person sample population between the age of 18 and 65. In addition, the team created software that measure actual viewership and online behavior (David F. Poltrack, Kevin Bowen, 2011).

2.5 Designing Outreach Programs

Our project is to assess LERD's outreach program, therefore, having a full understanding of what an outreach program is, how to design one and how to evaluate it are three topics necessary for us to know in order to properly conduct this assessment. For this reason, we research further in order to fulfill this requirement.

In "Outreach Schools: An Educational Innovation," by Billie E. Housego, the term *outreach* is described as a term used to express, "efforts to increase the availability and utilization of services, especially through direct intervention and interaction with the target population" (Alberta Education, 2009). Therefore, an outreach program is a strategy developed by an institution to increase awareness, dissemination of knowledge and utilization of techniques or services provided.

An outreach program varies greatly depending on the size of the organization, the given budget to develop the program, the goals and the objectives of the program. Due to these factors, there is no uniform outline for developing a successful outreach program. However, there are three basic steps that serve as a guide for creating a successful outreach strategy: make a plan, create a budget, and implement the plan (US Department of Agriculture, 2011). For the purposes of our study, we would also add a final step: evaluate the outreach program.

2.5.1 Make a Plan

In order to create an outreach plan that yields the desired outcomes, the institution must answer several questions to determine the initial direction in which to focus their strategy. Some of these questions are included below in Table 1.

1	Who is the target audience?
2	Why is the program needed?
3	Is the organization working with any partners?
4	What information needs to be conveyed to the audience?
5	In what languages will it be needed?

Table 1: Questions for Direction in Making an Outreach Plan (US Department of Agriculture, 2011)

By answering these questions, the team responsible for developing the outreach strategy will have a better understanding of the steps and activities that need to be completed to accomplish their goal (US Department of Agriculture, 2011). These questions also set in place the purpose and values of the program to guide the planning process. When the objectives of the program stray from the original purpose, refocusing on the ultimate goal is beneficial.

2.5.2 Create a Budget

The second step is to create a budget. After the plan is created, a list of all the required materials and resources must be recorded. It is with this step that the feasibility of the outreach plan is evaluated. If there are not enough funds for the plan, then the developing team must return to step 1 and create a more feasible plan according to the available budget (US Department of Agriculture, 2011).

2.5.3 Implement the Plan

The third step is to implement the plan. With the preparation of the necessary materials and resources, one can properly develop a timeline for executing the project. When unexpected obstacles occur, it is important to have alternate plans and account for extra time that might be required. It is in this stage that the flexibility of the plan will be evaluated. If a project is flexible, even when slight strays from the proposed plan occur, the ultimate goal remains achievable and the integrity of the project is maintained. Consequently, when a project is not flexible enough, it leads to failure after even small changes.

2.6 Evaluating an Outreach Program

Many organizations often make the mistake of evaluating a project only at its completion or too infrequently. This is the reason why most projects do not meet the maximum goal expectations. Cathy L. Martinez, consultant at the Center Point Institute, stated in 2005 that an,

“evaluation should be used as an ongoing management and learning tool to improve an organization's effectiveness” (Martinez, 2005). The evaluation process of an outreach program is equally as important as the design and development of the program. By evaluating the developed outreach strategy, the institution can measure any progress or success accomplished by the completed activities. Through evaluation, errors can be found and improvements can be made to achieve better outcomes.

An evaluation strategy fluctuates greatly depending on the established budget, the organization size and set time to complete the evaluation of the outreach plan. A set of tools to do a proper evaluation can be chosen by the organization or management team. This set of tools varies depending on the target audience, the outreach goal, objectives and priorities.

According to the model of the management department of the United States Department of Agriculture (USDA), there are six important outreach criteria that can help determine the level of success of the outreach strategy. These six criteria can be seen in Table 2 below.

1	Success of media outreach
2	Paid advertising
3	Public Service Announcements (PSA)
4	Partnership development
5	Events
6	Public awareness

Table 2: Key Criteria to Determine the Success of an Outreach Plan (US Department of Agriculture, 2011)

The importance of each criteria of the outreach program varies depending on the goal and objectives of the organization. The evaluation must focus primarily on the most important criteria for the particular organization. The other criteria are evaluated in descending order of importance.

2.7 Brown University Evaluation Model

Another outreach evaluation model has been produced by Brown University. This model is used to evaluate the university’s scientific works and communication programs. The evaluation method is categorized into two types. One is *Formative evaluation* and the other is

Summative evaluation. This evaluation method helped to determine if the outcomes of the outreach programs coincided with the main goals of the program. The tools used to evaluate are as follows in Table 3.

	Evaluation Tools
1	Surveys
2	Interviews
3	Focus Groups
4	Events
5	Classroom observations/Integration of technology

Table 3: Evaluation Tools Modeled at Brown University (Brown University, 2012)

The *Formative evaluation* provides constructive feedback as a project is executed. This feedback allows the evaluator to improve the details of their work while the project is in progress. The *Summative evaluation* shows the impacts of the program after the implementation process. This two-step evaluation process is the combination of both research and assessment (Brown University, 2012). With this evaluation process, constructive feedback can be obtained while the project is being executed to find flaws and necessary changes to improve the project as it progresses. Moreover, the impacts of the program are assessed after the implementation process to view the effectiveness of the program and evaluate if the project has met expectations. By following this model, LERD can perform a similar evaluation to optimize its outreach plan success.

2.8 Influence of International Communication and Media Globalization

One of the most important missions of LERD has been to provide its environmental knowledge in an attractive and understandable for its Thai audience. One of the media most commonly used by LERD is their website. With LERD's information available on the internet, attention can be increased to make LERD's environmental techniques more visible to people within the environmental field.

The world is viewed as a single, connected unit through international communication and media. In the past, communication was limited within local areas, and so information, traditions, and cultures were transferred only to other nearby communities. These walls across borders have

faded due to useful mediums to transfer the information such as the webpage and social network tools, news, magazines, and satellites (televisions). International outreach can be viewed as, "communication that occurs across international borders, that is over the borders of nation states" (McMillin, 2007). Therefore, international communication is a valuable tool for LERD to influence environmental institutions, and industrial companies outside of Thailand and make LERD and its ideals and methods world renown.

2.9 Selected Case Studies on Educational Material and Outreach

In this section, we will discuss two relevant case studies that present successful educational material and outreach initiatives. The first case study describes the importance of effective material to educate local residents about ecological responsibility. The second case study illustrates a model infrastructure for community outreach and innovative educational methods.

2.9.1 Dan Municipal Sanitation Association Center's Project

Dan Municipal Sanitation Association is an organization focused on studying environmental issues with its headquarters in Israel. Its main purpose is to develop methods to treat household waste and to promote recycling techniques. The organization is currently developing a recycling park, where the facilities generate energy from waste, and cooperates with the rehabilitation of Mount Hiriya. Table 4 below shows the activities conducted to educate people on the importance of recycling and reducing the amount of waste generated.

1	Artwork seminars on recycled works
2	Organized trips around the park
3	Audiovisual movies
4	Lectures on the subjects of waste and recycling

Table 4: Example Educational Activities (Hiriya, 2010)

These activities educate adults, children, and adolescents about the bond between quality of life and ecological responsibility. The Center for Environmental Education offers a variety of courses for schools, encapsulating all ages from kindergarten to high school, seasons, and subjects with teachers to accommodate all students. During the education process, students

examine their lifestyles from different perspectives while discussing practical ways of incorporating sustainable customs and behavior into their daily lives to support the environment.

The learning center offered four classes during the evenings for parents, green communities, and green schools interested in parent participation in the fields of ecology and recycling. During the classes, the visitors learned about "consumption culture", and the link between consumption and the media, as well as learning about the intelligent and economical consumption of a green family. Other workshops and activities were also available, such as basket weaving using plastic bags to stimulate creative ways to recycle.

The educational program was also designed to accommodate business owners and university students. While university students were given the opportunity to participate in internships, business owners were given informational presentations about business and specific industrial applications of waste management. The association was successful in its educational efforts as they receive 181 bags of garbage daily from visitor in attempts to avoid polluting the environment (Hiriya, 2010).

From this case study, it is important to understand that a successful educational program needs stimulation through application. That is, the visitors that come to learn at the center need accommodation for their specific needs and purposes. By appealing to the interests of the visitors, the learning process is greatly enhanced and the visitors' investment in environmental protection is stimulated.

2.9.2 Pitchandikulam Forest Case Study

Pitchandikulam Forest is dedicated to the preservation and restoration of a local tropical forest in Tamil Nadu, India. It was established in 1973 and since then, the 70-acre site has been transformed into a complete ecosystem with more than 800 species of plants (Pitchandikulam, 2012).

The Pitchandikulam Bioresource Center created a library, database, and a display area for artifacts and photos, as well as some local plants and animals in order to teach restoration ecology, environmental science, and the use of local medicinal plants. A major focus of Pitchandikulam is community outreach and they are currently working with 25 villages throughout the Kaluveli bioregion.

Pitchandikulam Forest became part of a national Medicinal Plant Conservation Network, coordinated by the Foundation for revitalization of local health traditions in Bangalore.

Collaborating with 30 other conservation areas, detailed programs of botanical and social documentation, conservation and planting initiatives have been developed. Through community outreach activities and delivering innovative education methods in the schools of the bioregion, Pitchandikulam Forest provides models of sustainable ecological practices. Traditional knowledge and technologies of the local people are being documented, displayed and woven into the Pitchandikulam landscape. A team of botanists and community activists work from Pitchandikulam on several projects to restore the indigenous forest and the traditional knowledge related to the local ecosystem. They have been also operating using natural sources of energy such as wind and solar power. Recently, they built a small dormitory to host students and researchers for stays of up to one year, where it was only the 3-4 single room cabins on the property in the past. In addition, the forest employs local villagers to create and paint the educational signage for the facility. This opportunity provides environmental education as well as a skillset for local artists.

A major component of Pitchandikulam Forest's work involves working with communities to empower them towards self-sustainability and involve them in the process of eco-restoration. The primary activities provided throughout the Kaluveli bioregion are environmental education, health camps, and awareness programs for health and hygiene. Community-specific activities include facilitating traditional healers, women's training groups, and workshops (Pitchandikulam, 2012).

The park helps the local communities to develop sustainable infrastructure and environmental literacy. Collaborating with village leaders, healers, self-help groups, youth groups, other NGOs, government departments, and students; the park is essentially focused on environmental issues, which impact local populations. Activities that will keep visitors interest in the subject are needed in order for them to understand more in detail the important aspects of the environmental knowledge.

Another example of a successful learning center is the Adyar Poonga project, a sub-center of the Pitchandikulam Forest. The Adyar River used to be heavily polluted with solid waste, untreated industrial effluents, and domestic sewage from slums. In 2006, the area was transformed into an eco-park through natural treatments (Auroville, 2011). Today, the eco-park offers environmental training courses, activities for students, workshops for villages, guided walks for visitors, and other activities organized by an education center. Furthermore, the project

also developed an outreach program with news and activities for visitors (Pitchandikulam, 2012). This park owes its success to not only solving environmental problems, but also providing useful information and training for visitors. The park has received positive feedback and it became a good model for other environmental learning centers.

2.10 Summary

The Chaipattana Foundation created LERD according to the decree of His Majesty, King Bhumibol Adulyadej. The project has built wastewater and waste treatment models ideal for Thai communities, which are simple, natural, and low cost. The researched methods have been adapted for wide implementation throughout Thai communities and industries. To further optimize this implementation of the environmental methods, the outreach efforts of LERD can be optimized as well. In order to achieve an effective outreach program, it is essential to study the background, strategy, and evaluation of outreach programs, to provide a firm basis for growth.

During our study we learned more about LERD's environmental techniques and outreach program, what a learning center is and how outreach programs are designed and operated. All this knowledge and understanding on the topic allowed us, as a team, to conduct a proper and effective assessment LERD's outreach program.

Chapter 3: Methodology

The focus of our group was to assess the efficiency of the current outreach program and the educational materials available to visitors at Laem Phak Bia Environmental Research and Development Project (LERD). Our goal was to evaluate LERD and to offer recommendations to increase the effectiveness of their means to transfer of environmental knowledge from LERD to visitors. This chapter describes in detail the methods and procedures we completed to meet our goal.

3.1 Objectives

In order to complete our project goal, we developed the following four objectives:

1. *Determine LERD's goals for their outreach program*
2. *Identify LERD's current plans to achieve their goals*
3. *Assess the effectiveness of LERD's plans in meeting their goals*
4. *Provide recommendations for improvement and expansion of LERD's outreach plans*

We were able to analyze the existing outreach methods that can enhance the outreach initiatives of LERD on a national and international level.

3.2 Determine LERD's Goals for their Outreach Program

In order to establish a baseline understanding of LERD's outreach program goals, we conducted two kinds of investigative techniques: archival research and open-ended interviews. Through these two methods we desired to obtain the official stated goals of LERD as well as the LERD staff's opinions and understandings of those goals.

3.2.1 Archival Research

We performed archival research with records that LERD provided to our group. This information consisted of annual internal reports on activities and data from work at the research center. Our team acquired internal reports 2007 through 2011. The names of the internal reports can be seen below in Table 5.

Name of Report	Year
Annual Report of LERD for the Board of Director	2011
Annual Complete Report	2011
Annual Report of LERD for the Board of Director	2010
Annual Complete Report	2010
Annual Region Report	2010
Annual Report of Research and Application of Waste and Wastewater Management	2009
Annual Report of Academic Service by LERD	2009
Annual Report of LERD Management and Follow-up	2009
Annual Report of Academic Service by LERD	2008
Annual Report of Academic Service by LERD	2007
Annual Report of LERD Management and Follow-up	2007
Annual Report of Project Promotion by LERD	2007
Annual Report of LERD for the Board of Director	2007
Annual Report of Media Distribution through Environmental Study	2007

Table 5: List of Archives Researched

The benefit of exploring these internal reports was that we determined the official goals, activities and services undertaken by the center, in addition to acquiring visitor statistics, and demographics.

3.2.2 Interviews with LERD Staff

To gain additional information about LERD's mission, we conducted standardized interviews, which provided identical stimulus among the subjects to gain responses that can be easily compared (Fowler & Mangione, 1990). We conducted standardized interviews with several categories of LERD staff including: upper management, and staff members. Questions posed during interviews with the different staff types varied based on staff type, but all questions relating to our first objective remained constant. These interviews helped to identify what the different categories of LERD staff viewed as LERD's overall goals and mission and who LERD's target audience was. A complete list of the staff interviewed, as well as their job positions with in LERD, can be found in Appendix A and the full list of interview questions for LERD staff viewed in Appendix B. Table 6 below is a summary of questions asked related to our first objective.

1	What is the goal of the outreach program of LERD?
2	What are the primary outreach objectives of LERD?
3	Who do you feel is the target audience of LERD?

Table 6: Sample Interview Questions for LERD Staff Related to our First Objective

After interviews were conducted, the interview answers and notes were translated into English, archived, and organized by interviewee type for further analysis. The process used to interpret our interview data was loosely based on Daily Interpretive Analysis. Daily Interpretative Analysis is a general summarization of the collected interview answers. In this summarization method, importance is placed on the general ideas and patterns found within the data (Wood, 2000). Due to analysis occurring in a daily routine within the fieldwork, the integrity of the data is not necessarily threatened by the passage of time. Our team was not able to exactly follow the timeline associated with Daily Interpretive Analysis because of the inherent lag time introduced by translation.

3.3 Identify LERD's Current Plans to Achieve their Goals

In order to provide recommendations for additional activities or programs to strengthen LERD's outreach initiatives, we first needed to know what LERD's current efforts and initiatives were. Our identification of their current plans is separated into two categories: outreach plans and site assessment.

3.3.1 Outreach Initiatives and Services

Outreach programs are the strategies LERD has used to attract its target audiences, which have been identified in the first objective. Outreach services are the educational material and processes involved in engaging the target audience in the environmental knowledge transfer and implementation of the environmental methods. To understand these methods, we conducted interviews with LERD's upper management, researchers, and office staff. Out of all the interviewees, we focused especially on the feedback from the head of public relations, as this key player is responsible for LERD's outreach to the public. During the interview, we asked questions about specific advertisement and broadcast techniques used by LERD. Examples of some interview questions are shown in Table 7 below.

1	How do you attract your target audience currently?
2	What kind of outreach programs does LERD have?
3	Can you list the outreach services that are currently used?
4	What advertisement, initiatives, and outreach programs does LERD have?

Table 7: Interview Questions Asked to LERD Staff about Outreach Plans

We also conducted interviews with some of LERD's current clients. The information obtained from these interviews was vital as this sample population is the receiving end of the outreach efforts of LERD. These interviews were important to gauge how LERD's services and outreach programs were being received and perceived by clients.

3.3.2 The Visitor Experience

As part of our site assessment, we also observed the facilities and resources of LERD, where the research is conducted. We visited the experimental site twice in order to obtain all the necessary information related to our study. We observed a lecture in Thai by the director of the center, Dr. Kasem Chankao, Ph.D., about the environmental methods at LERD. This lecture is regularly given to potential clients of the environmental techniques of LERD. Afterwards, we toured the LERD facility. We conducted a detailed observation of the center, focusing especially on the educational media available on site. In both visits, the LERD staff provided our team with their educational materials for further analysis.

When we visited the LERD experimental site for the first time, we were in the initial stages of data collection. We were given the opportunity to view a sample of the educational media used at LERD to educate visitors about the wastewater and waste treatment processes. The educational media we experienced included a lecture and a tour of the experimental site and we viewed one of LERD's educational videos. By involving ourselves in the learning experience visitors would have at the experimental site, we were able to see what was available to visitors and measure our own level of engagement with the educational program. We were also able to measure the effectiveness of the educational material with additional interviews with the visitors and the staff who were mainly responsible for the educational material. These observations helped us to understand what could be added to the outreach program at LERD to make it stronger.

3.4 Assess the Effectiveness of the Plans to Meet their Goals

Archival research assessed statistics on types and numbers of visitors to the site to understand the demographics of the visitors. This enabled us to assess potential for outreach to underrepresented demographics. Additionally, we reviewed the records of which organizations already implemented the methods developed at LERD. This information would prove vital for comparison to our own survey data that we collected and outline in the section below.

3.4.1 Surveys for Visitors

We created a survey that was passed out to visitors to LERD. The survey covered topics such as: demographic information, motives for visits, and ratings of various presentation materials. Samples of our survey, in Thai and English, can be seen in Appendix D. We used this information to compare actual visitor experience to LERD's desired visitor experience and to obtain the visitor's feedback on LERD's outreach programs. After comparing and contrasting the survey answers, we were able draw conclusions and investigate possible correlations between survey questions.

The first step in determining our survey process was to determine the necessary sample size that would properly reflect the population of interest. A population is defined as a set of all members about which a study desires to make inferences. This overall population sample will be taken because it is usually infeasible or cost effective to survey the entire population (Albright et al., 2010). We chose our target population to be all visitors that attend LERD in span of one year. Based on LERD's 2011 visitor attendance records found in their archives; the target population for 2012 was estimated to be about 75,000 visitors. We wished to therefore choose a sample size that provided a reasonable amount of sampling error while still being feasible for our group to survey. It was determined that for a population of 100,000 a sampling error of 10% occurs with a sample size of 96 and 3% for a sample of 1056 (Diamond, 1999).We chose for our survey a sample size of 100 visitors to give us about a 10% error when making conclusions and estimations for the entire population. In addition the sample size was chosen to conserve the cost and resources to produce physical surveys and the time necessary to collect all the surveys.

In an attempt to reduce error and reflect the amount of surveys we produced; we used a variation of cluster sampling and stratified sampling for our sampling method. Cluster sampling is where the population is separated into clusters, for example city blocks, and the clusters are randomly selected for surveying and all members surveyed. The primary advantages of cluster

sampling are sampling convenience and lower cost (Albright et al., 2010). Stratified sampling is when different subpopulations are identified in the population and a random sample is taken from each subpopulation separately. The important advantage of stratified sampling is that when used appropriately, it can greatly increase the accuracy of overall population estimates. This is because this method attempts to ensure that certain subpopulations are not under represented (Albright et al., 2010).

In our situation the clusters to be considered were individual visitor groups that visited LERD. LERD does not operate like a museum or other facility where there is a constant stream of visitors entering throughout the day, but typically in scheduled groups where all members are from the same organization. Due to the amount of surveys produced being less than the total number of visitors that visited the park during our time frame we specified to the LERD staff to only distribute about five surveys per group. This would prevent a situation such as a school group of thirty students depleting one third of our total surveys and thus being overrepresented in the data. By limiting the surveys for each cluster to five it ensured that more total clusters were surveyed and increased the chance for surveying a wider range of subpopulations. We would have liked to give a survey to every visitor that entered LERD during the time frame our surveys were collected, but this was not possible for reasons stated above.

Our actual survey results were less than the planned and ideal situation outlined above. Out of the 100 surveys we intended to collect only 66 were filled out upon the time of collection. This caused more error to be introduced into our data. Additionally, we noticed that the subpopulations that we gathered data from were not very random or evenly distributed. This meant that certain cities in our survey were only represented by one group type or all members of a particular group type were from the same city. For example in our data it shows that all visitors who identified with the Company/Business group type were from the city of Samut Sakhon. This leads to the erroneous conclusions that all visitors from Samut Sakhon will be Business/company representatives or that all Business/and company representatives who will visit LERD will only be from Samut Sakhon. Given a great sample size and sampling period the visitors would have had greater diversity and better resembled the overall visitor population.

3.4.2 Standardized Interviews

Standardized interviews with LERD's clients were also conducted to gain insight into the experience of successfully implementing LERD's wastewater techniques. Again, these

interviews were standardized to allow for simple comparison. A sample of these interview questions are presented below in Table 8.

1	How did you hear about LERD?
2	What is the purpose for your visit?
3	What services did LERD provide to your institution, community or business?
4	What were the outcomes of the implementation of LERD's wastewater management techniques in your area?

Table 8: Sample Interview Questions for LERD's Clients

We were interested in discovering if the services offered to the clients matched those that LERD claimed to offer and met the clients' expectations. In addition, we wished to determine if the interviewees became clients of LERD as a result of LERD's current outreach initiatives.

3.5 Provide Recommendations for Improvement the Outreach Program

Before we determined our own recommendations and improvements for the outreach program of LERD, we wanted to take into consideration the staff members' suggestions for improvement. This information was acquired solely through the use of formal interviews.

3.5.1 Formal Interviews

Our team conducted interviews that focused on possible improvements with all levels of staff at LERD. We asked for input specifically from the upper management, the research staff, and the field workers. The additional questions posed in these interviews are included below in Table 9.

1	Is the LERD outreach program currently meeting expectations?
2	What changes or improvements do you feel are necessary for programs in current use?
3	What do you want to see happen with the outreach program at LERD?

Table 9: Sample of Extended Interview Questions for LERD Staff

After the interviews were completed, the data analysis technique described in section 3.2 was also utilized. Specifically, daily interpretive analysis was used to find trends that emerged from the collected data

3.6 Summary

Through a series of carefully selected social science techniques, we were able to study the outreach program of LERD. We addressed the four following primary objectives:

1. *Determine LERD's goals for their outreach program*
2. *Identify LERD's current plans to achieve their goals*
3. *Assess the effectiveness of LERD's plans in meeting their goals*
4. *Provide recommendations for improvement to LERD's outreach plans and suggest additional methods of outreach*

By exploring these four objectives, we were able to develop new activities and techniques to assist in LERD's national and international goals of environmental preservation. We conducted the interviews and surveys with the upper management, researchers and office staff, visiting researchers, and current clients of the environmental methods along with archival research to gain personal and in-depth results and feedback of the current outreach program. This information allowed us to formulate strong recommendations to strengthen their current outreach strategy.

Chapter 4: Findings and Data Analysis

Throughout this chapter we will present the data collected from our site assessment, conducted interviews and surveys, as well as an in-depth analysis of these results. This chapter is divided in two sections: findings and analysis. The findings section presents raw data and the analysis section identifies trends in the findings that are relevant to the objectives of our project.

4.1 Findings

The findings outline the results of the site assessment, interviews, archival research, and surveys collected by our team. We conducted interviews in two locations in five different instances: three times at College of Environment, Kasetsart University, where Laem Phak Bia Environmental Research and Development Project's (LERD) Bangkok office is located, and twice at LERD facilities in Laem Phak Bia, Phetchaburi. Our team conducted a total of 28 interviews with LERD staff and clients and collected 66 surveys of visitors at LERD's experimental site.

4.1.1 Site Assessment

LERD's operating office is located at the College of Environment, Kasetsart University in Bangkok, where most of LERD's documents, meetings, and researcher presentations are held. Moreover, LERD's research library is also located within LERD's operating office and it is where annual reports, records, research papers, projects, journals, theses, and dissertations are stored. The library is a useful source to learn about LERD's programs, services, and completed activities, both scientifically and regarding the outreach program.

The experimental site, where the environmental techniques were developed, is located at Laem Phak Bia in the Ban Laem district of Phetchaburi province. The facilities at the site include an office building, a souvenir shop, and the experimental site where the different wastewater treatment techniques are researched and maintained.

Buses are provided for tours of the site due to the large size of LERD's environmental treatment area and for the convenience of visitors, as shown below in Figure 4. Also a LERD instructor is provided for each bus to explain areas of LERD's facilities to visitors and explain the project's waste management techniques.

Figure 4: The LERD Tour Bus

On the tour, visitors are able to observe the experimental techniques in action. The experimental complex includes five wastewater oxidation ponds, where microorganisms break down waste in the water over a period of 60 days. An example of a treatment lagoon is shown in Figure 5.

Figure 5: One of Five Wastewater Oxidation Ponds

Next, the tour bus takes the visitors to the grass filtration system area, where the visitors can observe the technique in action. This technique uses various water grasses to extract pollutants from wastewater as mentioned previously in the Literature Review Chapter (see Figure 6).

Figure 6: LERD's Grass Filtration System

After observing the grass filtration technique, visitors are taken to the concrete box composting station. At this station, visitors learn more about the function of the concrete box. The concrete composting box breaks down solid organic waste through a composting method that is outlined above in Chapter 2: Literature Review. The set-up of the concrete composting box is shown in Figure 7.

Figure 7: The Concrete Composting Box

The last stop on the visitors' tour is the natural mangrove ecosystem. After wastewater is treated in the lagoon and in the grass filtration systems, the water is then released back into the environment through a mangrove forest. The mangrove forest continues the natural treatment process further by creating aerobic zones for organic matter decomposition with the mangrove

roots. In addition to wastewater treatment, a pathway was built through the forest for the visitors to observe the mangrove ecosystem. We found during our visit that the pathway was in disrepair due to high tide damage and was not safe for travel. However, we were informed that the mangrove pathway was repaired and open to visitors again at the end of February. The mangrove forest is shown below in Figure 8.

Figure 8: The Mangrove Ecosystem

Also additional infrastructure is provided to aid visitor understanding of the wastewater treatment techniques at the LERD facilities. Such infrastructure includes a large directory map and explanatory posters. All the information in these materials is presented in Thai and displayed throughout the experimental site. A map of LERD's layout is shown in Figure 9 below:

Figure 9: The Layout of the Experimental Site

Currently a welcoming poster is located at the entrance of the experimental site for visitors. The first half of the poster narrates the story of LERD and how it was created to help the people of Thailand. The second half of the poster includes a map of the entire complex, detailing where each environmental procedure is located and what particular techniques are used. This poster is presented in Thai and English as shown in Figure 10.

Figure 10: The Entrance Poster with Map and History of LERD

Informational posters are displayed for every waste treatment technique throughout the grounds of the site. These posters have a short explanation of how the procedure works, area required and maintenance requirements for the environmental technique explained. Some of the posters have explanatory diagrams to enhance the understanding of the visitors. The title of each poster is in Thai and in English; however, the explanatory information and diagrams are only in Thai. Two photographs of information posters are shown in Figures 11 and 12 below.

Figure 11: Informational Poster for Oxidation Ponds

Figure 12: A Blank Information Poster at LERD Facilities

There is a main office and administration building at LERD in addition to the actual experimental site. This building is used mainly for office work and visitor lectures. The first floor consists of offices for researchers and academic staff. The second floor includes the site's main office as well as a large presentation room. The presentation room is used for giving lectures and seminars; as well as for showing videos and other presentations about LERD and its wastewater and waste treatment techniques.

Additionally there are models of the grass filtration, mangrove forest filtration, and concrete box municipal waste disposal system displayed in the presentation room. The dimensions of each model are approximately 1×0.45×0.30 meters. These models are simple 3D mock-ups of how the actual environmental procedure looks and works.

4.1.2 Interviews

Our team conducted interviews on five separate occasions, three times at the College of Environment, Kasetsart University, and twice at the LERD experimental site. As mentioned previously in Chapter 3: Methodology, our team identified five different categories of potential interviewees.

The five categories of interviewees identified were: LERD upper management, researching and office staff members, field workers, clients, and foreigners. The upper management category was defined as the people who are involved in the organization's strategic

decisions and determined the organization's focus. Some examples of people in this category are: department heads, board members, and organization founders. Staff members were defined as people who worked midlevel in the LERD organization, consisting of research scientists, outreach coordinators, and other office staff. Field workers were defined as the people who worked on the physical maintenance, and construction of the wastewater treatment systems. The clients were defined as people who represented communities or businesses that have already adopted LERD's wastewater treatment methods. Foreigners were defined as the visitors to LERD who were not originally from Thailand. Table 10 (below) shows the interview distribution by date and location, while Table 11 shows the categorization of the interviewees.

Date	Location	Duration of Interviews	Number of Interviews Conducted
Jan. 17, 2012	Kasetsart University	7 hours	9
Jan. 28, 2012	LERD	9 hours	17

Table 10: Interview Distribution

Interviewee	Interviews Conducted
Staff members	10
Field workers	7
Clients	5
Upper management	2
Foreigners	1

Table 11: Interviews' Demographics

The interviews conducted were all structured with similar questions for interviewees of similar categories. As mentioned before, the interview questions can be found in Appendix B. The findings of the data collected will be presented below by interviewee category.

Interviews: Upper Management

The two interviewees for this section were professors at Kasetsart University who are also part of the upper management at LERD. Both interviewees expressed that LERD's outreach program objective is to transfer and spread LERD's environmental knowledge and treatment

techniques throughout different parts of Thailand. Specific quotes related to various interviews can be found in Appendix C.

When LERD's upper management interviewees were asked who the target audience for their outreach efforts was, they answered: communities, government agencies, and Thai businesses and factories. The upper management identified their media outreach efforts to attract this audience as being communication through websites, TV programs, radio, and seminars. In addition, the upper management reported that international visitors rarely come to LERD when asked about international visitors traveling to LERD.

The upper management also expressed dissatisfaction with the implementation of the wastewater techniques in several communities when asked about possible improvements to the LERD outreach programs. They then listed many improvements related to communication between LERD and clients. This is exemplified by Aj Alongkorn's comments,

> I have to say I am dissatisfied with the implementation of our techniques. Many communities are interested; however, not many of them are currently using the techniques (Interview 24, January 28th, 2012).

This was attributed to the lack of communication between communities and LERD after the implementation process is completed. Communities were not receiving the proper support to maintain and operate the waste treatment techniques according to LERD's standards. The upper management suggested that a method and guidelines for following up on implementations is necessary. It is unrealistic to expect implemented treatment systems to be according to the standards that LERD desires and specifies without a constant mode of communication between clients and LERD,

Interviews: Staff Members

The interviews with LERD staff members and researchers took place at both the Kasetsart University office, and at the LERD experimental site. When the staff members were asked about the goals of LERD, there was a divided opinion among them as whether they should focus on knowledge transfer or on continuing to research and develop wastewater treatment techniques. The staff's opinions of LERD's target audience included government agencies, businesses and factories, students, and communities. The most prevalent opinion being that the target visitors were businesses. Moreover, the staff reported that LERD offered different presentations for different types of groups that visited LERD. This usually involved adjusting the

presentation to the correct age range and education level, suggesting an effort to cater to its many different target audiences.

Next, the staff reported that LERD's advertising programs predominantly included TV programs and the organization's website. In addition, the staff also stated that many services were provided by LERD to potential clients interested in adopting the wastewater treatment techniques. A majority of staff members listed educational handouts and site assessments for clients as the primary services offered.

The majority of staff members interviewed stated that they were satisfied with LERD's current outreach program, but this was not unanimous among staff members. Even among the staff members who were satisfied; ideas were offered about how to improve LERD. These improvements included additional researchers and facilities for the LERD site and improved community outreach through media that is easier to understand.

Interviews: Field Workers

We also interviewed a number of LERD field workers during our visit, whose primary responsibility is to maintain the wastewater treatment systems. This includes growing rice and other plants for the grass-filtration system, maintaining the mangrove forest ecosystem, and the lagoon treatment systems. The shifts for the workers were generally 7-8 hours a day with 1 day off on Sunday.

Additionally we found that the field workers play an almost nonexistent role in LERD's onsite outreach programs; nonetheless, they are heavily involved with the center's implementation programs. The field workers occasionally answer questions from visitors in the course of their workdays when personally approached by the visitor. We also found that none of the field workers had received any training in visitor interaction. The field workers' role outside of the experimental station includes setting up new systems for waste and wastewater treatment; and demonstrating system functionality.

The field workers reported that they welcomed the idea of changes and improvements to the experimental site. The majority of improvements recommended by the field workers mostly concerned the experimental site itself. Suggestions included the expansion of the site's working area and the addition of worker housing facilities.

Interviews: Clients

During our visit at the experimental site, we were also given the opportunity to interview representatives of organizations currently using LERD's wastewater and waste treatment techniques. Most of these clients also represented additional learning centers that LERD had established throughout other provinces of Thailand. After adopting the treatment techniques at their business or community, LERD asked productive and successful sites to become learning centers for their area.

All of the five current clients interviewed stared that they were present for the annual meeting review improvements in LERD's waste treatment process in the year 2011 when asked about the reason for their visit to LERD. We observed from this answer that very few representatives of the total number of organizations and communities were present for this annual meeting.

The interviewees in this category answered similarly for many questions. The majority of respondents revealed when asked how their organization initially heard about the programs at LERD and how they contacted LERD that it was through former Kasetsart University students, who were previously involved at LERD. This was an interesting finding, because it did not reflect the core outreach strategies that LERD staff had identified and focused on. We identified a new outreach channel that had not thoroughly been taken into consideration. In addition, all the clients reported that site assessments and implementation support were provided by LERD before and during the implementation process. Also most of LERD's clients reported that educational handouts, such as brochures and pamphlets, were inadequate for community outreach. This was due to the large amount of scientific terminology the handouts contained to explain the natural waste treatment methods. The clients requested new materials containing less scientific terminology.

Interviews: Foreigner

During our visit to LERD, we also interviewed a bird watcher and British national, Philip D. Round, a professor at Veterinary Science, Mahidol University. The purpose of his visit to LERD was to conduct ornithological research by banding and releasing birds. When asked how he heard about LERD, he stated that he heard about it thirteen years ago from a fellow bird watcher who was doing work at the site. Professor Round first came to LERD in 1999 and has made more than a hundred visits to date. He noted that he does not know much about LERD's

research, because most of LERD's academic papers are published exclusively in Thai. Professor Round also noted that LERD is well known worldwide by bird watchers, because LERD is advertised in many bird watching periodicals.

4.1.3 Surveys

As mentioned previously only 66 out of 100 of our surveys were returned filled out. A total of 10 questions were provided to visitors along with a space to leave comments. Additionally, several LERD staff members thought that the surveys were useful for their further evaluation and improvement of LERD. The staff requested for our team to return the surveys to LERD after the completion of our project. The full survey, in both English and Thai, can be found in Appendix D.

The first survey questions focused on the visitors' demographics and aimed to determine where visitors were coming from. The visitors in our LERD visitor sample came from nine separate cities and provinces throughout Thailand with the majority of respondents coming from Bangkok. A bar graph of the distribution of visitors is shown below in Figure 13.

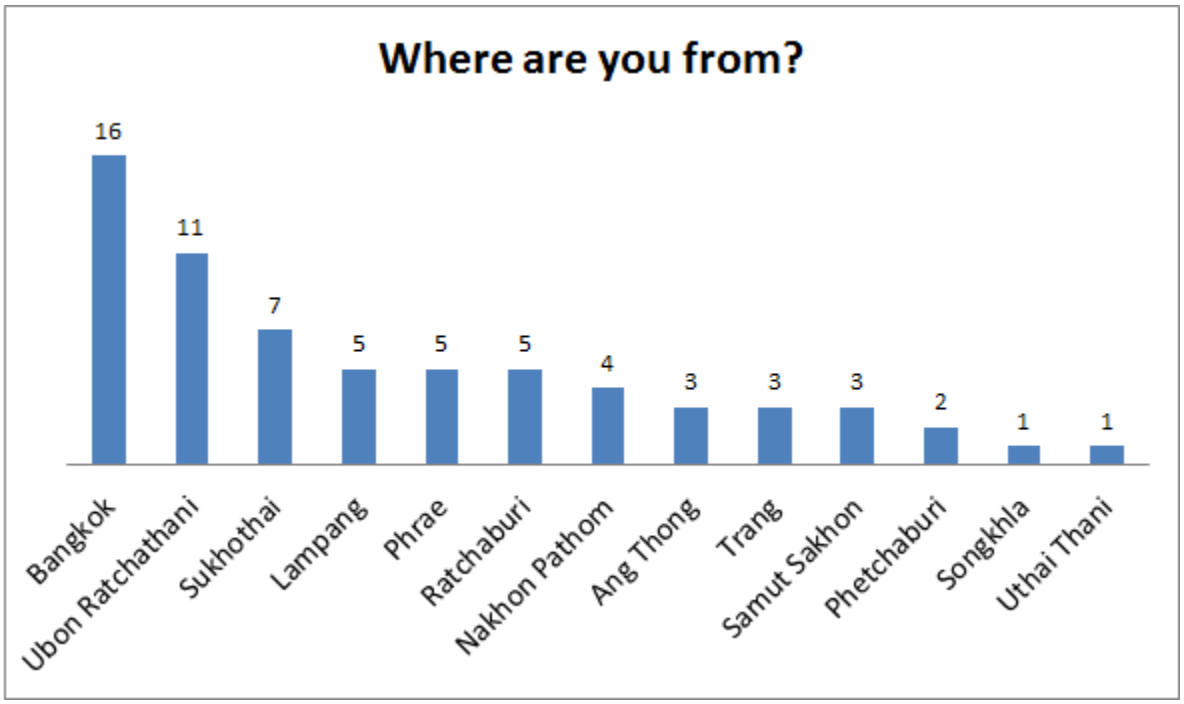

Figure 13: Bar Chart Showing the Number of Visitors from Each City

We created a map that identified the geographic location within Thailand of each of these provinces and cities to give a clearer understanding of the distances traveled by each visitor to come to LERD. When the distances were examined, we found that on average, visitors traveled 499 kilometers to visit LERD. All of these distances were measured as the distance to drive to LERD by car and were obtained using Google maps. The map of Thailand identifying the different provinces and cities of the visitors is shown in Figure 14 below:

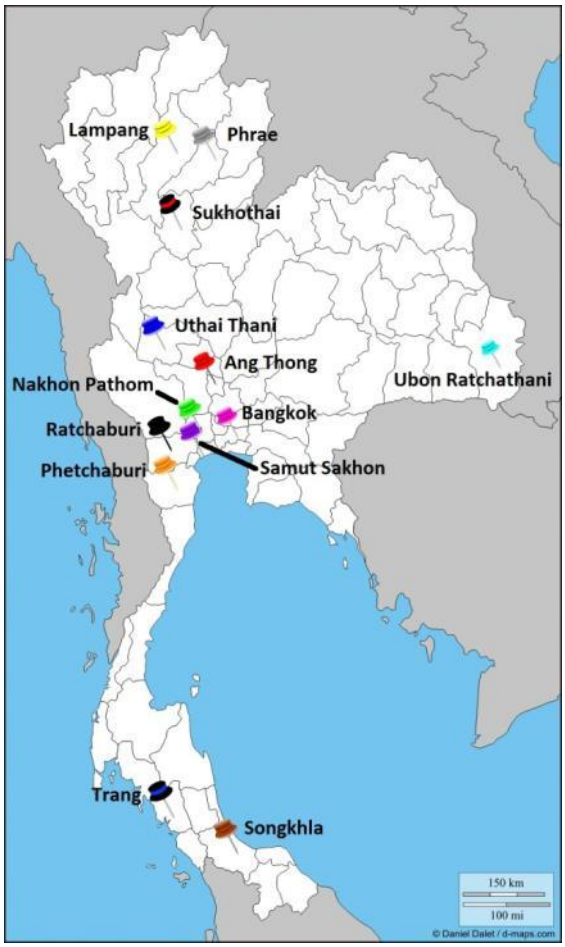

Figure 14: A Map of Thailand Showing Visitor Origins

The second question identified the visitor categories. This information allowed us to identify the target audiences that were visiting the site and understand which audiences were more common. We identified five unique visitor types from our surveys, which include business employees and representatives, community members, government administrators, school

teachers and students, and university students and professors. Based on our data, the most common visitor type was students and teachers. A pie chart showing the group types is shown below in Figure 15.

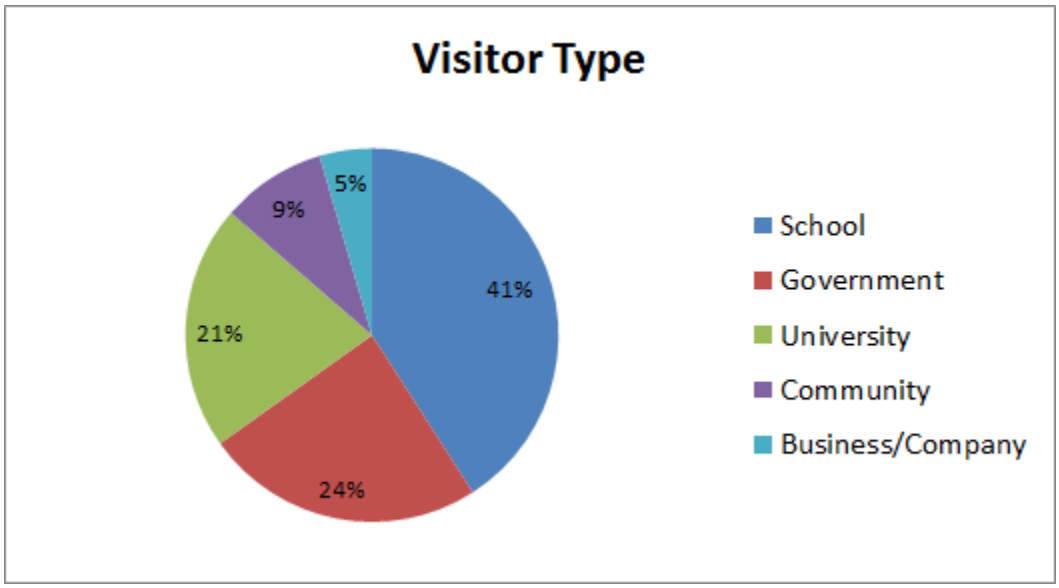

Figure 15: A Graph of Visitor Types

We also asked visitors to identify how they became aware of LERD and their research in order to evaluate the effectiveness of LERD's outreach methods. Respondents were given nine choices along with a tenth option, where they could choose "other," and write in a new choice. It was expected that respondents would circle one choice from this section, but 48% of respondents circled multiple options compared to 52% of respondents choosing a single option. To interpret this data, we counted up every marked choice on every survey regardless if multiple choices were made. From this we found that the two most common ways that visitors heard about LERD was first through LERD's website and then from activities carried out by LERD. A graph showing the results of this is shown below in Figure 16.

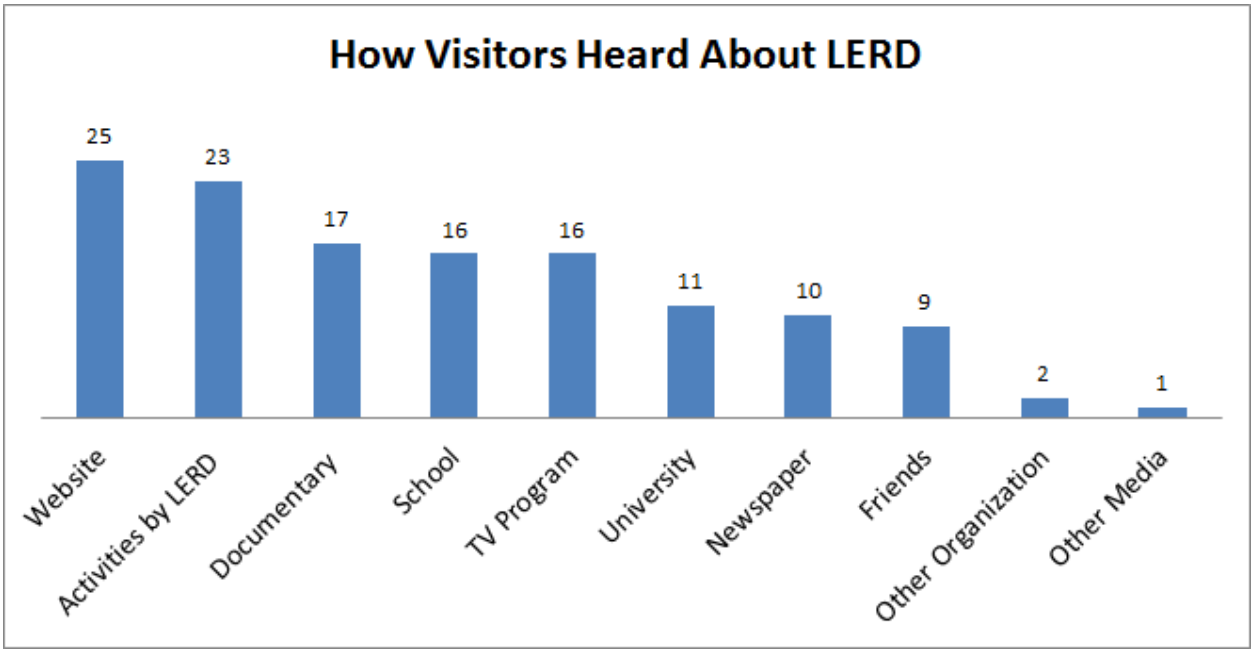

Figure 16: Graph of the Total Number Responses for Each Choice

The next type of data we gathered through our survey was ratings of the information and presentation quality of the programs offered by LERD. This was done by providing respondents with a 1-5 scale to rank each of the topics, as seen in the format in Figure 17 below:

7) What was your opinion of the information presented to you today?
(One being the worst and five being the best)

Bad 1 2 3 4 5 Good

Figure 17: Sample of the Method Use to Ask Respondents to Rate LERD's Presentations

The words "bad" and "good" were provided, and not translated into Thai, to indicate how our scale would rate the programs. However, the inclusion of these words introduced significant measurement error into our survey results. Measurement error occurs when the responses to questions posed do not reflect the surveyor's intentions (Albright et al., 2010). In our survey, several respondents circled the word "Good" instead of choosing a number on the rating scale. This was problematic because our numerical analysis of these questions would be incomplete. It

is through instances such as this one that it becomes clear that a properly designed survey can give you very accurate information and that poor design choices can lead to inaccurate data. This would intern greatly increase the chances that false conclusions would be drawn.

From the data we had, we found that 39% and 44% of respondents gave ratings of 5 for the presentation quality and the informational content, respectively. If these figures are expanded to include both high ratings of 4 and 5, the percentages increase to 65% and 68% respectively. Graphs showing the results for the information and presentation ratings are shown below in Figure 18 and Figure 19.

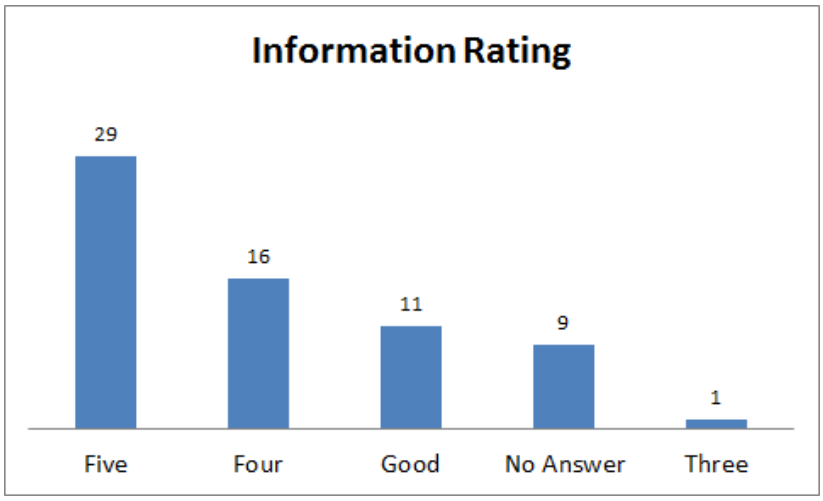

Figure 18: Results from the Visitor's Information Rating

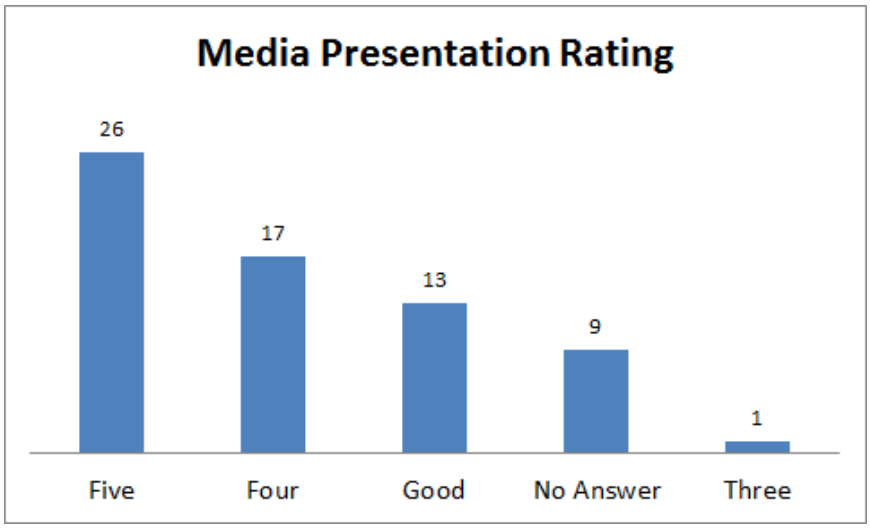

Figure 19: Results from the Visitor's Presentation Rating

We also asked visitors to choose the best presentation style in addition to asking the visitors to rate the different presentations. This question also had a minor amount of measurement error because the majority of respondents chose multiple answers when we intended for respondents to choose one answer. When all choices were counted up, 39% of the visitors preferred the tour as the best presentation style. The graph of these results can be seen below in Figure 20.

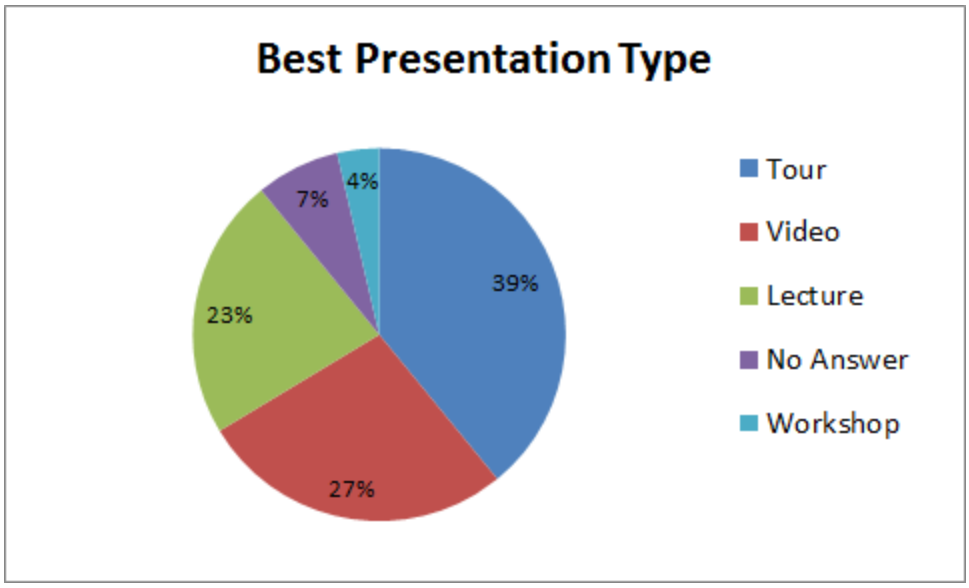

Figure 20: The Results for Best Presentation Type

The last two questions we asked visitors were about the visitors' desire to return to LERD and about the visitors' desire to implement LERD's waste treatment methods. In both cases, the majority of respondents replied "Yes" and very few respondents replied "No". In our data, we had more respondents who did not answer the question than visitors who answered "No."

4.1.4 Archival Research

Archival research was completed to supplement opinions from the interviews conducted. The archival sources used in this research were internal reports obtained from LERD's library located at the College of Environment, Kasetsart University. The main information that we intended to gather from the internal reports was data on visitor attendance, visitor demographics,

official documentation of the services offered at or through LERD, and LERD's official goals and mission statement. This information was found for years 2007 to 2011.

The mission statement of LERD was found in the annual reports for the board of director for years 2010 and 2011. The organization's official mission is to focus on researching and developing waste and wastewater management technologies, as well as, providing academic service and transferring LERD's knowledge to others.

The information related to visitor attendance for each year was in several internal reports, with the latest data being found in the 2011 reports. From interviewing LERD staff member, Mr. Thanawat Jinjaruk, we found that visitors included in LERD's visitor statistics were only the visitors who made appointments with the organization. Visitors who did not organize their trip were not counted in LERD's visitor data per year. For example, we were not counted visitors each time our team visited the LERD facilities.

The visitor data for each year the project site has been in operation was included in the Annual Report of the Project for the board of Directors, Year 2011. From this data, a clear increasing trend in annual visitors to LERD can be observed. The graph of this data is included below, in Figure 21.

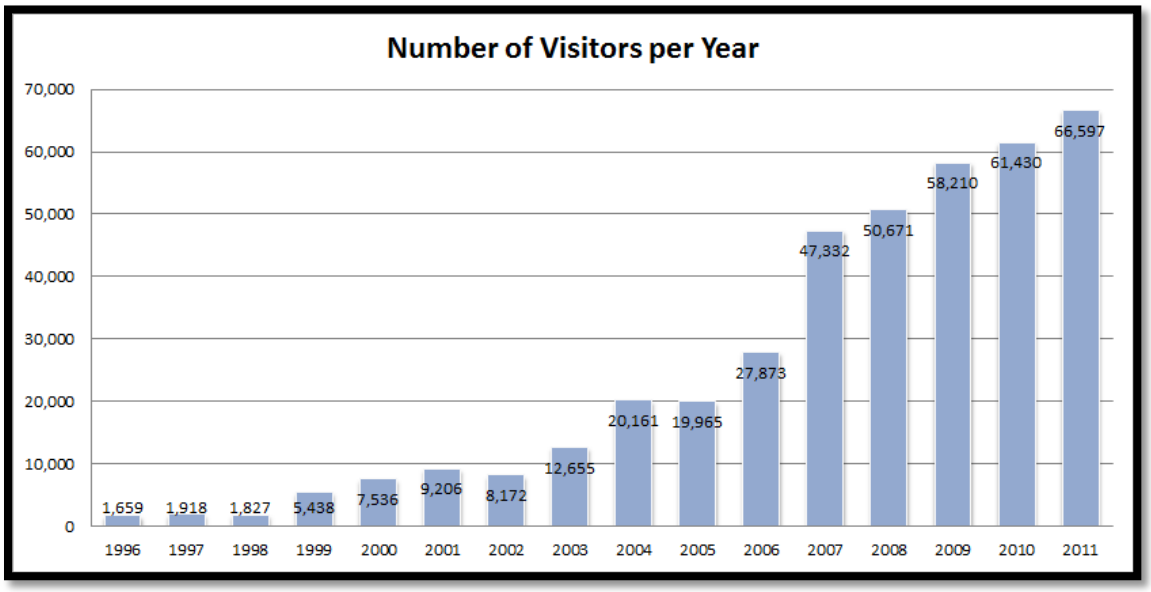

Figure 21: Annual Visitor Attendance from 1996 to 2011

The reports also included pie charts of the different demographics of visitors. Unlike the case with attendance figures, these charts were only available for the year in which the report was made. Conclusions were drawn on which audiences were increasing or decreasing in attendance by comparing the two charts. For the years 2007, 2010 and 2011, members of the government made up the largest occupational category and the smallest were state enterprises and foreigners. The charts are included in Figures 22 and 23 shown below for 2007 and 2011 respectively.

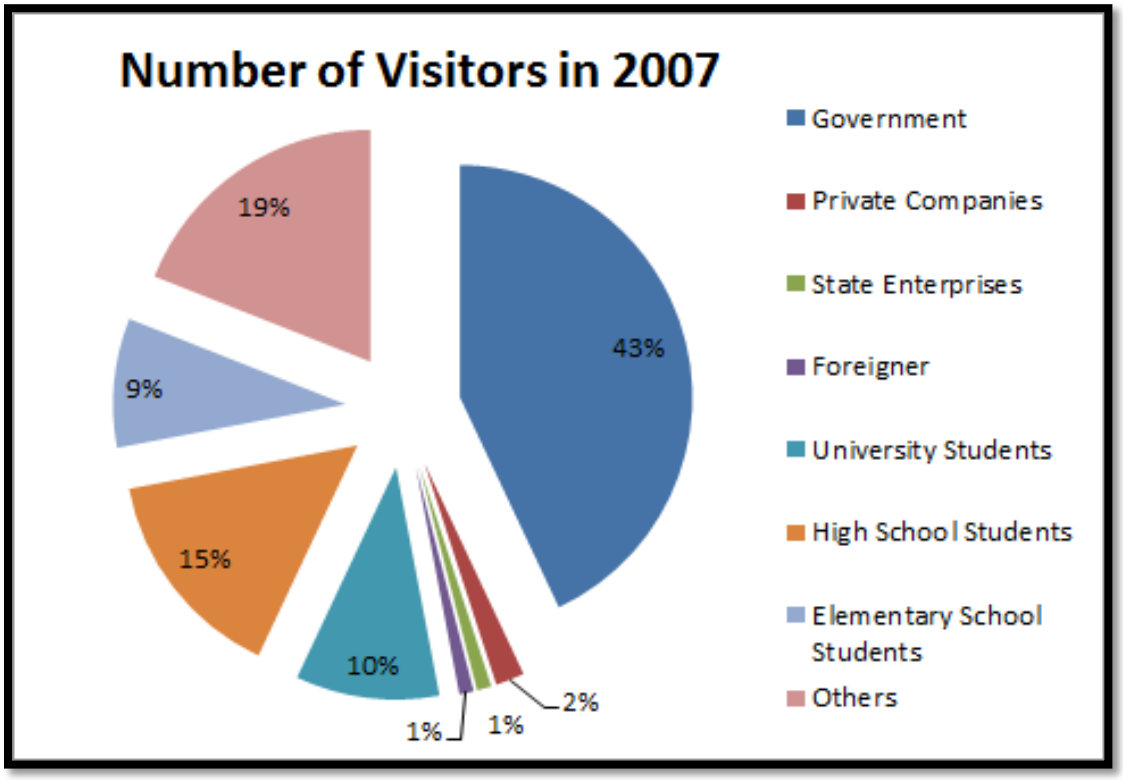

Figure 22: Visitor Demographics from 2007

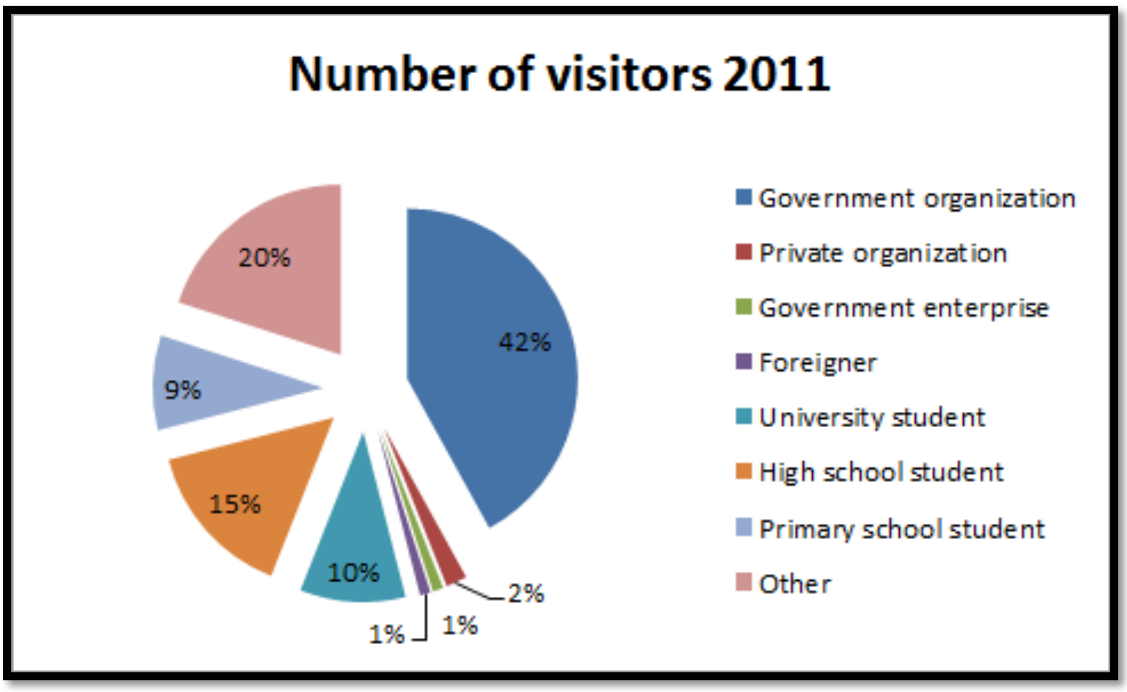

Figure 23: Visitor Demographics from 2011

The internal reports also listed many outreach initiatives carried out each year. This data included projects that LERD helped to develop in 2007, academic services completed in 2008, academic services and training and workshops completed in 2009, staff training programs in 2009, research done in 2009, important groups of visitors that visited LERD in 2010 and 2011, seminars and exhibitions held in 2011, and advertisements and public media released in 2011.

We found that in 2007 LERD provided outreach services to 5 schools and universities, 1 temple, 11 businesses and factories, and 15 communities and cities. All of this assistance involved waste treatment and environmental matters. This data illustrates that each year the center is actively involved with educating their audiences and advising solutions for the environmental problems in the area.

For 2008 it was found that LERD provided 19 academic services in Thailand, including wastewater and waste management site development. Five training programs and workshops were also provided by LERD throughout 2008. In 2009, LERD provide 24 academic services and 11 training programs and workshops. The list of provided services can be found in the Appendix E.

LERD also provided staff training activities, which included: 11 programs to raise staff intelligence on environmental preservation, 4 programs to increase staff sociability, 2 programs to improve visitor interaction, and 5 programs to inspire staff creativity. Also in 2009 a total of 105 research projects were initiated by LERD. Of the 105 projects, 17 were completed in 2009, 29 were completed in 2010, and 59 projects will be completed by 2014.

In 2010, LERD developed 3 academic programs, which included one related to the King's purpose, another related to wastewater from industrial factory, and the last related to wastewater from communities. Research that was also conducted in 2010 included the Chaipattana grease trap, economic aquatic animal, Book of Laem Phak Bia's Bird, and portable Chemical Oxygen Demand testing kit. Lastly, in 2010, the exchange program was developed. Four seminars were held by LERD. LERD was also promoted by 17 television programs and documentaries. The list of developed projects, seminar, and advertisement of LERD can be found in the Appendix E

In 2011, we found that LERD presented 4 seminars, one at a university and three at festivals. These presentations were spread throughout the whole year and involved the transfer of LERD's knowledge about natural ways to treat wastewater to local communities. In addition to the seminars in 2011, there were 11 television programs, 1 movie, 1 documentary and 1 magazine publication to promote and advertise LERD's programs. From this it is clear that a significant amount of effort and resources have been invested to advertisement and education. The archives our team accessed from LERD's library were internal reports that were located within LERD's library. These reports had been created for internal use within LERD, such as presenting the year's work in review for foundation board members and other upper management. From our initial investigation it became clear that several internal reports of this type were generated each year. Some reports provided an overall summary of activities, while others were lengthier and focused on specific LERD activities in extensive detail.

We also found that there was little to no standard structure for the organization of reports from year to year based on the reports available to our team. While visitor statistics and percentages were presented in reports from each year, topics such as lists of development projects and advertisement initiatives were not consistently mentioned each year. Due to these inconsistencies, it was difficult to understand the impact of past and current media advertisements as well as the changes in other categories. A standard guideline for information

included in reports from year to year would provide the necessary consistency to gauge LERD's changes and growth over time.

While trying to access LERD's internal reports it took several weeks and multiple visits to LERD's library to locate and collect all the relevant reports from recent years. On our first visit reports were only found for the years 2007 and 2011. Reports for intermediate years were not found until much later and provided crucial information that caused many revisions of our group's findings in the later stages of the project. It would have been beneficial to have easily located all the reports initially and established a full picture of LERD's activities early on.

A new program found through archival research, started in 2011, was a systematic evaluation system to measure the success of LERD's outreach program. LERD created five separate categories where they set goals against which to measure their work for the entire year. The evaluation system focused on the five main categories, which included academic services, research, publicize and promoting the knowledge transfer, social and environment responsibility and organization management. The statistics of their achievement were recorded and presented in the 2011 annual report. The list of information related to this evaluation system can be found in Appendix F.

LERD surpassed their set goals for the first category about academic services. LERD completed 48 services of managing waste and wastewater out of the 15 services they targeted to do. Additionally, LERD accomplished all their set goals for academic research. LERD created 34 waste projects out of the 34 set, as well as published12 international documents about their projects and research out of the 10 they originally set to published. Moreover, LERD did 10 presentations at international seminars out of the 5 set in their goals. Once again LERD met and exceeded their goals for publicized and promoted knowledge transfer category, and social and environment responsibilities category. For instance, LERD set to organize 10 activities to transfer environmental knowledge to others and they actually organized 14 activities. Furthermore, LERD established an 80% satisfaction for Royal value and they achieved a 95% satisfaction. The last category, project management, proved to be one more category were LERD successfully accomplished all their established goals. LERD achieved 100% staff attendance compared to the 80% established in their goals. Also, LERD accomplished 96.3% visitor satisfaction for site tours compared to 80% set in their goals. As a team, we can determine the importance of setting goals for LERD by looking at these multiple accomplishments.

4.1.5 Outreach Materials

LERD has developed various outreach materials in order to transfer the knowledge of the center's techniques to the Thai people and interested audience from other countries, and to increase the number of implemented wastewater and waste treatment techniques. The center offers educational materials including informative videos, pamphlets, and brochures. These materials are both in English and Thai, however both language versions have a different design, presentation style, and varying amount of informational content.

The brochures, which cover the various treatment techniques, give detailed explanations of the function of each waste treatment process. Also explained are the benefits of using these procedures, each treatment's efficiency, specific pollutants removed by the techniques, and the maintenance required. This information is displayed along with pictures, tables and explanatory diagrams to increase the level of understanding of the reader. The amount of scientific terms and concepts included in the brochures is at a level suitable for researchers and other academics, but may not deliver the information effectively to community members and non-academics. An example of this is the explanations and references to compounds and chemical processes using complex chemical formulas. This can be seen below in Figure 24.

Figure 24: The Informational Brochure Front Cover and Inside Pages

There are detailed pamphlets for every environmental technique, however, these were only found in Thai. Each pamphlet explains with great detail how each environmental technique works and the benefits of implementing it in a community, hospital, school or factory. Similar to the other educational media, the pamphlets also have explanatory diagrams to facilitate understanding of the procedures.

Additionally, an informational video is also displayed to visitors of the experimental site. The video is 20 minutes in length and provides a detailed overview of the projects at LERD. The beginning of the video covers the history and creation of LERD, which is followed by in-depth explanations, with graphs and diagrams, of how each environmental procedure works. These explanations are combined with interviews from the center's director, Prof. Kasem Chankao, Ph.D., and other important staff members of LERD. This video, both in English and Thai, is of professional caliber with high quality narration, images, and sound effects. A photograph of the video cover can be seen in Figure 25. The Thai and English video were separately made and have different informational content, but both cover similar topics.

Figure 25: Front Cover of LERD's Educational Video in English

4.1.6 Website

The project's official website is www.lerd.in.th; however, there is also an older version of website still available on the internet. The main content provided on the official website includes LERD's history, the environmental techniques developed, activities occurring at the site such as seminars and workshops. Unfortunately, many sections of the website, such as the activities

page, contained only a heading without any further information. The site does not appear to be kept up-to-date or maintained. In addition, we found that the website is exclusively presented in Thai, but in an attempt to appeal to international audiences a Google translate application is included to translate the website. Through the use of this function, we determined that the quality of translation of the website using this method is inadequate. An image of a section of the webpage that is not updated and includes no embedded information is shown below in Figure 26.

Figure 26: LERD's Main Activities Page

On the other hand, the previous version of LERD's website, www.lerd.org, offers easy to understand animations of LERD's environmental techniques. Images of the animations are shown below in Figure 27.

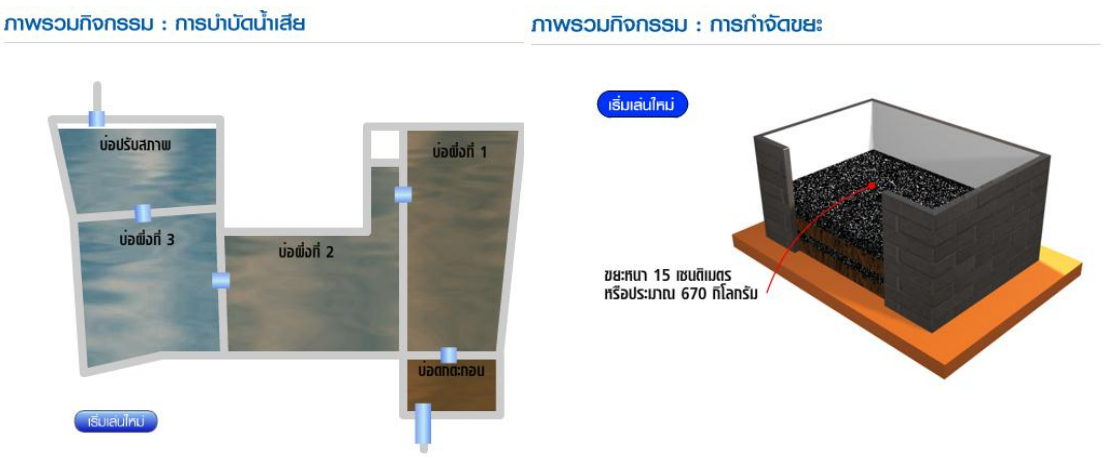

Figure 27: Image of Animations Found in One of the LERD Websites

Besides a traditional website, LERD also created a Facebook friend page located at facebook.com/lerd.in.th and a fan page located at facebook.com/LERDPJ. Despite having different web addresses, both pages have the same title. Detailed information regarding LERD's friend page can be found in Appendix G, our group will focus on LERD's active fan page.

The LERD fan page contains photo albums, project info, and various updates. The info section of the fan page covers the basic information of the project. This includes information about LERD's connection with the Chaipattana Foundation, the meaning of LERD, a speech regarding the goal of LERD's work, and states the names of the different treatment methods LERD developed. For the contact information on the fan page an inaccurate phone number is listed. In addition the fan page also provides LERD's email address, lerd.in.th@gmail.com, and a link to the primary LERD website, www.lerd.in.th. The main wall of LERD's fan page can be seen in Figure 28 below.

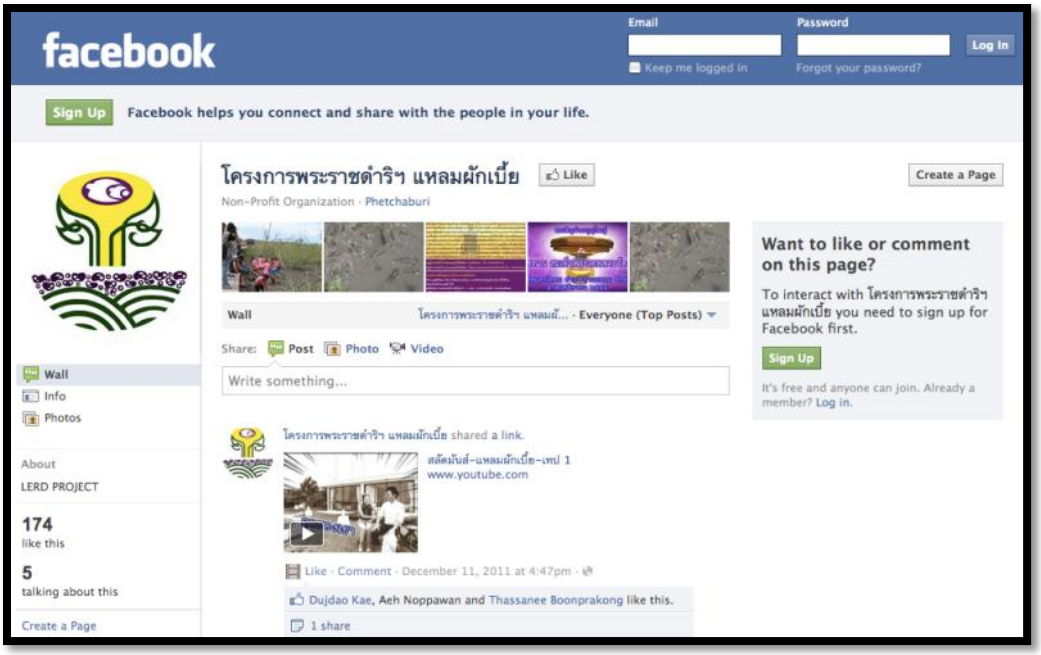

Figure 28: LERD's Fan Page

The LERD friend page in not listed on the fan page, however links originating from LERD's friend page are shared on the wall of the fan page. The fan page wall also includes posts of photos, project updates, and videos related to LERD and its activities. The photos on the fan page, unlike those on the friend page, are all related to the experimental site and the work and research done there. These photos include the mangrove forest, students planting mangroves, the gift shop, sunset at the site, and general site photos. Some people post questions about LERD on the wall, but they are not answered in a regular manner. Question replies usually came from LERD employees that happened to see the post and not from the fan page itself.

Besides the website, LERD also broadcasts segments through local TV programs, documentaries, and radio. Through these media, LERD is widely known across Thailand.

4.1.7 Findings Summary

Through our site assessment, archival research, and interviews, we found that LERD currently is using various strategies for their outreach programs. These strategies include internal reports, which are compiled every year to summarize all activities done each year also some client information. In addition, LERD also has various media for communication to introduce

visitors to LERD through website, Facebook, TV programs, radios, and handouts such as brochures and pamphlets.

We also learned from site assessment about all the current facilities and media that are available through the LERD experimental site. From our interviews with the LERD staff, we learned different members of the organization identify different target audiences for LERD and emphasize different aspects of LERD's goals. From interviews with current clients of LERD, we were able to collect views on the recipients of LERD's outreach efforts. After conducting archival research, we found the occupational background of the stated target audience, and found an increasing number of visitors for the past few years.

Lastly through our surveys we learned about the various visitor types who are traveling to LERD and their opinions about LERD's various programs. In addition, we also found out the various methods in which they head about LERD in the first place. The data from our sample will provide a snapshot of the entire visitor population for one year.

4.2 Analysis

In this section, we analyzed the data provided in the findings section in order to identify similarities and trends. To make sense of the data, the analysis will be organized according to our four objectives listed in the methodology chapter. For each of the objectives, the supporting data will be gathered from the findings section and analyzed appropriately. The trends found within each objective will be combined into an overall analysis in the summary of this section.

4.2.1 Objective 1: Determine LERD's Goals for their Outreach Program

To determine LERD's goals for their outreach program, we found trends that revealed LERD's stated goals for outreach, as well as their stated target audience. This analysis is based on the information found in the archival research and the interviews conducted with LERD staff.

We first researched LERD's archives to find LERD's official goals and target audience because the data provided in these files is the officially declared mission and goals of the organization. The 2011 internal reports listed LERD's specific numeric goals for their outreach efforts (refer to Appendix F). LERD's goals are established in five different categories: academic services, academic research, publicized and promoted knowledge transfer, social and environment responsibilities, and project management. We observed that the setting of goals and evaluating of the LERD's programs began in the year 2011.

The internal reports did not define LERD's official audience. By not defining target audience, LERD faces the difficult situation of focusing their outreach efforts only in a generic manner. As explained previously in Chapter 2: Literature Review, there are three basic steps in creating a successful outreach strategy by the US Department of Agriculture. The first step is making a plan and establishing to whom it would be directed all the efforts and activities undertaken by the organization. We noticed, based on the lack of this information in LERD's internal reports, that LERD currently has an incomplete plan and now faces the task of establishing a target audience in order to maximize their outreach activities.

After analyzing the data from the archives, we analyzed the data collected from the interviews with LERD staff and clients. We determined that the two types of interviewees who were best qualified to provide informed answers related to LERD's outreach goals were the upper management and the research staff. We were required to distinguish between the two, because both types of interviewee groups are closely related to the outreach program and sometimes are directly involved in its function. The two groups responded slightly differently when asked about LERD's outreach program goals. The two different answers were to develop the environmental techniques and the other is to transfer the environmental knowledge of LERD throughout Thailand. The upper management also stressed a secondary goal of making the scientific environmental information and the environmental techniques understandable for non-professionals in local communities. The staff answers tended to be based on their specific working areas. The data collected from both the interviewees' categories and the archives is very similar. Therefore, as a team, we concluded that the organization's upper management and research staff share LERD's overall mission, but would benefit from a refocusing.

Contrary to the archives, those interviewed defined a target audience for LERD's outreach initiatives. By comparing interview answers across our different categories we defined a target audience for LERD's outreach initiatives. By combining all staff answers, we established that LERD's target audience is: business owners, local communities, local and international researchers, high school and college students, and government administrators.

As a team, we believe this audience is too broad and limits LERD to only excel in the development and performance of their current activities for a couple of audiences. However, the other audiences only receive a generic effort and the desired outcome with them is not accomplished. Nonetheless, His Majesty, the King created this project to provide, to anyone who

is interested, the environmental knowledge necessary to improve their living situation as well as the one from others. Even though we believe there is a problem with the current size of the target audience, our main concern is the disagreement on a same target audience on behalf of the members of LERD. It is of high importance that all the members agree on one same audience in order to focus all their efforts towards the same goal.

4.2.2 Objective 2: Identify LERD's Current Plans to Achieve their Goals

We next focused on determining and analyzing LERD's current plans to achieve their goals. As previously discussed, the outreach services provided by LERD include TV programs, websites, informational brochures, site tours for visitors, and site assessments for potential clients.

Observations of the informational brochures, educational materials and videos, both in English and Thai revealed a high level of professionalism in each one of these outreach media. As a team, we believe that LERD, through these media, projects an image of professionalism, trustworthy and effectiveness to potential clients and visitors. The only problem with some of these media, such as the informational brochures, is the complex scientific explanations which are not suitable for many of the nonacademic audiences the handouts are distributed to. Handouts without comprehendible explanations about LERD's environmental methods and knowledge will remain unclear to many audiences who will not truly commit to implement these methods in their areas.

The current follow-up process, as mentioned previously, is inadequate and it is currently up to the client to maintain a close relationship with LERD. The majority of LERD's staff did not mention maintaining such relationships as a priority. In our opinion, this practice does not reflect the overall mission of the organization. LERD must create relationships of this nature to transfer environmental knowledge and promote the implementation of their environmental techniques, continuing such relationships are necessary. LERD has already begun to establish a follow-up and evaluation process; however, LERD's staff only utilizes this process upon client request.

4.2.3 Objective 3: Assess the Effectiveness of the Plans to Meet Their Goals

After analyzing the data regarding the current plans of LERD to achieve their goals, we then focused on determining if these plans were effectively meeting LERD's goals. This data

came primarily from the archives we researched, the interviews we conducted, and the surveys we collected.

LERD's annual report of 2011revealed the main visitors to the site were local governmental officials at 42%. This result is positive based on the results from the interviews with the staff, where government agencies were listed as a top target audience.

In addition, all visitor group percentages changed by 1% or less from 2007 to 2011, as seen in Figures 22 and 23. This finding suggests that LERD is currently not focused on expanding any particular visitor demographic in relation to others. This consistency can be attributed to LERD's broad target audience.

All LERD staff concurred that there are many people visiting the site every day. The annual reports revealed that the number of visitors is increasing every year. One of the staff interviewees suggested that one of the reasons behind this increase in number of visitors was due to an increase in TV programs on national television about LERD in the past 10 years. However, due to the lack of statistics or information from the archives, we cannot determine the accuracy of this claim.

The collected data revealed another channel through which LERD attracts visitors and clients, which is through LERD's affiliation with His Majesty the King's royal development projects. Even though there is little information about this connection and its impact on outreach in LERD's archives, both staff members and clients, mentioned this connection. This additional connection adds another layer of professionalism and credibility to the organization in the eyes of the Thai public.

At this time, the majority of visitors currently coming to LERD are Thai. Only 1% of the total visitors were classified as international visitors in 2007 and 2011. This data shows a potential area for growth and a new target for LERD's outreach initiatives. This potential new target audience needs more accommodation. Due to the small number of foreign visitors coming to the center, few LERD staff members speak English fluently. Furthermore, none of the informational signs throughout the site are translated into other languages besides Thai. If LERD provides appropriate educational and informational material, as well as trained staff members for an international audience, then LERD can expand the international visitor demographic greatly.

During the archival research, we gave primary focus to the 2011 internal reports outlining LERD's new evaluation and goal setting plan. Even though LERD met or exceeded all of their

goals in several categories it became apparent that many of LERD's goals were not set based on numbers and statistics of previous years. This internal report revealed that LERD exceeded its goal for visitor attendance by 31,905 visitors or 80% higher than intended. There were four other cases where LERD's numeric goals were exceed by over 50% of the value intended. While this may be considered a positive finding because it shows that LERD is actively meeting its own expectations, it also indicates that these goals require adjustment to be fully effective. When an organization sets goals they should be at a proper level to encourage effort to achieve.

After examining data from the archives and interviews, we analyzed data gathered from our visitor surveys. To help gauge the accuracy of our sample, when drawing conclusions for the overall visitor population, we compared certain data sets between the survey data and the archives. One of the primary comparisons made was examining the differences between visitor group types. In the archival research the most prevalent type of visitor that came to LERD in 2011 was government administrators at 42%, while from our own survey data, the most prevalent visitor type was students and teachers at 41% of all visitors. The reason for this difference is most likely due to the inherent error in our survey process because of the short time frame we collected data and the smaller than desired sample size that we attained. If given a longer period of time to conduct surveys and a larger sample size, our survey data would reflect the overall population more accurately. These conclusions were important to establish before conclusions for other questions were examined, in order to put our data into perspective and gauge the validity of any of our findings.

Part of determining the current effectiveness of LERD's outreach programs is identifying visitor opinion on current outreach programs used at LERD. Our group posed two questions in the survey, mentioned previously, that requested respondents to rate both the informational and presentation quality of LERD's programs. Our findings showed that majority of respondents rated both the quality of information and the quality of the information's presentation as the best rating of 5. Based on these results, we can conclude that the informational quality and the quality of presentation is not a category that LERD needs to address currently.

In addition to creating graphs to reflect the answers to our survey questions, our team also did comparative analysis between questions. This analysis attempted to discover any possible correlations between our different survey questions to reveal previously hidden information

about LERD's visitors and their experience at the site. We conducted this analysis using pivot tables available through Microsoft Excel.

The first correlation that our team found was between the visitor group type and whether the visitor had previously visited LERD. We found that visitors who were government administrators or community members were significantly more likely to have never visited LERD and its facilities previously, compared to all other visitor group types. With this information, LERD can prepare basic overviews of the wastewater and waste treatment techniques and site observations to not overwhelm new visitors with new environmental knowledge. With the other group types, different and more specialized information can be emphasized to further advance the comprehension of the visitor. A graph showing this trend is seen below in Figure 29.

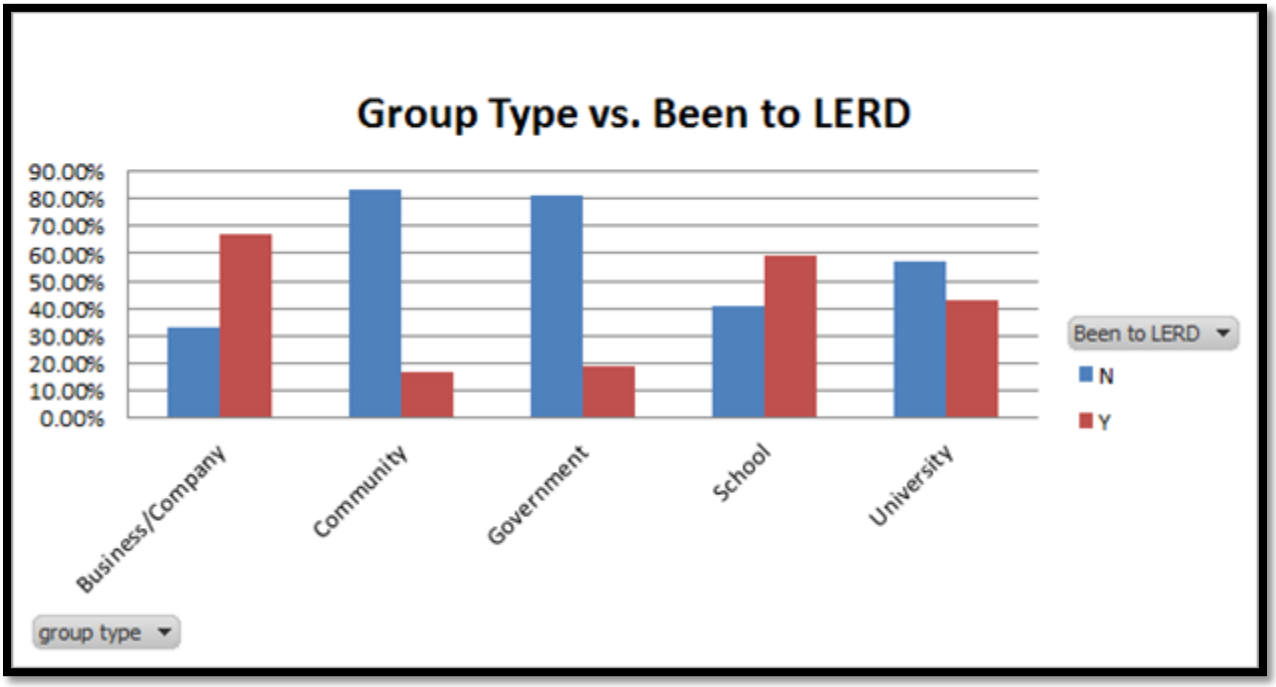

Figure 29: Trend Observed between Group Type and Previous LERD Visits

The next trend we observed was between the presentation experienced by the visitors and the visitors' desire to return to LERD. If visitors were given only tours, the majority of the respondents indicated no desire to return to LERD in the future. However, if visitors were given any other presentation option or combination of presentations, visitors were all significantly more likely to desire to return to LERD in the future. This information indicates that if LERD

wishes to interest visitors and turn them into repeat visitors, LERD should not offer visitors solely a tour, but must combine a site tour with other media presentations. A graph of the trend is shown below in Figure 30.

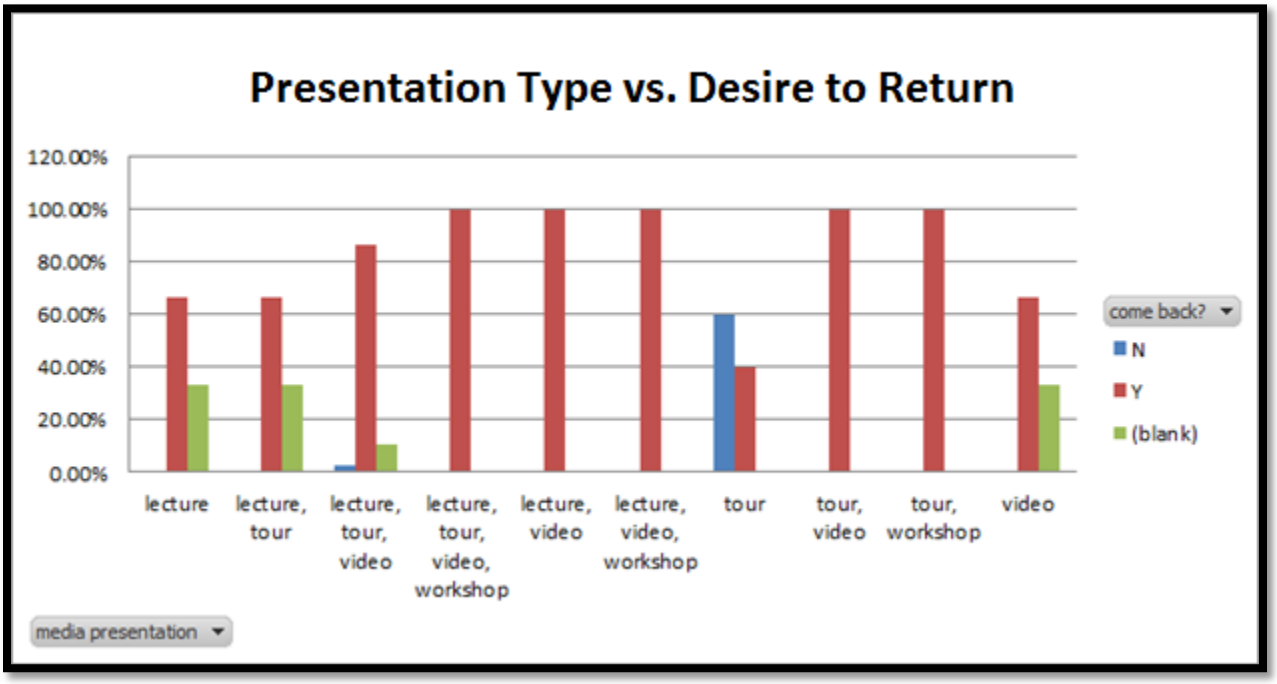

Figure 30: Visitors Who Were only Given a Tour Less Likely to Return

The last significant trend our survey revealed was a correlation between the responses for our two rating questions. By analyzing our data, it was found that if a visitor rated the informational value a 5, they were also highly likely to rate the media presentation a 5 as well. This trend was also observed for the ratings of 4, "Good" and when visitors left the rating section blank. Moreover, this trend most likely indicates that few visitors understood or perceived a large difference between what these two questions were asking them to rate. A table showing the relationship between both the ratings is shown below in Figure 31.

Percentages	Media rating					
Information rating	3	4	5	good	(blank)	Grand Total
3	0.00%	5.88%	0.00%	0.00%	0.00%	1.52%
4	0.00%	70.59%	15.38%	0.00%	0.00%	24.24%
5	100.00%	23.53%	84.62%	15.38%	0.00%	43.94%
good	0.00%	0.00%	0.00%	84.62%	0.00%	16.67%
(blank)	0.00%	0.00%	0.00%	0.00%	100.00%	13.64%
Grand Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Figure 31: Table of the Relationship between the Visitor's Ratings

4.2.4 Objective 4: Provide Recommendations for Improvement to the Outreach Plan

To give the team a good starting point for formulating recommendations, we decided to ask the interviewees about possible improvements for LERD's outreach programs. Many similar recommendations given by the interviewees were found after analyzing the data. The quality of the educational materials given to clients was one of the major issues that emerged. Even though the brochures and pamphlets are professional in nature, some of the clients stated that they did not completely understand the environmental techniques and how they functioned.

One finding, mentioned previously was that the board of directors pointed out that LERD's follow-up process could be improved. Many staff members revealed concerns regarding not having enough researchers and field workers in order to fulfill this demand. This followed the observed trend that the different interviewee categories were primarily concerned with improvements that benefitted their department primarily.

4.2.5 Summary

After carefully analyzing the collected data from our site assessment, archival research, interviews and surveys, we determined the major trends in LERD's organization from which to draw conclusions related to our objectives. The first trend we found was the inconsistency among the stated goals and focus of different LERD staff members. Although there was some overlap, there were still some differentiating opinions between what staff members understood LERD's mission and target audience to be. Without greater focus on outreach strategies, it is difficult to optimize LERD's outreach strategy. Confusion on the target audience and mission of an organization among its members can hinder LERD's ability to accomplish those goals

because different members are aiming their efforts in different directions. Greater focus can strengthen an organization as it brings all members to aim in one direction as opposed to multiple scattered ones.

LERD's attempts to utilize the internet for its outreach efforts are a good starting point for future development. Many of the inconsistencies found as well as the lack of necessary information will hinder and confuse potential viewers. The current website and Facebook fan page are a great start to using the internet for outreach, but some work can be done to realize the full potential of this medium for achieving LERD's goals.

To enhance knowledge transfer, LERD also needs to address the lack of simple and easy-to-understand informational materials provided to the visitors and clients. Likewise, the information onsite and most of the handouts provided are in Thai, which hinders potential expansion of the international audience demographic. Moreover, if LERD seeks to attract international visitors, there needs to be lecturers fluent in English or other languages besides Thai.

LERD's plans to satisfy of many of their established goals have proven to be highly successful, because on their first year of setting goals and evaluating LERD successfully accomplished them all. Therefore, we determined that LERD is a strong organization with great potential for improvement in all their fields in order to accomplish their overall mission.

Lastly, LERD has an inefficient system of archiving visitor and client information. Data found in the archives are not always double-checked and not all contact information for those visitors without set appointments is kept on record. Without an organized database with relevant information, it is difficult for LERD to monitor its progress of accomplishing its goal and mission.

Chapter 5: Recommendations & Conclusions

In this chapter, we present the final conclusions drawn from our findings and data analysis along with recommendations for the Chaipattana Foundation in regards to LERD. The recommendations are divided into five categories: administrative procedure improvement improved client interaction, staff outreach training, experimental site media, and LERD's online presence.

5.1 Administrative Procedure Improvement

The recommendations we have on administrative procedure improvement can be divided into two categories, administrative meetings and archive collection.

5.1.1 Administrative Meetings

Our interview data showed that different staff groups involved in LERD's outreach program not only had different understandings of LERD's goals, but also stated an exceptionally wide range of target audiences. Considering the inconsistencies found among the staff at LERD, **we recommend a meeting focused on outreach for every LERD department every 6 months**. The purpose of this meeting would be to maintain a high level of coordination in outreach efforts and to keep all staff focused on LERD's vision, mission, and the goals. Such a meeting would also be useful for departments to update each other on their progress and new ideas. If all members of the organization completely understand the central goal and principle target audience of LERD then more can be accomplished than if the staff worked as separate entities.

5.1.2 Revision of Organization Objectives

As shown in our findings, LERD set goals for the year 2011 in an effort to evaluate and improve their project, but many of them were met and exceeded by over 50%. **We recommend that LERD set more demanding goals corresponding to current statistic than the ones set in 2011.** This goal setting is an important tool for evaluating their progress in the future. Moreover, setting higher goals will motivate the staff more in both work quality and proficiency.

5.1.3 Archive Collection

We divided this subsection into two categories; the first category related to LERD's client contact records, and the second category focused on LERD's current archive organization.

Contact Records

According to our interviews with LERD staff and our site assessment, we observed a lack of a standardized system for recording visitor and client contact information. Currently LERD retains past client information within the pages of their internal reports, but not in separate source available for internal use within the organization. **We recommend that LERD create a standardized system for recording all clients' contact information.** This information can include: representative names, business or company names, addresses, email addresses, phone numbers, environmental problems onsite, suitable LERD wastewater or waste treatment techniques for implementation, and also any problems found with the implemented environmental technique. This information will prove useful in further recommendations about increased client interactions.

We also found that the records of current client information are not easily located and centralized. When we asked for the records of LERD's current clients, only one staff member's notebook was supplied to the team. With this current setup it is difficult for other staff members to access and poses a high risk of misplacement or damage to the information. **We recommend that LERD make the records computerized and available at the main library.** By having the records computerized at the library, the records can be easily located and shared among the staff. An example of an electronic database to store contact information can be seen in Appendix H.

Update Archives

Resulting from our personal experience trying to access LERD's internal reports, we discovered that several internal reports were missing and their whereabouts were unknown. In an effort to increase the organization of these records and increase efficiency in researching them, **we recommend that in the future, all LERD's internal reports are systematically organized and kept in one central location**. A suitable location to store the internal reports is LERD's current research library. By storing the information from past years in an easily accessible location for staff members, it increases the usability and effectiveness of the information contained in the reports. To further increase the usability of the internal reports, **we also recommend that LERD maintain two copies of each report that it stores in the library.** This would allow staff members to remove the reports from the library while still having a copy available for further reference by other staff. The goal of all these measures is to reduce the amount of time spent locating internal reports instead of learning from them.

From further examination of the internal reports during our research, we noticed that it became difficult to compare information from reports of different years. This was because many reports from different years did not list similar topics. Therefore, **we recommend that LERD adopt a standard format for writing the informational content of annual internal reports**. By adopting a standard format it becomes easier for the organizations growth and changes to be evaluated over a period of time by offering valid comparable information.

5.2 Improved Client Interaction

As mentioned earlier, a beneficial use of maintaining client contact information is that the creation of a follow-up program for clients becomes feasible and easy to implement. **We recommend that LERD maintains contact with their clients and visitors through use of previously mentioned contact information records.** With this measure, staff can introduce new techniques and update clients about improvements to the system and to also keep up with client's satisfaction on their services. For additional contact with clients, **we also suggest that LERD creates a monthly newsletter to inform current clients about new environmental ideas, recent LERD activities, seminars, and annual meetings.** The advantage of a newsletter is that clients and visitors can be updated easily and individuals that lack an Internet connection can also be reached. This follow-up process will not only significantly add to LERD's outreach services, but will also maintain more explicit and updated guidelines for clients. To further decrease distribution and resource costs, **we recommend that the newsletter be sent to clients through email or uploaded for download on LERD's website.** This measure would also possibly reduce the time necessary to create the newsletter and possibly allow for more frequent updates for clients.

A beneficial program that LERD currently uses is an annual client meeting; where LERD provides updates on their newly developed research. However, LERD does not invite its clients, which results in exceptionally low attendance figures. **We recommend that LERD develops an organized process to inform and invite all clients and other interested participants to the annual meetings.** Through this annual meeting, LERD can easily maintain direct contact with many of its clients and keep them informed and involved. In addition this recommendation utilizes a program that LERD already currently has, but expands upon it realizing the full potential.

Through observation, we found that there is currently no obvious choice within LERD staff to successfully coordinate and implement our previously stated follow-up recommendations. **We recommend for LERD to establish a permanent position for to maintain interaction with clients and to coordinate all follow-up programs.** Having a primary position to coordinate the follow-up process will increase LERD's chances of success and ensure that the necessary time and energy is focused to create a successful and a high quality follow-up program.

5.3 Staff Outreach Training

After analyzing data regarding LERD's handouts and how LERD's clients found out about LERD, we noted the potential impact additional field training for staff would have on the outreach program. Therefore, we have developed recommendations for outreach training for field workers, and students at the College of Environment at Kasetsart University. This training can vary from a few months to ongoing throughout the year.

5.3.1 Field Workers

Demonstrations and workshops on waste treatment systems outside of the experimental site are one of the key methods in LERD's outreach system. Communities tend to have less scientific background, which can be a barrier to LERD's outreach program. From our onsite interviews, we found that field workers, when outside of the experimental site, are involved in implementations of wastewater and waste treatment techniques. **We recommend that LERD should provide training for the field workers in demonstrating and transferring knowledge of the environmental treatment methods to communities**. With similar levels of basic scientific understanding, field workers can explain the waste water and waste treatment methods in a familiar and more comfortable way that is easier for nonprofessionals and local communities to understand. Even though the field workers do not have a degree in environmental management or environmental sciences, they can be trained to have the appropriate understanding required to teach and give simple explanations to communities about LERD's methods. As a result, local communities can fully understand the treatment methods and can apply them more effectively.

5.3.2 Students at the College of Environment, Kasetsart University

According to the interviews with the clients and visitors, one of most prevalent ways they heard about LERD was from the students of Dr. Kasem Chankao, Ph.D., who is a

professor at Kasetsart University and the current director of LERD. Taking advantage of this effective method, **we recommend that LERD trains environmental students involved with LERD on how to properly advertise LERD's wastewater and waste treatment techniques.** The College of Environment of Kasetsart University should encourage and utilize their students to maximize and effectively promote the ideals of LERD out to the communities, related organizations and businesses, thus disseminating LERD's techniques and ideas throughout Thailand.

5.4 Experimental Site Media

Recommendations on experimental site media refer to educational material and programs available to visitors and potential clients on visits to LERD. This includes: brochures, pamphlets, videos, and self-guiding tours.

5.4.1 Brochures, Pamphlets, and Videos

From several of our open-ended interviews, we found that LERD's educational handouts, such as brochures and pamphlets, were not suitable for community outreach among nonprofessionals. The current brochures and pamphlets available contain complex chemical formulas and advanced scientific terminology, which is not appropriate for an audience of community members. **We recommend that LERD provides appropriate educational materials be developed for presentation to local communities.** The simple brochure and pamphlet could state the main ideas of their techniques, such as the name of the environmental technique, short description, the purpose, limitation, space needed, materials required, and how it physically works, etc. An example of this can be seen in Appendix I. As a result, the community target audience will be effectively reached.

We also recommend that LERD tests a sample educational handout within surrounding communities, to evaluate comprehension. Local residents in the surrounding communities should be chosen because they closely resemble the target audience.

5.4.2 Current LERD Media Presentations

Our surveys revealed that a majority of LERD's visitors preferred media presentation. This indicates that the tour content and format that LERD utilizes presently is of high quality and is engaging and interesting to visitors. Therefore, **we recommend for LERD to continue offering site tours to all experimental site visitors.** While the site tour has less informational

content than lectures, handouts, or videos; it offers visitors direct examples of LERD's wastewater and waste treatment techniques. In addition, the site tour has also proven to be memorable and enjoyable to many visitors.

Moreover, out surveys also revealed data related to LERD's media presentations compared to visitors' desire to return to LERD for future visits. When only a site tour was offered to visitors, they were significantly less likely to desire to return to LERD in the future. **We recommend that LERD offers all their site tours in conjunction with other educational media presentations.** From our survey data we found interestingly that all other presentations offered by LERD are best suited for combination with the site tour. Through combinations of presentations LERD can gain the interest and enjoyment of visitors, mentioned previously, while also avoiding the possibility of discouraging repeat visits that the site tour appears to have when offered alone.

5.4.3 Self-Guiding Tours

Though LERD provides tours of their natural waste treatment facilities for visitors, there are limitations including the availability of staff for walk-ins and on Sundays when most staff have the day off. To accommodate these visitors **we recommend that self-guided tours be established at LERD.** This way, visitors and potential clients can still experience the site and learn the information even if they visit LERD on a Sunday or when a tour guide is unavailable.

To accomplish an effective self-guided tour**, we recommend LERD update signs, and infrastructure throughout the experimental site.** According to site assessment, we found that the signs and information stops available onsite are inadequate for self-guided tours. The signs need to have easier to understand descriptions involving simple scientific explanations. To further facilitate an adequate self-guided tour, **we also recommend that a welcoming station should be placed in a location where it is easily noticed as the visitors enter the site.** This welcoming station should include a map of the entire observational site, pamphlets to assist in guiding a visitor. An example of a poster on the LERD site in English can be seen in Appendix J. Updating the welcoming station, directional signs, and an informational station will offer proper information for visitors to guide themselves easily.

5.5 LERD's Online Presence

This category was split into two sections, one that dealt with improvements to LERD's primary website, and the other which focused on enhancing LERD's Facebook pages.

5.5.1 Primary Website

Based on the results from our surveys it became apparent that many visitors report learning about LERD through LERD's website. However, we determined through observation that LERD currently maintains multiple websites on the Internet, with each having inconsistent informational content and update frequency. Having more than one official LERD website may be cause confusion among viewers and lead to the spread of misinformation, distorting the common mission and goal of LERD. **We recommend that LERD maintains a single primary website and disable any old outdated websites.** This will reduce the confusion of viewers and provide a single location to find official LERD publications and information.

We also found through observation, that LERD's official website has several pages that are not updated or void of information beside page titles. **We recommend that LERD update its primary website frequently and ensure that there are no empty pages found within.** These improvements ensure that the information presented to visitors is accurate and up to the educational and presentational quality that LERD expects. In addition, these improvements will lead to an increase in visitors' perception of LERD's professionalism.

Another aspect that LERD is not fully optimizing is the presentations of information on their website. LERD's current primary website lacks of clear and understandable figures to explain the information presented. **We recommend that LERD augment its written wastewater and waste treatment information with example models, animations, and videos.** Examples of possible models are available in the previous version of the website (http://www.lerd.org/home.php). By including explanatory models and videos in addition to written information, the viewer's interest and engagement with the website will increase.

As mentioned, LERD's current primary website could have expanded its content with interesting and informative presentation media. As a quick improvement, **we recommend that LERD uploads its informational videos, which were already produced, to its website for easy viewing.** Uploading videos that LERD already presents and distributes onsite can eliminate the need for LERD to produce new material for the website of similar quality. The one perceived limitation and drawback to this recommendation is that the current videos length of 20 minutes.

Currently the video provides information and discusses all topics related to LERD and its various wastewater and waste treatment techniques. To help attach pertinent video content with informational content already located on the website **we also recommend that LERD divide its main instructional video into shorter segments before upload.** If LERD's website gives a variety of video clips that relate to specific information, the viewers can decide which clip and information to view. This would also easily ensure that the most important information for a specific topic is covered with little unrelated extraneous video footage.

The last conclusion drawn about LERD's main website is the lack of LERD's contact information. Also from the survey data mentioned previously we found that many visitors heard about LERD through their website. To increase the ease of which viewers can be turned into site visitors, **we recommend that LERD adds a section to its primary website that is dedicated to providing pertinent contact information.** This contact information should include a valid email address, telephone numbers for both LERD's Kasetsart offices and the LERD research site, as well as the addresses of both of those facilities. By providing this information LERD opens up a channel of communication so that viewers can contact LERD easily to ask questions, give comments and set up group visits to the facilities.

From interviews with staff and our observations, LERD's current website does not have additional versions translated into other languages, in the event that LERD wishes to expand its international reach. In order to accomplish this mission through the website, **we recommend that LERD translates its primary website into English.** The world is currently becoming more connected and English has become a language that is understood widely throughout the world. Therefore, through the translation of the site into English, LERD can appeal and make information accessible to many potential international viewers.

As mentioned previously, LERD also has multiple Facebook pages and websites related to its learning centers presented online. However, these tend to be difficult for viewers to find. To remedy this, **we recommend that LERD provides links to both the main websites of its various learning centers and also to its main Facebook fan page.** By fully interconnecting the LERD main page with those of its learning centers it allows viewers to navigate easily and efficiently to each center's website.

5.5.2 Facebook

LERD currently maintains a clear and informative Facebook fan page to interact through social networking with the general public. To enhance the presentational value of the current fan page, **we recommend that LERD create a "Welcome page" for their fan page** (please refer to glossary for differentiation between a fan page and a "welcome" page). A "Welcome page" would provide basic information about LERD in order to engage viewers' interest, thus improving the experience and first impression of fan page visitors. A sample "Welcome Page" can be viewed in Appendix L. In addition from our observations, LERD's presence in social media has been positive and LERD has gained followers. These followers have begun interacting with the organization's fan page and asking questions of LERD through this resource. In response to this trend **we also recommend that LERD uses its fan page to interact with their followers by providing updates about activities and events frequently.** By engaging directly with followers through their fan page, LERD can forge a deeper connection with its viewers and visitors than was previously possible.

5.6 Conclusion

Our team has been closely collaborating with LERD for the past eight weeks. In those eight weeks, we have realized the potential in the waste and wastewater treatment techniques developed by LERD to impact communities, cities, and provinces of Thailand. Such communities have hope in the endeavors by Laem Phak Bia Environmental Research and Development Project and the Chaipattana Foundation.

LERD's environmental treatment techniques have the ability to help rural and underprivileged communities tackle their wastewater and waste treatment needs cheaply and with natural means. This deep respect for the environment and for the pure intentions of helping to better the quality of life for others deserves highest respects to the organization and to His Majesty, the King.

The potential of this environmental research completed at LERD can be furthered by its outreach efforts to create a greater impact. Through a combination of site assessments, interviews, surveys, and archival research, our team found and analyzed the following areas in LERD's outreach system that can benefit from improvements:

1. Clear communication among LERD staff
2. Methods for maintaining visitor and client records

3. Clear communication between LERD and its clients
4. Continued staff training
5. Advertisement and educational media

After analyzing these deficiencies we make the following recommendation for our sponsor:

1. The improvement of LERD's administrative procedures
2. The creation a systematic follow-up process to improve LERD's interaction with clients
3. The provision of LERD's staff members with additional outreach training
4. The improvement educational materials and programs for the LERD experimental site
5. A reassessment of LERD's online interaction with visitors

With our recommendations, we hope to contribute to the improvement of the LERD outreach program. These recommendations have been presented to LERD, and the Chaipattana Foundation for the promotion of their collaborative effort. Working as an international team in an interdisciplinary setting, it has been a great pleasure to have the opportunity to work with an organization with civic duties and it is our hope that through this project, we can contribute to the improvement of LERD's outreach program.

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Appendix A: List of Interviewees at LERD

Name	Job Position/Company	Interviewee Number
Satreethai Poommai	Scientist, Researcher	1
Thanit Pattampaitoon	Environmental Researcher	2
Taweeporn Kannee	Environmental Researcher	3
Nirut Uppanunt	Environmental Researcher	4
Saowalak Boonmang	Environmental Researcher	5
Thanawat Jinjaruk	Environmental Researcher	6
Anonymous	Laem Phak Bia Environmental Research and Development South Learning Center	7
Chatri Nimpee	Scientist, Former director of LERD	8
Porngamol Singkhan	Environmental Researcher	9
Watcharapong Wararam	Researcher and PhD Student	10
Supamad Eamkrut	Lecturer	11
Chei Boonrod	Lagoon Treatment Management	12
Mr. Jumlong	Mangrove System Management	13
Supin Muangnoi	Field Workers Manager	14
Arom Intaraphong	Grass Filtration Management	15
Mr. Phet	Rice Field Management	16
Sumrong Payomdej	Waste Concrete Box Management	17
Sumran Payomdej	Demonstration Field	18
Wilai Wattaharn	Provincial Administrative Organization	19
Jutharat Chaisanam	Laem Phank Bia Environmental Research and Development Northeast Learning Center	20
Mr. Korntud	Private Company	21
Anonymous Professor in North LERD Learning Center	Utaradit Learning Center	22
Philip D. Round	British Nationalist, Ornithologist and professor at Veterinary Science, Mahidol University	23
Prof. Alongkorn Intalugsa	Professor at the Department of Environment at Kasetsart University	24
Prof. Thassanee Boonpakrong	Professor at Kasetsart University	25
Dr. Kasem Chankao, Ph.D.	Director of LERD	26
Ms. Noppawan Semvimol	Researcher, Ph.D. student	27
Pattaramol Sokunthika	Librarian	28

Table A.1: List of Interviewees by Number

Appendix B: Interview Questions for LERD Staff and Visitors

No.	Question
1	What is your name and what is your position at LERD?
2	What are the responsibilities of your position?
3	What are the primary outreach objectives of LERD?
4	Who do you feel is the target audience to LERD?
5	How do you attract your target audience currently?
6	Who are your main visitors? How many?
7	Do you have a database or record of all these visitors?
8	How are visits coordinated? Who coordinates them?
9	How long are the visits usually?
10	How many times monthly are visits coordinated?
11	Do you give different presentations to different kinds of groups? What are the different options?
12	Which wastewater treatment option is adopted most often?
13	What kind of outreach programs does LERD have?
14	How many businesses or communities have adopted LERD's methods?
15	How many international visitors have used the environmental methods shown at LERD?
16	What are the series of steps you take when a business/community is serious about implementing the environmental techniques?
17	Have you had a situation where the person lose his/her interest along the way?
18	What advertisement, initiatives, and outreach programs does LERD have?
19	Do you interact with other NGOs, environmental center, or research groups? If so, which ones, and how? If not, would you like to?
20	Can you list the outreach services that are currently used?
21	Which ones are you involved in?
22	What do you think are the strength of the outreach program?
23	What do you want to see happen with the outreach at LERD?
24	Is the LERD currently meeting its expectations? Why / Why Not? Is there anything you feel should be added to LERD outreach program? What?

Table B.1: Interview Questions for LERD Board of Directors

No.	Question
1	What is your name and what is your position at LERD?
2	What are the responsibilities for your position?
3	What are the primary outreach objectives of LERD?
4	Who do you feel is the target audience for LERD?
5	How do you attract your target audience currently?
6	Who are your main visitors? How many?
7	How many of the visitors are international?
8	Do you have a database or record of all these visitors?
9	How are visits coordinated? Who coordinates them?
10	How long are the visits usually?
11	How many times monthly are visits coordinated?
12	Do you give different presentations to different kinds of groups? What are the different options?
13	How many businesses or communities have adopted LERD's methods?
14	How many international visitors have used the environmental methods shown at LERD? Which wastewater treatment option is adopted most often?
15	What advertisement, initiatives, and outreach programs does LERD have?
16	Do you interact with other NGOs, environmental center, or research groups? If so, which ones, and how? If not, would you like to?
17	Can you list the outreach services that are currently used?
18	Which ones are you involved in?
19	Who is the target audience for these programs?
20	What do you think are the strengths of the outreach program?
21	What do you want to see happen with the outreach at LERD?
22	Is the LERD currently meeting its expectations? Why / Why Not? Is there anything you feel should be added to LERD outreach program? What?
23	What do you want to see happen with the outreach program at LERD?

Table B.2: Interview Questions for LERD Office Staff

No.	Question
1	What is your name and what is your profession?
2	What are the responsibilities for your position?
3	Do you interact with the visitors?
3a	If yes: How often do you interact with the visitors?
3b	Do the visitors understand enough the scientific background of it?
4	Do you help teach visitors specifically how to use the methods
5	Do you ever go to other sites to help set up a new system?
6	How often do you work at LERD? How long are your shifts?
7	Do you receive training on how to interact with the visitors? Do you see problems with language barriers?
8	Are you aware of any outreach programs at LERD?
9	Which ones are you involved in?
10	What do you want to see happen with the outreach at LERD?

Table B.3: Interview Questions for LERD Field Workers

No.	Question
1	What is your name and what is your profession?
2	Who do you work for?
3	What are the responsibilities for your position?
4	How did you hear about LERD?
5	What is the purpose of your visit today?
6	What kind of presentation did you receive today?
7	What more would you like to have done to help you have a better understanding?
8	What were you initially expecting to learn in your visit at LERD today?
9	Did your experience meet your expectations?
10	Would you implement these environmental methods in your organization?
11	Why is your company interested in using these methods?
12	Do you have any other comments or concerns?

Table B.4: Interview Questions for Visiting Clients

Appendix C: Interview Summaries

Note: The blue highlighted portions indicate the most frequent interview answers.

Board of Directors

1. **What are the primary outreach objectives of LERD?**
    - Transfer and spread the invented treatment methods throughout different parts of Thailand. Adapt the current techniques to be suitable for different environment and translate the scientific terms into an understandable language for communities.
2. **Who do you feel is the target audience to LERD?**
    - Communities, government, private sector
3. **How do you attract your target audience currently?**
    - Connection from Chaipattana foundation (well-known)
    - Website, TV program, local radio
    - Effective media increased the number of visitors during the year
    - Mostly, people that already experiencing the problems (communities/government)
    - Private sector – study and adapt in order to prevent problems
4. Do you have a database or record of all these visitors?
    - Yes
5. How are visits coordinated? Who coordinates them?
    - Lecture, site observation
6. Do you give different presentations to different kinds of groups? What are the different options?
    - Yes, they are given different depth of information according to their background
7. Which wastewater treatment option is adopted most often?
    - All, but depends on the environment of the area and problems
8. How many businesses or communities have adopted LERD's methods?
    - Many, but communities are not meeting his expectation
9. How many international visitors have used the environmental methods shown at LERD
    - Vietnam
    - The Princess Sirinthorn's guests (visits)
10. What are the series of steps you take when a business/community is serious about implementing the environmental techniques?

- Send out researchers for site assessment and plan/design and maintenance

11. What advertisement, initiatives, and outreach programs does LERD have?
    - Website, video, TV program, pamphlet, seminar
12. Do you interact between LERD and other organization? If so, which ones, and how? If not, would you like to?
    - Universities coming in for study/field trip/research
    - Gas station at Rayong
    - Doi tung at Chaing rai
    - Heineken
13. Can you list the outreach services that are currently used?
    - Implement outside of the experimental site
    - Learning-center of different regions of the country
    - Send out staffs for seminar/workshops/lectures
14. Is the LERD currently meeting its expectations? Why / Why Not? Is there anything you feel should be added to LERD outreach program? What?
    - Not quite meet the expectation of the implementation by communities, Should be improving throughout the future in order to satisfy the growing development of Thailand
    - Many communities are interested, however, not many of them are currently using (which is the Government's responsibility), so, the solution is to implement the ideas and transfer the knowledge individually to the communities.
    - Effective website/posters on site in English
    - Satisfy about outreach knowledge transfer
    - Should improve on the follow-up process due to the different environmental sites

Current Clients

- **How did you hear about LERD?**
    - Student of Dr. Kasaem
    - Attended seminar by LERD
    - King's Royal Project

- **What was the purpose of your visit?**
  - Annual meeting
- What was the problem you had and needed LERD to help fix?
  - High costs of previous method
  - Untreated wastewater
- Why choose LERD?
  - Low cost
  - Suitable for problem
  - Order of Princess Sirinthorn
  - LERD is one of the King's royal project
- **Services**
  - Offered lectures
  - LERD provided funding research and improvement
  - Researchers came for specific site assessment
  - Sent researchers to help implement the techniques
  - Provided annual report
- **Implementation outcome**
  - Reduced waste treatment cost
  - Their area was established as LERD learning center for diff region of Thailand
  - Awarded for best gas station
- Visits to new learning center
  - Approximately 200 visitors a year
  - 3-4 groups a month
- Services offered at new learning centers
  - Point of contact for this province
  - Seminars, workshops, lectures
  - Pamphlets, science fairs
  - Knowledge transfer
  - Websites
- Telling others
  - Koh Chang, Yala has implemented these systems

    - Will tell other people about LERD
- What they want to see happen
    - Better pamphlets that can explain complex science in easy understandable way.
    - Scientific terms hard to explain to communities

Field Staff

- **Do they have visitor interaction?**
    - Not officially, but sometimes receive questions from visitors
- Teach waste treatments methods to visitors?
    - Yes and no
- Did they go to other sites and help set up new systems?
    - Yes
    - Very often
    - Sometimes
    - Varies
- **What are shifts like?**
    - Usually 9:00-16:30
    - Sundays off
- Lecture on system maintenance?
    - Yes and no
- **Did they get training to interact with visitors?**
    - No
- **Outreach program awareness?**
    - Yes, I am aware of the outreach programs
    - Sometimes got out to communities to demonstrate
- Meeting expectations?
    - Yes
    - Mostly
- Comments?
    - Welcome for improvement

- Housing facility for staff
- Expand experimental site

Staff Members

15. What are the primary outreach objectives of LERD?

- (5) Transfer knowledge of waste water treatment to communities
- (3) Research waste water treatment
- (2) Solve the environmental problems of communities

16. Who do you feel is the target audience to LERD?

- (5) Private sector/companies/businesses/industry
- (4) Communities
- (4) Students/teachers
- (3) Researchers
- (2) Government
- (2) Internationals
- (1) All people
- (1) No preference

17. How do you attract your target audience currently?

- (3) Visitors make contact on their own
- (2) TV programs, websites, published media
- (1) Workshops, hands on activities
- (1) Just well-known
- (1) King's project

18. Who are the main visitors?

- (3) Students/teachers
- (3) Government administrators
- (3) Communities
- (1) Private sector/companies/businesses/industry

19. International visitors?

- International researcher

- No
- On the boards of companies that visit
- Vietnam Laos

20. Do you have a database or record of all these visitors?
    - Yes

21. How are visits coordinated? Who coordinates them?

- Staff/professor
- Visitors make contact

22. How long are visits
    - 2 hours/group-1/2 day - tour with site observation
    - 4 hours/group – 1 day with workshop
    - 1.5-2 hours visits

23. How many visits a month?
    - Everyday
    - 3-4 groups per day
    - 150 visitors per month
    - 1,000 visitors
    - 8,000 visitors per month
    - Many in August and September

24. Do you give different presentations to different kinds of groups?
    - Yes

25. What are the different options?
    - (4) Adjusted speech and video
    - (2) Activities, pamphlets, and animation for kids
    - (2) Academic and technical info for adults
    - (1) Different language presentations

26. Adopted by businesses? Which wastewater treatment option is adopted most often by businesses?
    - Yes listed in report
    - Mostly communities
    - Heineken

- Gas station
- Oxidation pond most commonly used

27. How many businesses or communities have adopted LERD's methods?
    - Many, but communities are not meeting his expectation
28. How many international visitors have used the environmental methods shown at LERD?
    - Few
29. What advertisement, initiatives, and outreach programs does LERD have?
    - (5) TV program
    - (4) Website
    - Brochure
    - Radio
    - Posters
    - Magazine
30. Do you interact between LERD and other organization? If so, which ones, and how? If not, would you like to?
    - No, not really
31. Can you list the outreach services that are currently used?
    - Posters, brochures, media
    - Training at schools
    - Invitation to community to visit
    - Site observations for companies
    - Learning-center of different regions of the country
    - Send out staffs for seminar/workshops/lectures
32. Is the LERD currently meeting its expectations?
    - (5) Yes
    - (3) No
33. Is there anything you feel should be added to LERD outreach program? What?
    - Not enough researchers
    - Not enough facilities
    - Media needs to be easier to understand
    - Wants a learning center

- Improve the outreach to communities
- Maintain consistency
- Not enough staff for large groups

Appendix D: Substantial Quotes from Interviewees

Board of Directors

(Interviewee 24) “Not quite meet the expectation of the implementation by communities, Should be improving throughout the future in order to satisfy the growing development of Thailand”

(Interviewee 24) “Many communities are interested, however, not many of them are currently using”

(Interviewee 25) “Effective media increased the number of visitors during the year.”

(Interviewee 25) Should improve on the follow-up process due to the different environmental sites

Staff Members

(Interviewee 6) “Media needs to be easier to understand.”

Current Clients

(Interviewee 21) “I want to see the better pamphlets that can explain complex science in easy understandable way.”

(Interviewee 21) “It is very hard to explain the scientific term to the communities.”

Appendix E: Surveys Given Out to Visitors (English & Thai Version)

Questionnaire for Visitors

Chulalongkorn University and Worcester Polytechnic Institute

1) Where are you from ……?

2) What type of group are you with?

Community Group	Government Agency
High School/Primary School	University
Private Company	Other……

3) Have you ever been to LERD center before?

Yes	No

4) Where did you hear about the environmental center?

Activities by LERD	Fellow of Industry
Documentary	Friend /Colleague
Newspaper	Radio
Teacher/School	TV Program
Website	Other……

5) What type of media or program was provided to you? Circle all that apply.

Lecture	Informational video
Guided tour	Workshop
Other……..	

6) What was your opinion of the information presented to you today?

Bad 1 2 3 4 5 Good

7) What was your opinion of the media chosen for your presentation?

Bad 1 2 3 4 5 Good

8) What type of presentation would you have preferred to experience?

Lecture Informational video

Guided tour Workshop

Other……

9) Would you want to come back to the environmental center?

Yes No

10) Are you interested in using the methods described today in your own community/business?

Yes No

11) Do you have any comments for the environmental center?

Contact: iqpssp5@wpi.edu

แบบสอบถามสำหรับผู้เข้าเยี่ยมชม

จุฬาลงกรณ์มหาวิทยาลัย และ Worcester Polytechnic Institute

1. คุณมาจากจังหวัดอะไร
2. คุณอยู่ภายใต้องกรค์อะไร

ชุมชน	หน่วยงานราชการ
โรงเรียน	มหาวิทยาลัย
บริษัทเอกชน	อื่นๆ……

3. คุณเคยมาที่โครงการแหลมผักเบี้ยนมาก่อนหรือไม่

เคย	ไม่เคย

4. คุณรู้จักโครงการแหลมผักเบี้ยได้อย่างไร

กิจกรรมโดยโครงการแหลมผักเบี้ย	องกรค์ใกล้เคียง
สารคดี	เพื่อน
หนังสือพิมพ์	รายการวิทยุ
ผ่านสถาบันการศึกษา	รายการโทรทัศน์
เว็บไซต์	อื่นๆ ……

5. โครงการได้มีการรองรับการเข้าเยี่ยมชมผ่านสื่อการสอนใดบ้าง

การบรรยาย	วิดิทัศน์
ทัศนาจรในพื้นที่ของโครงการ	การอบรม
อื่นๆ	

6. กรุณาประเมินข้อมูลในสื่อการสอนที่คุณได้รับในวันนี้

Bad 1 2 3 4 5 Good

7. กรุณาประเมินสื่อการสอนที่ถูกนำเสนอในวันนี้

Bad 1 2 3 4 5 Good

8. ในความคิดของท่าน สื่อการสอนใดที่มีประสิทธิภาพและเหมาะสมที่สุด

การบรรยาย	วิดิทัศน์
ทัศนาจรในพื้นที่ของโครงการ	การอบรม

อื่นๆ .....

9. คุณมีความประสงค์ที่จะกลับมาเยี่ยมโครงการอีกหรือไม่

ใช่ ไม่

10. คุณมีความสนใจที่จะนำวิธีบำบัดของโครงการแหลมผักเบี้ยไปใช้กับชุมชนหรือองกรค์ของคุณหรือไม่

ใช่ ไม่

11. ข้อเสนอแนะเพิ่มเติม

ติดต่อสอบถาม iqpssp5@wpi.edu

Appendix F: Archival Data

For the Year 2007

รายงานการดำเนินงานประจำปี 2007 โครงการศึกษาวิจัยและพัฒนาสิ่งแวดล้อมแหลมผักเบี้ยอันเนื่องมาจากพระราชดำริ

การบริการวิชาการแก่สังคม

Annual Report of Academic Services by LERD for the Year 2007

The following items are the projects that LERD helped to develop and improve the waste water treatment.

1. The waste water treatment at Wat Narunchara in Cha-am, Phetchaburi
2. The waste water treatment for Earth Born Company, Ratchaburi
3. The Ratchapat Audtaradit University Project
4. The waste water treatment for Leng Heng Agree Food Company
5. The waste water treatment at TOC glycol company
6. The waste water treatment for Wonder World Product Company
7. The waste water treatment at Kuiburi area
8. The waste water treatment at Faculty of science and technology, Ratchapat Pranakorn University
9. The Pollution management at Love Star factory
10. The waste water treatment at Authong, Suphanburi
11. The waste water treatment at Kao Prawiharn National Park
12. The waste water treatment at Piriyarai School
13. The waste water treatment at China Seafood factory
14. Environmental management at Lee-pae island
15. The waste water treatment at NakornPathom Province
16. The waste water treatment at Sarn ChaoPhoChui community
17. The water quality improvement at Mueng Bolan
18. The waste water treatment at Siam River Resort Hotel
19. The waste water treatment at Pamuenghang glycol factory
20. The waste water treatment at Chokemahachai Beverage Company
21. The waste treatment and management at Ratchaburi central market
22. The waste water treatment at Thai-Asia Pacific Brewery
23. The improvement of water quality at Kao Yoi area
24. The designing of water treatment system at Sanamchaiket area
25. The waste water treatment at Somsak Kang Service Partnership

26. The environmental management at the bill manufacturer of Treasury
27. The study of the water quality at Talaynoi, Kaikangwon Palace
28. The waste water management at Ratchapat Kumpangpet University
29. Data collecting from the Wat Narunchanaram
30. Waste water treatment at Suksasongkor Aumnadjarueng School
31. The waste and waste water treatment at Bungboon area
32. The waste and waste water treatment at Kantang city
33. The outreach academic program at huaiyod city

Annual Report of Project Promotion by LERD for the Year 2007

The numbers of visitors in LERD

1. Government 43%
2. Private Company 2 %
3. State Enterprises 1 %
4. Foreigner 1 %
5. University Level 10 %
6. High School 15 %
7. Primary School 9 %
8. Others 20 %

Wat Mahatat Worawiharn, Phetchaburi (March, 2007)

Type of waste	Amount of waste before the workshop (g)	Amount of waste after the workshop (g) Week:				
		1	2	3	4	Average
Organic	6500	2000	2500	2400	1200	2025
Plastic bag	1700	1200	1300	1800	1600	1475
Metal	-	-	-	-	-	-
Paper	460	200	160	300	200	215
Glass	270	-	210	200	30	110
Plastic bottle	540	200	440	200	200	260
Can	130	120	80	20	130	88
Foam box	80	40	10	100	1050	75
Wood	130	-	-	-	-	-
Total	9810	3660	4700	5020	3510	4222

Table F.1: Comparing Waste at Wat Mahatat Worawiharn, Phetchaburi (March, 2550)

Regent Cha-am Beach Resort Hotel, Phetchaburi (April 2007)

	Visitors	
	Amount (total 92)	Percentage (100%)
Gender		
Male	92	100
Female	-	
Age		
Below 40	2	2.2
14-50	30	32.7
51-60	58	62.9
Education		
Bachelor degree	49	53.3
Master degree	42	45.7

Table F.2: ผู้เข้าร่วมสัมมนา Regent Cha-am Beach Resort Hotel, Phetchaburi (April 2007)

	Visitors	
	Amount (total 92)	Percentage (100%)
Greeting		
High	22	23.9
Average	64	69.6
Low	5	5.4
Need improvement	1	1.1
Registration		
High	28	30.4
Average	63	68.5
Low	1	1.1
Document		
High	40	43.5
Average	46	50
Low	5	5.4
Need improvement	1	1.1

Table F.3: ความพึงพอใจต่อกิจกรรมก่อนการสัมมนาที่ Regent Cha-am Beach Resort Hotel, Phetchaburi (April 2007)

	Visitors	
	Amount (total 92)	Percentage (100%)
Exhibition		
High	17	18.5
Average	55	59.8
Low	18	19.6
Need improvement	2	2.2
Duration of Documentary		
High	42	45.7
Average	48	52.2
Low	2	2.2
Knowledge gain from the documentary		
High	47	51.1
Average	43	46.7
Low	2	2.2
Lecturer		
High	70	76.1
Average	22	23.9
Lecture Duration		
High	39	42.4
Average	48	52.2
Low	4	4.3
Need improvement	1	1.1
Knowledge gain from the lecture		
High	43	46.7
Average	48	52.2
Low	1	1.1
Irrigation debate		
High	37	40.2
Average	54	58.7
Low	1	1.1
Chaipattana debate		
High	45	48.9
Average	47	51.1
Kasetsart University debate		
High	38	41.3
Average	52	56.5
Low	2	2.2
Laem Phak Bia debate		
High	47	51.1
Average	44	47.8

Low	1	1.1

Table F.4: ความพึงพอใจต่อกิจกรรมระหว่างการสัมมนาที่ Regent Cha-am Beach Resort Hotel, Phetchaburi (April 2007)

	Visitors	
	Amount (total 92)	Percentage (100%)
Master of ceremonies (MC)		
High	32	34.8
Average	58	63
Low	1	1.1
Need improvement	1	1.1
Audiovisual aids		
High	40	43.5
Average	49	53.3
Low	2	2.2
Need improvement	1	1.1
Meeting room		
High	58	63
Average	34	37
Lunch		
High	43	46.7
Average	45	48.9
Low	3	3.3
Need improvement	1	1.1
Snack		
High	38	41.3
Average	52	56.5
Low	2	2.2
Accommodations		
High	44	47.8
Average	45	48.9
Low	3	3.3
Meeting room environment		
High	45	48.9
Average	45	48.9
Low	2	2.2
Overall Satisfaction		
High	45	48.9
Average	46	50
Low	1	1.1

Table F.5: Program Evaluation – Regent Cha-am Beach Resort Hotel, Phetchaburi (April 2007)

	Visitors	
	Amount (total 84)	Percentage (100%)
Do you understand the waste water and waste treatment system?		
Yes	83	98.8
No	1	1.2
Will you transfer your knowledge to other?		
Yes	81	96.4
No	3	3.6
Who will you transfer your knowledge to?		
Family member	13	15.5
Relative	4	4.8
Co-worker	28	33.3
Communities	37	44
Others	2	2.4
Which technique will you use to transfer your knowledge?		
Workshop	38	45.2
Campaign	17	20.2
Radio	4	4.8
Exhibition	7	8.3
Site Observation	11	13.1
Others	7	8.3

Table F.6: Surveys for LERD Visitors (April 26, 2007)

Chumchon Wat Prasartsit School, Ratchburi

Knowledge and understanding in waste and waste water treatment	Correct (%)	Wrong (%)
3 different type of garbage	98.7	1.3
Leaf, food scraps, and water bottle are Garbage	90.8	9.2
Insecticide container, light bulb, and battery are Hazardous waste	90.8	9.2
Glass bottle, scrap iron, plastic bag can be recycle	77.6	22.4
Trash Bins are separated into 3 color (Green, Red, and Grey)	78.9	21.1
Insecticide container can be buried in the ground	65.8	34.2
Garbage can decomposed by nature	72.4	27.6
Red trash bin is for hazardous waste only	78.9	21.1
Organic waste can be transform into manure	81.6	18.4
Green trash bin is for garbage	77.6	22.4
Water with disposed waste is wastewater	86.8	13.2
Contaminated water and water from personal use is considered to be waste water	90.8	9.2
There are 3 main sources of wastewater (Industrial, agriculture, and household)	90.8	9.2
Classifying and separating waste before disposing will prevent wastewater issue	77.6	22.4
Water is the natural resource that will never be used up, saving is not necessary	78.9	21.1
Wastewater from agriculture will contaminate the soil	65.8	34.2
Water treatment system in LERD used the nature by nature principle	72.4	27.6
Water from dish and clothes washing can use to watered the plant	78.9	21.1
Wastewater from communities doesn't affect the environment, because there is no toxic or chemicals	81.6	18.4
Saving water will decrease the communities' waste water	77.6	22.4
Total	80.72	19.28

Table F.7: Questionnaire for the Target Visitors (76 visitor) – Chumchon Wat Prasartsit School, Ratchburi (October 2007)

For the Year 2008

Annual Report for Academic Service year 2008

Academic Service:

1. Wastewater management at Punyanuntaram Temple, Pathumthanni province
2. Thai Ethoxylate Co., Ltd wastewater management, Rayong province
3. Boonserm Forkyorm Co.,Ltd wastewater management, Samutsakorn province
4. Kaoyao Subdistrict Municipality wastewater management. Phetchaburi province
5. Waste management at Ratchaburi city market, Ratchaburi province
6. Site Development at Potash Alum manufacturing factory, Nonthaburi province
7. Wastewater management at Siam Winery Co., Ltd., Samutsakorn province
8. Wastewater management at Ta-Yang District Office, Phetchaburi province
9. Wastewater management at Bang Pu Industrial Estate, Samutprakarn provine
10. Wastewater management Kantana Movie Town Co., Ltd, Nakorn Prathom province
11. Waste and wastewater management at Pattana Doi Tung project, Chiang Rai province
12. Wastewater management, Chiang Rai province
13. Wastewater management at Payabarn Baromrajachonnani College, Nonthaburi province
14. Wastewater management at Silpakorn University, Phetchaburi province
15. Wastewater management at Audsakakum Pangmun Banpong Co., Ltd., Ratchaburi province
16. Wastewater management at Aumpawa Chaipattananurak project, Samutsongkram province
17. Wastewater management at Yen Sabai Village, Samutsakorn province
18. Wastewater management at Rai Mamuang Prarachadumraj, Phetchaburi province
19. Training and workshop, Uthaithani province
20. Training and workshop, Chantaburiprovince
21. Training and workshop, Phetchaburi province
22. Training and workshop: waste disposal, Chiang Rai province
23. Training and workshop: waste management, Chiang Rai province
24. Training and workshop: waste disposal, Phetchaburi province

For the Year 2009

Annual Report Year 2009: Research and application of waste and wastewater management

Topic	Number of research
Waste management	1
Lagoon treatment	3
Grass filtration	2
Environmental effect	8
Social and economic (environment)	2
Publicize and environmental study	1

Table F.8: Research Done in 2009

Topic	Number of research
Waste management	2
Lagoon treatment	3
Environmental effect	5
Application	13
Social and economic (environment)	3
Publicize and environmental study	3

Table F.9: Continued Research in 2010

Topic	Number of research
Waste management	11
Lagoon treatment	22
Application	7
Social and economic (environment)	10
Publicize and environmental study	9

Table F.10: Research from 2010 to 2014

Annual Report for Academic Service Year 2009

Academic Service:

1. Water quality study at Rudeewanarai Palace, Prajuab Kririkan province
2. Water quality study for usage at Kraikangwon Palace, Prajuab Kririkan province
3. Water quality study at orchid farm, Nakorn Prathom province
4. Water management at Hanoi Lake, Vietnam
5. Water quality study at Bang Prork canal, Patumthani province
6. Chaipattana-Thai Red Cross Project, Phangnga procince
7. Grape compost study, Samutsakorn province
8. Wastewater management at Audsakakum Pangmun Banpong Co., Ltd., Ratchaburi province
9. Treatment of wastewater from fish industrial, Bangkok
10. Waste and wastewater management at Koh Si-Chang Subdistrict Municipality, Chonburi province
11. Wastewater management at Koh Chang Subdistrict Municipality, Trat province
12. Waste and wastewater management at Kanchanaburi city, Kanchanaburi province
13. U. L. Printing and Packaging Co., Ltd. wastewater management, Samutprakarn province
14. Wastewater management at Talard Nam See Park, Chonburi province
15. Phetchaburi River water quality study, Phetchaburi province
16. Permanent residence Baan Bang Kaya Project, Phangnga province
17. Environmental development program, Ratchaburi province
18. Waste and wastewater management at Talard Klang Sin-kha Sat-Nam, Samutsongkram province
19. Water quality study, Samutprakarn province
20. Waste and wastewater management at Maehongsorn city, Maehongsorn province
21. Wastewater management at coconut factory, Nakorn Prathom province
22. Water quality study at Kraikangwon Palace, Prajuab Kririkan province
23. Wastewater management at Kongkrai Lart Vittaya School, Sukhothai province
24. Wastewater management at Rajsattatum temple, Sukhothai province

Training and Workshop:

1. Community waste management at Don Makarm Yang-Nua School, Phetchaburi province
2. Yao-Wa-Chon Rak Laem Phak Bia project, Phetchaburi province
3. Waste and wastewater management for high school student, Phetchaburi province
4. Research for university student, Rajchapat Pranakorn University
5. Wetland water treatment
6. Waste and wastewater management for university student at Kasetsart University
7. Waste management at Baan Lard Subdistrict Municipality, Phetchaburi province.

8. Waste and wastewater management at Baan Krathumlom School, Nakorn Prathom province
9. Waste and wastewater management at Kongkrailard Vittaya School, Sukhothai province
10. Academic service for military student at Sunthinimit military school, Chumporn province
11. Academic service for student at Norng Ya Plong Vittayakom school, Phetchaburi province

Annual Report Year 2009: Management and Follow-up

Staff training:

Intelligent Focus

- Building experience from site observation
- Training and workshop: actinomycetes
- Training: Microsoft Excel, writing report
- Evaluation and follow-up study project
- Training: Wastewater (Biology)
- Training: Professional Web Design
- Training: Wastewater management by wetland
- Improving staff's abilities and knowledge project
- Biological Dosimetry of Exposure to Environment Carcinogens: Ionizing Radiation as a Model
- Training: Culture and Ethic 1
- Training: Culture and Ethic 2

Social Focus

- Training: Completing the research
- Physical checkup
- Building good relationship in organization
- "5 sor" activity

Play Focus

- Team building and walk rally
- Stress management

Creativity Focus

- Brainstorming: creating rules, strategies, and guideline
- Creating strategies for the technology transfer center
- Planning the inventory usage
- Brainstorming: creating an operational plan
- Follow-up meeting

For the Year 2010

Annual Report for the Board of Director Year 2010

Visitor attendance:

- 54,936 visitors
- 44% government organization
- 4% Private organization
- 1% State Enterprises
- 1% Foreigner
- 8% University student
- 17% High school student
- 7% primary school student
- 18% other

Group of visitors:

- Committee of Water Resource of Thailand
- Committee of Diplomat of Thailand
- Prime Minister Monsiuer Philippe Lacoste and researchers from Bordeaux, France
- Faculty of Medicine, Mahidol University
- Faculty of Economic, Ritsumeiken University, Japan
- Student from Asian Institute of Technology
- Monks from Mahachulalongkorn University

Mission Statement and Philosophy:

- Same as year 2011 (Old archive)

Service and project developed:

- Academic Service
    - Academic Service by King's purpose
    - Wastewater from Industrial factory
    - Wastewater from communities
- Exchange program
- Research Innovation
    - Chaipattana Grease Trap
    - Economic aquatic animal
    - Book of Laem Phak Bia's Bird
    - Portable COD testing kit

Seminar:

- Environmental Seminar: Community's wastewater management
- Youth and Environmental Seminar: Environmental Science
- LERD Open House
- Chaipattana Grease Trap

List of advertisements/Television Program:

- Chao-Kao-Kon television program, Nation Channel
- Samarn-Chan movie
- Pid-Thong-Lung-Aong-Pra-Patima documentary
- Kon-Thai-Huajai-Kaset television program
- Krongkarn-Hang-Shewit Royal Project television program
- Por-Luang-Kongrao documentary
- Sanook-Yok-Krua television program
- Poo-Wa-Pa-Teaw television program
- Royal Project documentary by Faculty of Communication Art, Bangkok University
- Documentary video in Modern 9 station
- Tourism documentary
- Royal promoting project documentary
- Documentary by Regional Daily Air Quality Department
- Chef-Mue-Tong television program
- Kru-Mue-Ar-Cheap television program
- Photo Variety television program
- Pinit-Nakorn television program

Annual Report of LERD for the Year 2010 (Branches)

- The annual report of the branches in northern, northeast, eastern, western, and southern part of Thailand

Northern branch

The knowledge transfer project

- Waste management training at Fai-Kwang Vittayakom School, Payao Province
- Waste management training at Barn Wang-Phong School, Lumphang Province
- Waste management training at Barn Mae-Sae School, Chiangmai Province
- Waste management training at Barm Huay Ka-min and Barn Huay Rai School, Oudtraradit Province
- Waste management training and workshop at Hard-Song-Kway Subdistrict Administration Organization, Oudtraradit Province
- Waste management training and workshop at Hard-Kuad Subdistrict Municipality, Oudtraradit Province
- Waste and wastewater management training and workshop at Krai-Lard Vittaya School, Sukhothai Province
- Waste and wastewater management training and workshop at Vittayalai Song Nakornsawan MahaChulalongkorn Rajvittayalai, Phijit Province

Academic service

- Publicize of northern part learning center at Pak-Mang Beach, Trung Province
- Water treatment academic service at Pruksawan Chotikaram Temple, Phijit Province
- Design wastewater treatment system at Wat Phanpee School, Pitsanulork Province
- Community service academic service at Tarn-tia Subdistrict Administration Organization, Sukhothai Province

Cooperation with organizations

- Pour School, Narn Province
- Thai-Rat Vittaya School, Oudtraradit Province
- Darn Mae Kham Mun School, Oudtraradit Province
- Fai-Kwang Vittayakom School, Payao Province
- Barn Mae-Sae School, Chiangmai Province
- Hard-Song-Kway Subdistrict Administration Organization, Oudtraradit Province
- Hard-Kuad Subdistrict Municipality, Oudtraradit Province

Northeast branch

Research Project

- The study of duration and techniques for waste ferment in concrete box
- The study of Pandanus Palm extract
- The study of the efficiency of wastewater treatment at Warin Chumrarb municipality slaughterhouse
- The study of the suitability of grass filtration in the community
- The study of inorganic matter form by waste ferment in concrete box
- The study of waste management of Warin Jaroensri market

The Knowledge Transfer Project

- Waste and wastewater management training and workshop at Song-Yae Tippaya, Yasothorn Province
- Publicize and transferring of waste and wastewater management at Rajchapat Ubonrajchatani University
- Publicize and transferring of waste and wastewater management at Phosai Pittayakarn, Ubonrajchatani Province
- Publicize of Northeast learning center in Thailand Research Expo 2010
- Publicize of Northeast learning center in The 6th Narasuan Environment Academic Seminar
- Training and workshop at Kumchum Pattana Subdistrict Municipality, Yasothorn Province
- Training and workshop at Na-Yia Subdistrict Municipality, Ubonrajchatani Province
- Training and workshop at Yasothorn City Municipality, Yasothorn Province

Academic Service

- Water Analysis at Ubonrajchatani City Municipality

Cooperation with Organizations

- Na-Yia Subdistrict Municipality, Ubonrajchatani Province
- Pitbun Mung Sa-harn Subdistrict Municipality, Ubonrajchatani Province
- Yasothorn City Municipality, Yasothorn Province
- Kumchum Pattana Subdistrict Municipality, Yasothorn Province

Eastern Branch

Research Project

- The study of the usage of waste ferment (fruit and vegetable)
- The study of applying wastewater management in gas station

The Knowledge Transfer Project

- Trash-free Community contest, Prapanarai Subdistrict Municipality
- Trash ferment project, Prapanarai Subdistrict Municipality

Academic Service

- Publicize of Grease Trap Project

Visitor Attendance

- 2097 visitors

Western Branch

Research Project

- The study of the effectiveness of wastewater treatment from Supanburi city municipality slaughterhouse

Southern Branch

Research Project

- The study of waste treatment by earth worm
- Wastewater treatment by electrochemistry
- Wastewater treatment by chemical precipitation

The Knowledge Transfer Project

- Publicize of the Learning center at Thai Children Day 2553
- Training and workshop of application of waste management technique
- Publicize and knowledge transfer of tree restoration
- Publicize and knowledge transfer of Environmental Day 2553
- Training and workshop of Saving natural resource and environment
- Publicize and knowledge transfer of waste management
- Training and workshop of organic waste ferment
- Training and workshop of community waste management

Academic Service

- Seminar at Si-kao district
- Training and workshop of waste ferment
- Seminar at Si-Kao hospital

For the Year 2011

รายงานผลการดำเนินงานประจำปี 2011 ฉบับผู้บริหาร

Annual Report of Project for the Board of Director Year 2011

Year	Visitors
1996	1659
1997	1918
1998	1827
1999	5438
2000	7536
2001	9206
2002	8172
2003	12655
2004	20161
2005	19965
2006	27873
2007	47332
2008	50671
2009	58210
2010	61430
2011	66597

Table F.11: The Number of Visitor Year 1996-2011

Group of visitors in year 2011

1. February: Board of director from Payao University
2. March: Health Science Institute, Silapakorn University and University of Cincinnati
3. April: Siam Kumachon Foundation
4. April: Office of the Royal Development Projects Boards
5. May: Faculty of Public Health, Mahidol University
6. May: Asia Institute of Technology
7. June: Department of Water Resources and Asia Institute of Technology
8. July: Department of Social Development and Welfare
9. August: Asian Management Institute Ltd. and German International Cooperation
10. July: Chaipattana Foundation
11. September: Ministry of Foreign Affairs
12. September: Prapokrao Institute

Exhibition to transfer knowledge and promote in 2011

1. January: “Doo Nok Insee Kong Dee Muang Petch Festival”
2. January – February: “Bon Sentang Karn Vijai Kasetsart University”
3. June: “Pid Tong Lung Pra Festival”
4. September: “Chum Chon KemKang Pongkan Paipibat Pradsajark Loke Lorn Festival”

To promote and advertise via public media in 2011

1. “84 Phansa Prayode Soo PruangPracha” Movie
2. “Pik Cheevit Mai” television program
3. “Diplomats in Siam” television program
4. “Kraokrai Kub Krom Vichakarn Kaset” television program
5. “Dala Villa” television program
6. “Yark Bork Rak Phor” television program
7. “Jeap Aom” television program
8. “Satanee See Keaw” television program
9. “Saladmun Unlimited” television program
10. “Techno and Innomag” Mag
11. “Rak Ban Gerd” television program
12. “Long krung’ television program
13. “ Pra aud cha ri ya parb puer pandin” Documentary
14. “Amarinprinting and publishing” Company
15. “Young MEA Dee Mission” TV program

Researches in 2011

1. Waste research project
2. Lagoon treatment research
3. Grass filtration research
4. The environmental effects and follow up with the quality research project
5. The use of techniques research project
6. The social and environmental economic academic research
7. Promoting and environmental research

The results of the research were published in the academic magazine, total of 22 researches.

Appendix G: Details of 2011 Report on LERD Program Evaluation

Vision: Project by the king, LERD. Transferring the knowledge of waste and wastewater management technologies base on nature by nature principle

Mission:
1) Research and develop the waste and wastewater management technologies, by following the king's purpose, to suit different communities.

2) Evaluate the effectiveness of waste and wastewater management technologies

3) To provide academic service and to transfer the knowledge

4) Evaluate the effectiveness of the knowledge transferring process to different communities.

Project	Goal	Actual
Managing waste and wastewater	15 services/year	48 services/year
Improvement of media	2 types of media	2 types of media (publish and Video)
Follow-up of Academic Service	80% satisfaction	84% satisfaction

Table G.1 LERD's Evaluation of Their Academic Services

Topic	Goal	Actual
Waste Lagoon treatment Grass filtration treatment Environmental consequence Application Social and Economic Publicize and environmental study Cooperation with other organization Promote and transfer	1) 34 projects/year 2) At least 10 international published projects/year 3) At least 5 presentations at international seminar/year	1) 34 projects/year 2) 12 international published projects/ year 3) 10 presentations at international seminar/year
Supplies purchasing	5 equipment for research	5 equipment for research

Table G.2: LERD's Evaluation of Their Academic Research

Project	Goal	Actual
Publicize and promoting the knowledge transfer	40,000 client/year	71,905 client/year
Knowledge transfer	10 activities	14 activities
Environmental network	At least 5 users/year	6 users/year

Table G.3: LERD's Evaluation of Their Publicizing and Promoting the Knowledge Transfer

Project	Goal	Actual
Public relation	1) At least 2 activities 2) 300 attendances	1) 8 activities 2) 1000 attendances
Royal Value	80% satisfaction	95% satisfaction

Table G.4: LERD's Evaluation of Their Social and Environment Responsibilities

Project	Goal	Actual
Staff improvement	1) 80% staff attendance 2) 80% staff satisfaction	1) 100% staff attendance 2) 90% staff satisfaction
Site improvement	80% visitor satisfaction	96.3% visitor satisfaction
LERD's income	150,000 baht/year	442,029.50 baht/year
Follow-up/Evaluation	75% of the projects are follow-up	97% of the projects were follow-up
Media improvement	1000 website visitors	1748 website visitors

Table G.5: LERD's Evaluation of Their Project Management

Appendix H: Detailed Information about LERD's Facebook Profile Page

On LERD's Facebook friend page, it appears that photos uploaded to the profile are unrelated to LERD's programs and do not advance LERD's goals or missions. An image of the friend page is shown below in Figure H.1.

Figure H.1: LERD's Main Facebook Profile Page

Currently LERD's Facebook friend page, lists no current activities of the organization and it is evident that minimal interaction occurs between LERD and its followers. Also on the information tab of LERD's profile page it was found that incomplete and incorrect contact information was provided. For example the phone numbers listed do not follow the format of Thai phone numbers. An image of the information tab is shown in Figure H.2 below:

Figure H.2: The Information Tab on LERD's Facebook Profile

Appendix I: Sample Database to Store Client & Staff Information (English & Thai Version)

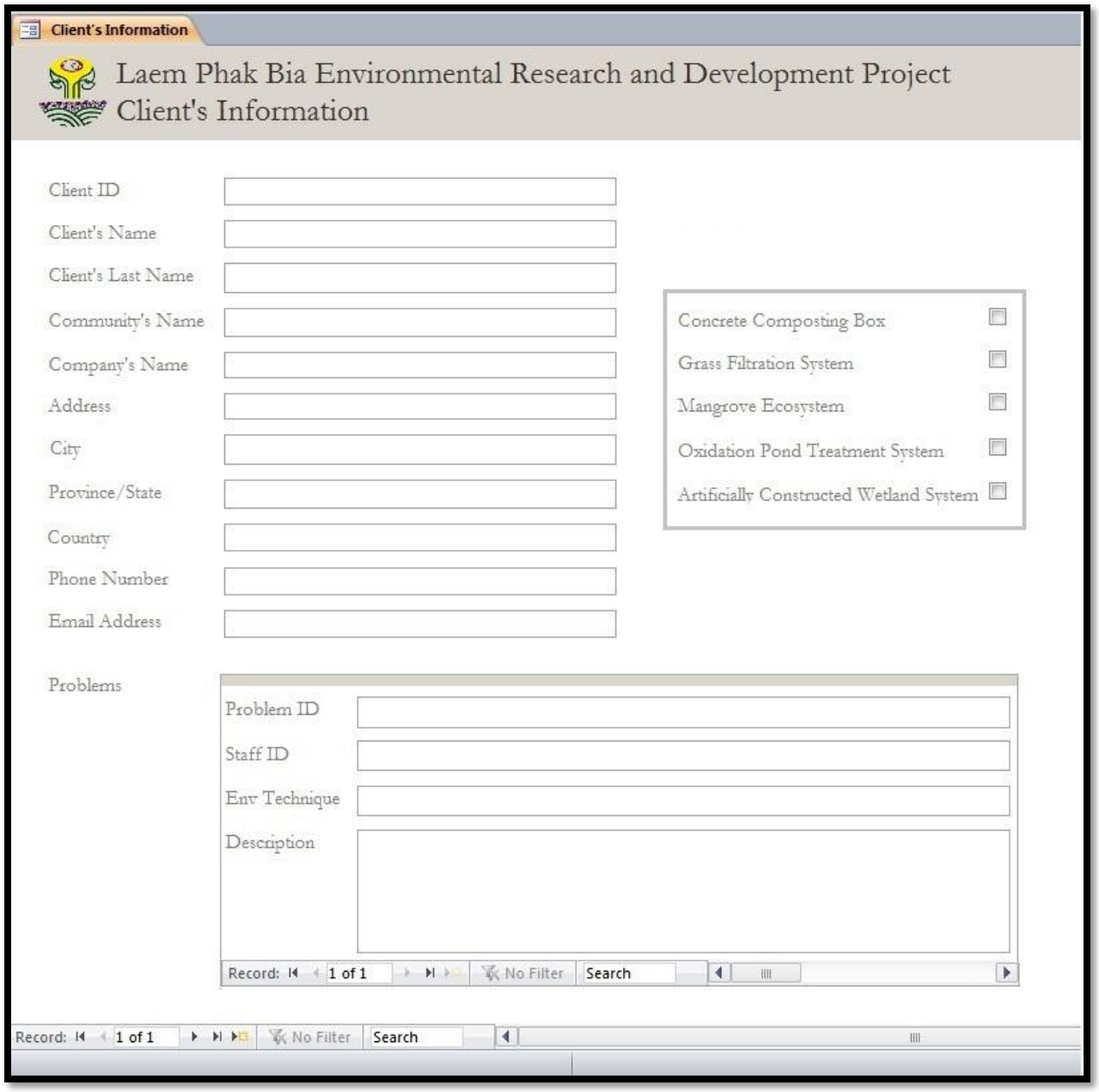


Figure I.1: Sample Database for Client Information (English Version)

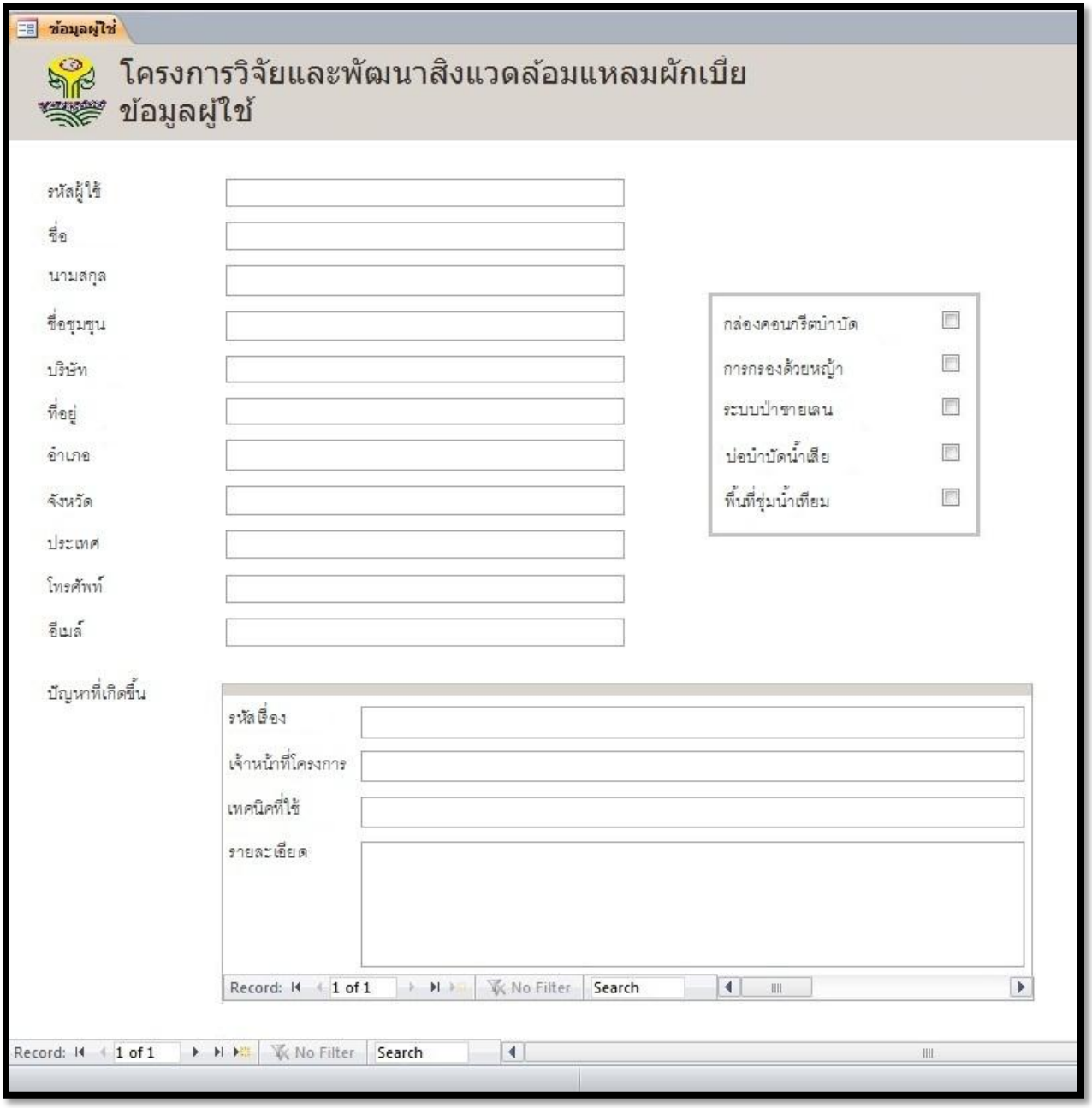


Figure I.2: Sample Database for Client Information (Thai Version)

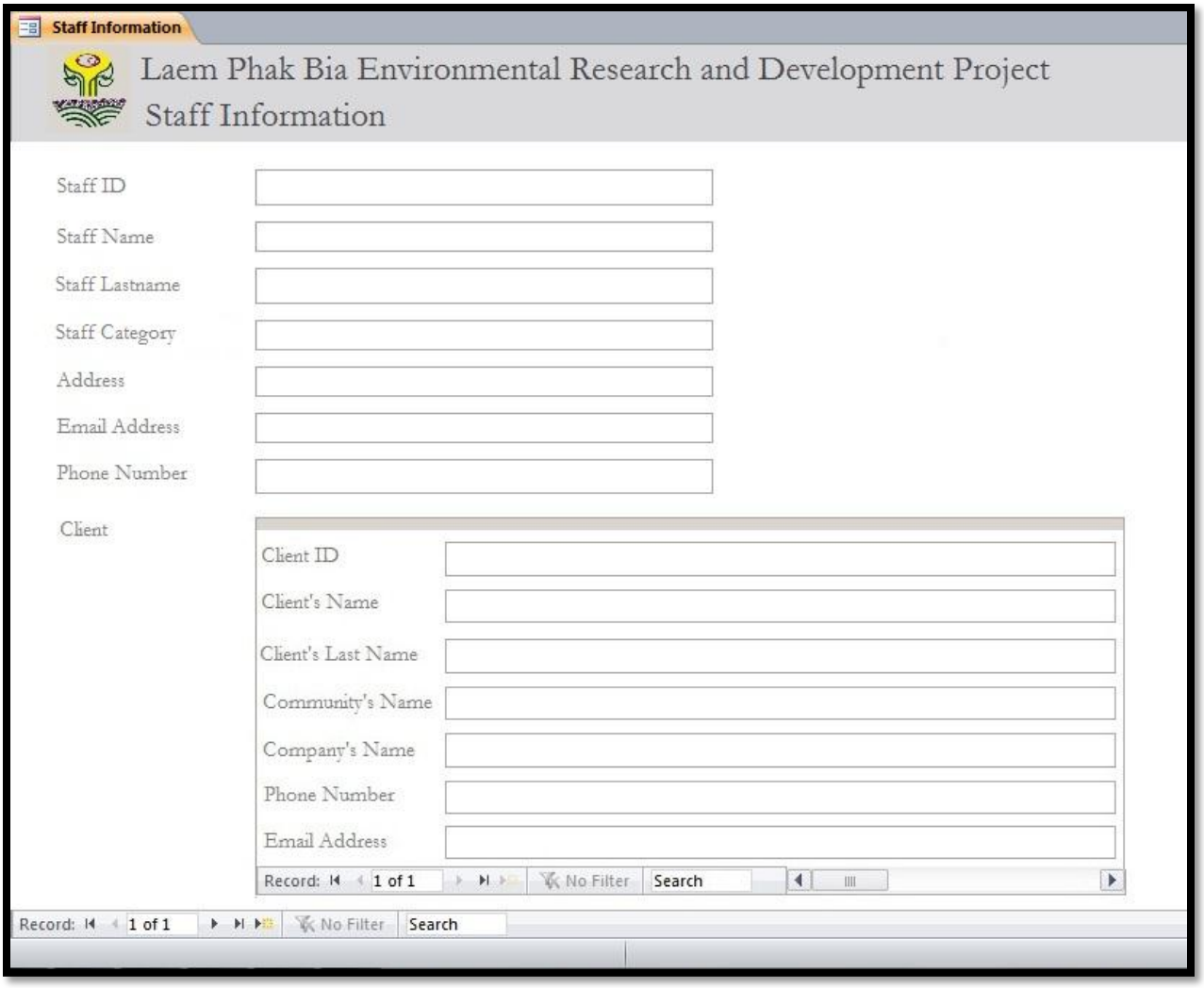


Figure I.3: Sample Database for Staff Information (English Version)

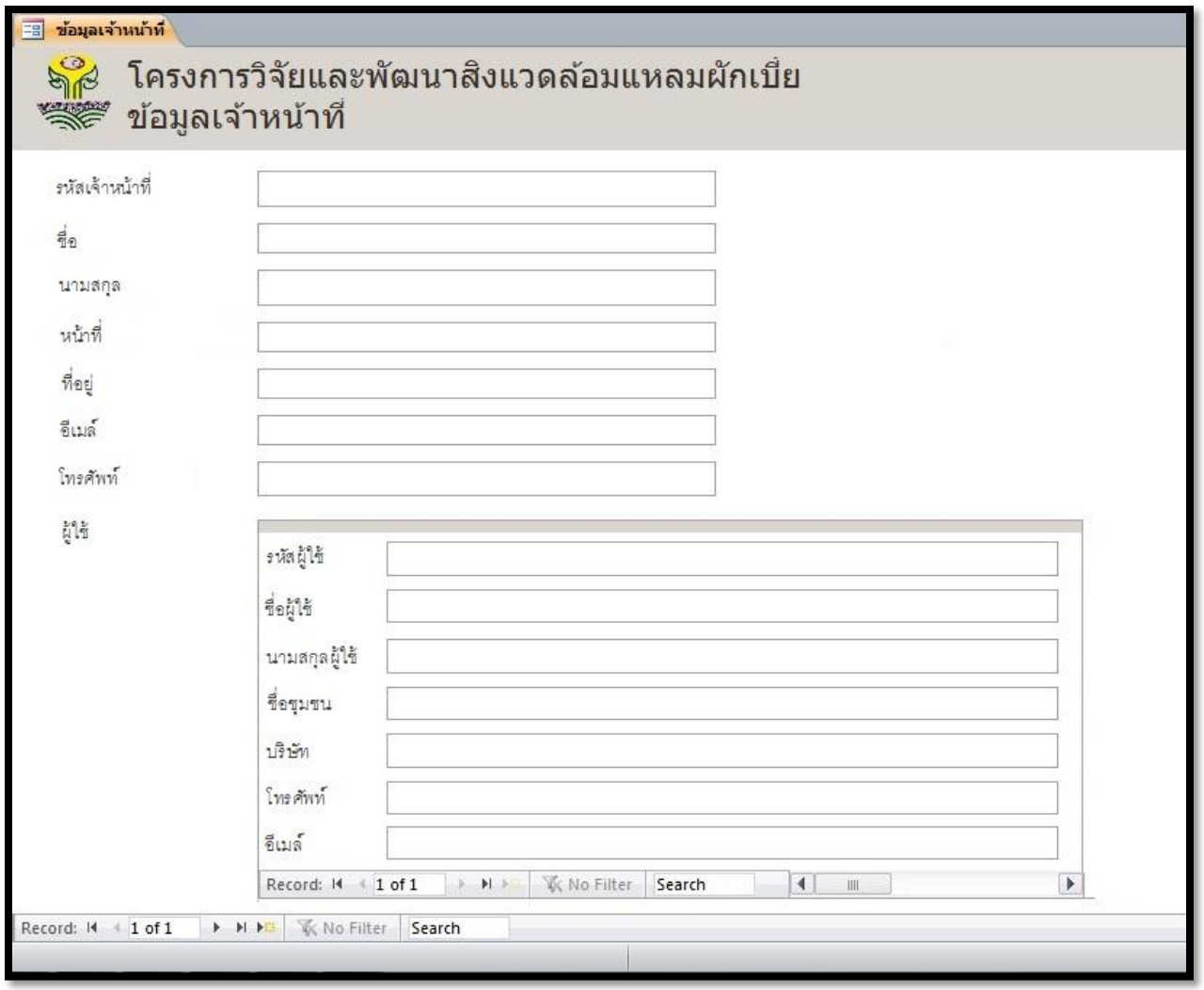


Figure I.4: Sample Database for Staff Information (Thai Version)

Appendix J: Example of a Brochure of Simple Information Suitable for Audience without Scientific Background (English & Thai Version)

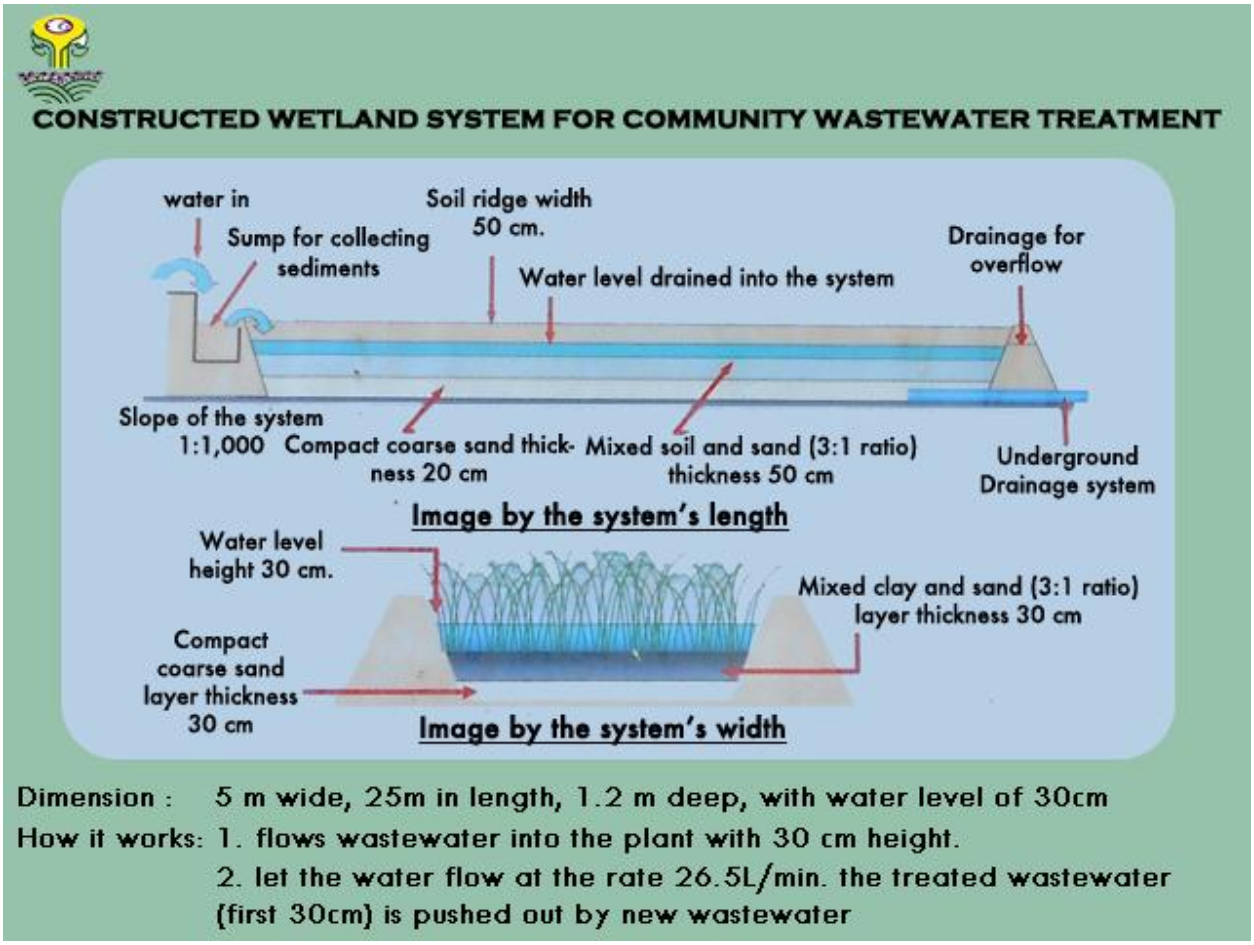
Figure J.1: Front View (English Version)

Figure J.2: Back View (English Version)

Figure J.3: Front View (Thai Version)

Figure J.4: Back View (Thai Version)

Appendix K: Sample Poster in English for the Experimental Site in the Event of International Interest



Appendix L: Sample Animations of Waste and Wastewater Treatment Techniques for Online Environmental Knowledge Transfer

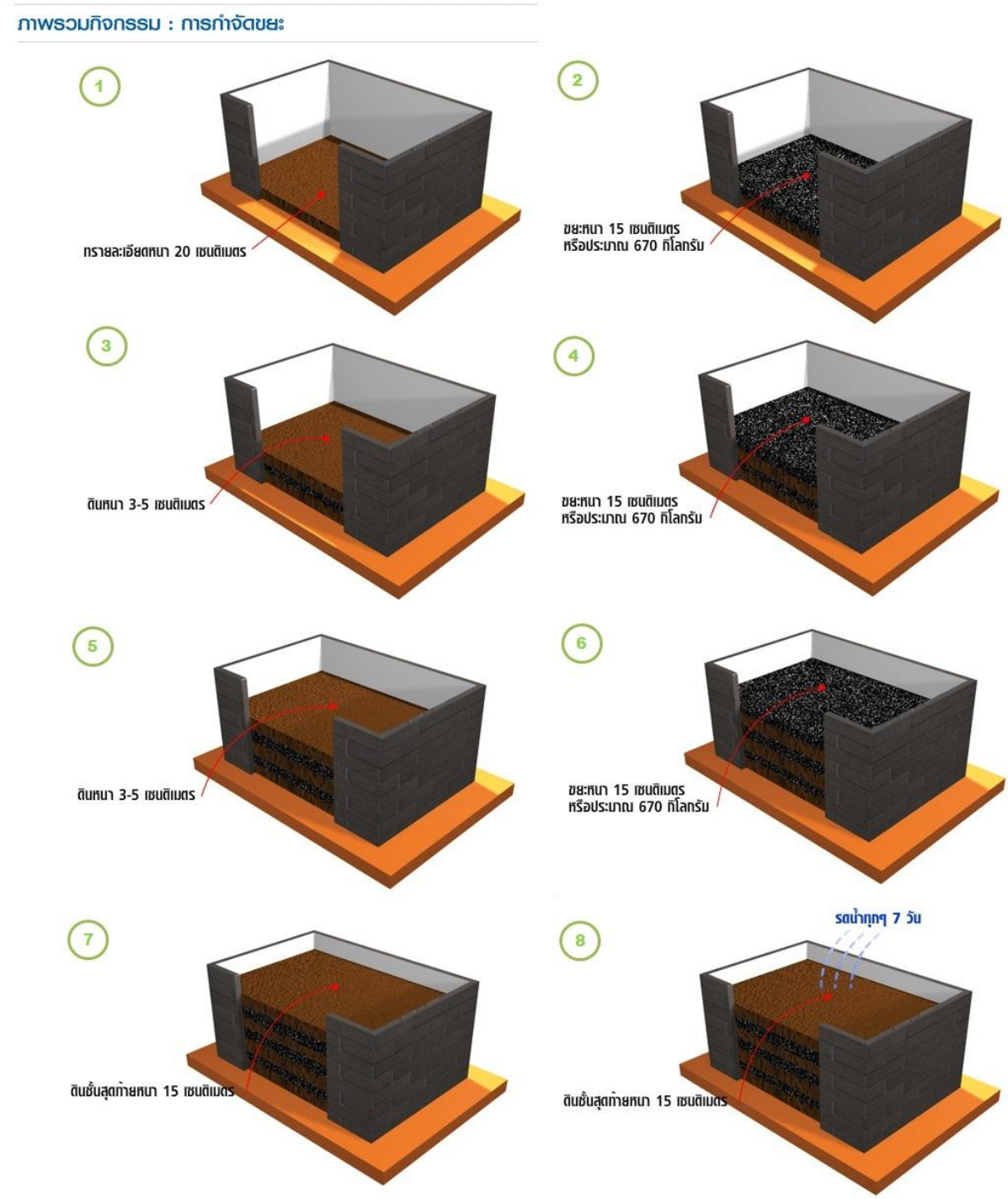


Figure L.1: Animation of Concrete Box Waste Composting

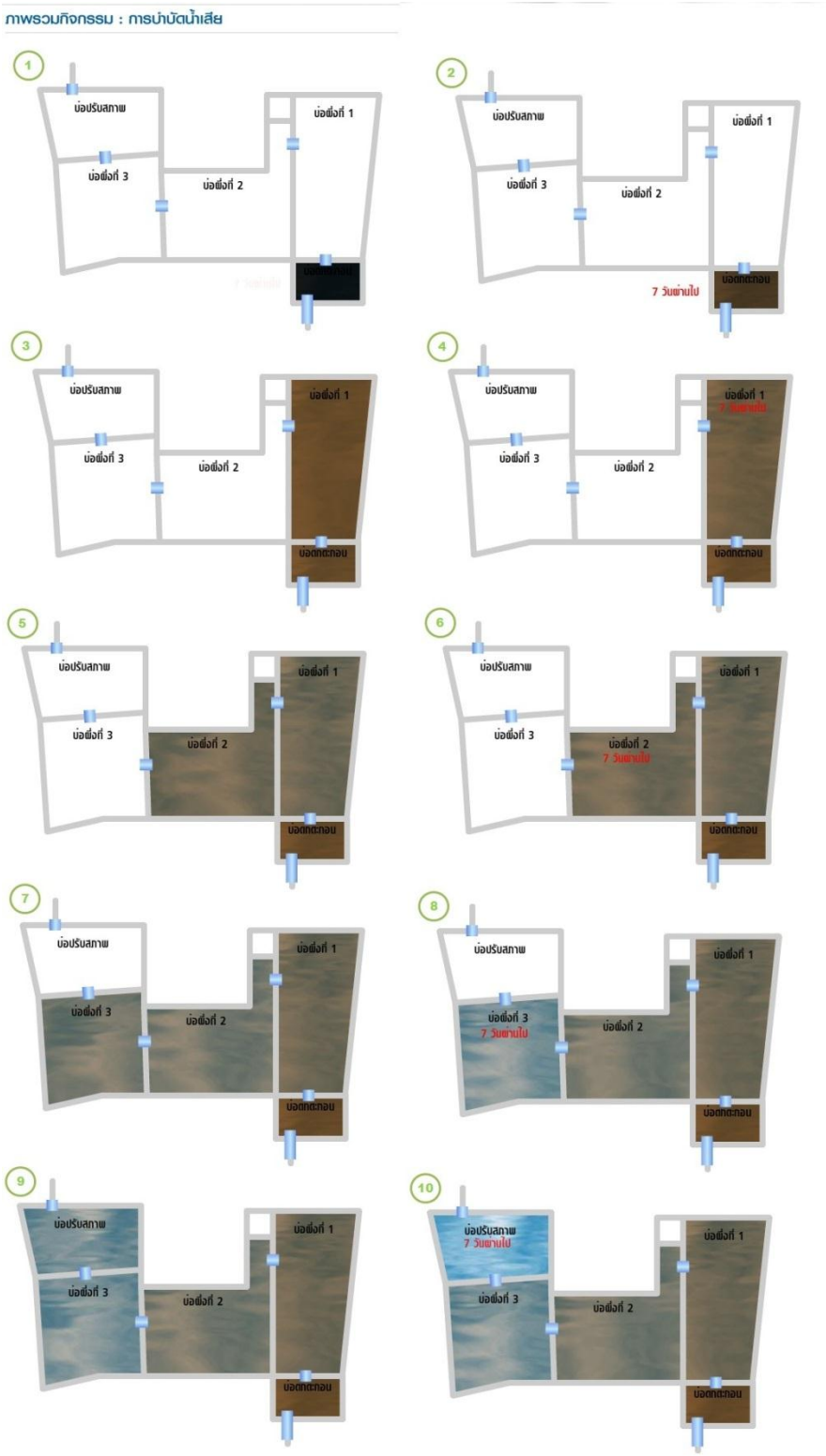


Figure L.2: Animation of Water Treatment Lagoon

Appendix M: Sample Facebook "Welcome Page"

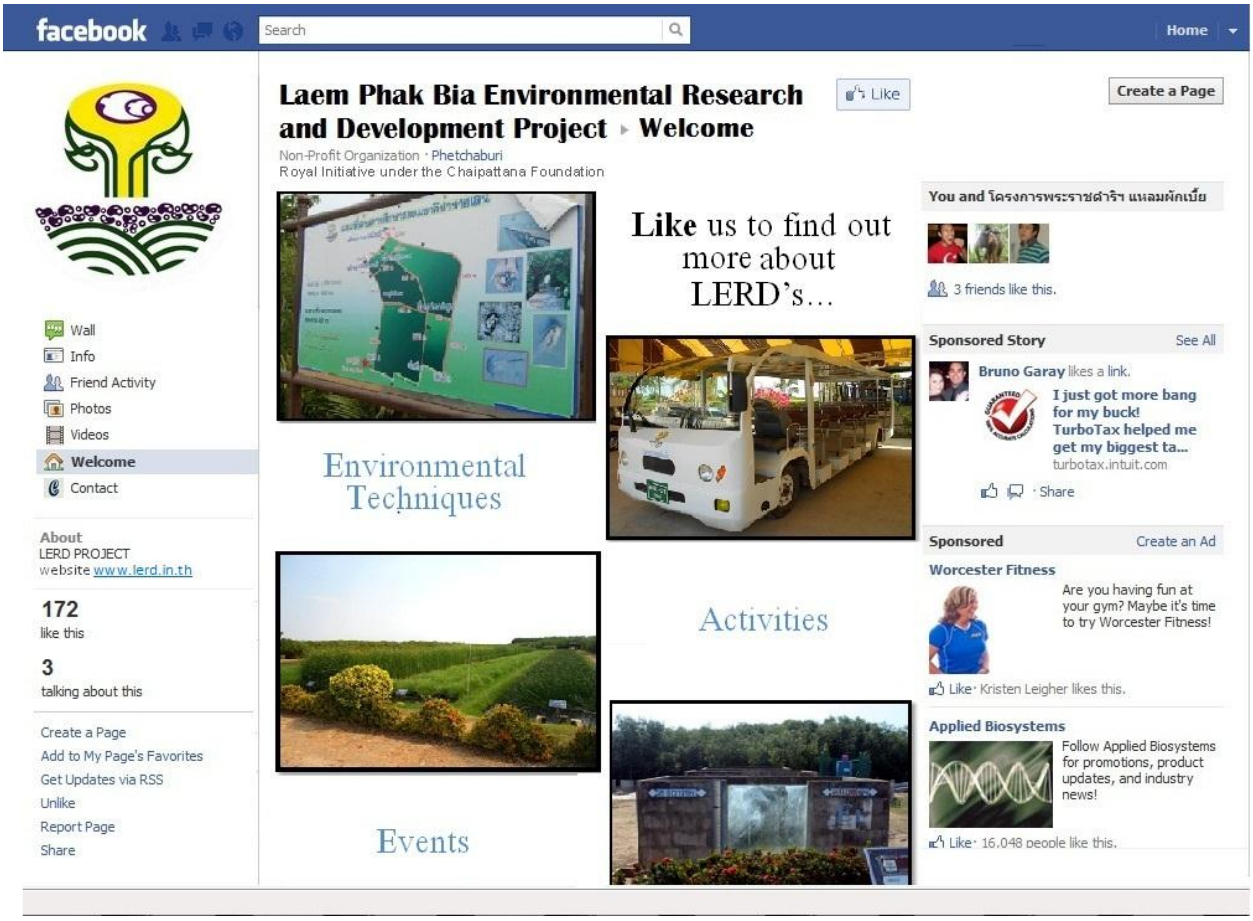


Figure M.1: Image of the Facebook "Welcome Page"