JAPAN INTERNATIONAL COOPERATION AGENCY
MINISTRY OF HEALTH
NATIONAL CENTER FOR ENVIRONMENTAL HEALTH
AND WATER SUPPLY

THE STUDY
ON
RURAL WATER SUPPLY AND SANITATION IMPROVEMENT
IN
NORTH-WEST REGION
IN
LAO PEOPLE'S DEMOCRATIC REPUBLIC

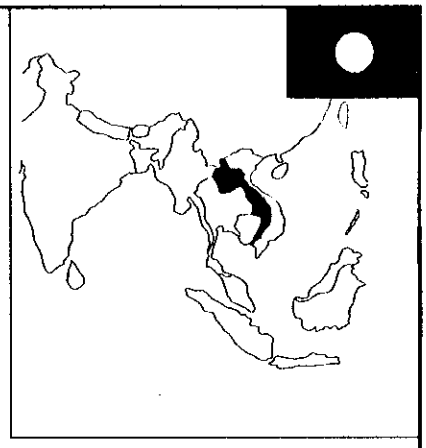
FINAL REPORT
SUMMARY REPORT

MARCH 2001

JAPAN TECHNO CO., LTD.

STUDY ON RURAL WATER SUPPLY AND SANITATION IMPROVEMENT IN NORTH-WEST REGION IN LAO PEOPLE'S DEMOCRATIC REPUBLIC

LOCATION MAP OF STUDY AREA



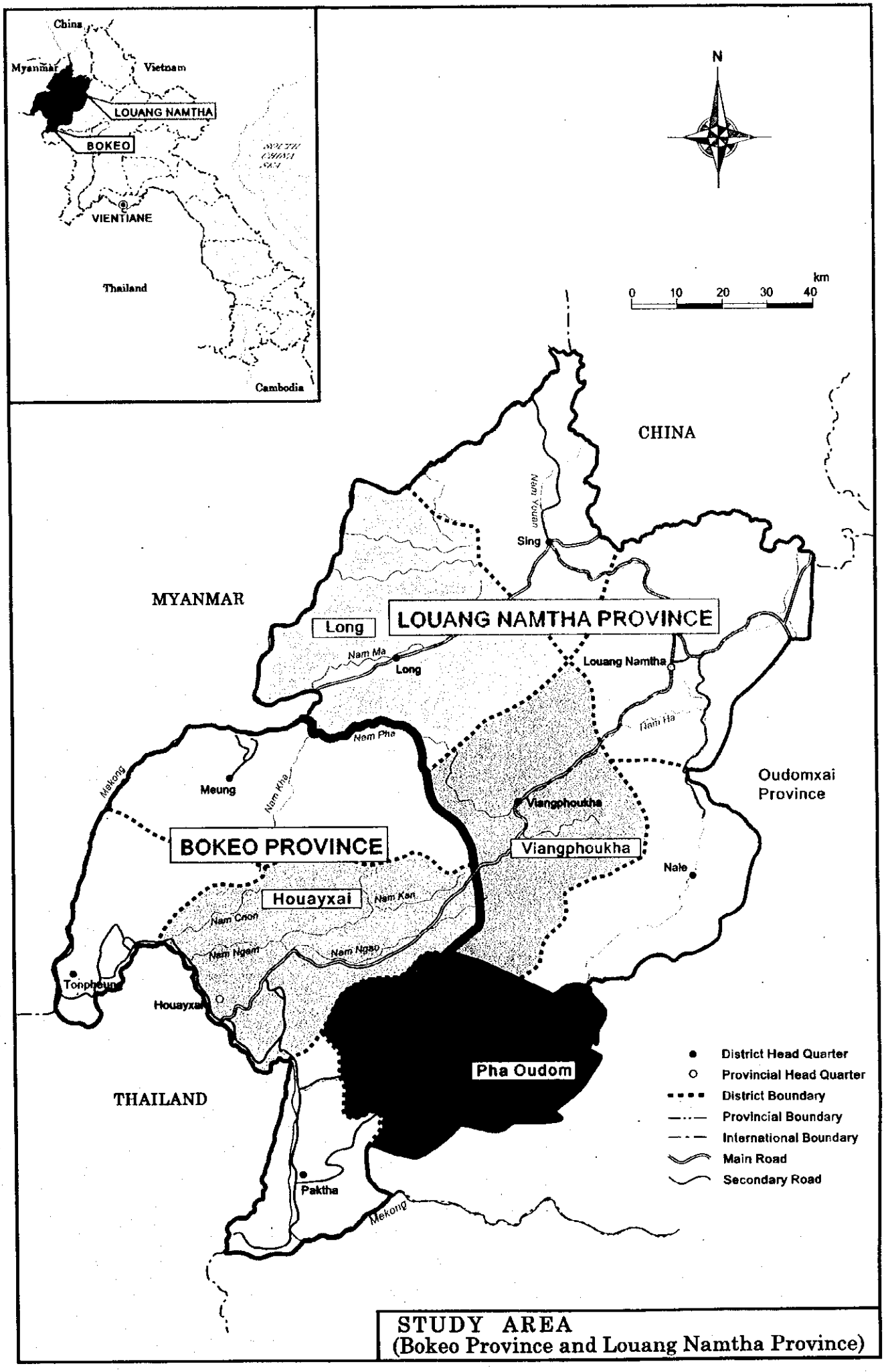
CHINA
MYANMAR
VIETNAM
THAILAND
CAMBODIA
SOUTH CHINA SEA
Phongsali
LOUANG NAMTHA
BOKEO
Oudomxai
Xam-Nud
Louangphrabang
Pek
Xaignabouri
VIENTIANE
Xaisomboun
Phonhong
Paksan
Mekong
VIENTIANE
THAILAND
Thakhek
VIETNAM
Khanthabouri
Saravan
Lamam
Pakse
Samak Khixai

STUDY AREA
(BOKEO and LOUANG NAMTHA PROVINCE)

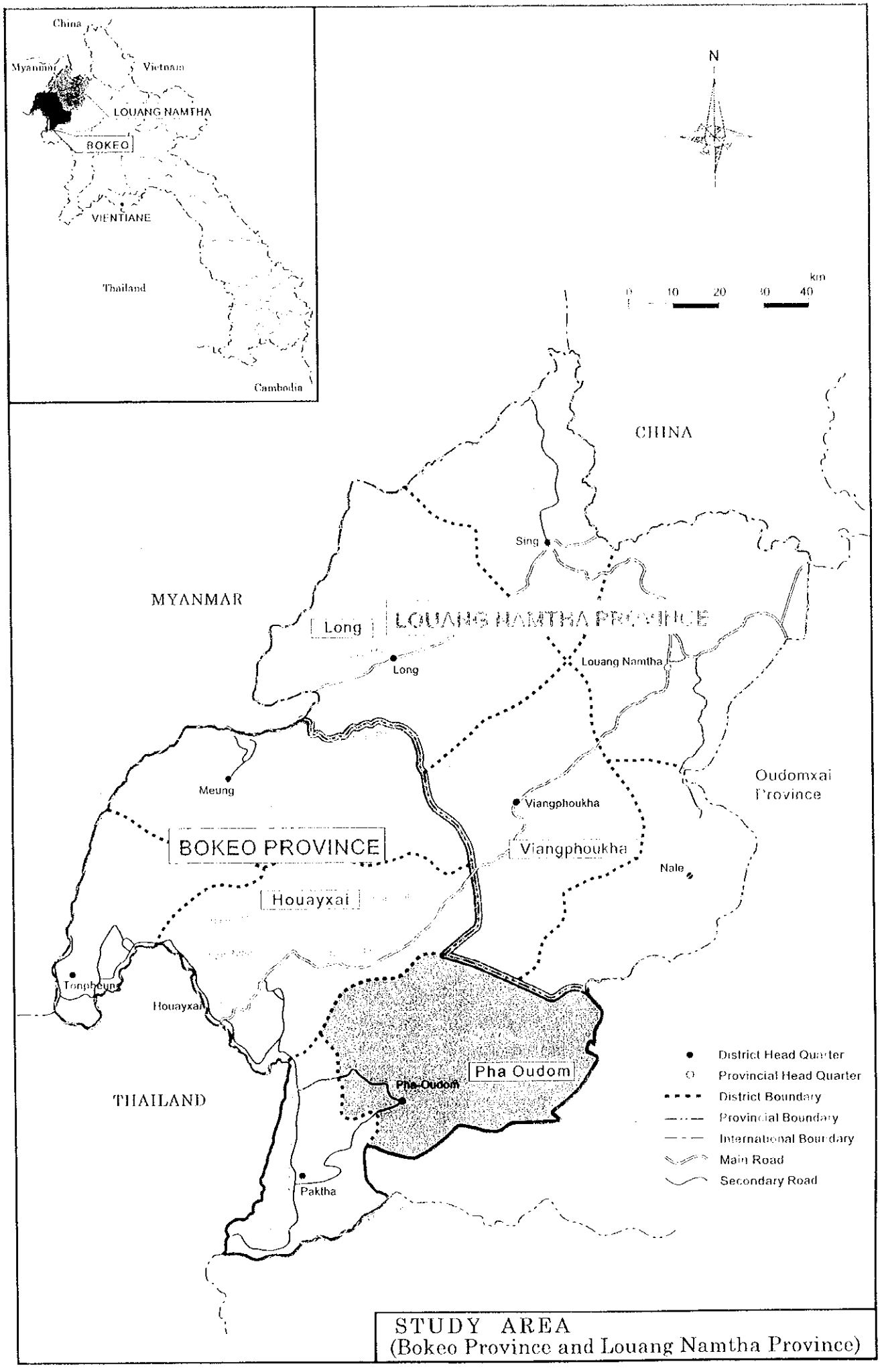
CASE STUDY AREA
(VIENTIANE PROVINCE)

- Provincial Head Quarter
- Capital of Country
- Provincial Boundary
- International Boundary
- Main Road

0 100 200 km



STUDY AREA
(Bokeo Province and Louang Namtha Province)



STUDY AREA
(Bokeo Province and Louang Namtha Province)

EXECUTIVE SUMMARY

The objectives of the Study on Rural Water Supply and Sanitation Improvement in North-West Region in Lao People's Democratic Republic (hereinafter referred to as "the Study") are:

1) to investigate the present situation of rural water supply and sanitation in the target villages, and identify the existing issues and problems.
2) to formulate a suitable water supply and sanitation improvement plan in the target villages, with mutual consent of the villagers and community.
3) to transfer technology on sustained development and management of water resources and sanitation for skills development and institutional reinforcement of Lao counterpart personnel (especially on the provincial and district levels) through participatory involvement throughout the course of the Study in pursuit of capacity building
4) to hold workshops during the course of the Study in order to share study results with concerned personnel and exchange views.

This Study is a participatory development study predominantly characterized by its application of the community participation approach. During the pilot activities of the present Study, the villagers are directly involved in the community dialogue at the target villages. These local villagers, comprehending all the relevant factors (i.e., functions of the facilities, methods of operation and maintenance, and the meaning of the village contributions as labor, local materials and required expenditures), have chosen by themselves the water and sanitation facilities such as gravity-fed water supply system and pour flush latrines that they are actually willing to construct and continue using.

The Study's consequent outcome, the pilot facilities and the master plan based on the pilot study results, would thus become far more acceptable, reliable, and sustainable than other existing systems and plans. The successful results would not only fulfill the requirements for improvements in water supply and sanitation, but also contribute to fostering a sense of ownership of the facilities owing to the adoption of the community participation approach in this Study.

The Study targets 81 villages in 4 Districts of Houayxai and Pha Oudom Districts in Bokeo Province, and Long and Viengphoukha Districts in Luang Namtha Province, which are located in the north-west region of the country These areas were selected because of their remoteness in line with the Sector Strategy.

The Study is divided into the following three phases which began in February 1999 and will be completed in March 2001.

Phase I:	Baseline Study and Analysis
Phase II:	Implementation of Pilot Study
Phase III:	Pilot Study Monitoring/Evaluation, Execution of Pilot Study Extension, and Formulation of Development Plan for Rural Water Supply and Sanitation

In Phase I, participatory training sessions including on-the-job training at the villages were held to build capacity of Provincial and District level Nam Saat staff as well as other local representatives. The trainees used their acquired knowledge to survey the target villages. The results of the village survey were used as baseline data to formulate the pilot studies and development plans.

The baseline data shows that the villagers are highly willing to participate in the construction works. According to the results of community dialogue with the villagers, through the informed choice concept, the most chosen type of water supply scheme is the gravity fed system (GFS) and for latrine, it is the pour flush type.

A pilot study was implemented in Phase II at 34 villages selected out of the 81 study target villages through an elaborate selection process. The pilot study was conducted in stages as follows.

Stage A:	Training of trainers (TOT) on community management, sanitation education and hygiene promotion, and operation and maintenance
Stage B:	Participatory village activities including community dialogue, committee organization, hygiene promotion, village contribution confirmation, community management and village agreement
Stage C:	Preparation for construction on participatory planning, construction scheduling, guidance on operation and maintenance and plan of action
Stage D:	Construction works for water supply and latrines construction through the participation of the villagers
Stage E:	Monitoring of behavioral changes and village awareness on social and sanitary improvements

Phase III continued the monitoring survey for evaluation. Also in this final phase, a pilot study extension was implemented at 17 villages to further build capacity and extend coverage of water supply and sanitation as a result of the favorable response of the previous pilot study. Then, development plans were formulated for improvement of water supply and sanitation of the target area.

The number of water supply and sanitation facilities constructed through the participation of the beneficiary villagers during the pilot study in Phase II and pilot study extension in Phase III are summarized below. (The list of facilities for each village are shown in Table 5-7 in Chapter 5.)

Phase	Implementation	No. of Villages	No. of Water Schemes			No. of Latrines
			GFS	Dug Well	Borehole	Pour Flush Latrine
II	Pilot Study	34	13	1	2	12
III	Pilot Study Extension	16*	8	1	0	12
Total		50	21	2	2	24

*The total number of target villages for the pilot study extension was 17, but a request was made to cancel one village, L-11 Nam Ma in Long District of Luang Namtha Province, due to their resettlement.

Information concerning the project for implementation of the villages remaining after completion of the pilot study and pilot study extension are summarized below.

- Thirty villages are remaining, but after changes such as joining together of villages and partial cancellation of a village due to implementation by another organization, the total number of villages to be implemented is 28.
- The facilities to be constructed are: 17 GFS schemes, 3 dug well villages and 2 undecided for a total of 22 schemes, with all 28 villages requesting pour flush type latrines.
- The cost estimation for the facilities is about US$309,000.
- Out of the 28 villages, 15 villages are ranked as having top priority for implementation, 9 villages as intermediate priority and 4 villages have low priority.

The benefits of implementing the project are as follows.

Increased Beneficiaries: The total beneficiaries of the 28 villages targeted for the project in the design year 2015 are projected to be 14,426 persons

Expansion of Coverage: At the District level, the coverage rate for water supply will increase from an average of 25% before the project to 44% after the project. Similarly, the sanitation coverage at the District level will improve from an average of 16% before the project to 29% after the project.

Improvements in Conditions of Sanitation and Hygiene: About 70% of the pilot village population reported a noticeable decrease in the number of water related diseases such as diarrhea after access to clean water and sanitation facilities. Similar improvements are conceivable for the project on the remaining villages.

Effects on Time Saved in Water Collection: About 91% of the pilot villages responded to reduction in time for water fetching by using the improved water supply facilities, with an average time reduction of more than 20 minutes. Therefore, similar time savings can be expected for the remaining village project. The reduced fetching time is used for caring their children, tending gardens and raising livestock with possibilities for increased income from these extraneous activities.

Contribution to Guiding Orientation and Capacity Building: The Project can contribute to guiding orientation of counterpart staff towards participatory methods and learning-through-sharing to apply demand-driven approaches. Also, capacity building of all level concerns can be effected through training sessions, OJT and actual applications in line with learning-by-doing.

The results on evaluation of the study developments are presented below.

Social Evaluation

- Overall ownership through participation is excellent in GFS schemes, which is especially true for villages of single-source, single-village GFS schemes.
- The level of ownership of the borehole scheme is not considered as satisfactory, because outside contractors have done most of the construction work, and groundwater had undesirable odor.
- Since most of the users of the water supply schemes are women, women's involvement in the total process of implementation of water schemes will contribute to reliable planning, effective management and sustainable maintenance that would reflect the actual needs.

Technical Evaluation

- The GFS scheme is technically sustainable and therefore can be considered as the most feasible scheme, and this conforms to the preference of the target villages.
- All types of latrines are technically feasible, but if sufficient water is available, the pour flush and septic tank type latrines are the most acceptable, but the pour flush type latrine is more preferable in consideration of costs.

Institutional Analysis

- The functions and roles of Nam Saat should be strengthened through further capacity building.
- Better coordination and collaboration are needed between central, Provincial and District level Nam Saat in terms of actual needs.
- The sector strategy must be revised to involve staff at all levels.

Financial Plan

- The pilot study villages contributed on the average about 33% of the total cost. This ratio reflects upon the actual situation of the Pilot Study villages which are located in the remotest areas, are very poor with the majority being ethnic minorities, and difficulties for payment would arise if the same stringent concepts are equally applied creating unfairness.

- Since the Sector Strategy is in the transitional stage, progressive introduction of a weighted approach to subsidy should be considered.
- No subsidy is provided for operation and maintenance of the facilities which is the responsibility of the beneficiary villagers, in line with the Sector Strategy
- The Pilot villages are collecting an average of about 100 kip/person/month as operation and maintenance fee, which is a reasonable amount if only routine maintenance is considered. However, in consideration of emergency situations or replacements, the monthly water fee for GFS villages should be raised to about 1,100 kip per person which is equivalent to about 3% of their average income to create a sustainable system

The conclusions made through the implementation of this Study are as follows.

(1) This Study has applied a demand-oriented approach wherever possible, but the nature of this Study required maintaining supply-oriented concepts with appropriate application of the merits of both approaches.

(2) The Study has involved target villagers, both men and women, in participatory planning which encouraged a greater sense of ownership to sustain the system.

(3) Good cooperation and support from concerned personnel from different levels of agencies are a few of the contributing factors to the success of this study.

(4) GFS water schemes and latrines are easier for communities to realize participatory activities because they require high level contributions. Whereas, boreholes receive low participation due to low requirements for community involvement.

(5) After completion of the water supply and sanitation facilities, social and economic impacts on the livelihood of the communities were noticeably observed.

(6) Village contributions should not be a forced effort, but rather a motivation effort in consideration of a balance between willingness-to-pay (in relation to the benefits conceived) and ability-to-pay.

As a result of implementing this Study, the following lessons and experiences were identified for enhancing future development studies and projects.

(1) The more needy the people are, the more motivated they are. The communities having self-help efforts, high self-sufficiency and pressing water needs were more participatory and cooperative with high ownership.

(2) Good coordination and cooperation among different sectors at all levels involved directly or indirectly in the study can contribute to its success.

(3) Promotion of sanitation through the construction of latrines in a village can serve as model case for neighboring villages in motivating them to want their own latrines to heighten their awareness towards sanitation.

(4) Experiences learned through on-the-job training are considered to be most effective for capacity building of Provincial and District level personnel.

In consideration of the above topics, the following recommendations and suggestions are made.

(1) The procedures used in this study as well as the lessons learned can be applied as model for other Provinces having similar socio-economic and environmental conditions.

(2) During the baseline survey and selection of target villages, enough time should be spent for in-depth assessment by using participatory techniques such as community dialogue, RRA and PRA.

(3) The level of village contribution should consider an appropriate balance between willingness-to-pay (resulting from the extent of benefits anticipated) and ability-to-pay. Subsidies in consideration of the less affluent, more remote and ethnic minority villages are quite significant for future developments.

(4) Central Nam Saat in collaboration with Provincial level staff must follow up on the Sector Strategy and its dissemination with the District level offices. Practical breakdown guidelines which are easier to read and understand should be formulated to match the local situation.

(5) Assistance is needed to Provincial and District Nam Saat in developing an operation and maintenance follow-up program to ensure sustainability of the implemented villages.

(6) Exchange and coordination activities should be carried out with other international donors and NGOs implementing similar activities to share information and experiences. and to avoid possible overlapping or repeated negative experiences.

CONTENTS

ABBREVIATIONS

ADB	Asian Development Bank
BHN	Basic human needs
CTA	Chief Technical Advisor
DF/R	Draft Final Report
EU	European Union
F/R	Final Report
GFS	Gravity Fed System
GI	Galvanized iron
GNP	Gross national product
HASWAS	Hygiene Awareness, Sanitation and Water Supply
HDPE	High density polyethylene
IC/R	Inception Report
ID/OS	Institutional Development and Organizational Strengthening
IEC	Information, Education and Communication
JFY	Japanese fiscal year
JICA	Japan International Cooperation Agency
KAP	Knowledge, Attitude and Practice
MSF	Medecins sans frontières
Nam Saat or NEW	National Center for Environmental Health and Water Supply
NGO	Non-governmental organizations
NTU	Nephelometric Turbidity Unit
PCM	Project Cycle Management
PI/R	Phase I Report
PII/R	Phase II Report
P/R	Progress Report
PRA	Participatory Rapid (or Rural) Appraisal
RRA	Rapid Rural Appraisal
SIDA	Swedish International Development Authority
TFR	Total fertility rate
TOT	Training of trainers
UNICEF	United Nations Children's Fund
VIP	Ventilated improved pit (latrine)
VLOM	Village Level Operation and Maintenance
WATSAN	Water and sanitation (committee)
WB WSP-EAP	World Bank Water and Sanitation Program-East Asia and the Pacific
WID	Women in development

CHAPTER 1 INTRODUCTION

1.1 Study Background

This report was compiled for the Study on Rural Water Supply and Sanitation Improvement in North-West Region in Lao People's Democratic Republic (hereinafter referred to as "the Study") in accordance with the Scope of Work agreed upon by the Ministry of Health and the Japan International Cooperation Agency (hereinafter referred to as "JICA").

Lao People's Democratic Republic, having a total land area of 236,800 km^2, is bordered by Vietnam to the East, Thailand to the West, Cambodia to the South, China to the North and Myanmar to the North-West. The population of the country is estimated at 4.8 million in 1997. The country is situated in the tropical monsoon climate zone with two distinct seasons: the rainy season lasting from May to October and the dry season occurring from November to April. The mean annual precipitation is 1,800 mm, the maximum temperature is 30°C with a mean annual temperature of 20°C, and the humidity during the rainy season surpasses 90%.

The Provinces of Bokeo and Luang Namtha, the Study area, is located in the North-West region of the country. According to the 1995 census, the population of Luang Namtha Province was 115,000 with almost 82% being rural population, and the population of Bokeo Province was 114,000 with the rural population covering about 95%. This mountainous area, bordering on Thailand, Myanmar and China, is the least developed area in the country.

In its Fourth Five Year National Plan (1996–2000), social development is emphasized along with the following objectives.

- Achieve an 8 to 8.5% per annum economic growth, restrain inflation to 10%, and aim for a per capita annual income of US$500 by the year 2000.
- Further develop the sectors of social development, education, health and welfare, and invest over 20% of the public investment into these sectors.
- Promote eradication of poverty, and place emphasis on improvement of basic infrastructures (road, water supply, power supply) in remote rural areas and expansion of social services (improve accessibility to health and medical facilities, increase employment and income opportunities, expand food and goods production)

Furthermore, in the Fourth Plan, the objectives for the rural water supply sector are to supply 60 lit/cap/day for communal tap users and 40 lit/cap/day for handpump users, and the improvement of the sanitary environment. Moreover, in line with the above Plan, the Ministry of Health launched the "Health for All" campaign to upgrade the public sanitation situation through the expansion of water service coverage in the rural areas.

With this background, the Government of Lao People's Democratic Republic requested a technical assistance from the Japanese government in 1995 to conduct a study for improvement of rural water supply and sanitation. In response to this request, JICA dispatched a Preparatory Study Team in October 1998 and formulated the Scope of Work for this Study.

1.2 Study Objectives

The objectives of the Study are:

1) to investigate the present situation of rural water supply and sanitation in the target villages, and identify the existing issues and problems.
2) to formulate a suitable water supply and sanitation improvement plan in the target villages, with mutual consent of the villagers and community.
3) to transfer technology on sustained development and management of water resources and sanitation for skills development and institutional reinforcement of Lao counterpart personnel (especially on the provincial and district levels) through participatory involvement throughout the course of the Study in pursuit of capacity building
4) to hold workshops during the course of the Study in order to share study results with concerned personnel and exchange views.

1.3 Study Area and Target Villages

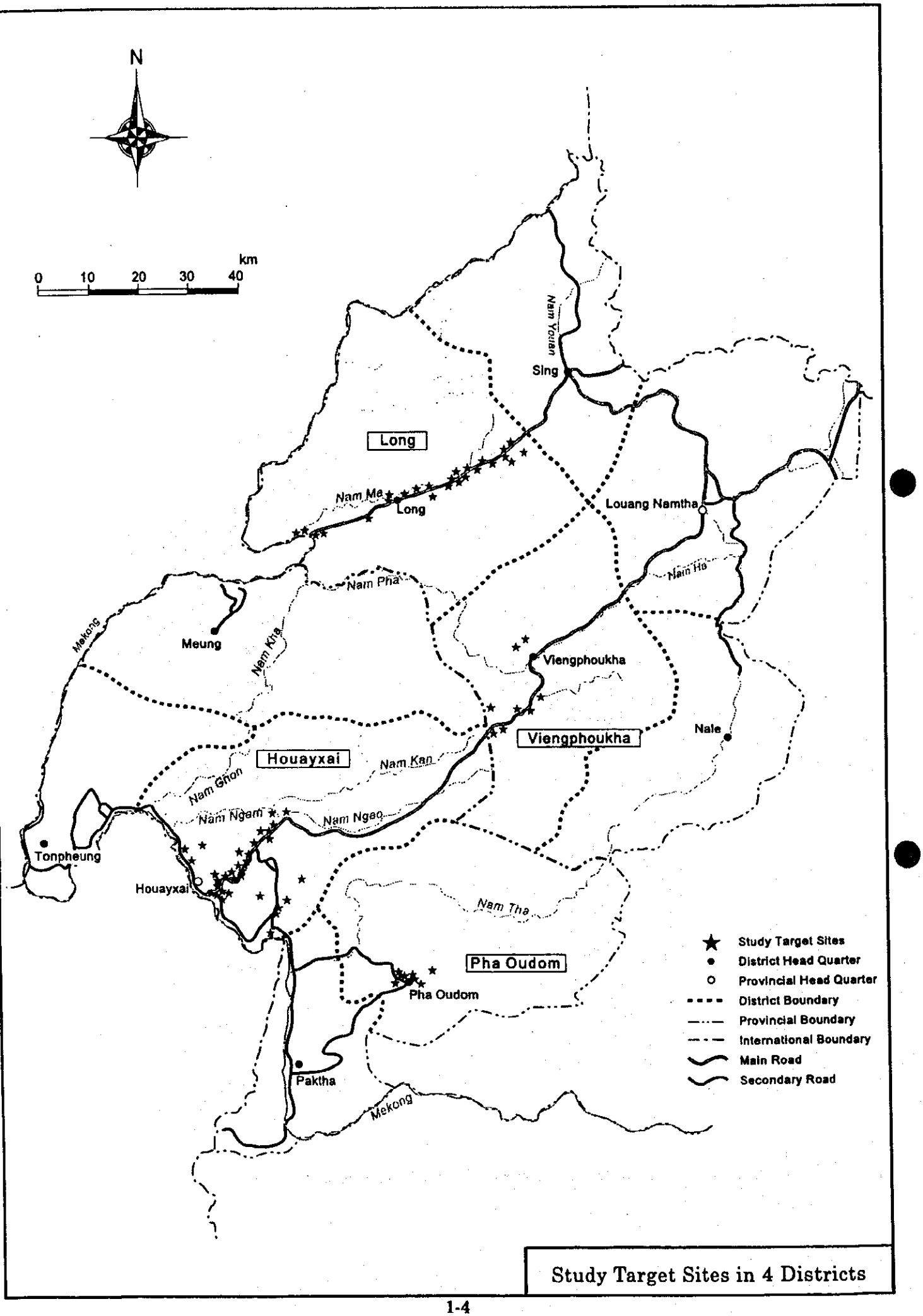
The Study area covers two Provinces of Luang Namtha and Bokeo, which are located in the north-west region of the country bordering with Thailand, Myanmar and China. The road distances from the capital Vientiane to Luang Namtha and Bokeo Provinces are about 830 km (through Luang Prabang and Oudomxay) and 630 km (through Thailand), respectively. There are few bridges across rivers along the approximately 200 km of road between Luang Namtha and Bokeo making road traffic almost impossible during the rainy season. The Study will target 4 Districts of Houayxai and Pha Oudom Districts in Bokeo Province, and

Long and Viengphoukha Districts in Luang Namtha Province. These areas were selected because of their remoteness in line with the Sector Strategy. The 81 villages targeted for this Study are listed in the following table.

List of Study Target Villages

District	No.	Village	District	No.	Village
Bokeo Province			Pha Oudom	P-1	Ban Phiengkham
Houayxai	H-1	Ban Poung	(9 Villages)	P-2	Ban Thinkeoneua
(39 Villages)	H-2	Ban Phokham		P-3	Ban Thinkeokang
	H-3	Ban Nam Ngao		P-4	Ban Thinkeotay
	H-4	Ban Houai Makeo		P-5	Ban Phaoudom
	H-5	Ban Done Phao		P-6	Ban Nathong
	H-6	Ban Nam Deua		P-7	Ban Phonexay
	H-7	Ban Namma		P-8	Ban Somsavang
	H-8	Ban Nampou		P-9	Ban Sonexay
	H-9	Ban May Phatthana	**Luang Namtha Province**		
	H-10	Ban Phousene	Viengphoukha	V-1	Ban Nam Mai
	H-11	Ban Bolek	(8 Villages)	V-2	Ban Nam Paman
	H-12	Ban May Ngang		V-3	Ban Donmay
	H-13	Ban Done Gneng		V-4	Ban Nam Phae
	H-14	Ban Mayhya		V-5	Ban Phoulan
	H-15	Ban Namtoi		V-6	Ban Pangxai
	H-16	Ban Xaychaleun		V-7	Ban Sakon/Layloth
	H-17	Ban Maynignom		V-8	Ban Namseua
	H-18	Ban Thongsengchan	Long	L-1	Ban Xiengkok May
	H-19	Ban Xiengnam	(25 Villages)	L-2	Ban Xiengkok Kao
	H-20	Ban Nongneun		L-3	Ban Pang An
	H-21	Ban Nale		L-4	Ban Luang
	H-22	Ban Chomchouk		L-5	Ban Don Savang
	H-23	Ban Paksang		L-6	Ban Nong Kham
	H-24	Ban Maypoukha		L-7	Ban Nam Bak
	H-25	Ban Namhotay		L-8	Ban Luang Phokham
	H-26	Ban Phibounthong		L-9	Ban Phaya Luang
	H-27	Ban Houakhoua		L-10	Ban Sivilay
	H-28	Ban Pakhaotay		L-11	Ban Nam Ma
	H-29	Ban Thongbia		L-12	Ban Hoai Mo
	H-30	Ban Viengmay		L-13	Ban Chakhamping
	H-31	Ban Done Keo		L-14	Ban Khok Hin
	H-32	Ban Hat Phouan		L-15	Ban Tinthat
	H-33	Ban Nampouktay		L-16	Ban Phatae Kao
	H-34	Ban Nampoukkang		L-17	Ban Silimoun
	H-35	Ban Done Xay		L-18	Ban Pheo Yae
	H-36	Ban Nam Samoktay		L-19	Ban Cha Yi
	H-37	Ban Leang		L-20	Ban Khalung
	H-38	Ban Done Xavanh		L-21	Ban Daen Kang
	H-39	Ban Nam Saen		L-22	Ban Namoun
				L-23	Ban Kang
				L-24	Ban Paxang
				L-25	Ban Phataemay

The distribution of the Study target villages is shown in the adjoining map.



Study Target Sites in 4 Districts

1.4 Study Description

The JICA Study Team will execute the Study in accordance with the following components:

1) Existing data and information shall be organized systematically and used effectively to fully comprehend local conditions related to living environment, water supply, sanitation, hydrogeology and other relevant subjects, and accurate field survey results shall be acquired to formulate an optimum development plan for improvement of rural water supply and sanitation. In addition, a previous project implemented through a Japanese grant assistance will be reviewed and reflected in the present Study.

2) The Pilot Study and workshops shall be effectively carried out for mutual understanding of current rural water supply/sanitation conditions and local requirements, in order to: (a) establish optimum solutions to the prevailing problems; (b) formulate a water supply and sanitation improvement plan most suitable in terms of water resources development potential; and (c) prepare an optimum operation and maintenance plan for a sustainable water supply and sanitation system.

3) The Study shall be executed in cooperation with counterpart personnel and target area villagers in order to complete the Study according to the schedule and with emphasis on technology transfer to build institutional capacity.

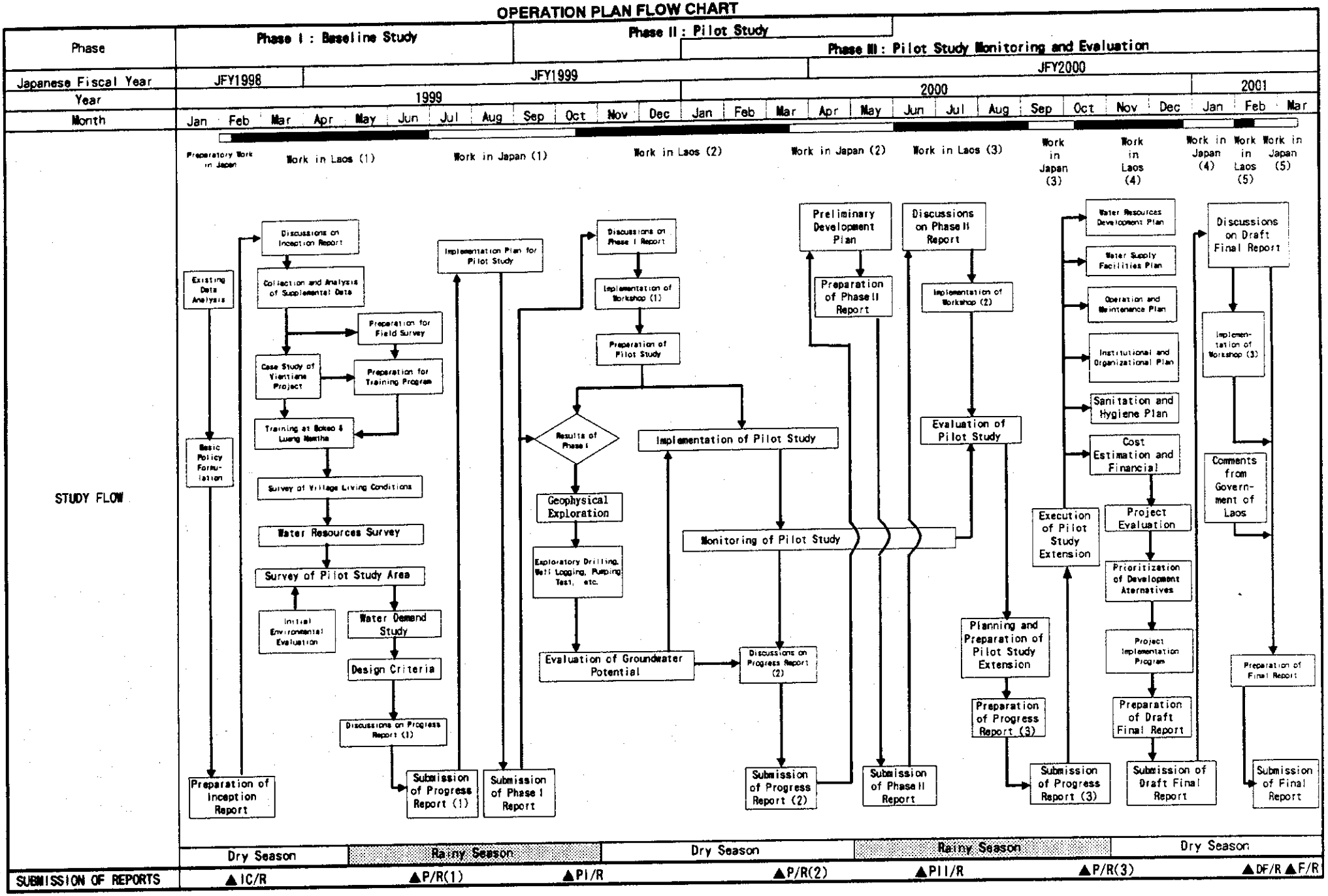
4) The concepts described in the Sector Strategy relating to community participation, informed choice and technology transfer shall be applied for this Study and necessary elaboration will be made. This Study can contribute to the promotion of the Sector Strategy.

Through the implementation of the pilot studies, the villagers were involved in the participatory process from the planning stage through the construction, and contributed labor, local materials and cash. As a result of this community participation, the following facilities were constructed.

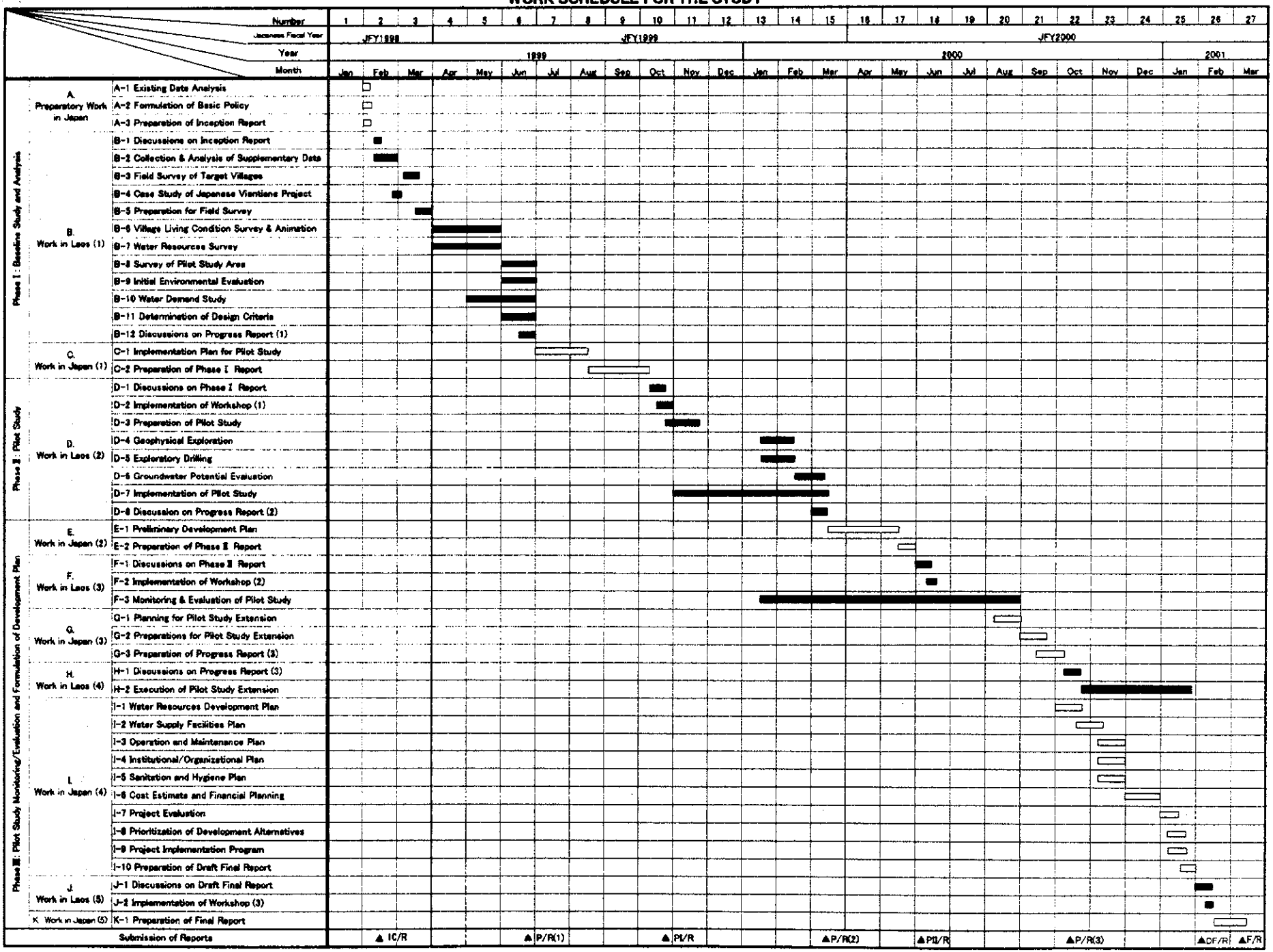
- Water Supply Facilities: Gravity fed systems (GFS), dug wells, boreholes
- Sanitation Facilities: Pour flush type latrines

The detailed work items and the Study sequence are depicted in the following flow chart and the work schedule.

OPERATION PLAN FLOW CHART



WORK SCHEDULE FOR THE STUDY



The scope of work for the Study is described below for each phase.

Phase I: Baseline Study and Analysis	
Preparatory Work in Japan	1. Collection, review and analysis of existing data and information 2. Formulation of basic policy and field survey method 3. Preparation of Inception Report
Work in Laos (1)	1. Explanation of and discussions on the Inception Report 2. Collection and analysis of supplementary information 3. Field survey of target villages 4. Case Study of Japanese Supported Vientiane Project 5. Preparatory work for investigation of rural living conditions and water resources 6. Investigation of rural living conditions 7. Water resources survey 8. Preliminary planning and investigation for the Pilot Study 9. IEE (initial environmental examination) 10. Projection of water demands 11. Determination of design criteria 12. Preparation of and discussions on Progress Report (1)
Work in Japan (1)	1. Establishment of Pilot Study implementation plan 2. Preparation of Phase I Report
Phase II: Implementation of Pilot Study	
Work in Laos (2)	1. Explanation of and discussions on Phase I Report 2. Execution of Workshop (1) 3. Preparation of Pilot Study 4. Geophysical exploration 5. Exploratory well boring and subsequent well logging, pumping test, etc. 6. Evaluation of groundwater resources potential 7. Execution of Pilot Study 8. Preparation of and discussions on Progress Report (2)
Phase III: Pilot Study Monitoring/Evaluation and Formulation of Development Plan for Rural Water Supply and Sanitation	
Work in Japan (2)	1. Preliminary formulation of development plan 2. Preparation of Phase II Report
Work in Laos (3)	1. Explanation of and discussions on Phase II Report 2. Execution of Workshop (2) 3. Monitoring and evaluation of Pilot Study
Work in Japan (3)	1. Planning for Pilot Study extension 2. Preparations for Pilot Study extension 3. Preparation of Progress Report (3)
Work in Laos (4)	1. Explanation of and discussions on Progress Report (3) 2. Execution of Pilot Study extension
Work in Japan (4)	1. Formulation of water resources development plan 2. Formulation of water supply facilities plan 3. Formulation of operation and maintenance plan 4. Formulation of organizational reinforcement plan 5. Formulation of sanitation improvement and hygiene education plan 6. Cost estimation and financial planning 7. Project evaluation 8. Prioritization of development alternatives 9. Formulation of project implementation program 10. Preparation of Draft Final Report
Work in Laos (5)	1. Explanation of and discussions on Draft Final Report 2. Execution of Workshop (3)
Work in Japan (5)	Preparation of Final Report

The JICA Study Team will prepare and submit the following reports to the Government of Lao People's Democratic Republic.

Report	No. of Copies	Language	Submission Period
Inception Report	30	English	Middle of February 1999
Progress Report (1)	30	English	End of June 1999
Phase I Report			Middle of October 1999
• Main Report	30	English	
• Reference Report	10	Lao	
• Sanitation Education Manual	5	Lao	
Progress Report (2)	30	English	Middle of March 2000
Phase II Report			Beginning of June 2000
• Main Report	30	English	
• Reference Report	10	Lao	
Progress Report (3)	30	English	Middle of October 2000
Draft Final Report			Beginning of February 2001
• Summary Report	15	English	
• Summary Report (reference)	15	Lao	
• Main Report	30	English	
• Main (reference)	15	Lao	
• Supporting Report	30	English	
• Data Book	30	English	
• Sanitation Education Manual	15	Lao	
• Operation and Maintenance Manual	15	Lao	
Final Report			March 2001
• Summary Report	15	English	
• Summary Report (reference)	30	Lao	
• Main Report	50	English	
• Main (reference)	30	Lao	
• Supporting Report	50	English	
• Data Book	50	English	
• Sanitation Education Manual	30	Lao	
• Operation and Maintenance Manual	30	Lao	

1.5 Study Team Members

The members of the Study Team are listed below.

Name	Function	Affiliation
Shoji FUJII	Team Leader/ Rural Water Supply/ Operation and Maintenance	Japan Techno
Shigeyoshi KAGAWA	Hydrogeology/ Environmental Analysis	Japan Techno
Noriyo AOKI	Social Survey/ WID•Community Participation I	Japan Techno*
Khamtanh CHANTY (Phase I) Sybounheung PHADANOUVONG (Phase II & III)	Social Survey/ WID•Community Participation II	Japan Techno**
Izumi ATSUTA	Sanitation Education/ Public Hygiene	Japan Techno***
Nobuyuki ISHII	Facilities Design I	Japan Techno
Toshimichi NAGANUMA	Geophysics/Drilling Advice	Japan Techno
Kiyoko TAKAMIZAWA	Facilities Design II/ Construction Supervision I/ Procurement II	Japan Techno
Akihiko UCHIYAMA	Cost Estimation/Procurement I/ Financial Planning	Japan Techno
Akinori MIYOSHI	Construction Supervision II	Japan Techno
JICA Technical Advisor		
Dr. Yuji MARUO	Leader of JICA Advisory Team	JICA Development Specialist

* From IC Net
** From Lao Consulting Group (Formerly Lao Montgomery Watson)
*** From Pro Act International

CHAPTER 2 SOCIO-ECONOMIC SITUATION

2.1 National Socio-economic Conditions

Lao PDR is a land locked country having a scarce population and is regarded as one of the least developed countries in the East Asian region with an estimated per capita GNP of US$400 (World Development Indicators). Agriculture remains the major sector of the economy, employing over 80 percent of the labor force. Structural reforms and macroeconomic management has contributed to macroeconomic stability, production growth, small private sector development and trade flows particularly with neighboring countries. However, the reform effort has slowed significantly and the macroeconomic environment has worsened considerably, with serious inflation and exchange rate depreciation in recent years. As of the middle of June in 1999, the Lao currency Kips was devaluated down to more than 100% of its value from the beginning of Phase I of this Study (February,1999). Although during Phase Ⅱ and Phase Ⅲ, the inflation has stabilized, it caused serious inflation to the Lao economy. As the majority of the population is engaged in subsistence activities, the impact of the Kip crisis on them is initially shielded. The actual effects of the economic crisis depends on the level of involvement of groups in the cash economy, their ability to produce sufficient food and other commodities for their own use, the degree of dependence on imported goods or inputs, and their ability to adjust their patterns of consumption or employment.

2.2 Regional Socio-economic Conditions

Road Infrastructure

Most of the pilot villages except Nam Seua in Viengphoukha District, and Nam Ngao, Hat Phouan and Leang in Houayxai District can be reached by road even in the rainy season. However, since the Pha Oudom road system remains undeveloped and crossing the Namtha river to reach the sites is impossible during the rainy season, the accessibility from Houayxai to Pha Oudom by car is regarded as hardly possible. Although the rainy season allowed only a few accessibility in Long District at the start of the survey, the road to Long District has since been significantly upgraded in the course of our study. Since then, the road has been accessible to the pilot villages even in the rainy season. The most difficulty the team faced was that the deteriorated road condition of National Route No.3 through Luang Namtha leading to Houayxai. Even in the dry season, once it rains, the ungraded dirt tracks along this route become severely muddy, and the Study Team vehicles became stuck at many places in Viengphouka.

Power Supply

Luang Namtha town can receive electricity for only 3 hours per day, but Long and Viengphoukha Districts are not yet receiving electricity. In Bokeo Province, especially Houayxai town has been receiving electricity since 1996 through powerline connections from Thailand. Since some villages in Houayxai and Pha Oudom Districts as well as Long District have generators of their own, villagers of those villages have become accustomed to using electrical goods such as the television. The demand survey in Bokeo Province shows that electricity is the highest priority. According to the Bokeo provincial plan, electrification will be expanded from Houayxai town to Ban Poung village, which is one of the target villages in Houayxai District, within the next few years.

Population Growth

In Luang Namtha, a family planning programme has been conducted only for Luang Namtha city, and other areas in Long District and Viengphoukha District have little contraceptive prevalence. The TFR (Total Fertility Rate) of Luang Namtha is higher (5.7) than that of national average (5.4). In Bokeo Province, the Department of Health took the initiative to conduct a family planning programme in Houayxai District, and then the TFR in Bokeo began to decrease down to 5.5.

Regional Economy

The regional economies of Luang Namtha and Bokeo Provinces are influenced by countries located next to these Provinces. Most of the commodities in Luang Namtha Province are imported from China. Long District near the Myanmar border has trade with Myanmar. Economy of Viengphoukha District, which is isolated both geographically and economically, is affected by weather conditions and insect damages. Goods and commodities in Bokeo Province come from Thailand, which gives rise to using Thai Baht as the currency in daily trade.

Educational Development

Most of the Targeted villages in Long and Viengphoukha District in Luang Namtha Province do not have schools inside the village and the enrollment ratio of primary schools is estimated at less than 15% according to the survey results. The enrollment ratio of primary schools in Houayxai District is estimated to be more than 50%, much higher than Long and Viengphoukha Districts. Literacy rate for the population aged 5 years and above is 27.75% in Viengphoukha and 10.65% in Long, 54.5% in Houayxai and 31.2% in Pha Oudom. The ability for Lao language is not the same by region and gender. In most of the villages, the male is a good Lao speaker, although female speak less fluently. In some regions, for example the remote rural minority villages (Mousir, Qui, Hmong villages) in Luang Namtha Province, women cannot speak Lao. Most of the Lao Lum, such as Leu women, are proficient in speaking, reading and writing.

2.3 Village Level Socio-economic Conditions of Study Target Villages

Water Fetching Distance and Time

According to the results of the Phase I village survey, 74% of the target villages replied that the distance from their village to their water points is less than 200 m. In 24 villages out of the 81 target villages, the distance to their existing water source is more than 200 m. Five villages are having difficulties in fetching water due to the long distance of more than 300 m to their water sources. The water sources of two villages, H-32 Hat Phouan and H-38 Done Xavanh, are located 500 m away from their villages. The water collecting time varies from village to village as well as among households in the same village. The villagers whose water points are located farther away tend to spend less time for daily fetching of water. The dry season requires a longer collection time than the rainy season. The main water fetchers are women, but in some villages, men are also collectors.

Water Related Problems

Water related issues and problems that villagers addressed are summarized in the table below. This shows that 22 villages out of the total of 81 or about 27% answered that their existing water is either dirty or turbid. Furthermore, 25 out of the 81 villages or about 31% addressed the need for water, of which 17 villages or about 21% specifically replied the need for drinking water.

Water related Problems Addressed by Villagers

Are there any problems related to water?	Villages	% /81 villages
☐ drinking water needed	17	21.0%
☐ water needed	8	9.9%
☐ water is highly turbid	6	7.4%
-turbid in rainy season	(5)	(6.2%)
☐ water is dirty	16	19.8%
-water is enough but not clean	(2)	(2.5%)
☐ water is insufficient	18	22.2%
☐ tap water needed	1	1.2%
☐ water collection point is very far	4	4.9%
☐ no water source	1	1.2%

Source: Result of Phase I Village Survey in 1999

Income Disparity

In general, villages situated in the Mekong River Basin in Houayxai and Long Districts enjoy a relatively affluent economy through income from non-farming activities. Some of the villages in Houayxai have gem mining concessions and also provide labor to the mining firm, which bring in extra income. Xiengkok Mai is becoming a trendy border spot for foreign tourists, of which villagers have boats for

crossing the border between Laos and Myanmar to the area of the so called "Golden Triangle". The income itself varies from village to village where the economic disparity among villages in Houayxai began to widen owing to the impact of the Mekong Basin development, its urbanization and increasing income from non-farming work. Long district economy is becoming improved thanks to the recent infrastructure development.

Cultivation Area

The average cultivation areas of paddy fields and upland fields by district are shown below. Houayxai, Pha Oudom and Long Districts are carrying out both upland and lowland rice cultivation. However, Viengphoukha is cultivating mainly upland rice, where the average paddy field of the target villages in Viengphoukha is only 2.6 ha.

Average Cultivation Area of Target Villages by District

District	Paddy Field(ha)	Upland Field(ha)
Houayxai	28.1	23.0
Pha Oudom	23.1	25.2
Viengphoukha	2.6	63.8
Long	21.5	10.6
Average	18.8	30.7

Source: Results of Field Survey, March-May 1999

Livestock Raising

Farmers raise livestock such as buffaloes, cattle, goats, pigs, ducks and chickens. Livestock also become property in case of villagers' financial needs. The price range of livestock in both Provinces is buffalo 2,000,000 to 2,200,000 kip; cow 675,000 to 990,000; pig 270,000 to 360,000; and chicken 18,000 to 22,000 kip for prices during March to May 1999. The average number of livestock of the villages in Houayxai shows their wealthy economic condition. In contrast, most of the farmers in Viengphoukha raise more pigs than cows or buffaloes.

Household Economy and Willingness to Contribute

The household incomes and willingness to contribute by District are shown below. The average number of household members is 6 or 7 persons. It is noted that the affluent economy of Houayxai does not reflect upon the overall willingness to contribute in comparison to other districts. Although Viengphoukha villages depend heavily on subsistence economy rather than cash economy, the willingness to contribute is higher than Houayxai. Long District, whose average willingness to contribute for construction is 82,701 kip and its median is 50,000 kip, shows the highest willingness to contribute.

Household Economy and Willingness to Contribute for Construction by District

Parameter	Houayxai	Pha Oudom	Viengphoukha	Long
Average Number of Household Members (persons)	6	7	6	6
Household Income				
• Average Annual Household Income (kip)	2,639,168	1,135,944	1,186,412	3,010,956
• Median Annual Household Income (kip)	1,560,000	622,600	590,000	1,680,000
• Maximum Annual Household Income (kip)*	3,290,000	8,930,400	4,714,000	9,620,000
• Minimum Annual Household Income (kip)*	186,000	172,250	70,000	412,000
Willingness to Contribute				
• Average Construction Contribution (kip/HH)	20,469	20,556	26,206	82,701
• Median Construction Contribution (kip/HH)	5,000	15,000	20,000	50,000

Source: Results of Phase I Village Survey and Household Survey held in 1999
*Excluding statistical error and adjusting the income to balance of expenses of each household

2.4 Village Level Socio-Economic Conditions of Pilot Study Villages

Beneficiaries

The total numbers of beneficiaries of the pilot villages are shown below. The total number of households is 1,936 households and the total population for the four Districts is 10,595 persons.

Population Data of Pilot Villages by District

District	No. of Households	Population	No. of Males	No. of Females
Houayxai	915	5,083	2,502	2,581
Pha Oudom	583	3,365	1,655	1,710
Viengphoukha	117	543	263	280
Long	321	1,604	811	793
Total	1,936	10,595	5,231	5,364

Source: Results of Phase I Village Survey in 1999

Ethnic Groups

The ethnic groups of the pilot villages and their distribution in the two Provinces are described in the table below. Lao Lum villages number 13 which include Leu, Thaidam, and Doi; Lao Theung, 17 villages such as Khmu, Lamae and Yuan; and Lao Sung, 4 villages such as Hmong and Akha. Among the pilot villages, Lao Theung shares 50%, whereas Lao Lum is 38.2% and Lao Sung, 11.8%.

Ethnic Composition of Pilot Villages

Classification	No. of Villages	Ratio(%)	Main Ethnic Group
Lao Lum	13	38.2	Leu, Thaidam, Doi
Lao Theung	17	50.0	Khmu, Lamae, Yuan
Lao Sung	4	11.8	Hmong, Akha
Total	34	100.0	

RRA and In-depth Survey

The RRA (Rapid Rural Appraisal) enables to rapidly and intensively assess the features of the living conditions of the rural population for diagnosis of issues and problems. RRA is designed as an on-going learning process for both local as well as external team members in a more cross-sectional way. They evaluate local know-how and relevant technology transfer with the communities. When it is applied in a more participatory way involving the community, it is called PRA (Participatory Rural Appraisal) which was conducted in the baseline survey of Phase I. In Phase I, physical layout mapping including infrastructure, water resources and land utilization mapping has been drawn by the villagers and survey team members, and other basic village socio-economic data were identified. In Phase II, social assessment was conducted in Daen Kang and Hoai Mo villages on 7 December 1999 and Chakhamping village on 15 December 1999 as preparation for monitoring. The reason for selecting these villages is that these villages are regarded as the most difficult pilot villages due to the features of their ethnic affiliation and their perception on water and sanitation related issues. The survey was carried out for more precise items such as time line village development history, religious and festival calendar including beliefs and taboos on water related practice, information on historical background of water-related rights, life time survey including water fetching time, examination of payment capability, and willingness and their understanding of cost of effectiveness as well as other items.

2.5 Gender and Ethnic Minority Issues

Gender Considerations

In order to incorporate gender considerations into the program, the survey was conducted through interviews regarding women's situation and social gender roles. Lao Lum women are better off in the access to resources such as land and capital. In accordance with matrilineal tradition, Lao Lum women inherit their parents' land and property, especially the youngest daughter of the family. Lao Lum men will marry and go out to live with their wives and the wives' parents, and work for the wives' families. Unlike Lao Lum women, Lao Theung and Lao Sung women have fewer rights and little control of their resources according to their patriarchal tradition. However, men of Lao Theung and Lao Sung have control over most of the resources such as land and in the decision making process. Participation of women in meetings or political events is limited. The number of women's participation is

always less than that of men. Without special considerations, men speak more than women, especially in public occasions. In most places, women and children, especially girl children are responsible for collection of water for domestic use. However, women have less opportunity to make decisions related to the fetching and usage of water than male. Therefore, women have been encouraged to participate in each workshop so they can address their situation and requirements in the project cycling.

Ethnic Minorities Issues

In Lao PDR, 68 ethnic minority groups are recognized and officially classified into three categories, that is, Lao Lum, Lao Theung and Lao Sung. In Long District, 86% of the total number of villages are Lao Sung, in contrast to 12% Lao Lum and 2% Lao Theung. Akha (Ikor) is the major minority tribe under the Lao Sung minority group in Long District. In Viengphoukha District, 40 % is Lao Sung, whereas 53% is Lao Theung and Lao Lum shares only 7%. 32% of the total target villages is Lao Lum (Leu, Thaidam, Phoutai, Phounoi), 47% is Lao Theung (Khmu, Lamae, Yuan, Doi) and 21% is Lao Sung (Hmong, Akha, Yao, Qui, Mouser). The ethnic composition of the surveyed villages in the fieldwork is shown below.

Ethnic Composition of Surveyed Villages in Field Work

Classification	No.of Villages	Ratio	Ethnic Group
Lao Lum	26	32%	Leu, Thaidam,Phoutai,Phounoi
Lao Theung	38	47%	Khmu, Lamae, Yuan, Doi
Lao Sung	17	21%	Hmong, Akha, Yao, Qui, Mouser
Total	81	100%	

Source: Results of Field Survey, March-May 1999

Minority Village Distribution by District

District	Leu	Thaidam	Khmu	Lamae	Yuan	Hmong	Akha
Houayxai	10	0	8	7	0	1	0
Pha Oudom	1	1	4	2	1	0	0
Viengphoukha	0	0	1	0	4	1	0
Long	8	2	0	0	0	1	7

Source: Results of Field Survey, March-May 1999

Ethnic minorities in the target villages mostly live in the mountainous area and preserve their own cultural heritage with a long history. They are independent and have pride in their skills for their own way of life such as farming, hunting and handcrafting. They have their own traditional water supply schemes using bamboo to transport water from the source.

CHAPTER 3 SANITATION AND HEALTH CONDITIONS

3.1 Epidemiology

The four target districts have been covered by corresponding four governmental hospitals[1] as their main health service provider. Each hospital provides certain statistics for in-patients, out-patients and other hospital activities. However, the formats differ from one to another as well as duration of data compilation. Furthermore, due to the strong tendency of self-treatment by the general population, hospital records may not represent well enough the actual health status of the local people. Nevertheless they are important source of information to approach to the real health situation in the area.

Bokeo Provincial Hospital has kept health data since 1990 as shown below. Other available health records from hospitals covering the target area are presented hereafter. Pha-Oudom District Hospital has not been contacted.

Bokeo Provincial Hospital Data for Number of Patients

Case	1990	1991	1992	1993	1994	1995	1996	1997	1998
Malaria	1,128	2,537	1,338	3,277	1,405	2,875	2,905	4,012	2,440
Diarrhea	410	509	296	338	188	197	214	469	349
Dysentery	169	152	148	150	71	113	92	214	114
Cholera	0	0	0	0	5	0	0	0	0
Tuberculosis (TB)	79	83	63	64	141	85	56	41	20
Pneumonia	197	275	176	363	385	574	1,044	1,104	931
Grippe	152	157	149	274	41	216	229	315	185

Viengphouka District Hospital Data for Number of Patients

Case	1997			1998								
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.
Malaria	41	32	32	35	28	19	16	30	44	92	60	41
Diarrhea	2	1	0	1	0	3	18	2	2	2	4	2
Pneumonia	8	10	2	8	6	4	10	9	2	0	1	2
Others	21	12	17	7	18	8	13	23	24	11	17	18

[1] One provincial hospital (Bokeo) and three district hospitals.

Long District Hospital Data for Number of Patients

Case	1998			1999		
	October	November	December	January	February	March
Malaria	15	9	23	16	12	10
Diarrhea	0	0	0	2	5	1
Dysentery	0	1	1	0	1	0
Pneumonia	3	5	3	8	6	12
Fever	0	0	0	6	2	0
Gastonia	1	0	2	1	1	1
Others	3	2	2	9	9	1

Among the 356 households surveyed at the four target districts, interviewees have responded to the question "*What are the most common diseases experienced by members of your family?*" with 61 kinds of disease or symptoms. The most frequent answer is Malaria (31%), followed by Diarrhea[2] (23%) and Fever (9%). The others category includes: Cough, Headache, Measles, Stomachache, and so on. These results are listed in the following table.

Diseases	Frequency	Ratio
Malaria	203	31%
Diarrhea	148	23%
Fever	61	9%
Others	233	36%
Total	645	100%

Those interviewees also responded to the specific cause of the diseases they believe. For Malaria, the majority could not identify its specific cause as can be seen in the table below.

Cause	Frequency	Ratio	Cause	Frequency	Ratio
Don't know	120	59%	Drink unboiled water	2	1%
Sleep without mosquito net	33	16%	Food and water are not clean	2	1%
Mosquito bite	20	10%	A lot of water around the house	1	0%
Unsanitary condition	12	6%	Go to work	1	0%
Go to forest	6	3%	Weather	1	0%
Don't know how to prevent	2	1%	When doing something	1	0%
Don't protect	2	1%	Total	203	100%

[2] Dysentery included

For Diarrhea, one third of the respondents refer to some risk of contamination from drinking water or food, while still more than half could not identify the causes.

Cause	Frequency	Ratio
Don't know	83	56%
Drink unboiled water	32	22%
Food is not clean	20	14%
Eat many fruits	4	3%
Bad practice in sanitation	4	3%
Children	2	1%
Fever	1	1%
Hard work	1	1%
Sun stroke	1	1%
Total	148	100%

3.2 Diarrhea

Due to the lack of bacteriological laboratory functions in both provincial and district hospitals in the study area, the term "diarrhea" generally includes Cholera, Dysentery and other variety of causes. However, as some local words for the disease indicate, health staffs as well as villagers differentiate Cholera and Dysentery from other diarrhea.

The local word "ton-ki-ha", which means a syndrome with watery diarrhea and vomiting, is used for Cholera. Experienced medical doctors can also identify the disease by its particular smell at clinical diagnosis. In Long district, an outbreak has occurred in July 1997 when 30 people got sick including one death at a village. A local doctor has identified it as coming from the nearby Myanmar border. In Houayxai district, another outbreak has been identified in 1994 with about 40 patients and 9 casualties. After the large outbreak of Cholera in Khammouan province in 1992, the risk of the disease seemed to have been reduced in this country. However, small-scale outbreaks still can occur particularly in those areas near the borders.

Dysentery is called "tom-bit" locally, and diagnosed clinically by severe stomach aches and stools with blood. Although it is very difficult to make a distinction between bacillary dysentery and amebic one without bacteriological laboratory, local doctors see the latter as the major one in this area. No major outbreaks of Dysentery have been reported in those areas recently. However, it seems endemic there with some hospitalized patients throughout a year. The Tetracycline tablet, called "Teta"

locally, is one of the most popular drugs in the local Drug Revolving Fund. People can access it without any prescription like in many developing countries. It may have affected epidemiological outcomes observed at the hospital levels.

Infection routes of those diseases have not been clearly identified yet, mostly due to the lack of epidemiological investigation capability at the local level. A part of this study result shows a significantly high rate of bacillary contamination in sampled dug wells. While people commonly prepare boiled water for drinking in the form of tea or some traditionally prepared herbal plant, "pakdomn" or "la" in it, some people in some ethnicity believe "raw" water is better for their health.

According to the KAP study done by UNICEF in 1996, people see benefits of having latrine as a convenience of not having to go far from the house, prevention of diseases, keeping area clean, and for privacy. Those reasons explain well the result of another village survey conducted by the Bokeo provincial health department and MSF, an NGO, in Houayxai district in 1998. That survey revealed that the population density and the length of stay at the current place are the major parameters to affect latrine demand, and this coincides with the observation of HASWAS as well.

3.3 Malaria

Two types of Malaria, *P. falciparum* and *P. vivax*, are endemic in the study area, and the former is the major one. People call it as "khai-nyung", which literary means "mosquito fever", and take anti-malaria drugs whenever they think it is Malaria. At the hospital level, they have a microscope in each hospital for blood tests.

There is a certain drug resistance in this area. Some doctors differentiate patients coming from easy access villages and those from remote ones because they have higher risks of drug resistance and are treated with different drugs.

In Bokeo and Louang-Namtha, where they are rich in natural forests and small streams, countermeasures against mosquitoes breeding seems not practically feasible. Under such circumstances, protection of individuals might be the only choice for disease prevention. Mosquito nets are commonly used in some villages but they are not perfect. Commonly employed tactics to reduce Malaria are: to distribute impregnated mosquito nets; to impregnate existing mosquito nets in the village; and to promote awareness of Malaria and the need for protection.

CHAPTER 4. WATER RESOURCES AND WATER USE SITUATION

4.1 Climate

The study target area, Bokeo and Luang Namtha Provinces, in the north-west region of the country belongs to the tropical monsoon climatic zone of Southeast Asia, and is characterized by the distinct division into the rainy season and the dry season: the rainy season is from April to October and the dry season, November to March. The precipitation rate in this area is very high at 1,400 mm to 3,000 mm per year, and especially in the mountainous areas of the study area, the annual precipitation rate can reach over 3,000 mm. The average monthly precipitation rate is the highest in July and August, where it reaches 430 to 480 mm in Houayxai town and 200 to 250 mm in Namtha town. Another characteristic of this area is for example, in Houayxai town, the monthly precipitation rate is still 250 mm in October at the end of the rainy season. On the other hand, records of many years have revealed that there was no precipitation at all from November to February, which is the dry season.

The monthly average temperature in the target area is very high ranging from 20℃ to 30℃ throughout the year. The difference in monthly average temperatures is very low at below 10℃, contributing to another characteristic of the tropical climate zone.

4.2 Topography, Geology and Hydrogeology

Considering the available water resources for water supply in the Study area such as groundwater and surface water, we must take careful attention to the natural environment in terms of topography, geology and hydrogeology.

Based on the field survey and the topographical map of the area, the topography of the study area can be classified into four zones as listed below:

Zone	Area	Elevation
Alluvial Fan Zone	Bokeo	350 m to 500 m
River Terrace Zone	Long, Viengphoukha	550 m to 750 m
Mountainous Basin Zone	Luang Namtha, Sing	520 m to 850 m
Steep Mountain Zone	Bokeo, Luang Namtha	900 m to 1,180 m

Alluvial fan is developed in the area of Houayxai and Pha Oudom in Bokeo Province. The river terrace zone along the narrow valley surrounded by the steep mountains is found in Long and Viengphoukha Districts, and Luang Namtha and Sing Districts are located on the typical mountainous basin. These topographic areas are covered by Alluvial and Diluvium deposits consisting of sands, silts, gravel and clay having thicknesses of several meters to several tens of meters with expected abundance of groundwater.

On the other hand, the steep mountain zone consists of sedimentary rocks such as sandstone, siltstone, shale and limestone ranging from the Paleozoic Era of the Silurian and Devonian Ages to the Mesozoic Era of the Triassic and Cretaceous Ages, and also intrusive rocks of granodiorite and granite of the Paleozoic Era of the Carboniferous to Permian Ages. This is where we can find spring waters and clean rivers flowing which can be used as the sources for the Gravity Fed System (GFS).

From a hydrogeological point of view, groundwater is found in the riverbeds of relatively flat areas in the river terrace zone, alluvial fan zone and mountainous basin zone. Groundwater in these areas has good water quality and is presently used for drinking. However, groundwater potential is limited due to thin unconfined aquifers. Also, confined groundwater exists in the hard rocks of the sandstone, shale, metamorphic and granite layers of the Tertiary, Cretaceous and Paleozoic Ages associated with cracks and faults. However, survey and development of groundwater is hardly carried out in both Luang Namtha and Bokeo Provinces due to poor water quality for drinking, such as the content of iron in the water.

4.3 Available Water Sources

The Mekong River which originates in the Himalaya mountains is the main river course of Laos, and most of the rivers flowing inside the country are tributaries of the Mekong River. The main river in the study area is the Nam Tha River originating from Luang Namtha Province flows from northeast to southwest into the Mekong River passing through Bokeo Province. Other rivers in the study area are Nam Ma river, Nam Ngam river, Nam Hoo river and Nam Tin river which flow from northeast to southwest all terminating into the Mekong River.

The water sources expected to be used as sources for the study target villages are further tributaries of the above rivers or springs related to the above sources. In the past, the rivers had stable base flow with abundant quantity and good quality owing to abundant rainfall and protected by deep forests. The recent deforestation activities in upstream areas and slash and burn farming have contributed to the decrease in flow rates of water resources. The decrease in river base flow in the dry season and increase of turbidity due to topsoil outflow in the rainy season are causing environmental problems in water quality and quantity.

On the other hand, abundant groundwater can be found as unconfined and confined aquifers in the riverbank terraces of Viengphoukha and Long Districts where villages have settled along the river; the inland basins of Luang Namtha, Sing and Pha Oudom Districts; and the Alluvial fan of lowlands of Houayxai District. However, it is reported that the confined groundwater in both Luang Namtha and Bokeo Provinces has a problem with water quality and cannot be used as drinking water in some areas. Groundwater surveys are not carried out scientifically in this area. In Houayxai District, only a few groundwater development projects using boreholes were implemented in the past, which were mostly by EU. Also, a groundwater development project to develop confined water was implemented in Luang Namtha Province through the support of the World Bank in 1994, where 18 boreholes were drilled, and due to dry wells and water quality problems, only 8 wells were successful (success rate of about 44%). Then, 3 boreholes were drilled in the river terrace zone found in the central part of the District capital of Viengphoukha, and these were successful. The depths of these boreholes are about 30 m and the water quality is acceptable. Tara pumps were installed and are still functioning without any major problems even after more than 3 years of operation and supplying precious drinking water to the villagers. As for unconfined groundwater, it is being drawn from traditional hand dug wells and concrete lined shallow wells, and is supplying drinking and domestic water to the villagers in many areas. These wells have depths of a few meters to 10 m or so with static water levels of a few meters, and water is fetched by hand using buckets. While the water quality of unconfined groundwater is good and water can be fetched easily, quantity can become a problem in the dry season and also these type of wells are easily contaminated by human sources, and therefore proper construction techniques, sanitary control and careful maintenance are necessary.

4.4 Water Use Situation

Presently, the existing water sources and water intake facilities for villagers are mainly river water and groundwater as follows.

(1) Traditional hand dug well
(2) Concrete lined shallow well with cover
(3) River and stream water
(4) Spring water
(5) Borehole

According to the annual calendar of water use, which was surveyed at a few villages in Long District, the shortages in water become prevalent at the end of the dry season and the villagers tend to use less water, whereas in the rainy season when water is abundant, more water is used, but problems with turbidity, odor and bad taste become apparent. The daily water use pattern reveals that water is used the most in the evening from about 5 p.m. to 9 p.m. for cooking, cleaning and bathing; the second most used period is in the morning from around 5 a.m. to 9 a.m. where water is used for cooking breakfast and cleaning; the tertiary water use period comes around noon to 3 p.m. when water is needed to cook lunch and other minor uses; and at other hours of the day, water is hardly used at all.

4.5 Water Quality

Water samples from existing and available water sources were carefully analyzed in the laboratory. The water quality analysis results for the study sites indicate water contamination in ammonium, nitrate, nitrite and coliform count. However, some of these contaminations could have originated from poor sampling practices at the sampling sites. Therefore, during the Pilot Study, the selected future water sources were properly sampled and carefully examined.

CHAPTER 5. DEVELOPMENT PLANS

5.1 Water Source Development Plan

5.1.1 Water Source and Intake Options

Considering the available water resources for water supply in the Study area such as groundwater and surface water, we must take careful attention to the natural environment. Based on the field survey, the topography of the study area can be classified into four zones as listed below.

Characteristics of Topographical Zones

Parameter	Alluvial Fan Zone	River Terrace Zone	Mountainous Basin Zone	Steep Mountain Zone
Area	Houayxai, Pha Oudom	Long, Viengphoukha	Luang Namtha, Sing	Bokeo, Luang Namtha
Formation	Alluvial and Diluvium deposits consisting of sands, silts, gravel and clay			Sedimentary rocks ranging from Silurian and Devonian periods of Paleozoic era to Triassic and Cretaceous periods of Mesozoic era, and also intrusive rocks of granodiorite and granite of Carboniferous to Permian periods of Paleozoic era
Elevation	350 m to 500 m	550 m to 750 m	520 m to 850 m	900 m to 1,180 m
Available Water Resources	Groundwater			Spring water and rivers

Presently, the existing water sources for villagers in the target area are mainly river water and groundwater through wells as follows. The possible sources and supply facilities for the villages are presented below.

Water Source and Supply Possibilities

Priority	Source	Supply Facility	Conditions
1st	Springs and rivers	GFS	Depends on geographic and topographic conditions
2nd	Groundwater	Dug well or borehole with handpump	Limited area dependant on hydrogeological conditions
3rd	Springs and rivers	Protected spring, Infiltration gallery	If groundwater potential is low and GFS is topographically difficult; Inconvenience in fetching water
4th	Rivers	Pumping up to village with motorized pump	More convenience in fetching water than 3rd priority, but high financial and technical requirements for operation and maintenance
5th	Groundwater	Borehole with motorized pump	Suitable for populated villages; High financial and technical requirements for operation and maintenance
6th	Rainwater	Rainwater collection	If no other source is available

GFS Intake

The intake structures for GFS schemes are made of concrete with three components. The stream water first passes through a bed of gravel and sand as a filter unit, and then enters the next tank for adjustment and sedimentation. The water from the second compartment goes through a pipe screened at the inlet which crosses the second compartment with a series of valves and an air release out to the transmission main. There is also a drainage valve to clean out the second tank. This structure assures clean water to be supplied through the tapstands.

Handpump

For dug wells and boreholes, handpumps are installed for convenience in pumping up the water. Various handpumps, including the Rope Pump Lao-99, Tara and Afridev, were installed for purposes of monitoring them during the pilot study. From the responses given by the villagers, the Rope Pump Lao-99 seems to be the most favored type due to the comfortability of turning the handle and easiness in repairing.

Other Possibilities

GFS is the most preferred water supply scheme as chosen by the rural population, followed by wells using handpumps. However, if the conditions do not allow for using GFS or handpumps, other methods must be sought. Some alternatives to the above intake facilities are listed below.

Other Water Supply Alternatives

Situation	Option	Disadvantage
Stream intake point lower than village, and located within reasonable distance	Protected spring	Inconvenience in fetching water due to location of facility
	Pumping up to village with motorized pump	High requirements for operation and maintenance
Borehole drilling in village difficult due to geographical reasons	Dug well outside of village	Inconvenience in fetching water due to distance from village
	Pumping up to village with motorized pump from borehole or dug well outside of village	High requirements for operation and maintenance
Surface water not available and groundwater difficult to develop	Rainwater collection	Requires sufficient annual rainfall, and year round availability is preferable; Requires durable collection structure

The water source to be used for supplying water to the village is determined through community dialogue with the villagers and using the concept of informed choice. The villagers know what sources are available for them to use. If a stream up on the mountain is available, then they most often select this as their source for a GFS scheme. If a village has an existing water supply facility such as a dug well, then they usually want a GFS if possible, but if there is no stream available, they request a borehole. However, for some target villages which chose boreholes, the hydrogeological conditions revealed difficulties for groundwater development in their villages.

Upon selection of the water source by the villagers, survey of the water source is required to determine its potential and appropriateness. For the GFS, topographic surveys using hand levels were made to assess the height difference between the source and the supplying village, and also the distance from the source to the village, as well as the topographical structure of the proposed pipeline route. For groundwater sources, their availability and potential must be surveyed by such methods as geoelectric prospecting.

Stream or River

The source of water for the gravity fed system (GFS) is a stream or river up on the mountain. The flow rates of these sources are usually abundant in the rainy season, but sometimes become insufficient in the dry season. The sources of the GFS for the Pilot Study have enough water all year round, except for the source to supply the Pha Oudom scheme.

If the source is insufficient, as is in Pha Oudom, the residents of the village must make all efforts to (1) conserve the forest around the intake so that the source will not be depleted (which means no slash and burn around the intake point), (2) conserve their daily use of water in order for everybody to receive water for a long time, and (3) plan a water fetching time schedule to minimize queuing and to avoid simultaneous tap opening (which can cause problems in water shortage at certain taps).

Dug Well

In the past, dug well points were selected using experience and intuition, but many have failed. Therefore for the pilot study, geoelectric prospecting was carried out to scientifically determine the depths of the aquifer and bottom rock layers using electric resistivity measurements. These data were used to make selection of possible well points. Prediction of the depth of the bottom rock layer by geoelectric prospecting greatly increases the success rate of dug wells. Use of this method is highly recommended to improve the chances of a successful dug well.

Borehole

As was explained above for the dug well, geoelectric prospecting is highly recommended but it is even more important for boreholes because of greater uncertainties. In order to increase the chances of a successful drilling, test boring is also advised. Then, after a well is sunk, the groundwater flow must be confirmed by making a pumping test to assure the groundwater potential. Another important factor for a successful well, both borehole and dug well, is to analyze the water for its quality to verify its compliance with drinking water standards.

5.1.2 Water Quality and Quantity

The results of water quality analyzed at the laboratory reveal that there are no serious water quality problems for either of the pilot study water sources. However, the groundwater of the boreholes had undesirable odor believed to be caused by biological effects of the geology. Three important parameters for consideration in the assessment of water quality are reviewed below.

Turbidity: The turbidity is usually high just after the rainy season. Three samples from the pilot villages indicated turbidity values above the Nam Saat water quality standard of 5.0 NTU in November 1999, but the turbidity recovered within the standard in the next samples taken in January 2000.

Iron: Only one source of the pilot villages indicated an iron content beyond the Nam Saat water quality standard of 0.4 mg/l in November 1999. However, in the sample of the next survey in January 2000, the iron content recovered within the standard.

Coliform Group: In the samples of two sources, the coliform group counts were found slightly beyond the standard. On the other hand, samples from other sites indicated that the coliform group count after the rainy season was low due to the large river discharge as compared with other periods. Further, the number of coliform increased in the dry season due to the decrease in the discharge and increase in human activities surrounding the water source. The present situation concerning water contamination is not so serious, but tap water in the villages should be boiled before drinking.

Most of the potential sources in the target area have enough flow all year round. The average consumption rate of the pilot villages as measured from readings on the water meters is about 38 lit/cap/day.

5.1.3 Water Source Plan

The water supply schemes of the pilot study villages are functioning very well with only minor problems. Most villages are satisfied with the supply, but the borehole villages have a problem with water quality where the water has an undesirable odor. Therefore, the difficulty in groundwater development was witnessed and indicates that future planning of groundwater sources requires careful consideration.

On the other hand, if alternatives such as the GFS and wells using handpumps are not possible, then other technology must be selected. These include, protected spring, rainwater collection, and use of motorized pumps. The technical aspects of protected spring and rainwater collection do not need explanation, as they are very simple methods. However, using motorized pumps requires careful consideration on their selection. Motorized pumps can be driven by electrical power or generators. For most of the rural areas, power lines are not available, and therefore, some type of generator must be considered. The most popular type is the generator using diesel as fuel, but in remote areas, procuring fuel may be difficult due to limited supply as well as economic reasons of the poor villagers. The use of unconventional power such as wind or solar can solve this problem if their conditions in sufficiency of wind speed and insolation are met. Operation and maintenance costs for wind and solar pumps are very low, but their initial costs are higher than conventional fuels, and especially solar equipment can be very high.

5.2 Water Supply and Sanitation Plan

5.2.1 Water Supply and Sanitation Options

Water Supply

Through this Study, the selection of future water sources was carried out by following the consensus of the villagers based on the concept of Informed Choice as stipulated in the Sector Strategy. As a result, the GFS or gravity fed system is the water supply system chosen by most of the rural population in the study target villages. The source for the GFS is a stream or spring water, and the water is allowed to flow naturally to the villages through pipelines using the force of gravity. The water supply systems chosen by the villagers are listed below in order of preference.

(1) GFS : Gravity Fed System
(2) Borehole
(3) Protected shallow well or dug well
(4) Spring protection
(5) Rain water collection

Sanitation

During the village field survey, in addition to the selection of water supply facilities, latrines as a means of sanitation were also selected through the consensus of the villagers using the concept of Informed Choice. As a result, the pour flush bowl single pit latrine is the sanitation system chosen by the majority of the target rural population. The pour flush type latrine is water dependant and must have a sufficient supply of water to function effectively. The latrines chosen by the villagers are listed below in order of preference.

(1) Pour flush bowl single pit latrine
(2) Ventilated improved single pit (VIP) latrine
(3) Cover latrine
(4) Conventional pit latrine
(5) Septic tank toilet

5.2.2 Design Parameters

When considering a GFS scheme, the following factors need to be confirmed during the water source survey. If, on the other hand, one of the above conditions cannot be met, then the GFS might present some problems and other supply alternatives need to be considered.

(1) Flow rate of source: The flow must be sufficient to cover the design supply rate all year round.

(2) Water quality: The water quality must be suitable for drinking during all seasons.

(3) Distance to source: The source must be within transportable distance to the target village.

(4) Location of source: There must be enough height difference to supply water by gravity to the target village.

Basically, one source should supply one village. However, if a suitable source is not available for each village and groundwater development is difficult, the necessity to supply a number of villages with one source will have to be considered. In this case, the following considerations are essential to assure sustainability in both financial and managerial terms.

(1) Are the preliminary preparation period and construction period sufficient in consideration of the facilities scale?

(2) Are the actual needs of each village confirmed (does each village really want a GFS)?

(3) Upon making agreement with each village carefully considering their economic situation and ethnic differences, is it possible to create an organization for independent operation and maintenance?

(4) Is a fair distribution of benefits possible in relation to water fees collected and contributions in materials, labor and cash from each village?

(5) When a problem arises in operation and maintenance of the facilities, can the WATSAN committee conduct appropriate intervention and solve the problem?

For multi-village supply with one source, although cost-effectiveness of the system can be an advantage, the other inevitable problems will most likely overweigh this advantage. Whereas the pipeline network and valve operation for a GFS should be simple, when a number of villages has to be supplied from one source, they become more complicated to increase the number of troubles in the system.

Management of the system will also become more complicated where disputes can occur between villages, and so a strong solidarity is required with a trusted leader who can have control over all the villages concerned.

Upon discussions between the Lao side and the Study team, the following design standards were adopted for the pilot study.

- Population growth rate: 2.9%
- Target year: 15 years
- Unit supply rate
  - For water scheme only: 45 lit/cap/day
  - For water scheme + latrine: 45 - 50 lit/cap/day

The design criteria adopted by Nam Saat concerning the number of facilities for various water schemes are listed below. However, the number of tapstands needs to be determined also by considering the geographical layout of the village.

Facility Unit	Design Criteria
Tap for GFS	80 – 120 persons
Dug Well or Borehole	150 – 200 persons
Latrine	1 household or family

5.2.3 Facilities Plan

GFS Schemes

Facilities' designing for GFS is based on the social survey, water source survey, topographic survey and other village surveys conducted at an earlier stage. Engineers from Provincial and District Nam Saat with support from Nam Saat central take the initiative to prepare the GFS design report which includes general village information, pipeline routing, bill of quantities, cost estimation and facilities drawings, among others.

Through the community dialogue, preparations should be made for village committee organization and construction planning, followed by the construction works. However during GFS construction works, modifications such as pipeline route alterations, pipe material replacements and pipe joint quantity changes are inevitable, and therefore the GFS design report must be revised into a GFS completion report to be used as reference for operation and maintenance of the facilities.

Unexpected problems due to various causes arise during GFS construction works which necessitate changes in the original design. Since construction machineries are not used for GFS construction and laborers from the village including women are trenching the pipe laying routes, areas difficult to trench such as hard rock formations can be encountered which will require altering the route or replacing the pipe material to iron for laying on the ground. Furthermore, even under appropriate supervision, during the period when the laborers are becoming familiar with their work, the still inexperienced villagers who are mostly farmers can damage tools and pipe materials. If modifications are required during construction work for GFS, the supervisor must reconfirm the design in consideration of technical matters such as head loss in the pipe and pressure at the tap.

Due to the implicated modifications required for GFS, planning an accurate budget is difficult during the basic design stage. Other than uncertainties related to natural conditions, the transportation costs of materials to remote villages are also dubious, and therefore, consideration of contingencies may be necessary when making cost estimations.

For designing of GFS, it is important to realize that the facilities are to be constructed and maintained by villagers who are mostly farmers living in remote areas. This means that the specifications should include facilities which are easy to construct, durable and simple to repair. Therefore, the facilities need to be designed in accordance with results of discussions with villagers, selection by the villagers and agreement with the villagers concerning the materials, specifications, construction methods and other relevant factors.

Standard Materials

The materials required for GFS can be divided into materials contributed by the village and those procured by other sources. For selection of the latter materials, the following factors should be considered.

- Are they suitable for use by the villagers?
- Are they effortless to install, simple to construct, and easy to repair?
- Can they withstand seasonal changes and different natural conditions?
- Can they be easily managed during operation and maintenance, as well as during stock inventory?
- Can remote villages easily procure spare parts?
- Can they be conveniently procured with the maintenance budget from collected water fees? Is it inexpensive?

The adopted standard materials for pipes, taps, water meters and others should consider the special characteristic of the GFS and also receive the understanding of the villagers.

Pipe Material	- The main material shall be HDPE pipes will be adopted. - Efforts should be made to procure both local and imported products in accordance with the required quantity and construction schedule.
Tap Type	- The lever type and propeller type are available - The villagers should make the choice of type
Water Meter	- Installation in tapstand is standard - All available type are imported - Unify the type in one village - For effective operation and maintenance, install meters at the intake and storage tank - For multi-village scheme using one water source, install meters in each supply area to manage distribution

Standard Facilities

The main facilities of the GFS are intake, transmission main, storage tank, supply line and tapstand. Although the construction works are supervised and controlled by Provincial and District Nam Saat officers, in consideration of the fact that the actual construction is done by the villagers themselves, the following specifications for facilities shall be the standards.

Intake Facility

- Reinforced concrete structure having sufficient durability to withstand stream yield increases and water level rising in the rainy season. For this durability, the reinforcement bar shall be over ϕ 10 mm, and the outer wall thickness shall be more than 125 mm.
- A structure which can prevent the inflow of silt, sand, gravel, leaves and other debris. The main standard measures to deter stream water inflow are as follows, but they should be adopted in accordance with seasonal fluctuations and surrounding conditions of the intake point.
  - □ Raise the wall higher than the stream water level during the rainy season,
  - □ Relocate the intake to a point where the stream cannot flow over the intake.
  - □ Install a screen capable of preventing silt and other particles from flowing into the transmission main even when the sedimentation compartment has been agitated.
- Appropriate shape and sufficient depth of foundation to withstand the water pressure during the rainy season

Transmission Main

- HDPE pipes shall be used for laying underground and GI pipes for laying on the ground.
- Air vents and drainage valves shall be installed inside valve boxes at required locations along the pipeline route in accordance with the topography.
- If the transmission distance is very long traveling several km, then drainage valves inside valve boxes shall be installed at a minimum rate of one for every 1 km.

Storage Tank

- Reinforced concrete structure using reinforcement bars of over ϕ 10 mm.
- For tanks of capacity less than 12 m^3, the outer wall and floor thicknesses shall be more than 150 mm. For capacity more than 12 m^3, the outer wall thickness, >200 mm, and floor thickness, >250 mm.
- Roofs of reinforced concrete, and of wooden frame with corrugated galvanized steel sheets are being built. However, the wood frame with steel sheet type roof, being the most familiar with the villagers, shall be the standard.
- All exposed piping around the tank, including the inflow pipe, outflow pipe, overflow pipe and drainpipe, shall be located in one area and enclosed in a concrete box having a hinged steel cover with a lock.
- If necessary for effect management, operation and maintenance of the system, gate valves can be installed in both inflow and outflow pipes.
- Especially in the case of one water source supplying multi-villages, and multiple outflow pipes are installed for each supply area, a gate valve shall be installed for each supply pipe.
- Since the storage tank is usually located on mountains and in forests, tall grass and weeds can grow thickly around the tank to interfere with operation and maintenance. So, the area around the tank shall be spread with pebbles and gravel.

Supply Pipeline

- HDPE pipes shall be standard.
- If necessary for effective operation and maintenance, gate valves inside valve boxes should be installed for each supply area.

Communal Tapstand

- Usually, reinforcement bars are not used in tapstand structures, but since many cracks and broken pieces were seen in the concrete floor and drainage, the structure shall use reinforcement bars of over ϕ 6 mm as standard.
- The installation of soakaways located more than 3 m away from the concrete floor is standard. However, other drainage methods are acceptable in accordance with the surrounding area and possibility of sanitary connection to existing drainage ways.
- The valve box containing a gate valve and a water meter shall have a drainage hole, and covered with a hinged steel cover having a lock.

Standard Works

Similar to selection of materials and facilities specifications for GFS, the construction method of GFS also needs consideration due to its special characteristic. Especially, the following standards for construction works and their applications concerning pipeline trenching and ground tamping need careful attention

Trench Depth for Pipeline	- Shall be 800 mm below ground level - Since the labor force is the villagers which include women, the depths tend to be shallow. Take appropriate measures to avoid this situation.
Pipe Laying Location	- Consider changes in river pattern in the rainy season for laying transmission main along rivers - Pipeline routing shall sufficiently confirm the situation in the surrounding, such as river banks being scraped during the rainy season.
Ground Tamping	- Sufficiently level and tamp the work site of storage Tanks and tapstands - The tapstand must be sited at a location which is sufficiently higher than the surrounding area, in consideration that the ground level for tapstands must be higher than the soakaway, and that leveling and tamping will lower the ground level.

Wells and Latrine

Design reports are also required for dug wells, boreholes and latrines, which include general information of the village, list of quantities of materials, cost estimations and facilities drawings.

For dug wells and boreholes, other than the specifications required for drilling the wells, specifications for conducting geoelectric prospecting and pumping test are also important. The following table shows an example of requirements for drilling, geophysical surveys, tests and analyses required for construction of boreholes and dug wells.

Parameter		Borehole	Dug Well
Drilling Specifications		ϕ 6" × 50 m	ϕ 1m × 10m
Geoelectric Prospecting	Number of Points	5 points/well	3 points/well
	Method	Wenner	Wenner
	Depth	100 m	12 m
Pumping Test	Step Drawdown Test	5 Steps	5 Steps
	Continuous Test	24 Hours	24 Hours
	Recovery Test	12 Hours	12 Hours
Water Quality Analysis		Drinking Water Standard Items	

One of the characteristics of this Study is that not only water supply facilities were implemented, but latrines were also constructed as means to improve the sanitation environment. The materials required for construction of latrines, other than the latrine bowl, are mostly procurable by the villagers, and latrines can be constructed easily by the villagers. The villagers can easily build the superstructure housing from materials such as bamboo, wood, rattan, asbestos, concrete blocks and any other locally available materials. If the basic design is observed, then the construction materials and shape can be decided by the villagers, but advise should be given on the following points.

- The latrine should be located away from cooking areas
- The latrine should be located in a place having enough ventilation
- The slope of the floor around the bowl should be finished to allow enough drainage

With simple technical guidance on construction and maintenance, villagers can easily constructed their own latrines, and if the villagers become sufficiently aware of the importance and necessity of latrines, then sanitation facilities can become a part of daily village life

The following lessons learned from the pilot study on the effects of sanitation facilities can be applied to future planning.

- For villages receiving both water and sanitation facilities, the two facilities gave multiple effects to improve the sanitary environment and raise the satisfaction of the villagers.
- For villages which received only water facilities, their desire for sanitation facilities became evident after the construction. This phenomenon shows the importance of using latrine construction as a model case.

Constructed Facilities

The water supply and sanitation facilities constructed through villagers' participation during the pilot study and pilot study extension are listed in the following table. Out of the 81 study target villages, a total of 50[1] villages were implemented as pilot studies with 21 GFS schemes, 2 dug wells and 2 boreholes, and 24 villages received pour flush type latrines.

[1] The total number of villages actually targeted for the two pilot studies was 51 villages, but during the implementation, a request was made to cancel one village, L-11 Nam Ma in Long District of Luang Namtha Province, due to its resettlement. Therefore the total number is 50 villages

Facilities Implemented through the Pilot Studies

Pilot Study				Pilot Study Extension			
No.	Village Name	Water Scheme	Latrine	No.	Village Name	Water Scheme	Latrine
Bokeo Province							
Houayxai District							
H-1	Poung	GFS	Pour Flush	H-2	Phokham	GFS/1 Scheme 2 Villages	Pour Flush
H-3	Nam Ngao	Dug Well		H-4	Hoai Makeo		Pour Flush
H-7	Namma	GFS	Pour Flush	H-5	Done Phao	GFS	
H-9	May Phatthana	Borehole		H-8	Namphou	GFS	Pour Flush
H-17	Maynignom	GFS 1 Scheme 9 Villages	Pour Flush	H-26	Phibounthong	Dug Well	
H-18	Thongsengchan			H-27	Houakhoua	GFS 1 Scheme 4 Villages	Pour Flush
H-19	Xiengnam			H-28	Pakhaotay		
H-20	Nongneun			H-29	Thongbia		
H-21	Nale		Pour Flush	H-30	Viengmay		Pour Flush
H-22	Chomchouk						
H-23	Paksang		Pour Flush				
H-24	Maypoukha		Pour Flush				
H-25	Namhotay		Pour Flush				
H-31	Done Keo	GFS	Pour Flush				
H-32	Hat Phouan	GFS					
H-37	Leang	Borehole					
Pha Oudom District							
P-1	Phiengkham	GFS 1 Scheme 9 Villages					
P-2	Thinkeoneua						
P-3	Thinkeokang						
P-4	Thinkeotay						
P-5	Phaoudom						
P-6	Nathong						
P-7	Phonexay		Pour Flush				
P-8	Somsavang						
P-9	Sonexay						
Luang Namtha Province							
Viengphoukha District							
V-6	Pangxai	GFS	Pour Flush	V-1	Nam Mai	GFS	Pour Flush
V-8	Nam Seua	GFS					
Long District							
L-1	Xiengkok May	GFS/1 Scheme 2 Villages	Pour Flush	L-6	Nong Kham	GFS	Pour Flush
L-2	Xiengkok Kao		Pour Flush	L-7	Nam Bak	GFS 1 Scheme 4 Villages	Pour Flush
L-4	Luang	GFS		L-8	Luang Phokham		Pour Flush
L-13	Chakhamping	GFS		L-9	Phaya Luang		Pour Flush
L-15	Tinthat	GFS		L-14	Khok Hin		Pour Flush
L-21	Daen Kang	GFS/1 Scheme 2 Villages		L-23	Kang	GFS	Pour Flush
L-12	Hoai Mo			L-11	Nam Ma	Cancelled*	
Total	34 Villages	16 Schemes (13 GFS) (1 Dug Well) (2 Borehole)	12 Latrine Villages	Total	16 Villages (1 Cancelled)	9 Schemes (8 GFS) (1 Dug Well	12 Latrine Villages
TOTAL	**50 Villages**	**25 Water Schemes (21 GFS, 2, Dug Well, 2 Borehole)**				**24 Latrine Villages (Pour Flush Latrine)**	

N.B.: *Due to resettlement of this village, a request was made to cancel this village.

5.2.4 Organization for Construction Works

Since the construction works of GFS is actually conducted by the villagers, the organization of the construction works must consider the community characteristics and nature of the villagers. Some villages have high availability of construction materials, while other villages cannot procure any materials; some villages have many skilled workers such as masons and carpenters, and other villages which consist mainly of farmers have very few skilled workers available. These differences in characteristics and nature of each village create differences in attitude towards acceptance of the construction works, which means that the supervision and control by Provincial and District Nam Saat staff require flexibility to cope with the different requirements.

For the villages having low availability of materials and only a few skilled workers, basic technical assistance in construction is inevitable, and elementary explanations on GFS including work demonstrations are needed. Therefore, for these villages, enough time must be anticipated in the scheduling. Furthermore, the manning assignments must also consider this situation by increasing the number of staff from all levels for supervision and coordination of these villages.

For the villages having understanding and experience in similar work also need attention. These villages may not have enough understanding as needed or they may be thinking easily about the construction, where in this case, the village is most of the time very loose about accepting the construction work. If their understanding on GFS is low, they might make requests such as additional tapstands, bigger diameter pipes and frequent changes in siting of facilities. If this is the situation, the supervisor in charge should not give in easily to accepting the additions and changes, but rather make explanations on the design particulars until they clearly understand the situation.

As participation is the key word to the construction works, the contributions in labor, local materials and cash from the village are very important. Furthermore, well managed collaboration between the villagers and the supervisors will greatly contribute to the smooth and effective progress of the construction works.

5.3 Sanitation Promotion and Hygiene Improvement Plan

5.3.1 Proposed Plans

To design an environmental health promotion program, although we need to focus upon some particular topics, the necessary messages are already established by the former efforts of the Ministry of Public Health and other concerned agencies. By reviewing existing training materials provided by those agencies, and also observing workshops conducted by the study team at some villages, certain communication difficulties have been identified. It is not only because of the different languages used by the ethnic minorities, but also the visual aids provided to support communication could not reach their understanding. It is partly because the visual aids are designed based on an average life pattern of a Laotian and some villages differ significantly from the average. Another important point is that the message should have been empirically acceptable for the target villagers, in order to have significant impacts to their attitude and practice change. For those reasons, the study team proposes three points of ideas for health promotion activities as follows.

Presentation of Actual Epidemic Episodes by Local Health Staff

Actual episodes such as cholera outbreaks in the villages with actual names of the places and persons should receive acceptance with the local people with the best of interest.

Actual Scenes of Village Life

Digital cameras and projectors can be used to show real scenes of life such as water fetching, preparation of food, bathing, washing, latrines and so on for clear understanding by the villagers of health related messages no matter how different they are from the average life pattern. It can be tailored out particularly for the target villages.

De-worming

Since knowledge of bacteriology is not common for ordinary people, to make them see real parasite infection in a simple way, de-worming is the most powerful IEC tool for health promotion. Ascariasis seems common in the study area, and therefore after taking de-worming medicine, a handful of roundworms will appear with the stool next morning. It will have an almost magical impact to raise health consciousness among the village society.