No

JAPAN INTERNATIONAL COOPERATION AGENCY
MINISTRY OF RURAL DEVELOPMENT, CAMBODIA

THE STUDY ON GROUNDWATER DEVELOPMENT IN SOUTHERN CAMBODIA

FINAL REPORT
MONITORING REPORT

JANUARY 2002

KOKUSAI KOGYO CO., LTD.

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SUMMARY

This report is compiled based on the Monitoring Study, which was conducted at the 20 pilot villages in southern Cambodia from the year 2000 and 2001.

1. Objectives of the Study

The primary objectives of the study were to ascertain the effectiveness and the improvements in O&M by the communities through the monitoring of water use conditions, the state of the pilot water supply facilities, residents' participation in O&M activities and improvements in health and sanitation.

2. Monitoring Methodology

The following questionnaires were used for the study. DWRS and PDRD staff conducted the monitoring study through interviews with villagers together with the Study Team.

- JICA Hand Pump Participatory Monitoring Sheet
- Questionnaire for monitoring VWC and WPC
- Questionnaire for Monitoring Five Sample Households

Groundwater samples were collected at each pilot well and temperature, pH, electric conductivity and oxidation - reduction potential were measured on site. The groundwater samples were sent to a laboratory for chemical analysis.

3. State of the Facility

24 test wells including 20 pilot wells are operative and in good condition. However, one well is inoperative due to the falling out of the U-seal in the year 2000. In addition, sand sediment and ferrous hydro-oxide sludge were found at several test wells. These test wells were repaired or re-developed to recover the yield.

The iron removal devices were utilized very often at 2 sites. However, they were not used or rarely used at 5 sites. In addition, the outlet valve of the device was broken at every site.

In order to encourage the use of iron removal devices, the iron removal devices (old type) were modified, and at the same time, the improved iron removal devices (new type) were installed at 11 sites during the years 2000 and 2001. 7 out of the 11 are being used and 4 are not used or used sometimes. Iron was effectively removed by both old and new types according to the WHO guideline value (0.3 mg/ℓ).

4. Water Quality, Quantity and Level

Groundwater samples of the test wells generally show high Fe concentration. Fe concentrations are particularly high in the test wells of Prey Veng and Svay Rieng. High chloride concentrations are found at the test wells in Kandal, Ta Keo and Peri-Urban Area (one test well in each province). Arsenic was not detected in any test well, however, fluoride exceeding the WHO guideline value, was detected at one test well in Peri-Urban Province. Manganese exceeding the WHO guideline value was also found in several test wells. The tendency of the water quality analyses is almost same as the results of analyses that were conducted in 1997, 1999, 2000 and 2001 at the same test wells.

The groundwater level is within 10 m everywhere except one test well. The difference in water level between the dry and rainy seasons ranges from 1 to 3 m. The pumping rate is stable and a sufficient quantity of water is available.

5. Arsenic in Existing Wells

Field water tests were carried out at 260 villages including the target villages for groundwater development. Arsenic was detected at 20 villages. Of the 20 villages, 11 showed arsenic concentrations of more than 0.05 mg/ℓ. The high arsenic zone is located in the alluvial lowland along the Mekong and Tonle-Bassac Rivers. It is necessary to conduct a detailed survey on the non-target villages and guide the villagers to stop drinking and to utilize iron removal devices.

6. Water use

Changes in water use were observed at the pilot water supply facilities (test well with hand pump) after their construction.

1) Amount of water used has increased.
2) Facilities are utilized not only in the dry season but all seasons.
3) Water is mainly used for washing and bathing.
4) Water is used for drinking and cooking, particularly, in the dry season.
5) The frequency of water fetching by children has increased since construction because water fetching is now easy.
6) The frequency of water fetching by women has also increased, however, the workload for women has not become heavier.
7) The residents feel the benefits of workload reduction and improvements in water quality and health and sanitary conditions after construction.

7. Participatory O&M

The followings are observed in the O&M of communities.

1) The number of users of the pilot water supply facilities is 34.7 households on average (population of about 170). However, the number was drastically reduced in the villages of Prey Veng, Svay Rieng and Kg. Speu because private wells are increasing particularly in these provinces.
2) VWC/WPC members are aware of their role in O&M activities. VWC/WPC meetings are not held regularly, however, the attendance rate of the residents is high when it is held. The residents have constructed fences around the facility, have been washing the sand filters in the iron removal devices, have replaced the valves with wooden plugs and have conducted sanitary education with their knowledge and local skills.
3) Water fees have been collected at only 7 villages. An average of 100 to 200 Riel per household was collected 5 times during the year 2000. The savings have reached 5,000 to 25,000 Riel per village up to now, however, it is not enough to cover repair costs for the hand pumps. In the villages where water fees have not been collected, people say that it hasn't been collected because the hand pumps are broken. Some villages used their savings in 2001 for repairs, purchasing soil to protect hand pumps from floods etc.

8. Education on the Environment and Sanitation

1) Generally, the caretakers have kept the water supply facilities clean. The residents

think that the well environment has improved and is clean compared with previous conditions. However, garbage is scattered around the platform and the ditch in many villages. Therefore, there is a need for more public education on environmental sanitation.

2) The use of water containers or jars and their covers is recommended for the residents in order to keep safe water. Such a daily practice has not increased compared with the survey results in 1999. However, the number of households that drink water without boiling it has increased. This might be due to too much confidence in the pilot water supply facility.
3) On the other hand, almost all residents replied that the sanitary education conducted by the Study Team was effective for their daily lives. Therefore, further education on sanitation and health is necessary to improve sanitary conditions in the villages considering the above matters.

9. Social and WID Issues

The pilot water supply facility plays many important roles in the pilot villages. It is a valuable water source for Female Headed Households (FHH) and reduces the women's housework. It is an easy and safe water supply facility for children and because it is a stable water source all year round, it is becoming an important water source for villagers including neighbors in the dry season.

Based on the WID points of view, the followings are recommended.

1) Enrichment of peripheral families
2) Enforcement of hygiene education
3) Installation of hygiene facilities
4) Consideration of FHHs and children
5) Involvement of women resources and empowerment of VWC/WPC

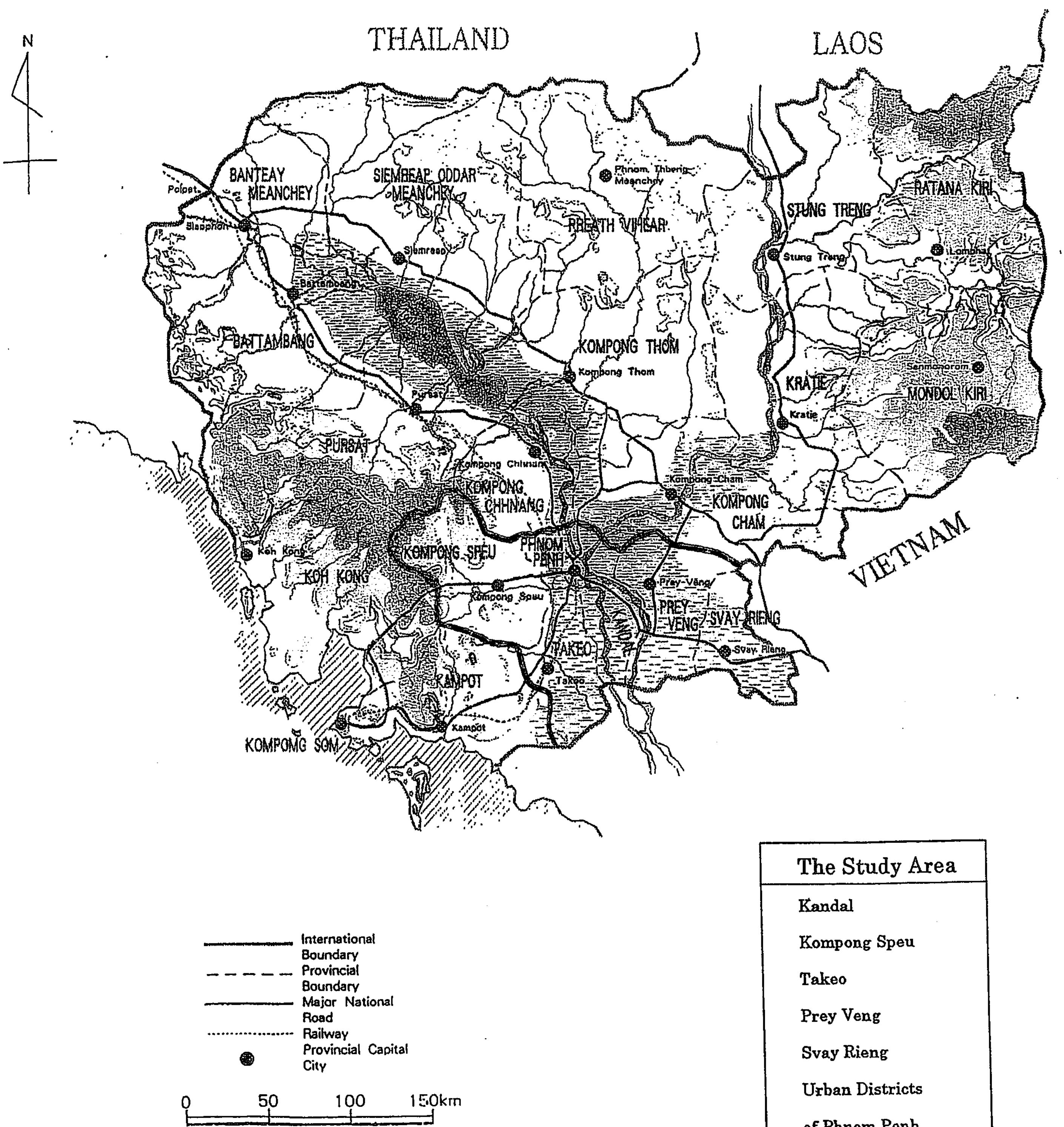
10. Government Support of O&M

1) DWRS staff sometimes visit the pilot villages, however, the staff from PDRD, district and commune do not visit.
2) The tools and spare parts for the hand pumps are not sufficiently stocked in the PDRD warehouse.

Request procedures for assistance in repairs and the purchasing of spare parts were documented but they are still not well known. The government agency should establish a system of support for the O&M of the communities including preparation of a tariff to cover the cost of repairs and spare parts.

LOCATION MAP OF THE STUDY AREA

CAMBODIA



The Study Area
Kandal
Kompong Speu
Takeo
Prey Veng
Svay Rieng
Urban Districts of Phnom Penh

ABBREVIATION

ADB:	Asian Development Bank
AICF:	Action Internationals Contre la Faim
B/C:	Benefit Cost Ratio
CARD:	Committee for Agricultural and Rural Development
CASD:	Community Action for Social Development
CCC:	Cooperation Committee for Cambodia
CWB:	Central Water Base
DCD:	Department of Community Development
DOH:	Department of Hydrology
DPB:	Department of Road and Bridges
DPWS:	Department of Provincial Water Supply
DRWS:	Department of Rural Water Supply
EIRR:	Economic Internal Rate of Return
EC:	Electric Conductivity
FHH:	Female-Headed Household
FSEDP:	First Socio-Economic Development Plan 1996~2000
GDP:	Gross Domestic Product
GRET:	Group de Recherche et d’Enchanges Technologiques
JICA:	Japan International Cooperation Agency
LWS:	Lutheran World Service
MAFF:	Ministry of Agriculture, Forestry and Fisheries
MIME:	Ministry of Industries, Mines and Energy
MOH:	Ministry of Health
MPWT:	Ministry of Public Works and Transport
MRD:	Ministry of Rural Development
NCHE:	National Center for Hygiene and Epidemiology
NIS:	National Institute of Statistics
NPRD:	National Program to Rehabilitate and Development Cambodia
NPV:	Net Present Value
PADEK:	Partnership for Development in Kampuchea
PDRD:	Provincial Department of Rural Development
PDRC:	Provincial Rural Development Committee
RGC:	Royal Government of Cambodia
PMU:	Project Management Unit
PRA:	Participatory Rapid Appraisal
PRASAC:	Program de Rehabilitation et Aqqui au Secteur Agricole du Cambodge

PRK:	People's Republic of Kampuchea
PWSA:	Phnon Penh Water Supply Authority
RGC:	Royal Government of Cambodia
S/W:	Scope of Work
TRT:	Trainer's Training
UNHCR:	United Nations High Commissions for Refugees
UNICEF:	United Nations Children's Education Fund
UNPA:	United Nations Population Fund
UNTAC:	United Nation's Transitional Authority in Cambodia
VDC:	Village Development Committee
VLOM:	Village Level Operation & Maintenance
VSC:	VLOM Steering Committee
VWC:	Village Water Committee
WATSAN:	Water and Sanitation
WES:	Water and Sanitation Program
WHO:	World Health Organization
WPC:	Water Point Committee
WUHE:	Water Use and Hygiene Education

The Study on Groundwater Development in Southern Cambodia
Final Report

Monitoring Report

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CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

The Study on Groundwater Development in Southern Cambodia commenced in December 1996 based on the Scope of Work (S/W) signed by the Ministry of Rural Development (MRD) and the Japan International Cooperation Agency (JICA) in September 1996. The Study, however, was discontinued in July 1997 due to armed strife in Cambodia during the first study work in Cambodia. The general elections held a year later calmed down internal conditions and consequently the Study was resumed in March 1999. In May of the same year, the second study work in Cambodia was completed. Based on the results of studies carried out until May 1999 and their analysis that was done in Japan, the Draft Final Report (II) (DF/RII) was prepared and submitted to the MRD. The DF/RII compiled the groundwater development and water supply plan targeting 241 villages in five southern provinces and recommended its early implementation.

The Study was also scheduled to continuously monitor 20 pilot water supply facilities in 20 villages until December 2001. The pilot water supply facilities were constructed in July 1997 as an important part of the Study in terms of groundwater hydrology as well as water supply for the village people. They are composed of deep wells, hand pumps, platforms and iron removal devices. Village Water Committees (VWC) and Water Point Committees (WPC) were established at these pilot villages during the study in Cambodia. The main purpose of the monitoring was to ascertain how the village people operate and maintain these facilities.

This is the final monitoring report. The report describes the results of the monitoring that was conducted from June 2000 to December 2001. The monitoring results should be reflected in the groundwater development and water supply plan in the future in Cambodia.

1.2 Monitoring Objectives & Pilot Villages

1.2.1 Objectives

The primary objective of the monitoring was to evaluate the effectiveness of the water supply facilities as well as find out the problems, which may occur in operation and maintenance (O&M) by the villagers. The monitoring activities focused on water use, facility conditions, community participation in O&M, the effectiveness of hygiene education, groundwater quality and levels, assisting capacity of MRD and PDRD, and so on.

Throughout monitoring, data was analyzed and used to improve the existing guidelines in rural water supply programs, such as VLOM, the standard platform design and, most importantly, O&M by the villagers on their own initiative.

It is important to learn from the villager's opinions by mobilizing the community and sharing information and experiences on the process and the results with all of the concerning agencies of every class and level. The Study also aimed at empowering the local community and government agencies to enhance their awareness for self-reliance. In order to achieve this goal, participatory monitoring was considered to a maximum extent.

1.2.2 Pilot Villages

The monitoring was carried out in the twenty (20) pilot villages out of the twenty four (24) villages where the test wells were constructed in July 1997 (see Figure 1.1 and Table 1.1).

1.3 Monitoring Methodology

Periodical monitoring was conducted in 20 pilot study villages, four (4) times at six (6) month intervals from May 2000 to December 2001. The Study Team employed some of PRA methods for monitoring in collaboration with the Department of Rural Water Supply (DRWS) and Provincial Department of Rural Development (PDRD) officials. Participatory monitoring has an advantage of sharing information and experiences among concerning parties, in particular, the local communities and to learn from them. Therefore, maximum involvement of local communities in monitoring activities was encouraged. The Study Team assisted the local committee members in mobilizing users for monitoring activities and the Water Point Committee (WPC) and Village Water Committee (VWC) members mobilized village users and promoted participatory monitoring. In order to make the cross-checking system function, great care was taken to involve people of all classes and levels in monitoring activities. The Study Team regularly visited the pilot villages. Participatory monitoring was made up of diagramming, ranking, meeting and open-ended interviews with various classes such as users, committee members, village leaders, vulnerable and illiterate people, both male and female.

Monitoring activities were implemented using the following four questionnaires prepared in the pilot survey on:

- Economic Impact of the Project
- Hand Pump Use
- VWC and WPC members
- Village Organization and Hygiene Education

Moreover, concerning iron removal devices, O&M activities and facility-use, questionnaires were prepared to gather the users' opinions. The results of the participatory monitoring were used to modify the design of the facility.

Throughout the monitoring period, follow-ups were conducted on five (5) sample families to ascertain the effectiveness of the facilities and the social impact and problems, such as water use, hygiene, household income and participation in activities.

Moreover, the assisting capacity of government agencies such as PDRD and DRWS offices was also monitored in terms of long-term sustainability. Specifically, observations were made on O&M materials, the notification system, the training of pump mechanics, management efficiency and so on.

The results collected from the monitoring conducted in every sector of the pilot study were analyzed. In consideration with those findings, the problems were adapted or modified. The initial fixed indicators and items were revised or were added to the monitoring scheme accordingly in order to achieve its own purpose effectively and precisely.

Monitoring items were determined in all sectors of the pilot study program. Monitoring items were analyzed quantitatively or qualitatively. An indicator for each monitoring item was quantitatively fixed as much as possible in order to measure change statistically. However, some indicators were qualitatively measured. For instance, community participation in O&M was analyzed qualitatively because it was mostly analyzed by invisible output such as organizational growth, committee behavior and committee self-reliance.

The following are monitoring items, which were key clues to understanding effectiveness, efficiency, accountability, equality and problems to be modified in the pilot study. The collected data was compared and analyzed with users to use as feedback.

(1) Water Use

The following items were monitored not only in terms of profit and problems in water use but also the socio-cultural, economic and local institutional impacts, of course considering gender:

- Time spent on fetching water before and after construction
- Distance traveled to fetch water before and after construction
- Frequency of water fetching per day
- Purpose of water use
- Quantity of water used daily
- The person who fetches water

(2) Facility Conditions

Facility conditions were monitored mainly by interviewing users and participatory ranking. Specifically, iron removal devices were carefully monitored in order to improve their design. Moreover, throughout the monitoring term, the study team took into consideration the significance of the committee members making the users sensitize to the purpose and effectiveness of the device, the proper use of the device and O&M methods, whenever it may be necessary.

1) Hand Pump

- Conditions of hand pump

- Damage of U-seal
- Sedimentation of sand and iron hydroxide
- Corrosion of steel material
- Proper length of pump rod

■ Conditions of platform and drain
- Crack and damage of the structure
- Appropriateness of water-flow in drain

■ Cleaning

2) Iron Removal Device

- Conditions of the device
- Cleaning
- Effectiveness of the device by comparing water quality before and after iron-removal
- Changes in purpose of water use before and after iron-removal
- Measurement of user acceptable values of iron for each purpose of water use
- Conveniences and inconveniences in use of the device

(3) Community Participation for O&M

The below items will be key issues to determine the effectiveness and matters of concern on what was input concerning O&M in the last meeting and training. Most of items have been analyzed qualitatively to see invisible output. The results on community participation in O&M will be reflected in the tentative VLOM guideline.

1) Organizational Growth

- Allocation of specific roles to committee members
- Increasing self-reliance by participating in community activities

2) Committee Behavior and Self-reliance

- Involvement of members in committee discussions and activities
- Degree of committee members' knowledge used effectively in their activities versus reliance on outside technicians and 'experts'.

3) Fund raising

- Collection of user fee and its management
- System of collecting the charge
- Amount collected per family

4) O&M activities

- Repair/maintenance work on hand pump and iron removal devices
- Cleaning
- Communication skills
- Recording skills concerning periodical inspections, repair work, user registration, inventory, accounting reports, meetings, etc.,

5) Activity indicators

- Size of membership (number of registered users)
- Frequency of meetings; amount of cash/labor contributed by users
- Amount of savings generated
- Management skills

(4) Beneficiaries of the project

Who benefits from the program and how the program benefits both male and females will mainly be monitored based on the below items.

- Number of target population actively using the facilities set up by the project
- Reduction in time spent on water fetching, how spared time is used, if there is any
- The population that benefits from the program
- The actual benefits of the program

(5) Effectiveness of Hygiene Education

The effectiveness of public educational activities on hygiene held in the last meeting of the pilot study was monitored by interviewing, observing and handing out questionnaires regarding the following items;

- Sanitary conditions of the hand pumps and their surrounding areas
- Proper disposal of litter and excrement
- Safe water use
- Cleaning

(6) Groundwater Quality and Level

Groundwater quality and level were monitored to study their conditions and the sustainability of the water resources by measuring following items;

- Changes in groundwater level during the dry and rainy seasons.
- Water analysis particularly on bacteria, such as colon bacillus, and iron by

compared the dry and rainy seasons.

- Confirming user acceptable values of iron for each purpose of water use

(7) Assisting Capacity of Each Government Agency

In general, the assisting capacity of government agencies was monitored by interviewing PDRD and MRD officials, the committee members and local people. At the provincial and national levels, the capacity of PDRD and MRD offices was monitored in terms of material and personnel, such as material storage conditions and staff's attitude. The trainers' input into the training programs was also monitored, according to tentative VLOM guidelines. The following are monitoring items for measuring the assisting capacity at the provincial and national levels:

- Procurement and inventory of maintenance tools and spare parts
- Repair team's accountability
- Notification system
- Recording skills

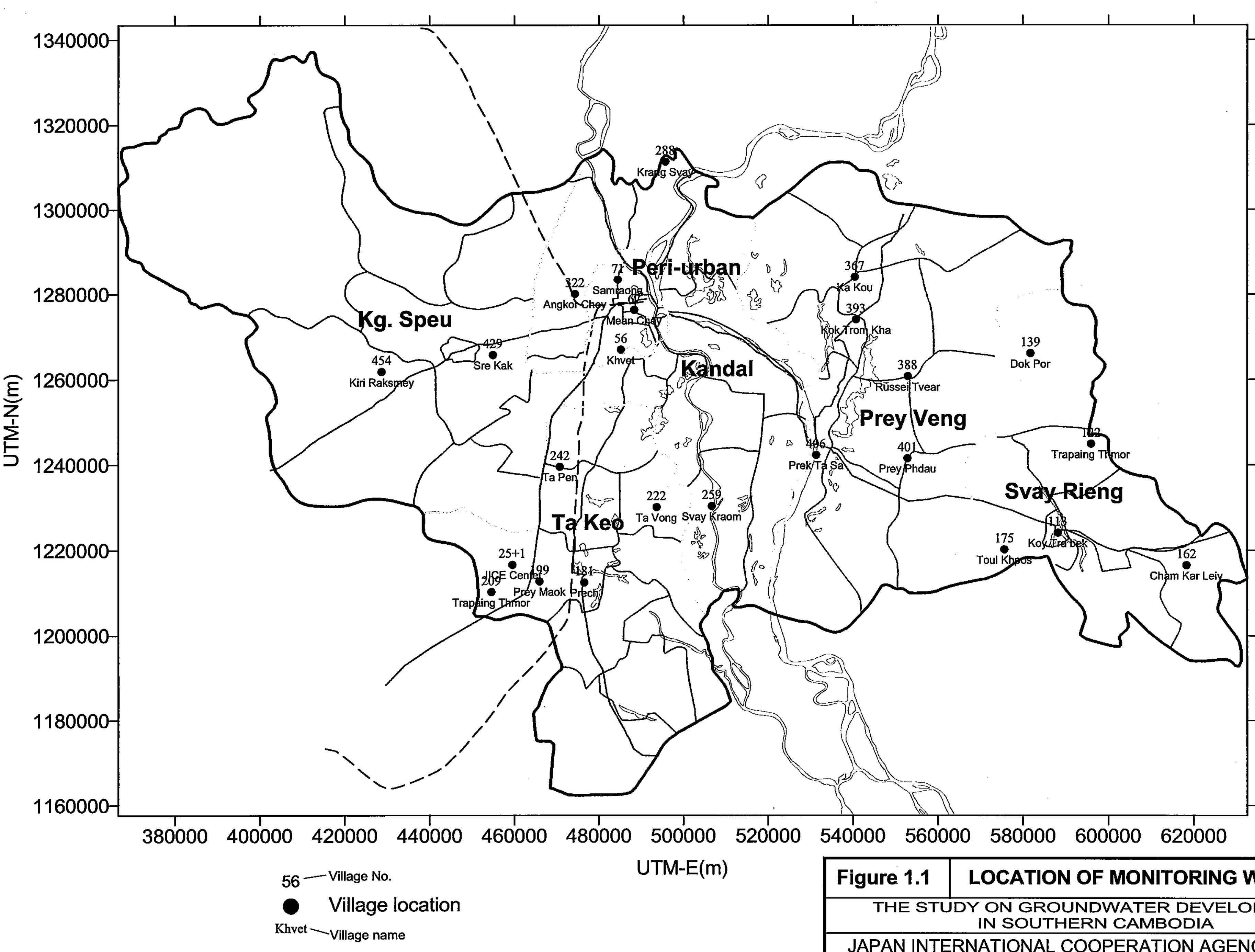

Figure 1.1	LOCATION OF MONITORING WELLS
THE STUDY ON GROUNDWATER DEVELOPMENT IN SOUTHERN CAMBODIA	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

Table 1.1 List of Pilot Study Villages

No.	Province	District	Village	Population*	Location		Remarks
					UTM-E(m)	UTM-N(m)	
56	Phnom Penh	Dangkao	Khvet	562	484926	1266465	
67	Phnom Penh	Dangkao	Mean Chey	3259	488660	1275999	
71	Phnom Penh	Russei Keo	Somrong	652	484983	1283229	not monitored
113	Svay Rieng	Svay Rieng	Koy Tra Bek	1374	587748	1224037	
122	Svay Rieng	Rom Doul	Trapaing Thmor	604	595913	1245674	
139	Svay Rieng	Ro Meas Hak	Dok Por	457	581674	1266154	
162	Svay Rieng	Chan Trei	Cham Kar Leiv	809	618359	1216428	
175	Svay Rieng	Svay Chrom	Toul Khops	1048	574586	1219825	
181	Ta Keo	Doun Keo	Preach	1091	478603	1212775	
199	Ta Keo	Tram Kak	Prey Maok	689	465890	1212780	
209	Ta Keo	Tram Kak	Trapaing Thma	800	454635	1210199	
222	Ta Keo	Prey Kabbas	Ta Vong	1197	493749	1230039	not monitored
242	Ta Keo	Bati	Ta Pen	384	471254	1239367	
259	Kandal	Kaoh Thum	Svay Kraom	1634	506870	1230577	
288	Kandal	Mukh Kampul	Krang Svay	1588	495710	1311424	
322	Kandal	Angsnuol	Angkor Chhey	115	475025	1280114	
367	Prey Veng	Pea Reang	Ka Kou	581	540495	1284118	
388	Prey Veng	Me Sang	Russei Tvear	718	553038	1260510	
393	Prey Veng	Kmapong Leav	Kok Trom Kha	524	540512	1274163	
401	Prey Veng	Ba Punum	Prek Phdau	622	552924	1241861	
406	Prey Veng	Peam R6	Prek Ta Sa	833	531212	1242164	not monitored
429	Kg. Speu	Peam Chor	Sre Kak	358	454500	1265612	
454	Kg. Speu	Phnom Srouch	Kiri Raksmey	480	429542	1260960	
(25/1)	Ta Keo		Nang Sray		459556	1216675	not monitored

*Population: Based on the village head interview in 1997.

CHAPTER 2

FACILITY CONDITIONS

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2.1 Technical Observation in 2000

2.1.1 Hand Pump

Of the 24 test wells constructed (including those in the 20 pilot villages), test well No.67 was damaged and the villagers could not use the well.

(1) Damage of the U seal

Due to the U-seal falling out, well No.67 cannot produce water and water discharge is not good in well No.367. The U-seal of the well No.322 was damaged due to sand abrasion.

(2) Sedimentation of Sand and Ferrous Hydroxide

Although well No.322 was washed in 1999 during the third field survey, a sand deposit was found near the check valve, adversely affecting the flow and discharge of water in the well. It seems that the well was not sufficiently developed during well construction. A small amount of both reddish brown and black sludge (ferrous hydroxide) was found in some parts of the rod. It might have been caused by oxidation of the dissolved iron and manganese.

(3) Rust

The bolt nut of the pump head of the well that is producing water of high electric conductivity is rusty. Dismantling the pump head is difficult in this case.

(4) Suitability of Pump Rod Length

The length of the pump rod was adjusted to a suitable length at four wells (well Nos.162, 175, 181 and 388). It seems that the pump rod was not properly set when the wells were constructed.

2.1.2 Platform and Drain

Cracks and/or gaps, caused by the settlement, were found at the joints connecting the platforms and the drains of all the test wells. Reinforcing of the joints should be required in future designs.

The walls of the platforms should also be removed because they seem to obstruct hand pump maintenance.

(1) Cracks and Damage

The platforms were generally in good condition; specially no damage or cracks were observed. However, because the structure that adjoins the platform and the ditch has subsided unequally, cracks have developed in the wells. These cracks were repaired in 1999. Although these damage was minor, more settlement than before was observed under the adjoining structure in well No.288 has. Also, a crack in one well (No.288) was detected; this is attributed to the unequal settlement of the ground around the platform.

(2) Stagnant Wastewater

Wastewater was not observed to be stagnant in the facility. However, the terminal section of the flow path forms a ditch or a pond, and wastewater was observed to be stagnant in areas with unfavorable drainage conditions.

(3) Cleaning of Facility

Facilities are generally clean but garbage was scattered around the flow terminal of many sites.

2.1.3 Iron Removal Device (IRD)

Only 2 of the iron removal devices installed in a total of 7 wells, are often used (Nos.139 and 162). The rest are used only sometimes - rarely.

(1) Condition of the facilities

In spite of repair in 1999, most of the valves are damaged due to children's pranks. The villagers have replaced the broken valves in wells No.162 and 175 with wooden plugs.

(2) Cleaning

The cleaning and the replacement of the filter of the device are being carried out by the villagers only at well No.162.

(3) Changes in Water Use Before and After Iron Removal

The iron removal device is effectively being used for drinking and cooking purpose in No.139 and No.162. For washing clothes and bathing, on the other hand, the villager are using pumped water directly without treatment.

(4) Use of the Device

Water pumped into the bucket is directly poured into the upper part of the IRD. Since the filter is churned when water is poured, a plank was devised and installed during this field survey as a buffer for water flow. Furthermore, since carrying a bucket and pouring water into the IRD may be strenuous for the villagers, a newly designed iron removal device was installed. Water flows directly into the new device from the hand pump. The results of the use of the two types of the iron removal devices will be compared.

2.1.4 Repair and Improvement of the Facility

(1) Hand Pump

For the broken hand pump of No.67, all riser pipes and pump rods were pulled up in order to pick up the plunger valve. After obtaining the plunger valve, all riser pipes, pump rods, valves and the pump head were re-installed properly. The damaged U-seal was removed and changed to a new one. The pump rod was shortened and re-installed properly.

(2) Iron Removal Device (IRD)

1) Repair Water Valves

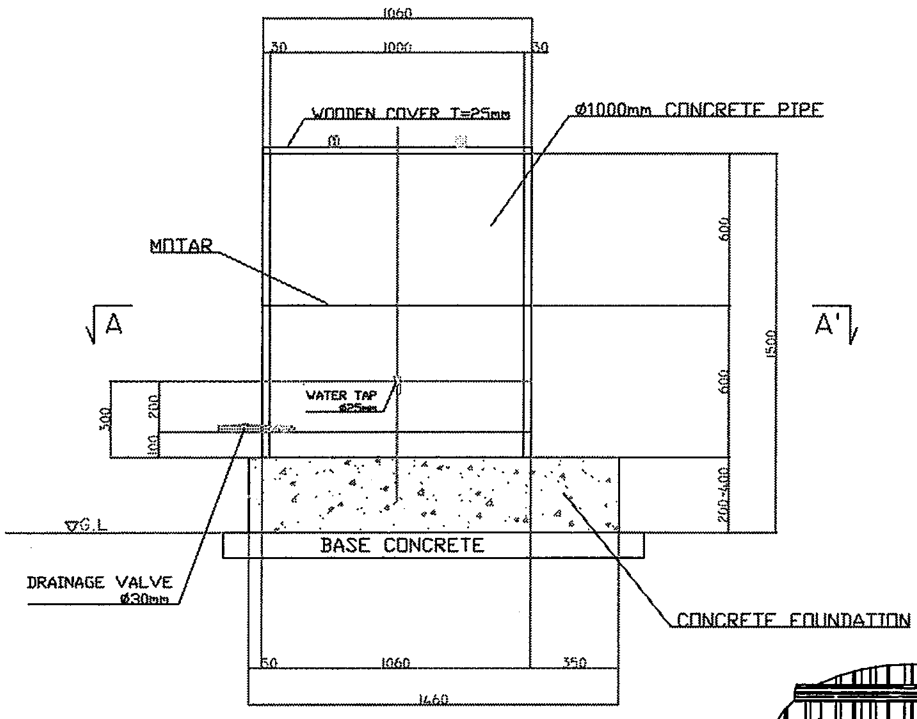
All broken water valves were changed to new valves in November 2000.

2) Improvement of the Device

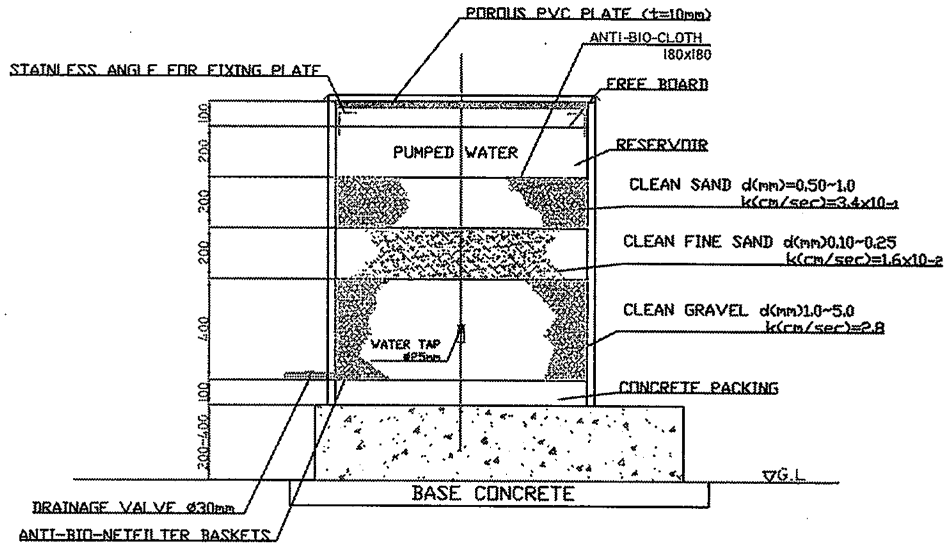
A PVC perforated plate has been installed at the upper part of the device in November 2000 for the following purposes. The drawing of the device is shown in Figure 2.1.

- To prevent the erosion and disturbance of the filter materials when water is poured into the device.
- To aerate water when it drops through the holes of PVC plate

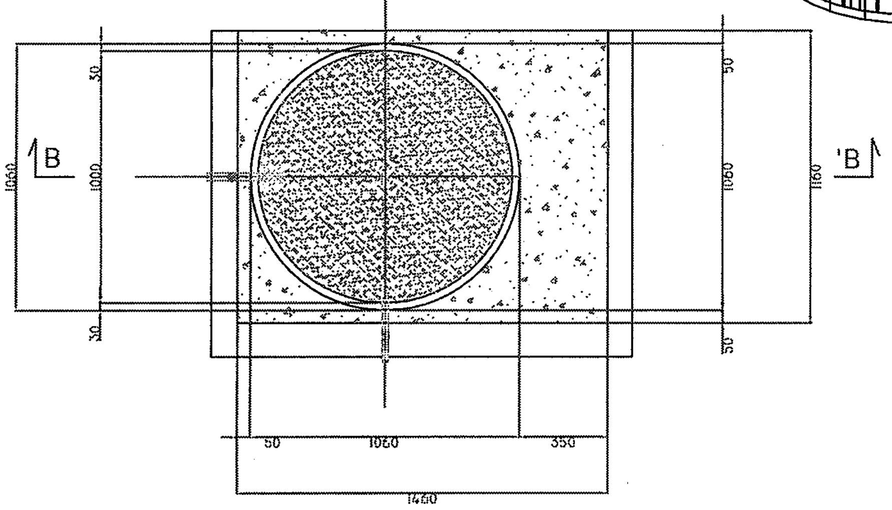
The photographs of conditions, repair and improvements of the existing facilities are shown in Figures 2.2 and 2.3.



ELEVATION



B-B' SECTION



A-A'SECTION

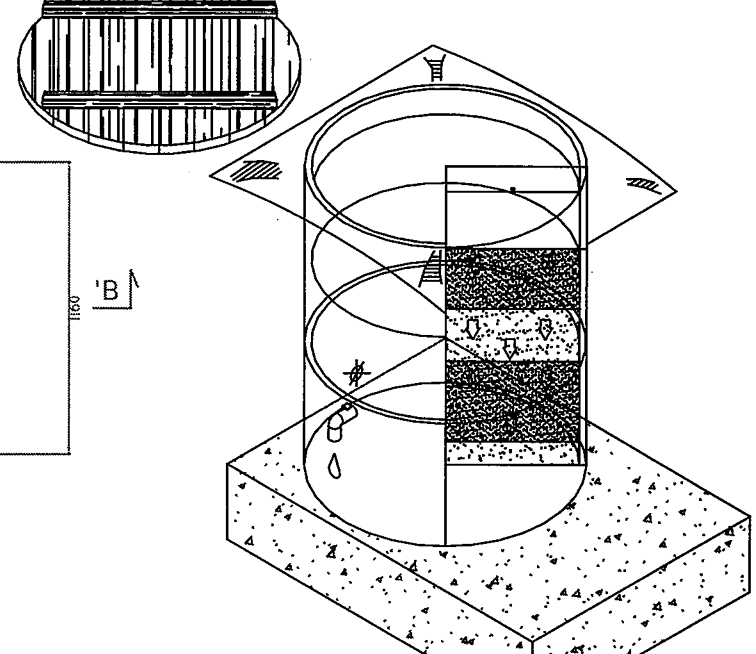


ILLUSTRATION OF DEVICE

LIST OF FILTER MATERIAL

MATERIAL	QUANTITY (m3)
CLEAN SAND	0.157
CLEAN FINE SAND	0.157
CLEAN GRAVEL	0.314

NOTE:d=DIAMETER OF MATERIAL
k=COEFFICIENT OF PERMEABILITY

THE STUDY ON GROUNDWATER DEVELOPMENT IN SOUTHERN CAMBODIA		
Figure 2.1		
IRON REMOVAL DEVICE (IRD)	SCALE	1:20
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		

1. U-seal caused jam in riser pipe at No.67

2. U-seal is abraded by sand at No.322

3. Sand Sedimentation at No.322

4. Ferrous hydroxide Sedimentation at No. 175

5. Rust of hand pump body at No.181

6. Abrased bush bearing at No.181

Figure 2.2

7. Longer pump rod at No.181

8. Damaged by settlement at No.288

9. Broken valve of IRD at No.175

10. Repairing valve of IRD at No.175

11. Installation PVC perforated plate for IRD

12. Wooden plug installed by villager

Figure 2.3

(3) Installation of Improved Iron Removal Device

Improved IRDs were installed at the same wells where the original devices were already installed in order to compare the usability. The design of the new device is based on the experience of UNICEF and modified by the Study Team. The drawing of the device is shown in Figure 2.4. The photograph of installation is shown in Figures 2.5, 2.6 and 2.7.

a) Purpose of Improvement

As part of the Study, iron removal devices were installed at seven wells in 1997, however, while surveying in 1999, it was found that only three were being used. Moreover, according to the Monitoring that was conducted in 1999, the users answered that the devices were difficult to use.

When using the original iron removal device, the users has to first pump water into a bucket with a hand pump and then lift the full bucket to pour the water into the upper part of the IRD. As the IRD is about 1.2m in height, the task is quite strenuous and difficult for children to use.

Therefore, the IRD should be improved so that it can be easily used by children.

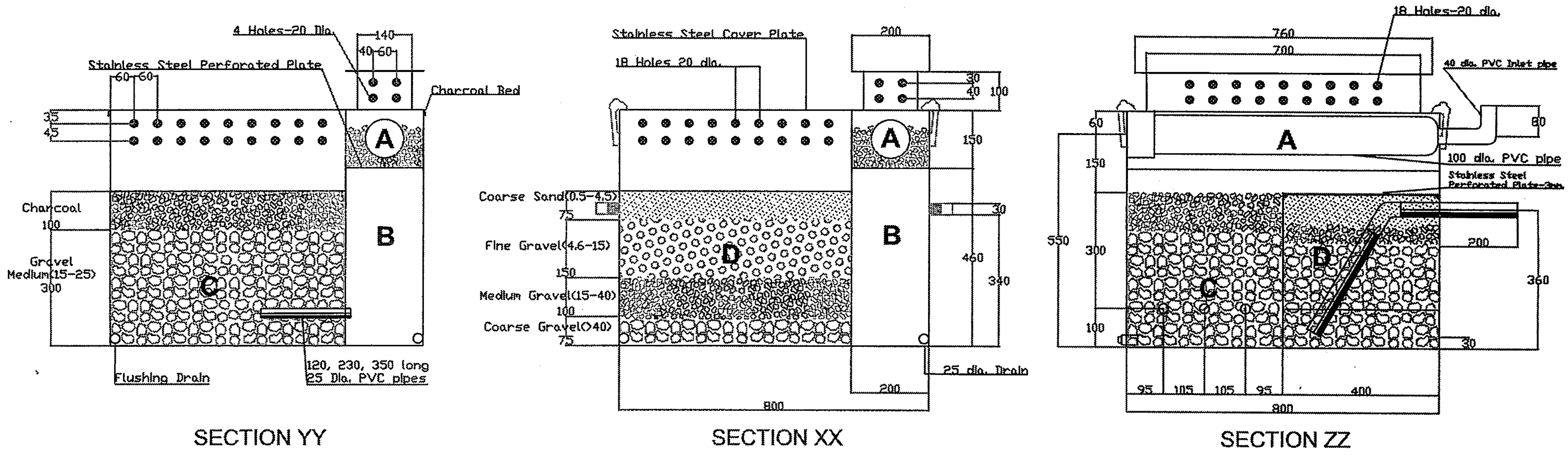
b) Characteristics of IRD

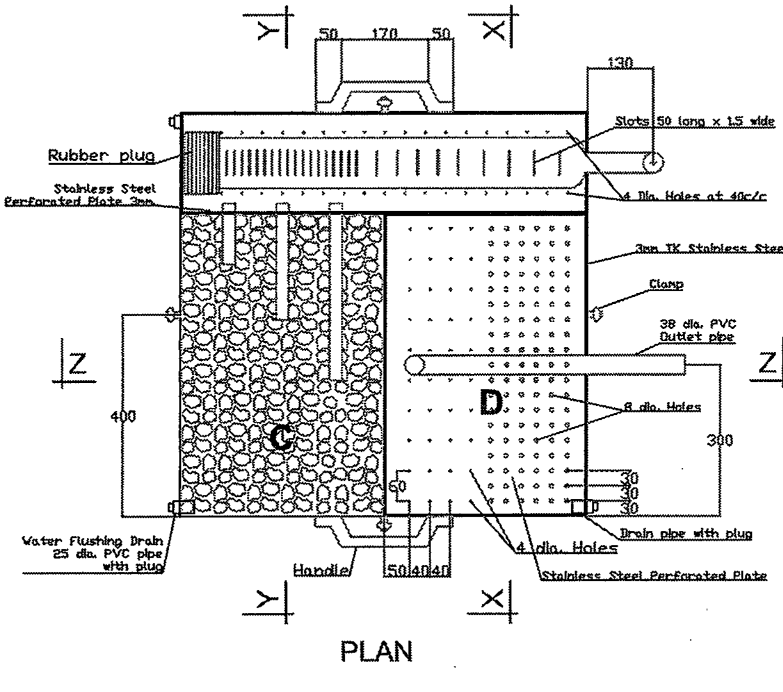
The efficiency of the original model and the improved model are compared in Table 2.1

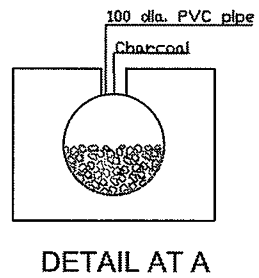
Table 2.1

Item	Original Model	Improved Model
Size	Big Size Round: diameter 100 cm Height: 150 cm	Compact Size Square: 80 cm x 80 cm Height: 61 cm
Casing Material	Concrete	Stainless Steel
Filter Material	Gravel and Sand	Gravel, Sand and Charcoal
Portability	Fixed Type	Movable and Light Weight
Operation	The user pumps water into a bucket by hand pump, carries it to the device and then lifts the bucket up to pour the water into the top of the device	Water flows directly into the device from the outlet of the hand pump through the connecting pipe
Maintenance	Caretaker has to work inside the device to remove filter materials because of its height	It is easy for caretaker to maintain because of its compact size and light weight

Item	Original Model	Improved Model
Effect on Iron Removal	Removal by aeration and filtration is expected	Removal by aeration, sedimentation, adsorption and filtration is expected
Water Rate	About 10 litters/min compared to 15 litters/min byHand Pump	About 10 litters/min compared to 15 litters/min by Hand Pump
Time Required to Remove Iron form Water	About 1minute/10 litters (This does not include the time needed to pump and transport the water from the pump to the IRD.	About 1 minute/10 litters
Hygiene	Small insects sometimes clime up and go into the device	Stainless steel is easier to wash and clean than concrete
Water Quality After Iron is Removed	It is possible to reduce iron concentrations below the WHO guideline (0.3mg/l) even if iron concentrations of original water are over 10 mg/l	It is possible to reduce iron concentrations below the WHO guideline (0.3mg/l) even if iron concentrations of original water are over 10 mg/l
Easiness of Construction	It is easy to construct on site using materials available on site	The device shall be manufactured in a factory that has the proper facilities and materials
Construction Cost	About 100 US$	About 1,000 US$







A Aeration Channel
B Sedimentation Chamber
C Absorption Chamber
D Filtration Chamber

NOTES :-
- Size of charcoal should be 13-15 approximately.
- Plugs should be removed and chambers flushed with clean water approx. every 2 weeks. Top of filter 'D' should be discarded, and made with similar materials.
- The 100 dia. PVC pipe should be cut on the top with slots 50 ctc in the first third, 40 ctc in the middle third, and 10 ctc in the last third of the pipe measuring from inlet.
- All floors are to slope towards the outlet pipe.
- All 20 mm. dia. holes should be covered with PVC mesh.
- All dimensions are in millimeters.

THE STUDY ON GROUNDWATER DEVELOPMENT IN SOUTHERN CAMBODIA		
Figure 2.4		
IMPROVED IRON REMOVAL DEVICE (IRD)	SCALE	1:5
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		

1. Washing the filter materials

2.Filling charcoal into inlet pipes

3. Setting the case

4. Cleaning inside of the case

5. Filling coarse gravel into D chamber

6. Filling medium gravel

Figure 2.5 Installation of Improved Iron Removal Device

7. Filling fine gravel

8. Filling coarse sand

9. Filling medium gravel into C chamber

10. Filling charcoal

11. Putting on the perforated plate

12. Connecting pipe from hand pump

Figure 2.6 Installation of Improved Iron Removal Device

13. Locking the cover

14. Completion

15. Completion

16. Tasting by the villager

Figure 2.7 Installation of Improved Iron Removal Device

2.2 Technical Observation in 2001

The scopes of facility monitoring works in 2001 are shown in Table 2.2. The results of technical observation by well are shown in Tables 2.4 and 2.5.

During the Monitoring Study conducted in 2000, there was a demand among the future pilot well users for an iron removal device to be installed. Therefore, as the iron concentrations were above the WHO guideline value, it was decided that they would be installed at the future pilot wells.

Moreover, the India Mark III pumps that were installed at the pilot wells during the final year of the Study were replaced with Afridev pumps, as it was learned that Afridev pumps were easier to maintain than India Mark III pumps.

Table 2.2 Scope of Facility Monitoring Works in 2001

No.	Village		Facility									
	No.	Name	Hand pump			Platform	Drain	IRD (iron removal device)				Well
								Old type	New type			
			Check existing condition	Install Afridev	Distribute spareparts and tools	Check existing condition	Check existing condition	Check existing condition	Check existing condition	Install IRD	Distribute manual and training	Disinfection
1	56	Khvet	○			○	○					
2	67	Mean Chey	○			○	○					
3	71	Samraong	○			○	○					
4	113	Koy Tra bek	○	○	○	○	○			○	○	○
5	122	Trapaing Thmor	○	○	○	○	○	○	○		○	
6	139	Dok Por	○	○	○	○	○	○	○		○	○
7	162	Cham Kar Leiv	○	○	○	○	○	○	○		○	○
8	175	Toul Khpos	○	○	○	○	○	○	○		○	○
9	181	Prech	○			○	○					
10	199	Prey Maok	○			○	○					
11	209	Trapaing Thmor	○			○	○					
12	222	Ta Vong	○			○	○					
13	242	Ta Pen	○			○	○	○	○		○	
14	259	Svay Kraom	○			○	○					
15	288	Krang Svay	○	○	○	○	○					
16	322	Angkor Chey	○			○	○					
17	367	Ka Kou	○			○	○			○	○	
18	388	Russei Tvear	○			○	○			○	○	
19	393	Kok Trom Kha	○			○	○					
20	401	Prey Phdau	○	○	○	○	○			○	○	○
21	406	Prek Ta Sa	○			○	○	○	○		○	
22	429	Sre Kak	○			○	○	○	○		○	
23	454	Kiri Raksmey	○			○	○					
24	25+1	JICE Center	○			○	○					
		Total	24	7	7	24	24	7	7	4	11	5

2.2.1 Hand Pump

All of the 24 test wells constructed (including those in the 20 pilot villages), are still functioning well except wells No.162 and No.401.

(1) Damage to O ring

Due to damage to the O-ring, water discharge is not good in wells No.162 and No.401. The hand pumps of both wells were of the same type, India Mark III. According to the caretakers of the both wells, they tried to repair the hand pumps but they did not succeed. Repairing an India Mark III hand pump is supposed to be more difficult than a Afridev hand pump.

(2) Corrosion of Riser Pipes and Pump Rods

Much rust was found in the pumped water of well No.401. Due to the corrosion of the riser pipes and pump rods, much rust was mixed into the well water. The standard material of India Mark III riser pipes and pump rods is galvanized steel. Steel may corrode, even galvanized steel. However the standard materials of riser pipes and pump rods of Afridev hand pumps are PVC and stainless steel, which are anticorrosive materials. Anticorrosive materials shall be adopted in the project to be implemented.

2.2.2 Platform and Drain

Cracks and/or gaps, caused by settlement, were found at the joints connecting the platforms and the drains in all the test wells. Reinforcing for the joints should be required for future designs.

The walls of the platforms should also be removed because they seem to obstruct hand pump maintenance work.

(1) Cracks and Damage

The platforms were generally in good condition, specially, no damage or cracks were observed. However, because the structure that adjoins the platform and the ditch has subsided unequally, cracks have developed in the wells. These cracks were repaired in 1999. Although the damage was minor, more settlement than before was observed under the adjoining structure in well No.288. Also, a crack in one well (No.288) was detected; this is attributed to the unequal settlement of the ground around the platform.

Figure 2.8 Crack in the Drain

(2) Stagnant Wastewater

Wastewater was not observed to be stagnant in the facility. However, the terminal section of the flow path forms a ditch or a pond, and wastewater was observed to be stagnant in areas with unfavorable drainage conditions.

(3) Cleaning of Facility

Facilities are generally clean but garbage was scattered around the flow terminal of many sites.

2.2.3 Iron Removal Device (IRD)

Figure 2.9 IRD - Old Type and New Type

(1) Use of the Device

Water pumped into the bucket is directly poured into the upper part of the old IRD. Since the filter is churned when water is poured, a plank was devised and installed during this field survey as a buffer for water flow. Furthermore, since carrying a bucket and pouring water into the old IRD may be strenuous for the villagers, newly designed iron removal devices were installed from 2000 to 2001. Water flow directly into the new device from the hand pump. The results of the use of the two types of iron removal devices are shown in Table 2.3.

Table 2.3 Use of the Device

Village		Installation (year)		Use	
No	Name	Old Type	New Type	Old Type	New Type
113	Koy Tra bek	-	2001	-	yes
122	Trapaing Thmor	1997	2000	no	sometimes
139	Dok Por	1997	2000	no	yes
162	Cham Kar Leiv	1997	2000	yes	no
175	Toul Khpos	1997	2000	no	sometimes
242	Ta Pen	1997	2000	no	no
367	Ka Kou	-	2001	-	yes
388	Russei Tvear	-	2001	-	yes
401	Prey Phdau	-	2001	-	yes
406	Prek Ta Sa	1997	2000	no	yes
429	Sre Kak	1997	2000	no	yes

(2) Changes in Water Use Before and After Iron Removal

The iron removal device is effectively being used for drinking and cooking purposes (Table 2.6). For washing clothes and bathing, on the other hand, the villagers are using pumped water directly without treatment.

(3) Effect of Iron Removal Device

7 old type IRDs and 11 new type IRDs have been installed at the 11 test wells since June 1997. Field water tests were conducted by the instant test kit for both raw and treated water in June and November 2001. As shown in Table 2.4 and Figure 2.10, iron was effectively reduced to less than the WHO guideline value (0.3 mg/ℓ). In Dok Por (No.139) in June 2001 and Russei Tvear (No.388) in November 2001, however, iron concentrations of treated water still exceeded the WHO guideline value. The filter material (sand and gravel) of the device should be properly washed or replaced to improve effectiveness.

Table 2.4 Effect of IRD by Field Test

Village		Fe (mg/l)					
		Jun-01			Nov-01		
No	Name	Well	Old Type	New Type	Well	Old Type	New Type
113	Koy Tra bek	***10.00***	-	-	***10.00***	-	0.20
122	Trapaing Thmor	***>10.00***	0.00	0.00	***10.00***	0.05	0.20
139	Dok Por	***5.00***	0.20	***0.50***	***10.00***	0.05	0.05
162	Cham Kar Leiv	***>10.00***	<0.05	<0.05	***10.00***	0.05	-
175	Toul Khpos	***8.00***	-	<0.05	***10.00***	0.20	0.05
242	Ta Pen	0.05	0.05	0.05	0.05	0.05	0.05
367	Ka Kou	***1.00***	-	-	***2.00***	-	0.20
388	Russei Tvear	***3.00***	-	-	***2.00***	-	***0.50***
401	Prey Phdau	***>10.00***	-	-	***5.00***	-	0.20
406	Prek Ta Sa	***>10.00***	<0.05	<0.05	***10.00***	0.20	0.20
429	Sre Kak	<0.05	<0.05	<0.05	0.05	0.05	0.05

WHO Guideline: 0.3 mg/l

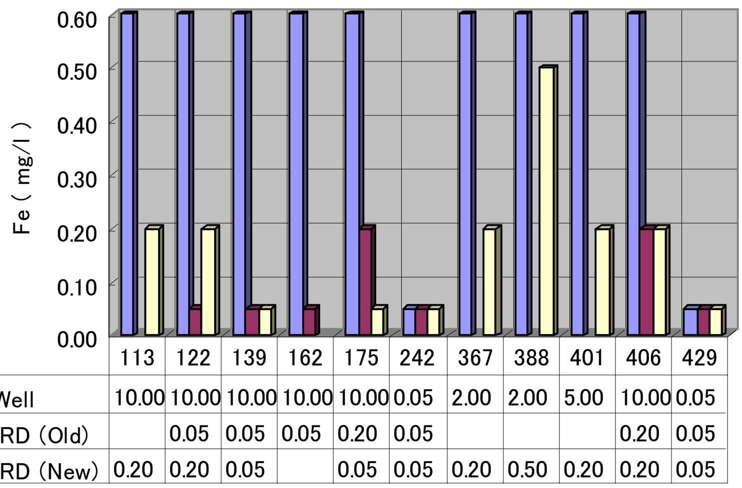


Figure 2.10 Effect of IRD by Field Test in November 2001

(4) Detection of Bacteria and Fecal Coliform

Slight amounts of bacteria and fecal coliform are detected as in the IRD treated water. In order to get safe water, countermeasures such as improving the device, disinfection or boiling water shall be considered.

(5) Operation and Maintenance

Sedimentation in the IRD causes the filter of the device to jam and reduces the iron reduction effect and water flow rate. In order to keep the iron reduction effect and the water flow rate, the cleaning and replacing of the filter in the device are necessary. More O&M training for IRD is required for caretakers.

Figure 2.11 Sedimentation in IRD

2.2.4 Repair and Improvement of the Facility

(1) Hand Pump

1) Change Hand Pump

India Mark III hand pumps were replaced with Afridev hand pumps at 7 wells (No.113, 122, 139, 162, 175, 288 and 401).

Figure 2.12 India Mark III and Afridev Hand Pump

2) Disinfections of Well

Due to the flood in 2000, bacteria and fecal coliforms have been detected in the well water at 5 wells (No.113, 139, 162, 175 and 401). In order to keep the water safe, these wells were properly disinfected in 2001.

(2) Iron Removal Device (IRD)

1) Installation of Additional Iron Removal Devices

New-type IRDs were installed at the 4 wells (No.113, 369, 388 and 401) where the iron concentration was over the WHO guideline value in 2001.

2.2.5 Technical Findings on Facility

(1) Hand Pump

- Afridev is superior to India Mark III

(2) Platform

- Space of existing platform is too small for users
- Wall is obstructing O&M activities
- Height of embankment shall be considered concerning flood level

(3) Drain

- A lack of reinforcement caused cracks in the concrete structures

(4) IRD

- An IRD can reduce iron concentrations to a value below the WHO guideline value
- Slight amounts of bacteria and fecal coliform are detected in the IRD treated water
- More training is needed for O&M of IRD
- It is necessary to confirm user's demand of IRD before installation, otherwise IRD will not be used

2.2.6 Problems Concerning IRDs and Items of future Investigation

- Similar to a hand pump, whether or not an IRD will be used depends on the quality of alternative water sources. If there is an alternative water source with water of better quality that of the well water after using an IRD, the device will be of no use to the residents. Concerning the future project, the installation of IRDs in each of the wells should be examined after fully understanding the quality of the well water and the residents' needs.

- Fecal coliforn and other common bacteria have been detected in water from wells where both the original and improved IRDs have been installed. The bacteria are believed to propagate in the water that settles inside the device. As part of maintenance activities, the devices should be periodically disinfected with bleaching powder.

- Both types of iron removal devices were installed during the Study. The improved model is expensive as it is made of stainless steel. However, it is possible to reduce costs by constructing the same model with concrete. If a design that is cheap and easy to construct is used, the users can build the devices themselves. Therefore, in the future Project, it is necessary to use a model that will be easy for the users to construct and to give guidance in installing the device.

- As the iron removal device continues to be used, the iron that settles clogs the filter in the device and its effectiveness decreases and it becomes difficult to pump the water. Therefor,e it is necessary to frequently clean the device. How often the device needs to be cleaned cannot be generally stated, as it will differ depending on the level of iron concentration in the raw water and how often the device is used. However, when water is not pumping efficiently, this is a sign that the filter should be cleaned. Once the device is installed, it is important that the users receive proper training in maintenance activities including the above-mentioned method of disinfecting.

Table 2.5 Technical Observation on Pilot Water Supply Facilities in 2001

(1/4)

Province	Village No.	Village Name	Hand Pump	Platform & Drain	IRD	Remark
Peri Urban	56	Khvet	Good condition	Platform is in good condition, Cracks at joint of platform and drain		
Peri Urban	67	Mean Chey	Good condition	Platform is in good condition Cracks at joint of platform and drain		
Peri Urban	71	Samraong	Bush bearing worn out	Good condition		
Svay Rieng	113	Koy Trabek	Removed existing India Mark III pump and installed Afridev pump on 27/07/01 Good condition	Platform is in good condition Half of drain is covered by the soil of road construction	New IRD was installed on 09/08/01	Disinfected on 27/07/01
Svay Rieng	122	Trapaing Thmor	Removed existing India Mark III pump and installed Afridev pump on 25/07/01 Good condition	Good condition No cleaning	Good condition	
Svay Rieng	139	Dok Por	Removed existing India Mark III pump and installed Afridev pump on 24/07/01 Good condition	Platform is in good condition Cracks at joint of platform and drain	Good condition	Disinfeced on 24/07/01

(2/4)

Province	Village		Hand Pump	Platform & Drain	IRD	Remark
	No.	Name				
Svay Rieng	162	Cham Kar Leiv	Removed existing India Mark III pump and installed Afridev pump on 26/07/01 Good condition	Platform is in good condition Cracks at joint of platform and drain	Water tap is broken and replaced with new valve by user	Has been disinfected
Svay Rieng	175	Toul Khpos	Removed existing India Mark III pump and installed Afridev pump on 27/07/01 Good condition	Platform is in good condition Cracks at joint of platform and drain	Membrane sheet of old IRD is lost	Has been disinfected
Takeo	181	Prech	Corrosion found	Good condition No cleaning		
Takeo	199	Prey Maok	Good condition	Platform is in good condition Small crack at joint of platform and drain		
Takeo	209	Trapaing Thmor	Good condition	Good condition		
Takeo	222	Ta Vong	Corrosion is found	Platform is in good condition Damaged at joint of platform and drain		
Takeo	242	Ta Pen	Good condition	Platform is in good condition Cracks at joint of platform and drain	Dirty inside of old IRD	

(3/4)

Province	Village		Hand Pump	Platform & Drain	IRD	Remark
	No.	Name				
Kandal	259	Svay Kraom	Good condition	Platform is in good condition Small crack at joint of platform and drain		
Kandal	288	Krang Svay	Removed exixting India Mark III pump and installed Afridev pump on 31/07/01 Good condition	Platform is in good condition Damaged at joint of platform and drain Cracks in drain		
Kandal	322	Angkor Chey	Good condition	Platform is in good condition Small crack at joint of platform and drain		
Prey Veng	367	Ka Kou	Good condition	Platform is in good condition Crack at joint of platform and drain	New IRD is installed on 06/08/01	
Prey Veng	388	Russei Tvear	Good condition	Platform is in good condition Crack at joint of platform and drain	New IRD is installed on 07/08/01	
Prey Veng	393	Kok Trom Kha	Good condition	Platform is in good condition Small crack at joint of platform and drain		

(4/4)

Province	Village		Hand Pump	Platform & Drain	IRD	Remark
	No.	Name				
Prey Veng	401	Prey Phdau	Removed exixting India Mark III pump and installed Afridev pump on 28/07/01 Good condition	Platform is in good condition Crack at joint of platform and drain	New IRD is installed on 08/08/01	Has been disinfected
Prey Veng	406	Prek Ta Sa	Good condition	Platform is in good condition Crack at joint of platform and drain	Good condition	
Kg. Speu	429	Sre Kak	Good condition	Good condition	Good condition	
Kg. Speu	454	Kiri Raksmey	Good condition	Good condition		
Takeo	25+1	JICE Center	Good condition	Platform is in good condition Crack at joint of platform and drain		

Table 2.6 Technical Observation on Water Use in 2001

(1/2)

Province	Village		Taste of Well Water	Use for Drinking	Use of IRD	Remark
	No.	Name				
Peri Urban	56	Khvet	Slight salty	Drinking		
Peri Urban	67	Mean Chey	Good	Drinking		
Peri Urban	71	Samraong	Salty	Not drinking		
Svay Rieng	113	Koy Trabek	Iron	Drinking after new IRD	Use New IRD	New IRD is never maintained by user
Svay Rieng	122	Trapaing Thmor	Iron	Drinking after new IRD	Sometimes use new IRD, not use old IRD	Both IRD is never maintained by user
Svay Rieng	139	Dok Por	Iron	Drinking after new IRD	Use only new IRD, not use old IRD	New IRD is maintained by user
Svay Rieng	162	Cham Kar Leiv	Iron	Drinking after Old IRD	Use only old IRD, not use new IRD	Old IRD is maintained by user
Svay Rieng	175	Toul Khpos	Iron	Drinking after new IRD	Sometimes use new IRD, not use old IRD	Both IRD is never maintained by user
Takeo	181	Prech	Salty	Not drinking		
Takeo	199	Prey Maok	Good	Drinking		
Takeo	209	Trapaing Thmor	Slight salty	Drinking		
Takeo	222	Ta Vong	Iron and Salty	Not drinking		
Takeo	242	Ta Pen	Slight salty	Drinking only in dry season	Never used both new and old IRD	Both IRD is never maintained by user
Kandal	259	Svay Kraom	Good	Drinking		

(2/2)

Province	Village		Hand Pump	Platform & Drain	IRD	Remark
	No.	Name				
Kandal	288	Krang Svay	Salty	Not drinking		
Kandal	322	Angkor Chey	Iron and Salty	Not drinking		Water is very smell and not clear in dry season
Prey Veng	367	Ka Kou	Iron	Drinking after new IRD	Use new IRD	New IRD is maintained by user
Prey Veng	388	Russei Tvear	Slight iron	Drinking after new IRD	Use new IRD	New IRD is never maintained by user
Prey Veng	393	Kok Trom Kha	Good	Drinking		
Prey Veng	401	Prey Phdau	Iron	Drinking after new IRD	Use new IRD	New IRD is maintained by user
Prey Veng	406	Prek Ta Sa	Iron and Slight salty	Drinking after new IRD	Use only new IRD, not use old IRD	New IRD is maintained by user
Kg. Speu	429	Sre Kak	Good	Drinking after new IRD	Use only new IRD, not use old IRD	New IRD is maintained by user
Kg. Speu	454	Kiri Raksmey	Slight salty	Drinking		
Takeo	25+1	JICE Center	Salty	Drinking only in dry season		

2.3 Result of the Questionnaire Survey for Facilities

The following graphs show the results of the questionnaire survey conducted on 20 pilot wells from 1999 to 2001.

2.3.1 Condition of Hand Pump

(1) Pump Condition

Most of the users think that the condition of the hand pumps are good. However it seems hand pumps become slightly worse every year.

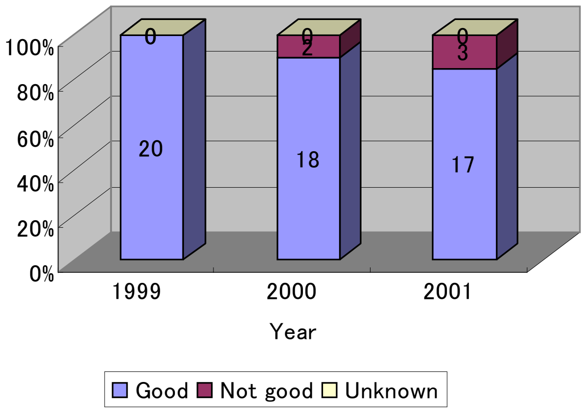


Figure 2.13 Condition of Hand Pump

(2) Yield

Most of the users think that the yield of the hand pumps is good.

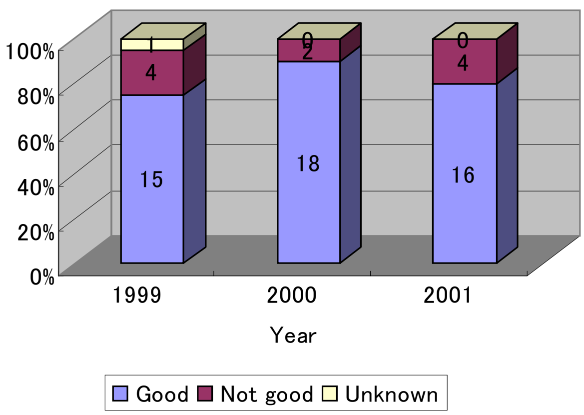


Figure 2.14 Yield of Hand Pump

(3) Functioning

90% of the users thought that the hand pumps were functioning well in 2001.

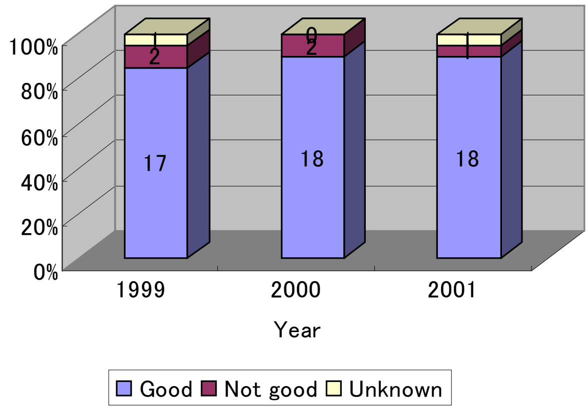


Figure 2.15 Functioning of Hand Pump

(4) Lubrication

30 % of the users thought that lubrication of the hand pumps was not good in 1999. However, due to O&M training in the study, 90 % of the users thought that lubrication of the hand pumps was good in 2001.

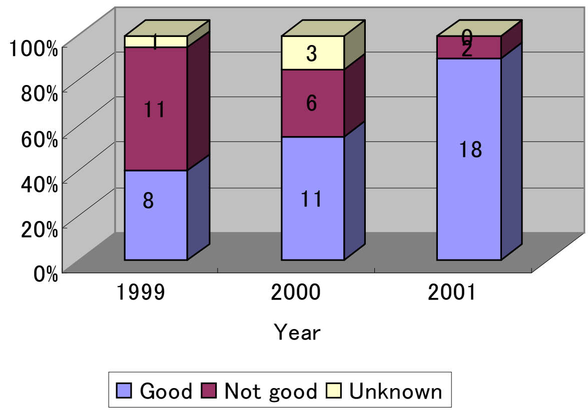


Figure 2.16 Lubrication of Hand Pump

(5) Easiness of Use

Most of the users think that the hand pumps are easy to use.

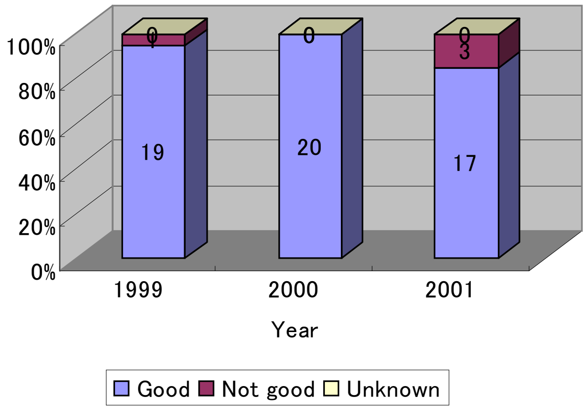


Figure 2.17 Easiness of Use Hand Pump

(6) Overall evaluation by users

Most of the users consider the well to be good.

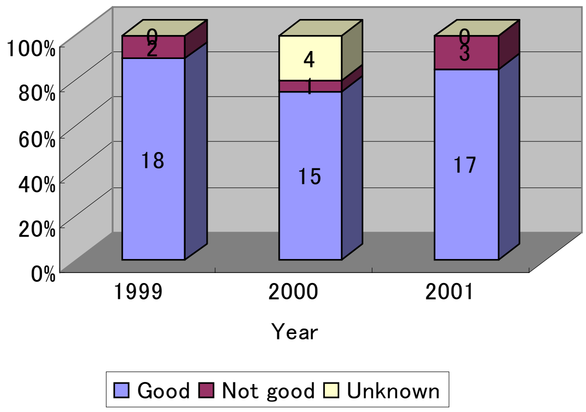


Figure 2.18 Overall Evaluation of Hand Pump by Users

(7) Additional Observation

Additional comments from users in 2001 are the followings.

- Easy to operate
- Hand pump is functioning well
- Well name plate is broken
- Not enough water comes up
- Water is safe
- Need more hand pump wells

2.3.2 Condition of Platform and Drainage

(1) Platform

Most of the users think that the platform is still in good condition.

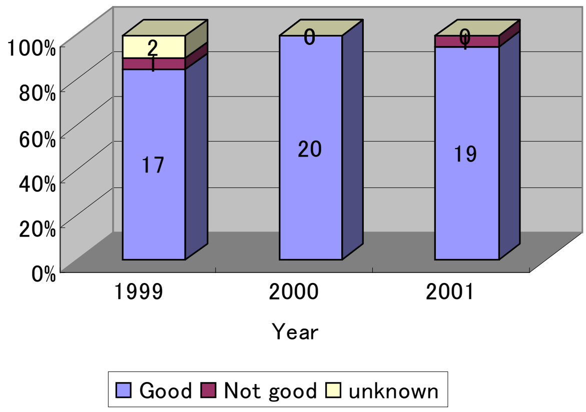


Figure 2.19 Condition of Platform

(2) Drain

95 % of the users thought that the drain of the platform was in good condition in 2000 after repaired in 1999. Due to some cracks in drain that occurred again due to settlement, only 75 % of the users thought that the drain of the platform was in good condition in 2001.

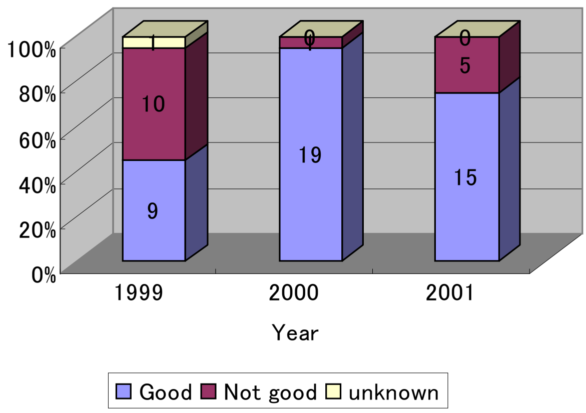


Figure 2.20 Condition of Drain

(3) Wall

100 % of the users think that the wall of the platform is still in good condition.

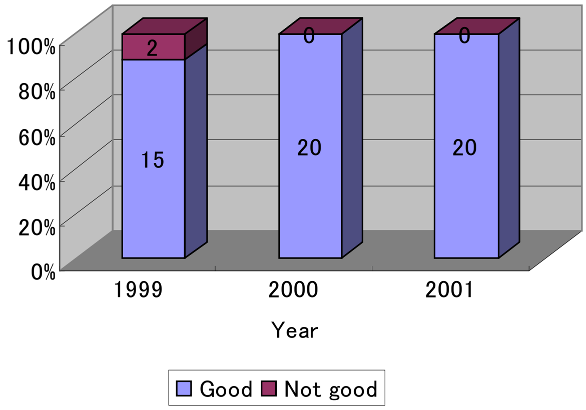


Figure 2.21 Condition of Wall

(4) Entrance

Most of the users think that the entrance of the platform is still in good condition.

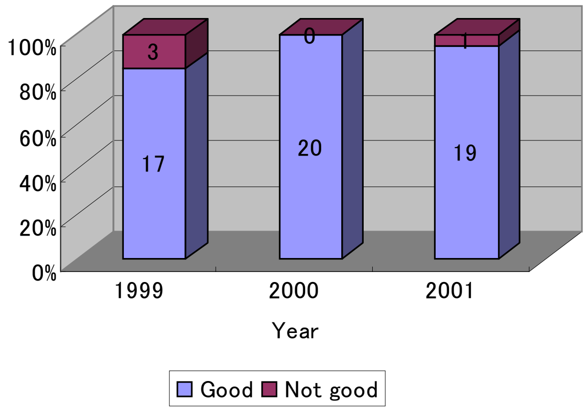


Figure 2.22 Condition of Entrance

(5) Easiness of Maintenance

Most of the users think that the maintenance of the platform is easy.

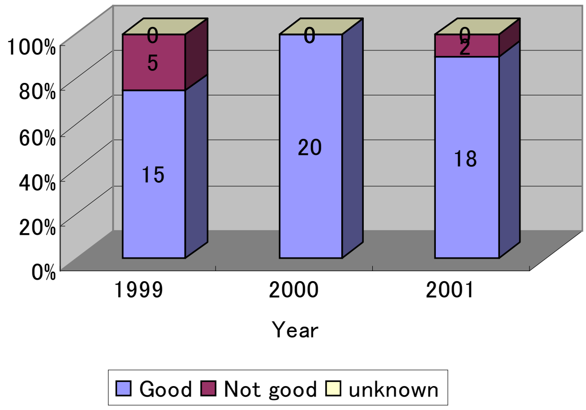


Figure 2.23 Easiness of Maintenance Platform and Drain

(6) Overall Evaluation by Users

Most of the users consider the platform to be good.

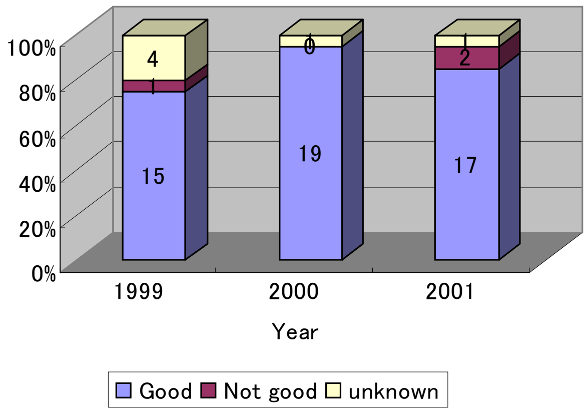


Figure 2.24 Overall Evaluation of Platform and Drain by Users

(7) Additional Observation

Additional comments from users in 2001 are the followings.

- Crack in Drain
- Leakage in Drain
- Bathing space is necessary

2.3.3 Iron Removal Device (IRD)

(1) Condition of IRD

About half of the users think that the both the old and new IRDs are not in good condition.

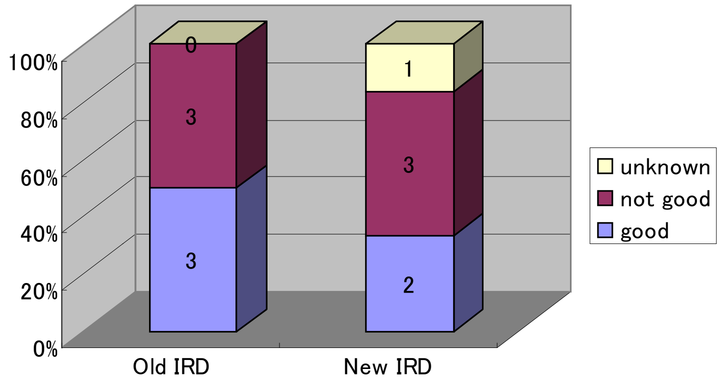


Figure 2.25 Condition of IRD in 2001

(2) Functioning of IRD

About half of the users think that the functioning of both the new and old IRDs is not good.

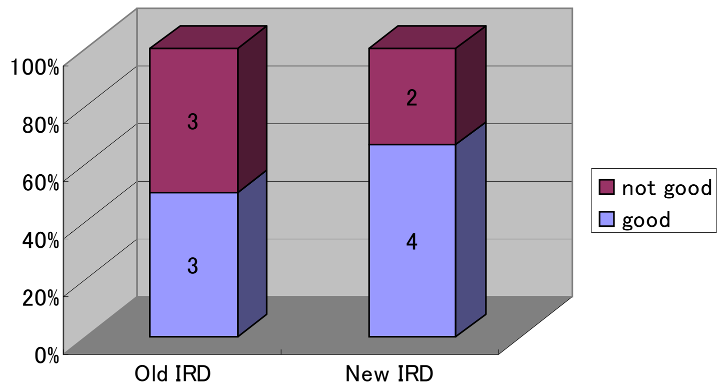


Figure 2.26 Functioning of IRD in 2001

(3) Easiness of Use

While most of the users answered that the old IRD is not easy to use, about 50 % of the users answered that the new IRD is easy to use.

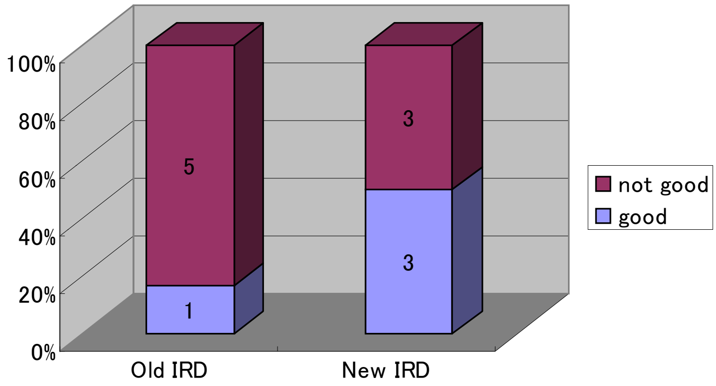


Figure 2.27 Easiness of Use IRD in 2001

(4) Easiness of Maintenance

While most of the users answered that maintaining the old IRD is not easy, about 80 % of the users answer that maintaining the new IRD is easy.

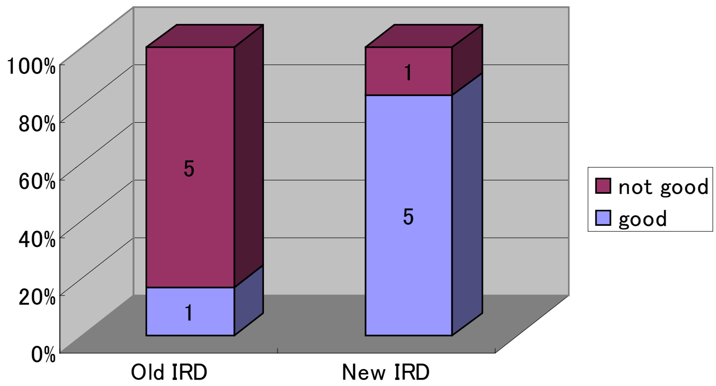


Figure 2.28 Easiness of Maintenance IRD in 2001

(5) Overall Evaluation by Users

While 30 % of users consider the old IRD to be good, 50 % of the users consider the new IRD to be good. 67 % of the users answered that the new IRD is better than the old IRD.

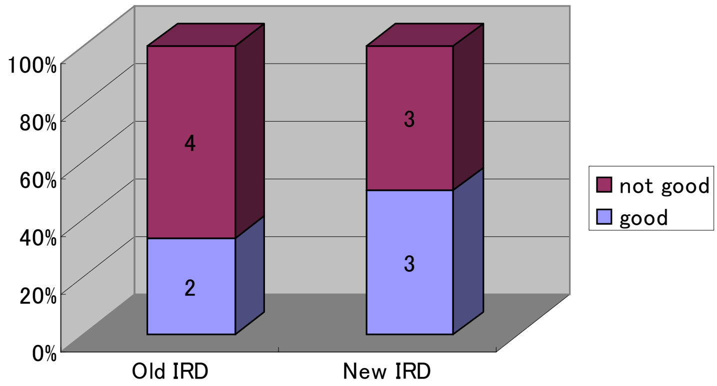


Figure 2.29 Overall Evaluation by Users in 2001

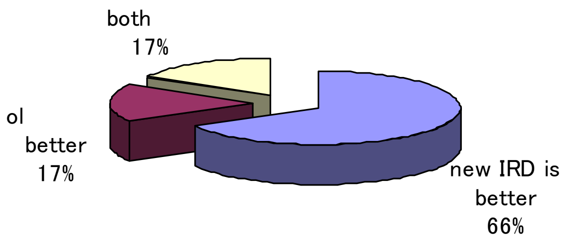


Figure 2.30 "Which is better IRD" answered by Users in 2001

(6) Additional Observation

Additional comments from users in 2001 are the followings.

- Water comes slowly
- Need a better IRD
- Old IRD is not used anymore
- Difficult to use IRD
- Easy to use
- Water from new IRD is good

2.3.4 Findings on Facility

(1) Hand Pump, Platform and Drain

- Most of the hand pumps and platforms are still in good condition since installed in 1997.
- Most of the users are satisfied with existing hand pumps, platforms and drains.

(2) Iron Removal Device

- Some of the users feel the IRDs are not easy to use.
- Users consider the new type to be better than the old type.

2.4 Result of the Questionnaire Survey for Water Use

2.4.1 Water Use Purpose

Due to the installation of the new IRD, the number of wells used for drinking purpose increased from 13 wells to 15 wells out of 20 wells.

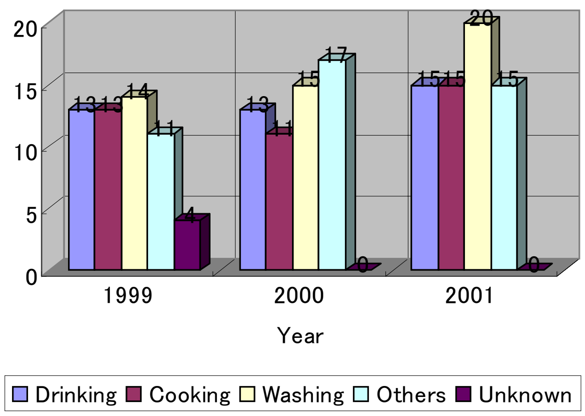


Figure 2.31 Water Use Purpose

2.4.2 Seasonal Water Use Purpose

Pumped water from 13 out of 20 wells is used for drinking in the dry season compared to 10 wells in rainy season.

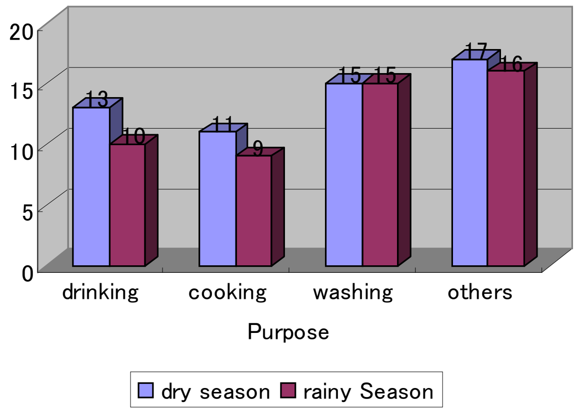


Figure 2.32 Seasonal Water Use Purpose in 2000

2.4.3 Accessibility (Physical and Social)

Most of the users think that accessibility of the well is good.

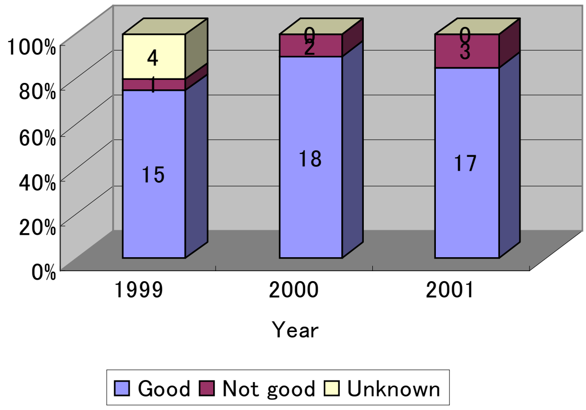


Figure 2.33 Accessibility to the Well

2.4.4 Taste, Smell and Color of Groundwater Evaluated by Users

(1) Well Water

Although a variety of chemical constituents are dissolved in the groundwater, according to the villagers, the water from 40 % of the test wells are felt to taste good, 35 % unfavorable because of an iron taste and 35 % salty in 2001. Regarding smell of the test well groundwater, however, 60 % of the test wells are felt to have an iron smell while 55 % is felt to smell good in 2001. Regarding the color of water, 75 % of the test wells are felt to look good in 2001.

Villagers, therefore, leave water in the jar for a while (sometimes overnight) to kill the smell and improve the taste. According to interviews with the villagers, water becomes better after leaving it for a while (in 5 villages). However, villagers complain that the water is clear at first but colored after some time (in 2 villages).

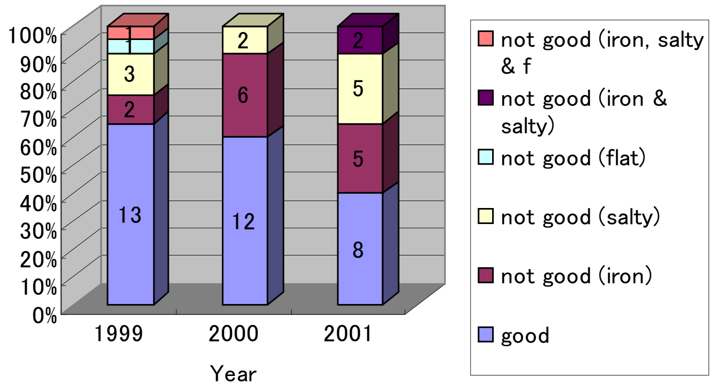


Figure 2.34 Taste of Well Water

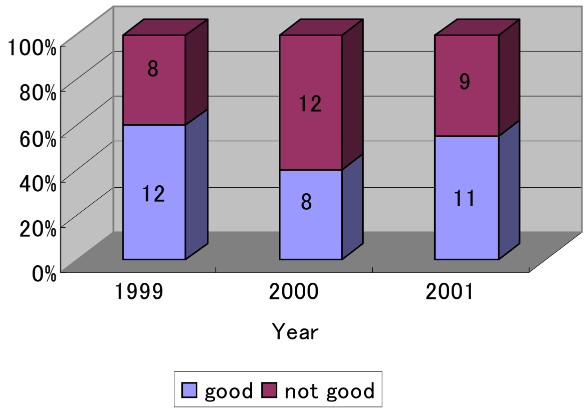


Figure 2.35 Smell of Well Water

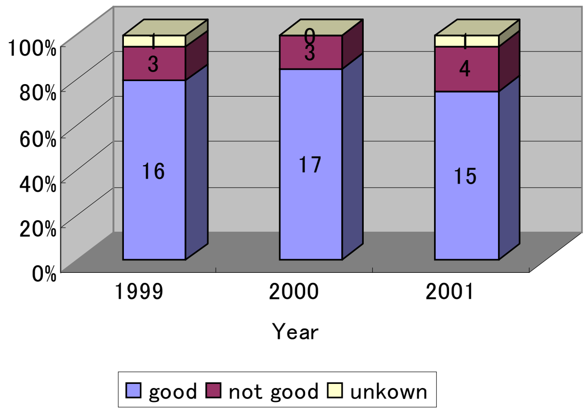


Figure 2.36 Color of Well Water

(2) IRD Treated Water

According to the villagers, about the half of the IRD treated water is still not good tasting. Regarding the smell and color of the water, about half of the IRD treated water are still not good.

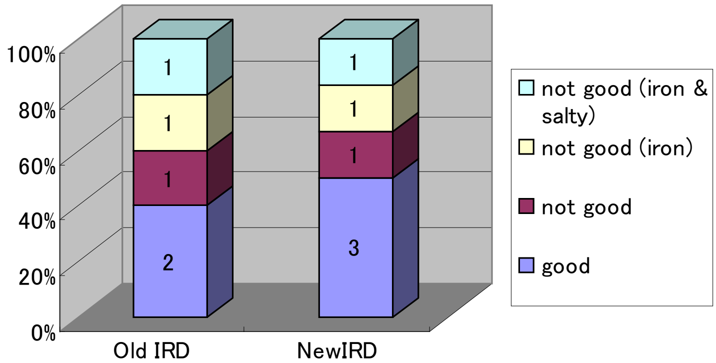


Figure 2.37 Taste of IRD Treated Water

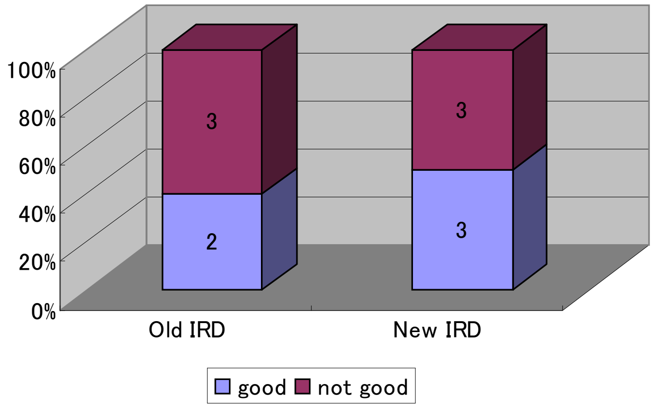


Figure 2.38 Smell of IRD Treated Water

Figure 2.39 Color of IRD Treated Water

2.4.5 Findings on Water Use

- Well water is used in all of pilot wells

- Salty water is never used for drinking and cooking purposes
- Some of users still feel the water has an iron taste even after treated by IRD
- If there is a better tasting alternative water source, well water is never used for drinking or cooking purpose

CHAPTER 3

GROUNDWATER QUALITY AND LEVEL

CHAPTER 3 GROUNDWATER QUALITY AND LEVEL

3.1 Groundwater Quality

3.1.1 Water Quality Measurement on Site

Water quality measurements were carried out on the test wells in 24 places to determine water temperature, electrical conductivity (EC), pH, oxidation-reduction potential (ORP), general bacteria and coliform group. Table 3.1 shows the results of field water analyses from 1999 to 2001. The monitoring results show no obvious change in water quality since 1999.

(1) EC

EC levels in the test wells in Peri-Urban, Kandal, Ta Keo and Kg. Speu were higher than 1,000 μS/cm. In most of the test wells in Prey Veng and Svay Rieng, however, EC levels were low and groundwater quality was favorable.

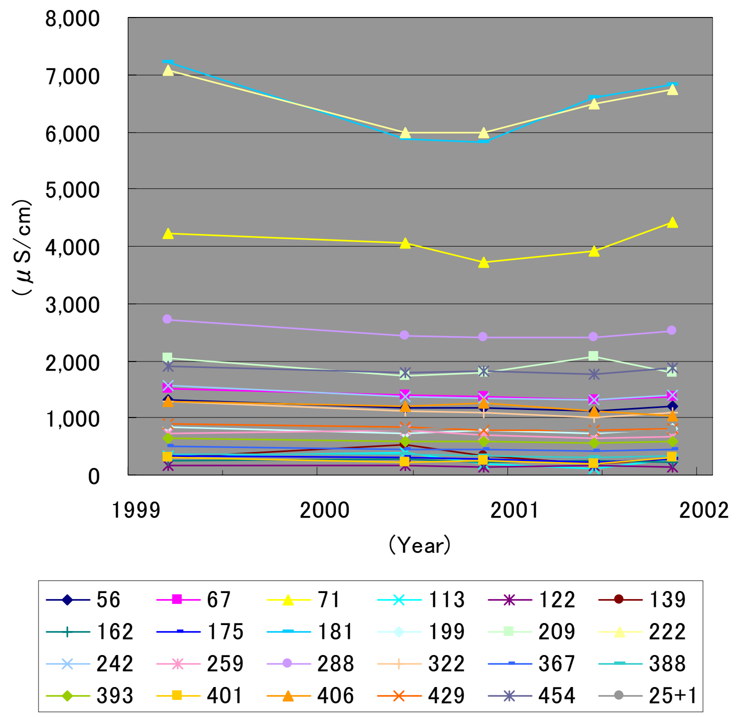


Figure 3.1 EC by Field Test 1999-2001

(2) pH

The pH level in the test wells ranges from 6.04 to 8.6, which shows neutral to slightly acidic or alkaline. Groundwater of the test wells in Peri-Urban, Kandal, Takeo and Kg. Speu is neutral to alkaline while neutral to slightly acidic in Svay Rieng and Prey Veng.

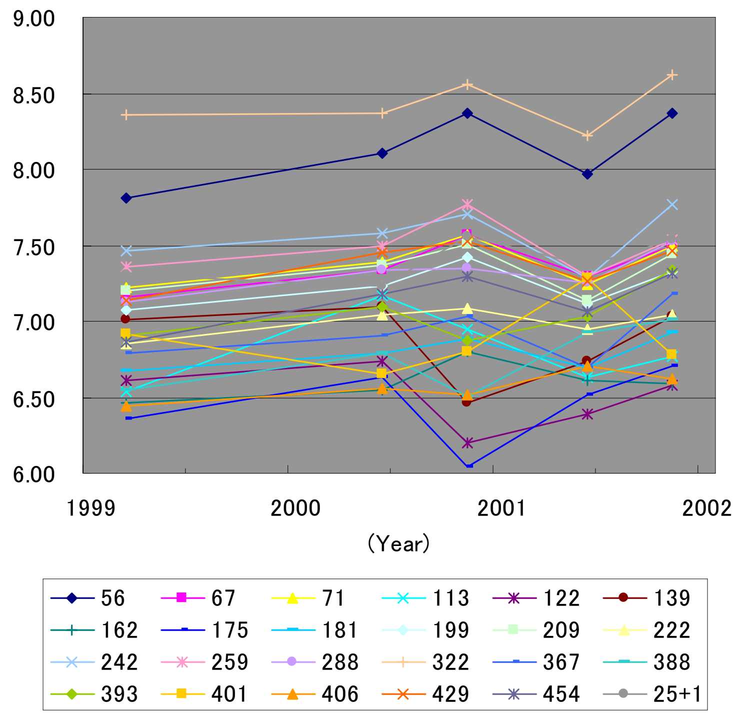


Figure 3.2 pH by Field Test 1999-2001

(3) ORP

The ORP levels in the test wells in Prey Veng and Svay Rieng were negative. They ranged from -4 mv at Kok Trom Kha (No.393) in Prey Veng to -137mv at Koy Trabek (No.113) in Svay Rieng. These negative levels of the test wells indicate that groundwater is under the reducing condition. In the contrast, the ORP level in groundwater in Peri-Urban and Kg. Speu was measured at more than +100 mV. In a part of Kandal and Ta Keo, however, ORP levels were also negative.

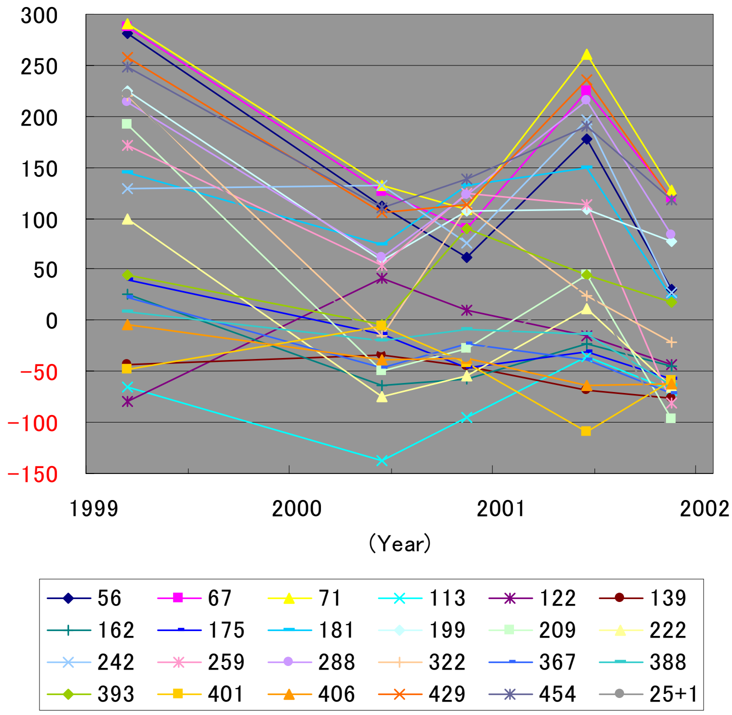


Figure 3.3 ORP by Field Test 1999-2001

(4) Bacteria and Coliform

A slight trace of general bacteria and coliform was detected in the test wells in Koy Tra Bek (No.113), Dok Por (No.139), Cham Kar Leiv (No.162) and Toul Khpos (No.175) in Svay Rieng in 2000. Those wells were disinfected in 2001.

(5) Arsenic

According to the results of a field test by AAN field test kit in November 2001, arsenic was not detected in any of the 24 test wells.

Table 3.1 Field Water Analysis of Test Well (1999-2001)

Village		Temp. (°C)					pH					EC (μS/cm)					ORP (mV)				
No	Name	Mar-99	Jun-00	Nov-00	Jun-01	Nov-01	Mar-99	Jun-00	Nov-00	Jun-01	Nov-01	Mar-99	Jun-00	Nov-00	Jun-01	Nov-01	Mar-99	Jun-00	Nov-00	Jun-01	Nov-01
56	Khvet	30.4	29.4	29.3	29.6	29.3	7.81	8.11	8.37	7.97	8.37	1,327	1,182	1,177	1,125	1,196	281	112	62	177	31
67	Mean Chey	30.3	31.3	30.6	30.5	29.9	7.16	7.34	7.57	7.29	7.50	1,498	1,399	1,370	1,324	1,378	288	126	90	224	119
71	Samraong	30.4	30.1	29.6	30.1	29.7	7.22	7.39	7.57	7.24	7.50	4,230	4,060	3,720	3,930	4,410	291	133	108	261	128
113	Koy Tra bek	29.7	29.1	28.8	29.5	29.2	6.54	7.17	6.95	6.63	6.77	337	405	184	119	269	-66	-137	-95	-35	-69
122	Trapaing Thmor	29.9	29.5	29.5	29.6	28.8	6.61	6.74	6.20	6.39	6.58	169	162	143	167	149	-80	42	10	-15	-44
139	Dok Por	28.7	29.5	29.3	29.0	28.4	7.01	7.10	6.46	6.74	7.03	294	520	342	187	290	-44	-34	-45	-69	-77
162	Cham Kar Leiv	29.9	29.5	30.0	29.2	29.6	6.46	6.55	6.80	6.61	6.59	249	292	231	259	221	26	-63	-58	-23	-45
175	Toul Khpos	30.7	30.5	29.7	29.6	28.9	6.36	6.63	6.04	6.52	6.70	337	308	288	218	278	40	-14	-47	-31	-58
181	Prech	30.5	30.2	30.0	30.0	30.2	6.67	6.79	6.88	6.69	6.93	7,210	5,870	5,830	6,600	6,830	144	75	133	150	23
199	Prey Maok	30.6	30.0	30.1	30.4	30.0	7.07	7.23	7.42	7.12	7.33	841	737	774	725	814	225	59	107	108	77
209	Trapaing Thmor	30.1	30.2	30.0	30.0	29.5	7.20	7.37	7.51	7.14	7.44	2,040	1,740	1,781	2,070	1,787	192	-50	-28	45	-96
222	Ta Vong	29.9	29.8	29.0	29.7	29.5	6.85	7.04	7.08	6.95	7.04	7,080	6,000	5,980	6,490	6,730	100	-75	-55	11	-66
242	Ta Pen	30.7	30.2	30.4	30.6	29.6	7.46	7.58	7.71	7.28	7.77	1,578	1,362	1,337	1,316	1,399	129	132	76	197	27
259	Svay Kraom	29.6	29.2	29.6	29.4	29.6	7.36	7.49	7.77	7.30	7.54	731	786	702	641	675	171	54	124	114	-81
288	Krang Svay	29.0	30.0	28.1	29.2	28.9	7.13	7.34	7.35	7.25	7.53	2,710	2,440	2,410	2,410	2,520	214	61	123	216	84
322	Angkor Chey	32.2	31.0	30.3	30.7	30.3	8.36	8.37	8.56	8.22	8.62	1,281	1,116	1,090	1,015	1,085	220	-15	110	24	-21
367	Ka Kou	29.6	29.0	29.0	29.2	28.0	6.79	6.90	7.03	6.69	7.18	496	450	459	421	452	23	-46	-23	-38	-71
388	Russei Tvear	29.9	29.6	28.0	29.3	29.1	6.55	6.79	6.51	6.93	7.01	365	359	334	306	324	8	-20	-9	-13	-63
393	Kok Trom Kha	31.3	30.0	30.0	30.4	27.3	6.91	7.10	6.87	7.03	7.34	648	583	596	550	597	45	-4	90	45	18
401	Prey Phdau	30.6	29.6	29.7	29.2	29.2	6.92	6.65	6.80	7.28	6.78	301	237	245	186	320	-48	-5	-42	-110	-59
406	Prek Ta Sa	29.4	29.1	29.0	29.0	29.8	6.44	6.56	6.52	6.71	6.62	1,287	1,205	1,254	1,127	1,042	-4	-38	-37	-63	-62
429	Sre Kak	30.0	29.5	29.9	29.0	28.8	7.14	7.45	7.53	7.26	7.46	893	847	778	780	813	257	106	114	236	118
454	Kiri Raksmey	30.1	29.8	29.4	29.5	29.1	6.86	7.18	7.29	7.06	7.32	1,907	1,791	1,815	1,754	1,887	248	111	139	190	118
25+1	JICE Center	30.4	30.2	29.6	30.2	30.1	7.31	7.23	7.56	7.37	7.54	876	797	868	756	797	222	-27	-37	35	-111

3.1.2 Water Quality Laboratory Testing

Samples were extracted from 24 test wells and 7 iron removal devices two times, in June and in November 2001, for water quality analysis in the laboratory. The laboratory results in June 2001 are shown in Table 3.4 along with the WHO guideline. Water quality items that exceed the permissible limit specified by WHO are represented in the colored column.

(1) Comparison with WHO Standards

Groundwater in almost all test wells has Fe levels exceeding the WHO guideline of 0.3 mg/ℓ. Groundwater also exceeds the 0.1 mg/ℓ level of the WHO guideline for Mn. In the Peri-Urban Area and Ta Keo, a lot of the wells have Na and Cl levels of over 200 mg/ℓ and 250 mg/ℓ, respectively. Similarly, TDS (Total Dissolved Solids) levels in many of the wells also exceed 1,000 mg/ℓ. Groundwater in some wells was also found to exceed the WHO guideline for SO_4, NO_3, and F. These results are almost the same as 1997 and 1999 laboratory tests conducted at the same test wells.

(2) Comparison with Water Quality Variations in Test Wells

The analysis of samples from 11 places carried out in June 2000 showed Fe levels exceeding the WHO guideline. While analysis of samples from 13 places carried out in June 1997 showed Fe levels exceeding the WHO guideline, it decreased to 9 places in May 1999 and again increased in June 2000. Fe levels were found to have increased in Svay Rieng and Prey Veng, particularly in Koy Trabek (No.113) and Cham Kar Leiv (No.162) where Fe levels were 32 mg/ℓ and 12 mg/ℓ, respectively (see Table 3.2 and Figure 3.4). The analysis of water samples taken from the same wells showed values that changed greatly, and it was particularly notable in Koy Trabeck (No. 113) and Prey Phdau (No. 401). Although this could be due to an actual change in iron concentrations, it could also be due to the fact that the analysis was conducted in a laboratory and not in the field.

Analysis carried out in 2000 showed an increase in Cl levels from 2,132 to 2,264 mg/ℓ in the village of Prech (No.181) and 2,245 to 2,380 mg/ℓ in the village of Ta Vong (No.222) in Ta Keo. According to the results of the analysis in 1997 and 1999, the Cl levels exceeded WHO guideline in 4 places and the levels found in the villages of Prek Ta Sa (No.406) in Prey Veng and Kiri Raksmey (No.454) in Kg. Speu also slightly exceeded the guideline in 2000 (see Table 3.3 and Figure 3.5).

Table 3.2 Fe by Laboratory Test 1997-2001

Village		Fe (mg/l) by Laboratory Test				
No	Name	Jun-97	May-99	Jun-00	Nov-00	Jun-01
56	Khvet	0.28	0.05	0.02	0.02	0.03
67	Mean Chey	0.05	0.26	0.32	0.05	0.02
71	Samraong	0.09	0.18	0.03	0.00	0.01
113	Koy Tra bek	4.00	9.60	32.00	19.00	-
122	Trapaing Thmor	2.70	5.40	5.10	4.10	6.00
139	Dok Por	2.50	10.00	5.40	4.50	7.10
162	Cham Kar Leiv	5.00	7.80	12.00	11.00	16.00
175	Toul Khpos	3.10	2.50	4.40	3.90	5.60
181	Prech	1.10	0.11	0.07	0.07	0.13
199	Prey Maok	0.02	0.01	0.05	0.04	0.08
209	Trapaing Thmor	0.04	0.11	0.10	0.26	0.03
222	Ta Vong	0.10	1.00	1.70	1.40	1.20
242	Ta Pen	0.44	0.20	2.00	0.35	0.11
259	Svay Kraom	0.07	0.05	0.10	0.09	0.08
288	Krang Svay	0.02	0.02	0.07	0.01	0.00
322	Angkor Chey	0.13	0.51	0.13	0.37	1.30
367	Ka Kou	1.00	0.09	1.30	0.96	1.40
388	Russei Tvear	1.40	0.27	1.10	1.40	1.80
393	Kok Trom Kha	0.25	0.07	0.07	0.08	0.19
401	Prey Phdau	0.88	7.60	3.10	8.40	27.00
406	Prek Ta Sa	5.20	4.50	5.90	6.10	8.90
429	Sre Kak	0.12	0.02	0.14	0.03	0.02
454	Kiri Raksmey	0.49	0.03	0.01	0.09	0.03
25+1	JICE Center	2.40	0.03	0.08	0.49	0.27

WHO Guideline: 0.3 mg/l

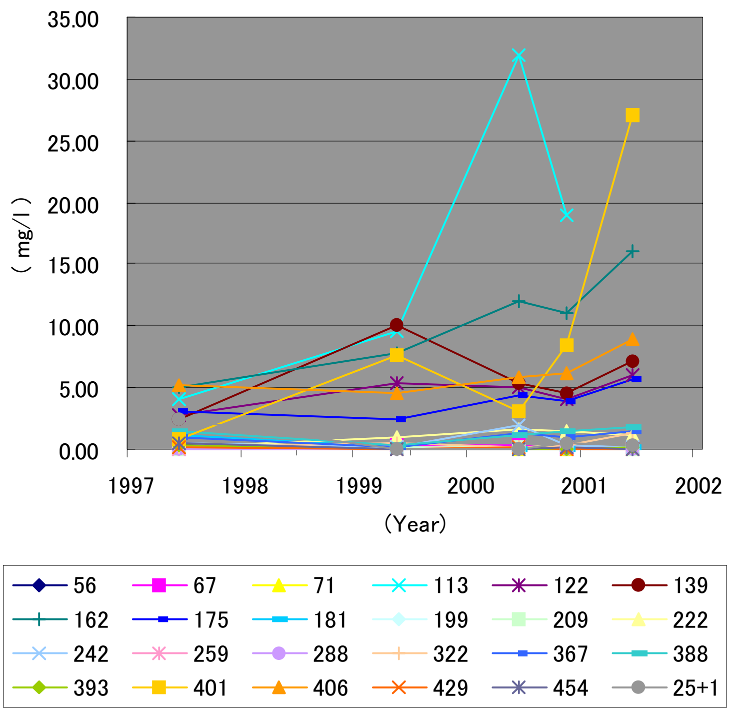


Figure 3.4 Fe by Laboratory Test 1997-2001

Table 3.3 Cl by Laboratory Test 1997-2001

Village		Cl (mg/l) by Laboratory Test				
No	Name	Jun-97	May-99	Jun-00	Nov-00	Jun-01
56	Khvet	48.0	53.0	48.0	55.0	53.0
67	Mean Chey	97.0	91.0	98.0	97.0	124.0
71	Samraong	455.0	444.0	624.0	564.0	649.0
113	Koy Tra bek	12.0	8.0	6.0	8.8	-
122	Trapaing Thmor	3.0	4.2	1.6	2.8	4.3
139	Dok Por	3.8	1.9	0.0	2.4	2.4
162	Cham Kar Leiv	1.5	3.1	0.8	0.8	2.3
175	Toul Khpos	3.1	0.8	0.4	1.2	0.8
181	Prech	1,690.0	2,132.0	2,264.0	2,260.0	2,210.0
199	Prey Maok	21.0	22.0	15.0	34.0	33.0
209	Trapaing Thmor	166.0	116.0	123.0	116.0	114.0
222	Ta Vong	2,130.0	2,245.0	2,380.0	2,340.0	2,280.0
242	Ta Pen	27.0	29.0	7.2	20.0	20.0
259	Svay Kraom	39.0	31.0	46.0	34.0	27.0
288	Krang Svay	136.0	29.0	24.0	22.0	25.0
322	Angkor Chey	30.0	22.0	22.0	25.0	24.0
367	Ka Kou	8.4	5.4	2.8	0.8	8.6
388	Russei Tvear	9.6	2.7	0.8	4.4	3.5
393	Kok Trom Kha	6.1	3.1	2.0	2.0	3.1
401	Prey Phdau	9.2	3.1	0.4	0.8	2.7
406	Prek Ta Sa	272.0	261.0	257.0	281.0	253.0
429	Sre Kak	35.0	65.0	55.0	63.0	78.0
454	Kiri Raksmey	135.0	222.0	252.0	271.0	241.0
25+1	JICE Center	25.0	22.0	20.0	36.0	21.0

WHO Guideline: 250 mg/l

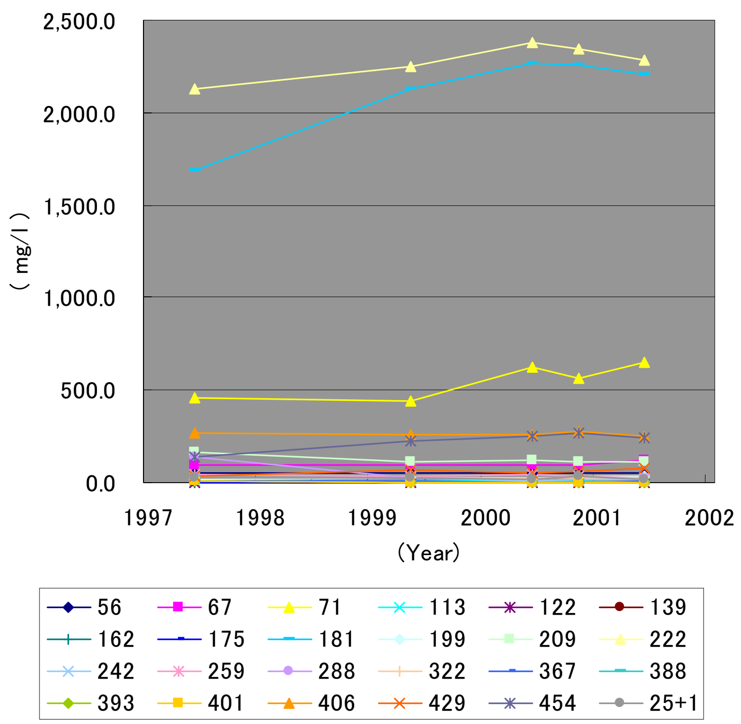


Figure 3.5 Cl by Laboratory Test 1997-2001

Table 3.4 Water Analysis by Laboratory Test on June 2001 (1/4)

From: Siam Tone	No		1	2	3	4	5	6	37	38	7
Set No : 1/44	Laboratory No.		44271	44272	44273	44274	44275	44276	44537	44538	44277
	Village No		56	67	71	122	122(F1)	122(F2)	139	139	162
Date Anal: July 10-20,2001	Sample Name	WHO Guideline	Khvet	Mean Chey	Samraong	Trapaing Thmor	Trapaing Thmor after FiltrationNo. 1	Trapaing Thmor after Filtration No. 2	Hand-Pump	New IRD	Cham Kar Leiv
pH; Laboratory value.			7.40	6.96	7.10	6.53	7.02	6.43	7.93	7.91	6.25
Specific Conductance. Laboratory value(uS/cm.)			1,220	1,400	4,450	178	173	180	310	300	231
Calcium (Ca)	(mg/L)		10	52	76	12	13	12	27	26	15
Magnesium(Mg)	(mg/L)		2.0	30	63	3.9	2.9	3.9	10	9.4	5.9
Sodium (Na)	(mg/L)	200	279	223	846	16	14	17	18	18	21
Potassium (K)	(mg/L)		1.6	2.4	5.6	3.9	5.2	3.8	5.8	5.5	4.7
Total Iron (Fe)	(mg/L)	0.3	0.03	0.02	0.01	6.0	1.1	0.03	7.1	0.87	16
Manganese (Mn)	(mg/L)	0.1	0.00	0.01	0.03	0.27	0.05	0.22	0.43	0.06	0.57
Ammonia(NH_4)	(mg/L)	1.5	0.02	0.32	0.38	0.12	0.03	0.00	0.12	0.21	0.23
Arsenic (As)	(mg/L)	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.018	0.005	0.00
Carbonate (CO_3)	(mg/L)		0	0	0	0	0	0	0	0	0
Bicarbonate (HCO_3)	(mg/L)		617	675	863	91	78	93	177	171	132
Dissolved gascarbondioxide(CO_2)	(mg/L)		39	118	110	43	12	55	3.3	3.4	119
Chloride (Cl)	(mg/L)	250	53	124	649	4.3	5.1	3.5	2.4	3.2	2.3
Sulfate (SO_4)	(mg/L)	250	74	47	432	1.8	0.3	1.5	0.4	0.0	0.9
Nitrate (NO_3)	(mg/L)	50	0.0	19	433	0.1	6.7	0.0	0.2	0.0	0.0
Fluoride (F)	(mg/L)	1.5	2.30	0.35	0.85	0.14	0.08	0.13	0.13	0.07	0.16
Silica (SiO_2)	(mg/L)		26	35	25	51	39	52	37	38	53
Total Hardness as $CaCO_3$	(mg/L)		34	252	450	46	44	46	109	104	62
Permanent Hardness as $CaCO_3$	(mg/L)		0	0	0	0	0	0	0	0	0
Total Dissolved Solids. (TDS)	(mg/L)	1000	752	864	2,960	144	126	140	196	186	185
Appearance of water at time Analysis			Clear	Clear	Clear	Precipitated iron	Small amount of precipitated iron	Clear	Precipitated iron	Small amount of precipitated iron	Large amount of precipitated iron

Table 3.4 Water Analysis by Laboratory Test on June 2001 (2/4)

From: Siam Tone	No		8	9	10	11	12	13	14	15	16
Set No : 1/44	Laboratory No.		44278	44279	44280	44281	44282	44283	44284	44285	44286
	Village No		162(F1)	162(F2)	175	175(F1)	175(F2)	181	199	209	222
Date Anal: July 10-20,2001	Sample Name	WHO Guideline	Cham Kar Leiv after Filtration No. 1	Cham Kar Leiv after Filtration No. 2	Toul Khpos	Toul Khpos after FiltrationNo. 1	Toul Khpos after FiltrationNo. 2	Prech	PreyMaok	Trapaing Thmor	Ta Vong
pH; Laboratory value.			6.64	6.42	6.38	7.10	6.41	6.70	7.26	7.23	6.84
Specific Conductance. Laboratory value(uS/cm.)			226	249	270	393	360	6,450	774	1,990	6,550
Calcium (Ca)	(mg/L)		15	19	13	34	18	552	78	48	600
Magnesium(Mg)	(mg/L)		5.9	5.4	14	9.3	15	156	24	34	215
Sodium (Na)	(mg/L)	200	21	20	19	21	24	828	70	446	515
Potassium (K)	(mg/L)		5.0	5.8	3.5	6.0	6.3	5.8	0.7	1.4	6.8
Total Iron (Fe)	(mg/L)	0.3	0.09	0.94	5.6	0.98	0.71	0.13	0.08	0.03	1.2
Manganese (Mn)	(mg/L)	0.1	0.00	0.01	0.70	0.14	3.2	0.11	0.20	0.13	1.90
Ammonia(NH_4)	(mg/L)	1.5	0.00	0.00	0.02	0.08	0.00	0.46	0.42	0.20	1.16
Arsenic (As)	(mg/L)	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carbonate (CO_3)	(mg/L)		0	0	0	0	0	0	0	0	0
Bicarbonate (HCO_3)	(mg/L)		128	124	126	103	144	392	468	958	268
Dissolved gascarbondioxide(CO_2)	(mg/L)		47	76	84	13	89	125	41	90	62
Chloride (Cl)	(mg/L)	250	3.1	2.3	0.8	10	9.4	2,210	33	114	2,280
Sulfate (SO_4)	(mg/L)	250	2.8	7.0	26	24	39	74	0.4	166	43
Nitrate (NO_3)	(mg/L)	50	0.3	0.0	0.0	80	4.6	0.2	0.0	0.0	0.3
Fluoride (F)	(mg/L)	1.5	0.16	0.19	0.29	0.10	0.36	0.33	0.24	0.38	0.44
Silica (SiO_2)	(mg/L)		54	43	49	38	34	45	39	23	37
Total Hardness as $CaCO_3$	(mg/L)		62	70	90	124	108	2,020	296	260	2,380
Permanent Hardness as $CaCO_3$	(mg/L)		0	0	0	40	0	1,700	0	0	2,160
Total Dissolved Solids. (TDS)	(mg/L)	1000	170	165	194	275	226	4,070	477	1,310	3,830
Appearance of water at time Analysis			Clear	Small amount of precipitated iron	Precipitated iron (Iron_Bacteria)	Large amount of insoluble matter	Small amount of dark_brown ppt.	Clear	Clear	Clear	Precipitated iron and insoluble matter

Table 3.4 Water Analysis by Laboratory Test on June 2001 (3/4)

From: Siam Tone	No		17	18	19	20	21	22	23	24	25
Set No : 1/44	Laboratory No.		44287	44288	44289	44290	44291	44292	44293	44294	44295
	Village No		242	242(F1)	242(F2)	25 + 1	259	288	322	367	388
Date Anal: July 10-20,2001	Sample Name	WHO Guideline	Ta Pen	Ta Pen after Filtration No. 1	Ta Pen after Filtration No. 2	JICE Center	Svay Kraom	Krang Svay	Angkor Chey	Ka Kou	Russei Tvear
pH; Laboratory value.			7.42	8.07	6.81	7.33	7.45	7.29	7.86	6.94	6.76
Specific Conductance. Laboratory value(uS/cm.)			1,400	1,120	1,270	808	672	2,560	1,090	463	334
Calcium (Ca)	(mg/L)		22	10	11	45	54	30	4.0	34	17
Magnesium(Mg)	(mg/L)		8.8	3.4	5.4	21	37	22	0.5	18	8.3
Sodium (Na)	(mg/L)	200	336	232	307	114	42	655	260	41	45
Potassium (K)	(mg/L)		1.2	6.5	6.4	1.0	2.4	3.8	1.0	2.3	3.1
Total Iron (Fe)	(mg/L)	0.3	0.11	3.1	0.18	0.27	0.08	0.00	1.3	1.4	1.8
Manganese (Mn)	(mg/L)	0.1	0.05	0.32	0.04	0.05	0.30	0.02	0.12	0.35	0.32
Ammonia(NH_4)	(mg/L)	1.5	0.07	0.18	0.14	0.21	0.45	0.15	0.00	0.26	0.00
Arsenic (As)	(mg/L)	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carbonate (CO_3)	(mg/L)		0	0	0	0	0	0	0	0	0
Bicarbonate (HCO_3)	(mg/L)		939	623	850	506	388	1,650	696	291	194
Dissolved gascarbondioxide(CO_2)	(mg/L)		57	8.5	211	38	22	135	15	53	54
Chloride (Cl)	(mg/L)	250	20	0.0	24	21	27	25	24	8.6	3.5
Sulfate (SO_4)	(mg/L)	250	2.2	3.4	0.5	1.5	1.4	117	3.4	0.0	5.8
Nitrate (NO_3)	(mg/L)	50	0.0	6.6	0.0	0.0	6.2	0.0	0.0	0.0	0.0
Fluoride (F)	(mg/L)	1.5	0.39	0.22	0.49	0.25	0.51	0.63	2.14	0.38	0.30
Silica (SiO_2)	(mg/L)		38	22	43	28	37	43	21	46	56
Total Hardness as $CaCO_3$	(mg/L)		90	40	50	200	284	168	12	156	76
Permanent Hardness as $CaCO_3$	(mg/L)		0	0	0	0	0	0	0	0	0
Total Dissolved Solids. (TDS)	(mg/L)	1000	891	594	818	482	398	1,710	660	295	236
Appearance of water at time Analysis			Clear	Clay and Colloidal	Insoluble matter	Clear	Small amount of insoluble matter	Clear	Insoluble matter Yellow color	Small amount of precipitated iron	Small amount of precipitated iron

Table 3.4 Water Analysis by Laboratory Test on June 2001 (4/4)

From: Siam Tone	No		27	28	29	30	31	32	33	34	35
Set No : 1/44	Laboratory No.		44297	44298	44299	44300	44301	44302	44303	44304	44305
	Village No		393	401	406	406(F1)	406(F2)	429	429(F1)	429(F2)	454
Date Anal: July 10-20,2001	Sample Name	WHO Guideline	Kok Trom Kha	Prey Phdau	Prek Ta Sa	Prek Ta Sa after Filtration No. 1	Prek Ta Sa after Filtration No. 2	Sre Kak	Sre Kak after Filtration No. 1	Sre Kak after Filtration No. 2	Kiri Raksmey
pH; Laboratory value.			7.23	6.64	6.85	7.10	6.41	6.89	7.37	6.91	7.09
Specific Conductance. Laboratory value(uS/cm.)			600	253	1,210	1,240	1,230	831	217	794	1,930
Calcium (Ca)	(mg/L)		46	8.5	52	25	46	96	22	98	132
Magnesium(Mg)	(mg/L)		19	7.0	29	47	28	28	4.4	21	61
Sodium (Na)	(mg/L)	200	67	40	169	172	169	17	12	35	174
Potassium (K)	(mg/L)		4.7	2.4	3.7	4.7	4.3	0.5	3.0	0.6	1.6
Total Iron (Fe)	(mg/L)	0.3	0.19	27	8.9	0.05	0.08	0.02	0.25	0.00	0.03
Manganese (Mn)	(mg/L)	0.1	0.59	0.80	2.0	0.02	0.05	0.06	0.01	0.02	0.07
Ammonia(NH_4)	(mg/L)	1.5	0.40	0.00	0.58	0.51	0.30	0.40	0.11	0.64	0.81
Arsenic (As)	(mg/L)	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carbonate (CO_3)	(mg/L)		0	0	0	0	0	0	0	0	0
Bicarbonate (HCO_3)	(mg/L)		386	151	237	248	183	343	81	318	689
Dissolved gascarbondioxide(CO_2)	(mg/L)		36	55	53	32	114	71	5.5	63	90
Chloride (Cl)	(mg/L)	250	3.1	2.7	253	254	273	78	10	77	241
Sulfate (SO_4)	(mg/L)	250	3	1.5	45	48	44	21	0	20	38
Nitrate (NO_3)	(mg/L)	50	0.0	0.1	0.1	0.3	1.0	13	19	20	0.0
Fluoride (F)	(mg/L)	1.5	0.30	0.37	0.42	0.30	0.41	0.36	0.26	0.38	1.23
Silica (SiO_2)	(mg/L)		61	26	58	50	47	37	17	37	37
Total Hardness as $CaCO_3$	(mg/L)		192	50	250	255	230	355	74	330	580
Permanent Hardness as $CaCO_3$	(mg/L)		0	0	56	52	80	74	8	70	15
Total Dissolved Solids. (TDS)	(mg/L)	1000	395	192	738	723	703	460	128	467	1,030
Appearance of water at time Analysis			Clear	Large amount of Precipitated iron	Precipitated iron	Clear	Clear	Clear	Small amount of insoluble matter	Clear	Clear

3.2 Water Level

The monitoring results show no obvious change in water level between 1997 and 2000 except in Mean Chey (No67) in Peri-Urban (see Table 3.5 and Figure 3.6). Because the test well in Mean Chey is located near the center of Phnom Penh city, it seems that the water level of the test well is influenced by water pumped for industrial use.

Table 3.5 Water Level 1997-2000

Village		Water Level (m)		
No	Name	Aug-97	Mar-99	Jun-00
56	Khvet	-6.3	-7.6	-7.2
67	Mean Chey	-9.1	-13.1	-14.8
71	Samraong	-1.7	-	-
113	Koy Tra bek	-0.6	-1.5	-1.2
122	Trapaing Thmor	-3.8	-	-
139	Dok Por	-5.6	-5.1	-
162	Cham Kar Leiv	-3.1	-3.5	-3.5
175	Toul Khpos	-2.5	-	-
181	Prech	-3.5	-	-4.2
199	Prey Maok	-2.8	-3.8	-3.8
209	Trapaing Thmor	-2.7	-3.1	-3.2
222	Ta Vong	-4.6	-	-
242	Ta Pen	-5.9	-4.4	-6.8
259	Svay Kraom	-1.5	-5.4	-3.8
288	Krang Svay	-8.7	-	-
322	Angkor Chey	-3.7	-3.4	-
367	Ka Kou	-6.5	-8.2	-6.4
388	Russei Tvear	-5.0	-6.2	-5.1
393	Kok Trom Kha	-5.5	-6.6	-5.9
401	Prey Phdau	-5.0	-4.9	-5.1
406	Prek Ta Sa	-1.4	-5.7	-
429	Sre Kak	-3.5	-3.2	-3.1
454	Kiri Raksmey	-1.8	-4.6	-2.6
25+1	JICE Center	-3.1	-2.5	-

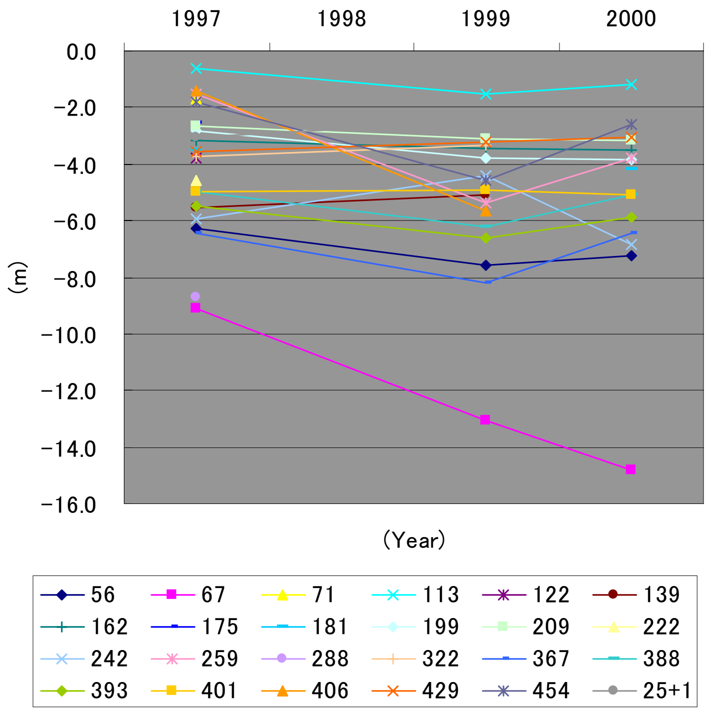


Figure 3.6 Water Level 1997-2000

CHAPTER 4

ARSENIC ISSUES

CHAPTER 4 ARSENIC ISSUES

4.1 Field Measurement of Arsenic

4.1.1 Methodology

Fieldwork on water quality monitoring was conducted from June 13th to August14th, 2001. Two groups were organized to visit the 241 target villages. The fieldwork consisted of interviews, in-situ water quality measurement and sketch mapping. In the first two weeks, from 13th to 26th June, the monitoring groups were trained by the JICA Study Team to learn necessary techniques including work plan formulation, monitoring preparation, sampling point selection, sampling, in-situ measurement, sketch mapping, data arrangement and calibration, checking of meters, etc.

In order to select sampling points, interviews were carried out to get information about the distribution of water sources of the surveyed villages. Data on water sources, especially for wells, such as names of owner and creator, construction year, depth and others specifications were also obtained by interview.

In-situ water quality measurements were carried out for general and specific parameters. The general parameter, consisted of water temperature, pH, ORP (Oxidization and Reduction Potential) and EC (Electricity Conductivity). Iron (Fe) and arsenic (As) were selected for the specific parameters. The general parameters were measured using potable water quality meters. Iron and arsenic were measured with test packs and Hironaka-type field test kits, respectively.

Figure 4.1 shows the procedures of the fieldwork. Procedures of arsenic and iron measurement are shown in Figure 4.2 and Figure 4.3. Water sampling was carried out according to the procedure shown in Annex 1.

In order to clarify the water-quality distribution in the villages and notify when detailed surveys or new water source development would be carried out, sketch maps were created in each village centering on the sampling points. Figure 4.4 shows the procedure for sketch mapping.

Sketch maps were only created in villages where at least one water source could be found. Out of the 260 surveyed villages, a total of 245 sketch maps were created.

The following features were included on the sketch map: direction arrows, coordinates in UTM (Universal Transverse Mercator's projection), a scale, roads, rivers, ponds, main buildings (such as temples, hospitals, schools, bridges and so on). The main characteristics of survey points were also put onto the sketch maps, such as the nature of the water source, names of owner and creator, and in-situ water quality measurement results of iron and arsenic.

4.1.2 Sampling

A total of 241 villages were selected as target villages for the monitoring, and 3 points in each village were selected as survey points. However, in several villages no or less than 3 water sources could be found. Therefore, 20 supplementary villages adjacent to the target villages (or near the central point if the distance between target villages was too long) were selected to get the water quality data. The number of villages and water sources being visited for in-situ water quality measurement are 260 and 745, respectively. Figure 4.5 shows the location of surveyed villages.

If more than 3 points could be found in a village, survey points were selected according to priority in the order of boreholes, dug wells, and other kinds of water sources. However, out of the 241 target villages, 53 have no boreholes, and 21 do not have any water sources using groundwater. Table 4.1 classifies the water sources in each province.

Table 4.1 Distribution of Water Source for Sampling

Province	Borehole	Combine well	Dug Well	Pond	River	Rain Water	Total
Phnom Penh	54	2	55	78	1	---	190
Ta Keo	107	---	54	24	---	---	185
Kg. Speu	45	---	50	9	1	---	105
Kandal	57	1	18	22	1	1	100
Svay Rieng	64	5	23	---	---	---	92
Prey Veng	58	---	17	1	---	---	76
Total	385	8	217	134	3	1	748
Percentage	51.5	1.1	29.0	17.9	0.4	0.1	100

The details of in-situ water quality measurement are shown in Annex2.

4.1.3 Water Quality Standard for Arsenic

Arsenic was included in the in-situ water quality measurement as a specific parameter.

Arsenic was recognized and used from ancient times as a toxic substance, however, attention has been drawn to groundwater contamination by arsenic only since a little more than ten years ago.

In addition to the southern part of Cambodia, groundwater with high arsenic levels has also been found in neighboring countries such as Thailand, Malaysia and Vietnam. Arsenic contamination of groundwater is becoming a regional problem. In 1997, a JICA Study Team conducted the first tests in the Study Area in six villages with possible arsenic contamination, but no village was found to have high arsenic levels at that time. The first report of possible high arsenic concentrations in groundwater was issued by WHO, when a water quality survey was carried out in February 2000.

Of the earth's metals, arsenic ranks 20th in terms of amount, and occurs naturally in rocks and soil, water, air, and plants and animals, and find its way into the environment through natural activities such as volcanic action, erosion of rocks, and forest fires, or through human activity. Arsenic itself is insoluble, however, most of its compounds are water solubility.

In industries, arsenic is often used for manufacturing glass, preservative substances, agricultural chemicals, semiconductors, etc.

Arsenic exists, not only in plants and animals, but also in the human body in very small quantities. However, there is no evidence to show arsenic as a necessary element for our health. The human body can absorb arsenic through the stomach and intestines or the lungs. Although it might be quickly excreted, arsenic usually remains in hair or nails for many years.

Arsenic itself and many of its compounds are virulent poisons. Some of the proven effects of arsenic on the human body are gastroenteric stimulus, hypofunction of nerves, heart, blood vessels and other internal-organs, lesions on the skin, and various kinds of cancers, such as bladder, lung, kidney, liver, etc.

Arsenic contamination in drinking water is a problem of because of its toxicity. However, The toxicity of arsenic changes according to its form. Organic arsenic within plants and animals seems free from toxicity. Arsenic concentrations in sea fish and meat or fowl can reach levels as high as 0.4~118 mg/kg and 0.44 mg/kg, much higher than the present WHO drinking water quality guideline value.

However, most arsenic exists in an inorganic form in groundwater and generally, inorganic arsenic is much more poisonous than organic arsenic. Of the inorganic forms of arsenic, the toxicity of arsenic III is more than 10 times that of arsenic V. In other words, the toxicity of drinking water with 0.1 mg/ℓ of arsenic V is lower than that of the water with 0.01 mg/ℓ of arsenic III.

Nevertheless, establishing a water quality standard value for arsenic is a problem that hasn't been completely solved. A standard value of 0.05 mg/ℓ has been taken by many countries for a long time, however, in the second edition of the WHO guideline for drinking-water quality published in 1996, a provisional value of 0.01 mg/ℓ was recommended.

USEPA also decided to change the standard value of arsenic, and put out a recommended value of 0.005 mg/ℓ, together with 3 comment values of 0.003, 0.01 and 0.02 mg/ℓ in 2000. In January 2001, America decided to set the same value as WHO (0.01 mg/ℓ) to be the new standard value for arsenic, based on the conclusion that the maximum economic efficiency could be expected by this value. According to an EPA report, the revision of the water quality standard value for arsenic will prevent 19~31 and 19~25 cases of bladder and lung cancer respectively, and 5~8 and 16~22 deaths due to bladder and lung cancer, with a savings of US$ 140~180 million per year.

A number of methods to remove arsenic from drinking water have been tested, such as Activated Alumina (AA), Coagulation / Filtration (C/F), Ion Exchange (IE), Reverse Osmosis (RO), Electrodialysis Reversal (EDR) etc. It is technically feasible to remove 0.03 mg/ℓ of arsenic in water supplies; however, the cost of the level of treatment required is high. Furthermore, as arsenic has no proven health benefits and the risk of various cancers still remains even at a level of 0.01 mg/ℓ, the lowest possible concentration of arsenic in drinking water is desirable, however, technical limitations and high costs restrict the adoption of a more severe standard value.

According to a USEPA estimation, about 5.5 % of all water services will need to take measures to reduce arsenic in their drinking water due to the revision of the standard value. The total national costs per year would be approximately $US 181 million. Facing the problem of health risks and the cost for countermeasures, USEPA set the water quality standard at a level that "maximizes health risk reduction benefits at a cost that is justified by the benefits".

In addition, WHO claims to set the water quality standard of a country on the basis of synthesizing the concerned conditions in the country, such as natural environment, life style, etc. It is necessary to think of a drinking water quality standard value for arsenic in Cambodia, since a standard has not been set yet. The simplest method might be to adopt the value proposed by WHO, however, a value, which is more suitable to the situation of Cambodia, should be determined based on previous studies and investigations. Other factors such as capability and costs of monitoring and water source management, expected benefits and so on should also be considered with the most importance placed on human health.

4.1.4 Villages Affected by Arsenic Contamination

Though there is still the question of how to establish the water quality standard for arsenic in Cambodia, the situation of arsenic contamination in the villages has been revealed by the survey. Figure 4.6 and Table 4.2 show the summary of the results of the arsenic analysis based on the maximum value detected in each village.

As shown in Figure 4.6, arsenic levels are confirmed to be less than 0.01 mg/ℓ. in 240 out of the 260 villages (about 92.4 % of surveyed villages in the Study Area). This result indicates that the majority of the villages in the Study Area is arsenic free, or can be identified as arsenic safe.

In 9 villages, about 3.5 % of all the surveyed villages, the maximum arsenic levels were found to range from 0.01 to 0.05 mg/ℓ, just between the standard values of the first and second editions of WHO guidelines. Although it is still questionable whether water with arsenic concentrations of this level should be declared unsuitable for drinking in Cambodia, water sources in this arsenic rank should at least be considered as risky for a drinking water supply.

In 11 villages, about 4.3 % of all the surveyed villages, arsenic levels were found to be as high as over 0.05 mg/ℓ, obviously unsuitable for use as drinking water. In 8 villages in particular, arsenic levels exceeded the present WHO standard value by more than 10 times, so that countermeasures have to be taken such as development of alternative water sources.

Table 4.2 Summary of Arsenic Analysis Result(1)
Distribution of Maximum Value

Province	nd	<0.01	0.01-0.05	0.05-0.1	>0.1	Total
Kandal	24	6	3	0	5	38
Prey Veng	16	6	2	0	2	26
Phnom Penh	43	19	2	2	1	67
Svay Rieng	24	5	2	0	0	31
Kg. Speu	33	2	1	0	0	36
Ta Keo	58	4	0	0	0	62
Total	198	42	9	3	8	260
Percentage	76.2%	16.2%	3.5%	1.2%	3.1%	100%

Figure 4.7 shows the distribution of the maximum value in the Study Area.

Table 4.3 shows the list of all villages, where arsenic has been found at concentrations over 0.01 mg/ℓ from at least one water source.

Table 4.3 List of Villages With Arsenic Problem

(1/2)

No	Province	District	Commune	Village	$As\text{-}FK_{avrag}$	$As\text{-}FK_{max}$	As-Lab
262	Kandal	Kaoh Thum	Prek Sdei	Prek Ta Mem	0.375	0.5	0.303
258	Kandal	Kaoh Thum	Prek Thmei	Svay Kandal	0.2	0.6	0.205
407	Prey Veng	Peam R6	Neak Loeung	Prek Thum	0.168	0.5	0.151
290	Kandal	Mukh Kampul	Svay Ampear	C. T. Phloah	0.007	0.02	0.091
363	Prey Veng	Kanh Chreach	Preal	Kouk Roka	0.014	0.04	0.07
97	P. Penh	Ruessei	Svay Pak	Lor Kambao	0.2	0.3	0.049*
36	P. Penh	Dangkao	Prey Veng	Trapaing Svay	0.017	0.05	0.023

(2/2)

No	Province	District	Commune	Village	As-FK$_{avrag}$	As-FK$_{max}$	As-Lab
406	Prey Veng	Peam R6	Neak Loeung	Prek Ta Sa	0.053	0.2	.0019*
22	P. Penh	Dangkao	Kouk Rokar	Chumrov	0.005	0.01	0.014
S-13	Kandal	Ta Khmau	K. Samnanh	Koki	0.55	0.6	---
Sp-7	Kandal	Ta Khmau	K. Samnanh	Temple	0.4	0.4	---
S-12	Kandal	Kaok Thom	Prek Sdey	Prek Pok	0.15	0.3	---
Sp-6	Kandal	Angsnuol	Snor	Snor	0.01	0.01	---
375	Prey Veng	K. Mear	Kranhung	Pongro	0.003	0.01	0.008
289	Kandal	Mukh Kampul	Svay Ampear	K. Prasat	0.007	0.01	0.005
431	Kg. Speu	Peam Chor	Rolaing Chak	Sre Cheng	0.003	0.01	0.003*
153	Svay Rieng	Chan Trei	Pras Sat	Kandal	0.005	0.01	0.003
46	P. Penh	Dangkao	Cheung Aek	Prek Pranak	0.017	0.05	nd
78	P. Penh	Ruessei	P.Penh Thmei	Dei Thmei	0.003	0.01	nd*
174	Svay Rieng	Svay Chrom	Cham Bok	Ta Nu	0.003	0.01	nd*

* : Not all water samples for laboratory analysis are from the boreholes where relatively high concentrations of arsenic were found by field kit measurement, because the wells were broken and other reasons.

4.1.5 Arsenic Contaminated Area

In villages where more than 3 existing water sources can be found, in-situ water quality measurements were carried out at 3 or more survey points. Therefore, the risk of overlooking water sources containing high arsenic concentrations would be small, and the average value of arsenic in the village could be obtained. Table 4.4 shows the summary of the results of the arsenic analysis based on the average value in each village.

Table 4.4 Summary of Arsenic Analysis Result(2)

Distribution of Average Value

Province	nd	<0.01	0.01-0.05	0.05-0.1	>0.1	Total
Kandal	24	8	1	0	5	38
Prey Veng	16	7	1	1	1	26
Phnom Penh	43	21	2	0	1	67
Kg. Speu	33	3	0	0	0	36
Svay Rieng	24	7	0	0	0	31
Ta Keo	58	4	0	0	0	62
Total	198	50	4	1	7	260
Percentage	76.2%	19.2%	1.5%	0.4%	2.7%	100%

The average value of arsenic concentrations measured has also been used as the representative value in each surveyed village to create the contamination map shown in Figure 4.8.

Within the Study Area, all villages in the three provinces, Ta Keo, Kg. Speu and Svay Rieng, were confirmed to have an average arsenic value less than 0.01 mg/ℓ. This indicates that either the village is arsenic free, or that although suspicious water sources might exist there, safe water sources also exist so that changing to an alternative water sources can be easily performed.

In the other three provinces, Kandal, Peri-Urban and Prey Veng, arsenic levels are found over 0.05 mg/ℓ in some villages. One of them is the village of Lor Kambao, which is situated to the north of Peri-Urban. Two boreholes, with depths of 21 and 26 m, respectively, were used to withdraw groundwater from a shallow aquifer. Arsenic levels were detected as high as 0.3 mg/ℓ form both the two boreholes to indicate the possibility that arsenic contamination has spread to the shallow aquifer.

Similar to Lor Kambao, all the surveyed boreholes in another two villages, Koki and Prek Ta Memin in Kadal Province, are found to be contaminated with arsenic. In view of the relatively serious contamination conditions and an absence of good alternative water sources, these villages should be established as urgent areas in formulating countermeasures.

As shown in Figure 4.8, arsenic contamination is distributed in a belt-like zone (the urgent area) that stretches along the Mekong River.

4.1.6 Contamination Ratio of Water Sources

Water sources in the Study Area can be classified into 4 types: boreholes, combined wells, dug wells, and surface water. Figure 4.9 shows the percentage of arsenic contaminated samples in the different types of water sources. The water source groups are expressed in the chart according to depth; and this sequence is believed to generally be consistent to the change of water environment from reduction to oxidation.

With the exception of combined wells, the percentage of arsenic contaminated samples decreases just according to the sequence of groups. All samples with arsenic levels over 0.05 mg/ℓ are from boreholes, and all samples from surface water have arsenic levels less than 0.01 mg/ℓ.

If there is no problem concerning drinking water quality other than arsenic, it is undoubtedly a good idea to change the water source from groundwater to surface water in possible villages. However, compared with groundwater especially in an area of plains like the Study Area, supplies from surface water are not stable enough; They are easily affected by human and animal activity and contain relatively more germs and, therefore are unsuitable for drinking purposes without being treated and disinfected.

4.2 Results of Laboratory Analysis

Based on the results of the in-situ measurements, all villages with arsenic levels over the present WHO guideline value, and villages with iron levels largely over the WHO guideline value were selected for laboratory analysis sampling.

Water sampling was carried out over two weeks from the 3rd to the 20th of September, 2001. However, three villages, Prek Ta Mem and Svay Kandal in Kandal, and Kouk Roke in Prey Veng, where quite high arsenic levels were detected by the in-situ measurements, were impossible to access in September because of floods. These three villages were visited by motorbike, boat and on foot on October 10th and 11th.

The following 21 parameters were selected for laboratory analysis: pH, EC, calcium (Ca), magnesium (Mg), Sodium (Na), potassium (K), ammonia (NH4), Fe, Manganese (Mn), silicon dioxide (SiO2), As, carbonate (CO3), hydrogen carbonate (HCO3), carbon dioxide (CO2), chloride (Cl), sulfate (SO4), nitrate (NO3), fluoride (F), hardness total, hardness non carbonate, and total dissolved solids (TDS).

In addition to the 36 samples taken in the water quality monitoring survey, 24 more samples were taken from JICA pilot wells also, to make a total of 60 laboratory analyzed samples.

4.2.1 Correlation of FK and Laboratory

Compared with the field kit measurements, laboratory analysis is much more accurate and better for very minute detections. However, the procedure is complex and a lot of time, expensive equipment and skilled technicians are required. Therefore, laboratory analysis can only be used for checking the results of in-situ measurements and the majority of samples have to be measured by field kit.

Figure 4.10 shows the relation of the results between field kits and laboratory analysis. The correlation coefficient acquired is larger than 7.4, to indicate that it is fairly consistent. The correlation equation suggests that the results of field kits tend to be larger than the results of laboratory analysis.

4.2.2 Water Quality Pattern

Figure 4.11 shows the ratio of the main components in groundwater by a tri-linear diagram. The diamond graph in the figure is generally divided into four domains and the majority of the groundwater in the Study Area is located in domain I, and II and the adjacent domain, V. This indicates a typical pattern of fresh groundwater. The result suggests that groundwater water from the aquifer being used for existing water sources is mainly recharged by rainfall, and there seems to be no possibility of influence by special geological conditions like mining. However, the several samples taken from domain VI, in particular, have chloride as the prevailing component in anion, suggesting the possibility of the existence of fossil water.

Most of the samples with high arsenic levels were taken from domain I with calcium and hydrogen-carbonate prevailing in cation and anion, respectively. This kind of water quality pattern is usually found in relatively fresh groundwater.

4.2.3 Hexa-Diagram and EPM (Equivalents Per Million)

Figure 4.12 is the Hexa-Diagram of the Study Area. The following points can be found from the diagram.

- The water quality pattern changes from calcium a hydrogen carbonate type to a sodium and potassium chloride type, when the EPM (Equivalents Per Million) gets larger. The quantity of dissolved substances in the groundwater increases, and then the EPM goes up in proportion to the length of the period after the recharge from rainfall into aquifer. Calcium is easily absorbed into surface soil as compared with sodium and potassium, and as a result of ion exchange, the ratio of sodium and potassium increases in proportion to the length of time groundwater is stagnant in the aquifer.

- Villages with high EPM tend to concentrate on the western side of the Mekong River. Although evidence is not enough to explain this characteristic, the following reasons might be taken into consideration.

  - On the western side of the Mekong River, there is the boundary of the Mekong groundwater basin, which separates the thick sediment in the basin and the basement rocks to the west. Therefore, sediment there might be different from the sediment within the basin.
  - Water quality is affected by basement rocks.

- No obvious difference in water quality patterns could be found between samples with and without arsenic; however, total EPM can be found in the tendency that arsenic containing samples are generally in middle rank. Since EPM in the same area generally changes in proportion to the period the groundwater is stagnant, the difference in size of the hexa-diagram suggests that groundwater highly contaminated with arsenic stagnates in the aquifer for neither too long nor too short a period.

4.2.4 Arsenic and Water Environment

The water quality parameters pH and ORP were measured in the field survey. These two parameters are different from other water quality parameters in that they do not represent any particular components, but represent the balance of all components in water, and are to be used as indicators of the water environment.

Figure 4.13 shows the relation between arsenic level and the water environment. The range of pH levels in water sources with high arsenic concentrations is within 6.6 to 7.5. As for ORP, all water sources with an arsenic level over 0.1 mg/ℓ are located in a domain of ORP less than 15 (mV). That is, there tends to be water with high arsenic levels in a reduction environment with a nearly neutral pH.

Previous studies in many other countries on the mechanism of arsenic disolved into groundwater have put out several hypotheses, and the most popular one is that arsenic contained in soil and rocks tends to disolved into groundwater in a reduction environment. In addition, if the reduction environment is strong, arsenic can easily exist in the form of arsenic III.

4.2.5 Arsenic and Other Water Quality Parameters

The relation between arsenic and other water quality parameters was checked by laboratory analysis. Figure 4.14 shows the correlation coefficients. For all water quality parameters, the correlation coefficient to arsenic is low, between 0 and 0.3.

Ammonia has the largest correlation coefficient to arsenic, however, this does not mean that ammonia takes part in or affects the behavior of arsenic. The large correlation coefficient is considered to be due to the fact that both arsenic and ammonia easily exist in a reduction environment.

Of the cation components, iron has the biggest correlation coefficient to arsenic. Similar results have been found in many other countries.

4.2.6 Iron Distribution

Figure 4.15 shows iron distribution together with the location of villages where the average arsenic level is over 0.01 mg/ℓ. On the whole, iron is higher in the eastern region than the western region. In addition, a high iron zone can be identified along the Mekong River in compliance with the high arsenic zone. Generally, in villages with relatively high levels of arsenic, iron is also in high levels, however, arsenic is not be high in many other villages where iron is high.

Contamination of arsenic in groundwater is usually related to the problem of iron, because of the well-known tendency of arsenic to settle together with iron, especially when the water environment changes from reduction to oxidation. And in the opposite case, arsenic is also supposed to dissolve into water together with iron.

On the other hand, iron itself is also an important water quality parameter in the Study Area. Of all the elements, iron is ranked 4th in terms of abundance on the earth, and is contained in large amounts in the human body as an essential nutritional component. However, clothes would become discolored if washed with water containing iron levels above 0.3 mg/ℓ, and water would have a metallic odor if the iron content is over 0.5~1.0 mg/ℓ. In addition, some iron-related problems would occur in industry and water supply systems.

In consideration of health, the minimum daily requirement for iron is estimated at about 10~50 mg/day, therefore, the superfluous ingestion of iron through drinking water is not likely to occur. As a matter of fact, in many cases supplements of iron are needed rather than a reduction of intake.

In the WHO guideline the reference value for iron is given as 0.3 mg/ℓ, but it is not a health-based guideline parameter. The value of iron was set based on user complaints about the staining of laundry and sanitary wear.

A little more than half, 135 out of the 260 surveyed villages (52 %), were found to have iron levels over the WHO proposal guideline value. The average value of in-situ iron tests is summarized and shown in Table 4.5.

Table 4.5 Summary of Iron Analysis Result
Distribution of Average Value

Province	<0.3	0.3-1	1-2	2-5	>5	Total
Kandal	20	8	3	4	3	38
Kg. Speu	23	9	2	1	1	36
Phnom Penh	41	18	7	1	0	67
Prey Veng	4	3	11	6	2	26
Svay Rieng	6	7	9	7	2	31
Ta Keo	31	20	7	4	0	62
Total	125	65	39	23	8	260
Percentage	48.1%	25.0%	15.0%	8.8%	3.1%	100%

Iiron changes its form and solubility in water according to ORP and/or pH,. Iron exists in groundwater, usually in the form of ferrous hydrogen carbonate [Fe(HCO3)2]. Particularly, in colorless and transparent groundwater with a pH below seven (7), iron is almost always in this form. Ferrous hydrogen carbonate has a tendency to be oxidized. When groundwater is extracted and left to aerate, the ferrous hydrogen carbonate in the extracted groundwater will change to ferric hydroxide [Fe(OH)2], which is brown in color and insoluble.

As iron has the characteristic of having a tendency to precipitate, iron can be removed from groundwater comparatively easily. In one experience in Bangladesh, a well water sample was agitated by a stick for about 10 minutes and then left for about one hour. As a result the dissolved iron content of the well water sample decreased from 5 to 0.5 mg/ℓ.

In villages where iron levels are too high to be suitable for domestic water use, a simple way to solve the problem is to adopt the iron removal device (IRD) that was designed and used in JICA pilot wells. With this kind of IRD, iron can be reduced to a level low enough to meet the WHO’s guideline value.

4.3 Findings and Recommendation

4.3.1 Findings

The followings are the main findings in this water quality monitoring survey:

- A little less than 10% of water sources are identified as facing an arsenic problem in southern Cambodia.
- Villages with relatively serious arsenic problems concentrate in the central part of the Study Area, forming an belt-like zone along the Mekong River.
- Arsenic levels are closely related to the water environment. All samples with arsenic levels over 0.1 mg/ℓ appear in the domain of ORP below 15 mV.
- The result of water quality pattern analyses suggests that the majority of arsenic contaminated water stagnates in aquifers for relatively short periods.
- The ratio of arsenic contamination goes down according to the depth of the water source (In sequence from boreholes to surface water).
- No significant correlation can be identified between arsenic and analyzed water quality parameters. However, a high iron zone is identified along the Mekong River, corresponding with the high arsenic zone.

The following are the main recommendations about the arsenic issue in the Study Area.

- Although the general characteristics of the distribution of arsenic in the Study Area have been revealed by sample surveys, some matters concerning the arsenic problem still remain. The most urgent issue is to confirm, particularly in the high arsenic contaminated zone, the safety of all the existing water sources. Therefore, a screening survey should be carried out and a groundwater database should be established including the results of the screening survey.

  Since there are many factors concerning the screening survey is many matters such as budget, length of survey period, and preparation of manpower and equipment, implementation of the survey is expected to take time and will not cover the entire Study Area immediately. Therefore, areas should be prioritized as follows:

  a. Urgent Area: villages within the arsenic contamination zone

  b. Second Urgent Area: villages around the urgent area

  c. Third Urgent Area: other suspicious villages and their adjacent areas.

d. Ordinary Area: the rest of the villages in the Study Area

Field kits are available for arsenic measurement in the screening survey, however, some of the samples, e.g. 10 % of the total samples, should also be analyzed in a laboratory to ensure the accuracy of the screening survey.

- Based on the results of the screening survey, the problem water sources should be informed to the users and owners, by marking them in red paint or some other simple but efficient method. And measures should be taken immediately to stop the use of water sources with arsenic levels too high for a drinking water supply.
- As for countermeasures against arsenic problems, usage and/or development of alternative water sources are considered to be the optimum method. In villages where safe water sources exist, this kind of alternation is easy to be performed, however, for villages where safe water sources are absent, the following countermeasures should be taken: the development of groundwater from other aquifers; the popularizing of rain water harvest facilities; and/or the establishment arsenic removal equipments.
- Since there are some limitations in budget, technical feasibility, and so on, implementation of the countermeasures mentioned above usually take a relatively long period of time, and the options are not always available everywhere. Therefore, it is necessary to adopt any helpful methods to reduce arsenic from water, even though the method might not be perfect for arsenic removal.

One method is to make the most use of iron removal devices (IRD). Because of the tendency of arsenic to settle together with iron, it can be assumed that some arsenic will be removed along with iron when an IRD is used.

Another helpful method is aeration. The water taken from a well should be left for a relatively long time (for example 10 hours) before drinking. Within this period, the water environment can be expected to change from reduction to oxidation, while arsenic would settle together with iron, and change its form from arsenic III to arsenic V, reducing its toxicity. Before being aerated the water should be agitated by a stick for several minutes, as this would increase the efficiency of aeration.

Before starting: check the route and necessary materials of the survey

Move from base camp to destination village by vehicle

Find village chief or responsible person to interview to determine the wells to be surveyed as soon as possible

Member A: begin to create the sketch map and make a record of coordination, addresses, well specifications

Member B: as the sketch map is created, take water samples based on the standard sampling procedure

Member B: measure As according to the SOP for As field Kit

Member B: while waiting for the As testing solution to react (10 min), measure the parameters of well water quality and record the result

Complete the As measurement

Make sure all items have been completed and no materials are forgotten

Move to the next destination and repeat the in-situ measurement

Go back to base camp

*** Member A and member B should help each other to make the work proceed smoothly and efficiently.

Figure 4.1 SOP (Standard Operating Procedure) for Field Survey

Take HgBr2-paper out of the stock tubes

↓

Put a test paper into plastic cap

↓

Measure 10 ml of water sample in the 20 ml test tube

↓

Add ca. 0.1 g KI powder

↓

Add ca. 0.1 g SnCl2 powder reagents

↓

Add ca. 0.3 g Zinc powder

↓

Add 3 ml 1+1 HCl (1+1) solution

↓

Immediately connect the filter apparatus to the test tube

↓

Allow it to react for 10 min

↓

Remove clamp and pick-up the Mercury bromide paper disk

↓

Using the color chart, estimate amount of arsenic present

** If the color shown on the paper disk is so different to the color chart that it is difficult to estimate the arsenic concentration, a water sample has to be taken for cross checking after going back to the base camp. And the water sample should be taken according to the procedure of SOP.

Figure 4.2 SOP (Standard Operating Procedure) for As Field Test Kit

Make a hole in the tube with a pin.

↓

Strongly squeeze the tube with fingers to drive inner air out.

↓

Take a sample using a syringe even in a half of a tube and shake it well.

↓

Determine the concentration after 2 minutes by comparing it with the color chart attached to the case lid.

** The low concentration iron test pack is proposed as the main method of iron measurement, however, in case that the iron concentration is over 2 mg/ℓ, the above procedure has to be repeated in-situ by using a high concentration iron test pack.

Figure 4.3 SOP for Fe Analysis by Test Pack

Find village chief as soon as possible

↓

Ask the village to guide the group to the first survey point

↓

On the way to the survey point, explain the procedure to create the sketch map

↓

As soon as arriving at the first survey point, start measuring the water quality and prepare the sketch map by the following procedure

↓

1. Draw main line features (roads and rivers)

↓

2. Draw main public facilities (schools, hospitals, temples, etc.)

↓

3. Draw and number existing water sources (wells, ponds, rivers, etc.)

↓

4. Draw other features (resident blocks, forests, paddy fields, etc)

↓

Complete the sketch map, if necessary redraw it on the next page

** A draft sketch map should be drawn by a local person (village chief or responsible person) after a detail explanation of the requirements and procedures.

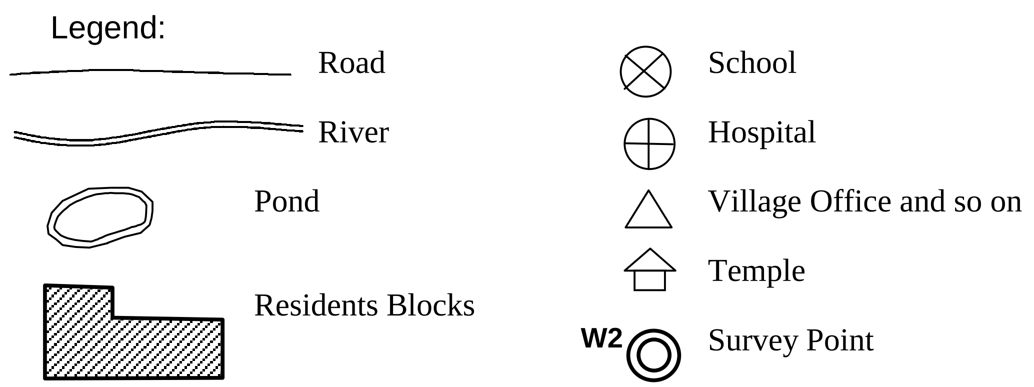


Figure 4.4 SOP (Standard Operating Procedure) for Creation of Sketch Map

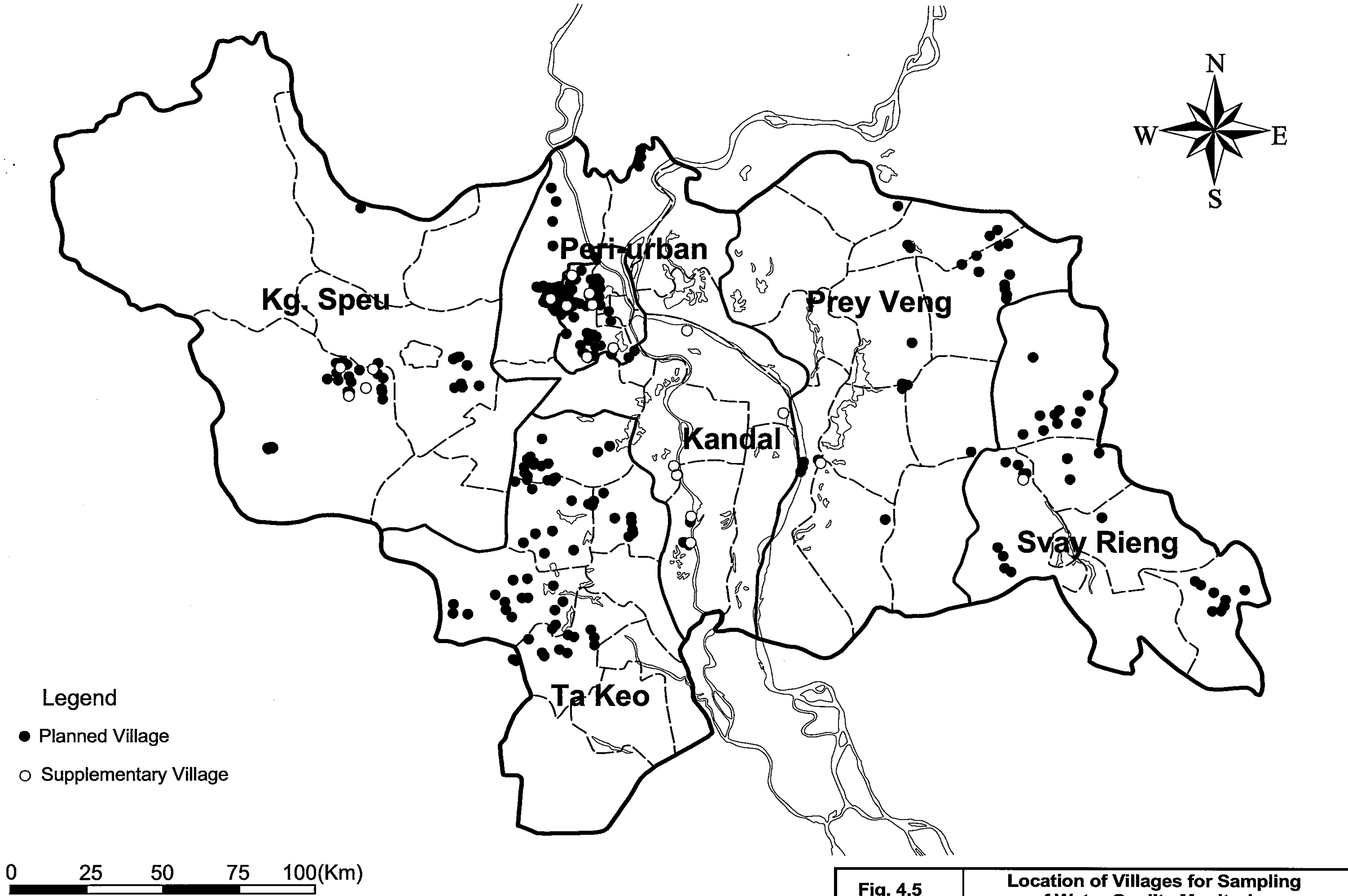


Fig. 4.5	Location of Villages for Sampling of Water Quality Monitoring

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

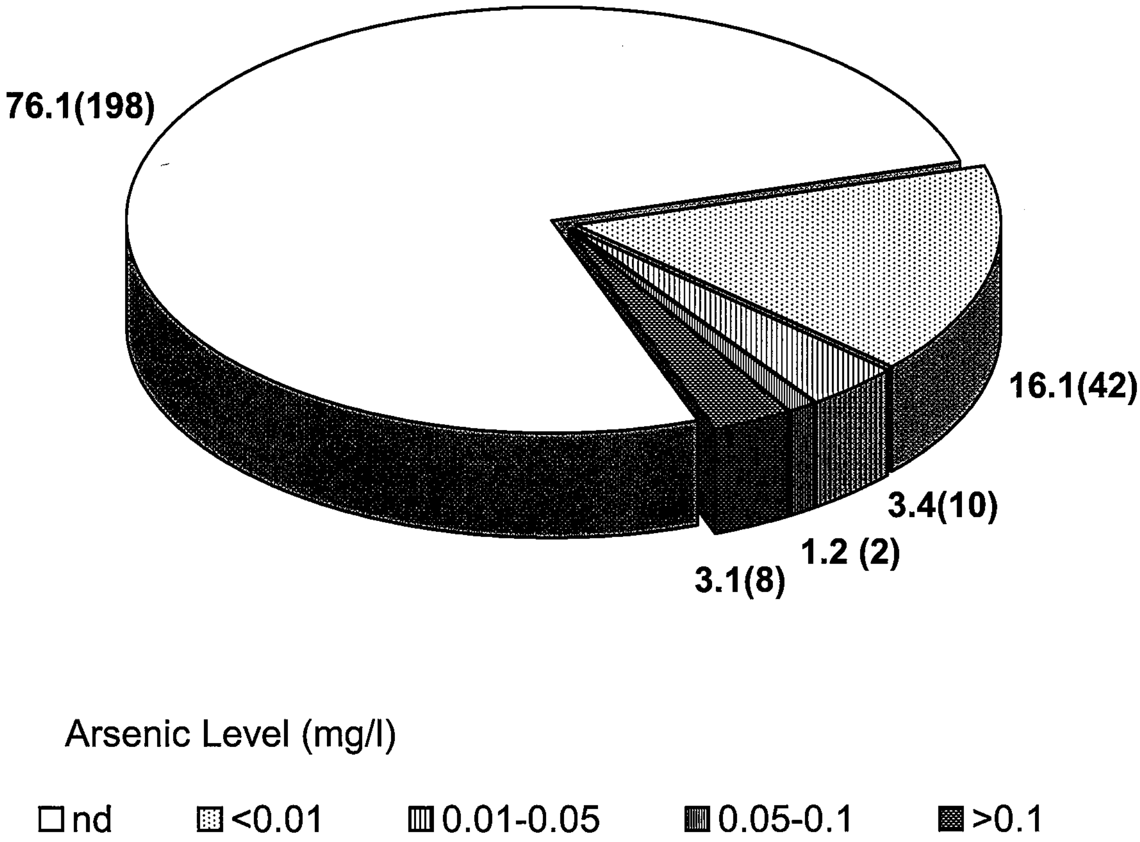

Figure within parenthesis is the number of villages in the corresponding rank

Fig. 4.6	Percentage of Surveyed Villages in Each Arsenic Rank

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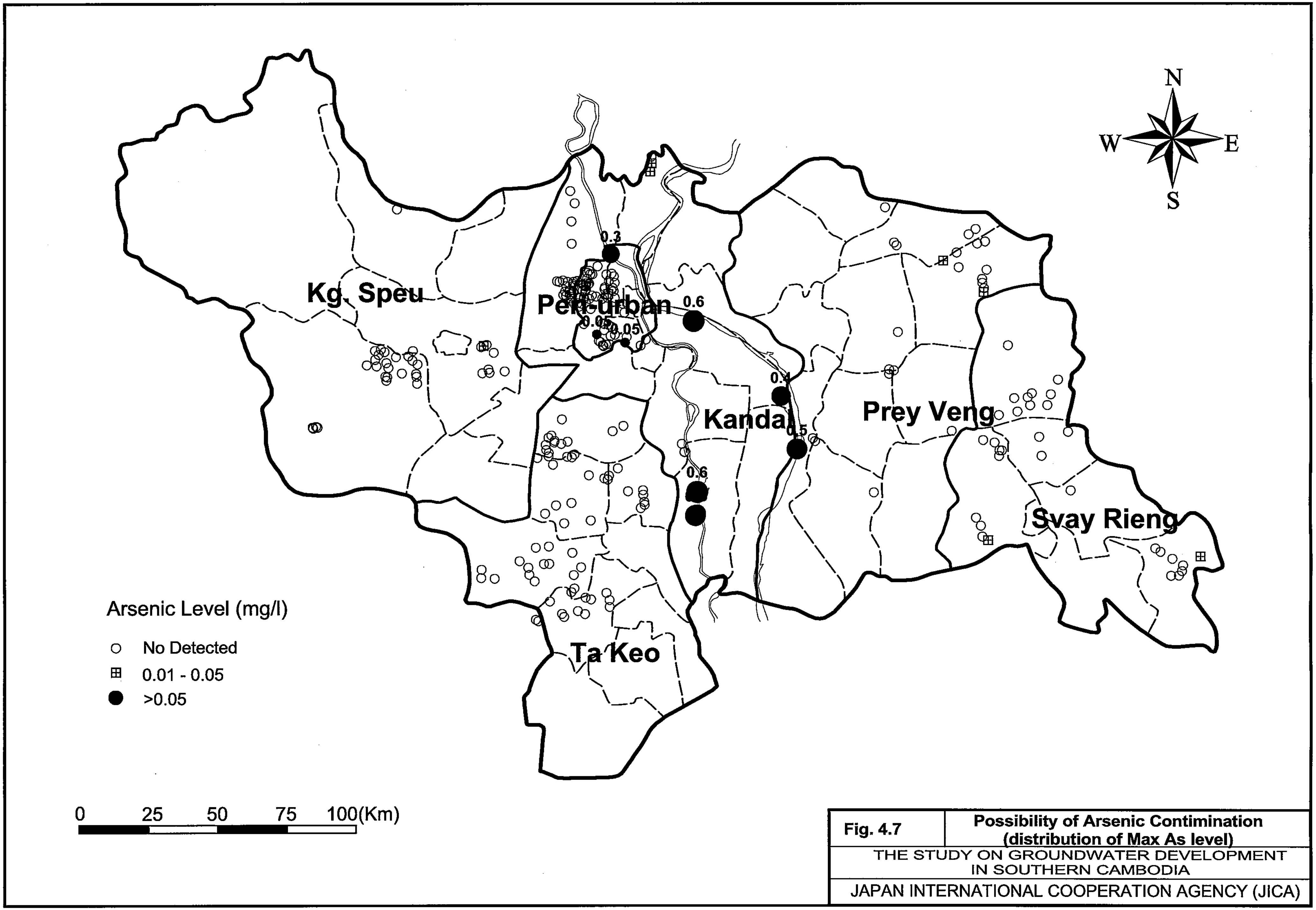

Fig. 4.7	Possibility of Arsenic Contimination (distribution of Max As level)
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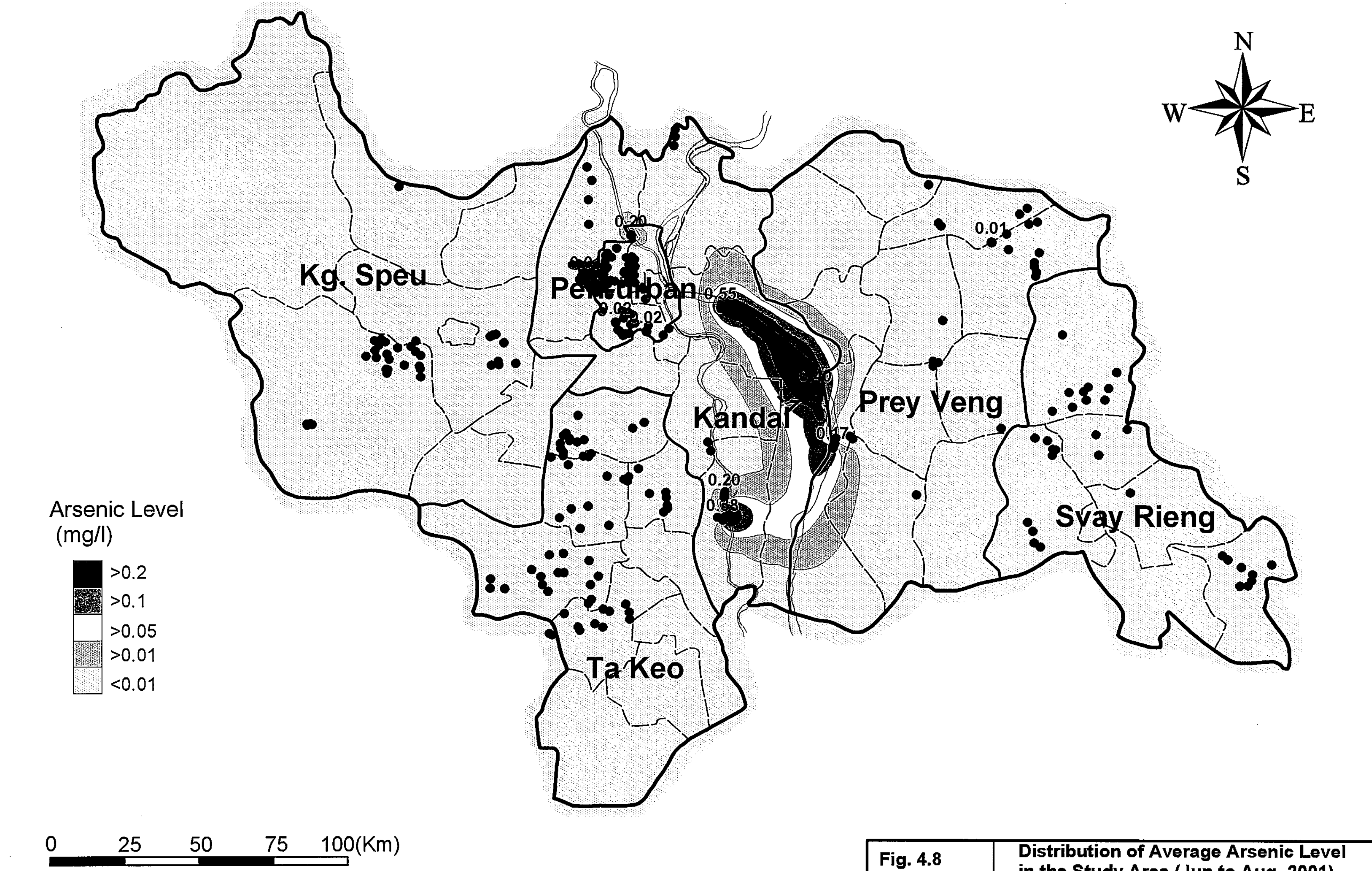

Fig. 4.8	Distribution of Average Arsenic Level in the Study Area (Jun to Aug. 2001)
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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

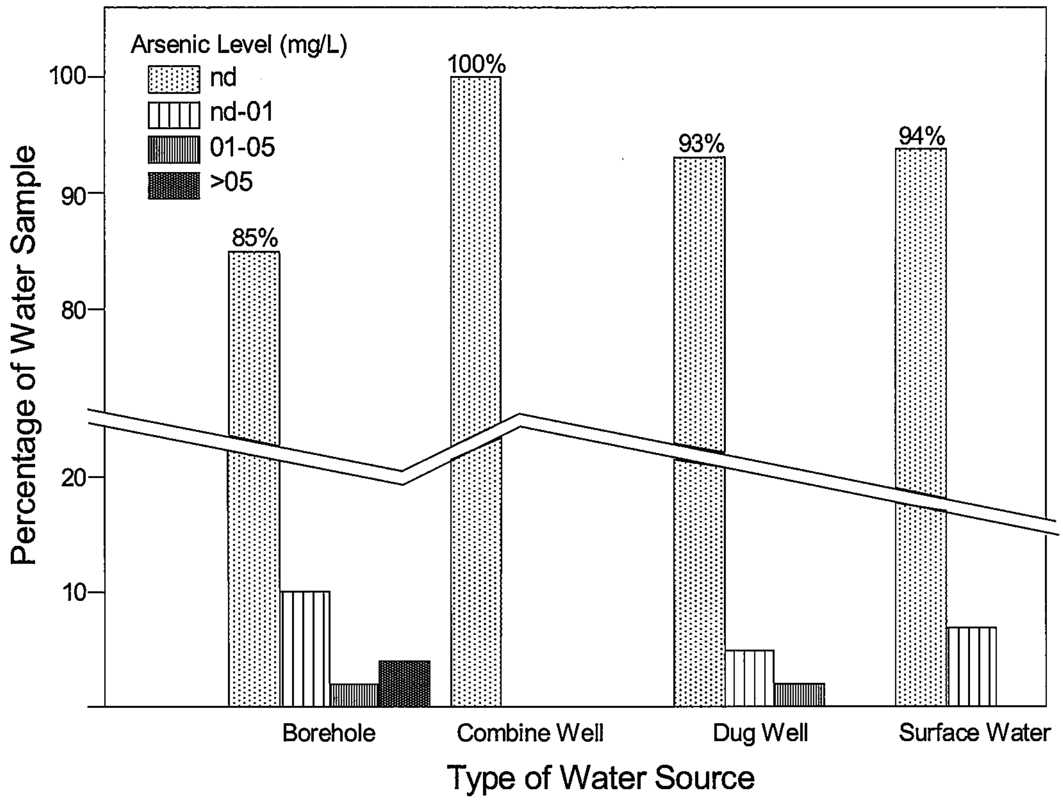

Fig. 4.9	Change of Arsenic Contamination Ratio by Water Source Type

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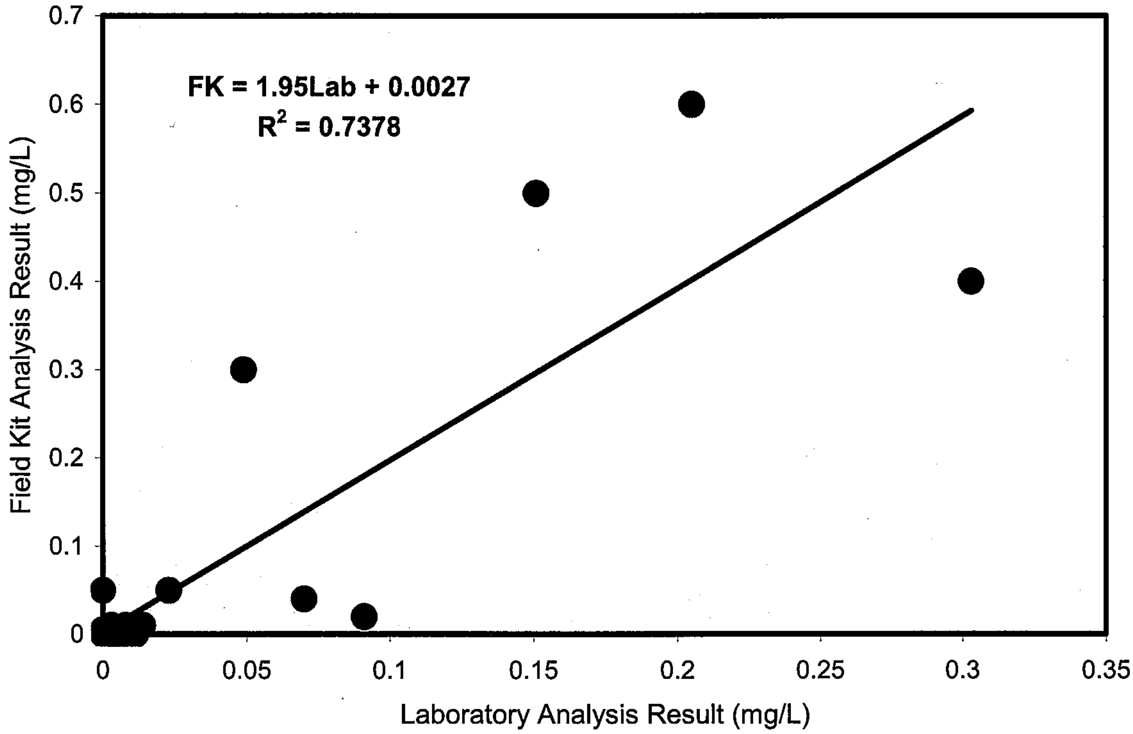

Fig. 4.10	Comparison of Arsenic Analysis Results By Using Field Kit and Laboratory

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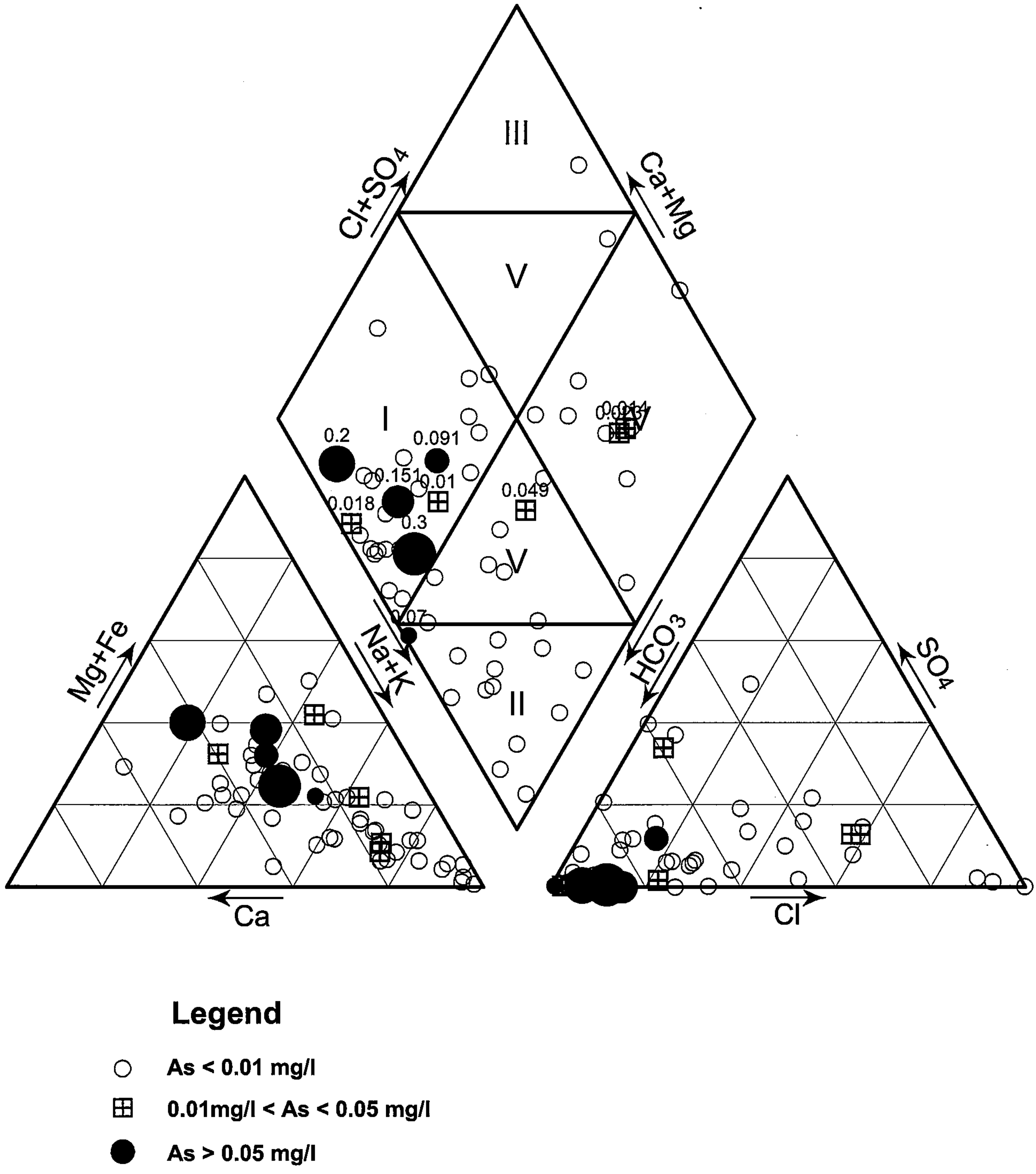

Fig. 4.11	Trilinear Diagram of 60 Water Samples.

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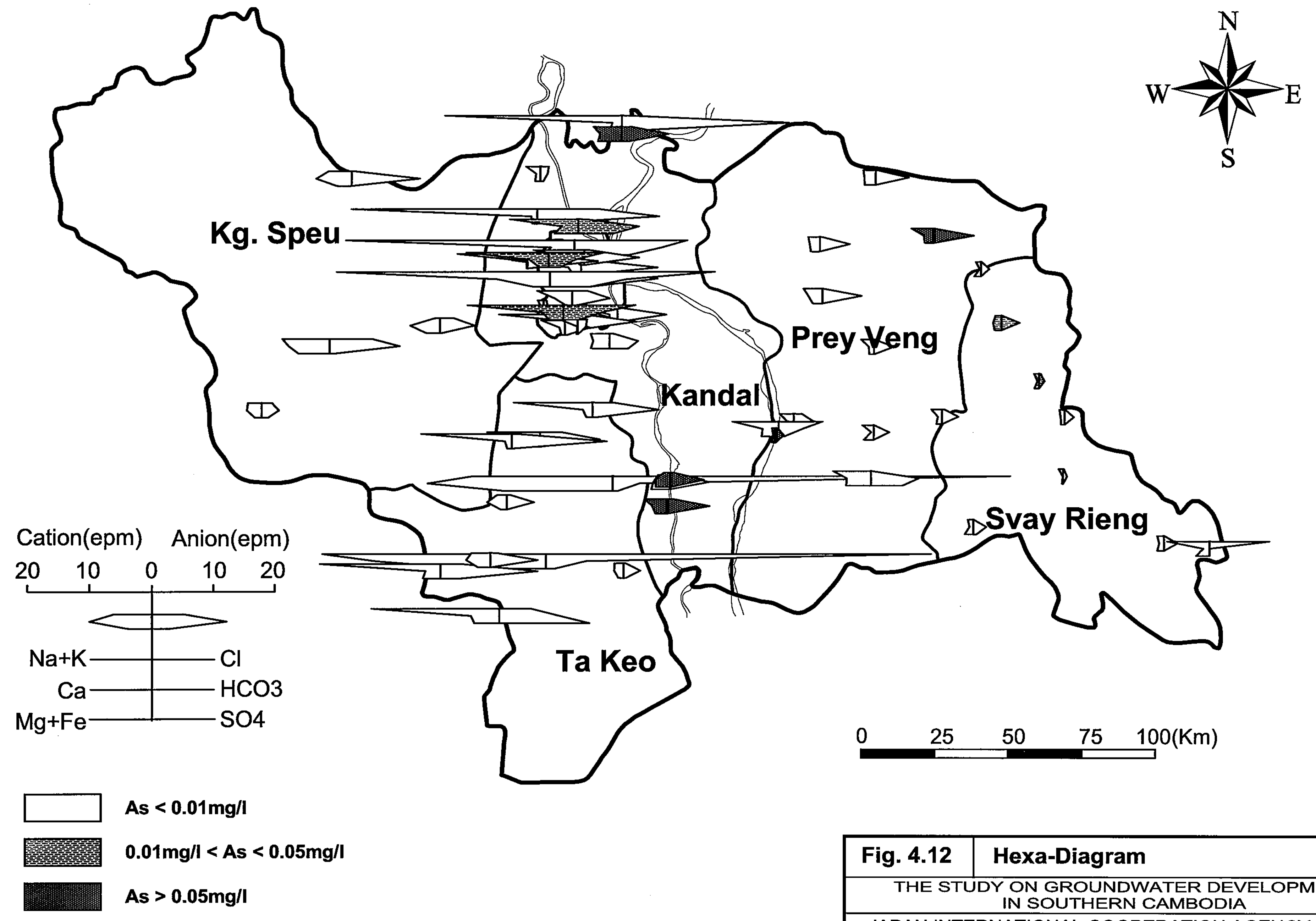

Fig. 4.12	Hexa-Diagram
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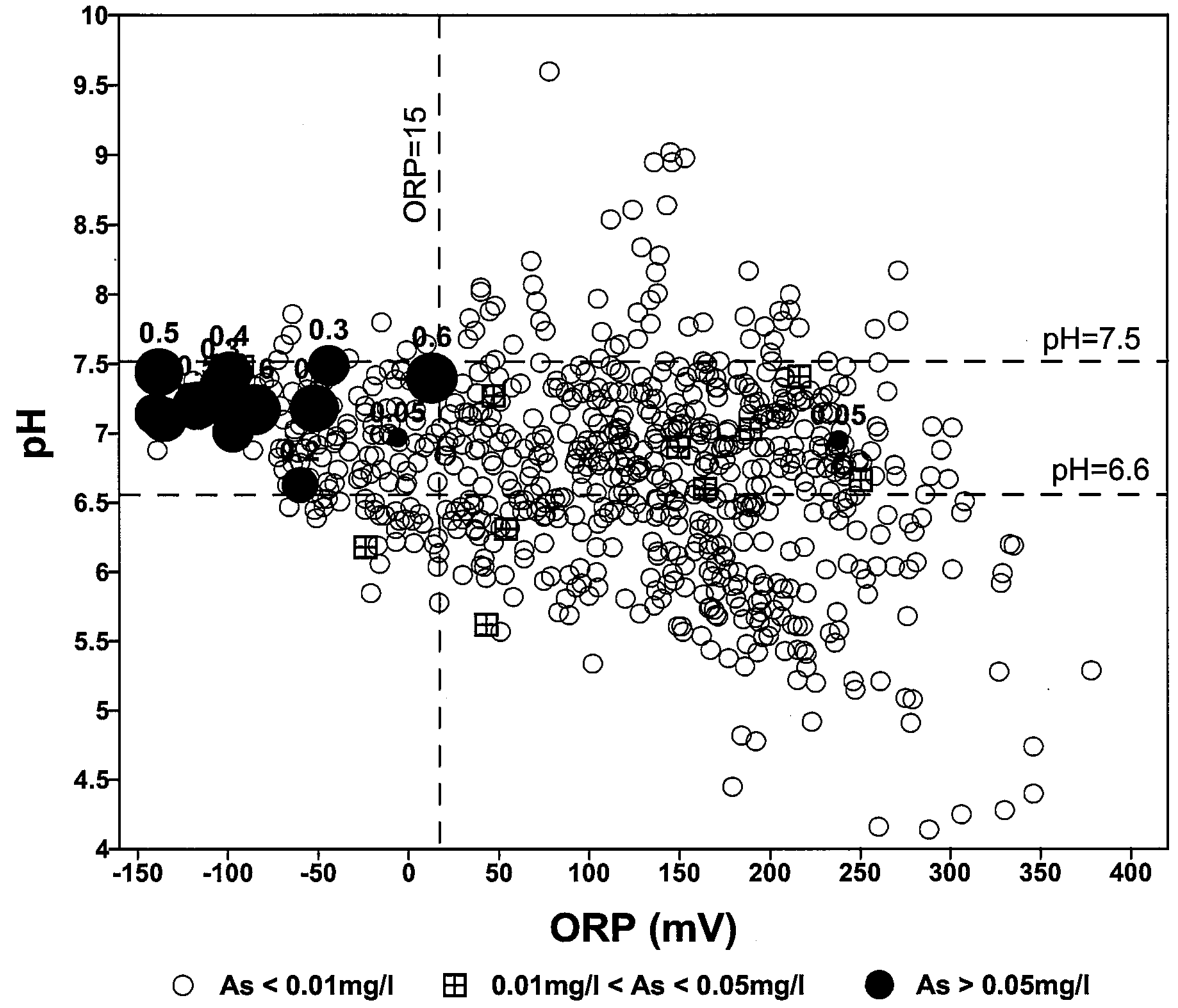

Fig. 4.13	Relation of Arsenic to pH and ORP

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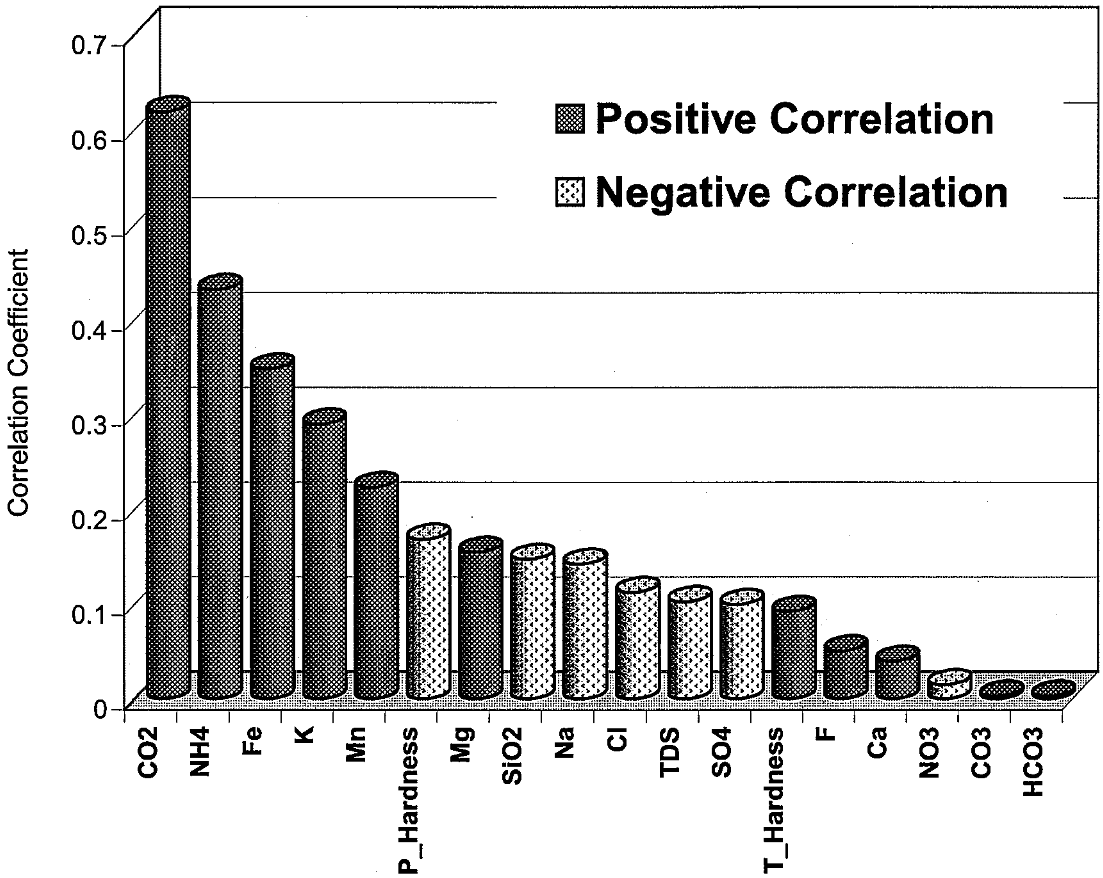

Fig. 4.14	Correlation Coefficient between Arsenic And Other Water Quality Parameters

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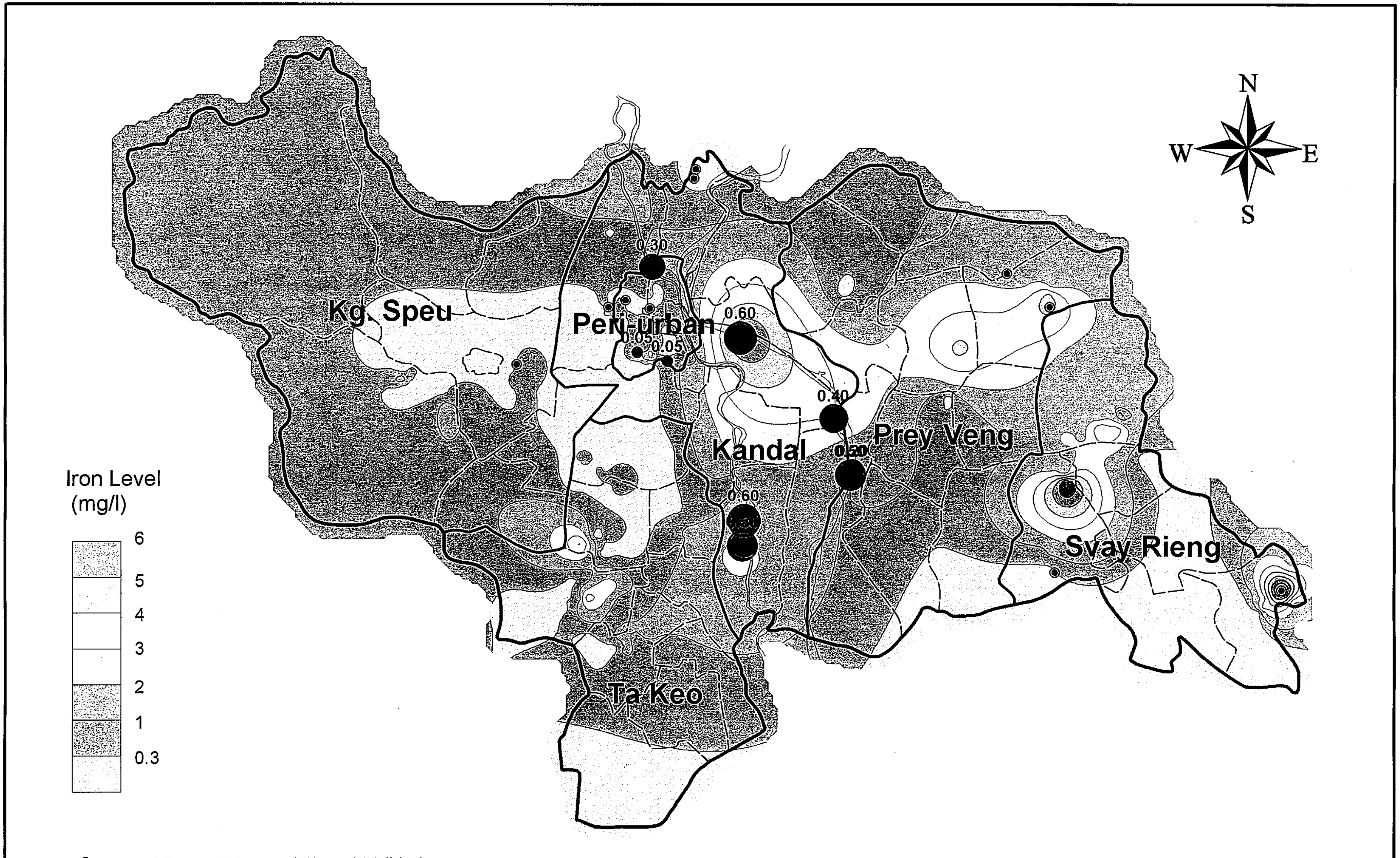

Fig. 4.15	Distribution of Average Iron Level in the Study Area (Jun to Aug. 2001)
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CHAPTER 5

RESULTS OF QUESTIONNAIRE SURVEY

CHAPTER 5 RESULTS OF QUESTIONNAIRE SURVEY

5.1 Community Participation for O&M

5.1.1 Growth of Community Organization

(1) Allocation of specific roles to committee members

The establishment of a Village Water Committee (VWC)/Water Point Committee (WPC) was confirmed in all twenty pilot villages when the JICA Study Team and Counterparts visited those villages in the 2000 monitoring survey as shown in Table 5.1. In the 2000 and 2001 monitoring surveys, it was found that some of the VWC/WPC members moved out of the village or died, but replacements were not found for those positions. In such cases, new persons were appointed by villagers during the monitoring surveys.

Regarding the activities of VWC/WPC, questions were asked to VWC/WPC members three times, namely, just after the establishment of VWC/WPC (Baseline survey), one year after (2000 monitoring survey) and two years after the establishment of VWC/WPC (2001 monitoring survey). One of the questions asked in the baseline survey was “How would you like to contribute to the committee?” and in order to see how well VWC/WPC were functioning, the question “What kind of activities have you been doing in the past year?” was asked both in the 2000 and 2001 monitoring surveys. Furthermore, in order to see how much each member had been involved in the activities, the question “Were you actively engaged in those activities?” was added in the 2001 monitoring survey and the answer choices were, ‘very active’, ‘active’, ‘average’ and ‘not active’. The results of the surveys are shown below.

When the results of these first three surveys were compared, it became apparent that each member had a more concrete idea about what his/her responsibilities were as a VWC/WPC member with time and experience, as concluded from the results of the 2000 monitoring survey. For instance, while the chairpersons replied that they would like to contribute to the committee by “taking a leadership role”, “facilitating O&M” and “good collaboration” in the baseline survey, their responses changed to more specific ones such as “giving some advice to villagers”, “participating in the meetings” and “taking care of the hand pumps”, etc during the monitoring period. The number of persons who replied that they were not engaged in any activities at all for each role decreased to only 3~5 % in the 2001 monitoring survey from 10~30 % in the previous year. The results also showed that VWC/WPC members generally perceived their involvement level in the activities to be high (see Figure 5.4, Figure 5.8, Figure 5.12, Figure 5.16). The number of members who replied that they were either “very active”, “active”, or “average” accounted for 95 % for chairpersons and secretaries, 85 % for accountants, and 86 % for caretakers.

Another notable improvement is the extensiveness of the tasks each person performs. Members of the VWC/WPC are assuming not only their own roles but also other members’ roles when other members are busy. It is considered that more active participation of VWC/WPC members in O&M and mutual cooperation among them can be expected with time and experience.

If some VWC/WPC members move out of the villages or will not be in the village for a while as they are working in Phnom Penh, they should be replaced with people who are available in order to secure the functioning of VWC/WPC.

a) Chairperson

1) Baseline survey

Base: Total interviewees (20)		
Chairperson (Baseline survey)	**No.**	**(%)**
Taking leadership	13	65%
Facilitation in O&M	4	20%
Good collaboration	3	15%
Total	**20**	**100%**

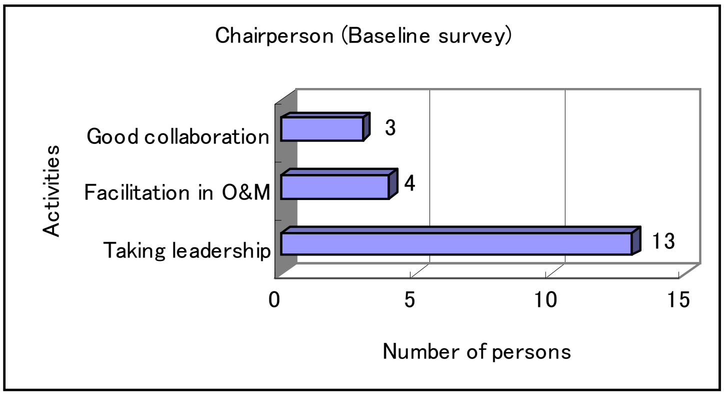


Figure 5.1 Activities of Chairperson (Baseline survey)

2) 2000 Monitoring survey

Base: Total interviewees (20)		
Chairperson (2000 Monitoring survey)	**No.**	**(%)**
Cleaning platform	1	5%
Giving advice to villagers	7	35%
No activities	2	10%
Participated in the meeting	5	25%
Repairing HP	1	5%
Taking care of HP	4	20%
Total	**20**	**100%**

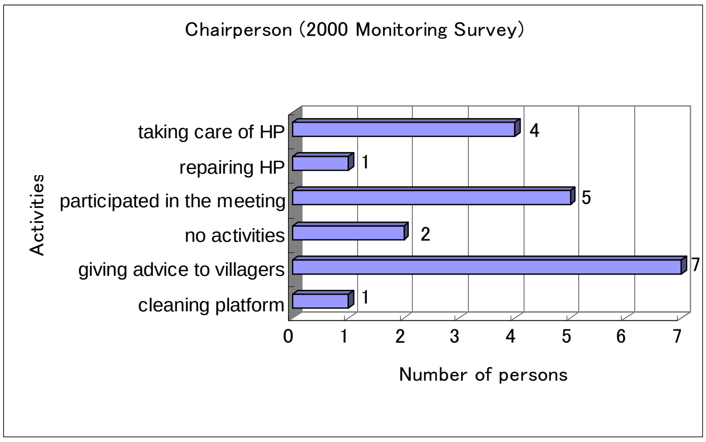


Figure 5.2 Activities of Chairperson (2000 Monitoring survey)

3) 2001 Monitoring survey

Base: Total interviewees (20)		
Chairperson (2001 Monitoring survey)	**No.**	**(%)**
Cleaning platform	3	15%
Giving advice to villagers	5	25%
No activities	1	5%
Participated in the meeting	3	15%
Promoting meetings to users	4	20%
Repairing HP	1	5%
Taking care of HP/maintenance	2	10%
Taking initiatives among VWC	1	5%
Total	**20**	**100%**

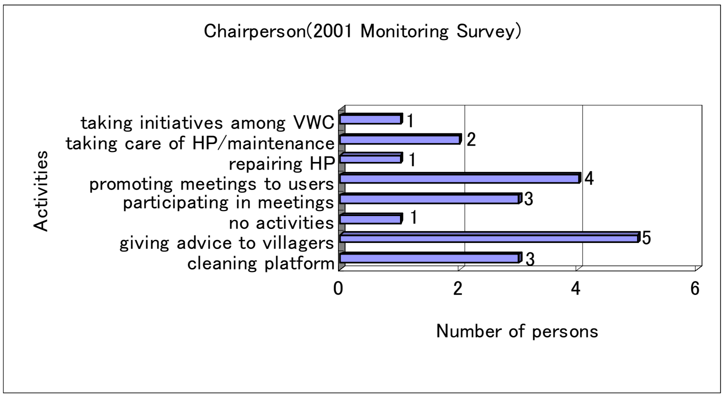


Figure 5.3 Activities of Chairperson (2001 Monitoring survey)

4) Involvement level in VWC

Base: Total interviewees (20)		
Involvement level-Chairperson (2001 Monitoring survey)	**No.**	**(%)**
Active	6	30%
Average	4	20%
Not active	1	5%
Very active	9	45%
Total	**20**	**100%**

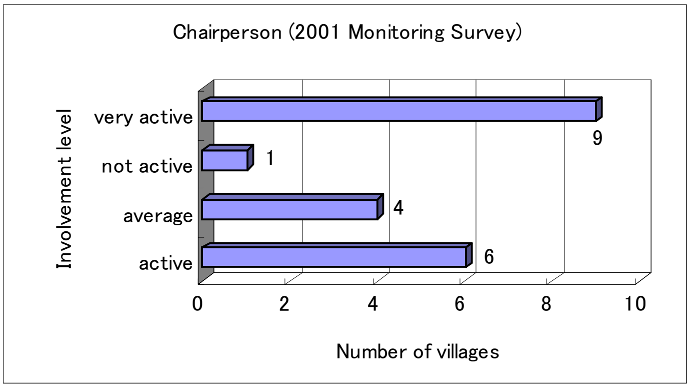


Figure 5.4 Involvement level in VWC Activities (Chairperson)

b) Secretary

1) Baseline survey

Base: Total interviewees (20)		
Secretary (Baseline survey)	**No.**	**(%)**
Facilitation in O&M	9	45%
Participation	7	35%
Recording activities	3	15%
Facilitation in fund raising	1	5%
Total	**20**	**100%**

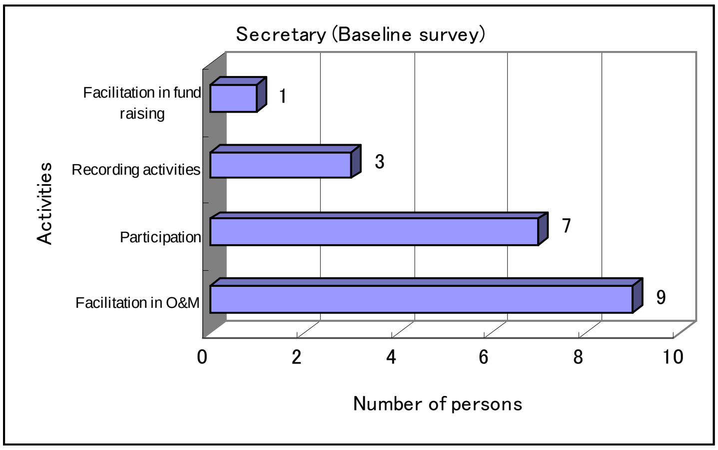


Figure 5.5 Activities of Secretary (Baseline survey)

2) 2000 Monitoring survey

Base: Total interviewees (20)		
Secretary (2000 Monitoring survey)	**No.**	**(%)**
Cleaning platform	1	5%
Giving advice to villagers	6	30%
No activities	4	20%
Participated in the meeting	3	15%
Registering users	2	10%
Repairing HP	1	5%
Taking care of HP	3	15%
Total	**20**	**100%**

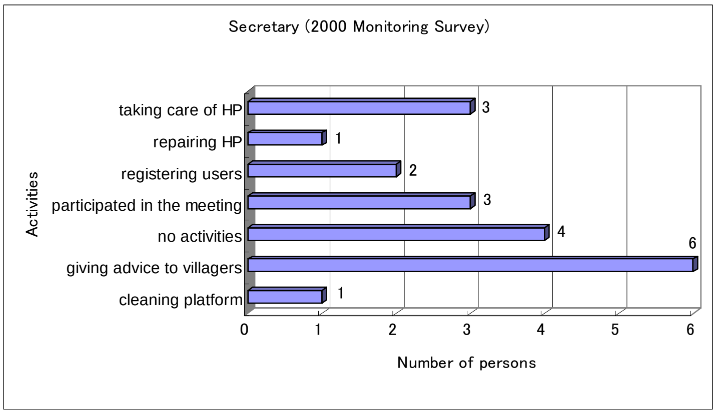


Figure 5.6 Activities of Secretary (2000 Monitoring survey)

3) 2001 Monitoring survey

Base: Total interviewees (20)		
Secretary (2001 Monitoring survey)	**No.**	**(%)**
Cleaning platform	1	5%
Giving advice to villagers	2	10%
Keeping livestock away	1	5%
Keeping records	6	30%
Making fence	1	5%
No activities	1	5%
Participated in the meetings	2	10%
Registering users	2	10%
Repairing HP	1	5%
Taking care of HP	1	5%
Unknown	2	10%
Total	**20**	**100%**

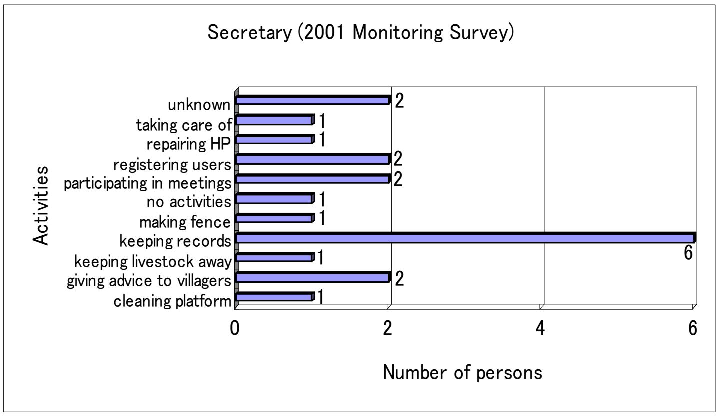


Figure 5.7 Activities of Secretary (2001 Monitoring survey)

4) Involvement level in VWC

Base: Total interviewees (20)		
Involvement level-Secretary (2001 Monitoring survey)	**No.**	**(%)**
Active	7	35%
Average	4	20%
Not active	1	5%
Very active	8	40%
Total	**20**	**100%**

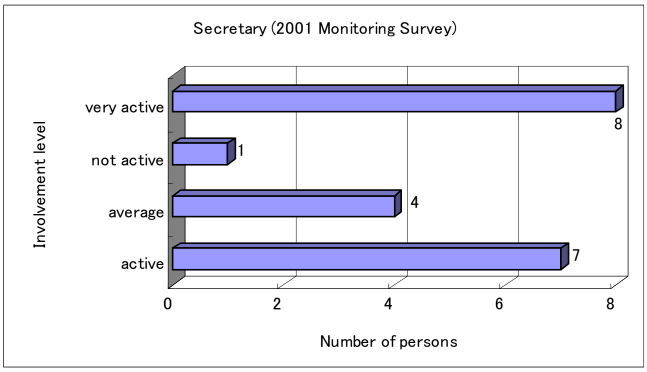


Figure 5.8 Involvement level in VWC Activities (Secretary)

c) Accountant

1) Baseline survey

Base: Total interviewees (20)		
Accountant (Baseline survey)	**No.**	**(%)**
Facilitation in fund raising	13	65%
Management of the fund	3	15%
Participation	3	15%
Training in O&M	1	5%
Total	**20**	**100%**

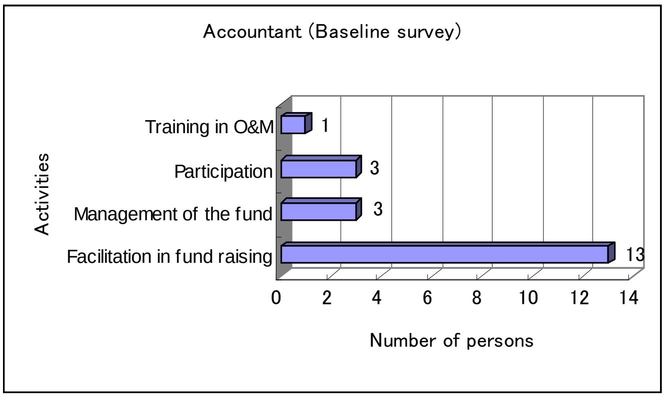


Figure 5.9 Activities of Accountant (Baseline survey)

2) 2000 Monitoring survey

Base: Total interviewees (20)		
Accountant (2000 Monitoring survey)	**No.**	**(%)**
Collecting money	6	30%
Giving advice to villagers	3	15%
No activities	6	30%
Participated in the meeting	1	5%
Repairing HP	1	5%
Taking care of HP	2	10%
Others	1	5%
Total	**20**	**100%**

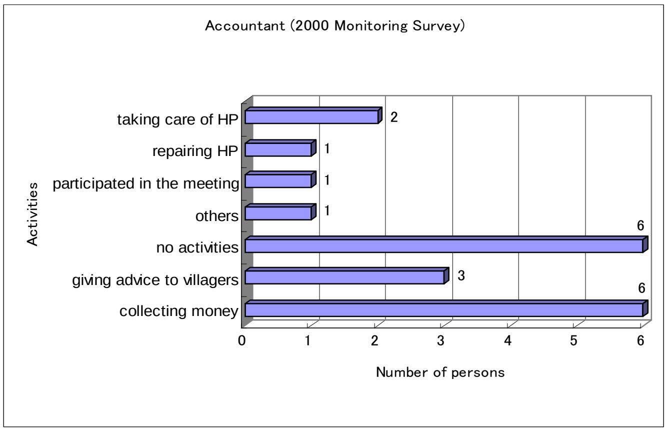


Figure 5.10 Activities of Accountant (2000 Monitoring survey)

3) 2001 Monitoring survey

Base: Total interviewees (20)		
Accountant (2001 Monitoring survey)	**No.**	**(%)**
Cleaning platform	2	10%
Collecting money	6	30%
Giving advice to villagers	1	5%
Keeping livestock away	1	5%
No activities	1	5%
Participate in the meeting	3	15%
Promoting fee collection	2	10%
Repairing HP	1	5%
Unknown	2	10%
Others	1	5%
Total	**20**	**100%**

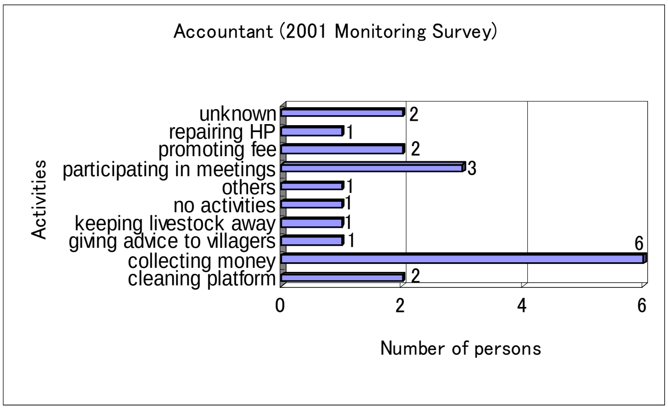


Figure 5.11 Activities of Accountant (2001 Monitoring survey)

4) Involvement level in VWC

Base: Total interviewees (20)		
Involvement level-Accountant (2001 Monitoring survey)	No.	(%)
Active	3	15%
Average	7	35%
Not active	2	10%
Very active	7	35%
Unknown	1	5%
Total	**20**	**100%**

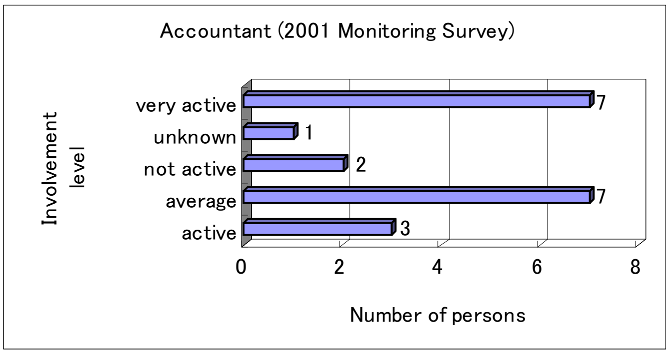


Figure 5.12 Involvement Level in VWC (Accountant)

d) Caretakers

1) Baseline survey

Base: Total interviewees (80)		
Caretakers (Baseline survey)	No.	(%)
Participation in O&M	47	58%
Training users in O&M	19	24%
Education in hygiene	12	15%
Facilitation in O&M	2	3%
Total	**80**	**100%**

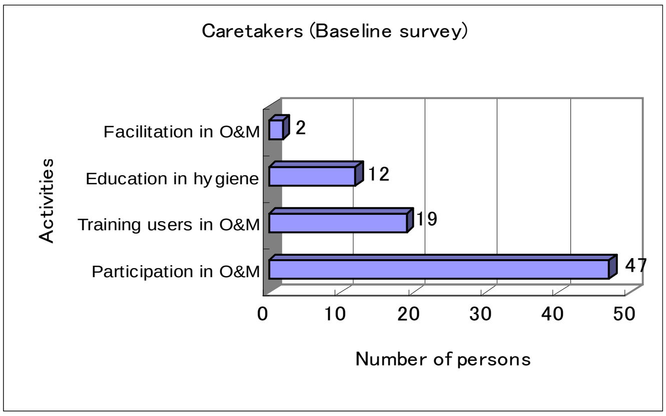


Figure 5.13 Activities of Caretaker (Baseline survey)

2) 2000 Monitoring survey

Base: Total interviewees (80)		
Caretakers (2000 Monitoring survey)	No.	(%)
Cleaning platform	27	34%
Giving advice to villagers	7	9%
No activities	11	14%
Participated in the meeting	3	4%
Receiving training	2	2%
Repairing HP	13	16%
Taking care of HP	8	10%
others	9	11%
Total	**80**	**100%**

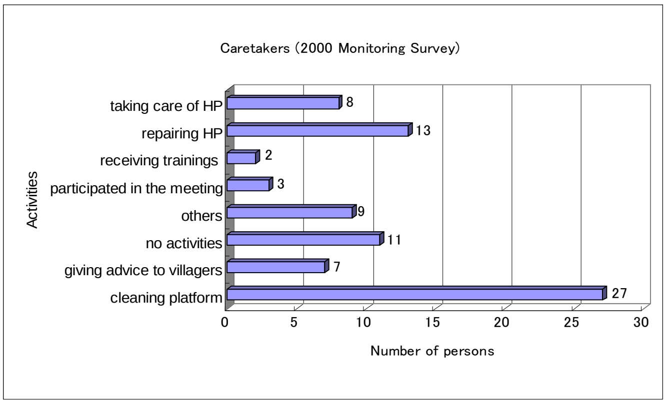


Figure 5.14 Activities of Caretaker (2000 Monitoring survey)

3) 2001 Monitoring survey

Base: Total interviewees (20)		
Caretakers (2001 Monitoring survey)	**No.**	**(%)**
Cleaning platform	35	44%
Giving advice to villagers	11	14%
Keeping livestock away	2	3%
Making fence	1	1%
No activities	2	3%
Participate in the meeting	1	1%
Repairing HP	12	15%
Taking care of HP/maintenance	7	8%
Others	2	3%
Unknown	7	8%
Total	**80**	**100%**

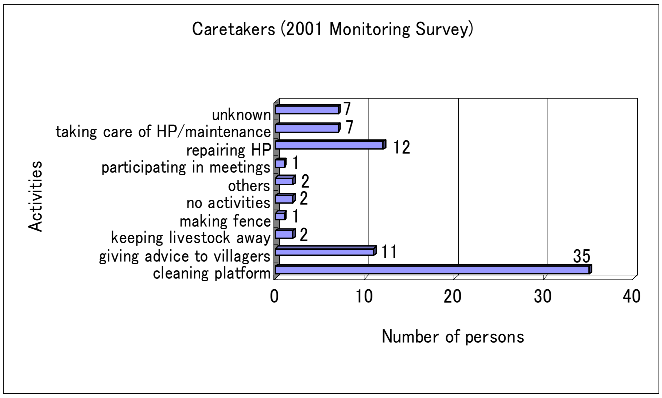


Figure 5.15 Activities of Caretakers (2001 Monitoring survey)

4) Involvement level in WPC

Base: Total interviewees (20)		
Involvement level-Caretakers (2001 Monitoring survey)	**No.**	**(%)**
Active	17	21%
Average	20	25%
Not active	4	5%
Very active	32	40%
Unknown	7	9%
Total	**80**	**100%**

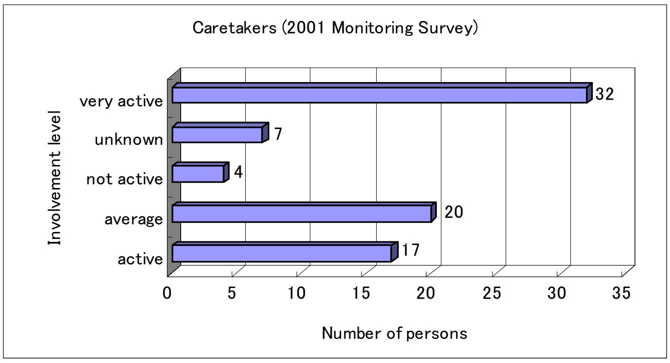


Figure 5.16 Involvement Level in WPC (Caretakers)

(2) Increasing self-reliance by participating in community activities

All VWC/WPC members expressed that they were happy to be elected as VWC/WPC members when they were interviewed in the baseline survey. As a result of the 2000 and 2001 monitoring surveys, it was revealed that members were eager to contribute more to the improvement of the O&M of JICA hand pumps and they expressed their appreciation towards the support from other users.

Some positive changes were observed among VWC/WPC members after they became VWC/WPC members. 63 % of the members expressed that they had changed in better ways as shown in Figure 5.17. 31 % replied that they became more responsible for the activities of villages and 24 % felt that they not only became more responsible for the activities of the villages, but they were more confident about themselves and felt that they were respected more by other villagers.

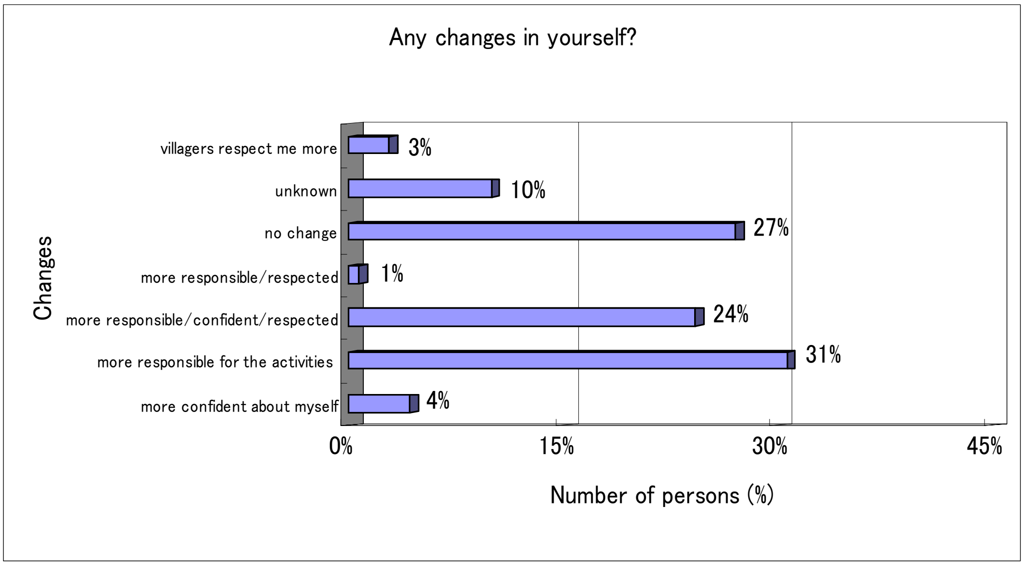


Figure 5.17 Changes in VWC/WPC Members

According to the results of the 2001 questionnaire survey of five sample families, the number of people that are members of at least one of the village committees has increased by 36 % from 1999 and by 7 % even from 2000 as shown in Figure 5.18. Willingness to be active as a member of a committee dropped to 82 % in 2001, a drop of 11 % from the previous year as shown in Figure 5.19. This is because villagers are busy working in the rice fields or doing housework. However, VWC/WPC members evaluated that 63 % of the users were 'more cooperative' while only 9 % were 'less cooperative' and another 9% did not cooperate at all ('lack of cooperation') as shown in Figure 5.20.

It can be concluded that villagers' participation in community activities has been increasing and users are becoming more cooperative in the O&M activities of JICA hand pumps. Moreover, the sense of ownership towards JICA hand pumps has started to grow among users. However, it is important to note that the users' willingness to participate in activities has been declining. Unless users' awareness towards the importance of O&M activities for JICA hand pumps are enhanced, O&M activities will not be sustainable as users will give priority to their own work.

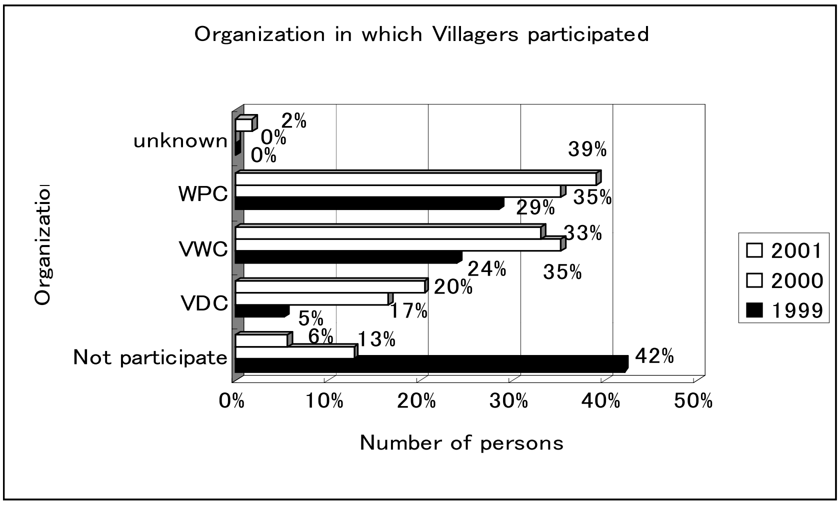


Figure 5.18 Organizations in which Villagers have participated

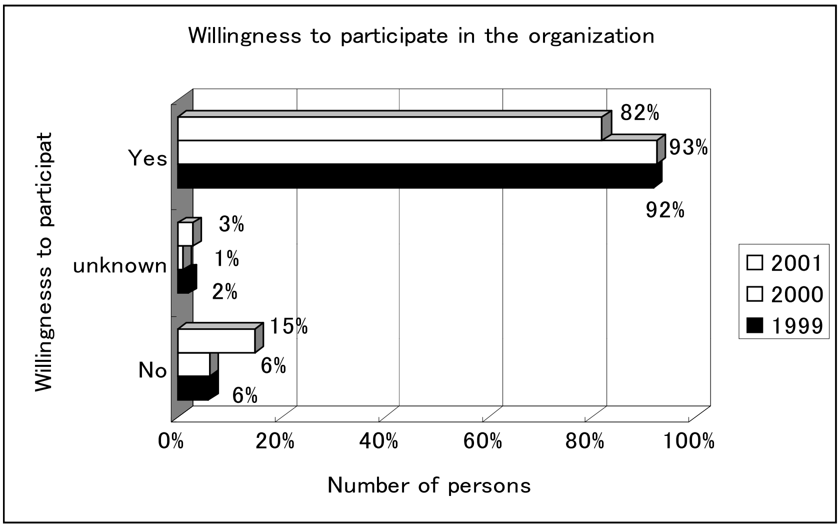


Figure 5.19 Willingness to participate in the Organizations

Base: Total interviewees (140)		
Level of cooperation of users (2001 Monitoring survey)	**No.**	**(%)**
Lack of coop. from far users	5	4%
Lack of coop. from users with private HP	7	5%
Less cooperative	12	9%
More cooperative	90	63%
No change	12	9%
Unknown	14	10%
Total	**140**	**100%**

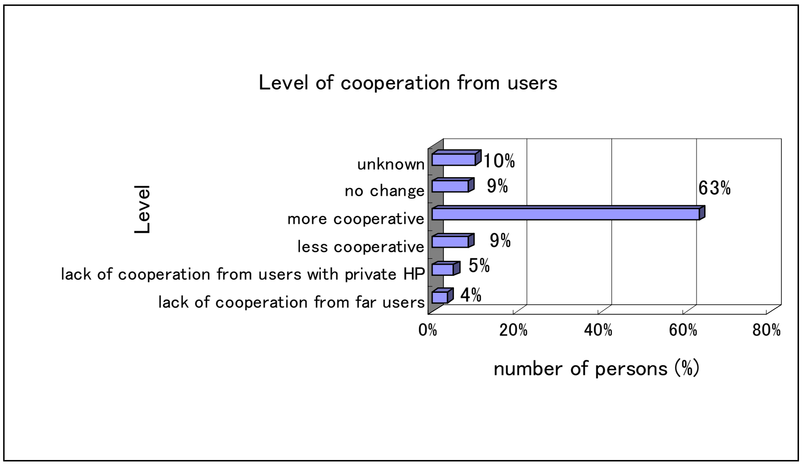


Figure 5.20 Level of Cooperation from Users

5.1.2 Committee Behavior and Self-reliance

(1) Involvement of members in committee discussions and activities

Although all VWC/WPC members in each village were asked their average attendance rate to the meetings in the 2000 monitoring survey, each VWC/WPC member was asked again in the 2001 monitoring survey to enhance the accuracy of the data. The attendance rate to the meetings showed some increase in 2001. 78 % (109 out of140 members) of VWC/WPC members replied that their attendance rate was high at 91~100 % in 2001, which was an 8 % increase from that in 2000 as shown in Figure 5.21. The number of the meetings held and the attendance rate in each village is shown in Table 5.1. The 2000 monitoring survey revealed that meetings were generally arranged when an issue needed to be discussed and they were not planned regularly. However, results from the 2001 monitoring survey showed that the meetings started to be held more regularly. It is highly recommended that regularly scheduled meetings are actually held.

	2000		**2001**	
Attendance rate to the meeting	**No.**	**(%)**	**No.**	**(%)**
91-100%	14	70%	109	78%
71-90%	2	10%	1	1%
31-50%	0	0%	2	1%
Never	4	20%	24	17%
Unknown	0	0%	4	3%
Total	**20**	**100%**	**140**	**100%**

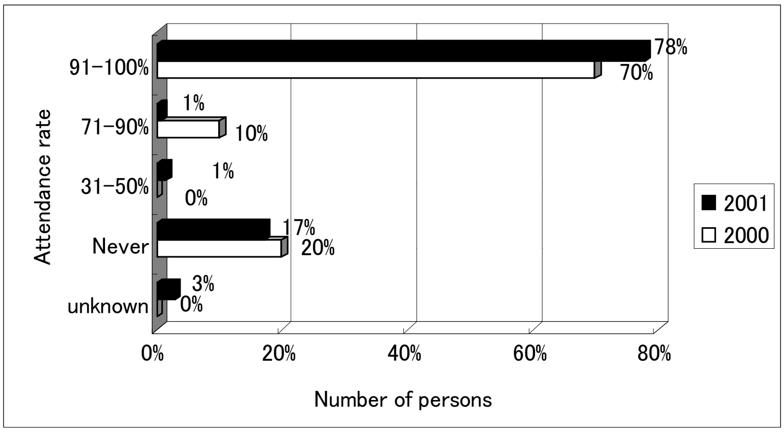


Figure 5.21 Attendance rate to the meetings

The 2001 monitoring survey showed that the topics of discussion at the meetings concerned daily O&M and user fees (see Figure 5.22). This shows that once a basic system is established such as VWC/WPC members and user fee collection, the main concerns of villagers center around O&M issues.

Base: Total interviewees (20)		
Topics discussed in the meetings (2001 Monitoring survey)	**No.**	**(%)**
Daily O&M	2	10%
Daily O&M + others	2	10%
Daily O&M + user fee	1	5%
Daily O&M + user fee + others	1	5%
Daily O&M + user fee + price	10	50%
Never met	3	15%
User fee + price	1	5%
Total	**20**	**100%**

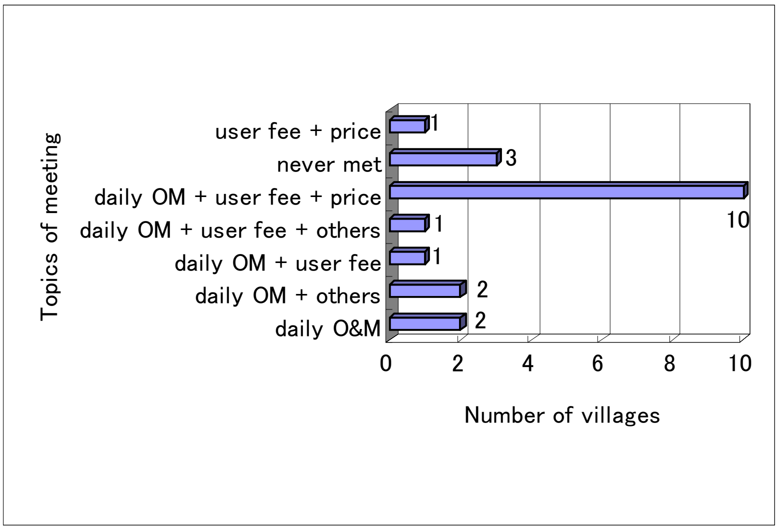


Figure 5.22 Topics discussed in the Meetings

The activities of each committee member and their involvement level in the activities are shown in Figure 5.1 through Figure 5.16, and they were already examined in Section 5.1.1 (1).

It can be evaluated that in general, members of VWC/WPC started to take part in the discussions and activities of the committee more actively. This tendency is especially strong in the villages in which JICA hand pumps are frequently used. Since more regular meetings started to be planned, it is highly encouraged that those meetings shall be held as planned including the users as well to facilitate O&M of JICA hand pumps.

(2) Organizational management skills

It has been over two years since VWC/WPC were established. As shown in Table 5.1, all users were already registered in all the villages by the time the 2000 monitoring survey was carried out, meetings were held among VWC/WPC/users more than once in each village except one village and each member of VWC/WPC had been fulfilling his/her role in daily O&M activities.

Records are kept of the activities, another important factor for good organizational management, in 75 % (15/20 villages) of the pilot villages according to the 2001 monitoring survey, although some villages keep records of all the activities and others do not. Keeping records of all the activities of WVC/WPC is extremely important to secure the sustainability of their activities.

The 2001 monitoring survey confirmed that the savings started to be utilized for O&M activities. They were used to purchase soil (to protect platforms from floods), sand (for IRD), and grease, etc.

Since some villages were not sure who to contact if JICA hand pumps were broken, the survey team thoroughly explained procedures to them during monitoring surveys. According to the 2001 monitoring survey, 85 % (17/20 villages) of the villages replied that they now understood who to contact.

It became apparent that users perceived that VWC/WPC function well. 90 % of sample families evaluated that VWC/WPC in their villages were functioning well while only 4 % evaluated they were not functioning well.

Base: Total interviewees (100)		
Evaluation of VWC/WPC by villagers (2001 Monitoring survey)	**No.**	**(%)**
It is functioning well	90	90%
It is not functioning well	4	4%
Unknown	6	6%
Total	**100**	**100%**

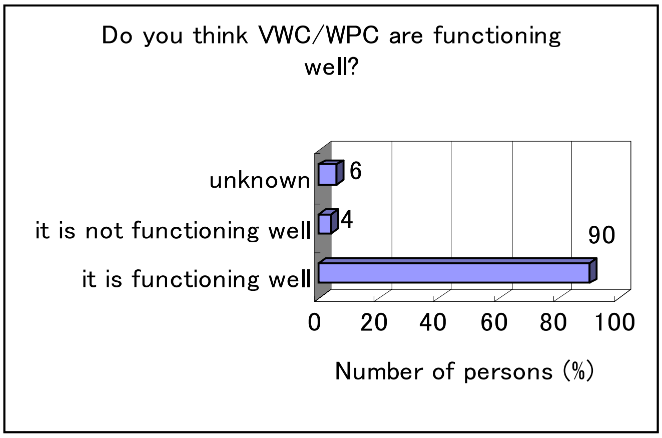


Figure 5.23 Evaluation of VWC/WPC by Villagers

The following were the major improvements observed in the 2001 monitoring survey of VWC/WPC management.

1) The scheduling of regular meetings
2) An increasing awareness of respective roles to be assumed as VWC/WPC members
3) The improved management of funds

VWC/WPC members appeared to be more aware of what needs to be done in daily O&M and they are actually more involved with O&M activities compared with last year, especially in the villages in which hand pumps are frequently used.

(3) Degree of local people's knowledge used effectively by committee members in their activities versus reliance on outside technicians and 'experts'

The observations made on Local people's knowledge used effectively by VWC/WPC and reliance on outside technicians and 'experts' in the 2000 and 2001 monitoring surveys are summarized in the table below.

Local people's knowledge used by VWC/WPC	Reliance on outside technicians and 'experts'
• Making a fence made of bamboo around platform of JICA hand pump to keep off animals. • Making a bathing place • Cleaning sand out of Iron Removal Device (IRD) when villagers judge it needs to be cleaned. • WPC replaced a valve in IRD with wooden valve when it was broken. • Providing hygiene education to villagers on occasions when many villagers gather in such as ceremonies.	• Major repair is requested of PDRD. • There were many requests for construction of a bathing space around platform but users have not taken the initiative to make it on their own except in one village.

Table 5.1 Comparison of Activities of VWC/WPC (2000/2001)

No.	Province	Well No.	Village	Number of users *1			VWC/ WPC Establishment		No. of meetings			Frequency			Attendance rate (%)		Record of activities		
				2000	2001	+/-	2000	2001	2000	2001		2000	2001		2000	2001	2000	2001	
1	Svay Rieng	139	Dok Por	21	21 (21.6%)	±0	Yes	Yes	2	1		When necessary	1/year	---	100	100	Yes	Yes	---
2		162	Cham Kar Leiv	23	24 (15.6%)	+1	Yes	Yes	2	13		When necessary	1/month	---	100	100	Yes	Yes	---
3		113	Koy Tra Bek	10 (3%)	10*2	±0	Yes	Yes	4	3		1/3 months	1/4months		100	100	Yes	No Notes	---
4		122	Trapaing Thmor	50	4 (2.8%)	-46	Yes	Yes	1	1	---	Sometimes	1/year	---	100	100	No Notes	No Notes	---
5		175	Toul Khpos	42	42 (21.8%)	±0	Yes	Yes	2	2	---	When necessary	2/year	---	71.4	100	Yes	Yes	---
6	Prey Veng	388	Russei Tvear	32 (32.3%)	24 (20.0%)	-8	Yes	Yes	1	2		When necessary	2/year	---	100	100	Yes	Yes	---
7		367	Ka Kou	14 (9.8%)	14 (11.2%)	±0	Yes	Yes	3	3	---	1/3 months	1/3 months	---	100	100	---	Yes	---
8		393	Kok Trom Kha	20	3(2.5%)	-17	Yes	Yes	0	0	---	None	None	---	---	---	No	Yes	
9		401	Prey Phdau	17 (12.6%)	17 (12.6%)	±0	Yes	Yes	2	0		When necessary	When necessary	---	100	---	Yes	Yes	---
10	Takeo	199	Prey Maok	43	43 (30.1%)	±0	Yes	Yes	2	6		---	6/year		100	100	Yes	Yes	---
11		209	Trapaing Thmor	29	31 (20.7%)	+2	Yes	Yes	2	1		2/year	1/year		100	42.9	Yes	No	
12		181	Prech	110	136 (69.7%)	+26	Yes	Yes	0	3		None	3/year		---	69.2	No	Yes	
13		242	Ta Pen	16	16 (22.5%)	±0	Yes	Yes	1	2		When necessary	When necessary	---	100	100	No	Yes	
14	Kandal	288	Krang Svay	40	43 (12.6%)	+3	Yes	Yes	0	2		None	2/year		---	100	Yes	Yes	---
15		322	Angkor Chey	27 (100%)	29 (100%)	+2	Yes	Yes	1	1	---	1/year	1/year	---	100	100	Yes	Yes	---
16		259	Svay Kraom	38 (12.7%)	38 (12.6%)	±0	Yes	Yes	1	2		1/year	2/year		100	100	Yes	Yes	---
17	Peri-Urban	56	Khvet	57 (47.2%)	60 (47.6%)	+3	Yes	Yes	2	3		When necessary	3/year	---	100	100	Yes	Yes	---
18		67	Mean Chey	30	50(4.9%)	+20	Yes	Yes	1	12		When necessary	1/month		100	98.0	---	No	----
19	Kompong Speu	429	Sre Kak	45	45 (62.5%)	±0	Yes	Yes	0	2		None	2/year		---	90.0	No	No	---
20		454	Kiri Raksmey	30 (26.4%)	39 (39.0%)	+9	Yes	Yes	3	0		When necessary	None		81.0	---	Yes	Yes	---

(Note) *1 Total number of users was 694 in June, 2000 and 689 in June, 2001. Approximately 34.7 and 34.5 users were registered per one JICA HP in 2000 and 2001 respectively. ( ) shows ratio of JICA HP users (households) against population (households).
*2 Estimated number of users.

5.1.3 Fund Raising

(1) Collection of user fees and its management

Both the 2000 and 2001 monitoring surveys confirmed that user fees are collected in 35 % of the total villages (7 out of 20 villages) as shown in Figure 5.24 and Table 5.3. However, in the 2001 monitoring survey, two of the seven villages in which fees had been collected, were found to have stopped and other villages, which had not collected before, started. Replacing JICA hand pumps with private hand pumps was a reason for stopping fee collection.

Furthermore, the thirteen villages in which user fees were not collected were asked why they had not been collected. Accountants explained that they did not want to collect money in the fear that the money would be lost or stolen as they did not have a safe place to keep the money such as a safety box. Others replied that they did not have to collect money because they were confident that they could collect it from users when money was needed to repair the JICA hand pump. Some VWC members explained that users were more willing to contribute money as repair costs rather than as a user fee. In all cases, VWC members interviewed replied that money would be collected without any problems in the case that a JICA hand pump was broken.

The frequency of fee collection in each village is shown in Table 5.3. While the average frequency of fee collection was 4.9 times in the 2000 monitoring survey, in 2001, it was 2.0 times. One village had collected user fees eighteen times by June 2000 (but quit collecting since then) which raised the average in the 2000 monitoring survey. In general, collecting user fees about two times a year appears to be the most common practice in the pilot villages.

The user fee collected is generally managed by an accountant in the village. If an accountant can not collect the fee from the users, either the chairperson or a secretary collects the fee instead. Money is normally kept in a moneybox at the collector’s house. Although the collected fees had not been used when the survey team interviewed in June 2000, seven villages replied in the 2001 monitoring survey that they used the money for hand pump maintenance on things such as purchasing spare parts, grease, and soil to protect the hand pumps from floods. Villagers gradually started to learn how to utilize the savings.

1) The same result in both the 2000 and 2001 Monitoring surveys

Base: Total interviewed village (20)		
User fee collection	No.	(%)
No	13	65%
Yes	7	35%
Total	**20**	**100%**

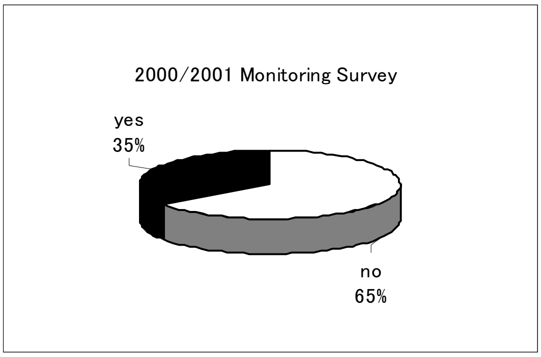


Figure 5.24 User fee collection (2000 & 2001)

(2) Method of collecting the user fee

According to the 2001 monitoring survey, 71.4 % (5/7 villages) of the villages in which user fees were collected responded that either accountants or other VWC members collected the fee by visiting each user's house. Anther two villages replied that the fees were collected by voluntary contribution. The results were exactly the same as those in 2000. Fee collectors explained that visiting each user's house to collect the user fee was the most common and appropriate method in their villages.

1) 2001 Monitoring survey

Base: Total interviewed village (20)		
User fee collection methods (2001)	**No.**	**(%)**
Never collected	13	65%
Visiting each house	5	25%
Volunteer contribution	2	10%
Total	**20**	**100%**

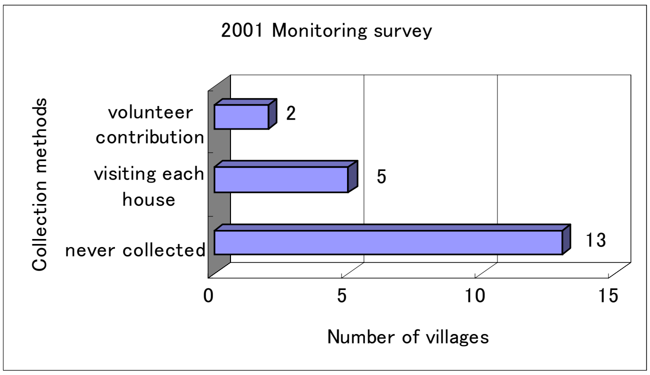


Figure 5.25 User fee collection methods (2001)

(3) Amount collected per family

The amount collected per household in each village is shown in Table 5.3 and the user fee comparisons between 2000 and 2001 are shown in Figure 5.26 and Figure 5.27. The data suggests that the most favorable amount for a user fee is 100 to 200 Riel at a time. In some villages, the fee amount is not fixed as the amount is determined by user's discretion.

1) 2000 Monitoring survey

Base: Total interviewed village (20)		
User fee	No.	(%)
100-200R	5	25%
100-900R	1	5%
200-500R	1	5%
No collection	13	65%
Total	**20**	**100%**

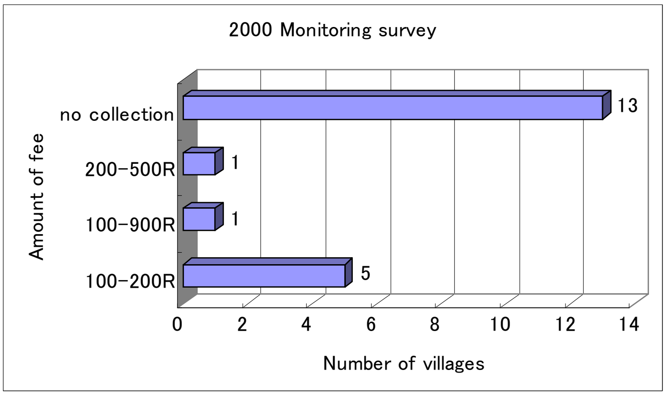


Figure 5.26 Amount collected as user fee(2000)

2) 2001 Monitoring survey

Base: Total interviewed village (20)		
User fee	No.	(%)
100-200R	3	15%
201-300R	1	5%
301-400R	1	5%
According to family	2	10%
Never collected	13	65%
Total	**20**	**100%**

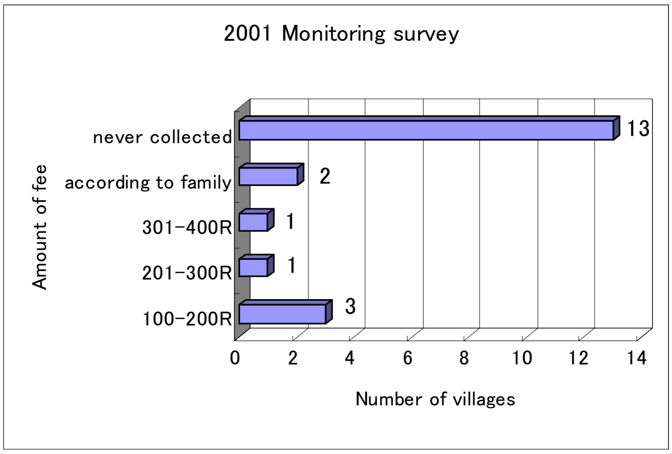


Figure 5.27 Amount collected as user fee (2001)

(4) Willingness to pay

In the 2001 monitoring survey, 60 % of the pilot villages (12 out of 20 villages) were willing to pay (WTP) 100~200 Riel/month as the user fee as shown in Table 5.2. (Five of those villages expressed that they were willing to pay 100 Riel/month, six villages replied their WTP was 200 Riel/month and one village replied 100~200 Riel/month.) In the villages in which user fees were not collected, the villagers insisted that users would contribute to the repair costs once the hand pump was broken.

Table 5.2 Willingness to pay (WTP) for user fee

No.	Province	Village	Amount of WTP (R/month)	No.	Province	Village	Amount of WTP (R/month)
1	Svay Rieng	Dok Por	Repair costs	11	Takeo	Trapaing Thmor	500R
2		Cham Kar Leiv	200R	12		Prech	100R
3		Koy Tra Bek	100-200R	13		Ta Pen	500R
4		Trapaing Thmor	200R	14	Kandal	Krang Svay	Will pay if broken
5		Toul Khpos	100R	15		Angkor Chey	100R
6	Prey Veng	Russei Tvear	200R	16		Svay Kraom	201-300R
7		Ka Kou	200R	17	Peri-Urban	Khvet	400R
8		Kok Trom Kha	Repair costs	18		Mean Chey	300R
9		Prey Phdau	200R	19	Kompong Speu	Sre Kak	200R
10	Takeo	Prey Maok	100R	20		Kiri Raksmey	100R

Base: Total interviewed village (20)		
Willingness to pay	**No.**	**(%)**
100-200R	12	60%
201-300R	2	10%
301-400R	1	5%
401-500R	2	10%
Will pay if broken	1	5%
Will contribute repair cost	2	10%
Total	**20**	**100%**

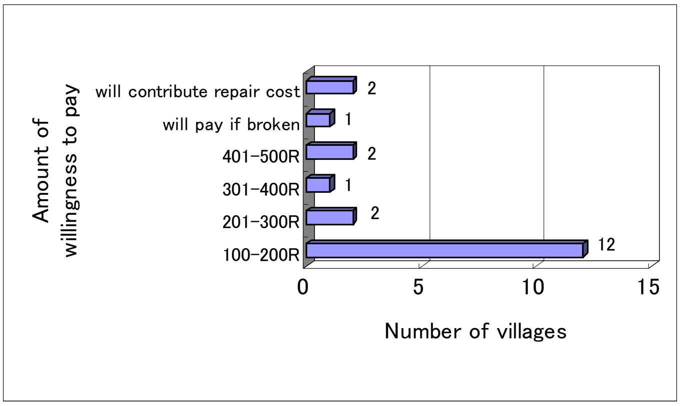


Figure 5.28 Willingness to pay

Table 5.3 Comparison of Fee Collection Conditions (2000/2001)

No.	Province	Well No.	Village	Fee collection (Yes or No)		Amount *[1]			Frequency			Collection method		Savings amount			Money keeping method	
				2000	2001	2000	2001		2000	2001		2000	2001	2000	2001		2000	2001
1	Svay Rieng	139	Dok Por	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
2		162	Cham Kar Leiv	Yes	Yes	200R	200R	---	5 times	2 times		House to house	House to house	18,000 R	24,000 R		Funds are managed by secretary	Kept in a safebox
3		113	Koy Tra Bek	Yes	No	100R	---	---	18 times	---	---	House to house	---	18,000 R	---	---	Funds are managed by chairperson	---
4		122	Trapaing Thmor	Yes	No	100R	---	---	once	---	---	House to house	---	12,000 R	---	---	Funds are managed by secretary	---
5		175	Toul Khpos	Yes	Yes	100R	200-300R		5 times	3 times		House to house	House to house	10,000 R	10,000 R	---	Kept in the house	Accountant keeps
6	Prey Veng	388	Russei Tvear	No	Yes	---	100-300R		---	2 times		---	House to house	---	5,000R		---	Accountant keeps
7		367	Ka Kou	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
8		393	Kok Trom Kha	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
9		401	Prey Phdau	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
10	Takeo	199	Prey Maok	Yes	Yes	100R	100R	---	2 times	2 times	---	At meeting	House to house	6,700R	6,700R	---	Kept in the money box	Chairperson keeps
11		209	Trapaing Thmor	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
12		181	Prech	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
13		242	Ta Pen	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
14	Kandal	288	Krang Svay	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
15		322	Angkor Chey	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
16		259	Svay Kraom	Yes	Yes	100-900R	Depends on the users	---	2 times	2 times	---	Voluntary contribution	House to house	24,900 R	4,200R		Funds are managed by accountant	Accountant keeps
17	Peri-Urban	56	Khvet	Yes	Yes	200-500R	100R		Once	Once	---	House to house	Voluntary contribution	7,000R	Spent all		Funds are managed by accountant	Spent all
18		67	Mean Chey	No	Yes	---	300-500R		---	2 times		---	House to house	---	50,000 R		---	Accountant keeps
19	Kompong Speu	429	Sre Kak	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---
20		454	Kiri Raksmey	No	No	---	---	---	---	---	---	---	---	---	---	---	---	---

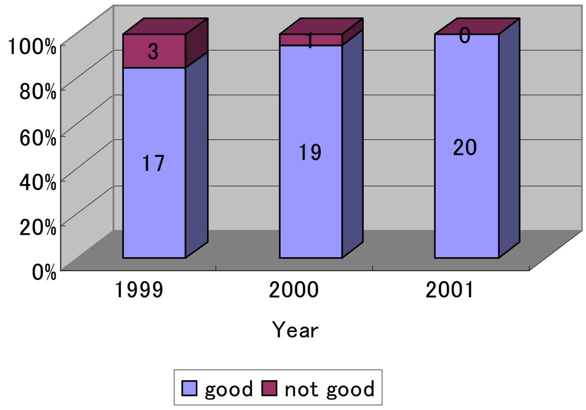
(Note) *[1] Amount shows the fee collected at a time.

5.1.4 O&M Activities

(1) Evaluation of O& M System by Users

According to the results of monitoring in June 2001, 100 % of the users evaluated that the existing O&M system, which was established in 1999 by this study, was good (Figure 5.29) and 90 % of the users evaluated that the functioning and skills of existing WPC were good (Figure 5.30).

Figure 5.29 Evaluation of O&M system



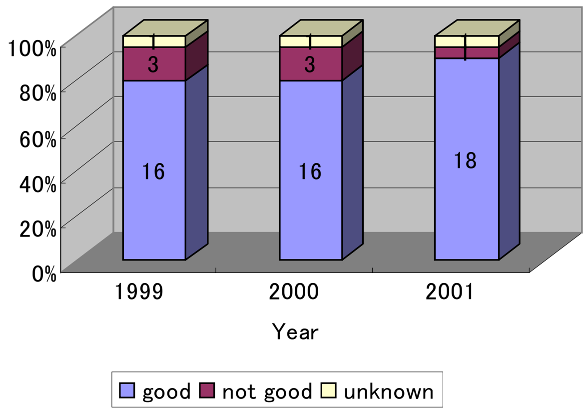


Figure 5.30 Evaluation of Functioning and Skills of Water Point Committee

(2) Repair and Maintenance of Facilities

As most of the wells have been functioning well since the completion of construction in 1997 and the Study Team did most of the repairs during the study period, it was found that WPC caretakers did the repairs in only a few cases. Those repairs were minor such as removing damaged U-seals and putting in a new one.

As for cleaning, most of the wells have been kept clean by the caretakers.

Compared to 60 % of the users not knowing how to use the hand pump tool kit in 2000, 100 % of the users knew in 2001 due to the O&M training during monitoring period.

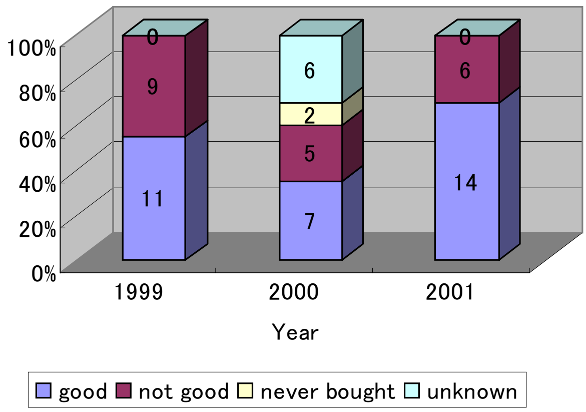


Figure 5.31 Availability of Spare Parts

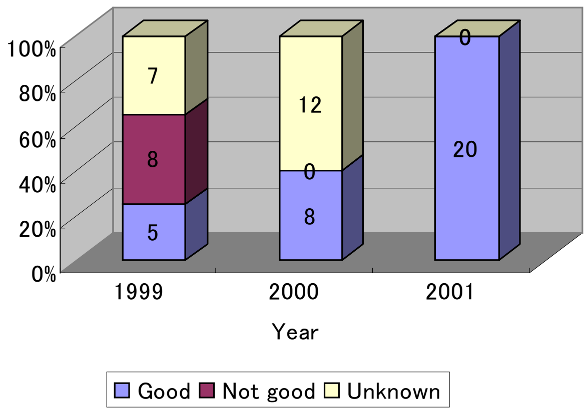


Figure 5.32 Availability of Tool Kits

(3) Communication System

We found that users gave up trying to repair their hand pumps, even the hand pump that was not functioning in No.67 in June 2000, and did not request any assistance from MRD or PDRD even though the notification system for O&M (see Figure 5.33) and a Maintenance Order Form are indicated in the Operation and Maintenance Manual distributed to every WPC from March to April, 1999.

More additional information such as addresses, telephone numbers, names of people in charge, etc., on MRD and PDRD need to be distributed to the WPC.

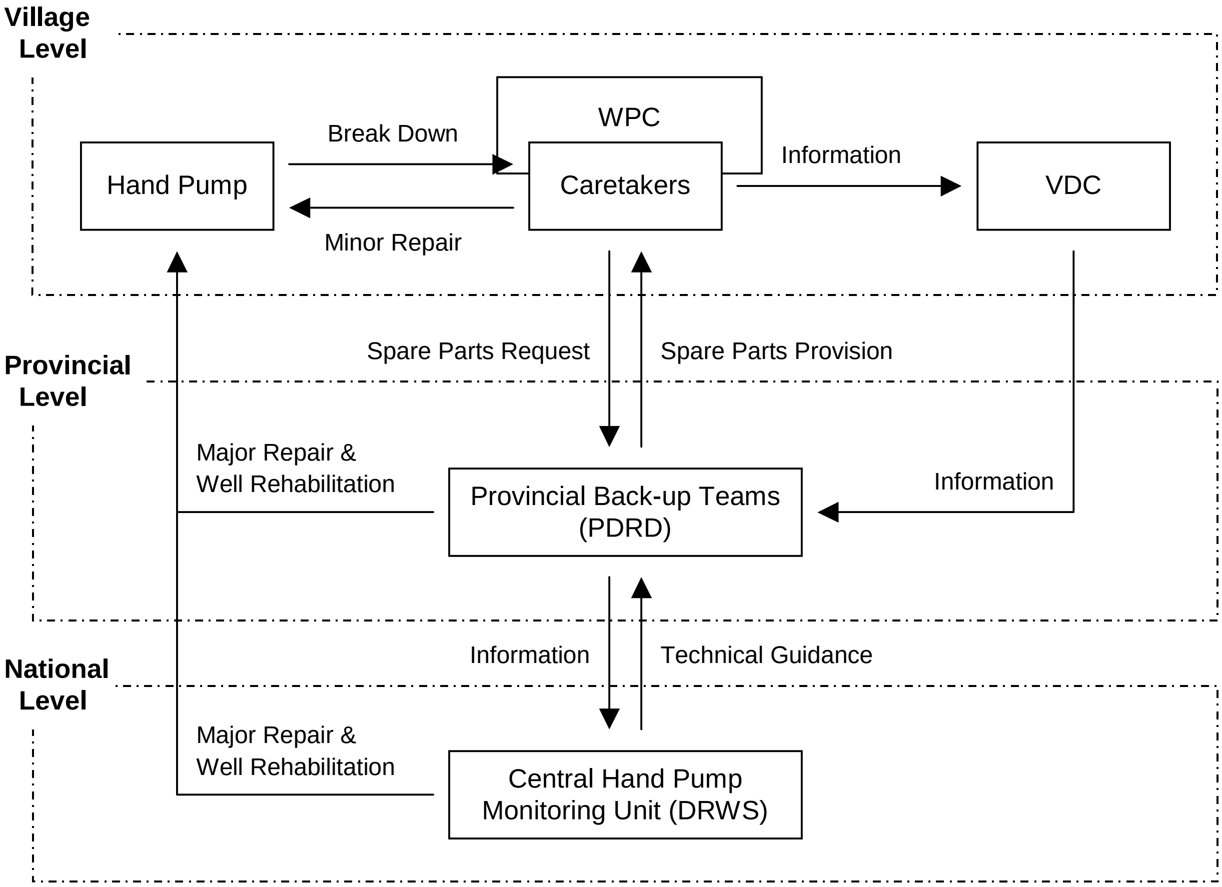


Figure 5.33 Notification System for O&M

(4) Recording of Maintenance, Repairs and Spare Parts

A Form of Maintenance History is availabe in the Operation and Maintenance Manual distributed to every WPC from March to April 1999. However, WPC has not yet made records of repair and maintenance. WPC has no records of storage of spare parts either.

The caretakers of WPC need to receive training in recording skills.

5.1.5 Organizational and Activity Indicators

(1) Size of membership (number of registered users)

The number of registered users in the twenty pilot villages was monitored from 1999 through 2001 and the results are shown in Table 5.4. It was first confirmed in May 1999 in the baseline survey and the number of users was then monitored in the 2000 and 2001 monitoring surveys.

The average number of users in one village was 34.5 in 2001, while in 2000 it was 34.7 as shown in Table 5.4. Both the 2000 and 2001 monitoring surveys showed that 60 % of villages registered 21 to 50 users (see Figure 5.34 and Figure 5.35). Prominent changes observed in the 2001 monitoring survey are the shift of the highest zone of the user number from 21~30 in 2000 to 41~50 and the user increase in the1~10 user zone.

A sharp decrease in the number of users could be observed especially in Prey Veng and Compong Speu in the 2000 monitoring survey due to the introduction of private hand pumps, and the bad taste and smell of the water from JICA hand pumps. The 2001 monitoring survey showed that the total number of users had slightly decreased from the previous year. A striking decrease in users was observed in two villages in Prey Veng and one village in Svay Rieng due to the introduction of private hand pumps. A user increase was confirmed in one village each in Ta Keo, Compong Speu and Peri-Urban since new families moved into the villages and registered as users.

Table 5.4 Number of Users Registered in Pilot Study Villages

No.	Province	Village	Number of users				
			May, 1999	June, 2000		June, 2001	
				No.	Fluctuation	No.	Fluctuation
1	Peri-urban	Khvet	56	57	+1	60	+3
2	Peri-urban	Mean Chey	55	30	-25	50	+20
3	Svay Rieng	Koy Tra Bek	*	10	-	10[*3]	±0
4	Svay Rieng	Trapaing Thmor	*	50	-	4	-46
5	Svay Rieng	Dok Por	19	21	+2	21	±0
6	Svay Rieng	Cham Kar Leiv	*	23	-	24	+1
7	Svay Rieng	Toul Khpos	*	42	-	42	±0
8	Takeo	Prech	54	110	+56	136	+26
9	Takeo	Prey Maok	35	43	+8	43	±0
10	Takeo	Trapaing Thmor	30	29	-1	31	+2
11	Takeo	Ta Pen	13	16	+3	16	±0
12	Kandal	Svay Kraom	37	38	+1	38	±0
13	Kandal	Krang Svay	41	40	-1	43	+3
14	Kandal	Angkor Chey	27	27	±0	29	+2
15	Prey Veng	Ka Kou	113	14	-99	14	±0
16	Prey Veng	Russei Tvear	127	32	-95	24	-8
17	Prey Veng	Kok Trom Kha	*	20	-	3	-17
18	Prey Veng	Prey Phdau	24	17	-7	17	±0

No.	Province	Village	Number of users				
			May, 1999	June, 2000		June, 2001	
				No.	Fluctuation	No.	Fluctuation
19	Kompong Speu	Sre Kak	72	45	-27	45	±0
20	Kompong Speu	Kiri Raksmey	94	30	-64	39	+9
	Total		797	694*1	-	689*2	-

Note: * showed that user registration was not completed as of May, 1999.
*1 Average number of users in one village as of June, 2000 was 34.7. (694/20= 34.7)
*2 Average number of users in one village as of June, 2001 was 34.5. (689/20=34.45)
*3 Estimated number of users

1) 2000 Monitoring survey

Base: Total interviewed village (20)		
Number of Users (2000)	No.	(%)
1 to 10	1	5%
11 to 20	3	15%
21 to 30	6	30%
31 to 40	3	15%
41 to 50	3	15%
51 to 70	1	5%
71 to 90	0	0%
91 to 110	1	5%
unknown	2	10%
Total	**20**	**100%**

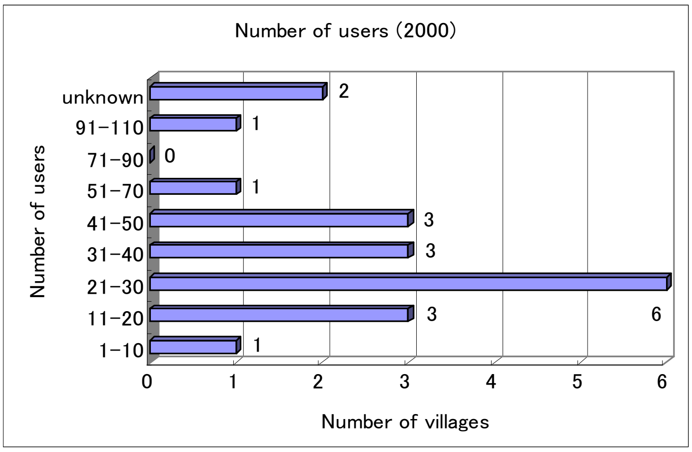


Figure 5.34 Number of users (2000)

2) 2001 Monitoring survey

Base: Total interviewed village (20)		
Number of Users (2001)	No.	(%)
1 to 10	4	20%
11 to 20	1	5%
21 to 30	4	20%
31 to 40	3	15%
41 to 50	5	25%
51 to 70	1	5%
111-150	1	5%
unknown	1	5%
Total	**20**	**100%**

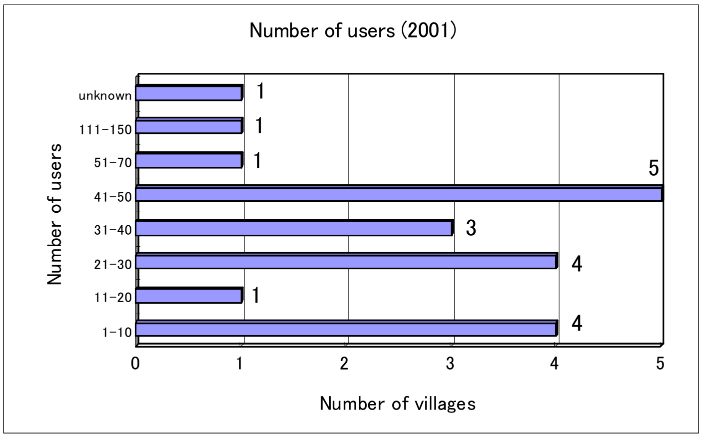


Figure 5.35 Number of users (2001)

(2) Frequency of meetings

While the 2000 monitoring survey confirmed the average number of meetings held by VWC/WPC in the year before was 1.5 times, the 2001 monitoring survey confirmed double of that (3.0 times). This is because the frequency of meetings sharply increased to a monthly basis in two villages, Cham Kar Leiv and Mean Chey as shown in Table 5.1.

As can be seen in both the 2000 and 2001 survey results, holding meetings once to three times a year are the most common practice accounting for 70~75 % of the total. Although three to four villages did not hold meetings every year, only one village among them has never organized formal meetings before since there were only three users and they live next to each other.

1) 2000 Monitoring survey

Base: Total interviewed village (20)		
Number of meetings held (2000)	**No.**	**(%)**
1	6	30%
2	7	35%
3	2	10%
4	1	5%
Others or 0	3	15%
unknown	1	5%
Total	**20**	**100%**

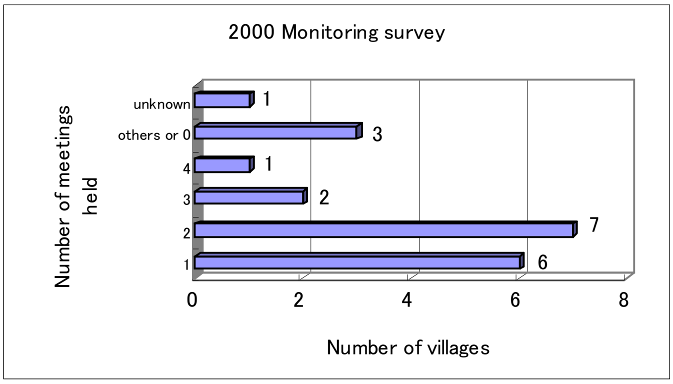


Figure 5.36 Number of meetings held (2000)

2) 2001 Monitoring survey

Base: Total interviewed village (20)		
Number of meetings held (2001)	**No.**	**(%)**
0	3	15%
1	4	20%
2	6	30%
3	4	20%
4	0	0%
More than 5	3	15%
Total	**20**	**100%**

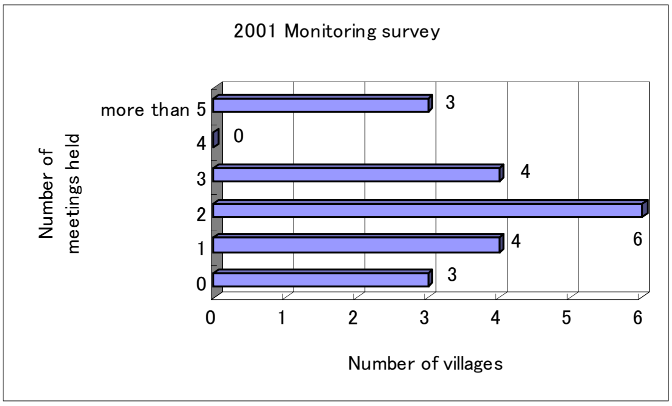


Figure 5.37 Number of meetings held (2001)

(3) Amount of savings generated

65 % of the pilot villages (13 out of 20 villages) never collected user fees. The remaining 35 % (7 out of 20 villages) collected it but one village spent all of it on repairs, therefore, six villages had savings as of June 2001. As shown in Table 5.3, the savings ranged from 4,200 to 50,000 Riel. Cham Kar Leiv and Mean Chey had the highest savings of 24,000 Riel and 50,000 Riel, respectively. Although the 2000 monitoring survey confirmed that the savings were kept unused, some villages used savings by the time the survey team visited the villages in June 2001 for repairs, and purchasing soil to protect hand pumps from floods, etc.

On the whole, the amount of savings is extremely small. The highest savings of Mean

Chey are equivalent to US$12.8[*1] only. This will not be sufficient for repairing a hand pump. Although villagers insist that they are confident in collecting money from users if a JICA hand pump is broken, it is highly recommended that the user fee is collected regularly. In some villages in which the user fee was not collected and there were no savings, VWC/WPC members purchased necessary maintenance materials at their own expenses.

1) 2000 Monitoring survey

Base: Total interviewed village (20)		
Amount of savings (2000)	No.	(%)
20001-25000R	1	5%
15001-20000R	2	10%
10001-15000R	2	10%
5001-10000R	2	10%
No collection	11	55%
Unknown	2	10%
Total	**20**	**100%**

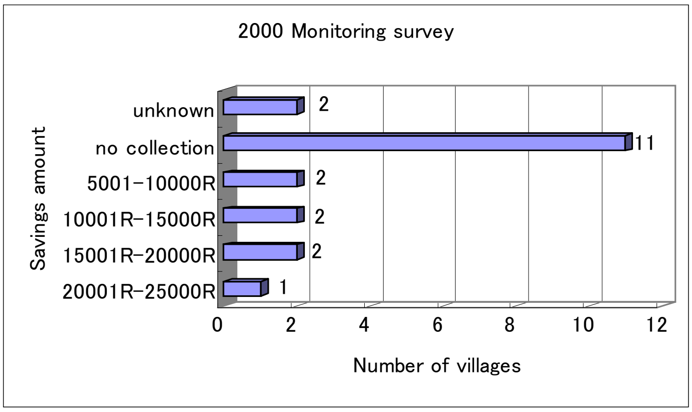


Figure 5.38 Amount of savings (2000)

2) 2001 Monitoring survey

Base: Total interviewed village (20)		
Amount of savings (2001)	No.	(%)
More than 25001R	1	5%
20001-25000R	1	5%
5001-10000R	2	10%
1000-5000R	2	10%
Spent	1	5%
Never collected	13	65%
Total	**20**	**100%**

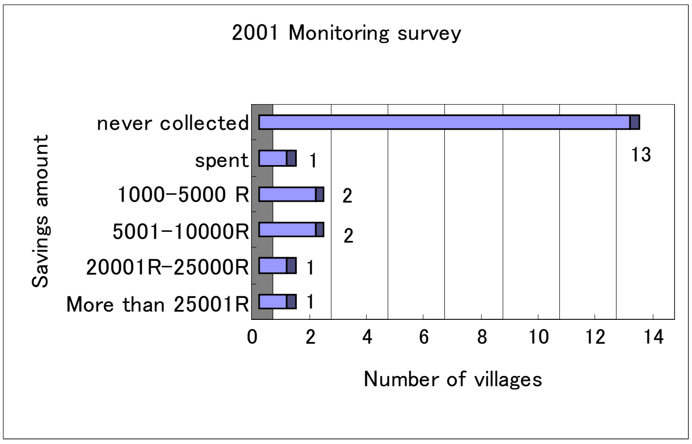


Figure 5.39 Amount of savings (2001)

5.1.6 Assisting Capacity at Each Government Agency

(1) Technical Visit By Government Staff

Figure 5.40, Figure 5.41, Figure 5.42 and Figure 5.43 show the frequency of visits to the village by the government staff. MRD and PDRD staff often visit the village to see the conditions of the hand pump, therefore, in 2000, 80% replied that MRD staff come to the village “sometimes “and 100 % for the PDRD staff. On the other hand, in the same year, 15 % replied that District and Commune staffs come “sometimes”. The above-mentioned means that the government staff are merely checking the states of the hand pumps but not repairing them. However, frequency of visit to the village by the government staff decreased in 2001. Technical intervention by government staff shall be reinforced in the implementation stage.

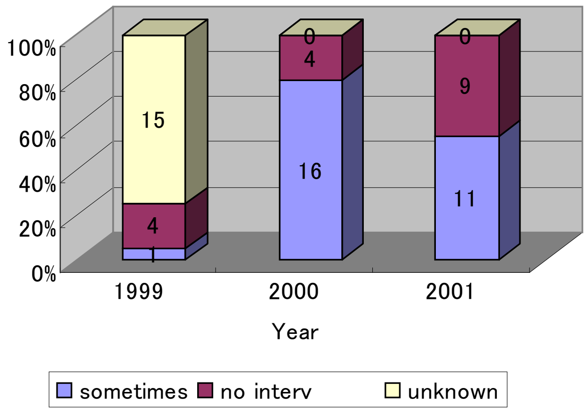


Figure 5.40 Technical Intervension by DRWS

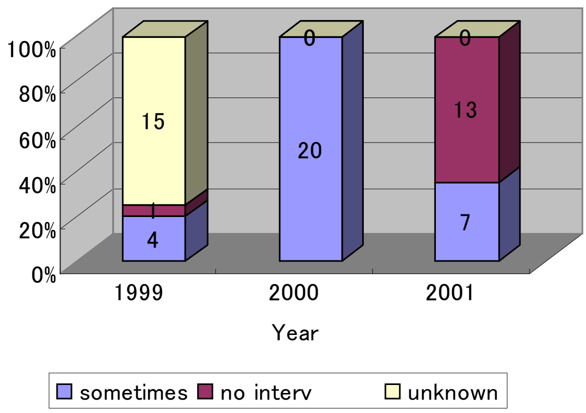


Figure 5.41 Technical Intervention by PDRD

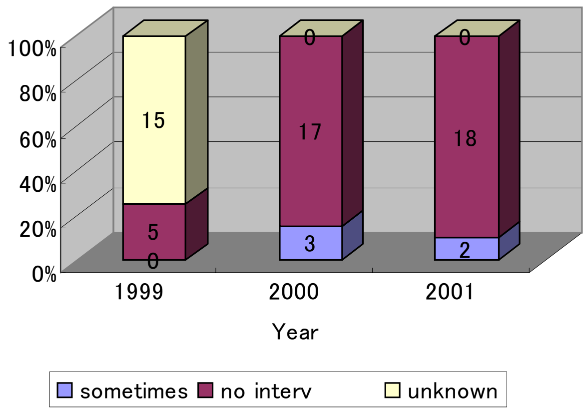


Figure 5.42 Technical Intervention by District

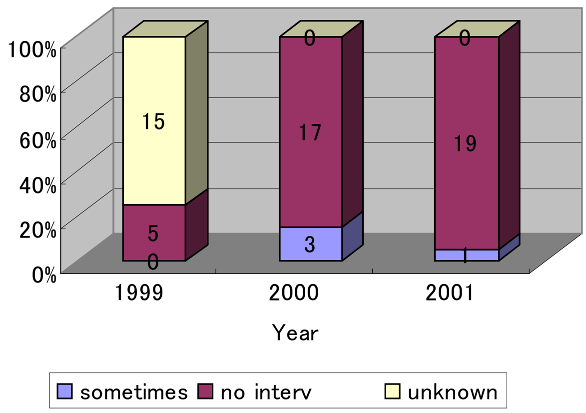


Figure 5.43 Technical Intervention by Commune

(2) Storage of Spare Parts

A minimum of spare parts and tools were provided to WPC and the caretakers were given a training of hand pump maintenance during the Study Period. The Study Team also recommended that some spare parts of hand pumps should be stored at the PDRD warehouse to be used as a future spare supply for the WPC. But there was no stock of spare parts of hand pumps at PDRD, District and Commune levels.

Therefore, in order to procure the primary stock of spare parts, the Study Team distributed the standard spare parts to PDRD in 2001 in the following quantities.

Level	Organization	Quantity (set)
Central Hand Pump Monitoring Unit	DRWS	4
Provincial Backup Teams	PDRD, Peri-Urban	3
Provincial Backup Teams	PDRD, Svay Rieng	5
Provincial Backup Teams	PDRD, Ta Keo	6
Provincial Backup Teams	PDRD, Kandal	3
Provincial Backup Teams	PDRD, Prey Veng	5
Provincial Backup Teams	PDRD, Kompong Speu	2
Total		28

When the spare parts in the WPC run out, WPC can purchase new spare parts from PDRD. And when the stock of spare parts in PDRD is finished, PDRD shall purchase additional spare parts as new stock from the following sole agent with the money gained from selling previous spare parts to WPC.

Name	Person in Charge	Address	Phone
PPS International Co., Ltd	Mr. Prasad	PO Box 2063, PP III, #32, Street352, Phnom Penh	023-213452 023-363125 023-722417(fax)

(3) Repair Team

There are some experienced MRD and PDRD technical staff that are familiar with the maintenance and repair of the hand pumps. They are capable of organizing a repair team. However, a team was not officially organized. In addition, such skilled technical personnel are not presently found at the District and Commune levels,.

(4) Notification System

According to the notification system (see Figure 5.33) proposed by the Study Team, if a hand pump is damaged seriously, beyond the capabilities of the village community, provincial or national support is necessary.

The method of requesting spare parts was explained to the users. Moreover, maintenance and spare parts order forms were already prepared and distributed by the Study Team. Therefore, it is recommended that the MRD and PDRD prepare a tariff of regular maintenance and repair of the facilities together with a price of the spare part A list of existing person in charge of this system is shown in (Table 5.5).

Table 5.5 List of the Person in Charge of the Notification System for O&M

Level	Organization	Name of Director	Person in Charge	Address	Phone
Central Hand Pump Monitoring Unit	DRWS	Dr. Mao Saray	Mr. Sam Bonal	Kampuchea Krom Blvd. Rd #139, Phnom Penh	023-883272
Provincial Backup Teams	PDRD, Peri-Urban	Mr. Sam Than	Mr. Phan Sarun	#271, Trapaing Chhuk Village, Tuek Thla Commune, Russei Keo District	011-864459
Provincial Backup Teams	PDRD, Svay Rieng	Mr. Mey Lonn	Mr. Sao Sam Ouern	Soun Thmei Village, Prey Chhlak Commune, Svay Rieng District	044-945717
Provincial Backup Teams	PDRD, Ta Keo	Mr. Thor Sen	Mr. Pak Choun	Chak Village, Roka Krau Commune, Doun Keo District	016-872558
Provincial Backup Teams	PDRD, Kandal	Mr. Chap Moch	Mr. Un Chann	Ta Khmau Village, Ta Khmau Commune, Ta Khmau District	016-823948
Provincial Backup Teams	PDRD, Prey Veng	Mr. Tauch Setha	Mr. Ney Khon	Village No.3, Kampong Leav Commune, Kampong Leav District	043-944502 043-348026
Provincial Backup Teams	PDRD, Kompong Speu	Mr. Im Sam An	Mr. Chhim Mony	Svay Krovanh Village, Chhbar Mon District	012-881874

(5) Maintenance Recording Skills

Recording skills are one of the most important factors needed to communicate with outsiders and review their activities. If the hand pump undergoes several breakdowns or needs spare parts, the date it breaks down, the date it is repaired, the repair cost, the cause of the breakdown, and the person handling the repair should be recorded in the form for records as proposed by the Study Team. However, there are no records of repairs and maintenance at any government levels. MRD and PDRD staff need to be Trained in recording skills.

5.2 Social and WID Issues

5.2.1 Method of Monitoring

In order to monitoring social and WID issues, a questionnaire for family users (in 20 villages, 5 sample families per village), observation of the village, and a semi-structured interview with women users were carried out by C/P and the study team. These studies took place under respect of autonomy of MRD/DRWS staffs and PDRD staffs and enough communication among the study team members.

The questionnaire for the families (the households survey) was conducted twice (at the first and third monitoring study) in order to compare the results to that of the baseline study in 1999. The main objective of the household survey was to study the use of the hand pumps and water, the effect of hygiene education and the people’s will to participate in order to analyze the change one year and two years after the hand pumps were installed and to apply the results into planning a participatory operation and maintenance system.

Semi-structured interviews with women (at the third monitoring, in 18 villages) were conducted to get an understanding women’s use of the water supplies. The objective of these interviews was to learn women’s real opinions, which are difficult to obtain in the household surveys. The data obtained in the interviews are more reflective of the true situation.

5.2.2 Use of JICA HPs

The JICA HPs are used for drinking, cooking, washing, bathing and animal-raising unless there is big problem in quality and quantity of water. Especially, in Peri-Urban and Kompong Speu, the JICA HPs are appreciated with its high water quality and the number of users is increasing in some villages. Some people from neighboring villages come to fetch water at JICA HPs and the people from the villages that own the HPs are tolerant to them. In the dry season, the HPs are especially important for residents in peripheries for procuring safe water.

(1) Water for Drinking

Figure 5.44 shows JICA HPs are used for 60 % of drinking water in the dry season and 40 % in the rainy season. In 2000 and 2001, there is a slight decrease, which is due to the fact that users who are not familiar with the taste of JICA HP’s water prefer rainwater, and in some villages, private hand pumps are becoming more popular. However, since it is not likely that the use rate will continue to decrease, this figure (60 % in dry season, 40 % in rainy season) should be placed as a fixed rate. The same result was for cooking water.

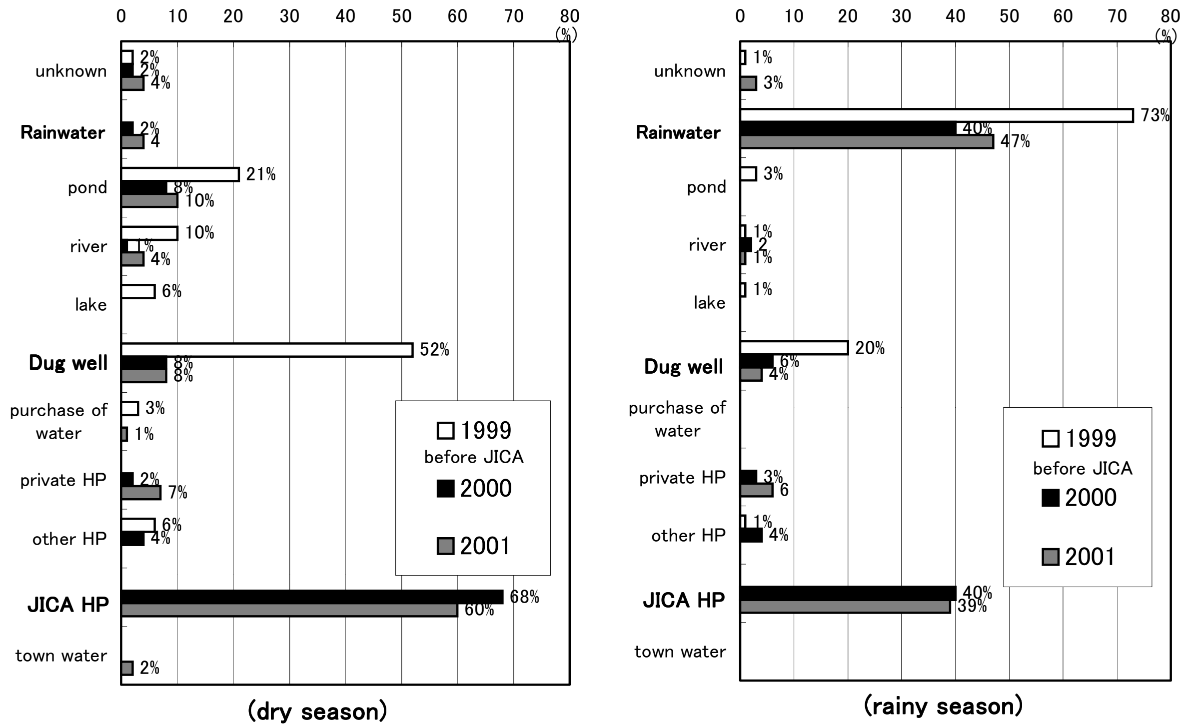


Figure 5.44 Main Drinking Water Source before and after JICA HP (Dry season & Rainy Season)

The following figure gives additional information on drinking water. Since 1999, more than 40 % of the households have answered that JICA HP water was their favorite water. As storing rainwater depends on the weather, the rate of use of JICA HPs depends also on the weather.

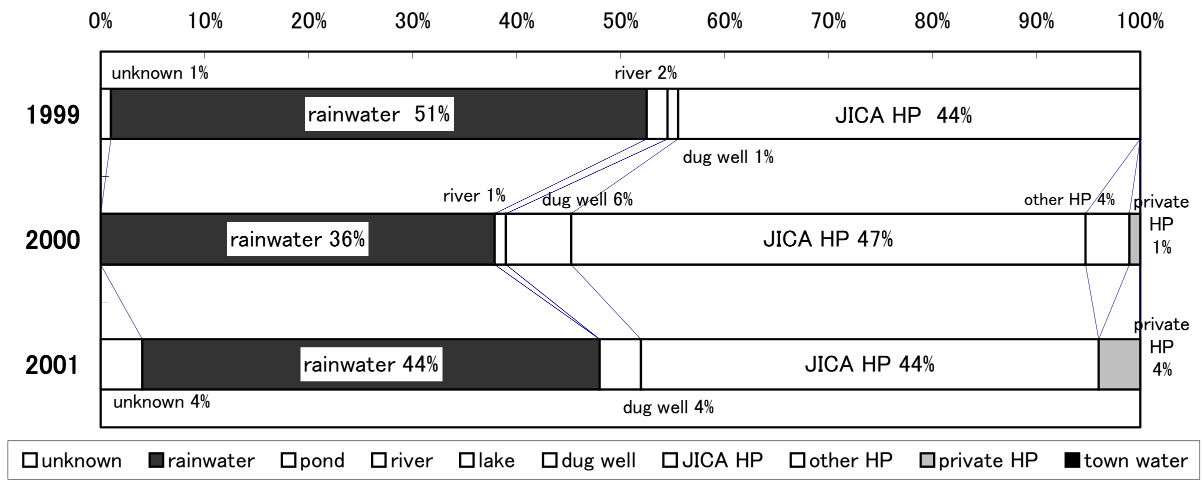


Figure 5.45 Favorite Drinking Water after JICA HP

(2) Water for Washing and Bathing

After installing JICA HPs, their water has been used for drinking, cooking, washing, bathing and raising animals. The following figure shows the changes of place for washing and bathing between before and after the installation of JICA HPs. After installation, both in 2000 and 2001, more than 70 % of households use JICA HPs for washing and bathing, therefore, it can be said that the JICA HPs have become a stable water source for them.

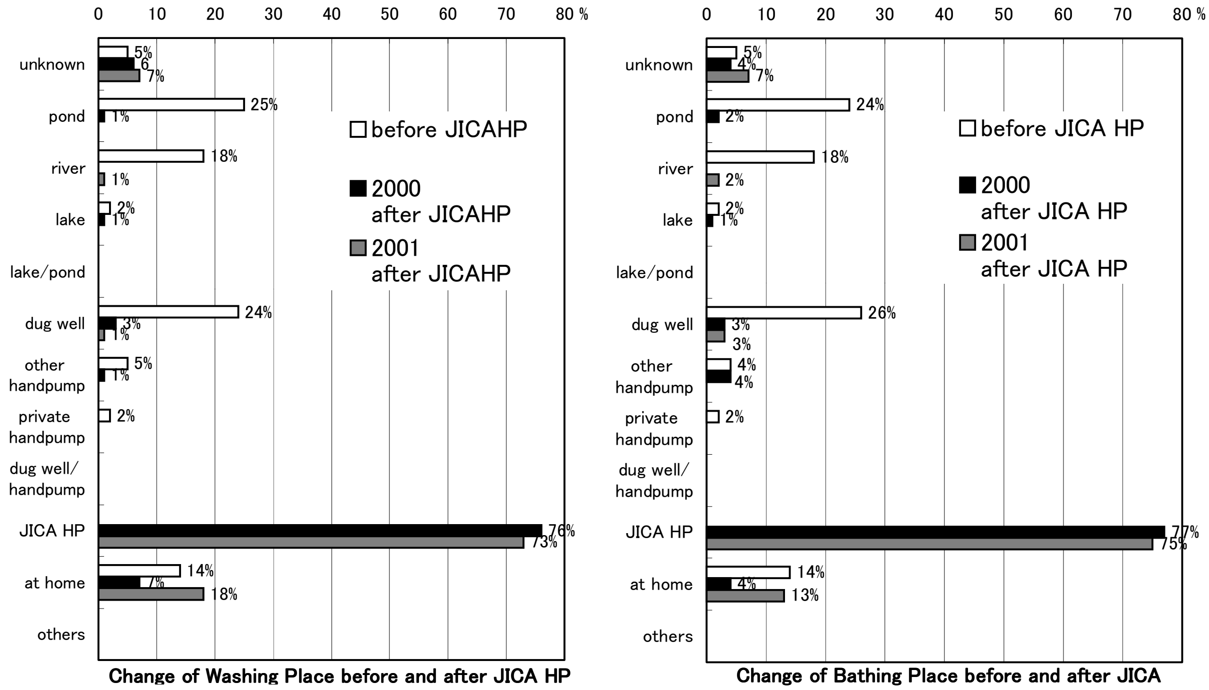


Figure 5.46 Change of Washing Place and Bathing Place

(3) Increase of private hand pumps and children users of JICA HPs

For reasons of increased income and its convenience, the number of private hand pumps is increasing. The price of installation is around 200,000 Riel, materials, parts, boring and installation fees included. There is a tendency to own private hand pumps, particularly in Svay Rieng and Prey Veng, and the number of users of JICA HPs is decreasing in some villages.

However, as the operation of private hand pumps is difficult for children, they often use JICA HPs in the village where thr number of users of the JICA HPs is decreasing. In a village, for example, the registered number of users has decreased, but the JICA HP is situated just next to a primary school (160 students) and it plays a very important role for children. The local residents need to be informed of the use of HPs by neighboring schools and hospitals even in villages where the number of private hand pumps is increasing, and installation and management of JICA HPs needs to be discussed.

The following figure shows the person who fetched water after installation of JICA HPs. At first (in 1999), the percentage of children (both male and female) who fetched water was only 4 %, however the percentage increased to 24 % in 2000 and 29 % in 2001. The reason for this change is not just because they were given a new chore, but also because the pumps are easy to use even for small children. In the daytime, children are the main users of JICA HP for bathing and drinking water. It is necessary to take children-users into consideration as regular users even when adult use another sources.

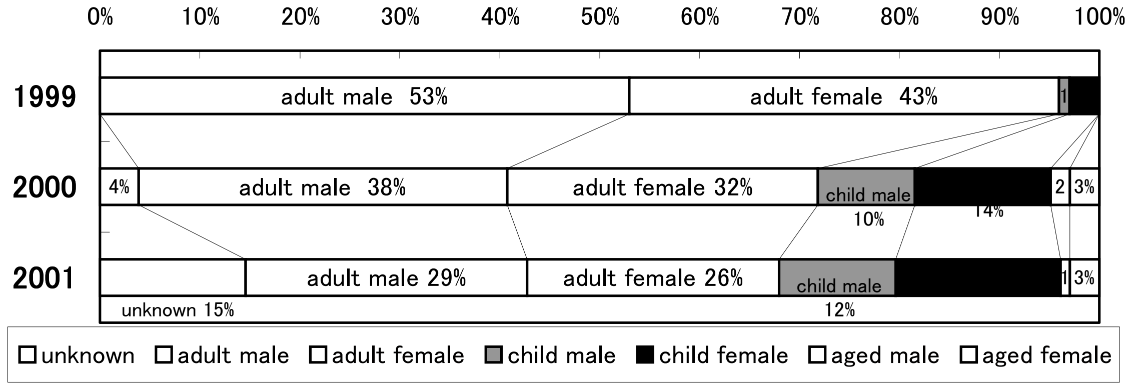


Figure 5.47 Person Who Fetched Water after installation of JICA HP (multiple answer)

In addition, as private hand pumps break down easily and their users are partly dependent on JICA HPs, the JICA HPs give them security all through the year.

(4) Increase of migrant workers

The number of migrant workers from villages to towns is increasing. This is due to poor rice crops because of the flood from the previous year (farmers cannot prepare seeds and fertilizers) and postponement of rice planting because of a delay in the rainy season in the present year. However, the basic reason is that more and more farmers cannot get enough cash income without going out to work in town. The family situations of the migrant workers in the pilot villages are as follows.

- Whole families that stay and work in town during off-season (dry season)
- Husband that stay in town all year round and while their wives look after their family and farm.
- Woman-headed families that depend entirely on income from work in town (going back to their villages in weekends)
- Young members of a family (both men and women) that work in town during weekdays and go back to their villages on weekends.

The influences of the increase in migrant workers on use of JICA HPs and water use:

- The number of users decrease
- Members of VWC/WPC are not in villages
- The pumps are used mainly early in the morning and in the evening and on Sundays because users are in village only early in the morning and in the evening and weekends.
- Water fetching and washing hours are concentrated in the early morning and at night because only women work on farms during daytime. They usually wash clothes on weekends.
- Women prefer to install private hand pumps closer to their houses because they work both at home and on the farm.
- Without men, especially in the faming season, water fetching is very hard for women and they use a water source based on convenience rather than safety. Women use nearer water sources. They drink the water without boiling it even though they know it is better boiled.
- More people have used hygiene facilities(toilet), more people want to install them.

5.2.3 Water Quality and Quantity

The evaluation on water quality and quantity of JICA HPs is higher in the dry season than the rainy season. In dry season, they use water from the pumps for purposes that they do not use it for in rainy season. The reasons are:

- They can store rainwater easily by using roofs in the rainy season.
- Many people prefer the taste of rainwater to that of JICA HPs.
- JICA HPs require more time for washing clothes than dug wells and private hand pumps because their one stroke gives less water than others.

And there are various opinions in a single village about water quality and quantity of JICA HPs. There are some households that never use rainwater for sanitary reasons and there are some who live close to JICA HPs but use river water for drinking.

For improving the hygiene of the residents, it is necessary not only to give sustainable and regular hygiene education but also to apply visual typed educational materials for people who are illiterate.

(1) Water quality of JICA HPs

The main factor of judging water quality is if it is drinkable or not.

The most important factor for drinking water is taste and smell. The standard of taste and smell is rainwater. In 3 villages (1 in Ta Keo, 2 in Kandal) among 20 villages people do not at all drink the water of JICA HPs. In 2 villages in Ta Keo, people use the water of JICA HPs for drinking but not for rice cooking because the water turns yellow when it is heated and has a bad taste). In these 2 villages, they use rainwater and dug well water for cooking. Women strongly request better quality water from JICA HPs for cooking.

In addition, even people who did not use JICA HPs use it after installing an IRD which is very efficient from the viewpoint that people’s biggest interest about water is obtaing drinking water.

In many villages, they leave water over night to improve its quality (reducing iron smell). It is one of their customs.

(2) Water quantity of JICA HPs

More people complain that JICA HPs with IRDs pump less per stroke. It takes too much time, especially for washing as it requires large amount of water. When installing an IRD, the study team taught them to remove the IRD when they need a large amount of water, and leave it when using the HPs for drinking and cooking. In the monitoring, C/Ps taught users again the appropriate operation of IRDs. However, in some JICA HPs it was difficult to use for washing because the color of the clothes is changed by the.

There are some complaints from users of JICA HPs without IRD. Most of the complaints are due to concentration of the hours the pumps are used. Some women users propose installation of simple water tanks to store water and the establishment of users rules about using hours.

- As most women wash clothes in the morning or/and evening, HPs constantly being used during these hours. Some villages established a rule that one person can make 52 strokes (about 30 liters) at a time in the morning and evening.
- In the farming season (rainy season), the hours the wells are used concentrated in the morning and evening.
- Women cannot fetch water during the daytime because they work on the farms so

they do it in the morning and/or evening.

- Some JICA HPs are crowded on Sundays with young women and FHH who work in towns and go back to villages on weekends.
- Compared with hand pumps of shallow level (20 to 30 meters), JICA HPs give less water per stroke.

In spite of the complaints listed above, JICA HPs are important water sources for washing in the dry season. Getting water as clear as rainwater in the dry season is very helpful for women to wash and bathe.

5.2.4 Women and Water Use

It is not too much to say that "all the housework is connected with water". Usually, both men and women fetch water, but the role shifts to women or children in families which men are out for work in town or in FHHs(female headed households). Under this condition, women would like to use JICA HPs for all purposes.

According to the interviews in the pilot villages, women answered that the heaviest work for them is rice planting/harvesting. Cooking/dishing up and washing clothes are the most time-consuming housework for them, which are heavy burdens in busy season for farming. Access to a water source has a big influence on their daily lives. Easy access to safe water leads directly to a reduction of work for women. In addition, the procurement of safe water in terms of health, especially keeping children from diseases, is a matter of high concern for women. According to the questionnaire in the pilot villages, many women wish to have more knowledge about hygiene and health. At the same time, JICA HPs are the only water source fthat children can use safely. It is quite preferable for mothers that children can drink and frequently bathe with safe water.

(1) Female Headed Households in the pilot study area

The following figure shows water use of JICA HPs by FHHs (female headed households) and the other households. In the Households Survey, 20 out of 100 households are FHHs. The data displayed in this figure is from the Households Survey in 2001. The most remarkable part of this analysis is that FHHs show more increased factors for cooking, washing, bathing and for animals in comparison with the other households (for all the purpose except for drinking and for agriculture). The other households show more decreased factors (for almost all purposes), however FHHs show no decreased factors for washing, bathing, animals.

It is necessary that the FHHs who are considered as the weak in society use JICA HPs for more various purposes.

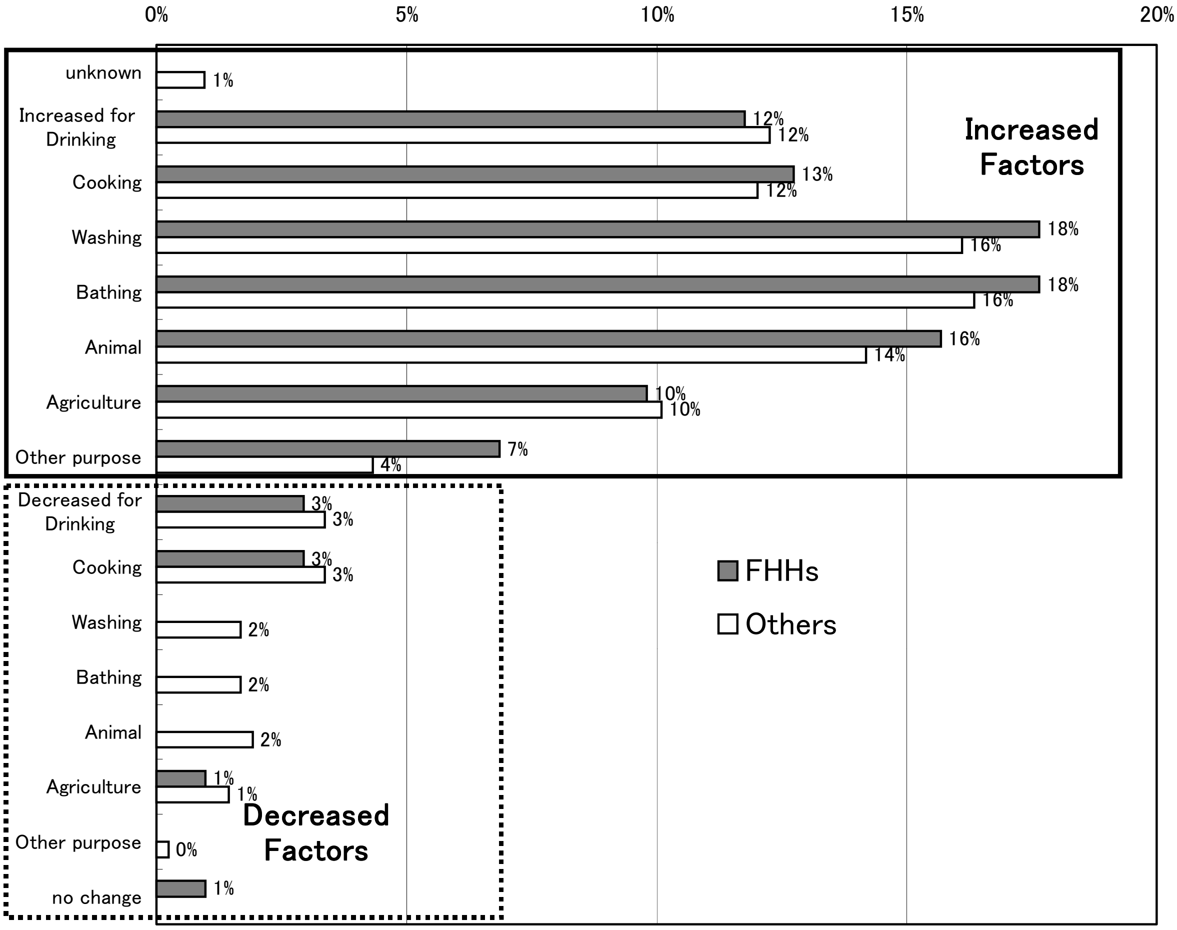


Figure 5.48 Change of Water Use after JICA HP for Female Headed Households(FHHs) and Others in 2001

The following figure presents the benefits of JICA HPs of FHHs and the other households. In 2000, 30 % of FHHs answered that thanks to JICA HPs, their water source become nearer, but in 2001, 24 % of them mentioned new benefits such as “can save money” and “can save time”. At the same time, the answer “decrease of illness” increased. For FHHs, JICA HPs do not only provide a close water source, but they also bring them side effects such as reduction of disease and time saving. Meanwhile, there was no big difference in the answers from 2000 and 2001 among the other households. An increased number of the other households mentioned “can save time” and “decrease of illness” as the FHHs did.

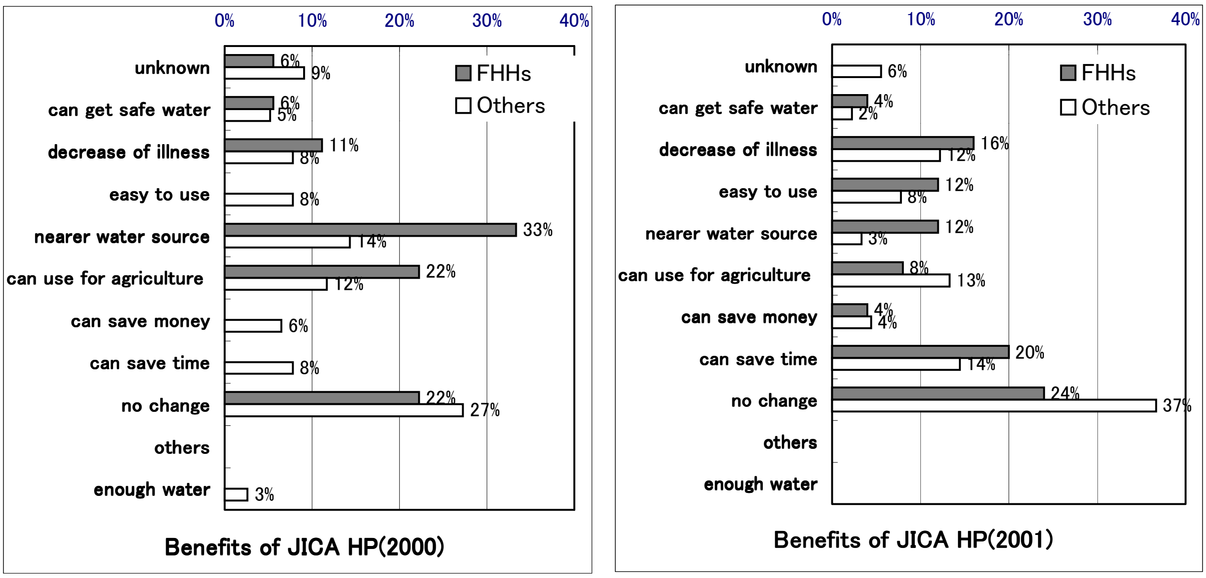


Figure 5.49 Benefits of JICA HP for Female Headed Households(FHHs) and Others

The following figure shows the method of drinking water of FHHs and the other households. Before hygiene education, 47 % of FHHs drank water directly and 43 % boiled water. After hygiene education, the percentage of those who drank directly decreased to 43 % and those who boil water increased to 55 %. However, compared with the other households, 10 % more FHHs drank water directly and 10 % less FHHs boil water. It could be gathered from this case that FHHs are busier than the other households with housework and farming and have no time for boiling water, and they cannot apply their knowledge of hygiene into daily life.

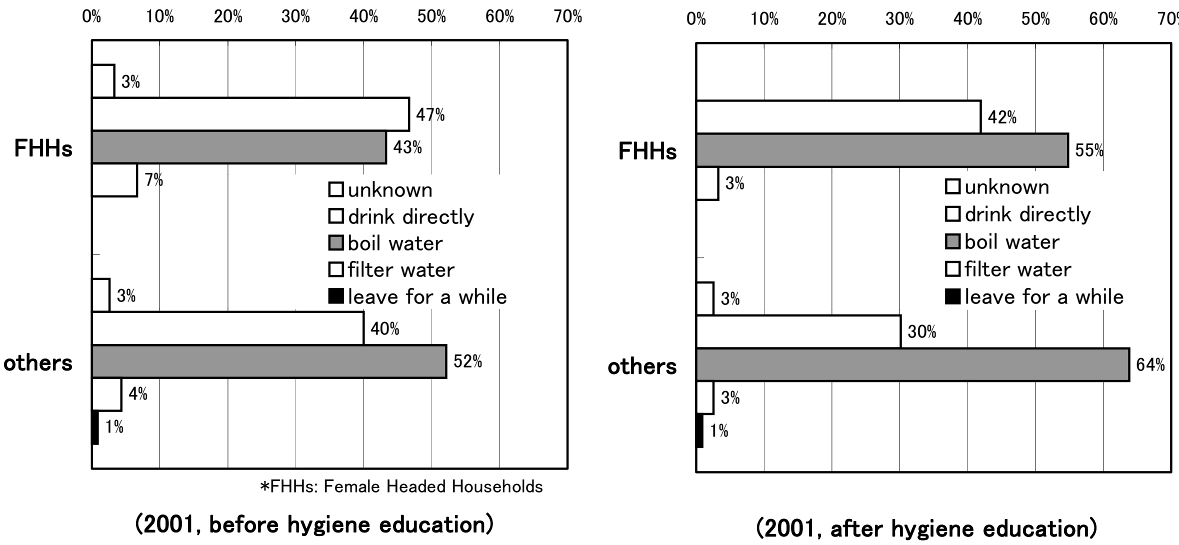


Figure 5.50 Method of Drinking Water (2001, before and after hygiene education)

(2) Operation and Maintenance in WID

a) VWC/WPC activities

Members of VWC/WPC are shown in the following figure. 60 % of VWC/WPC members are male, 80 % in VWC only. Since establishment, male members have dominated the committees. However, women participate as caretakers of WPC, and women or girls do most of the daily cleaning. There are many women who want to become a committee member for the reason that they want to continue to use JICA HPs for a long time and to participate in decision-making. In future, arrangements need to be made to let positive women participate more in the committees. In the first stage of establishing a committee, women appear to be passive because of a lack of comprehension about the activities, but they become more positive once they understand the activities and the importance of HPs. For making good use of women resources, some strategies that should be taken into consideration are, for example, starting a committee with small number of members and adding one by one, year by year.

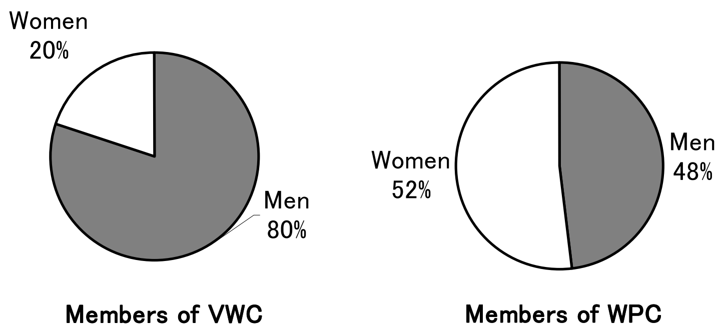


Figure 5.51 Members of VWC and WPC

b) Operation and Maintenance issues

Women users request a brush for cleaning, a litter bin, and a fence (to keep children from playing around HPs, to prevent dumping garbage). Basically, discussions among users is the most required solution for management issues, but people are not yet familiar wiht having a constructive discussion. It is necessary to promote a system in which women can put their useful ideas into practice.

On the other hand, there are many women who do not know how to inform when a HP gets broken. We need another explanation to users about maintenance and management of HPs not only when installing them but also once users are accustomed to HP operation.

c) Facilities around HPs (washing place, water tank, bathroom for women)

There are many people who desire an extension of the platforms for a washing place. It is difficult to do for reasons of hygiene, but it is possible to install a facility separate from the platform. And also, many people wishes to have water tanks to store water to use not only for washing but also for bathing. It may save time for housework as well.

Many young women wish to have a bathroom close to HPs for bathing. Villagers bathe several times a day, but young women cannot bathe at ease because some HPs are situated along a main traffic route and some are installed in a conspicuous place.

d) Hygiene facilities

Because bushes are being used less as toilets, people wish to have latrines installed; Women (especially young women) strongly requested this. But they do not want a public toilet, if it has to be shared with others, with 2 to 4 families at most. Villagers want to construct a toilet by themselves if they can be provided cement-rings and latrines (US$ 20 in all).

5.2.5 Findings and Recommendations

Although there is difference between the farming season and the off-season, it seems that people require more convenience in water use because of physical burdens on women and increasing migrant workers. However JICA HPs play the following important roles in the pilot villages:

Very valuable water source for FHHs
Reduction of women's housework
Easy and safety water facility for chidren
Important water source for villagers including neighbor villagers in the dry season
Guarantee of safe water all through the year
Based on the above points, the recommendations introduced from the monitoring are:

a) Enrichment of peripheral facilities

Make use of HP water more convenient by installing simple water-tanks, washing places and bathrooms for women.

b) Enforcement of hygiene education

Conduct sustainable and regular hygiene education by developing visual educational materials according to the level of literacy of the people who are busy working at home and on farms avoiding the busy season for farmers.

Enforce hygiene education in cooperation with schools and village health centers especially for mothers and expectant mothers who have a big influence on children's health and who pay attentions to sanitary conditions.

c) Installation of hygienic facilities

Provide materials for or subsidize the installation of latrines.

d) Consideration to FHHs

FHHs are busier than the other households with housework and farming, so they cannot apply their knowledge of hygiene into daily life. However they understand the secondary effectiveness of JICA HP such as reduction of disease and time saving. The number of FHHs in a village should be considered one of the criteria of a project.

e) Consideration to children

Children use more JICA HPs for bathing and drinking water than other water sources because it is easier to use. Take children users into consideration as regular users even when adult use another sources. And also the water condition of schools and hospitals need to be examined.

f) Involvement of women

It is necessary to establish a system in which women can participate positively in VWC/WPC. Evaluate appropriately the importance of preventive maintenance and cleaning and give people guidance in applying women's ideas.

g) Empowerment of VWC/WPC

Direct VWC/WPC to change members under discussion among users when some present members are always away from the village or do not take part in the committee.

The Data Analyses of the Households Survey

The following are the main data analyses of the households survey from 1999 to 2001.:

Table 5.6 Change of Water Use after JICA HP

	2000 increased factor	2001 increased factor	2000 decreased factor	2001 decreased factor
drinking	63 (14.3%)	63 (14.0%)	12 (21.8%)	17 (24.6%)
cooking	66 (15.0%)	63 (14.0%)	10 (18.2%)	17 (24.6%)
washing	84 (19.1%)	85 (18.9%)	6 (10.9%)	7 (10.1%)
bathing	83 (18.9%)	86 (19.2%)	7 (12.7%)	7 (10.1%)
animal	72 (16.4%)	75 (16.7%)	7 (12.7%)	8 (11.6%)
agriculture	51 (11.6%)	52 (11.6%)	7 (12.7%)	7 (10.1%)
other purpose	21 (4.8%)	25 (5.6%)	2 (3.6%)	1 (1.4%)
unknown	－ (－)	－ (－)	0 (0.0%)	4 (5.8%)
no change	－ (－)	－ (－)	4 (7.3%)	1 (1.4%)

Compared with 2000 and 2001,there is no big difference among increased factors for change of water use. Meanwhile, in terms of the decreased factors, “drinking” got 12 points (21.8 %) in 2000 and 17 points (24.6 %) in 2001 and "cooking" got 10 points (18.2 %) in 2000 and 17 points (24.6 %) in 2001.

Table 5.7 Change of Water Use after JICA HP for FHHs and Others

	2000 female headed	2000 others	2001 female headed	2001 others
unknown	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (1.0%)
increased for drinking	13 (14.0%)	50 (12.4%)	12 (11.8%)	51 (12.3%)
increased for cooking	13 (14.0%)	53 (13.2%)	13 (12.7%)	50 (12.0%)
increased for washing	14 (15.1%)	70 (17.4%)	18 (17.6%)	67 (16.1%)
increased for bathing	14 (15.1%)	69 (17.2%)	18 (17.6%)	68 (16.3%)
increased for animal	13 (14.0%)	59 (14.7%)	16 (15.7%)	59 (14.2%)
increased for agriculture	10 (10.8%)	41 (10.2%)	10 (9.8%)	42 (10.1%)
increased for other purpose	3 (3.2%)	18 (4.5%)	7 (6.9%)	18 (4.3%)
decreased for drinking	2 (2.2%)	10 (2.5%)	3 (2.9%)	14 (3.4%)
decreased for cooking	2 (2.2%)	8 (2.0%)	3 (2.9%)	14 (3.4%)
decreased for washing	2 (2.2%)	4 (1.0%)	0 (0.0%)	7 (1.7%)
decreased for bathing	2 (2.2%)	5 (1.2%)	0 (0.0%)	7 (1.7%)
decreased for animal	2 (2.2%)	5 (1.2%)	0 (0.0%)	8 (1.9%)
decreased for agriculture	2 (2.2%)	5 (1.2%)	1 (1.0%)	6 (1.4%)
decreased for other purpose	0 (0.0%)	2 (0.5%)	0 (0.0%)	1 (0.2%)
no change	1 (1.1%)	3 (0.7%)	1 (1.0%)	0 (0.0%)

2000: There are more increased factors and less decreased factors among households others than female headed households.

2001: Conversely from 2000, there are more increased factors among female headed households but more deceased factors among others, and, there is no answer for "decreased for washing, bathing and for animal", in particular.

Table 5.8 Main Drinking Water(Rainy season & Dry season)

	1999 Rainy season	2000 Rainy season	2001 Rainy season	1999 Dry season	2000 Dry season	2001 Dry season
unknown	1 (1.0%)	0 (0.0%)	3 (3.0%)	2 (2.0%)	2 (2.1%)	4 (4.0%)
rainwater	73 (73.0%)	40 (42.1%)	47 (47.0%)	0 (0.0%)	2 (2.1%)	4 (4.0%)
pond	3 (3.0%)	0 (0.0%)	0 (0.0%)	21 (21.0%)	8 (8.4%)	10 (10.0%)
river	1 (1.0%)	2 (2.1%)	1 (1.0%)	10 (10.0%)	1 (1.1%)	4 (4.0%)
lake	1 (1.0%)	0 (0.0%)	0 (0.0%)	6 (6.0%)	0 (0.0%)	0 (0.0%)
dug well	20 (20.0%)	6 (6.3%)	4 (4.0%)	52 (52.0%)	8 (8.4%)	8 (8.0%)
purchase of water	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (3.0%)	0 (0.0%)	1 (1.0%)
private HP	− (−)	3 (3.2%)	6 (6.0%)	− (−)	2 (2.1%)	7 (7.0%)
other HP	1 (1.0%)	4 (4.2%)	0 (0.0%)	6 (6.0%)	4 (4.2%)	0 (0.0%)
JICA HP	− (−)	40 (42.1%)	39 (39.0%)	0 (0.0%)	68 (71.6%)	60 (60.0%)
town water	− (−)	− (−)	0 (0.0%)	− (−)	− (−)	2 (2.0%)

In 1999, 52 % used dug well water for drinking but in 2000 and 2001, the rate of drinking dug well water reduced to 10 % and instead, 71.6 % drank JICA HP water and in 2001, the rate increased to 60 %.

In 1999, 73 % answered that they drink rainwater that decreased to 44 % in 2000 and 47 % in 2001. About 40 % answered "JICA HP" in 2000 and 2001 that shows no change. We can say that drinking water of JICA HP is fixed.

Table 5.9 Favorite Drinking Water

	1999	2000	2001
unknown	1 (1.0%)	0 (0.0%)	4 (4.0%)
rainwater	51 (51.5%)	36 (37.9%)	44 (44.0%)
pond	0 (0.0%)	0 (0.0%)	0 (0.0%)
river	2 (2.0%)	1 (1.1%)	0 (0.0%)
lake	0 (0.0%)	0 (0.0%)	0 (0.0%)
dug well	1 (1.0%)	6 (6.3%)	4 (4.0%)
JICA HP	44 (44.4%)	47 (49.5%)	44 (44.0%)
other HP	0 (0.0%)	4 (4.2%)	0 (0.0%)
private HP	− (−)	1 (1.1%)	4 (4.0%)
town water	− (−)	− (−)	0 (0.0%)

The favorite water was from JICA HP (44.4 % in 1999, 49.5 % in 2000 and 44 % in 2001) and rainwater (51.5 % jg in 1999, 37.9 % in 2000 and 44 % in 2001) through out the three years.

Table 5.10 Method of Drinking Water in FHHs and Others

	1999 female headed	1999 others	2000 female headed	2000 others
unknown	0 (0.0%)	1 (1.3%)	0 (0.0%)	0 (0.0%)
drink directly	8 (40.0%)	12 (15.0%)	11 (42.3%)	49 (43.0%)
boil water	12 (60.0%)	67 (83.8%)	14 (53.8%)	64 (56.1%)
filter water	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
leave for a while	0 (0.0%)	0 (0.0%)	1 (3.8%)	1 (0.9%)

2001 before education	2001 before education female headed	2001 before education others	2001 after education female headed	2001 after education others
unknown	1 (3.3%)	3 (2.6%)	0 (0.0%)	3 (2.6%)
drink directly	14 (46.7%)	46 (40.0%)	13 (41.9%)	35 (30.2%)
boil water	13 (43.3%)	60 (52.2%)	17 (54.8%)	74 (63.8%)
filter water	2 (6.7%)	5 (4.3%)	1 (3.2%)	3 (2.6%)
leave for a while	0 (0.0%)	1 (0.9%)	0 (0.0%)	1 (0.9%)

1999: More FHHs drank directly (40 %) than others (15 %).
2000: There was no difference between female-headed households and others.
2001: In comparison to 2000, there was no change among others, 10.5 % fewer FHHs boil water, 4.4 % more of them drank directly. After hygiene education, the result was the same as 2000. But among others, 9.8 % less of them drank directly and 31.6 % more boiled water.

Table 5.11 Main Cooking Water after JICA HP (Rainy season & Dry season)

	2000 Rainy Season	2001 Rainy Season	2000 Dry Season	2001 Dry Season
unknown	0 (0.0%)	4 (4.0%)	2 (2.1%)	6 (6.0%)
rainwater	37 (38.9%)	42 (42.0%)	1 (1.1%)	1 (1.0%)
pond	0 (0.0%)	1 (1.0%)	7 (7.4%)	10 (10.0%)
river	2 (2.1%)	3 (3.0%)	1 (1.1%)	7 (7.0%)
lake	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
dug well	7 (7.4%)	7 (7.0%)	8 (8.4%)	8 (8.0%)
purchase of water	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
private HP	3 (3.2%)	5 (5.0%)	2 (2.1%)	7 (7.0%)
other HP	4 (4.2%)	0 (0.0%)	4 (4.2%)	0 (0.0%)
JICA HP	42 (44.2%)	38 (38.0%)	70 (73.7%)	59 (59.0%)
town water	− (−)	0 (0.0%)	− (−)	2 (2.0%)

In 2000, 73.7 % answered that they use JICA HP for cooking in the dry season, but in 2001, the rate decreased to 59 %.
Both in 2000 and 2001, more than 40 % answered that they use rainwater for cooking in the rainy season. 44.2 % in 2000 and 38 % in 2001 use JICA HP for cooking.

Table 5.12 Main Washing Water Source after JICA HP (Rainy season & Dry season)

	2000 Rainy Season	2001 Rainy Season	2000 Dry Season	2001 Dry Season
unknown	3 (3.2%)	5 (5.0%)	3 (3.2%)	8 (8.0%)
rainwater	30 (31.6%)	40 (40.0%)	0 (0.0%)	1 (1.0%)
pond	1 (1.1%)	0 (0.0%)	4 (4.2%)	2 (2.0%)
river	2 (2.1%)	3 (3.0%)	0 (0.0%)	3 (3.0%)
lake	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
dug well	3 (3.2%)	3 (3.0%)	5 (5.3%)	8 (8.0%)
purchase of water	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
private HP	3 (3.2%)	5 (5.0%)	1 (1.1%)	6 (6.0%)
other HP	3 (3.2%)	0 (0.0%)	4 (4.2%)	0 (0.0%)
JICA HP	50 (52.6%)	44 (44.0%)	78 (82.1%)	71 (71.0%)
town water	− (−)	0 (0.0%)	− (−)	1 (1.0%)

In 2000, about 50 % answered that they use JICA HP for washing in the rainy season, but in 2001, it decreased to 44%. And the rate of use of rainwater increased from 31.6 % in 2000 to 40 % in 2001.
In 2000, about 80 % answered that they use JICA HP for washing in dry season, but in 2001, the rate decreased to 71 %.

Table 5.13 Change Washing Place by JICA HP

	2000 before JICAHP	2000 after JICAHP	2001 after JICAHP
unknown	5 (5.3%)	6 (6.3%)	7 (7.0%)
pond	25 (26.3%)	1 (1.1%)	0 (0.0%)
river	18 (18.9%)	0 (0.0%)	1 (1.0%)
lake	2 (2.1%)	1 (1.1%)	0 (0.0%)
lake/pond	− (−)	− (−)	− (−)
dug well	24 (25.3%)	3 (3.2%)	1 (1.0%)
other hand pump	5 (5.3%)	1 (1.1%)	0 (0.0%)
private hand pump	2 (2.1%)	0 (0.0%)	0 (0.0%)
dug well/ hand pump	− (−)	− (−)	− (−)
JICA HP	− (−)	76 (80.0%)	73 (73.0%)
at home	14 (14.7%)	7 (7.4%)	18 (18.0%)
others	0 (0.0%)	0 (0.0%)	0 (0.0%)

Before installing JICA HP, many people washed at ponds and lakes, but after JICA HP, 80 % washed at JICA HP in 2000 and 73 % in 2001. It can be said that washing at JICA HP has been established.

Table 5.14 Change of Bathing Place by JICA HP

	2000 before JICA HP	2000 after JICA HP	2001 after JICA HP
unknown	5 (5.3%)	4 (4.2%)	7 (7.0%)
pond	24 (25.3%)	2 (2.1%)	0 (0.0%)
river	18 (18.9%)	0 (0.0%)	2 (2.0%)
lake	2 (2.1%)	1 (1.1%)	0 (0.0%)
lake/pond	− (−)	− (−)	− (−)
dug well	26 (27.4%)	3 (3.2%)	3 (3.0%)
other hand pump	4 (4.2%)	4 (4.2%)	0 (0.0%)
private hand pump	2 (2.1%)	0 (0.0%)	0 (0.0%)
dug well/ HP	− (−)	− (−)	− (−)
JICA HP	− (−)	77 (81.1%)	75 (75.0%)
at home	14 (14.7%)	4 (4.2%)	13 (13.0%)
others	0 (0.0%)	0 (0.0%)	0 (0.0%)

The change of bathing place is similar to that of washing place. 81.1 % bathed at JICA HP in 2000 and 75 % in 2001, which implies that JICA HP has been established as a bathing place.

Table 5.15 Change of Frequency of Washing/Bathing by JICA HP

	1999 Frequency of washing	1999 Frequency of bathing	2000 Frequency of washing/bathing	2001 Frequency of washing/bathing
unknown	− (−)	− (−)	6 (6.3%)	6 (6.0%)
0	1 (1.0%)	1 (1.0%)	− (−)	− (−)
1	5 (5.0%)	− (−)	− (−)	− (−)
2	17 (17.0%)	− (−)	− (−)	− (−)
3	31 (31.0%)	− (−)	− (−)	− (−)
4	15 (15.0%)	− (−)	− (−)	− (−)
5	7 (7.0%)	− (−)	− (−)	− (−)
more than 6	24 (24.0%)	− (−)	− (−)	− (−)
less than 5	− (−)	5 (5.0%)	− (−)	− (−)
less than 10	− (−)	8 (8.0%)	− (−)	− (−)
less than 15	− (−)	47 (47.0%)	− (−)	− (−)
less than 19	− (−)	1 (1.0%)	− (−)	− (−)
more than 20	− (−)	38 (38.0%)	− (−)	− (−)
increased	− (−)	− (−)	69 (72.6%)	70 (70.0%)
decreased	− (−)	− (−)	5 (5.3%)	12 (12.0%)
no change	− (−)	− (−)	15 (15.8%)	12 (12.0%)

To the question of whether the frequency of washing and bathing had changed since 1999, 72.6 % (69 points) answered “increased” in 2000 and 70 % (70 points) in 2001.

Table 5.16 Reason for Not Using JICA HP

	2000	2001
unknown	2 (2.1%)	9 (9.0%)
it is far	1 (1.1%)	3 (3.0%)
bad taste	16 (16.8%)	27 (27.0%)
bad water quality	2 (2.1%)	5 (5.0%)
difficult to use	0 (0.0%)	0 (0.0%)
insufficient quantity	4 (4.2%)	0 (0.0%)
it is broken	0 (0.0%)	0 (0.0%)
no need	4 (4.2%)	6 (6.0%)
not applicable	66 (69.5%)	50 (50.0%)

The dominant reason for not using JICA HP is bad taste of water. The rate of “bad taste” was 16.8 % in 2000 and 27 % in 2001.

Table 5.17 More Women Fetch Water after JICA HP

	2000	2001
unknown	2 (2.1%)	4 (4.0%)
yes	45 (47.4%)	56 (56.0%)
no	48 (50.5%)	40 (40.0%)

In 2000, about the half answered that women fetch water more than before installing JICA HP, in 2001, the rate increased slightly to 56 %.

Table 5.18 JICA HP gave more Burdens on Women

	2000	2001
unknown	17 (17.9%)	24 (24.0%)
yes	28 (29.5%)	48 (48.0%)
no	50 (52.6%)	28 (28.0%)

In 2000, 29.5 % answered that JICA HP put a bigger workload on women, and in 2001, the rate increased to 48 %.

Table 5.19 Frequency of Water Fetching at Traditional Water Sources

	1999	2000 dry season	2000 rainy season	2001 dry season	2001 rainy season
unknown	12 (12.0%)	25 (26.3%)	34 (35.8%)	7 (7.0%)	11 (11.0%)
1	17 (17.0%)	9 (9.5%)	35 (36.8%)	8 (8.0%)	30 (30.0%)
2	38 (38.0%)	26 (27.4%)	14 (14.7%)	29 (29.0%)	20 (20.0%)
3	16 (16.0%)	21 (22.1%)	6 (6.3%)	14 (14.0%)	3 (3.0%)
4	5 (5.0%)	6 (6.3%)	0 (0.0%)	10 (10.0%)	1 (1.0%)
5	7 (7.0%)	3 (3.2%)	1 (1.1%)	2 (2.0%)	0 (0.0%)
more than6	5 (5.0%)	2 (2.1%)	1 (1.1%)	1 (1.0%)	0 (0.0%)
0	- (-)	3 (3.2%)	4 (4.2%)	29 (29.0%)	35 (35.0%)

In 2000,in both the dry and rainy seasons, only 3~4 % answered “0 times” for frequency of water fetching at traditional water sources. In 2001, 29 % in the dry season and 35 % in the rainy season did not fetch water at traditional water sources, which means that the place for fetching water has changed.

Table 5.20 Person who Fetched Water before JICA HP

	1999	2000	2001
unknown	0 (0%)	2 (2.0%)	11 (10.8%)
adult male	61 (61%)	47 (47.5%)	45 (44.1%)
adult female	37 (37%)	32 (32.3%)	30 (29.4%)
child male	1 (1%)	6 (6.1%)	9 (8.8%)
child female	1 (1%)	9 (9.1%)	5 (4.9%)
aged male	0 (0%)	2 (2.0%)	1 (1.0%)
aged female	0 (0%)	1 (1.0%)	1 (1.0%)

In 1999, the rate of children male and female was only 2 %, but it increased in 2000 (15.2 %) and in 2001 (13.7 %).

Table 5.21 Person who Fetches Water after JICA HP

	1999	2000	2001
unknown	0 (0.0%)	4 (3.9%)	15 (14.6%)
adult male	53 (53.0%)	38 (36.9%)	29 (28.2%)
adult female	43 (43.0%)	32 (31.1%)	26 (25.2%)
child male	1 (1.0%)	10 (9.7%)	12 (11.7%)
child female	3 (3.0%)	14 (13.6%)	17 (16.5%)
aged male	0 (0.0%)	2 (1.9%)	1 (1.0%)
aged female	0 (0.0%)	3 (2.9%)	3 (2.9%)

In 1999, the rate of adults was extremely large (96 %), but it decreased in 2000 (68.7 %) and 2001 (53.4 %). The rate of children was 4 % in 1999 and it increased by 20~30 % in 2000 and 2001.

Table 5.22 Person who Fetches Water in FHHs and Others

1999	female headed before JICA HP)	others before JICA HP	female headed after JICA HP	others after JICA HP
unknown	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
adult male	10 (50.0%)	51 (63.8%)	9 (45.0%)	44 (55.0%)
adult female	10 (50.0%)	27 (33.8%)	11 (55.0%)	32 (40.0%)
child male	0 (0.0%)	1 (1.3%)	0 (0.0%)	1 (1.3%)
child female	0 (0.0%)	1 (1.3%)	0 (0.0%)	3 (3.8%)
aged male	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
aged female	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
2000	female headed before JICA HP)	others before JICA HP	female headed after JICA HP	others after JICA HP
unknown	1 (5.3%)	1 (1.3%)	3 (15.0%)	1 (1.2%)
adult male	5 (26.3%)	42 (52.5%)	5 (25.0%)	33 (39.8%)
adult female	9 (47.4%)	23 (28.8%)	9 (45.0%)	23 (27.7%)
child male	2 (10.5%)	4 (5.0%)	1 (5.0%)	9 (10.8%)
child female	2 (10.5%)	7 (8.8%)	2 (10.0%)	12 (14.5%)
aged male	0 (0.0%)	2 (2.5%)	0 (0.0%)	2 (2.4%)
aged female	0 (0.0%)	1 (1.3%)	0 (0.0%)	3 (3.6%)
2001	female headed before JICA HP)	others before JICA HP	female headed after JICA HP	others after JICA HP
unknown	3 (15.0%)	8 (9.8%)	4 (20.0%)	11 (13.3%)
adult male	9 (45.0%)	36 (43.9%)	2 (10.0%)	27 (32.5%)
adult female	6 (30.0%)	24 (29.3%)	6 (30.0%)	20 (24.1%)
child male	1 (5.0%)	8 (9.8%)	2 (10.0%)	10 (12.0%)
child female	1 (5.0%)	4 (4.9%)	5 (25.0%)	12 (14.5%)
aged male	0 (0.0%)	1 (1.2%)	0 (0.0%)	1 (1.2%)
aged female	0 (0.0%)	1 (1.2%)	1 (5.0%)	2 (2.4%)

1999 Before installing JICA HP, the percentage of adult males and adult females who fetched water was almost equal among FHHs. Among others, 80 % of those in charge of fetching was male. After JICA HP, the number of adult males who fetched water among FHHs decreased by 5 %. Among others, the percentage of adult males decreased by 55 %.

2000 Among FHHs, more than 40 % of those who fetched water were adult females. There was no big difference after installing JICA HP. Among others, JICA HP helped to decrease the number of adult males who fetched water from 52.5 % to 39.8 %but there was a relative increase in that of children and aged people.

2001 Among FHHs, JICA HP helped to decrease the number of adult male who fetched from 45 % to 10 % and increased that of female children from 5 % to 25 %. Among others, the number of adult males and females decreased by 5~10 %and increased that of children both male and female.

Table 5.23 Understanding of VDC, VWC and WPC in FHHs and Others

	1999 female headed	1999 others	2000 female headed	2000 others	2001 female headed	2001 others
unknown	0 (0.0%)	1 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (2.3%)
VDC	1 (3.7%)	6 (5.7%)	6 (18.8%)	25 (16.1%)	7 (17.5%)	37 (21.1%)
VWC	8 (29.6%)	24 (22.6%)	9 (28.1%)	57 (36.8%)	14 (35.0%)	57 (32.6%)
WPC	6 (22.2%)	32 (30.2%)	8 (25.0%)	58 (37.4%)	17 (42.5%)	67 (38.3%)
no	12 (44.4%)	43 (40.6%)	9 (28.1%)	15 (9.7%)	2 (5.0%)	10 (5.7%)

1999: In comparing the FHHs and others, the participation rate is in reverse.
2000 : 20~30 % of FHHs participate in each committee, 18.8 % in VDC. Among others, 40 % participate in each VWC and WPC, with a particularly low participation rate of 16.1 % in VDC.
2001: In contrast with the past 2 years, there is little difference between FHHs and others.

Table 5.24 Frequency of Diarrhea (babies)

	1999	2000	2001
unknown	0 (0.0%)	0 (0.0%)	3 (3.0%)
0	85 (85.0%)	77 (81.1%)	80 (80.0%)
1	2 (2.0%)	4 (4.2%)	3 (3.0%)
2	0 (0.0%)	5 (5.3%)	3 (3.0%)
3	6 (6.0%)	3 (3.2%)	5 (5.0%)
4	2 (2.0%)	4 (4.2%)	2 (2.0%)
5	2 (2.0%)	1 (1.1%)	1 (1.0%)
more than 6	3 (3.0%)	1 (1.1%)	3 (3.0%)

80 % answered “0 times” for baby's diarrhea throughout the three years. In 1999, 13 % answered “3 to 6 times”, but in 200 and 2001, only 10 % answered “1 to 4 times”. The rate is decreasing.

Table 5.25 Frequency of Diarrhea (children)

	1999	2000	2001
unknown	0 (0.0%)	0 (0.0%)	7 (7.0%)
0	74 (74.0%)	72 (75.8%)	66 (66.0%)
1	9 (9.0%)	6 (6.3%)	4 (4.0%)
2	6 (6.0%)	7 (7.4%)	5 (5.0%)
3	6 (6.0%)	1 (1.1%)	5 (5.0%)
4	1 (1.0%)	2 (2.1%)	3 (3.0%)
5	1 (1.0%)	4 (4.2%)	3 (3.0%)
more than6	3 (3.0%)	3 (3.2%)	7 (7.0%)

Compared with babies, the answer “0 times” among children was 70 % throughout the three years. In 1999, the most dominant answer was “1 to 3 times”, but in 2000 and 2001, frequency is scattered from 1 time to 6 times, appearing to increase.

Table 5.26 Frequency of Diarrhea (adults)

	1999	2000	2001
unknown	0 (0.0%)	0 (0.0%)	5 (5.0%)
0	62 (62.0%)	57 (60.0%)	65 (65.0%)
1	10 (10.0%)	5 (5.3%)	5 (5.0%)
2	5 (5.0%)	10 (10.5%)	9 (9.0%)
3	9 (9.0%)	7 (7.4%)	7 (7.0%)
4	5 (5.0%)	3 (3.2%)	1 (1.0%)
5	2 (2.0%)	6 (6.3%)	3 (3.0%)
more than6	7 (7.0%)	7 (7.4%)	5 (5.0%)

60 % of adults answered “0 times” throughout the three years. 23 % in 1999, 24.2 % in 2000 and 16 % in 2001 got diarrhea 3~6 times, which means that the number of people who got diarrhea several times has decreased.

Table 5.27 Other Diseases

	1999	2000	2001
unknown	42 (41.6%)	12 (12.5%)	22 (21.0%)
cold	8 (7.9%)	9 (9.4%)	7 (6.7%)
headache	1 (1.0%)	2 (2.1%)	1 (1.0%)
fever	28 (27.7%)	27 (28.1%)	32 (30.5%)
typhoid	6 (5.9%)	5 (5.2%)	5 (4.8%)
skin disease	1 (1.0%)	1 (1.0%)	0 (0.0%)
stomachache	− (−)	4 (4.2%)	1 (1.0%)
others	15 (14.9%)	6 (6.3%)	4 (3.8%)
no disease	− (−)	30 (31.3%)	33 (31.4%)

Fever is the most dominant disease apart from diarrhea and 30 % get fevers each year. A remarkable point is that 41.6 % answered “unknown” in 1999 which reduced to 10~20 % in 2000 and 2001, as well as the fact that about 30 % answered "no disease" in 2000 and 2001. This may be because they have been paying more and more attention to their health.

Table 5.28 Frequency of Jar Cleaning in FHHs and Others

	1999 female headed	1999 others	2000 female headed	2000 others
unknown	– –	– –	0 (0.0%)	1 (1.3%)
0	1 (5.0%)	4 (5.0%)	0 (0.0%)	1 (1.3%)
1	2 (10.0%)	5 (6.3%)	0 (0.0%)	8 (10.4%)
2	1 (5.0%)	10 (12.5%)	6 (33.3%)	14 (18.2%)
3	2 (10.0%)	5 (6.3%)	0 (0.0%)	15 (19.5%)
4	4 (20.0%)	26 (32.5%)	1 (5.6%)	8 (10.4%)
5	1 (5.0%)	6 (7.5%)	1 (5.6%)	8 (10.4%)
6	3 (15.0%)	1 (1.3%)	0 (0.0%)	1 (1.3%)
7	0 (0.0%)	0 (0.0%)	1 (5.6%)	4 (5.2%)
8	1 (5.0%)	3 (3.8%)	3 (16.7%)	1 (1.3%)
9	0 (0.0%)	0 (0.0%)	5 (27.8%)	14 (18.2%)
more than 10	5 (25.0%)	20 (25.0%)	1 (5.6%)	2 (2.6%)

2001	2001 before education female headed	2001 before education others	2001 after education female headed	2001 after education others
unknown	0 (0.0%)	5 (6.3%)	0 (0.0%)	4 (5.0%)
0	7 (35.0%)	14 (17.5%)	1 (5.0%)	2 (2.5%)
1	0 (0.0%)	17 (21.3%)	1 (5.0%)	10 (12.5%)
2	4 (20.0%)	9 (11.3%)	5 (25.0%)	14 (17.5%)
3	5 (25.0%)	17 (21.3%)	6 (30.0%)	24 (30.0%)
4	2 (10.0%)	5 (6.3%)	1 (5.0%)	9 (11.3%)
5	0 (0.0%)	3 (3.8%)	3 (15.0%)	6 (7.5%)
6	1 (5.0%)	2 (2.5%)	0 (0.0%)	1 (1.3%)
7	0 (0.0%)	2 (2.5%)	1 (5.0%)	2 (2.5%)
8	0 (0.0%)	0 (0.0%)	1 (5.0%)	1 (1.3%)
9	1 (5.0%)	6 (7.5%)	1 (5.0%)	7 (8.8%)
more than 10	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

1999: More others answered “4 times” and more FHHs answered “6 times”.

2000: 10~20 % more FHHs answered “2 times, 8 times, 9 times” than others.

2001: 35 % of FHHs answered “0 times” before hygiene education but after hygiene education, the rate of “0 times” deceased by 5 %, “5 times” increased by 15 % and “1~3 times, 7~8 times” increased by 5 %.

Table 5.29 Place of Excrement Disposal in FHHs and Others

	2000 female headed	2000 others	2001 female headed	2001 others
unknown	9 (50.0%)	41 (53.2%)	1 (5.0%)	9 (11.3%)
homestead/ near house	2 (11.1%)	3 (3.9%)	1 (5.0%)	6 (7.5%)
farm	7 (38.9%)	23 (29.9%)	13 (65.0%)	39 (48.8%)
burn	0 (0.0%)	1 (1.3%)	0 (0.0%)	0 (0.0%)
communal disposal place	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
bury	0 (0.0%)	5 (6.5%)	0 (0.0%)	0 (0.0%)
collect in the pit	0 (0.0%)	3 (3.9%)	5 (25.0%)	26 (32.5%)
latrine	0 (0.0%)	1 (1.3%)	0 (0.0%)	0 (0.0%)
others	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

2000: 38.9 % of FHHs and 29.9 % of others answered “farm”.
2001: The answer of “farm” increased by 15 % among both female-headed households and others. The answer of “bury” increased from 3.9 % to 32.5 % among others and from 0 to 25 % among FHHs.

Table 5.30 Benefits of JICA HP

	2000	2001
unknown	8 (8.4%)	5 (4.3%)
can get safe water	5 (5.3%)	3 (2.6%)
decrease of illness	8 (8.4%)	15 (13.0%)
easy to use	6 (6.3%)	10 (8.7%)
nearer water source	17 (17.9%)	6 (5.2%)
can use for agriculture	13 (13.7%)	14 (12.2%)
can save money	5 (5.3%)	5 (4.3%)
can save time	6 (6.3%)	18 (15.7%)
no change	25 (26.3%)	39 (33.9%)
others	0 (0.0%)	0 (0.0%)
enough water	2 (2.1%)	0 (0.0%)

In 2000, 6.3 % answered that they can save time thanks to JICA HP and the rate of this answer increased to 15.5 % in 2001. On the other hand, 17 % answered “nearer water source” in 2000, but the rate of this answer decreased to 5.2 % in 2001.

Table 5.31 Benefits of JICA HP for FHHs and Others

	2000 female headed	2000 others	2001 female headed	2001 others
unknown	1 (5.6%)	7 (9.1%)	0 (0.0%)	5 (5.6%)
can get safe water	1 (5.6%)	4 (5.2%)	1 (4.0%)	2 (2.2%)
decrease of illness	2 (11.1%)	6 (7.8%)	4 (16.0%)	11 (12.2%)
easy to use	0 (0.0%)	6 (7.8%)	3 (12.0%)	7 (7.8%)
nearer water source	6 (33.3%)	11 (14.3%)	3 (12.0%)	3 (3.3%)
can use for agriculture	4 (22.2%)	9 (11.7%)	2 (8.0%)	12 (13.3%)
can save money	0 (0.0%)	5 (6.5%)	1 (4.0%)	4 (4.4%)
can save time	0 (0.0%)	6 (7.8%)	5 (20.0%)	13 (14.4%)
no change	4 (22.2%)	21 (27.3%)	6 (24.0%)	33 (36.7%)
others	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
enough water	0 (0.0%)	2 (2.6%)	0 (0.0%)	0 (0.0%)

In 2000, 7 % of others answered “easy to use, can save money, can save time” but no FHHs gave those answers. In contrast, more FHHs answered "nearer water source, can use for agriculture" than others.

In 2001, 36.7 % of others and 24 % of FHHs answered “no change”. Compared with last year, the answers “easy to use”, “can save money”, “can save time” increased this year, especially that of “can save time”, which increased by 20 %.

Table 5.32 Problems of JICA HP

	2000 female headed	2000 others	2001 female headed	2001 others
unknown	1 (5.6%)	7 (9.1%)	0 (0.0%)	5 (5.6%)
can get safe water	1 (5.6%)	4 (5.2%)	1 (4.0%)	2 (2.2%)
decrease of illness	2 (11.1%)	6 (7.8%)	4 (16.0%)	11 (12.2%)
easy to use	0 (0.0%)	6 (7.8%)	3 (12.0%)	7 (7.8%)
nearer water source	6 (33.3%)	11 (14.3%)	3 (12.0%)	3 (3.3%)
can use for agriculture	4 (22.2%)	9 (11.7%)	2 (8.0%)	12 (13.3%)
can save money	0 (0.0%)	5 (6.5%)	1 (4.0%)	4 (4.4%)
can save time	0 (0.0%)	6 (7.8%)	5 (20.0%)	13 (14.4%)
no change	4 (22.2%)	21 (27.3%)	6 (24.0%)	33 (36.7%)
others	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
enough water	0 (0.0%)	2 (2.6%)	0 (0.0%)	0 (0.0%)

The answer “unknown” for problem of JICA HP increased from 78.9 % in 2000 to 95 % in 2001, which means that there are fewer obvious problems.

Table 5.33 Benefits of Project in FHHs and Others

1999	female headed	others
unknown	0 (0.0%)	1 (1.1%)
no benefit	2 (9.5%)	2 (2.3%)
nearer water source	2 (9.5%)	8 (9.2%)
improved water quality	4 (19.0%)	14 (16.1%)
improved water quantity	2 (9.5%)	8 (9.2%)
improved public health	4 (19.0%)	27 (31.0%)
reduced work load	6 (28.6%)	27 (31.0%)
other benefits	1 (4.8%)	0 (0.0%)

2000	female headed	others
unknown	1 (5.6%)	4 (5.2%)
no benefit	1 (5.6%)	0 (0.0%)
nearer water source	2 (11.1%)	10 (13.0%)
improved water quality	5 (27.8%)	14 (18.2%)
improved water quantity	0 (0.0%)	6 (7.8%)
improved public health	0 (0.0%)	13 (16.9%)
reduced work load	5 (27.8%)	15 (19.5%)
other benefits	3 (16.7%)	13 (16.9%)
save money	0 (0.0%)	2 (2.6%)
don't worry about water	1 (5.6%)	0 (0.0%)

2001	female headed	others
unknown	0 (0.0%)	8 (6.6%)
no benefit	0 (0.0%)	0 (0.0%)
nearer water source	9 (27.3%)	20 (16.5%)
improved water quality	4 (12.1%)	22 (18.2%)
improved water quantity	3 (9.1%)	2 (1.7%)
improved personal health	4 (12.1%)	18 (14.9%)
improved public health	0 (0.0%)	0 (0.0%)
reduced work load	0 (0.0%)	2 (1.7%)
other benefits	3 (9.1%)	7 (5.8%)
save money	1 (3.0%)	0 (0.0%)
don't worry about water	0 (0.0%)	1 (0.8%)
easy to use	4 (12.1%)	18 (14.9%)
save time	5 (15.2%)	23 (19.0%)

1999:Compared with others, more FHHs answered no benefits (9.5 %) and other benefits (4.8 %). 31 % of others pointed out improvement in public health.
2000: 27.8 % of FHH pointed out improvements in water quality and another 27.8 % pointed out a reduction in workload.
2001: Compared to others, more FHH (27.3 %) answered that water source became nearer.

Table 5.34 Needs for the Project

	1999	2000	2001
unknown	1 (1.0%)	10 (10.8%)	13 (9.4%)
no needs	13 (12.5%)	14 (15.1%)	5 (3.6%)
more handpumps	58 (55.8%)	36 (38.7%)	50 (36.2%)
better water quality	16 (15.4%)	9 (9.7%)	19 (13.8%)
more water quantity	3 (2.9%)	2 (2.2%)	4 (2.9%)
better platform	8 (7.7%)	3 (3.2%)	3 (2.2%)
repair tool kit	2 (1.9%)	2 (2.2%)	2 (1.4%)
spare parts	1 (1.0%)	2 (2.2%)	0 (0.0%)
bathroom	− (−)	7 (7.5%)	15 (10.9%)
fence around JICA HP	− (−)	4 (4.3%)	5 (3.6%)
Latrines	− (−)	(−)	11 (8.0%)
others	2 (1.9%)	1 (1.1%)	7 (5.1%)
fix the well	− (−)	3 (3.2%)	4 (2.9%)

The dominant answer for needs for the project was “more HP” (55.7 %/58 points in 1999, 38.7 %/36 points in 2000 and 36.2 %/50 points in 2001). The answers of “bathroom” and “latrines” increased.

Table 5.35 Purchase of Water after JICA HP

	1999 before JICA HP	1999 after JICA HP	2000	2001
unknown	0 (0.0%)	0 (0.0%)	5 (5.3%)	5 (5.0%)
yes	15 (15.0%)	2 (2.0%)	5 (5.3%)	6 (6.0%)
no	85 (85.0%)	98 (98.0%)	85 (89.5%)	89 (89.0%)

Before installing JICA HP, 15 % bought water and after JICA HP, the rate of purchasing water decreased (2 %). In 2000 and 2001, the purchasing rate stayed low (5~6 %).

Effectiveness of Hygiene Education

5.2.6 Sanitary Conditions around the JICA Hand Pump

According to the inspection of JICA hand pumps and questionnaire surveys carried out in the 2000 and 2001 Monitoring Surveys by the JICA Study Team and the counterparts together with PDRD staff, the sanitary conditions around JICA hand pumps have been well maintained as a whole.

Questionnaire surveys carried out in the Baseline Survey and the 2000 and 2001 monitoring surveys show that overall evaluation of sanitary conditions around the JICA hand pumps by users has been improving year by year. The users who evaluated sanitary conditions around the JICA hand pumps as “good” accounted for only 65 % in 1999, but it increased to 80 % in 2000 and 90 % in 2001.

However, when the sanitary conditions were asked about in more detail, users who evaluated the sanitary conditions “around the drainage” and “around the platform” as “not good” increased by 25 % and 10 % respectively compared with the figures in 2000.

The Survey Team also confirmed that the biggest problem regarding the environment of JICA hand pumps was the garbage being thrown inside or around the platform or the drainage. Although caretakers seemed to keep the platform and the hand pump vicinity clean, and they were helping users to adopt sanitary practices, there needs to be more cooperation from users by raising their awareness on sanitation through hygiene education.

In some villages, villagers’ unique efforts were observed. For instance, fences were made to keep animals off the platform and some villagers planted flowers around the platform. Another village made a separate bathing place about 5 m away from the platform to keep the platform clean and free from contamination. Since many users wash their clothes or bathe in the platform in most of the villages at present, it is encouraged to clean the inside of the platform after they bathe or wash clothes to keep the hand pump vicinity sanitary and clean.

(1) Overall evaluation of sanitary condition around the JICA hand pump by users

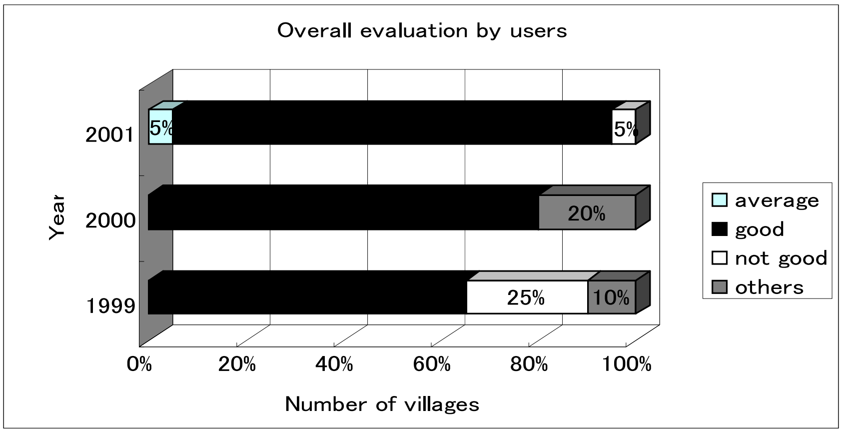


Figure 5.52 Overall evaluation by users

(2) Around the drainage

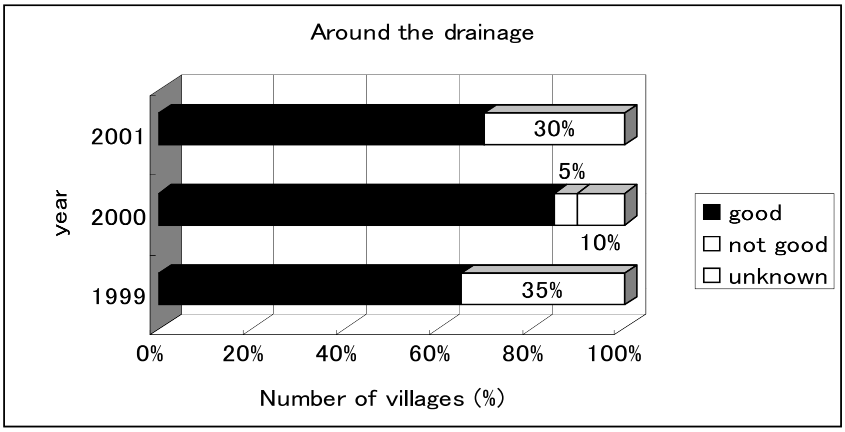


Figure 5.53 Around the drainage

(3) Inside of the platform

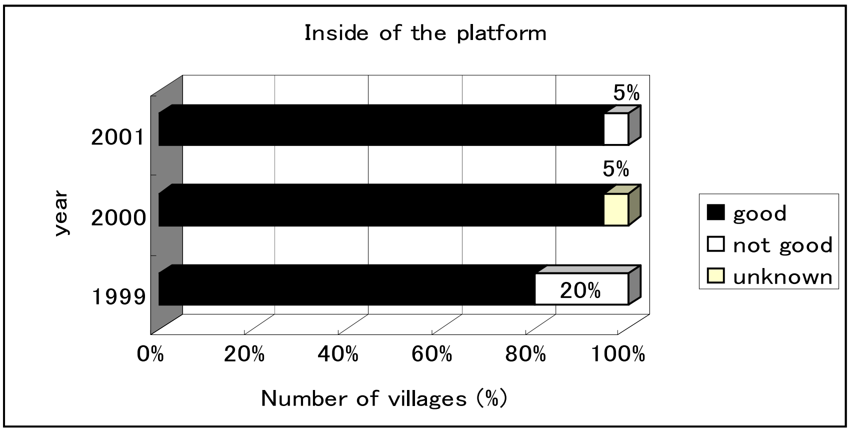


Figure 5.54 Inside of the platform

(4) Around the platform

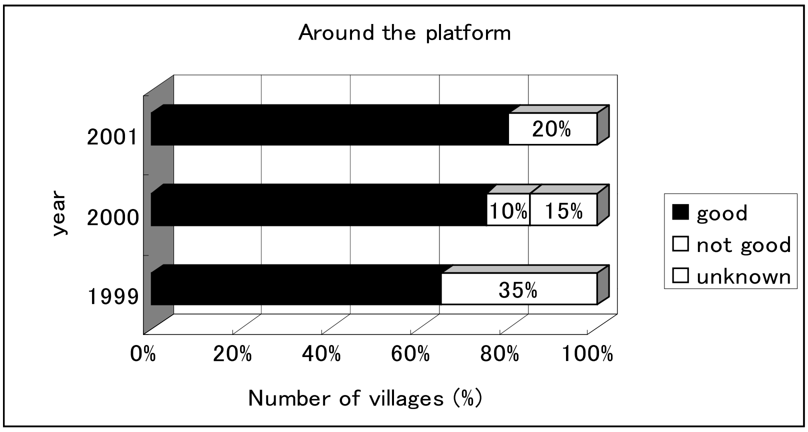


Figure 5.55 Around the platform

(5) Additional observation

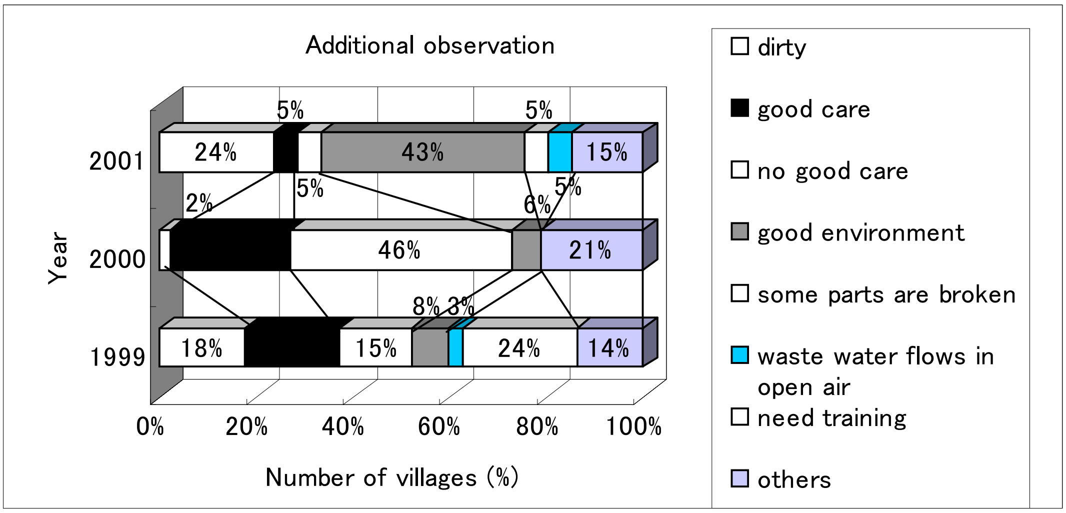


Figure 5.56 Additional observation

Regarding additional observations concerning the users', emphasis was placed on whether or not care was given sufficiently to the hand pump environment in 2000, however, in the 2001 monitoring survey, villagers' attention has shifted to whether or not the hand pump environment was good. It can be said that by 2001 VWC/WPC members had already been assuming their roles so that the hand pump had been taken care of. Therefore, concerns of the villagers were directed more towards the environment itself. 43 % of villagers considered that the hand pump environment to be good while 24 % perceived it to be dirty in the 2001 monitoring survey.

5.2.7 Disposal of Garbage and Excrement

(1) Garbage disposal

Organic waste is traditionally either burnt (27 % in 2000 and 35 % in 2001), disposed of in the farm/field (28 % in 2001), or collected in a pit (26 % in 2001) in the villages as shown in Figure 5.57. Inorganic waste is normally burnt by each household.

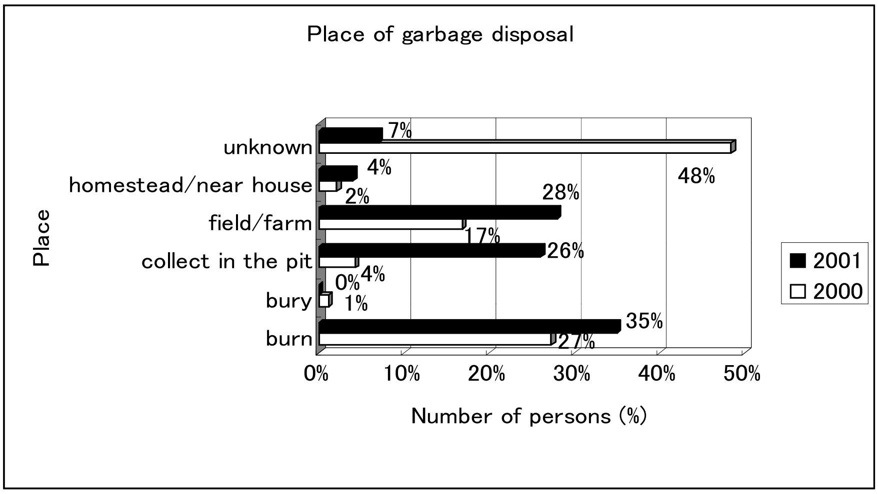


Figure 5.57 Places of garbage disposal

(2) Excrement disposal

In most of the houses in the rural villages, there are no latrines. Villagers commented that they preferred to find places around their houses in the open air that they could use as a toilet. As shown in Figure 5.58, the excrement is collected in a pit or used as fertilizer in the field.

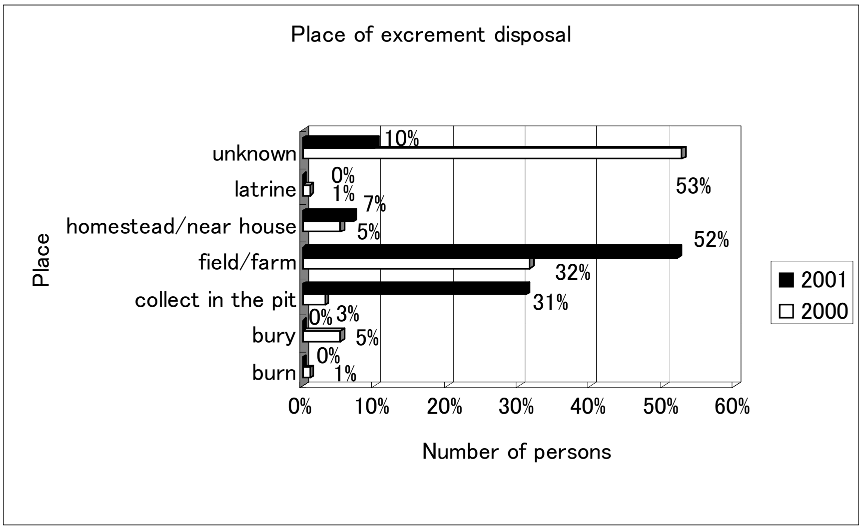


Figure 5.58 Places of excrement disposal

5.2.8 Safe Water Use

Villagers' daily sanitary practice on how to secure safe water was monitored through questionnaire surveys. The following figures, which were confirmed in the 2001 monitoring surveys, show the comparison of villagers' hygiene practice before and after hygiene education provided by JICA/counterpart/PDRD. Hygiene education was provided in the pilot villages in 1999.

(1) Distinction of containers

94% of the sample families replied that they distinguished water containers for drinking and washing hands after they received hygiene education. The number of families who distinguish containers increased by 29 % after hygiene education was provided.

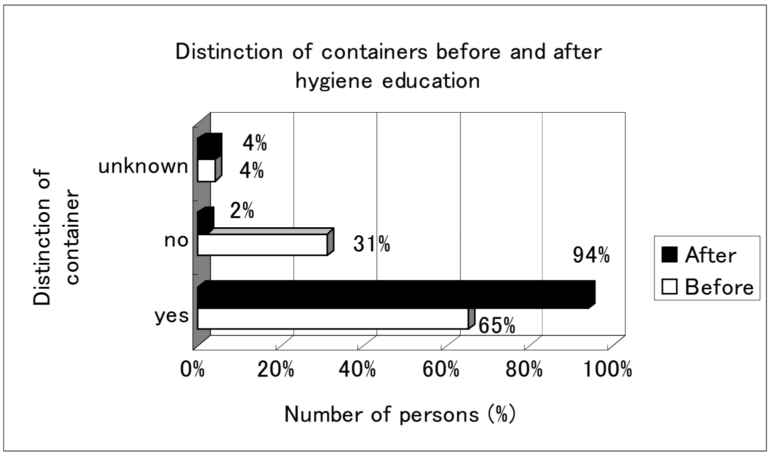


Figure 5.59 Distinction of containers

The frequency of cleaning containers (or jars) has increased as a whole after hygiene education was provided as shown in Figure 5.60.

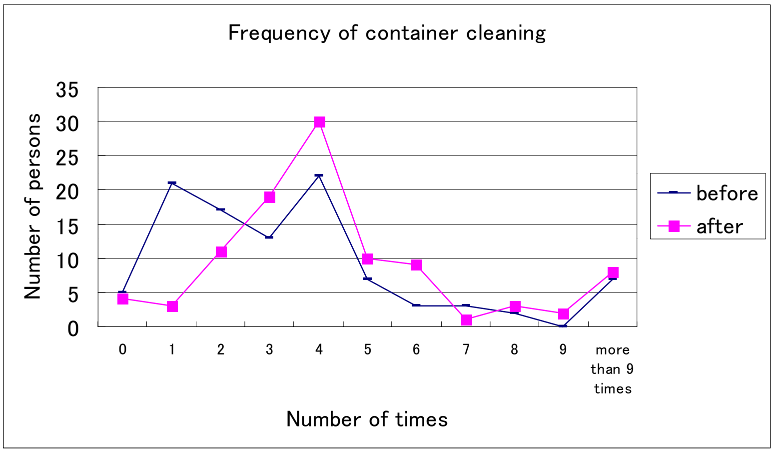


Figure 5.60 Frequency of container cleaning

(2) Method of drinking water

The number of sample families who drink water after they boil increased by 11.6 % (to 61.9 %) in 2001. In addition, the number of people who drink water directly from the vessel has decreased by 8.7 %(to 32.7%)in 2001. It is considered that hygiene education has been effective in adopting hygienic practices.

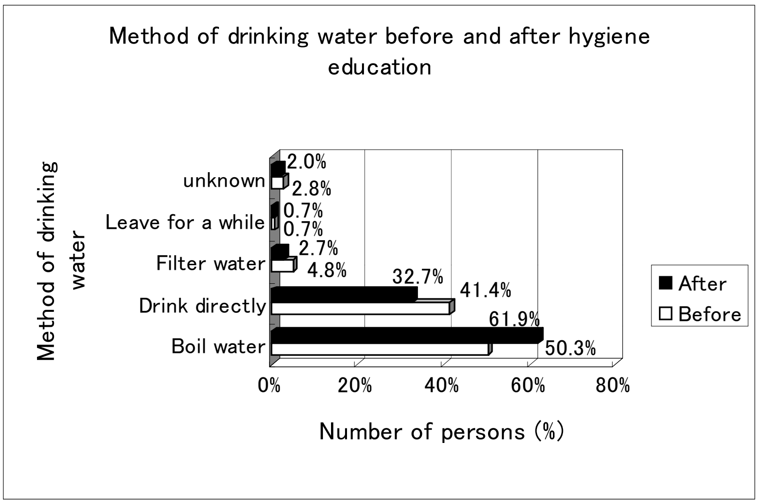


Figure 5.61 Method of drinking water

The reasons why people do not boil water were further asked. It was found that those people believed that it was not necessary to boil it as the water was safe or they were too busy to boil water.

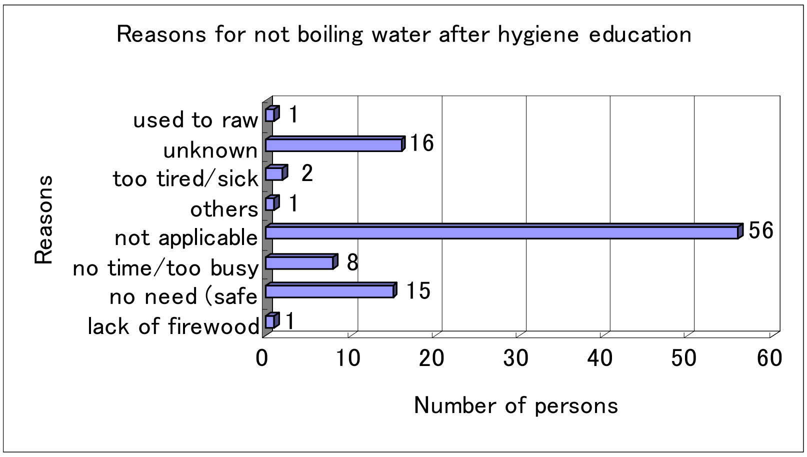


Figure 5.62 Reasons for not boiling water

(3) Use of cover for jar

The number of sample families who use covers for jars increased by 30 % (to 92 %) after hygiene education was provided.

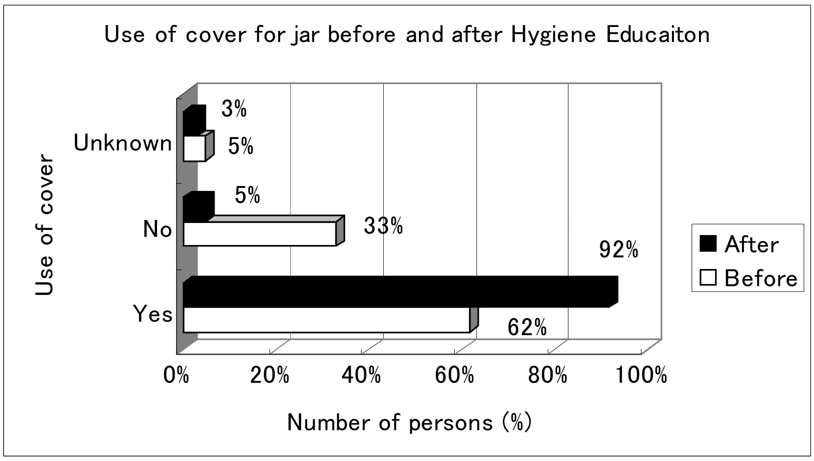


Figure 5.63 Use of cover for jar

(4) Hygiene education provided during the project by JICA

In the 2000 and 2001 Monitoring Surveys, the effectiveness of hygiene education in understanding how to secure safe water was asked. In both years, 96~98 % of sample families replied it was effective as shown in Figure 5.64.

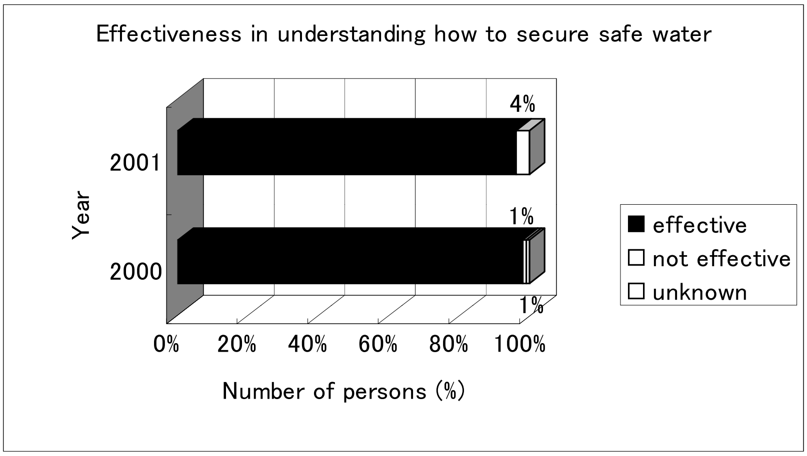


Figure 5.64 Effectiveness in understanding how to secure safe water

Whether or not hygiene education was helpful in improving hygiene conditions was further asked. As shown in Figure 5.65, more than 95 % of the sample families replied that it was helpful.

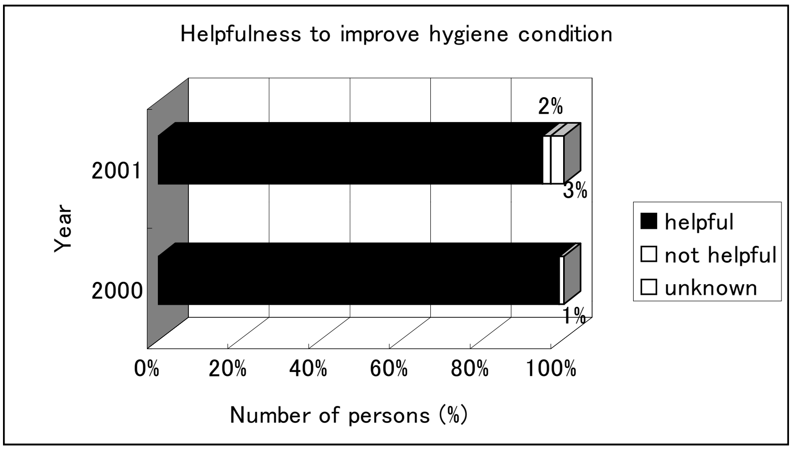


Figure 5.65 Helpfulness to improve hygiene condition

It was also found that 78 % of sample families interviewed still wish to receive hygiene education (see Figure 5.66).

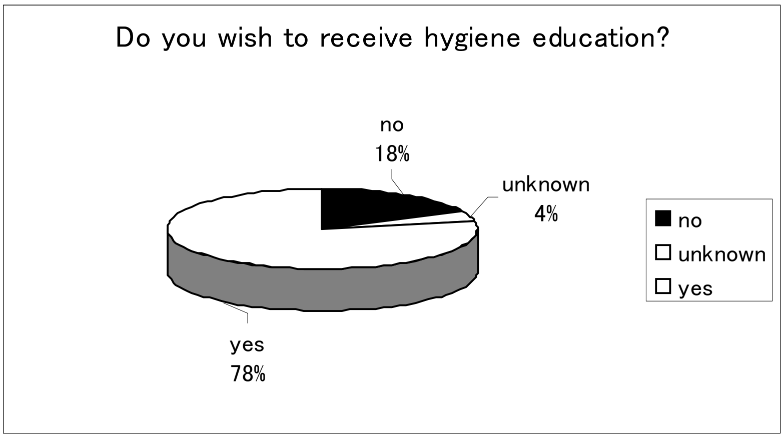


Figure 5.66 Willingness to receive hygiene education

Based on the results of two years of Monitoring Surveys, it can be concluded that hygiene education provided by JICA/counterpart/PDRD was effective and was contributing to the improvement of villagers' hygiene conditions.

It is recommended that hygiene education shall be provided continuously. Visual aids such as educational videos and educational panels which attract the attention of children and illiterates would be effective since there are many illiterates who are responsible for the health of the family and fetching water.

CHAPTER 6

CONCLUSIONS

CHAPTER 6 CONCLUSIONS

The followings are conclusions of the monitoring, which was conducted from June 2000 to December 2001.

(1) Water Utilization

The pilot wells are generally utilized for all purposes. They are utilized frequently for drinking, cooking, washing and so on in the dry season, particularly. However, the existing water sources are also utilized at the same time and the rainwater use increases in the rainy season. Several pilot wells of high chloride concentration are not utilized for drinking purpose. Water fetching is a role of the adult. The male adult is mostly engaged in water fetching. However, water fetching by children increased because of easy accessibility and hand pump operation.

(2) Conditions of Facilities

All the facilities are in good conditions and hand pumps are operative. However, a breakdown and reduction in water quantity due to the falling out and abrasion of U-seals were observed at several hand pumps. Muddy water was observed at one well due to sand accumulation. It is therefore necessary to strengthen the PDRD support system for the repair and maintenance of the hand pumps. There were many cracks at the joint of the drain and the platform. The future design must take this point into consideration. It is necessary to guide the villagers to improve drainage because stagnant water was observed at the edge of the drain in several pilot wells.

(3) Iron Removal Device (IRD)

Both old and improved types of IRDs are effective in reducing iron concentration less than the WHO guideline value. However, out of 7 old type IRDs only 2 sets are being utilized. Out of 11, 7 improved IRDs are being utilized. Most of the villagers prefer the improved IRDs while one village is continuously utilizing the old IRD. Neither type of IRD was used in Ta Keo Province. It is necessary to conduct dissemination activity for the villagers on the effect of IRDs and train them for operation and maintenance.

(4) Groundwater Quality and Levels

Electric conductivity (EC) of the groundwater is high in the western side of the study area (right bank of the Mekong River) and low in the eastern side (left bank of the Mekong River). Iron and manganese exceed WHO guidelines in many pilot wells, particularly in the eastern side. Slight concentrations of arsenic and fluoride are also detected at several wells in the field test. Since the detected values are close to WHO guidelines, it is judged that they might not affect to human health. Arsenic was not detected in the laboratory tests. Seasonal change of groundwater level ranges from 1 to 2 m and no reduction of water quantities was observed.

(5) Arsenic Survey in Existing Wells

The results of the surveys on water quality in 260 villages including the target village for groundwater development, showed arsenic in 20 villages. Of the 20 villages, arsenic concentration were more than 0.05 mg/ℓ in 11 villages. The high arsenic zone is located in the alluvial lowland along the Mekong and Tonle-Bassac Rivers. It is necessary to conduct detailed surveys for the non-target villages and guide the villagers to stop drinking and to utilize IRD.

(6) O&M by Community Participation

The number of the users of the pilot well is 170 in average (34 households). There are several villages in Prey Veng and Svay Rieng where the number decreased drastically due to diffusion of private wells. Hand pump maintenance is generally performed well and the villagers can repair minor damage of the hand pump by themselves. Their willingness to participate in O&M of the community is high. On the other hand, water fees are being collected at only 7 villages out of the 20 monitored villages. The other 13 villages collect money when the hand pump is broken. Collected fees are utilized for repair and maintenance of the platform and IRD.

(7) Project Benefits

The pilot well is effective in making water use more convenient as safe water can be supplied stably throughout the year. It also greatly reduced the time spent on water fetching and contributed to reducing the workload of women. Children can operate the hand pump easily and the volume of water use increased. It is also effective for improvements in health and hygiene conditions. It is an important water source for the people living in the villages neighboring the pilot village as well.

(8) Effect of Hygiene Education

The resident not only utilize the pilot well but also existing water sources, therefore, hygiene education is important. As a result of hygiene education, the residents understood the use of safe water more deeperly than before and the practices of using water jars and boiling of water are performed frequently. Hygiene education must be continued systematically long into the future using visual aids and presentations.

(9) Assisting Capacity of Government

PDRD staff never visited or supported the pilot village individually except the study team’s visit during the monitoring period. PDRD has a water supply section and staff, however, it dose not function due to lack of equipment and fund. The MRD should support PDRD financially, strengthen the manpower and establish the support system in the future.

ANNEX

Annex-1 Standard Operation Procedure for Well Water Sampling

(a) Hand pump well : Remove stagnant water in the tube by lifting water by pump (approx. 5 min.).
Production well : If the pump is stopped, operate it for approx. 5 min to remove stagnant water.
Pond water : Sample water should be taken from the point as far from bank as possible.

(b) While pumping as noted in (a), fill in the required item in the field survey sheet.

(c) Measure As (arsenic) and dissolved iron (Fe^{2+}) using the field kit.

(d) Measure water quality parameters of pH, ORP, EC and the temperature. Read the pH, EC and temperature values after each value has become stable. For ORP, read the value after becoming stable.

In case a sample contains suspended solids, shake it well in order to mix it uniformly before collecting a sample for testing. All sample bottles shall be rinsed at least 3 times beforehand with the sampled water.

(a) Add 0.5 ml of conc. hydrochloric acid (for arsenic analysis grade) to 250 ml of the sample to be used for arsenic testing in order to lower its pH to approximately 1, then store in a cool dark place.

(b) Samples to be used for the following tests should be kept in a cool dark place: Chemical Oxygen Demand (COD), Ammonium ion, Nitrous acid ion, Nitric acid ion, Cyanide, Hardness, TDS, Sulfate ion, Chloride ion, Bicarbonate ion, and fluoride ion.

(c) Concerning samples to be used for testing the following metal elements, the pH should be lowered to about 1 by adding 20 ml of nitric acid to 2.5 l of the sample, and the samples should be stored in a dark cool place: copper, zinc, lead, cadmium, nickel, chrome, mercury, sodium, potassium, calcium, magnesium, etc.

(d) Concerning samples to be used for testing dissolved arsenic, dissolved iron and dissolved manganese, filter at the site immediately after collecting a sample, through a filter paper with a 0.45 μm mesh by applying a vacuum (if filtration is difficult because of water condition, pre-filter using a 5 C filter paper), discard the first 50 ml of filtrate and keep the rest of the filtrate as a sample, then lower the pH to about 1 by adding 2.5 ml of nitric acid to 250 ml of the dissolved iron and dissolved manganese sample. In case of dissolved arsenic, add 0.5 ml of hydrochloric acid instead and all type of samples are stored in a dark cool place.

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
6/13	S-13	505525	1272237	W2	BH	28.8	7.4	642	13	3	0.6	Public		UNICEF	
6/13	S-13	505562	1272200	W1	BH	29.1	7.18	657	-52	10	0.5	Public		UNICEF	
6/13	Sp-7	526624	1254188	W1	BH	29.3	7.43	458	-99	3	0.4	Public		China	
6/18	13	479909	1277103	W2	Pond	29	6.2	17.6	333	0.5	nd	Public	---	---	---
6/18	13	479961	1276676	W3	DW	30.3	5.28	17.9	327	0.3	nd	Public	---	Village	1962
6/18	13	490671	1278990	W1	BH(broken)	no data	no data	no data	no data	no data	no data	Public	76	UNICEF	1988
6/18	445	438684	1258913	W1	BH	29	6.77	144.8	47	1	nd	Public	36	UNICEF	1987
6/18	445	438806	1258710	W2	BH	29.2	6.79	152.9	249	0.05>	0.003	Public	35	UNICEF	1997
6/18	445	438568	1259097	W3	BH	29.1	6.87	119.6	256	0.05>	nd	Public	36	UNICEF	1997
6/18	465			W3	Pond	32.4	9.02	26.8	145	0.05	nd	Public	---	---	---
6/18	465	431804	1258935	W1	DW	29	6.91	93.4	213	0.05	nd	Public	5	Village	1993
6/18	465	431430	1258578	W2	BH	30	7.17	126.7	206	0.05	nd	Public	32	UNICEF	1999
6/18	471			W1	BH(broken)	no data	no data	no data	no data	no data	no data	Public	---	China	1997
6/18	471	413700	1246780	W3	DW	27.9	5.53	54.2	196	1	nd	Public	4	Village	2000
6/18	471	413630	1246630	W2	DW	27.1	5.61	32	151	10	0.005	Dok Sarau	3	Private	2001
6/18	474	433999	1299161	W1	BH	30.3	6.92	104.2	241	0.3	nd	Public	50	GOC	2000
6/18	474	434818	1299160	W2	BH	29.4	6.88	90.6	295	0.01	nd	Public	30	GOC	2000
6/18	474	433114	1298783	W3	BH	30.3	6.81	96.6	223	2.0	nd	Public	32	GOC	2000
6/19	258	506323	1231076	W3	BH	29.2	7.41	63.1	50	0.3	nd	Pheam	38	Pheam	1996
6/19	258	506438	1231246	W1	BH	29.1	7.17	65	-85	10<	0.6	School	34	UNICEF	1999
6/19	258	506438	1231246	W2	BH	28.3	7.88	60.3	205	0.05	nd	School	36	UNICEF	1999
6/19	261	504818	1226122	W2	Rain Water	27.4	7.75	4.9	258	0.05>	nd	---	---	---	---
6/19	261	504818	1226122	W1	BH(broken)	no data	no data	no data	no data	no data	no data	---	---	---	1994
6/19	309	493930	1267776	W2	BH	28.9	7.36	84.2	30	0.3	nd	Teum Khorn	42	Private	1994
6/19	309	494343	1268188	W3	BH	29.2	7.4	93.9	-77	0.3	0.001	Teuk Soksan	41	Private	1995
6/19	309	493683	1267460	W1	BH	28.4	7.38	75	82	0.05	nd	Eum Em	42	UNICEF	1998
6/19	311	476411	1281100	W2	DW	28.5	4.4	22.7	346	0.3	nd	Sen Sear	4.5	Private	1976
6/19	311	476319	1281259	W3	DW	27.8	5.29	59.4	378	0.05	nd	Public	5	Village	1976
6/19	311	476381	1281161	W1	DW	27.5	6.56	57.5	286	0.05	nd	Em Bay	6	Memsdf	1998
6/19	317	476039	1277634	W2	Pond	30.3	5.99	7.5	329	0.05	nd	Public	---	---	---
6/19	317	476215	1276210	W3	Pond	32	8.98	36.3	153	0.05	nd	Public, Tap. Temple	---	---	---
6/19	317	475954	1277609	W1	BH	30	5.71	33.1	237	0.1	nd	Soeung Khocan	23	Private	2000
6/19	327	473600	1282268	W1	Pond	29	6.19	10.4	335	0.3	nd	Public	---	---	---
6/19	327	474780	1281555	W3	Pond	27.7	6.43	16.3	306	2	nd	Public	---	---	---
6/19	327	473599	1282151	W2	BH	29.5	6.61	112	96	0.5	nd	Public	26	Village	1997
6/19	423	460067	1260175	W3	Pond	28.4	7.3	15.3	265	0.05	nd	Public	---	---	---
6/19	423	459869	1260218	W1	BH	30.1	6.99	99.7	162	0.05	nd	Public	28	Prasac	2001
6/19	423	459826	1260074	W2	BH	30.4	6.94	111.8	50	0.3	nd	Public	28	Prasac	2001
6/19	S-12	506583	1226013	W2	BH	28.2	7.52	40.8	232	0.05	nd	Public	---	---	---
6/19	S-12	506175	1225994	W1	BH	28.8	7.01	66.4	-97	10	0.3	Pouch Chaun	25	Private	1999
6/20	153			W2	BH	28.9	4.14	119.4	288	8	0.005	Ok Phy	21	Private	1998
6/20	153	627386	1215876	W3	BH	29.2	5.62	112.8	43	10<	0.01	School	40	S.F	2001
6/20	153	627053	1215802	W1	BH	29.2	4.82	120.4	184	10	0.001	Public	28	S.F	2001

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
6/20	157	623030	1213809	W1	DW	28.5	6.69	21.1	258	0.3	0.005	Public, Yeay	5	UXFAM	1993
6/20	157	623085	1213851	W2	BH	29.5	6.52	21.8	61	2	nd	Public	27	S.F	2000
6/20	157	623003	1213416	W3	BH	29.5	6.26	35.5	39	4	0.005	Kheau Meau	27	Private	2001
6/20	158	620939	1215276	W3	BH	28.4	5.75	12.2	183	0.5	nd	Mom Sokha	45	Private	1996
6/20	158	620526	1215745	W1	BH	29.4	5.66	12.6	185	2	0.005	Public	39	GOC	2000
6/20	158	619979	1214765	W2	BH	28.5	6.2	21.5	166	0.3	0.005	Public, Thun Yen	42	GOC	2000
6/20	161	616610	1218176	W3	DW	28.9	5.21	21.2	261	0.3	nd	Public	33	OXFAM	1993
6/20	161	616128	1217622	W2	DW	30.2	5.92	15.9	328	0.05	nd	Public	39	GOC	1993
6/20	161	616475	1217476	W1	BH	30.1	6.07	19.2	281	0.05	nd	Om Sac	35	Private	1996
6/21	117	589217	1239839	W2	BH	27.6	6.69	28.1	67	3.5	0.005	Duong Kuay	37	Private	1995
6/21	117	589386	1239871	W3	BH	28.1	6.6	28.4	57	2	nd	Nguon Saren	39	Private	2001
6/21	117	589077	1239841	W1	BH	27.9	6.54	30	84	0.3	0.005	Tep Vanna	39	Private	2001
6/21	122	595431	1245966	W1	BH	27.4	6.35	17.5	277	0.05	0.005	Public	96	JICA	1997
6/21	122	595683	1244677	W3	BH	28.5	5.58	8	238	0.1	0.005	Svey Hoeun	33	Private	1997
6/21	122	595549	1246226	W2	BH	28.4	5.62	8.2	212	0.3	nd	Chan Sam	34	Private	2001
6/21	146	590609	1251627	W2	DW	28.1	6.02	20.7	301	0.05	nd	Public	35	Village	1995
6/21	146	590403	1252878	W3	BH	28.5	5.32	6.6	186	0.3	0.005	Meak Chorn	32	Private	1998
6/21	146	590761	1251563	W1	BH	29.4	5.89	15.4	153	10	nd	Public	33	GOC	2001
6/21	150	592998	1257863	W2	DW	28.9	4.74	38	346	0.05	nd	Loek Khon	25	Private	1998
6/21	150	592700	1257531	W1	BH	29.8	5.81	12.2	181	1	nd	Kim Vun	28	Private	1999
6/21	150	593792	1259003	W3	BH	28.4	5.38	5.7	177	4	nd	Loek Yem	24	Private	2001
6/21	174	576168	1219986	W3	BH	28.8	6.32	23.4	168	0.05	nd	Touch Vut	32	Private	1999
6/21	174	576334	1219847	W1	BH	29.1	6.21	22.1	75	0.3	nd	Peam Sameun	35	Private	2001
6/21	174	576712	1219285	W2	BH	28.6	6.31	23.7	54	0.5	0.01	Mau Sam	33	Private	2001
6/21	175	574881	1220589	W2	BH	29.1	6.47	14.3	73	0.05	nd	Has Khorn	25	Private	1999
6/21	175	575176	1220510	W1	BH	29.5	6.44	16.1	71	0.1	nd	Nhes Seau	29	Private	2001
6/21	177	573727	1225184	W3	BH	29.1	6.7	12.9	137	0.05	nd	So Phal	23	Private	1996
6/21	177	573371	1225056	W1	BH	28.7	6.03	14.9	95	1.5	nd	Neung Vorn	30	Private	1998
6/21	177	573374	1224936	W2	BH	28.7	6.44	24	56	1	nd	Yous En	22	Private	1999
6/21	179	574677	1223188	W2	DW	28.7	6.75	38	225	0.05	nd	Meung Vong	35	Private	1995
6/21	179	574771	1223118	W3	BH	29.5	6.42	25.4	6	2.5	nd	Un Seab	45	Private	1999
6/21	179	574673	1223147	W1	BH	29.2	6.47	35.9	192	0.05	nd	Prum Sokum	16	Private	2000
6/22	388	552714	1261147	W2	BH	30	6.73	13.2	128	0.05	nd	Public	36	HEKS	1993
6/22	388	552588	1260076	W1	BH	29.8	6.65	18.4	-11	3	0.001	Pen Van	50	Private	2000
6/22	389	552631	1259734	W1	BH	29.9	6.75	20	68	0.1	nd	Veach Pet	51	Private	1998
6/22	389	552666	1259381	W2	BH	29.4	6.83	21.2	57	0.05	nd	Cheung Nat	48	Private	2000
6/22	390	553775	1260368	W1	BH	29.3	7.03	27.2	-63	3	nd	Cheang Kung	48	Private	1998
6/22	390	553734	1260110	W3	BH	28.9	6.8	17.8	46	0.2	nd	Sum Cheung	45	Private	1999
6/22	390	553774	1260511	W2	BH	29.3	6.79	16.5	5	1	nd	Meala	55	Private	2000
6/22	404	534414	1244100	W1	BH	28.9	6.45	38.1	176	0.05	nd	Public	44	GOC	1997
6/22	404	533659	1244337	W3	BH	30.1	6.58	52.7	119	0.05	nd	Public	53	GOC	1997
6/22	404	534800	1243666	W2	BH	30.4	6.76	45.6	99	0.1	nd	Public	45	GOC	1997
6/22	406	530755	1242291	W4	BH	29.2	6.63	44.1	-60	10<	0.2	Public, Heng Kry	28	UNICEF	1992

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
6/22	407	530436	1241412	W1	BH	28.8	6.94	19.3	70	0.1	nd	Public	43	Village	1995
6/22	407	530536	1241724	W3	BH	28.9	7.44	17.8	-138	2	0.5	Sor Kim	36	Private	1996
6/22	407	530326	1241206	W2	BH	29.1	6.84	68.3	20	0.5	0.005	Chum Sany	53	Private	2000
6/23	362	568610	1288707	W2	BH	28.4	6.75	32.5	205	0.05	nd	Public	16	Village	1960
6/23	362	569152	1288490	W1	DW	28.3	6.95	34.9	185	0.05	nd	Nony Veng	14.5	Private	1994
6/23	362	568846	1288671	W3	BH	28.2	6.43	22.3	224	0.2	nd	Public, Cheum Phem	24	UNICEF	1997
6/23	372	575046	1282259	W2	BH	29.8	5.7	8.9	128	0.5	nd	Yeay Kan	36	Private	1996
6/23	372	574975	1282105	W1	BH	29.5	5.61	8.4	149	3.5	nd	Long Yong	36	Private	1997
6/23	372	574959	1282524	W3	BH	29.4	5.42	7.6	193	0.3	nd	Vey	25	Private	2000
6/23	373	574990	1281607	W3	BH	29	6.1	13.4	42	10<	0.005	Ta Meam	unkown	Private	1999
6/23	373	575052	1281283	W1	BH	28	6.04	11.5	269	0.3	nd	Teng Tak	45	Private	1999
6/23	373	575030	1281224	W2	BH	28.9	5.96	14.1	43	10<	0.003	Rom Pho	41	Private	2000
6/23	376	575830	1279496	W4	DW	29.9	6.02	18	177	0.3	nd	Public	7	Village	1978
6/23	376	575438	1280213	W2	DW	28.9	6.2	15.9	173	0.05	nd	Public	17	Village	1990
6/23	376	575115	1280401	W3	BH	29.1	5.81	10.9	87	10	nd	Phorn Man	28	Private	2001
6/23	376	575330	1280380	W1	BH	27.9	5.83	15.3	100	10	0.005	Sok Khoeum	28	Private	2001
6/23	377	575728	1291288	W3	BH	28.9	6.18	15.4	113	1	0.005	Svy Seam	31	Private	1998
6/23	377	575784	1291374	W2	BH	29.2	6.18	15.4	104	1	nd	Khun	28	Private	1998
6/23	377	575496	1291135	W1	BH	29.1	6.35	16.1	105	1	nd	Public	31	GOC	1999
6/23	379	573815	1290770	W1	BH	29.1	5.34	4.3	102	5	nd	Public	40	UNICEF	1998
6/23	379	573815	1290770	W2	DW	28.1	5.43	16.7	219	0.2	nd	Douk Mau	7	Private	1998
6/23	379	573743	1290753	W3	DW	28.2	5.21	4	246	1	nd	Phan Na	30	Private	1999
6/25	182	476357	1216675	W2	BH	30.2	5.98	448	89	8	0.005	Public	29	UNICEF	1999
6/25	182	476197	1216517	W1	BH	30.1	6.8	446	111	0.05>	nd	Mao Vanntha	28	GOC	2000
6/25	182	476126	1216787	W3	BH	29	5.56	438	233	0.05>	nd	Public	26	GOC	2000
6/25	187	473842	1223715	W3	BH	29.3	7.16	181.3	41	0.1	nd	Ear Tech	41	Private	1997
6/25	187	474528	1223728	W2	DW	28.8	7.02	83.3	167	0.05>	nd	Public	37	CPP	1998
6/25	187	474472	1223736	W1	DW	28.5	7.15	152	229	0.05>	nd	Public	37	CPP	1998
6/25	200	470525	1218217	W3	Pond	30.4	6.45	13.8	149	1	nd	Public	---	---	---
6/25	200	470557	1218196	W1	BH	30.3	6.52	66.3	64	0.1	nd	Public	27	UNICEF	1998
6/25	200	470578	1218145	W2	BH	30.2	7.29	131.2	38	0.05>	nd	Public	30	UNICEF	2001
6/25	213	463394	1214898	W3	BH	30	6.02	11.2	250	0.05	nd	Public	27.5	AICF	1993
6/25	213	463594	1214658	W2	BH	28.7	7.33	67.9	83	0.05>	nd	Public	40	Village	1998
6/25	213	463573	1214491	W1	BH	29.3	7.36	72.2	-49	0.5	nd	Public	40	GOC	2001
6/25	227	477971	1202892	W3	BH	29	6.57	199.9	69	0.1	nd	Public	22	KAFS	1999
6/25	227	477010	1202564	W1	BH	29.1	7.05	199.9	32	0.1	0.002	Public	17	KAFS	2000
6/25	227	477663	1202514	W2	BH	29.5	7.87	174.6	127	0.05	nd	Ean Yan	20	Private	2001
6/25	228	476901	1208208	W2	Pond	27.4	6.65	6.6	219	0.5	nd	Public	---	---	---
6/25	228	476514	1208004	W1	BH	28.7	6.88	199.9	37	0.1	nd	Hen Khorn	26	Private	2000
6/25	231	473739	1201726	W2	DW	27.1	5.84	145.9	254	0.05	nd	Ouk Sary	3	Private	1988
6/25	231	473767	1202229	W1	BH	27	6.78	106	92	0.05	nd	Public	12	KAFS	1996
6/26	19	480552	1284381	W2	Pond	28.8	7.33	207	188	0.3	nd	Temple	4	Pagoda	---
6/26	19	480074	1284233	W1	BH	29.3	7.19	175.3	-7	0.5	nd	Public	31	UNICEF	1988

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
6/26	2	480605	1275099	W1	Pond	27.6	6.55	25.4	247	0.5	nd	Public	5.5	---	---
6/26	2	480828	1275117	W3	Pond	27.8	6.77	25.8	269	0.3	0.005	Public	---	---	---
6/26	2	480581	1275265	W2	Pond	28	6.76	24.8	163	0.5	nd	Public	---	---	---
6/26	21	482352	1285449	W1	DW	29	4.91	119.1	278	0.05	nd	Public	4	HEKS	1993
6/26	21	482357	1285358	W2	DW	27.3	7.15	49.7	148	0.3	nd	Mr. Kuch Rat	5	Private	1993
6/26	28	478690	1281085	W1	BH	30	7.71	226	-65	0.1	nd	Public	80	HEKS	1998
6/26	28	478854	1281070	W2	BH	30.2	7.8	227	-15	0.5	0.005	Public	80	HEKS	1998
6/26	30	478686	1271487	W3	Pond	30.4	6.74	8.3	241	0.1	nd	Public	---	---	---
6/26	30	479295	1271502	W2	Pond	29.4	6.78	7.96	166	0.05	nd	Public	---	---	---
6/26	30	479137	1271624	W1	DW	28.2	6.06	12.2	243	0.3	nd	Public	5.5	Village	1996
6/26	37	486501	1268962	W2	Pond	25.9	6.5	10.05	187	0.5	nd	Public	---	---	---
6/26	37	486575	1268950	W3	Pond	27.2	6.8	13.34	164	0.1	nd	Public	---	---	---
6/26	37	486458	1268933	W1	BH	28.5	6.4	45.2	137	0.05	nd	Public	20	Village	1999
6/26	53	482984	1267343	W2	BH	29.7	6.83	104.6	101	0.05	nd	Public	30	SAWA	1999
6/26	53	483068	1267146	W1	BH	28.4	6.04	19.2	42	1	0.005	Public	25	SAWA	2000
6/26	53	483037	1267037	W3	BH	30	6.64	49.2	-1	1	nd	Public	26	SAWA	2000
6/26	86	486621	1277896	W1	Pond	29.1	7.41	37.9	129	2	nd	Mrs. Tuon Sokha	---	Private	---
6/26	86	486493	1277776	W2	Pond	29.3	8.17	73.2	188	0.1	nd	Public	---	---	---
6/26	86	486322	1277694	W3	Pond	30	8.95	56.7	136	1	nd	Public	---	---	---
6/26	9	478515	1279659	W3	Pond	29.6	6.93	411	122	0.05	nd	Mr. Peuk Pat	5	---	---
6/26	9	478977	1279584	W1	Pond	28.4	6.05	13.4	153	5	nd	Public	3	---	---
6/26	9	478641	1279567	W2	DW	28.7	6.19	22.8	170	0.05	nd	Son Kung	5	Private	1995
6/27	42	484379	1271376	W1	Pond	29	6.86	9.58	236	0.1	nd	Public	---	---	---
6/27	42	483788	1271557	W2	DW	27.7	6.46	12.62	242	0.5	nd	Public	5	Village	1996
6/27	42	483597	1271605	W3	BH	30.3	6.62	50.3	41	0.5	nd	San Saveun	17	Private	2000
6/27	64	488837	1274265	W1	BH	29.8	6.52	58.3	147	0.05	nd	Mr. Phauk Vath	45	Private	1998
6/27	64	488815	1274594	W2	BH	32.1	7.26	86.8	215	0.05	nd	Mr. Uy Morn	82	Private	2001
6/27	64	488815	1273944	W3	DW	29.6	6.54	110.2	86	0.1	nd	Mr. S. Ch. Reum	5.5	Private	2001
6/27	67	488628	1276412	W3	DW	28	7.36	20.5	186	0.05	nd	Temple	13	Pagoda	1996
6/27	67	488119	1276512	W1	BH	30.4	7.26	154.7	229	0.05	nd	Public	50	JICA	1997
6/27	67	488291	1276290	W2	BH	29.3	7	33.2	167	0.05	nd	Pok Vy	30	Private	2000
6/27	70	485578	1283875	W2	Pond	29	7.34	39.2	242	0.05	nd	Public	---	---	---
6/27	70	485801	1283468	W3	Pond	29	7.1	21.3	200	0.1	nd	Public	---	---	---
6/27	70	485799	1283454	W1	BH	29.6	7.3	172	101	0.05	0.005	Public	54	China	1998
6/27	72	486761	1283134	W3	DW	30.4	7.26	62.3	91	0.05	nd	Public	45	DEBIT	1997
6/27	72	486192	1282954	W2	DW	30.9	7.07	61.9	166	0.05	nd	Mrs. Ch. Norum	70	Private	1998
6/27	72	485969	1282773	W1	DW	31.1	7.41	110	154	0.05	nd	Minda	77	Minda	1998
6/27	75	485919	1279326	W2	BH	30	7.43	77.6	90	0.05	nd	Mrs. Kong Channa	65	Private	1995
6/27	75	485995	1279634	W1	BH	30.2	7.34	111.9	-20	0.1	nd	Public	47	REBANA	2000
6/27	75	486795	1279395	W3	BH	30	7.14	146.4	23	0.1	nd	Mr. Ouk Chy	29	Private	2000
6/27	76	485884	1280271	W2	DW	29	7.92	58.2	48	0.05	nd	Mrs. Som Samay	16	Private	1991
6/27	76	486100	1280099	W3	BH	29.5	7.11	108.8	69	0.05	nd	Mr. Han	40	Private	1992
6/27	76	485880	1280208	W1	BH	30.3	7.46	120.9	115	0.05	nd	Mr. Meas Yonary	28	Private	1998

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
6/29	36	482042	1268932	W1	Pond	28.6	6.47	3.46	29	1	nd	Public	2.5	---	---
6/29	36	482243	1269042	W2	DW	29	6.95	256	238	0.05	0.05	Public	9	UNICEF	1963
6/29	36	482231	1269035	W3	BH	29.2	6.74	429	-15	2	nd	Mr. Sar Kiry	25	Private	1998
6/29	38	483476	1269692	W3	Pond	28.9	6.92	9.49	237	0.1	nd	Temple	3	Pagoda	---
6/29	38	484130	1270325	W2	DW	28.6	7.25	464	207	0.05	nd	Mr. Um Muth	6	Private	1940
6/29	38	484200	1270110	W1	DW	28.7	6.53	156.3	243	0.05	nd	Mr. Duch Sorn	15	Private	1995
6/29	40	485639	1270895	W3	BH	27.7	7.07	106.6	-34	5	nd	Public	36	UNICEF	1984
6/29	40	485481	1270855	W1	BH	29.8	7.77	197.2	197	0.5	nd	Mr. Sam Chhun	37	Private	1998
6/29	40	485721	1270942	W2	BH	29	7.54	68.9	-33	0.3	nd	Mr. Rong Sam An	30	Private	2001
6/29	44	484770	1271277	W3	Pond	28.5	6.63	6.87	195	0.05	nd	Public	3	---	---
6/29	44	485188	1271290	W2	DW	29.6	5.76	45.2	136	0.5	nd	Public	15	Village	1962
6/29	44	484960	1271402	W1	DW	29.2	7.11	430	208	0.05	nd	Public	13	Village	1965
6/30	35	482865	1267463	W3	DW	28.8	7.05	241	290	0.05>	nd	Public, Mr. O.S.	6	Village	1991
6/30	35	482673	1267490	W2	DW	28.9	6.8	48.6	116	0.05	nd	Mr. Ngem Soeun	7	Private	1996
6/30	35	482364	1267349	W1	BH	28.4	6.41	113.6	122	0.05	nd	Mr. Suon Sokna	14	Private	1999
6/30	39	485627	1268487	W3	Pond	27.7	7.17	4.83	159	0.05	nd	Public	---	---	---
6/30	39	485282	1268724	W1	BH	29.2	6.1	34.3	64	10	nd	Mr. Sim Yoeun	21	Private	1997
6/30	39	485582	1268701	W2	BH	29.5	8.01	95.5	138	0.3	nd	Public, Mr. K. K.	48	UNICEF	2001
6/30	56	484341	1266581	W3	Pond	30.2	7.05	11.19	259	0.1	nd	Public	---	---	---
6/30	56	484239	1266382	W2	Pond	30.3	6.51	5.16	308	2	nd	Public	---	---	---
6/30	56	484517	1266748	W1	BH	28.4	7.84	116.2	186	0.05>	nd	Public	54	JICA	1997
6/30	57	485140	1266710	W1	Pond	28	7.28	4.87	233	0.1	nd	Public	---	---	---
6/30	S-5	483585	1266344	W2	BH	30	7.53	137.2	-72	1	0.005	Public	31	UNICEF	1994
6/30	S-5	483575	1266522	W3	DW	28.5	6.92	265	103	0.05>	nd	Mr. Som Sopual	9	Private	1996
7/2	41	483575	1271731	W2	DW	29	6.4	32.1	137	0.1	nd	Mr. Chhuob Chhin	4	Private	1960
7/2	41	483583	1271666	W3	BH	30	7	427	41	0.5	nd	Public, Mr. T. P.	29	Village	1999
7/2	41	483598	1271607	W1	BH	30.2	6.52	457	34	2	nd	Mr. Som Savoeun	30	Private	2000
7/2	46	488921	1266927	W2	Pond	28.5	7.48	5.14	242	0.05>	nd	Public	---	---	---
7/2	46	489005	1267184	W3	Pond	29.2	7.01	6.12	260	0.05>	nd	Public	---	---	---
7/2	46	488954	1267065	W1	BH	29.4	6.97	42.1	-6	2	0.05	Public	40	UNICEF	1998
7/2	48	477638	1276746	W2	Pond	29.2	6.75	12.49	239	0.3	nd	Public	2	---	---
7/2	48	477702	1276288	W1	Pond	31.4	7.15	10.36	234	0.1	nd	Public	2.5	---	---
7/2	48	477427	1276709	W3	Pond	29	6.45	6.85	233	0.3	nd	Public	3	---	---
7/2	49	477834	1275106	W2	Pond	29.3	7.52	13.43	142	0.1	nd	Public	3	---	---
7/2	49	477931	1275119	W1	Pond	28	7.02	14.9	239	0.5	nd	Public	8	---	---
7/2	49	477856	1277008	W3	Pond	28.4	6.78	13.41	235	0.05	nd	Akrun.Temple	2	Pagoda	---
7/2	50	476230	1276169	W3	Pond	30.9	8.95	38.2	146	0.05>	nd	Ta Phew Temple	6	Pagoda	---
7/2	50	476815	1276703	W1	Pond	30	6.39	9.48	284	0.5	nd	Public	3	---	---
7/2	50	476652	1276675	W2	DW	28.2	7.3	57.4	214	0.5	nd	Touch Phorn	11	Private	1954
7/2	52	478735	1276421	W3	Pond	29.4	7.41	10.91	208	0.1	nd	Public	3	---	---
7/2	52	478196	1276372	W1	BH	29.9	6.41	206	76	0.05>	nd	Public	33	GOC	2001
7/2	52	478481	1276437	W2	BH	30.3	6.98	366	-40	0.05>	nd	Public	53	GOC	2001
7/2	55	483927	1266073	W2	Pond	30.2	7.51	5.01	260	0.05>	nd	Public	---	---	---

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/2	55	483817	1266240	W1	Pond	30.4	7.04	6.45	301	0.05>	nd	Public	---	---	---
7/2	55	483652	1266280	W3	Pond	30.5	7.81	6.64	271	0.05	nd	Public	---	---	---
7/2	S-8	489353	1268298	W1	BH	28.8	6.94	65.1	22	0.3	nd	Public, Mr. Ing Sorn	27	Village	1990
7/2	S-8	489326	1268478	W1	BH	31.4	7.74	135.3	37	0.1	nd	Mr. Thorn	27	Private	2001
7/3	12	478928	1278033	W3	Pond	28.4	6.77	17.28	240	0.3	nd	Public	5	---	---
7/3	12	479001	1278206	W1	DW	28.2	7.31	651	222	0.05>	nd	Sea Cheun	12	Private	1968
7/3	12	479132	1277649	W2	BH	29.6	7.67	224	202	0.05	nd	School	39	UNICEF	2000
7/3	14	477344	1279746	W3	DW	28.5	6.56	52.1	116	0.3	nd	Mr. Kuor Korm	5	Private	1960
7/3	14	477396	1279801	W2	DW	29	6.75	106	195	0.05>	nd	Mr. Bin Born	5	Private	1989
7/3	14	477444	1279824	W1	DW	28.4	6.82	326	214	0.05>	nd	Mr. Korn Pnat	4	Private	1990
7/3	4	480729	1278335	W1	Pond	28.4	7.15	7.01	210	0.05>	nd	Public	3	---	---
7/3	4	481083	1278449	W2	Pond	28.1	7.4	8.5	170	0.05	nd	Public	3.5	---	---
7/3	4	481152	1278383	W3	Pond	29	6.96	6.9	136	0.05	0.005	Mr. Doek	4	---	---
7/3	47	479319	1276603	W3	Pond	28.9	8	9.9	211	0.05	nd	Public	2	---	---
7/3	47	479719	1276635	W2	Pond	28	6.6	10.7	150	0.05>	0.005	Public	4	---	---
7/3	47	479520	1276694	W1	Pond	28.7	7.01	9.24	176	0.05	nd	Public	1.5	---	---
7/3	5	479295	1277552	W3	Pond	28	6.51	8.79	240	0.1	nd	Public	3.5	Pagoda	---
7/3	5	480892	1277381	W1	Pond	28.2	6.12	11.36	138	2	nd	Public	1.5	---	---
7/3	5	480875	1277722	W2	Pond	28.3	7.23	8.15	194	0.5	nd	Mr. Seum Seng	6	---	---
7/3	51	477568	1277654	W3	Pond	30.2	7.76	6.14	216	0.05>	nd	Public	2	---	---
7/3	51	477524	1278009	W2	Pond	30.1	8.17	7.42	271	0.5	nd	Public, Mr. Kul	2	---	---
7/3	51	477508	1277909	W1	BH	28.7	6.93	443	-41	3	0.005	Mr. Ouch Pual	28	Private	2001
7/3	6	481890	1278021	W3	Pond	27.9	6.77	6.64	242	0.1	nd	Public	5.5	---	---
7/3	6	481982	1278142	W2	DW	28.3	7.58	201	200	0.05>	nd	Mrs Seng Eng	7	Private	1995
7/3	6	481994	1278274	W1	BH	28.7	7.37	314	153	0.05>	0.003	Public	70	Mr. Loy & E.Hart	1997
7/4	10	479445	1279764	W1	Pond	27.1	6.02	6.45	231	0.5	nd	Public	3	---	---
7/4	10	479480	1280641	W2	DW	28.2	6.44	112.6	199	0.05	nd	Mr. Paung Peoh	5	Private	1999
7/4	10	479572	1280983	W3	DW	28.1	6.55	75.3	203	0.3	nd	Mr. Ong Bu Theun	4.5	Private	2001
7/4	11	479343	1279477	W2	Pond	27.4	6.79	6.97	251	0.1	nd	Public	6	---	---
7/4	11	479613	1279030	W1	Pond	28.5	8.64	6.76	143	0.05	0.005	Public	3	Pagoda	---
7/4	11	479483	1280619	W3	DW	27.7	6.58	51.9	220	0.05>	nd	Mrs. Theun Vang	4	Private	1995
7/4	15	477572	1281661	W2	Pond	28.4	8.24	14.2	68	0.05	nd	Mr. Leng Leang	2.2	---	---
7/4	15	477829	1281417	W1	Pond	27.5	7.3	42	112	0.05>	nd	Public	2.5	---	---
7/4	15	476907	1282267	W3	DW	27.6	5.49	155.1	236	0.1	nd	Public	6	Village	1980
7/4	16	479543	1281202	W1	DW	28	7.52	731	201	0.05	0.001	Mrs Song Sokveun	3	Private	1993
7/4	16	479846	1281273	W2	DW	28.7	7.33	658	206	0.05	0.001	Public	6	RVNA	1995
7/4	16	479716	1281562	W3	DW	28.3	6.29	9.77	280	0.05	nd	Public	3	Village	Long ago
7/4	22	479484	1280681	W1	DW	28.6	6.67	171.1	299	0.05>	nd	Public	6	Village	1950
7/4	22	479504	1280815	W3	DW	28	6.72	237	236	0.05>	0.005	Public	3	Village	1996
7/4	22	479600	1280721	W2	DW	29	6.66	204	250	0.05>	0.01	Public	4.5	Village	2000
7/4	23	479722	1280982	W3	Pond	26.8	6.88	9.39	238	0.05	nd	Chuk Va Temple	3	Pagoda	---
7/4	23	480353	1281070	W1	DW	28.1	7.23	183.7	209	0.05	nd	Mr. Nel La	5+10	Private	1995
7/4	23	480166	1281016	W2	DW	27.4	7.22	501	227	0.05	0.005	Mr. Phun Sous	5	Private	1998

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/4	24	478157	1282346	W3	Pond	26.1	6.41	10.25	265	0.1	nd	Temple	3	Pagoda	---
7/4	24	477171	1281600	W2	DW	27.1	6.04	8.57	259	0.3	nd	Mr. Paeaoh	8	Private	1979
7/4	24	477093	1281812	W1	DW	27.2	5.68	6.57	276	0.3	0.001	Public	7	Village	Long ago
7/4	29	479010	1280810	W3	DW	28	6.56	18.98	158	0.3	nd	Public	4.5	Village	1950
7/4	29	478923	1280931	W2	BH	29.7	8.07	141.2	69	0.1	0.005	Public	80	HEKS	1998
7/4	29	478851	1281071	W1	BH	29.5	7.88	201	45	0.5	nd	Public	80	HEKS	1998
7/4	8	479325	1279399	W3	Pond	27.2	6.89	21.4	173	0.05>	nd	Mr. Mol Sok	2	---	---
7/4	8	479344	1279476	W2	Pond	27	6.91	7.27	175	0.05	nd	Public	4.5	---	---
7/4	8	479417	1279280	W1	Pond	25.5	7.33	20.1	171	0.05	nd	Public	2.5	---	---
7/5	18	481450	1282891	W3	Pond	27.9	6.75	6.89	231	0.5	nd	Public	1.5	---	---
7/5	18	480553	1284379	W1	Pond	27.2	6.37	12.22	238	0.5	nd	Kab Srov Temple	4	Pagoda	---
7/5	18	481276	1283225	W2	DW	28.6	6.91	596	227	0.05>	nd	Mr. Ourng Ngoun	9	Private	1998
7/5	20	479654	1283714	W3	Pond	27.8	6.3	7.22	248	0.5	nd	Public	3	---	---
7/5	20	480104	1283833	W2	Pond	28.9	6.27	6.51	261	1	nd	Mr. Chang Saron	3	---	---
7/5	20	479975	1283905	W1	Pond	28.3	6.58	9.61	233	0.5	nd	Public	1.5	---	---
7/5	25	479353	1283273	W2	Pond	30.4	7.03	12.39	219	0.3	nd	Public	2	---	---
7/5	25	479822	1282804	W1	DW	27.9	6.89	197.7	229	0.05	nd	Mr. Leng Lay	9	Private	1994
7/5	25	480196	1281315	W3	DW	28	7.81	500	207	0.05>	nd	Mr. Sam Ly	4	Private	1994
7/5	27	480432	1281277	W3	Pond	29.4	7.26	12.74	215	0.1	nd	Temple	3	Pagoda	---
7/5	27	480207	1281260	W2	DW	27.8	7.24	315	219	0.05>	nd	Mr. Art LA	3.5	Private	2000
7/5	27	480237	1281166	W1	DW	28.2	7.4	385	208	0.05>	nd	Mr. Phorn Am	3	Private	2001
7/5	78	485100	1278726	W3	Pond	30	7.28	20.7	157	0.05	nd	Public	12	---	---
7/5	78	484997	1278922	W2	Pond	29.3	6.6	24.5	164	1	0.01	Public	4	---	---
7/5	78	484669	1278749	W1	Pond	29.5	7.03	35	149	0.1	nd	Public	4	---	---
7/5	79	485664	1279433	W3	DW	29.7	6.69	45	270	0.05	nd	Mr. Chea Sorn	60	Private	1997
7/5	79	485773	1279642	W2	BH	27.8	7.79	119.9	134	0.05	nd	Mr. Pr. K. & P. P.	60	Private	1998
7/5	79	485667	1279881	W1	BH	28.9	7.44	107.1	117	0.05>	nd	Mr. Cheng Sokhorn	60	Private	1999
7/5	82	484077	1279889	W3	DW	29	6.37	86.2	185	0.05	0.005	Mr. Por Heng	8	Private	1990
7/5	82	484001	1279980	W1	DW	28.5	6.77	107.2	127	0.05	nd	Public	8.5	Village	1998
7/5	82	483918	1280060	W2	DW	28.7	6.8	132.4	136	0.05	nd	Public	5.5	Village	1999
7/5	83	485093	1281715	W2	Pond	27.7	7.52	65.8	163	0.5	0.005	Public	1.5	---	---
7/5	83	485044	1281936	W3	Pond	28	7.13	12.24	196	0.05	nd	Public	1.5	---	---
7/5	83	485068	1281735	W1	BH	29.2	7.46	94.4	182	1	nd	Public	30	UNICEF	2001
7/6	26	480532	1283485	W1	DW	28.3	7.07	18.63	151	1	0.005	Public, Kong Hoeun	12	Village	1992
7/6	26	480653	1283578	W3	DW	28.2	5.98	73.4	192	0.05	nd	Public	6.5	Village	1993
7/6	26	480654	1283539	W2	DW	28.4	5.88	14.85	207	0.3	0.005	Public	6	Village	1994
7/6	71	484440	1283388	W2	Pond	28.1	6.78	12.94	211	0.5	nd	Mr. Sou Vart	2	---	---
7/6	71	484402	1283304	W1	Pond	29.4	6.69	5.97	241	2.5	nd	Mr. Phem Khen	1.5	---	---
7/6	71	484551	1283545	W3	BH	30	7.22	460	191	0.05>	nd	Public	60	JICA	1997
7/6	80	486533	1281724	W1	Pond	27.5	7.07	14.63	194	0.3	nd	Public	1	---	---
7/6	80	486306	1281220	W3	BH	28.5	7.15	81.2	39	0.1	nd	Mr. Tay Sreng	60	Private	1993
7/6	80	486607	1281364	W2	BH	30	7.36	127.2	62	0.05	nd	Public	46	PADEK	1999
7/6	97	485836	1288164	W2	River	28.5	7.64	12.48	117	0.05>	nd	Public	---	---	---

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/6	97	485466	1288242	W1	BH	29.2	7.49	166.2	-44	0.1	0.3	Public	21	PHA	1996
7/6	97	485371	1288355	W3	BH	29.8	7.35	136.6	-104	3.5	0.3	Public	26	Village	1997
7/6	S-1	480531	1284381	W1	Pond	28.5	6.68	17.2	117	0.5	nd	Temple	3	Pagoda	---
7/6	S-1	480072	1284238	W2	BH	30.1	7.15	159.8	33	0.3	nd	Public	31	UNICEF	1988
7/6	S-1	480264	1284350	W3	BH	31	7.33	138.9	57	0.05	0.005	Public	31	UNICEF	1988
7/6	S-4	484735	1280431	W3	Pond	29.3	7.89	16.02	211	0.05	nd	S. Andet, Temple	4.5	Pagoda	---
7/6	S-4	483759	1280349	W1	DW	27.8	6.78	27.5	240	0.5	nd	Mr. Ny Sok	10	Private	1995
7/6	S-4	483833	1280292	W2	Cmbn well	28.8	6.91	288	205	0.05	nd	Mr. Cheavbuna	6+5	Private	1997
7/7	S-2	484851	1277768	W1	BH	29.4	7.35	112.8	182	0.05>	0.005	Chhem Thom	80	Private	1999
7/8	S-2	484679	1277956	W2	Cmbn well	27.8	5.95	139.5	253	0.05>	nd	Sam Son	10+20	Private	1990
7/8	S-2	484687	1277798	W3	BH	29.6	6.98	109.3	228	0.05>	nd	Prak Sokkhorn	40	Private	1996
7/9	259	506284	1230666	W3	BH	29.2	7.46	61	-11	0.3	nd	Public	38	Village	1999
7/9	259	506223	1230508	W2	BH	28.7	7.39	62.1	-7	0.05	nd	Public	40	Village	1999
7/9	259	506257	1230463	W1	BH	28.8	7.48	641	-40	0.3	0.005	Public	38	Village	2001
7/9	288	495290	1311689	W1	BH	28.9	7.26	271	171	0.05>	nd	Public	49	JICA	1997
7/9	288	495428	1311286	W3	DW	29.4	6.9	94.9	194	0.05>	nd	Public	7.2	Chebche	1997
7/9	288	495322	1311946	W2	BH	29.5	7.34	278	135	0.05>	nd	Public	40	China	1999
7/9	289	495531	1310127	W2	Canal	27.9	7.41	11.29	216	0.1	0.01	Public	---	Village	---
7/9	289	495388	1310251	W1	Pond	31	7.03	14.06	189	0.1	0.01	Chreuk Tol	5	---	---
7/9	289	495301	1309867	W3	Cmbn well	28.4	7.14	99.6	197	0.05>	nd	Public	10+30	CIDSE	1996
7/9	290	494857	1307209	W3	DW	27.9	7.14	215	188	0.05>	nd	Public	7+5	CIDSE	1996
7/9	290	494968	1307571	W2	DW	28.9	7.27	111.7	47	0.05	0.02	Public	10+20	CIDSE	1996
7/9	290	495253	1309490	W1	DW	28.2	6.9	150	197	0.05>	nd	Public	10+29	CIDSE	1996
7/9	Sp-3	503350	1240740	W1	BH	29.8	7.37	101.4	-80	0.5	nd	Mr. Vanna	40	Private	2000
7/9	Sp-4	503332	1240793	W1	BH	29.8	7.3	230	-64	0.5	nd	Mr. Tong Leng	36	Private	2001
7/9	Sp-5	502662	1242741	W1	BH	29.3	7.2	65.8	-71	2	nd	Mr. Meas Sem	27	Private	1998
7/10	315	475895	1278565	W1	Pond	31.4	6.89	12.81	236	0.5	nd	Public	3	---	---
7/10	315	475497	1278545	W2	Pond	35.2	7.68	16.92	189	0.5	nd	Public	1.5	---	---
7/10	315	475621	1279110	W3	BH	31.1	7.32	250	-75	1	nd	Public	45	Social fund	1997
7/10	316	475895	1277754	W2	BH	28.8	5.81	37.8	120	0.5	0.001	Public	9	Mr. Darel	2000
7/10	316	475944	1277616	W3	BH	30.2	5.94	52	75	2.5	0.001	Rath Cheun	25.5	Private	2000
7/10	316	475838	1277773	W1	DW	29.3	6.39	187.4	188	0.05>	nd	Public	9	Village	Long ago
7/10	318	476319	1278198	W3	Pond	29.5	6.02	10.75	277	0.7	nd	Public	2.5	---	---
7/10	318	476122	1278037	W1	BH	28.6	5.94	134.8	147	0.3	nd	Public	24	Private	2000
7/10	318	476107	1278061	W2	BH	30.1	6.69	146	33	0.5	nd	Public	29	Village	2000
7/10	319	476543	1279133	W1	Pond	32.3	6.6	8.3	159	0.5	nd	Public	---	---	---
7/10	320	476122	1279008	W3	Pond	31.3	7.14	11.54	153	0.5	nd	Public	2.5	---	---
7/10	320	476465	1279348	W2	Pond	28.2	6.44	14.87	63	0.5	nd	Public	2	---	---
7/10	320	476575	1279386	W1	Pond	29.2	6.83	15.95	207	0.1	nd	Public	3	---	---
7/10	324	473665	1278598	W2	DW	28.5	6.18	6.64	219	0.1	nd	Public	8	Wellger	1994
7/10	324	473875	1278693	W1	DW	28.9	7.68	186.8	127	0.05>	nd	Public	12	JRS	1994
7/10	324	474636	1278254	W3	BH	28.9	6.68	9.36	113	0.3	nd	Public	2.5	Pagoda	Long ago
7/10	325	474810	1278414	W2	Pond	30.2	6.92	9.62	174	0.3	nd	Public	2.5	---	---

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/10	325	474763	1278423	W1	BH	29.6	7.5	110	45	0.05	nd	Public	36	UNICEF	1986
7/10	325	474636	1278254	W3	DW	28.9	6.68	9.36	113	0.3	nd	Public	5.5	Village	1996
7/10	S-9	479107	1277644	W2	BH	30.5	7.64	173.5	10	0.1	nd	Public	50	UNICEF	1988
7/10	S-9	479132	1277651	W1	BH	31.2	7.5	209	165	0.05>	nd	Public	39	UNICEF	2000
7/11	310	476302	1281711	W3	Pond	31.3	6.89	14.22	145	0.1	nd	Public	3	---	---
7/11	310	476654	1281746	W2	DW	29.6	7.48	639	150	0.05>	0.005	Public	4.5	Personal sponsore	2001
7/11	310	476454	1281534	W1	DW	29	7.22	180.2	148	0.05>	nd	Mr. Sun Soeun	7	Private	2001
7/11	313	475614	1279264	W3	Pond	30.7	6.69	10.07	289	0.5	nd	Public	3	---	---
7/11	313	475605	1279591	W1	BH	29.9	8.54	87.6	112	0.05>	nd	Public	34	UNICEF	1986
7/11	313	475786	1279688	W2	DW	28.8	7.36	63.6	238	0.05>	nd	Public	6	Village	2000
7/11	321	474446	1279601	W2	Pond	30.5	7.14	9.24	206	0.1	nd	Public	2	---	---
7/11	321	474634	1279172	W3	Pond	30.1	6.81	14.27	249	0.7	nd	Public	2.5	---	---
7/11	321	474523	1279351	W1	BH	29.8	7.44	108.4	160	0.05>	nd	Public	30	UNICEF	1986
7/11	322	474625	1280424	W3	Pond	36.9	8.34	16.98	129	1	nd	Public	2	---	---
7/11	322	475236	1281025	W1	Pond	34.6	6.73	6.82	212	0.5	nd	Pnead Temple	5	Pagoda	---
7/11	322	474555	1280474	W2	BH	32.5	8.28	125.3	139	0.05>	nd	Public	34	JICA	1997
7/11	328	473328	1281641	W2	DW	29.5	7.73	162.8	107	0.05>	nd	Public	7	CRF	1996
7/11	328	473346	1281587	W1	BH	30	7.44	131.6	98	0.05>	nd	Public	36	ACAPE	1997
7/11	328	472788	1281681	W3	BH	30.5	7.44	118.4	164	0.05>	nd	Public	34	UNICEF	1997
7/11	329	472447	1282039	W3	Pond	31.5	6.74	6.72	190	0.3	nd	Public	2.5	---	---
7/11	329	472639	1281638	W2	BH	30.4	7.5	113.7	16	0.05	nd	Public	26	SEDIF+ACAPE	1997
7/11	329	472527	1281691	W1	BH	30.6	7.52	120.2	172	0.05>	nd	Public	26	UNICEF	1997
7/12	277	492876	1266325	W3	BH	29.5	7.09	59.2	4	0.1	nd	Yong Norn	30	Private	1991
7/12	277	492656	1266351	W1	BH	30.5	6.99	100.5	-16	0.3	nd	Mean Thol	27	Private	1998
7/12	277	492742	1266314	W2	BH	33.5	7.23	75.4	-93	3	0.005	KHY Kheang	31	Private	2001
7/12	280	476774	1300448	W1	BH	30.6	6.31	22.4	-7	10<	nd	Public	29	UNICEF	1987
7/12	280	476826	1300291	W2	BH	30.9	7.13	89	119	0.05>	nd	Public	26	MRD	1995
7/12	280	476802	1300593	W3	BH	30.6	7.42	54.2	166	0.05>	nd	Public	28	ACAPE	1999
7/12	281	475393	1303907	W3	BH	29.9	6.45	100.3	114	0.05>	nd	Public	35	MRD	1995
7/12	281	476061	1303153	W1	BH	30.3	7.14	75.7	232	0.05	nd	Public	35	S.F	2000
7/12	281	475804	1303129	W2	BH	30.3	7	55.6	54	0.05	nd	Public	25	S.F	2001
7/12	282	475737	1296095	W3	BH	30	7.49	145.9	12	0.1	nd	Public	34	UNICEF	1988
7/12	282	476317	1296124	W1	BH	31	7.12	88.1	102	0.05	nd	Public	24	King Sihnu team	1997
7/12	282	476044	1296094	W2	BH	30.1	7.18	83.3	-12	0.1	nd	Public	20	China	1998
7/12	286	476183	1291034	W3	BH	29.3	7.42	294	-103	2	nd	Public	34	UNICEF	1987
7/12	286	476098	1290626	W1	BH	30.3	7.45	176.2	-92	1	nd	Public	34	UNICEF	1991
7/12	286	476015	1290637	W2	BH	30.1	7.42	178.1	-18	0.1	nd	School	20	MRD	2000
7/12	312	476315	1280733	W2	Pond	29.7	7.44	12.7	198	0.05>	nd	Public	1.5	---	---
7/12	312	476698	1280738	W1	Pond	29.3	7.15	21.4	203	0.05>	nd	Public	3	---	---
7/12	326	475946	1281598	W2	DW	28.2	6.43	8.73	139	0.5	nd	Public	4.5	Village	1972
7/12	326	474741	1281556	W3	DW	28.3	5.54	12.63	162	0.05	nd	Public	4	Village	1972
7/12	326	474730	1281795	W1	DW	29.9	7.62	493	114	0.05>	nd	Mr. Sem Ream	9	Private	2001
7/12	Sp-6	475598	1279136	W1	BH	31	7.39	221	19	0.1	0.01	Public	45	GOC	1997

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/13	442	437649	1262838	W3	BH	30.5	6.82	238	93	0.05	nd	Public	28	UNICEF	1988
7/13	442	437738	1262805	W2	BH	30.3	6.76	567	120	0.05	nd	Public	18	Social fund	2000
7/13	442	437666	1262703	W1	BH	30.6	6.92	257	116	0.05>	nd	Public	18	Social fund	2000
7/13	443	438893	1261690	W1	BH	30.1	6.84	582	21	0.5	nd	Public	25.6	UNICEF	1988
7/13	443	438882	1262031	W3	BH	30	6.91	203	96	0.05	nd	Public	39	S.F	2000
7/13	443	438872	1261787	W2	DW	28.5	7.04	90	162	0.05>	nd	Meas Vnthy	3.5	Private	2001
7/13	444	437766	1265069	W1	Pond	29	7.33	16.17	170	0.05	nd	Public	---	---	---
7/13	446	435187	1259645	W2	DW	27.8	7.21	130.1	189	0.05>	nd	Public	6	Village	1940
7/13	446	435259	1259716	W1	DW	29.9	7.23	85.1	217	0.1	nd	Public	6.5	Village	1995
7/13	446	435025	1259664	W3	DW	29.5	7.96	141.7	134	0.05	nd	Public	5	Village	1995
7/13	451	431020	1258925	W1	DW	27.2	7.1	94.2	203	0.05	nd	Chea Ky	6	Private	1962
7/13	451	431165	1258876	W2	BH	30.1	7	167.4	15	0.1	nd	Public	30	UNICEF	1986
7/13	451	431285	1258818	W3	DW	27.6	7.8	129.4	163	0.05>	nd	Lov Rimly	5	Private	1995
7/13	466	433690	1263342	W3	DW	32.5	7.97	63.5	105	0.05	nd	Public	3	Village	1960
7/13	466	433761	1263752	W2	DW	29.5	7.01	194.1	145	0.05>	nd	Public	8	Village	1999
7/13	466	433712	1263681	W1	DW	28.8	7.25	151.4	134	0.05>	nd	Public	7	Village	1999
7/13	S-10	436748	1263809	W2	Pond	34.3	8.61	22.9	124	0.05	nd	Public	4	---	---
7/13	S-10	436661	1263751	W1	BH	30.3	6.99	155	186	0.05>	nd	Public	18	PAFD	1996
7/13	S-11	435187	1259645	W2	DW	27.8	7.21	130.1	189	0.05>	nd	Public	6	Village	1940
7/13	S-11	435025	1259664	W3	DW	29.5	7.96	141.7	134	0.05	nd	Public	5	Village	1995
7/13	S-11	435259	1259716	W1	DW	29.9	7.23	85.1	217	0.1	nd	Public	6.5	Village	1995
7/14	262	505913	1225585	W3	BH	29.3	7.14	60.1	-140	3	0.3	Public	28	UNICEF	1996
7/14	262	505960	1225509	W2	BH	29.7	7.2	72.7	-117	3	0.5	Public	15	Village	1999
7/14	262	505951	1225472	W1	BH	31.4	7.24	72	-99	3	0.3	Public	18	Village	2000
7/14	262	506081	1225674	W4	BH	29.7	7.1	51.4	-135	10<	0.4	Mr. Peung	15	Private	2001
7/14	Sp-1	506460	1231765	W1	BH	30	7.86	91.6	-64	0.05	0.005	Public	39	UNICEF	1988
7/16	383	554766	1269764	W3	BH	29	6.2	21.9	14	5	nd	Public	49	Mr. Yorn+Singa	1997
7/16	383	554717	1269405	W2	BH	29.3	6.22	21.6	-7	5	nd	Public	48	Mr. Yorn&Singa	1997
7/16	383	554781	1269503	W1	BH	29.6	6.21	21.1	3	3	nd	Keat San	48	Private	2000
7/16	406	530990	1242682	W3	BH	29	7.43	28.2	-42	0.5	nd	Public	30	Village	1994
7/16	406	530832	1242536	W2	BH	29.2	7.48	34.4	-92	0.1	0.01	Public	45	Village	1996
7/16	406	530830	1242442	W1	BH	29.4	7.27	50.1	-28	0.05	nd	Public	144	JICA	1997
7/16	408	531106	1243484	W2	BH	29.5	7.15	31.8	31	0.05>	nd	Public	34	UNICEF	1993
7/16	408	531086	1243708	W3	BH	29.4	7.27	50.1	-28	0.05	nd	Public	42	Village	1996
7/16	408	531082	1243629	W1	BH	31.2	7.32	46.3	-107	2	0.005	Public	46	ADB	1999
7/16	409	548970	1230802	W2	Pond	30.3	7.17	9.06	159	0.05>	nd	Public	4	Pagoda	---
7/16	409	548905	1230868	W1	BH	31	7.03	118.4	177	0.05>	nd	Public	45	MRD	1995
7/16	409	548969	1231533	W3	BH	31.8	7.06	130.9	-60	1	nd	Public	42.5	SFC	1997
7/16	Sp-2	534807	1243389	W1	BH	29.9	7.38	93.5	-119	4	0.005	Em Sokhim	25	Private	2000
7/17	361	565809	1286368	W2	BH	31	6.79	46.3	-60	2	nd	Put Peng	25	Private	1999
7/17	361	576406	1282611	W3	BH	30.2	6.68	37.5	-55	2.50	nd	Om On	24	Private	2000
7/17	361	565809	1286368	W1	DW	29.9	6.94	97.7	235	0.05>	nd	Temple	4.5	Monks	2000
7/17	363	565806	1286380	W3	DW	28.5	7.29	115.1	190	0.05>	nd	Public	7	Village	1960

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/17	363	565423	1287029	W1	BH	29.7	7.28	65.3	-118	2	0.04	Nul Yeoun	26	Private	1999
7/17	363	565576	1286760	W2	BH	31.2	7.17	72.9	-111	2	0.001	Public	30	Village	1999
7/17	374	576386	1284553	W2	DW	29.1	5.08	3.99	279	1	nd	Public, Thoeun	6.5	Village	1998
7/17	374	575941	1284490	W1	BH	29.4	4.92	3.45	223	0.5	nd	Em RA	21	Private	2001
7/17	374	575836	1284445	W3	BH	30.1	5.57	7.57	51	2	nd	Public, Mr. Nov	18	Village	2001
7/17	375	575481	1279206	W1	DW	28.6	6.71	98.2	96	0.05>	nd	Public	5	Village	1960
7/17	375	575236	1279238	W2	DW	29.6	6.22	21.6	196	0.05>	nd	Public	7	Village	1960
7/17	375	575186	1279245	W3	BH	30.2	6.18	19.9	-24	10<	0.01	Uch Nay	18	Private	2001
7/18	350	551818	1299888	W3	BH	29.3	6.93	78.1	150	0.5	nd	Public	7	Village	1983
7/18	350	551605	1299428	W2	BH	29.7	6.71	64	-21	0.5	nd	Phan Yem	28	Private	1997
7/18	350	551520	1299036	W1	BH	31	6.67	57.2	-59	2.5	nd	UPP, Rum	39	Private	1999
7/18	356	554844	1289988	W2	BH	29.6	5.48	5.55	187	0.05	nd	Len Nak	19	Private	1997
7/18	356	554379	1290355	W1	BH	28.2	5.69	22.1	89	3	nd	Yee Lim	21	Private	1998
7/18	356	554045	1290640	W3	DW	28.8	6.72	102.1	127	0.05>	nd	Public	12	Village	long history
7/18	357	553626	1291186	W3	DW	28.8	7.1	66.7	118	0.05	nd	Public	8	Village	1967
7/18	357	553850	1290976	W2	BH	28.8	6.79	59.4	-5	0.05	nd	Phan Oun	24	Private	1998
7/18	357	553917	1290876	W1	BH	27.7	6.19	44	-17	5	nd	Public	25	CAC	2001
7/18	378	573402	1294189	W1	DW	28.7	5.43	28.6	208	0.05	nd	Public	6	Village	1996
7/18	378	573343	1294288	W2	DW	28.2	5.64	22.7	194	0.05>	nd	Public	7	Village	1997
7/18	378	573543	1294291	W3	DW	27.8	5.68	32.2	206	0.05	nd	Public	5	Village	1998
7/18	380	571783	1292995	W2	DW	29	5.92	10.28	204	0.05>	nd	Public, Ta Kay	5	Village	1984
7/18	380	571855	1293033	W1	DW	28.8	6.15	10.18	211	0.05>	nd	Public, Mr. C. T.	6	Village	1994
7/18	380	571554	1292919	W3	BH	28.9	6.04	13	16	10<	nd	Public, Yann	34	PRASAC	2000
7/20	420	457250	1264635	W2	BH	31	6.89	86.9	-68	2	nd	Public	24	UNICEF	1987
7/20	420	457235	1264708	W3	DW	29.5	7.03	331	117	0.05>	nd	Leng Lim	9	Private	1995
7/20	420	457331	1264576	W1	BH	31.2	6.89	93.4	39	0.05>	nd	Public	24	BRASAK+MRD	2001
7/20	424	456012	1260167	W3	Pond	31.5	6.81	7.5	175	1	nd	Public	2	---	---
7/20	424	456015	1260955	W2	BH	29.7	6.65	193.9	-45	5	nd	Public	18.5	UNICEF	1987
7/20	424	455956	1260716	W1	BH	30.3	6.8	125	105	0.05	nd	Public	30	Prasak	2001
7/20	426	454639	1259861	W3	BH	31.1	6.99	134.1	74	0.05>	nd	Public	43	UNICEF	1996
7/20	426	454356	1259480	W1	DW	29	6.92	157.6	180	0.05	nd	Public	5	Concern	1996
7/20	426	454646	1259788	W2	BH	31.3	6.93	106.3	161	0.05>	nd	Public	25	UNICEF	1999
7/20	469	414695	1246687	W1	DW	27.8	6.06	85.6	170	0.05	nd	Public, Kong Ny	5	Village	1995
7/20	469	414937	1246651	W2	DW	28.2	6.53	80.2	137	0.5	nd	Public, Mr. Hum	3.5	Village	2001
7/20	469	414875	1246718	W3	DW	28.7	5.9	69.1	179	0.3	nd	Public, Mr. B. S.	3	Village	2001
7/20	470	414675	1246664	W1	DW	28.2	7.06	166.9	149	0.1	nd	Song Meng	3	Private	1997
7/20	470	414811	1246627	W2	DW	27.7	6.15	136	158	0.05>	nd	Teng Sokchea	3	Private	2000
7/20	470	414860	1246627	W3	DW	27.8	5.54	86.9	199	0.05>	nd	Public, Mr. Korn	2.5	Village	2000
7/20	472	413709	1246497	W3	DW	27.8	4.45	19.29	179	0.05	nd	Public, Chea Socheat	8	Village	1995
7/20	472	413930	1246396	W2	DW	28.4	5.61	21.1	215	0.05	nd	Public	6	Village	2000
7/20	472	413803	1246458	W1	DW	28.8	4.28	46.9	330	0.05>	nd	Public, Long Kum	3	Village	2000
7/23	105	595667	1231588	W3	DW	28.6	6.49	15.52	126	0.3	nd	Saum Saven	7	Private	1950
7/23	105	596260	1231589	W2	BH	29.8	6.16	11.2	64	0.3	nd	Sang Tha	18	Private	1999

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/23	105	596688	1231532	W1	BH	28.5	6.05	7.19	40	1	nd	Nun Mok	18	Private	2000
7/23	118	588927	1244432	W1	BH	30.1	6.74	20.5	-39	1.5	nd	Public, Yin Woeun	30	Village	1996
7/23	118	588738	1244440	W2	BH	29.7	6.64	22.2	-41	2	nd	Public, Mr. Thol	29	Village	1999
7/23	118	588266	1244350	W3	BH	30.2	6.74	30.8	-26	1.5	nd	Public	36	Village	2000
7/23	151	583492	1250458	W1	BH	29.8	6.47	23.4	1	1.5	nd	Public, Chea	33	Village	2000
7/23	151	583286	1250466	W3	BH	29.9	6.45	24	-19	2	nd	Mom Chon	33	Private	2000
7/23	151	583565	1250502	W2	BH	30	6.45	23.1	-24	2	nd	Keo Thin	33	Private	2001
7/23	392	567737	1245629	W1	BH	28.1	5.89	24.5	93	0.8	nd	Public	32	Pagoda	1998
7/23	392	567811	1245659	W3	BH	29.7	6.32	15.36	51	0.3	nd	Chen. Yee	30	Private	2001
7/23	392	567585	1246101	W2	BH	30.2	6.35	32	8	2	nd	Chan Sovan	30	Private	2001
7/24	139	581191	1266035	W2	DW	29.2	6.66	18.9	55	0.05	nd	Temple	7	Village	1960
7/24	139	581116	1266475	W3	DW	31.5	5.15	8.2	247	0.05>	nd	Public	3	Village	1998
7/24	139	581189	1266535	W1	BH	30.5	6.38	13.9	-2	3	nd	Public, Nguon Chem	27	UNICEF	2001
7/24	144	588858	1257006	W1	BH	29.1	6.3	15.54	37	0.1	nd	Meas Samon	26	Private	2000
7/24	144	585921	1253692	W3	DW	29.8	6.47	24.4	108	0.05>	nd	Public, Suos Dorn	29	Village	2000
7/24	144	585900	1253950	W2	BH	30.5	6.47	24.4	-66	3	nd	Public, Suon Pually	25	Village	2001
7/24	145	585921	1253692	W3	DW	29.8	6.47	24.4	108	0.05>	nd	Public	8.5	Social fund	1992
7/24	145	585895	1254086	W1	BH	30.8	6.53	24.2	-48	3	nd	Mak	30	Private	2000
7/24	145	585900	1253950	W2	BH	30.5	6.47	24.4	-66	3	nd	Public, Tem Voug	31	Village	2001
7/24	148	586419	1251541	W1	BH	28.7	6.41	29.7	-13	5	nd	Reav Sean	37	Private	1998
7/24	148	586474	1252263	W2	BH	29.7	6.37	22.5	-5	4	nd	Sou Naun	43	Private	1999
7/24	148	586608	1252210	W3	BH	28.5	6.37	21.6	2	3	nd	Saum Lim	28	Private	2000
7/24	149	591325	1254513	W1	Cmbn well	28.8	5.91	20.1	182	0.05	nd	Public	7+24	OXFAM	1994
7/24	149	591673	1254628	W3	BH	28.4	4.78	24.9	192	1	nd	Prom. Din	27	Private	1999
7/24	149	591263	1254686	W2	DW	30.6	4.25	10.76	306	0.05	nd	Chark Boen	10	Private	2001
7/24	152	582540	1254026	W1	DW	29.3	7.01	45.8	161	0.05>	nd	Public	7.5	Village	1969
7/24	152	582915	1253200	W3	BH	29.7	6.45	21.6	21	0.5	nd	You Leng	31	Private	1996
7/24	152	582600	1253880	W2	BH	29.9	6.41	25	-16	4	nd	Meas Saun	33	Private	2000
7/24	167	579323	1241050	W1	Cmbn well	29.5	6.5	36.3	-19	2	nd	Public	31+24	UNICEF	1998
7/25	137	579008	1249634	W2	BH	31.2	6.88	31	-86	3	nd	Public	38	Village	1996
7/25	137	579176	1249648	W3	BH	29.9	6.83	31.1	-72	2	nd	Public, Duong Va	30	Village	1998
7/25	137	578802	1249651	W1	DW	30.7	6.68	26.3	-26	2	nd	Public	6	UNICEF	2001
7/25	163	577904	1243307	W2	DW	30.4	7.2	34.3	-24	0.1	nd	Public	6	UNF	1998
7/25	163	578030	1242835	W1	BH	31	6.83	48.7	-48	1	nd	Public, Seng Rong	35	Village	1999
7/25	163	577976	1242933	W3	BH	30.9	7.04	48.3	18	0.05>	nd	Public, Nou Than	21	Children Right	2000
7/25	167	579825	1241108	W3	BH	29.7	6.45	29.3	66	0.05>	nd	En Yeang	21	Private	1997
7/25	167	580001	1241093	W2	BH	30	6.39	31.5	-51	7	nd	Khem Panga	22	Private	1998
7/25	168	579129	1241033	W3	BH	30.3	6.48	30.1	36	0.05	nd	Khov Houng	19	Private	1996
7/25	168	579191	1241365	W1	BH	29.2	6.39	44.9	108	0.05	nd	Kim Hea	22	Private	1998
7/25	168	579157	1241182	W2	BH	30	6.57	37.6	-53	5	nd	Chan Sareth	24	Private	1999
7/25	172	575377	1243435	W1	DW	29.3	7.64	75	-69	0.05>	nd	Public	7	Village	1993
7/25	172	575284	1243503	W2	BH	29.9	6.78	32.2	-64	1	nd	Public	30	Village	1998
7/25	172	574992	1243839	W3	BH	29.7	6.74	29	-69	3	nd	Public, Tep Phan	40	Village	2000

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/25	S-6	579038	1239692	W3	BH	29.4	6.51	36.5	-38	6	nd	Mao Aorn	32	Private	1998
7/25	S-6	579018	1239916	W1	BH	31.2	6.47	29	-47	10	nd	Koet Chaun	33	Private	1999
7/25	S-6	579040	1239695	W2	BH	29.8	6.53	30.8	-45	7	nd	Chan Sothun	33	Private	1999
7/26	155	621918	1211242	W3	DW	28.2	6.37	96	161	0.05>	nd	Public, Mr. K. Ch.	8	Village	1979
7/26	155	622172	1211230	W1	DW	28.6	5.88	115.5	211	0.05>	nd	Public, Er Sar	4	Village	1986
7/26	155	622101	1211259	W2	DW	28.5	5.79	170.1	207	0.05>	nd	Public, Roeu Ket	5	Village	1991
7/26	156	620491	1211183	W3	DW	29.3	5.96	31.2	134	0.05	nd	Him Sobon	4	Village	1940
7/26	156	619998	1211194	W1	DW	28.7	5.99	24	146	0.05	nd	Public, Khai Tep	4	Village	1994
7/26	156	620106	1211176	W2	DW	29	6.43	24.6	111	0.05	nd	Public, Tha	7	Village	1995
7/26	159	622667	1212277	W2	DW	28.9	5.89	222	105	0.05>	nd	Houy Sophan	4	Private	1962
7/26	159	622778	1212394	W3	Cmbn well	28.9	6.16	190.2	166	0.05>	nd	Kam Yang	4.2+12	Private	1993
7/26	159	622933	1212225	W1	BH	28.9	5.78	98.8	17	10<	nd	Tep Yorn	28	Private	1998
7/26	162	617566	1216968	W2	Cmbn well	28	7.12	62.4	46	0.05>	nd	Public	8+40	OXFAM	1993
7/26	162	618117	1216599	W3	Cmbn well	28.8	5.74	9.26	166	0.05>	nd	Public	5+26	Mr. Sau Sidim	1998
7/26	162	617168	1217153	W1	BH	31	6.14	19.61	17	1	nd	Public	25	S.F	2000
7/30	429	454265	1266039	W2	DW	29.5	6.57	45.8	176	0.05>	nd	Keo Sophoal	4.5	Private	1983
7/30	429	454391	1265941	W1	BH	29.5	7.17	177.5	-51	0.5	nd	Public	12	SIHNU Team	1999
7/30	429	454139	1266071	W3	DW	28.3	6.5	62	191	0.05>	nd	Public	4.5	SIHNU Team	1999
7/30	431	454694	1266250	W3	DW	28	6.53	159.2	170	0.05>	nd	Yeam Phorn	3.5	Private	1979
7/30	431	454885	1266220	W1	DW	27.6	6.72	161.8	178	0.05	nd	Public	5	UNICEF	1987
7/30	431	454901	1266441	W2	DW	28.3	6.9	28.1	149	0.05	0.01	Public	5	SIHNU Team	1999
7/30	432	455648	1266690	W1	Pond	28.5	5.97	6.47	168	1	nd	Public	2	---	---
7/30	432	455691	1266032	W3	Pond	29	6.72	13.61	146	0.1	nd	Public	2	---	---
7/30	432	455411	1266846	W2	Canal	30.5	6.52	14.47	138	1	nd	Public	---	Village	Long ago
7/30	459	430163	1265455	W1	BH	30.3	7.22	110.1	26	0.05	nd	Public, Mr. Th. W.	25	UNICEF	1988
7/30	459	430038	1265432	W3	DW	28.8	7.33	85.9	105	0.05>	nd	Mr. Neang	5	Private	2001
7/30	459	430145	1265375	W2	DW	28.3	7.24	78.9	104	0.05>	nd	Mr. Loug Thun	4	Private	2001
7/30	461	431168	1264915	W2	BH	30	7	132.6	-11	0.3	nd	Public, Mr. Yong	25	UNICEF	1988
7/30	461	430333	1264420	W1	BH	30.4	6.84	250	-22	0.5	nd	Public, Mr. Say	42	UNICEF	1988
7/30	461	431330	1265036	W3	BH	30.1	7.01	93.5	-63	1	nd	Temple	39	LWS	1997
7/30	463	431437	1262317	W3	BH	29.7	6.97	249	26	0.05	nd	Public	36	UNICEF	1988
7/30	463	431328	1262244	W2	DW	32	7.53	104.5	48	0.05>	nd	Public	5	Village	1994
7/30	463	431500	1261880	W1	DW	29.2	7.51	186.1	73	0.05>	nd	Mr. Uy Sok	7	Private	1998
7/31	246	471767	1243194	W3	DW	29.5	6.57	180.8	104	0.05	nd	Chan Eng	3	Private	1989
7/31	246	471974	1243299	W2	DW	28	5.6	12.14	200	0.1	nd	Public	3.4	San. Khun	1995
7/31	246	472115	1243899	W1	DW	29	5.44	18.03	167	0.05	nd	Public	3	Village	1999
7/31	247	470947	1243999	W1	DW	28.5	5.22	140.1	215	0.05	nd	Public	3	Village	1973
7/31	247	470254	1244354	W3	DW	28.6	5.2	81.3	225	0.5	nd	Sory Soen	3.5	Private	1995
7/31	247	470461	1244210	W4	DW	29.4	5.31	93.4	220	1	nd	Kim Ly	2.5	Private	1999
7/31	247	470343	1244217	W2	DW	29.2	6.34	75.5	149	0.05	nd	Public	4	Village	2000
7/31	249	471257	1244868	W1	Pond	31.4	6.62	5.51	192	0.1	nd	Temple	3	Pagoda	---
7/31	249	471081	1244914	W2	BH	30	6.86	137.4	-61	1	nd	Public	21	UNICEF	1990
7/31	249	471208	1244393	W3	DW	29.1	5.85	16.73	220	0.1	nd	Public	2.9	Village	Long ago

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
7/31	254	485964	1246604	W3	BH	30.4	8.05	131.7	40	0.05	nd	Public, Mr. Ch. P.	48	UNICEF	1992
7/31	254	486050	1245263	W2	BH	30.3	7.64	178.4	58	0.05>	nd	Public	27	UNICEF	1993
7/31	254	485984	1245403	W1	BH	31	7.68	171.7	33	0.05	nd	Public, Mr. Srosn	52	Social fund	2001
7/31	255	488493	1247023	W1	DW	30.2	7.23	64.1	51	0.05>	nd	Public	8	WPC	1998
7/31	255	488676	1247097	W3	DW	30.1	7.14	70.7	84	0.05>	nd	Public	9	WPC	1998
7/31	255	488548	1247054	W2	BH	30.6	7.46	136.9	-4	0.05	nd	Public	20	Social fund	2001
7/31	256	473464	1248541	W3	BH	30	7.6	116	-1	0.05>	nd	Public	50	UNICEF	1988
7/31	256	473910	1248725	W1	DW	29.4	6	19.9	104	0.3	nd	Mr. Chen	4	Private	1995
7/31	256	473866	1248564	W2	DW	28.4	6.55	15.79	122	0.05>	nd	Public	5	Villager	1999
8/1	183	476442	1239530	W1	DW	28.7	5.71	55.8	195	0.05	nd	Public	4.5	Som Rangsy	1986
8/1	183	476042	1239587	W2	BH	30.1	6.93	117.9	11	0.1	nd	Public	27	S.F	1998
8/1	183	475922	1239419	W3	BH	29.9	7.31	109.4	-50	0.3	nd	Public	28	S.F	1998
8/1	195	471524	1237748	W3	BH	30.6	6.99	125.1	116	0.05	nd	Public	44	S.F	2000
8/1	195	471595	1237156	W1	BH	30.9	7.2	134.8	-42	0.3	nd	Public	43	S.F	2000
8/1	195	471704	1238196	W2	BH	31.7	6.99	114.1	-20	0.3	nd	Public	40	S.F	2000
8/1	241	471926	1243066	W1	DW	29.7	7.29	62.1	121	0.05	nd	Public	5	Village	2001
8/1	241	471851	1243046	W3	DW	29.9	7.04	180.9	146	0.05>	nd	Public, Hor Horn	4	Village	2001
8/1	241	471861	1243100	W2	DW	29.4	7.25	148	137	0.05>	nd	Public, Phork Yoeun	5	Village	2001
8/1	250	474975	1239466	W3	DW	29.2	6.12	20	174	0.5	nd	Public	3.4	Village	1996
8/1	250	475105	1239693	W2	DW	28.6	6.93	50.1	138	0.05>	nd	Public	5	Village	1998
8/1	250	474975	1239712	W1	DW	28.2	5.96	11.89	173	0.3	nd	Public	2.5	Village	1998
8/1	252	475266	1243224	W3	DW	29.6	6.12	54.2	149	0.05>	nd	Public, Thou mine	4	Village	1996
8/1	252	475323	1243228	W2	DW	30.3	6.4	19.13	145	0.05	nd	Public, Mr. Pong	3	Village	1998
8/1	252	474825	1243337	W1	DW	29.2	6.01	16.81	166	0.05	nd	Public	5	Village	1999
8/1	253	473642	1242875	W2	DW	31.1	7.3	87.8	87	1	nd	Public	5	Village	1992
8/1	253	473733	1242532	W3	DW	29.6	6.92	15.33	30	0.3	nd	Public	6	Village	1995
8/1	253	473444	1242811	W1	DW	30	5.68	9.05	171	0.05	nd	Public, Mr. P. E.	5	Personal Sponsore	1997
8/2	191	469661	1226008	W3	BH	29.8	6.57	42.2	-61	2	nd	Public	37	China	1998
8/2	191	470274	1226072	W1	BH	28.6	5.85	47	-21	10<	nd	Public	38	S.F	2000
8/2	191	469026	1226029	W2	DW	28	6.22	96.1	135	0.05>	nd	Public	6+24	RADCROSE	2000
8/2	242	470269	1239729	W3	DW	28.8	6.15	25.1	138	0.3	nd	Public	3	Village	1995
8/2	242	470645	1239763	W1	DW	29.8	5.44	13.43	215	0.05	nd	Public, Ouk Rein	6	Village	1998
8/2	242	470507	1239736	W2	BH	28.9	6.32	40.7	56	0.5	nd	Public	37	S.F	2000
8/2	243	470717	1240764	W3	DW	32.2	6.47	12.42	189	0.1	nd	Public, Mr. M. N.	4	Village	1993
8/2	243	470567	1240408	W1	BH	31.2	7.44	127.5	39	0.1	nd	Public	24	UNICEF	1996
8/2	243	470349	1240443	W2	DW	30.7	7.77	28.1	155	0.05	nd	Public	4	Village	1996
8/2	244	467574	1239272	W1	DW	29.8	6.7	24.9	123.4	0.05	nd	Public	4	Village	1992
8/2	244	467829	1239470	W2	DW	30.1	6.95	40.9	98.9	0.05>	nd	Public	4	Village	1998
8/2	244	467975	1239372	W3	DW	29.2	5.92	17.9	196.2	0.05>	nd	Public	6	Village	1998
8/2	245	470129	1241523	W2	BH	29.7	7.03	81.5	-34	0.3	nd	Public	37	S.F	2000
8/2	245	469641	1241283	W3	DW	29.6	6.45	22.2	180	0.05	nd	Public	4	W.V.S	2001
8/2	245	470091	1240928	W1	DW	29.3	6.48	26.7	185	0.05>	nd	Public	4	W.V.S	2001
8/2	248	469168	1242476	W1	DW	29	5.67	6.52	192	0.05>	nd	Public	4	Village	1960

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
8/2	248	470132	1242569	W2	DW	28.8	5.78	8.44	193	0.05>	nd	Public	4	Village	1996
8/2	248	470227	1242399	W3	DW	29.7	5.73	16.24	202	0.05	nd	Public	6	Village	2000
8/3	186	480145	1234976	W2	Pond	29.2	6.9	12.49	9	0.05	nd	Public, Noeun Nim	4	---	---
8/3	186	480414	1235550	W3	Pond	29.4	6.5	5.2	76	0.3	nd	Public	3	---	---
8/3	186	480225	1234986	W1	Pond	28.7	6.79	14.79	77	0.1	nd	Private	3	---	---
8/3	214	487247	1236964	W3	BH	29.5	7.37	431	-47	0.05	nd	Public, Sa wong	32	MRD	1997
8/3	214	487278	1236294	W1	BH	31.2	7.16	294	-48	0.3	nd	Public, Mr. Chuon	30	UNICEF	1997
8/3	214	487295	1237243	W2	BH	30.8	6.97	447	-45	0.1	nd	Public, Mr. Sokhom	25	Village	2001
8/3	215	485122	1235196	W3	Pond	32.2	7.09	11.64	140	0.05	nd	Public	5	---	---
8/3	215	485098	1235104	W2	BH	30.2	7.17	239	4	0.1	nd	Public, Pen Se	26	Personal Sponsore	1999
8/3	215	485049	1234975	W1	BH	30.1	7.07	313	-10	0.3	nd	Public, Kann Hort	44	Social fund	2000
8/3	216	484933	1234165	W1	BH	29	6.45	175.6	-52	0.5	nd	Public	18	UNICEF	1994
8/3	216	484714	1234316	W2	BH	28.7	5.81	129.9	140	0.5	nd	Van Thorn	17	Private	1998
8/3	216	484783	1233984	W3	BH	29.4	5.73	205	169	0.3	nd	Public	13	FAO	2001
8/3	217	483939	1234397	W1	BH	29.5	7.4	193.8	-55	0.1	nd	Chou Savoen	29	Private	2000
8/3	217	483927	1234231	W2	BH	29.3	6.41	110.2	220	0.1	nd	Sor Lin	10.5	Private	2001
8/3	217	484039	1234726	W3	BH	23.5	6.21	262	160	0.05>	nd	Pou Chuy	13.5	Private	2001
8/3	223	489695	1231478	W3	Pond	32.2	6.77	8.3	172	0.5	nd	Public	3	---	---
8/3	223	489679	1231609	W2	BH	29.7	6.49	202	36	0.5	nd	Public	41	SIHNU Team	1997
8/3	223	489752	1231006	W1	BH	30.4	6.44	242	81	0.1	nd	Public	31	SIHNU Team	2001
8/4	194	471839	1227706	W1	DW	28.4	6.49	5.34	190	0.05>	nd	Public, San Phat	4	Village	1995
8/4	194	472685	1228016	W3	DW	29.4	6.11	19.29	175	0.05>	nd	Public, Mr. Phun	4	Village	2001
8/4	194	472488	1228211	W2	DW	28.3	6.9	21.3	177	0.05>	nd	Public	3.5	Village	2001
8/6	190	476766	1228624	W1	BH	29.6	6.89	403	-57	2	nd	Public	43	GRT	1998
8/6	190	475903	1228599	W2	BH	29.9	6.41	34.9	92	0.05	nd	Public	18	Soen Son Spaty	1998
8/6	190	475475	1228535	W3	BH	30.4	6.29	30.9	96	0.1	nd	Public	18	GRT	1998
8/6	218	493634	1228531	W1	BH	29.5	6.44	439	-7	2	nd	Public, Mr. Thoeun	35	UNICEF	1998
8/6	218	493602	1229109	W3	BH	29.6	6.35	354	47	0.5	nd	Public, Mr. Phal	28	Village	1998
8/6	218	493635	1228840	W2	BH	28.9	6.31	454	37	1	nd	Public, Mr. Eng	35	Village	2001
8/6	219	493688	1228299	W3	BH	28.9	6.39	447	83	1	nd	Public, Am Kong	28	Village	1996
8/6	219	493737	1227970	W1	BH	29.2	6.63	378	-67	2	nd	Public, Teang Khy	25	Social fund	2000
8/6	219	493681	1228140	W2	BH	29.4	6.6	379	-44	2	nd	Public, Ath Yon	24	Social fund	2000
8/6	220	492991	1227364	W1	BH	29.4	6.92	151.4	-50	2	nd	Public, Yeay Yoeu	25	Social fund	2000
8/6	220	492584	1227332	W3	BH	29.5	6.99	161.3	-15	0.5	nd	Public, Mr. Pin	25	Social fund	2000
8/6	220	492829	1227370	W2	BH	29.2	6.93	144.2	4	0.3	nd	Public, Mr. Chhin	25	Village	2001
8/6	221	492829	1231378	W3	BH	30.9	6.95	15.07	122	0.5	nd	Temple	3	Pagoda	1989
8/6	221	493563	1231703	W2	BH	29.3	6.4	366	75	0.1	nd	Klouh Seang	40	Private	1999
8/6	221	493657	1231832	W1	BH	30	6.38	366	30	0.5	nd	Public	30	S.F	2001
8/6	222	493378	1230533	W2	BH	29.3	6.15	536	145	0.1	nd	El Man	27	Private	1999
8/6	222	493350	1230655	W3	BH	29.3	6.25	518	16	2	nd	Run. Da	30	Private	1999
8/6	222	493429	1230394	W1	BH	29.3	4.16	1027	260	0.3	nd	Chea Cheang	33	Private	1999
8/7	180	476470	1211237	W2	BH	28.3	6.44	283	26	1	nd	Public, Mr. Tr. S.	25	UNICEF	1998
8/7	180	476797	1211477	W1	BH	27.6	6.73	574	-1	0.5	nd	Public, Mr. M. M.	25	UNICEF	1998

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
8/7	180	476433	1211270	W3	BH	27.7	6.53	185.8	-24	1	nd	Public, Mr. Tive	20	Village	2000
8/7	181	478531	1213327	W2	Pond	29	6.53	15.16	81	1	nd	Temple	3	---	---
8/7	181	478180	1213070	W1	BH	29.5	6.62	660	73	0.1	nd	Public, Mr. E. B.	59	JICA	1997
8/7	181	478288	1213228	W3	BH	30.2	6.77	658	25	0.3	nd	Khuou Kal Yan	28	Private	2001
8/7	188	481041	1224429	W1	DW	28.5	7	6.31	111	0.05>	nd	Public, Mr. H. K.	7	Village	2001
8/7	188	480180	1224387	W3	DW	28.9	6.87	699	109	0.05>	nd	Public, Mr. Sang Hai	7	Village	2001
8/7	188	480773	1224422	W2	DW	28.3	7.33	460	80	0.05>	nd	Public, Mr. Ch. V.	6.5	Village	2001
8/7	202	470353	1213957	W1	BH	29.1	5.9	45.9	196	0.3	nd	Public	22	UNICEF	2000
8/7	202	470622	1214030	W2	BH	29.7	6.06	33.8	-16	10<	nd	Public	38	S.F	2001
8/7	202	471017	1214079	W3	BH	29.8	6.37	87	24	0.1	nd	Public	37	S.F	2001
8/7	203	467501	1218100	W3	BH	30.2	7.33	90	-96	0.3	nd	Public	31	UNICEF	1989
8/7	203	467386	1218584	W2	BH	29.4	7.45	91.4	-4	0.05	nd	Public	28	UNICEF	2000
8/7	203	467364	1217074	W1	BH	29.2	7.34	90.5	-84	0.1	nd	Public	37	S.F	2001
8/7	204	469323	1214412	W3	DW	28.3	6.22	17.07	185	0.05	nd	Noub. Sauo	5.5	Private	1998
8/7	204	469159	1213756	W1	BH	29.9	6.67	144.6	-28	2	nd	Public	19	MCC	1999
8/7	204	469583	1213779	W2	BH	30.5	6.57	124.5	143	0.05>	nd	Public	12	UNICEF	1999
8/8	196	467145	1209820	W1	BH	28.5	5.71	50.4	83	1	nd	Chan Horn	16	Private	1997
8/8	196	466940	1209763	W2	BH	29.4	5.57	61.1	152	0.5	nd	Many Rea	16	Private	1999
8/8	196	467207	1209935	W3	BH	29.9	5.82	66.8	58	0.5	nd	Public	30	S.F	2001
8/8	198	465960	1211996	W1	BH	28.8	6.98	88	-9	0.05	nd	Public	18	MCC	1998
8/8	198	465849	1211151	W2	BH	28.9	7.28	60.6	47	0.05>	nd	Public	27	MCC	1998
8/8	198	465818	1210973	W3	BH	29	6.84	115	-19	0.3	nd	Brach. Phorl	28	Private	1999
8/8	199	465696	1212669	W3	Pond	33.3	7.49	6.1	112	0.5	nd	Public	4.5	---	---
8/8	199	465498	1213118	W2	BH	30.4	7.04	76.3	45	0.05>	nd	Public	40	JICA	1997
8/8	199	465574	1213505	W1	BH	30.7	6.94	76.3	-54	0.3	nd	Public	31	ECC	1998
8/8	209	454249	1210560	W2	Pond	33	7.38	8.46	1	0.3	nd	Public, Mr. Chea	3	---	---
8/8	209	454281	1210681	W3	Pond	31.3	7.02	11.59	114	0.5	nd	Public, Mr. Mab	2	---	---
8/8	209	454255	1210508	W1	BH	30.4	7.15	197.4	-24	0.1	0.005	Public	51.5	JICA	1997
8/8	210	457938	1210829	W3	DW	29.4	7.04	61.7	116	0.05>	nd	Public, Ta Lorn	5	UNICEF	1993
8/8	210	457098	1210060	W1	BH	29.6	7.32	118.1	-56	0.1	nd	Public, Mr. T. M.	38	Social fund	2001
8/8	210	457456	1210403	W2	BH	29.1	6.95	121.7	-40	0.5	nd	Public, Mr. N. L.	41	Social fund	2001
8/8	211	454361	1212557	W1	Pond	31.9	7.95	14.31	71	0.05>	nd	Public, Mr. P. Th.	2	---	---
8/8	211	454268	1212596	W2	Pond	31.8	7.81	6.07	73	0.1	nd	Public, Mrs. Y. N.	2	---	---
8/8	211	454296	1212636	W3	BH	29.5	7.24	201	90	0.05>	nd	Public, Mrs. K.	36	MRD +ADB	1999
8/9	234	484349	1206585	W1	DW	28.7	6.77	183.6	106	0.05>	nd	Saum Ben	5.5	Private	1996
8/9	234	484473	1207080	W3	BH	29.4	5.98	343	30	3	nd	Hean On	21	Private	1997
8/9	234	484512	1207323	W2	BH	28.9	5.84	379	163	0.5	nd	Pan Yos	16	Private	1999
8/9	235	485492	1205437	W1	Pond	29.7	6.88	15.22	130	1	nd	Temple	2	Pagoda	---
8/9	235	484734	1205045	W3	BH	29	6.48	141.2	44	0.05>	nd	Nel Yeam	25	Private	1998
8/9	235	485353	1205388	W2	BH	29.1	6.21	356	47	3	nd	Chem. Phany	40	Private	1999
8/9	236	485315	1203597	W1	BH	28.7	6.44	421	32	0.3	nd	Krey Mouy	23	Private	1997
8/9	236	485391	1203704	W3	BH	29.4	6.38	568	40	0.5	nd	Sok Phorn	23	Private	2000
8/9	236	485031	1203666	W2	BH	29.6	5.98	641	53	0.3	nd	Sor Su Cheat	27	Private	2000

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
8/9	238	467175	1200691	W3	Pond	26.7	6.57	20	166	2	0.005	Public, Mr. D. N.	2	---	---
8/9	238	467549	1200507	W2	Pond	29.6	7	6.3	137	0.05	nd	School	3	---	---
8/9	238	467503	1200389	W1	BH	28.6	7.07	260	105	0.05	nd	Temple	54	UNICEF	1998
8/9	239	467990	1200235	W3	Pond	27.4	5.09	31.8	275	0.5	nd	Public, Mr. Yea La	2.5	---	---
8/9	239	468052	1200182	W2	Pond	27.1	6.84	28.6	156	0.5	nd	Public, Mr. Rum	2.5	---	---
8/9	239	467999	1200232	W1	Pond	29.7	5.61	9.22	218	0.1	nd	Public, Mr. Deach	2.5	---	---
8/9	240	470721	1204946	W2	DW	28.3	7.19	345	111	0.05>	nd	Public, Mr. S. N.	8	Personal Sponsore	2000
8/9	240	470803	1204947	W3	DW	28.5	6.67	180.5	140	0.05>	nd	Public, Mr. Sok Sem	7	Village	2001
8/9	240	470771	1205025	W1	DW	28.7	6.83	106.8	120	0.05	nd	Public, Mr. Kychon	7	SELLA	2001
8/10	184	476768	1240228	W3	Pond	30.7	6.51	6.37	148	1	nd	Public, Seng Tieng	2.5	---	---
8/10	184	476844	1240124	W1	BH	29.7	7.1	118.1	-69	2	nd	Public, Mr. Sroy	36	China	1998
8/10	184	476732	1240170	W2	DW	28.5	6.43	41.7	130	0.05	nd	Public, Mak OM	5	Village	1998
8/10	225	475907	1207867	W3	BH	30.2	7.06	219	-20	0.1	nd	Public, Mr. Hul Hin	24.2	Republic of China	2000
8/10	225	476014	1207123	W2	BH	29.5	6.62	197.4	-2	1	nd	Public, Mr. Heng	24.5	Republic of China	2000
8/10	225	476096	1206721	W1	BH	29.9	6.88	87.9	-139	2	nd	Public, Yuos Phea	23.6	Republic of China	2000
8/10	226	474405	1201371	W2	Pond	29.5	6.91	213	21	0.1	nd	Temple	3	---	---
8/10	226	474059	1201176	W1	BH	29.1	6.65	226	16	0.3	nd	Public	15	Japanese	1997
8/10	226	474205	1201223	W3	BH	28.5	5.86	6.2	170	0.1	nd	Public	22	Village	1998
8/10	232	480844	1205477	W3	BH	29.6	5.69	320	170	0.5	nd	Nub Nike	26	Private	1998
8/10	232	480618	1205511	W1	BH	28.7	5.97	238	79	2	nd	Public	16	Mr. Lim Meng	2000
8/10	232	480777	1205427	W2	BH	29.4	5.87	335	137	0.05	nd	Public	27	Mr. Ch. Bomom	2000
8/10	233	479329	1206247	W3	Pond	28.4	6.35	19.38	165	1	nd	Public	2	---	---
8/10	233	479462	1205448	W2	Pond	28.5	5.75	8.08	167	2	nd	Public	2.5	---	---
8/10	233	479459	1205994	W1	BH	28.7	6.31	617	27	3	nd	Public	30	S.F.A.C	2000
8/10	237	479283	1202084	W2	BH	29.4	5.91	445	143	0.5	nd	Mom Yun	30	Private	1999
8/10	237	479267	1201776	W3	BH	28.6	5.92	417	96	3	nd	Public	30	Mr. S. H. Loung	2000
8/10	237	479249	1201916	W1	BH	28.8	6	434	182	0.2	nd	Public	28	Kun. An (U.S.A)	2000
8/13	441	438717	1259165	W3	Pond	30.4	8.16	9.66	137	0.05>	nd	Temple	3	---	---
8/13	441	438786	1259746	W2	BH	29.3	6.88	165.3	94	0.5	nd	Public, Mr. Hek	30	Social fund	2000
8/13	441	438176	1259714	W1	BH	29.7	6.86	179.9	75	0.2	nd	Public	33	Social fund	2000
8/13	450	438691	1257149	W3	BH	30.1	6.87	208	-33	3.5	nd	Public	27	UNICEF	1987
8/13	450	438847	1257150	W2	BH	29.8	6.89	246	64	0.2	nd	Public, Mr. Chea	31	Social fund	2000
8/13	450	438935	1257334	W1	BH	30	6.94	230	118	0.2	nd	Public, Mr. P. S.	35	Social fund	2000
8/13	454	429054	1261427	W2	DW	28.2	6.96	230	57	0.05>	nd	Public	6	WFP	1992
8/13	454	429122	1261303	W3	BH	30.4	7	187	88	0.05	nd	Public	24	JICA	1997
8/13	454	428960	1261411	W1	BH	29.5	6.88	230	98	0.05>	nd	Public	35	S.W.L	1997
8/13	455	426558	1261862	W2	DW	29.1	7.83	19.68	34	1	nd	Public	5	Village	1992
8/13	455	426600	1261271	W1	DW	27.4	7.17	79.1	132	0.05>	nd	Public	4.5	Village	1992
8/13	455	427032	1261796	W3	DW	27.9	7.3	60	130	0.05>	nd	Public	6	Village	1998
8/13	456	429188	1262795	W3	DW	27.9	7.25	116.8	107	0.05>	nd	Public	5	L.W.S	1997
8/13	456	428732	1262979	W1	BH	29.5	6.89	390	-71	5	nd	Public	28	L.W.S	1998
8/13	456	428212	1263067	W2	DW	28.2	7.54	77.5	106	0.05>	nd	Public	4.5	Village	Long ago
8/13	473	414478	1246859	W2	DW	27.2	5.8	102.7	195	0.5	nd	Mr. Try Saraun	4	Private	1999

Annex-2 Result of Interview and In-situ Water Quality Measurement

Date	Vlg No	Easting	Northing	Well No	W Source	WT	pH	EC	ORP	Fe	As	Owner	Depth	Creater	Year
8/13	473	414425	1246840	W1	DW	27.4	6.31	90.5	161	0.05>	nd	Mr. Kham Nan	3	Private	2000
8/13	473	414624	1246950	W3	DW	28.7	9.6	225	78	0.05	nd	Public, Mr. Vutu	5	Village	2001
8/14	428	456104	1259540	W2	Pond	27.9	6.95	13.44	105	1	nd	Public	2	---	---
8/14	428	456329	1259961	W3	BH	29.9	6.75	227	129	0.05>	nd	Public	22	UNICEF	1995
8/14	428	456239	1259954	W1	BH	29	6.84	103.7	72	0.05>	nd	Public	30	Prasac+MRD	2001
8/14	457	428740	1265179	W2	DW	27.8	7.74	113	76	0.05>	nd	Public	4	Village	1981
8/14	457	428803	1264889	W3	BH	30.1	6.94	108.3	-5	0.05>	nd	Public	42	L.W.S	1997
8/14	457	428438	1265279	W1	BH	29.6	7.29	178.4	96	0.05>	nd	Public	54	L.W.S	1997
8/14	464	431927	1260829	W1	DW	28.1	7.3	222	116	0.05	nd	Public, Mr. Kuy Nai	5	Village	1993
8/14	464	431787	1261203	W2	DW	27.5	7.29	120.4	128	0.05	nd	Public, Ngeth Nuon	5.5	Village	1993
8/14	464	431988	1260925	W3	DW	27.7	7.44	137.9	140	0.05>	nd	Public, Yeay Seak	5	Village	1997
8/14	S-3	431229	1258015	W3	BH	31.3	7.14	140.9	134	0.5	nd	Public, Mr. Mon	35	Social fund	2000
8/14	S-3	431499	1257930	W1	BH	30.2	6.96	208	75	0.5	nd	Public, Mr. V. &E.	40	Social fund	2000
8/14	S-3	431587	1257935	W2	DW	29.6	7.49	95.6	95	0.2	nd	Mr. Hem Saroeun	4	Private	2001
8/14	S-7	429594	1264164	W2	BH	30.6	7.46	104.9	-105	1	nd	Public	45	UNICEF	1986
8/14	S-7	429599	1264372	W1	BH	30.6	7.13	75.8	35	0.05>	nd	Public	42	L.W.S	1997
8/14	S-7	429540	1263848	W3	DW	29	8.02	63.9	40	1	nd	Public	6	Village	Long ago

Annex 3 Laboratory Water Quality Analysis on November 2001

No.	Village No.	Village Name	pH	EC (mS/cm)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	NH4 (mg/l)	As (mg/l)	CO3 (mg/l)	HCO3 (mg/l)	CO2 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Si (mg/l)	T-Hard (mg/l)	N-Hard (mg/l)	TDS (mg/l)
WHO Guideline Values for Drinking Water (mg/l)							200		0.3	0.1	1.5	0.01				250	250	50	1.5				1000
1	56	Khvet	7.64	1180	11	1	296	1.7	0.04	0.00	0.15	0.000	0	599	22	53.8	69.8	0.07	2.55	27	32	0	758
2	67	Mean Chey	7.33	1375	51	30	218	2.4	0.02	0.00	0.48	0.000	0	654	49	95.3	44.4	24.15	0.35	36.4	252	0	825
3	71	Samroang	7.32	4060	78	62	828	5.2	0.02	0.01	0.50	0.003	0	823	63	636.8	425.0	416.80	0.87	27.2	450	0	2890
4	113	Koy tra bek	6.6	254	10	5	38	3.3	6.4	0.41	2.10	0.010	0	130	52	7.9	8.5	0.00	0.26	50.7	48	0	197
5	113	Koy trabek	6.87	272	13	5	38	3.9	0.32	0.05	0.33	0.004	0	136	29	7.9	7.7	0.42	0.2	49.5	52	0	193
6	122	Trapaing Thmor	6.34	135	8	3	15	3.7	4.9	0.26	0.45	0.004	0	73	53	4.4	0.5	0.10	0.2	57.8	34	0	135
7	122(F1)	Trapaing Thmor	7.4	141	10	3	13	5.6	0.31	0.00	0.30	0.003	0	73	5	4.8	0.1	8.62	0.09	42.6	38	0	125
8	122(F2)	Trapaing Thmor	6.85	153	10	3	17	4.4	5.3	0.01	0.30	0.004	0	71	16	5.9	3.3	4.12	0.21	49.9	38	0	139
9	139	Dok Por	6.74	258	22	8	17	5.5	5	0.26	1.70	0.008	0	156	45	0.8	0.0	0.10	0.09	39.7	90	0	178
10	139(F1)	Dok Por	7.74	318	33	8	18	8.4	3	0.00	0.50	0.008	0	177	5	1.2	1.8	11.93	0.12	37.6	116	0	211
11	139(F2)	Dok Por	7.08	321	30	12	18	5.9	0.09	0.01	0.38	0.001	0	197	26	0.8	0.0	0.61	0.11	37.2	122	0	202
12	162	Cham Kar Leiv	6.37	193	14	5	17	5.8	7.6	0.55	1.60	0.009	0	110	75	0.8	2.1	0.10	0.15	32.6	56	0	142
13	162	Cham Kar Leiv	6.78	187	14	4	17	5.7	0.06	0.00	0.23	0.001	0	106	28	5.6	1.7	0.00	0.14	63.2	54	1	171
14	175	Toul Khpos	6.51	257	13	13	19	3.9	5.7	0.77	0.56	0.015	0	120	59	2.0	26.7	0.10	0.23	52.3	84	0	196
15	175(F1)	Toul Khpos	7.05	356	28	6	32	7.1	0.61	0.08	0.50	0.003	0	102	15	39.6	18.6	9.85	0.27	29.1	94	10	226
16	175(F2)	Toul Khpos	6.92	350	17	13	33	9	1.4	0.06	0.05	0.008	0	114	22	8.3	41.6	18.28	0.26	45.5	94	0	241
17	181	Prech	6.85	6800	552	156	773	5.8	0.2	0.11	3.10	0.001	0	378	85	2289.9	74.7	0.36	0.27	45.9	2020	1710	4090
18	199	PreyMaok	7.36	738	96	26	48	0.6	0.04	0.24	0.80	0.008	0	465	32	39.2	2.6	0.15	0.2	43.9	345	0	487
19	209	Trapaing Thmor	7.44	1780	44	28	401	1.3	0.13	0.12	0.40	0.002	0	920	53	110.1	99.8	0.04	0.3	25.4	226	0	1160
20	222	Ta Vong	7	6530	536	214	546	6.7	2.5	2.10	3.60	0.016	0	244	39	2221.4	40.7	0.50	0.54	38.8	2220	2020	3730
21	242	Ta Pen	7.71	1370	21	8	342	1.3	0.06	0.03	0.15	0.001	0	937	29	22.6	2.8	0.00	0.37	40.7	86	0	901
22	242(F1)	Ta Pen	8.05	407	34	7	42	6.1	0.12	0.02	0.20	0.003	0	228	3	9.4	3.2	4.32	0.02	14.9	114	0	234
23	242(F2)	Ta Pen	8.23	1330	12	5	342	4.3	0.44	0.08	0.40	0.008	0	856	8	29.3	2.6	16.03	0.43	37.8	50	0	872
24	25 + 1	JICE Center	7.59	798	43	21	110	1	0.35	0.05	0.30	0.005	0	481	20	23.8	1.1	0.07	0.21	29.7	196	0	469
25	259	Svay Kraom	7.43	660	52	37	37	2.5	0.08	0.33	0.45	0.010	0	374	22	28.1	2.6	0.31	0.65	38.9	280	0	384
26	288	Krang Svay	7.59	2510	30	23	604	4	0.01	0.00	0.18	0.001	0	1615	66	23.7	121.8	0.09	0.58	45.9	168	0	1650
27	322	Angkor Chey	8.12	1080	4	1	273	1.2	0.15	0.02	0.15	0.050	0	668	8	25.3	2.8	0.03	2.19	23.3	16	0	663
28	367	Ka Kou	6.97	450	34	18	39	2.3	1.7	0.34	0.26	0.010	0	280	48	5.2	0.0	0.05	0.32	51.5	156	0	290
29	367(F1)	Ka Kou	7.1	430	34	18	41	2.3	0.03	0.00	0.27	0.006	0	282	36	6.7	0.1	0.00	0.31	50.3	156	0	291
30	388	Russei Tvear	6.88	312	18	7	44	3	1.8	0.30	0.29	0.012	0	185	39	4.4	5.6	0.08	0.28	55.6	74	0	231
31	388(F)	Russei Tvear	7.14	326	19	8	43	4.6	2.5	0.14	0.10	0.016	0	193	22	5.1	5.2	0.36	0.28	54.2	80	0	237
32	393	Kok Trom Kha	7.12	574	45	19	67	4.8	0.1	0.53	0.43	0.019	0	376	46	4.8	3.1	0.23	0.29	67	192	0	398
33	401	Prey Phdau	6.66	217	7	4	37	2	3.6	0.37	0.24	0.008	0	128	45	1.2	4.1	0.04	0.37	72.4	34	0	195
34	401(F)	Prey Phdau	6.86	213	7	4	37	2.2	0.3	0.01	0.15	0.004	0	126	28	0.8	3.0	0.04	0.31	71.4	34	0	188
35	406	Prek Ta Sa	6.7	1060	46	26	144	3.4	6.6	1.70	1.80	0.017	0	205	65	224.6	38.0	0.23	0.3	59.6	220	52	652
36	406(F1)	Prek Ta Sa	7.9	850	41	14	130	5	0.03	0.00	0.37	0.008	0	160	3	174.8	31.1	4.78	0.38	30.7	158	27	511

Annex-4 Questionnaires for Monitoring Survey

Questionnaires for Monitoring Survey (I)

The Study on Groundwater Development in Southern Cambodia

Questionnaires for
Monitoring (1) for Five Sample Households

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1)Date: /   /   /   2)Name of Village: 3)Commune:

4)District: 5)Province:

6)Name of the head of sample family: (No.   )

7)Classification of the sample family: A   B   C   D   E
(Please circle one)

8)Name of Monitors:

*Classification of sample families: A: A family which lives near JICA well
B: A family which lives far from JICA well
C: A family which lives about between A&B type family
D: A family which is female-headed-household
E: A family which consists of only elder people

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1. After JICA hand pump was installed, did your source of income change?
If yes, how and why?

2. After JICA hand pump was installed, did the amount of water used in your family increase or decrease? Please tick in the brackets of water use purposes.

<u>Increased</u>		<u>Decreased</u>	
Drinking	[ ]	Drinking	[ ]
Cooking	[ ]	Cooking	[ ]
Washing	[ ]	Washing	[ ]
Bathing	[ ]	Bathing	[ ]
Water for animal	[ ]	Water for animal	[ ]
Agriculture	[ ]	Agriculture	[ ]
Others	[ ]	Others	[ ]

3. After the JICA hand pump was installed, did the places where you wash cloths and bath change? From where to where?

1.Washing clothes — If yes — before JICA HP ( )
After JICA HP ( )

2. Bathing — If yes — before JICA HP ( )
After JICA HP ( )

If you answered, you use JICA HP for washing and bathing, did the frequency of these activities increase?

If yes, before (times/day)
After (times/day)

4. What kind of attention do you pay while using JICA hand pump? (Please circle)

1. You don't do urination and defecation near the public well.
2. You avoid livestock from the public well.
3. You don't dump garbage near the public well.
4. You don't sprinkle water near the public well.
5. You don't hang out the washing on the hand pump.
6. Is there any other attention? If yes, please specify:

[ ]

5. Where do you dispose litter?

6. Where do you dispose excrement?

7. Which water does your family like better for drinking? [Please choose best 3]

		No.1	No.2	No.3
1.	Rainwater	[ ]	[ ]	[ ]
2.	Water of ponds	[ ]	[ ]	[ ]
3.	Water of River	[ ]	[ ]	[ ]
4.	Water of lake	[ ]	[ ]	[ ]
5.	Water of dug well	[ ]	[ ]	[ ]
6.	Water of JICA hand pump	[ ]	[ ]	[ ]
7.	Water of bore-hole by other organization	[ ]	[ ]	[ ]

8. After hygiene education by JICA team, when does your family wash your hands?

1.	After defecation	[yes : no]
2.	Before eating	[yes : no]
3.	After eating	[yes : no]
4.	Before cooking	[yes : no]
5.	After working	[yes : no]
6.	After touching livestock	[yes : no]

9. After hygiene education by JICA team, what does your family use for washing hands?

1. Water only [yes : no]
2. Soap [yes : no]
3. Ash [yes : no]
4. Rice bran [yes : no]
5. Other[please specify what you use] [ ]

10. After hygiene education by JICA team, does your family have different water containers for drinking and washing hands?

[yes : no]

11. After hygiene education by JICA team, how does your family drink water from the vessel for dipping water from jar?

Drink directly from the vessel [yes : no]
Drink after boiling the water [yes : no]
In other ways [yes : no]
Specify [ ]

12. After hygiene education by JICA team, does your family put a cover on the jar?

[yes : no]

13. After hygiene education by JICA team, how many times does your family wash inside of jars per month?

[times]

14. Is hygiene education helping you to understand how to secure safe water?

(1) yes
(In what way? <e.g. putting cover on the jar, etc.>)
(2) no

15. Is hygiene education helping you to improve your hygiene conditions?

(1) yes
(In what way? <e.g. improvement of health condition, etc.>)
(2) no

16. **How many times does your family have diarrhea per year? How long does it usually last?**

Babies(0-3 years old)	Children(4-12)	Youths& Adults(13-)
Baby 1 [Age:] [times] [M / F] [days] Baby 2[Age:] [times] [M / F] [days] Baby 3[Age:] [times] [M / F] [days]	Child 1[Age:] [times] [M / F] [days] Child 2[Age:] [times] [M / F] [days] Child 3[Age:] [times] [M / F] [days] Child 4[Age:] [times] [M / F] [days] Child 5[Age:] [times] [M / F] [days]	Adult1 [Age:] [times] [M / F] [days] Adult2[Age:] [times] [M / F] [days] Adult3[Age:] [times] [M / F] [days] Adult4[Age:] [times] [M / F] [days] Adult5[Age:] [times] [M / F] [days]

17. **Apart from diarrea, which diseases did your family have for past one year?**

Babies[0-3 years old]	Children[4-12]	Adults[13-]
Baby 1 [Age:] [ ] [days] Baby 2[Age:] [ ] [days] Baby 3[Age:] [ ] [days] . .	Child 1[Age:] [ ] [days] Child 2[Age:] [ ] [days] Child 3[Age:] [ ] [days] Child 4[Age:] [ ] [days] Child 5[Age:] [ ] [days]	Adult1 [Age:] [ ] [days] Adult2[Age:] [ ] [days] Adult3[Age:] [ ] [days] Adult4[Age:] [ ] [days]. Adult5[Age:] [ ] [days]

18. Please name the organizations that any of your family members belong to.

- [ ]
- [ ]

19. Do you know the activity of

1. Village Development Committee [yes : no]
2. Village Water Committee [yes : no]
3. Water Point Committee [yes : no]

20. Do you participate in the activity of

1. Village Development Committee [yes : no]
2. Village Water Committee [yes : no]
3. Water Point Committee [yes : no]

If yes, which activities do you participate in?

[ ]

21. Are you willing to participate in village communal activities?

[yes : no]

*If **No**, why?*

[ ]

22. Which actual water sources does your family use most <u>after the installation of JICA hand pump</u>? [Please select 3 sources which you use most. Select sources from <u>rain: pond: river: lake: dug well: buy water: other hand pumps and JICA hand pump</u>]

(1) Drinking

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

(2) Cooking

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

(3) Washing

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

(4) Others

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

23. If your family does not use JICA hand pump for drinking, why not?

[ ]

24. How many times a day <u>does</u> your family go to <u>traditional water sources</u> to fetch water?

Dry season [times a day]
Rainy season [times a day]

25. How many times a day <u>does</u> your family go to <u>JICA hand pump</u> to fetch water?

Dry season [times a day]
Rainy season [times a day]

26. Who is in charge of fetching and carrying water?

<u>**Before** JICA hand pump was installed</u> [Age:] [Male : Female]
<u>**After** JICA hand pump was installed</u> [Age:] [Male : Female]

27. Do you think that, after JICA hand pump was installed, more women fetch and carry water?

Yes [   ]
No [   ]

If yes, do you think it gives women more burden (more work)?

Yes [   ]
No [   ]

28. How is the distance to JICA hand pump (in minutes)? [min   ]

29. How is the distance to other water sources (in minutes)? [min   ]

30. Do you still buy water after JICA hand pump was installed?
[yes : no]

If ***Yes***, why?
[   ]

31. Do you think the new JICA hand pump has improved your life in terms of water use and other aspects? [yes : no]

1) If ***YES***, what are <u>good things</u>?
[   ]

2) If ***NO***, what are <u>not-good things</u>?
[   ]

3) If ***NO***, how do you think it is improved?

[ ]

32. Does your family think that VWC and WPC are functioning very well?

Yes ( ) No ( )

If no, what are problems?

( )

33. Any other comments on JICA hand pump or the Project (good things, problems, needs, etc.)

ការសិក្សាដើម្បីការអភិវឌ្ឍន៍ទឹកក្រោមដីភាគខាងត្បូងនៃប្រទេសកម្ពុជា

សំនួរសំរាប់

ការអង្កេត(១)លើគ្រួសារគំរូ ៥

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១). ថ្ងៃ: / / / ២). ឈ្មោះភូមិ: ៣). ឃុំ :

៤). ស្រុក : ៥).ខេត្ត :

៦). ឈ្មោះមេគ្រួសារគំរូ :

៧). ចំណាត់ថ្នាក់នៃគ្រួសារគំរូ : A B C D E
(សូមគូសរង្វង់លើអក្សរតែមួយ)

៨). ឈ្មោះអ្នកអង្កេត :

* ចំណាត់ថ្នាក់នៃគ្រួសារគំរូ : A : គ្រួសារដែលរស់នៅជិតអណ្តូងរបស់អង្គការ ឆៃកា (JICA)
B : គ្រួសារដែលរស់នៅឆ្ងាយពីអណ្តូងរបស់អង្គការ ឆៃកា (JICA)
C : គ្រួសារដែលរស់នៅរវាង គ្រួសារ (A) និង គ្រួសារ (B)
D : គ្រួសារដែលមានស្ត្រីជាមេគ្រួសារ
E : គ្រួសារដែលមានតែមនុស្សចាស់

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១) ក្រោយពីអណ្តូងស្នប់ឆៃការបានតំឡើងរួច តើប្រភពចំណូលរបស់លោកអ្នកផ្លាស់ប្តូរដែរឬទេ ?
ប្រសិនបើផ្លាស់ប្តូរ តើដោយរបៀបណា ព្រោះអ្វី ?

២) ក្រោយពីអណ្តូងស្អប់នៃការបានតំឡើងរួច តើបរិមាណទឹកលោកអ្នកប្រើប្រាស់ក្នុងគ្រួសារ កើនឡើង ឬ ថយចុះ ?
ចូរគូសក្នុងរង្វង់ក្រចកនៃតារាខាងក្រោម ។

<u>កើនឡើង</u>		<u>ថយចុះ</u>	
បរិភោគ	[ ]	បរិភោគ	[ ]
ចំអិនអាហារ	[ ]	ចំអិនអាហារ	[ ]
បោកគក់	[ ]	បោកគក់	[ ]
ងូត	[ ]	ងូត	[ ]
ទឹកសំរាប់សត្វពាហនៈ	[ ]	ទឹកសំរាប់សត្វពាហនៈ	[ ]
កសិកម្ម	[ ]	កសិកម្ម	[ ]
ផ្សេងៗ	[ ]	ផ្សេងៗ	[ ]

៣) ក្រោយពីអណ្តូងស្អប់នៃការបានតំឡើងរួច តើកន្លែងដែលអ្នកបោកគក់ និង ងូត ផ្លាស់ប្តូរឬទេ ?
ពីកន្លែងណាទៅកន្លែងណា ?

ក- បោកគក់ ប្រសិនបើមាន ពីមុន អណ្តូងស្អប់របស់នៃការ ( )
ក្រោយពី អណ្តូងស្អប់របស់នៃការ ( )

ខ- ងូត ប្រសិនបើមាន ពីមុន អណ្តូងស្អប់របស់នៃការ ( )
ក្រោយពី អណ្តូងស្អប់របស់នៃការ ( )

ប្រសិនបើផ្លាស់ប្តូរលោកអ្នក ប្រើប្រាស់ អណ្តូងស្អប់របស់នៃការសំរាប់បោកគក់ និង ងូត មានភាពញឹកញាប់ឬទេ?
ប្រសិនបើ ញឹកញាប់ ពីមុន (ប៉ុន្មានដង/មួយថ្ងៃ)
ក្រោយពី (ប៉ុន្មានដង/មួយថ្ងៃ)

៤) មានការប្រុងប្រយ័ត្នអ្វីខ្លះ លោកអ្នកនៅពេលដែលអ្នកប្រើប្រាស់ អណ្តូងស្អប់របស់អង្គការនៃការ?
ចូររង្វង់លេខខាងក្រោម :

ក-មិនត្រូវបត់ជើងតូច និងបត់ជើងធំ នៅក្បែរអណ្តូងសាធារណៈ ។

ខ-ការពារសត្វពាហនៈមិនអោយមកក្បែរអណ្តូងសាធារណៈ។

គ-មិនចោលសំរាមក្បែរអណ្តូងសាធារណៈ។

ឃ-មិនជះទឹក ក្បែរអណ្តូងសាធារណៈ។

ង-មិនហាលខោអាវលើអណ្តូងស្នប់សាធារណៈ។

ច-តើមានការយកចិត្តទុកដាក់ណាផ្សេងទៀតទេ ? បើមាន សូមអធិប្បាយ

( )

៥) តើប្រភពទឹកអ្វីគ្រួសាររបស់លោកអ្នកចូលចិត្តសំរាប់បរិភោគជាងគេ ? (ចូរជ្រើសរើសចំនួន ៣)

	លេខ១	លេខ ២	លេខ៣
ក-ទឹកភ្លៀង	[ ]	[ ]	[ ]
ខ-ទឹកស្រះ ឬ ត្រពាំង	[ ]	[ ]	[ ]
គ-ទឹកព្រែក ឬ ទន្លេ	[ ]	[ ]	[ ]
ឃ-ទឹកបឹង	[ ]	[ ]	[ ]
ង-ទឹកអណ្តូងលូ	[ ]	[ ]	[ ]
ច-ទឹកអណ្តូងខួងឆែការ	[ ]	[ ]	[ ]
ឆ-ទឹកអណ្តូងខួងដោយអង្គការផ្សេងទៀត	[ ]	[ ]	[ ]

៦) ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការឆែការហើយ តើគ្រួសារលោកអ្នកដុសលាងដៃនៅពេលណា ?

ក-ក្រោយពេលបត់ជើងរួច [ចាស់ / បាទ : ទេ]

ខ-មុនពេលបរិភោគ [ចាស់ / បាទ : ទេ]

គ-ក្រោយពេលបរិភោគ [ចាស់ / បាទ : ទេ]

ឃ-មុនពេលចំអិនអាហារ [ចាស់ / បាទ : ទេ]

ង-ក្រោយពេលបំពេញការងារ [ចាស់ / បាទ : ទេ]

ច-ក្រោយពេលប៉ះពាល់សត្វពាហនៈ [ចាស់ / បាទ : ទេ]

៧) ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការឆែការហើយតើគ្រួសារលោកអ្នកប្រើប្រាស់អ្វីសំរាប់លាងដៃ?

ក-តែទឹកមួយមុខ [ចាស់ / បាទ : ទេ]

ខ-សាប៊ូ [ចាស់ / បាទ : ទេ]

គ-ផេះ [ចាស់ / បាទ : ទេ]

ឃ-អង្កាម [ចាស់ / បាទ : ទេ]

ង-ផ្សេងៗទៀត (រៀបរាប់តែអ្វីដែលលោកអ្នកប្រើប្រាស់) [ ]

៨) ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការនៃការហើយ តើគ្រួសាររបស់លោកអ្នកមានពាងទឹកសំរាប់បរិភោគ និងជុសលាងផ្សេងពីគ្នាឬទេ ? (បាទ ទេ)

៩) ក្រោយពីទទួលការអប់រំអនាម័យពីអង្គការនៃការហើយ តើលោកអ្នកបរិភោគទឹកដែលដងចេញពីពាងយ៉ាងដូចម្តេចដែរ ?

ហូបទឹកក្នុងផ្តិលផ្ទាល់	[ចាស់ / បាទ : ទេ]
ហូបទឹកក្រោយពេលចំអិន	[ចាស់ / បាទ : ទេ]
ដោយវិធីផ្សេងៗ	[ចាស់ / បាទ : ទេ]
បញ្ជាក់	[ ]

១០) ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការនៃការហើយ តើគ្រួសាររបស់លោកអ្នកមានធ្វើកំរបពាងឬទេ?

(បាទ ទេ)

១១) ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការនៃការហើយ តើគ្រួសាររបស់លោកអ្នកលាងសំអាតពាងប៉ុន្មានដងក្នុងមួយខែ ? (ដង)

១២) តើការអប់រំអនាម័យបានជួយអោយលោកអ្នកបានយល់ពីការប្រើប្រាស់ទឹកប្រកបដោយសុវត្ថភាពឬទេ?

ក-បាទ [ក្នុងមធ្យោបាយណាមួយ (ដូចជា ការប្រើកំរបគ្របពាង)

]

ខ-ទេ

១៣) តើការអប់រំអនាម័យបានជួយអោយស្ថានភាពអនាម័យរបស់លោកអ្នកប្រសើរឡើងដែរឬទេ?

ក-បាទ [ក្នុងមធ្យោបាយណាមួយ (ដូចជា ភាពប្រសើរឡើងនៃសុខមាលភាព)

]

ខ-ទេ

១៤) ទើក្នុងគ្រួសាររបស់លោកអ្នកមានកើតជំងឺរាគរូសប៉ុន្មានដងក្នុងមួយឆ្នាំ ? ហើយវាបន្ទាយរយៈពេលប៉ុន្មានដែរ ?

កូនង៉ែត (០៣ឆ្នាំ)	កូនក្មេង (៤-១២)	ជំទង់ និង ពេញវ័យ (១៣-)
	ក្មេង ១ [អាយុ :] [ដង]	
កូនង៉ែត១ [អាយុ :] [ដង]	[ស្រី / ប្រុស] [ថ្ងៃ]	ពេញវ័យ ១ [អាយុ :] [ដង]
[ស្រី / ប្រុស] [ថ្ងៃ]	ក្មេង ២ [អាយុ :] [ដង]	[ស្រី / ប្រុស] [ថ្ងៃ]
កូនង៉ែត២ [អាយុ :] [ដង]	[ស្រី / ប្រុស] [ថ្ងៃ]	ពេញវ័យ ២ [អាយុ :] [ដង]
[ស្រី / ប្រុស] [ថ្ងៃ]	ក្មេង ៣ [អាយុ :] [ដង]	[ស្រី / ប្រុស] [ថ្ងៃ]
កូនង៉ែត៣ [អាយុ :] [ដង]	[ស្រី / ប្រុស] [ថ្ងៃ]	ពេញវ័យ ៣ [អាយុ :] [ដង]
[ស្រី / ប្រុស] [ថ្ងៃ]	ក្មេង ៤ [អាយុ :] [ដង]	[ស្រី / ប្រុស] [ថ្ងៃ]
	[ស្រី / ប្រុស] [ថ្ងៃ]	ពេញវ័យ ៤ [អាយុ :] [ដង]
	ក្មេង ៥ [អាយុ :] [ដង]	[ស្រី / ប្រុស] [ថ្ងៃ]
		ពេញវ័យ ៥ [អាយុ :] [ដង]
		[ស្រី / ប្រុស] [ថ្ងៃ]

១៥) ក្រៅពីជំងឺរាគរូសតើគ្រួសារលោកអ្នក មានកើតជំងឺអ្វីផ្សេងទៀតទេកាលពីមួយឆ្នាំមុន ?

កូនង៉ែត (០៣ឆ្នាំ)	កូនក្មេង (៤-១២)	ជំទង់ និង ពេញវ័យ (១៣-)
	ក្មេង ១ [អាយុ :] [ ]	
កូនង៉ែត១ [អាយុ :] [ ]	[ថ្ងៃ]	ពេញវ័យ ១ [អាយុ :] [ ]
[ថ្ងៃ]	ក្មេង ២ [អាយុ :] [ ]	[ថ្ងៃ]
កូនង៉ែត២ [អាយុ :] [ ]	[ថ្ងៃ]	ពេញវ័យ ២ [អាយុ :] [ ]
[ថ្ងៃ]	ក្មេង ៣ [អាយុ :] [ ]	[ថ្ងៃ]
កូនង៉ែត៣ [អាយុ :] [ ]	[ថ្ងៃ]	ពេញវ័យ ៣ [អាយុ :] [ ]
[ថ្ងៃ]	ក្មេង ៤ [អាយុ :] [ ]	[ថ្ងៃ]
	[ថ្ងៃ]	ពេញវ័យ ៤ [អាយុ :] [ ]
	ក្មេង ៥ [អាយុ :] [ ]	[ថ្ងៃ]
	[ថ្ងៃ]	ពេញវ័យ ៥ [អាយុ :] [ ]
		[ថ្ងៃ]

១៦) សុំរៀបរាប់ឈ្មោះអង្គការដែលមាននរណាម្នាក់ក្នុងគ្រួសារលោកអ្នកជាសមាជិករបស់អង្គការនោះ ?

■ [ ]

■ [ ]

១៧) តើលោកដឹងអំពីសកម្មភាព របស់:

១. គណៈកម្មាធិការអភិវឌ្ឍន៍ភូមិ [ចាស់ / បាទ : ទេ]

២. គណៈកម្មាធិការទឹកភូមិ [ចាស់ / បាទ : ទេ]

៣. គណៈកម្មាធិការចំណុចអណ្តូង [ចាស់ / បាទ : ទេ]

១៨) តើលោកអ្នកចូលរួមក្នុងសកម្មភាពរបស់ :

១. គណៈកម្មាធិការអភិវឌ្ឍន៍ភូមិ [ចាស់ / បាទ : ទេ]

២. គណៈកម្មាធិការទឹកភូមិ [ចាស់ / បាទ : ទេ]

៣. គណៈកម្មាធិការចំណុចអណ្តូង [ចាស់ / បាទ : ទេ]

ប្រសិនបើឆ្លើយ, ចាស់ / បាទ, តើសកម្មភាពមួយណាដែលអ្នកចូលរួម ?

[ ]

១៩) តើលោកអ្នកមានឆន្ទៈចង់ ចូលរួមក្នុងសកម្មភាពរបស់សហគមន៍ភូមិដែរឬទេ ?

[ចាស់ / បាទ : ទេ]

ប្រសិនបើឆ្លើយ, ទេ, ហេតុអ្វី ?

[ ]

២០) តើប្រភពទឹកអ្វីដែលគ្រួសារលោកអ្នកប្រើប្រាស់ច្រើនជាងគេ<u>ក្រោយពេលសាងសង់អណ្តូងស្នប់របស់អង្គការផែនការ</u> (សូមជ្រើសរើសតែប្រភពទឹក ៣ ដែលគ្រួសារលោកអ្នកប្រើប្រាស់ច្រើនជាងគេ ។ ប្រភពទឹកមាន : <u>ទឹកភ្លៀង ស្រះ, ត្រពាំង ស្ទឹង ទន្លេ បឹង អណ្តូងលូ ទិញទឹក ទឹកអណ្តូងស្នប់ផ្សេងៗ និង អណ្តូងស្នប់ផែនការ</u>)

(១) ទឹកផឹក

១. រដូវវស្សា [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២. រដូវប្រាំង [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

(២) ដាំស្ល

១. រដូវវស្សា [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២. រដូវប្រាំង [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

(៣) បោកគក់

១. រដូវវស្សា [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២. រដូវប្រាំង [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

(៤) ផ្សេងៗ

១. រដូវវស្សា [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២. រដូវប្រាំង [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២១) ប្រសិនបើគ្រួសារលោកអ្នកមិនប្រើប្រាស់អណ្តូងស្នប់របស់ រ៉ៃការ សំរាប់ផឹក ហេតុអ្វី ?

[ ]

២២) តើក្នុងមួយថ្ងៃប៉ុន្មានដង ដែលគ្រួសារលោកអ្នកទៅប្រភពទឹកបុរាណដើម្បីដួសទឹក ?

រដូវប្រាំង [ដង / ថ្ងៃ]

រដូវវស្សា [ដង / ថ្ងៃ]

២៣) តើក្នុងមួយថ្ងៃប៉ុន្មានដង ដែលគ្រួសារលោកអ្នកទៅអណ្តូងស្នប់រ៉ៃការដើម្បីដួសទឹក ?

រដូវប្រាំង [ដង / ថ្ងៃ]

រដូវវស្សា [ដង / ថ្ងៃ]

២៤) តើអ្នកណាជាអ្នកទទួលដួសទឹក និង យូទឹក ?

មុនពេលអណ្តូងស្នប់រ៉ៃការបានជីក [អាយុ :][ប្រុស : ស្រី]

ក្រោយពេលអណ្តូងស្នប់រ៉ៃការបាជនីក [អាយុ :][ប្រុស : ស្រី]

២៥) តើអ្នកគិតថាក្រោយពីអណ្តូងស្នប់តំលើងហើយ ស្ត្រីនៅតែជាអ្នកដងទឹកដដែលឬ ?

បាទ [ ]

ទេ [ ]

ប្រសិនបើបាទ អ្នកគិតថាជាបន្ទុករបស់ស្ត្រីថែមទៀតឬ (ការងារបន្ថែម)

បាទ [ ]

ទេ [ ]

២៥) តើចំងាយប៉ុន្មានទៅអណ្តូងស្នប់នៃការ (ជានាទី)

[នាទី]

២៦) តើចំងាយប៉ុន្មានទៅប្រភពទឹកដ៏ទៃទៀត ?

[នាទី]

២៧) តើអ្នកនៅតែទិញទឹកក្រោយពីអណ្តូងស្នប់នៃការបានសាងសង់រួច ?

[បាទ. ទេ]

ប្រសិនបើទិញហេតុអ្វី ? [ ]

២៨) តើលោកអ្នកគិតថាអណ្តូងស្នប់អង្គការនៃការ បានធ្វើឱ្យជីវភាព នឹងស្ថានភាពដ៏ទៃទៀតរបស់លោកអ្នកប្រសើរឡើងដែរឬទេ ?

[បាទ. ទេ]

ក) ប្រសិនបើឆ្លើយ បាទ តើអ្វីដែលល្អ ? [ ]

ខ) ប្រសិនបើ ទេ តើអ្វីដែលមិនល្អ ? [ ]

គ) ប្រសិនបើ ទេ តើលោកអ្នកគិតថាធ្វើឱ្យប្រសើរឡើងដោយរបៀបណា ?

[ ]

២៩) តើគ្រួសាររបស់លោកអ្នកគិតថា គទភ និង គអទ ដំណើរការបានល្អដែរឬទេ ?

[បាទ. ទេ]

ប្រសិនបើទេ តើអ្វីដែលជាបញ្ហា ?

[ ]

៣០) តើមានយោបល់ណាមួយចំពោះអណ្តូងស្នប់នៃការ ឬ គំរោងនេះដែរឬទេ ?

[អ្វីដែលល្អ បញ្ហាអ្វី សេចក្តីត្រូវការអ្វី ។ល។]

The Study on Groundwater Development in Southern Cambodia

Questionnaire for Monitoring (1) on VWC and WPC

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1)Date: / / /   2)Name of Village: 3)Commune:

4)District: 5)Province:

6)Name of VWC and WPC members:

a. Chairperson (VWC):
b. Secretary(VWC):
c. Accountant(VWC):
d. Caretaker 1(WPC):
e. Caretaker 2(WPC):
f. Caretaker 3(WPC):
g. Caretaker 4(WPC):

7)Name of Monitors:

---

1. Actual number of user registered ( ) (Check the notebook)

If increased, why ( )
If decreased, why ( )

2. Have activities been appropriately recorded? Yes ( ) (Check the notebook)
No ( )

3. Have VWC/WPC collected money for repair from users?

If yes, how much/family? ( )
How many times ? ( )
How did you collect? ( )
How did you use them? ( )
How do/did you keep money?( )
How much money do you keep now? ( )

4. When did you collect money from users, what kind of problems did you have?

5. How many times did you hold meetings among VWC/WPC and with users in the past one year?

VWC	(	)
WPC	(	)
Users	(	)

6. How often do you hold meetings?

VWC	(	) time(s) per month
WPC	(	) time(s) per month
Users	(	) time(s) per month

7. How is the attendance situation of the committee members?

8. What kind of activities have you been doing in the past one year?

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

9. **What kind of good things did you do for hand pump maintenance?**

No.	Name	Response
1	**Chairperson**	
2	**Secretary**	
3	**Accountant**	
4	**Caretaker 1**	
5	**Caretaker 2**	
6	**Caretaker 3**	
7	**Caretaker 4**	

10. **What are/were the problems you have/had faced in terms of hand pump maintenance?**

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

11. What kind of support did you receive from users and/or other organizations (commune, district, province and central government)?

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

12. Do you think that you have changed, in any sense, since you have been selected as VWC/WPC members?

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

13. Are/were there any problems in the village or among hand pump users in terms of JICA hand pump?

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

14. Any other opinions, if any.

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

ការសិក្សាដើម្បីការអភិវឌ្ឍន៍ទឹកក្រោមដីភាគខាងត្បូងនៃប្រទេសកម្ពុជា

តារាងសំនួរសំរាប់អង្កេតលើ គណៈកម្មាធិការទឹកភូមិ និង

គណៈកម្មាធិការចំណុចអណ្តូង

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១). ថ្ងៃទី :　/　/　/　　២). ឈ្មោះភូមិ :　　៣) ឃុំ :

៤). ស្រុក :　　៥). ខេត្ត :

៦). ឈ្មោះរបស់គណៈកម្មាធិការទឹកភូមិ និង ជាសមាជិក :

ប្រធាន (គណៈកម្មាធិការទឹកភូមិ)

ក. លេខា (គណៈកម្មាធិការទឹកភូមិ)

ល. គណនេយ្យ (គណៈកម្មាធិការទឹកភូមិ)

ឃ. អ្នកថែរក្សា ១ (គណៈកម្មាធិការចំណុចអណ្តូង)

ង. អ្នកថែរក្សា ២ (គណៈកម្មាធិការចំណុចអណ្តូង)

ច. អ្នកថែរក្សា ៣ (គណៈកម្មាធិការចំណុចអណ្តូង)

ឆ. អ្នកថែរក្សា ៤ (គណៈកម្មាធិការចំណុចអណ្តូង)

៧). ឈ្មោះអ្នកអង្កេត :

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១) ចំនួនអ្នកប្រើប្រាស់ពិតប្រាកដ ដែលបានចុះឈ្មោះ (　　) (ពិនិត្យក្នុងសៀវភៅកំណត់ត្រា)

ប្រសិនកើន ហេតុអ្វី (　　)

ប្រសិននៅដដែល ហេតុអ្វី (　　)

ប្រសិនថយចុះ ហេតុអ្វី (　　)

២) សកម្មភាពទាំងនេះត្រូវបានកត់ត្រា ត្រឹមត្រូវឬទេ ? បាទ (　) (ពិនិត្យក្នុងសៀវភៅកំណត់សំគាល់)

ទេ (　)

៣) តើ ក.ទ.ភ/ក.អ.ទ បានប្រមូលថវិការពីអ្នកប្រើប្រាស់ឬទេ ?

ប្រសិនបើបាន . ចំនួនប៉ុន្មាន/១គ្រួសារ ? ( )

ប៉ុន្មានដង ? ( )

ប្រមូលដោយវិធីណា ? ( )

ប្រើប្រាស់ថវិការនេះរបៀបណា ? ( )

រក្សាថវិការនេះយ៉ាងដូម្តេច ? ( )

បច្ចុប្បន្នអ្នករក្សាថវិការបានចំនួនប៉ុន្មាន ? ( )

៤) អ្នកបានប្រមូលថវិការពីអ្នកប្រើប្រាស់នៅពេលណា ហើយអ្នកមានបញ្ហាអ្វីខ្លះ ?

៥) តើអ្នកបានប្រជុំ ជាមួយ គ.ទ.ភ /គ.អ.ទ ព្រមទាំងអ្នកប្រើប្រាស់ ប៉ុន្មានដងកាលពីមួយឆ្នាំមុន ?

គ.ទ.ភ ( )

គ.អ.ទ ( )

អ្នកប្រើប្រាស់ ( )

៦) តើអ្នកបានប្រជុំជាញឹកញាប់ទេ?

គ.ទ.ភ ( ) ប៉ុន្មានដង/មួយខែ

គ.អ.ទ ( ) ប៉ុន្មានដង/មួយខែ

អ្នកប្រើប្រាស់ ( ) ប៉ុន្មានដង/មួយខែ

៧) តើក៏រិតចំនួនសមាជិកគណៈកម្មការចូលរួមមានប៉ុន្មាន ?

៨) តើសកម្មភាពអ្វីខ្លះអ្នកបានធ្វើកាលពីមួយឆ្នាំកន្លងមក ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

៩) តើវត្ថុបំណាងល្អអ្វីខ្លះ ដែលអ្នកបានធ្វើការថែរក្សាស្ងប់?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

១០) តើមានបញ្ហាអ្វីខ្លះដែលអ្នកបានជួបប្រទះក្នុងការថែរក្សាស្នប់ ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

១១) តើការផ្គត់ផ្គង់អ្វីខ្លះអ្នកបានទទួលពីអ្នកប្រើប្រាស់ ឬ អង្គការផ្សេងទៀត? ដូចជា ថ្នាក់ឃុំ ថ្នាក់ស្រុក មន្ទីរអភិវឌ្ឍន៍ខេត្ត ឬ ថ្នាក់ជាតិ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

១២) តើអ្នកគិតថាមានការផ្លាស់ប្តូរ ក្នុងគំនិតណាមួយឬទេ ចាប់តាំងពីអ្នកបានត្រូវជ្រើសរើសជា សមាជិក គ.ទ.ភ/គ.អ.ទ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

១៣) តើមានបញ្ហាអ្វីខ្លះនៅក្នុងភូមិ ក្នុងចំណោមអ្នកប្រើប្រាស់អណ្ដូងស្នប់របស់អងការ ឆែការ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

១៤) តើមានមតិអ្វីខ្លះទេ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

JICA Hand Pump Participatory Monitoring Sheet

(To be filled in by Provincial Staff, VWC / WPC with the participation of users)

Date: **Name of Village:** **Commune:**

District: **Province:** **Well No:**

Population of Village: **No. of users (No. of family):**

Construction Date: / / **HP Type:** **Mark III (** **)** **Afridev (** **)**

Names of Monitors:

1. **Hand Pump :**

Items	Good	Not Good	Remarks
Pump Condition			
Yield			
Function			
Lubrication			
Easiness of use			
Hand pump tool kit			
Water Use Purpose			Dry season Drinking ( ) Washing ( ) Cooking ( ) Others ( )
			Rainy season Drinking ( ) Washing ( ) Cooking ( ) Others ( )
Accessibility (physical and social)			
Overall evaluation by users			
Additional Observation:			

2. **Platform :** (The height of embankment: 0cm 10cm 20cm 30cm)
(No. of entrance: 2 3)

Items	Good	Not Good	Remarks
Platform Condition			
Drainage			
Wall			
Entrance			
Easiness of maintenance			
Overall evaluation by users			
Additional Observation			

3. **Iron Reduce Device (IRD):** (Existence of IRD: Yes No)

Items	Good	Not Good	Remarks
IRD condition			
Function			
Easiness of use			
Easiness of maintenance			
Overall evaluation by users			
Additional Observation			

4. **Well Environment:**

Items	Good	Not Good	Remarks
Around the drainage			
Inside of the platform			
Around the platform			
Overall evaluation by users			
Additional Observation			

5. **Water Quality:**

Items	Good	Not Good	Remarks
Taste			If not good: Iron ( ) Salty ( ) Flat taste ( )
Smell			
Color			
Additional Observation			

6. **Operation and Maintenance (O&M):**

Items	Good	Not Good	Remarks
O&M system in place			
Availability of funds for O&M			
Availability of spare parts			
Function and skills of Water Point Committee			
Additional Observation			

7. **Technical Intervention by Level:**

Levels	Date	Activities	Remarks
Central (MRD)			
Provincial (PDRD)			
District			
Commune			
Additional Observation			

8. **Other Opinions and/or Comments on JICA Hand Pump**

តារាងត្រួតពិនិត្យអង្កេតមើលអណ្តូងស្នប់របស់អង្គការ JICA
ដែលបានចូលរួម(បំពេញដោយមន្ត្រីខេត្ត, VWC/WPC
ជាមួយអ្នកប្រើប្រាស់ដែលបានចូលរួម)

ថ្ងៃ.ខែ.ឆ្នាំ : ឈ្មោះភូមិ : ឃុំ :

ស្រុក : ខេត្ត : លេខអណ្តូង :

ប្រជាជនក្នុងភូមិ : ចំនួនអ្នកប្រើ :

ថ្ងៃ.ខែ តំលើងស្នប់ : / / ប្រភេទស្នប់ : ឥណ្ឌាម៉ាក III ( ) អាហ្វ្រីដេហ្វ ( )

ឈ្មោះអ្នកអង្កេត :

១. ស្នប់ :

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
លក្ខខណ្ឌស្នប់			
ទិន្នផល			
មុខងារ			
ការដាក់ខ្លាញ់			
ស្រួលប្រើ			
ឧបករណ៍សំរាប់ដោះស្នប់			
គោលបំណងនៃការប្រើប្រាស់ទឹក			រដូវប្រាំង ផឹក ( ) បោកគោក ( ) ដាំស្លរ ( ) ផ្សេងៗ ( ) រដូវវស្សា ផឹក ( ) បោកគោក ( ) ដាំស្លរ ( ) ផ្សេងៗ ( )
ដំណើរការទៅបាន			
ការវាយតំលៃជាទូទៅរបស់អ្នកប្រើប្រាស់			
ការត្រួតពិនិត្យបន្ថែម :			

២. ផែនអណ្តូង : (កំពស់ដីសំរាប់ធ្វើផែនអណ្តូង : 0cm 10cm 20cm 30cm)

(ចំនួនច្រកចូល : ២ ៣)

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
លក្ខណ័នៃផែនអណ្តូង			
ចង្អូរ			
ខឿនអណ្តូង			
ច្រកចូល			
ភាពងាយស្រួលនៃការថែទាំ			
ការវាយតំលៃជារួមរបស់អ្នកប្រើប្រាស់			
ការត្រួតពិនិត្យបន្ថែម :			

៣. អាងច្រោះជាតិដែក (មានរឺ អត់ បាទ ទេ)

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
លក្ខណ័នៃអាងច្រោះជាតិដែក			
មុខងារ			
ភាពងាយស្រួលក្នុងការប្រើប្រាស់			
ភាពងាយស្រួលនៃការថែទាំ			
ការវាយតំលៃជារួមរបស់អ្នកប្រើប្រាស់			
ការត្រួតពិនិត្យបន្ថែម :			

៤. បរិស្ថានជុំវិញអណ្តូង ៖

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
ជុំវិញចង្ហូរទឹក			
នៅខាងក្នុងផែនអណ្តូង			
ជុំវិញផែនអណ្តូង			
ការវាយតំលៃជារូមរបស់អ្នកប្រើប្រាស់			

ការត្រួតពិនិត្យបន្ថែម ៖

៥. គុណភាពទឹក ៖

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
រសជាតិ			
ក្លិន			
ពណ៌			

ការត្រួតពិនិត្យបន្ថែម ៖

៦. ការអនុវត្តន៏ និង ការថែទាំ :

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
ប្រព័ន្ធនៃការអនុវត្តន៏ និង ការថែទាំនៅកន្លែង			
ការរកថវិការសំរាប់ ការអនុវត្តន៏ និង ការថែទាំ			
ការរកគ្រឿងបន្លាស់			
មុខនាទីនិងជំនាញរបស់គណៈកម្មការអណ្តូងទឹក			
ការត្រួតពិនិត្យបន្ថែម :			

៧. ក៏រិតនៃការធ្វើអន្តរាគមន៏ផ្នែកបច្ចេកទេស :

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
មជ្ឈមណ្ឌលកណ្តាល(ក្រសួងអភិវឌ្ឍន៏ជនបទ)			
មន្ទីរអភិវឌ្ឍន៏ជនបទ			
ស្រុក			
ឃុំ			
ការត្រួតពិនិត្យពន្ថែម :			

៨. ទស្សនៈ និង មតិផ្សេង ៗ ស្តីអំពីអណ្តូងស្នប់របស់អង្គការ JICA

Questionnaires for Monitoring Survey (II)

The Study on Groundwater Development in Southern Cambodia

Questionnaires for
Monitoring (2) for Five Sample Households

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1)Date: / / / 2)Name of Village: 3)Commune:

4)District: 5)Province:

6)Name of the head of sample family: (No.)

7)Classification of the sample family: A B C D E
(Please circle one)

8)Name of Monitors:

*Classification of sample families: A: A family which lives near JICA well
B: A family which lives far from JICA well
C: A family which lives about between A&B type family
D: A family which is female-headed-household
E: A family which consists of only elder people

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1. After JICA hand pump was installed, did your source of income change?
If yes, how and why?

2. After JICA hand pump was installed, did the amount of water used in your family increase or decrease? Please tick in the brackets of water use purposes.

Increased		Decreased	
Drinking	[ ]	Drinking	[ ]
Cooking	[ ]	Cooking	[ ]
Washing	[ ]	Washing	[ ]
Bathing	[ ]	Bathing	[ ]
Water for animal	[ ]	Water for animal	[ ]
Agriculture	[ ]	Agriculture	[ ]
Others	[ ]	Others	[ ]

3. After the JICA hand pump was installed, did the places where you wash cloths and bath change? From where to where?

1.Washing clothes If yes before JICA HP ( )
After JICA HP ( )

2. Bathing If yes before JICA HP ( )
After JICA HP ( )

If you answered, you use JICA HP for washing and bathing, did the frequency of these activities increase?

If yes, before (times/day)
After (times/day)

4. What kind of attention do you pay while using JICA hand pump? (Please circle)

1. You don't do urination and defecation near the public well.
2. You avoid livestock from the public well.
3. You don't dump garbage near the public well.
4. You don't sprinkle water near the public well.
5. You don't hang out the washing on the hand pump.
6. Is there any other attention? If yes, please specify:

[ ]

5. Where do you dispose litter?

6. Where do you dispose excrement?

7. Which water does your family like better for drinking? [Please choose best 3]

		No.1	No.2	No.3
1.	Rainwater	[ ]	[ ]	[ ]
2.	Water of ponds	[ ]	[ ]	[ ]
3.	Water of River	[ ]	[ ]	[ ]
4.	Water of lake	[ ]	[ ]	[ ]
5.	Water of dug well	[ ]	[ ]	[ ]
6.	Water of JICA hand pump	[ ]	[ ]	[ ]
7.	Water of bore-hole by other organization	[ ]	[ ]	[ ]
8.	private hand pump	[ ]	[ ]	[ ]
9.	town water	[ ]	[ ]	[ ]

8. After hygiene education by JICA team, when does your family wash your hands?

1.	After defecation	[yes : no]
2.	Before eating	[yes : no]
3.	After eating	[yes : no]
4.	Before cooking	[yes : no]
5.	After working	[yes : no]
6.	After touching livestock	[yes : no]

9. After hygiene education by JICA team, what does your family use for washing hands?

1. Water only [yes : no]
2. Soap [yes : no]
3. Ash [yes : no]
4. Rice bran [yes : no]
5. Other[please specify what you use] [ ]

10. Does your family have different water containers for drinking and washing hands?

(Before hygiene education was provided by JICA)

[yes : no]

(After hygiene education was provided by JICA)

[yes : no]

11. How does your family drink water from the vessel for dipping water from jar?

(Before hygiene education was provided by JICA)

Drink directly from the vessel [yes : no]
Drink after boiling the water [yes : no]
In other ways [yes : no]
Specify [ ]

(After hygiene education was provided by JICA)

Drink directly from the vessel [yes : no]
Drink after boiling the water [yes : no]
In other ways [yes : no]
Specify [ ]

12. If you drink water without boiling even after hygiene education, please give reasons.

( )

13. Does your family put a cover on the jar?

(Before hygiene education was provided by JICA)

[yes : no]

(After hygiene education was provided by JICA)

[yes : no]

14. How many times does your family wash inside of jars per month?
(Before hygiene education was provided by JICA)
[times]
(After hygiene education was provided by JICA)
[times]

15. Is hygiene education helping you to understand how to secure safe water?
(1) yes
(In what way? <e.g. putting cover on the jar, etc.>)
(2) no

16. Is hygiene education helping you to improve your hygiene conditions?
(1) yes
(In what way? <e.g. improvement of health condition, etc.>)
(2) no

17. Did you receive hygiene education before? [yes : no]

18. Do you want to receive hygiene education more? [yes : no]
If yes, how often do you want to receive hygiene education? ___time(s)/month・year

19. What kind of knowledge/information would you like to acquire regarding hygiene?
( )

20. How many times does your family have diarrhea per year? How long does it usually last?

Babies(0-3 years old)	Children(4-12)	Youths& Adults(13-)
Baby 1 [Age:] [times] [M / F] [days] Baby 2[Age:] [times] [M / F] [days] Baby 3[Age:] [times] [M / F] [days]	Child 1[Age:] [times] [M / F] [days] Child 2[Age:] [times] [M / F] [days] Child 3[Age:] [times] [M / F] [days] Child 4[Age:] [times] [M / F] [days] Child 5[Age:] [times] [M / F] [days]	Adult1 [Age:] [times] [M / F] [days] Adult2[Age:] [times] [M / F] [days] Adult3[Age:] [times] [M / F] [days] Adult4[Age:] [times] [M / F] [days] Adult5[Age:] [times] [M / F] [days]

21. Apart from diarrea, which diseases did your family have for past one year?

Babies[0-3 years old]	Children[4-12]	Adults[13-]
Baby 1 [Age:] [ ] [days] Baby 2[Age:] [ ] [days] Baby 3[Age:] [ ] [days] . .	Child 1[Age:] [ ] [days] Child 2[Age:] [ ] [days] Child 3[Age:] [ ] [days] Child 4[Age:] [ ] [days] Child 5[Age:] [ ] [days]	Adult1 [Age:] [ ] [days] Adult2[Age:] [ ] [days] Adult3[Age:] [ ] [days] Adult4[Age:] [ ] [days]. Adult5[Age:] [ ] [days]

22. Are there any illness or disease prevalent in your village now?

( ) Yes   ( ) No

If yes, what are they? (   )

23. Please name the organizations that any of your family members belong to.

- [   ]
- [   ]

24. Do you know the activity of

1. Village Development Committee [yes : no]
2. Village Water Committee [yes : no]
3. Water Point Committee [yes : no]

25. Do you participate in the activity of

1. Village Development Committee [yes : no]
2. Village Water Committee [yes : no]
3. Water Point Committee [yes : no]

If yes, which activities do you participate in?

[   ]

26. Are you willing to participate in village communal activities?

[yes : no]

*If **No**, why?*

[   ]

27. Which actual water sources does your family use most after the installation of JICA hand pump? [Please select 3 sources which you use most. Select sources from rain: pond: river: lake: dug well: buy water: other hand pumps and JICA hand pump]

(1) Drinking

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

(2) Cooking

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

(3) Washing

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

(4) Others

1. Rainy season [No. 1 ( ), No.2 ( ), No.3 ( )]
2. Dry season [No. 1 ( ), No.2 ( ), No.3 ( )]

28. If your family does not use JICA hand pump for drinking, why not?

[ ]

29. How many times a day does your family go to traditional water sources to fetch water?

Dry season [times a day]
Rainy season [times a day]

30. How many times a day does your family go to JICA hand pump to fetch water?

Dry season [times a day]
Rainy season [times a day]

31. Who is in charge of fetching and carrying water?

<u>**Before** JICA hand pump was installed</u> [Age:] [Male : Female]
<u>**After** JICA hand pump was installed</u> [Age:] [Male : Female]

32. Do you think that, after JICA hand pump was installed, more women fetch and carry water?

Yes [ ]
No [ ]

If yes, do you think it gives women more burden (more work)?

Yes [ ]
No [ ]

33. How is the distance to JICA hand pump (in minutes)? [min]

34. How is the distance to other water sources (in minutes)? [min]

35. Do you still buy water after JICA hand pump was installed?
[yes : no]

If ***Yes***, why?
[ ]

36. Do you think the new JICA hand pump has improved your life in terms of water use and other aspects? [yes : no]

1) If ***YES***, what are <u>good things</u>?
[ ]

2) If ***NO***, what are <u>not-good things</u>?
[ ]

3) If ***NO***, how do you think it is improved?

[ ]

37. Does your family think that VWC and WPC are functioning very well?

Yes ( ) No ( )

If no, what are problems?

( )

38. Any other comments on JICA hand pump or the Project (good things, problems, needs, etc.)

ការសិក្សាដើម្បីការអភិវឌ្ឍន៍ទឹកក្រោមដីភាគខាងត្បូងនៃប្រទេសកម្ពុជា

សំនួរសំរាប់

ការអង្កេត(២)លើគ្រួសារគំរូ ៥

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១). ថ្ងៃ: / / / ២). ឈ្មោះភូមិ: ៣). ឃុំ :

៤). ស្រុក : ៥).ខេត្ត :

៦). ឈ្មោះមេគ្រួសារគំរូ :

៧). ចំណាត់ថ្នាក់នៃគ្រួសារគំរូ : A B C D E
(សូមគូសរង្វង់លើអក្សរតែមួយ)

៨). ឈ្មោះអ្នកអង្កេត :

* ចំណាត់ថ្នាក់នៃគ្រួសារគំរូ : A : គ្រួសារដែលរស់នៅជិតអណ្តូងរបស់អង្គការ ជៃកា (JICA)
B : គ្រួសារដែលរស់នៅឆ្ងាយពីអណ្តូងរបស់អង្គការ ជៃកា (JICA)
C : គ្រួសារដែលរស់នៅរវាង គ្រួសារ (A) និង គ្រួសារ (B)
D : គ្រួសារដែលមានស្ត្រីជាមេគ្រួសារ
E : គ្រួសារដែលមានតែមនុស្សចាស់

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១) ក្រោយពីអណ្តូងស្នប់ជៃកាបានតំឡើងរួច តើប្រភពចំណូលរបស់លោកអ្នកផ្លាស់ប្តូរដែរឬទេ ?
ប្រសិនបើផ្លាស់ប្តូរ តើដោយរបៀបណា ព្រោះអ្វី ?

២) ក្រោយពីអណ្តូងស្នប់នៃកាបានតំឡើងរួច តើបរិមាណទឹកលោកអ្នកប្រើប្រាស់ក្នុងគ្រួសារ កើនឡើង ឫ ថយចុះ ?
ចូរគូសក្នុងវង់ក្រចកនៃតារាងខាងក្រោម :

<u>កើនឡើង</u>		<u>ថយចុះ</u>	
បរិភោគ	[ ]	បរិភោគ	[ ]
ចំអិនអាហារ	[ ]	ចំអិនអាហារ	[ ]
បោកគក់	[ ]	បោកគក់	[ ]
ងូត	[ ]	ងូត	[ ]
ទឹកសំរាប់សត្វពាហនៈ	[ ]	ទឹកសំរាប់សត្វពាហនៈ	[ ]
កសិកម្ម	[ ]	កសិកម្ម	[ ]
ផ្សេងៗ	[ ]	ផ្សេងៗ	[ ]

៣) ក្រោយពីអណ្តូងស្នប់នៃការបានតំឡើងរួច តើកន្លែងដែលអ្នកបោកគក់ និង ងូត ផ្លាស់ប្តូរឬទេ ?
ពីកន្លែងណាទៅកន្លែងណា ?

ក- បោកគក់ ប្រសិនបើមាន ពីមុន អណ្តូងស្នប់របស់នៃកា ( )
ក្រោយពី អណ្តូងស្នប់របស់នៃកា ( )

ខ- ងូត ប្រសិនបើមាន ពីមុន អណ្តូងស្នប់របស់នៃកា ( )
ក្រោយពី អណ្តូងស្នប់របស់នៃកា ( )

ប្រសិនបើផ្លាស់ប្តូរលោកអ្នក ប្រើប្រាស់ អណ្តូងស្នប់របស់នៃកាសំរាប់បោកគក់ និង ងូត មានភាពញឹកញាប់ឬទេ?
ប្រសិនបើញឹកញាប់ ពីមុន (ប៉ុន្មានដង/មួយថ្ងៃ)
ក្រោយពី (ប៉ុន្មានដង/មួយថ្ងៃ)

៤) មានការប្រុងប្រយ័ត្នអ្វីខ្លះ លោកអ្នកនៅពេលដែលអ្នកប្រើប្រាស់ អណ្តូងស្អប់របស់អង្គការផែកា?

ចូរគូសរង្វង់លេខខាងក្រោម :

ក-មិនត្រូវបត់ជើងតូច និងបត់ជើងធំ នៅក្បែរអណ្តូងសាធាណៈ។

ខ-ការពារសត្វពាហនៈមិនអោយមកក្បែរអណ្តូងសាធារណៈ។

គ-មិនចោលសំរាមក្បែរអណ្តូងសាធារណៈ។

ឃ-មិនជះទឹក ក្បែរអណ្តូងសាធារណៈ។

ង-មិនហាលខោអាវលើអណ្តូងស្អប់សាធារណៈ។

ច-តើមានការយកចិត្តទុកដាក់ណាផ្សេងទៀតទេ ? បើមាន សូមអធិប្បាយ

( )

៥) តើលោកអ្នកចាក់សំរាមចោលនៅឯណា?

៦) តើលោកអ្នកចាក់លាមកសត្វចោលនៅឯណា?

៧) តើប្រភពទឹកអ្វីគ្រួសាររបស់លោកអ្នកចូលចិត្តសំរាប់បរិភោគជាងគេ ? (ចូរជ្រើសរើសចំនួន ៣)

	លេខ១	លេខ ២	លេខ៣
១. ទឹកភ្លៀង	[ ]	[ ]	[ ]
២. ទឹកស្រះ ឬ ត្រពាំង	[ ]	[ ]	[ ]
៣. ទឹកព្រែក ឬ ទន្លេ	[ ]	[ ]	[ ]
៤. ទឹកបឹង	[ ]	[ ]	[ ]
៥. ទឹកអណ្តូងលូ	[ ]	[ ]	[ ]
៦. ទឹកអណ្តូងខួងផែកា	[ ]	[ ]	[ ]
៧. ទឹកអណ្តូងខួងដោយអង្គការផ្សេងទៀត	[ ]	[ ]	[ ]
៨. អណ្តូងស្អប់ឯកជន	[ ]	[ ]	[ ]
៩. ទឹកម៉ាស៊ីន	[ ]	[ ]	[ ]

៨) ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការផែកាហើយ តើគ្រួសារលោកអ្នកដុសលាងដៃនៅពេលណា ?

១. ក្រោយពេលបត់ជើងរួច [ចាស់ / បាទ : ទេ]

២. មុនពេលបរិភោគ [ចាស់ / បាទ : ទេ]

៣. ក្រោយពេលបរិភោគ [ចាស៎ / បាទ : ទេ]

៤. មុនពេលចំអិនអាហារ [ចាស៎ / បាទ : ទេ]

៥. ក្រោយពេលបំពេញការងារ [ចាស៎ / បាទ : ទេ]

៦. ក្រោយពេលប៉ះពាល់សត្វពាហនៈ [ចាស៎ / បាទ : ទេ]

៩) ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការឆៃកាហើយតើគ្រួសារលោកអ្នកប្រើប្រាស់អ្វីសំរាប់លាងដៃ?

១. តែទឹកមួយមុខ [ចាស៎ / បាទ : ទេ]

២. សាប៊ូ [ចាស៎ / បាទ : ទេ]

៣. ផេះ [ចាស៎ / បាទ : ទេ]

៤. អង្កាម [ចាស៎ / បាទ : ទេ]

៥. ផ្សេង១ទៀត (រៀបរាប់តែអ្វីដែលលោកអ្នកប្រើប្រាស់) [ ]

១០) តើគ្រួសារលោកអ្នកមានពាងទឹកសំរាប់ផឹក និងដុសលាងដៃផ្សេងគ្នារឺទេ?

-(មុនពីទទួលការអប់រំអនាម័យពី អង្គការឆៃកា) (បាទ ទេ)

-(ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការឆៃកា) (បាទ ទេ)

១១) តើលោកអ្នកបរិភោគទឹកដែលដងចេញពីពាង យ៉ាងដូចម្តេចដែរ ?

-(មុនពីទទួលការអប់រំអនាម័យពីអង្គការឆៃកា)

ហូបទឹកក្នុងផ្តិលផ្ទាល់ [ចាស៎ / បាទ : ទេ]

ហូបទឹកក្រោយពេលចំអិន [ចាស៎ / បាទ : ទេ]

ដោយវិធីផ្សេង១ [ចាស៎ / បាទ : ទេ]

បញ្ជាក់ [ ]

-(ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការឆៃកា)

ហូបទឹកក្នុងផ្តិលផ្ទាល់ [ចាស៎ / បាទ : ទេ]

ហូបទឹកក្រោយពេលចំអិន [ចាស៎ / បាទ : ទេ]

ដោយវិធីផ្សេង១ [ចាស៎ / បាទ : ទេ]

បញ្ជាក់ [ ]

១២) ចូរបញ្ជាក់មូលហេតុ ប្រសិនបើលោកអ្នកផឹកទឹកមិនដាំពុះបន្ទាប់ពីទទួលការអប់រំអនាម័យមក

(   )

១៣) តើគ្រួសាររបស់លោកអ្នកមានធ្វើកំរបពាងឬទេ?

-មុនពីទទួលការអប់រំអនាម័យពី អង្គការ នៃកាហើយ

(បាទ   ទេ)

-ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការ នៃកាហើយ

(បាទ   ទេ)

១៤) តើគ្រួសាររបស់លោកអ្នកលាងសំអាតពាងប៉ុន្មានដងក្នុងមួយខែ ?

-មុនពីទទួលការអប់រំអនាម័យពី អង្គការ នៃកាហើយ   (ដង)

-ក្រោយពីទទួលការអប់រំអនាម័យពី អង្គការ នៃកាហើយ   (ដង)

១៥) តើការអប់រំអនាម័យបានជួយអោយលោកអ្នក បានយល់ពីការប្រើប្រាស់ទឹកប្រកបដោយសុវត្ថិភាពឬទេ?

ក-បាទ [ក្នុងមធ្យោបាយណាមួយ (ដូចជា ការប្រើកំរបគ្របពាង)]

ខ-ទេ [   ]

១៦) តើការអប់រំអនាម័យបានជួយអោយស្ថានភាពអនាម័យរបស់លោកអ្នកប្រសើរឡើងដែរឬទេ?

ក-បាទ [ក្នុងមធ្យោបាយណាមួយ (ដូចជា ភាពប្រសើរឡើងនៃសុខមាលភាព]

ខ-ទេ [   ]

១៧) ពីមុនលោកអ្នកមានបានទទួលការអប់រំអនាម័យរឺទេ? (បាទ : ចាស់)

១៨) តើលោកអ្នកចង់បានទទួលការអប់រំអនាម័យថែមទៀតរឺទេ? (បាទ : ចាស់)

ប្រសិនបើបាទ តើប៉ុន្មានដងលោកអ្នកចង់បានទទួលការអប់រំអនាម័យថែមទៀតនេះ?

-ដង/ខែ- ឆ្នាំ

១៩) តើចំណេះដឹង រឺពត៌មានអ្វីចង់បានបន្ថែមអំពីការអប់រំអនាម័យនេះ?

(   )

២០) តើក្នុងគ្រួសាររបស់លោកអ្នកមានកើតជំងឺរាគរូស ប៉ុន្មានដងក្នុងមួយឆ្នាំ? ហើយវាអូសបន្លាយរយៈពេលប៉ុន្មានដែរ ?

កូនង៉ែត (០៣ឆ្នាំ)	កូនក្មេង (៤-១២)	ជំទង់ និង ពេញវ័យ (១៣-)
កូនង៉ែត១ [អាយុ :] [ដង]	ក្មេង ១ [អាយុ :] [ដង]	ពេញវ័យ ១ [អាយុ :] [ដង]
[ស្រី / ប្រុស] [ថ្ងៃ]	[ស្រី / ប្រុស] [ថ្ងៃ]	[ស្រី / ប្រុស] [ថ្ងៃ]
កូនង៉ែត២ [អាយុ :] [ដង]	ក្មេង ២ [អាយុ :] [ដង]	ពេញវ័យ ២ [អាយុ :] [ដង]
[ស្រី / ប្រុស] [ថ្ងៃ]	[ស្រី / ប្រុស] [ថ្ងៃ]	[ស្រី / ប្រុស] [ថ្ងៃ]
កូនង៉ែត៣ [អាយុ :] [ដង]	ក្មេង ៣ [អាយុ :] [ដង]	ពេញវ័យ ៣ [អាយុ :] [ដង]
[ស្រី / ប្រុស] [ថ្ងៃ]	[ស្រី / ប្រុស] [ថ្ងៃ]	[ស្រី / ប្រុស] [ថ្ងៃ]
	ក្មេង ៤ [អាយុ :] [ដង]	ពេញវ័យ ៤ [អាយុ :] [ដង]
	[ស្រី / ប្រុស] [ថ្ងៃ]	[ស្រី / ប្រុស] [ថ្ងៃ]
	ក្មេង ៥ [អាយុ :] [ដង]	ពេញវ័យ ៥ [អាយុ :] [ដង]
		[ស្រី / ប្រុស] [ថ្ងៃ]

២១) ក្រៅពីជំងឺរាគរូសតើគ្រួសារលោកអ្នក មានកើតជំងឺអ្វីផ្សេងទៀតទេកាលពីមួយឆ្នាំមុន ?

កូនង៉ែត (០៣ឆ្នាំ)	កូនក្មេង (៤-១២)	ជំទង់ និង ពេញវ័យ (១៣-)
	ក្មេង ១ [អាយុ :] [ ]	
កូនង៉ែត១ [អាយុ :] [ ]	[ថ្ងៃ]	ពេញវ័យ ១ [អាយុ :] [ ]
[ថ្ងៃ]	ក្មេង ២ [អាយុ :] [ ]	[ថ្ងៃ]
កូនង៉ែត២ [អាយុ :] [ ]	[ថ្ងៃ]	ពេញវ័យ ២ [អាយុ :] [ ]
[ថ្ងៃ]	ក្មេង ៣ [អាយុ :] [ ]	[ថ្ងៃ]
កូនង៉ែត៣ [អាយុ :] [ ]	[ថ្ងៃ]	ពេញវ័យ ៣ [អាយុ :] [ ]
[ថ្ងៃ]	ក្មេង ៤ [អាយុ :] [ ]	[ថ្ងៃ]
	[ថ្ងៃ]	ពេញវ័យ ៤ [អាយុ :] [ ]
	ក្មេង ៥ [អាយុ :] [ ]	[ថ្ងៃ]
	[ថ្ងៃ]	ពេញវ័យ ៥ [អាយុ :] [ ]
		[ថ្ងៃ]

២២) តើបច្ចុប្បន្ននេះ ជាទូទៅនៅក្នុងភូមិមានជំងឺរីទេ?

( ) បាទ   ( ) ទេ

ប្រសិនមាន តើជំងឺអ្វី? (   )

២៣) សុំរៀបរាប់ឈ្មោះ អង្គការដែលមាននរណាម្នាក់ក្នុងគ្រួសារលោកអ្នក ជាសមាជិករបស់អង្គការនោះ ?

■ [   ]
■ [   ]

២៤) តើលោកដឹងអំពីសកម្មភាពរបស់:

១. គណៈកម្មាធិការអភិវឌ្ឍន៍ភូមិ [ចាស់ / បាទ : ទេ]

២. គណៈកម្មាធិការទឹកភូមិ [ចាស់ / បាទ : ទេ]

៣. គណៈកម្មាធិការចំណុចអណ្តូង [ចាស់ / បាទ : ទេ]

២៥) តើលោកអ្នកចូលរួមក្នុងសកម្មភាពរបស់ :

១. គណៈកម្មាធិការអភិវឌ្ឍន៍ភូមិ [ចាស់ / បាទ : ទេ]

២. គណៈកម្មាធិការទឹកភូមិ [ចាស់ / បាទ : ទេ]

៣. គណៈកម្មាធិការចំណុចអណ្តូង [ចាស់ / បាទ : ទេ]

ប្រសិនបើឆ្លើយ, ចាស់ / បាទ, តើសកម្មភាពមួយណាដែលអ្នកចូលរួម ?

[   ]

២៦) តើលោកអ្នកមានឆន្ទៈចង់ចូលរួមក្នុងសកម្មភាពរបស់សហគមន៍ភូមិដែរឬទេ ?

[ចាស់ / បាទ : ទេ]

ប្រសិនបើឆ្លើយ, ទេ, ហេតុអ្វី ?

[   ]

២៧) តើប្រភពទឹកអ្វីដែលគ្រួសារលោកអ្នកប្រើប្រាស់ច្រើនជាងគេ ក្រោយពេលសាងសង់អណ្តូងស្នប់របស់អង្គការផែកា? (សូមជ្រើសរើសតែប្រភពទឹក ៣ ដែលគ្រួសារលោកអ្នកប្រើប្រាស់ច្រើនជាងគេ។ ប្រភពទឹកមាន : ទឹកភ្លៀង, ស្រះ, ត្រពាំង, ស្ទឹង, ទន្លេ, បឹង, អណ្តូងលូ, ទិញទឹក ទឹកអណ្តូងស្នប់ផ្សេងៗ និង អណ្តូងស្នប់របស់ផែកា)

(១) ទឹកផឹក

១. រដូវវស្សា [ទី១ (   ), ទី២ (   ), ទី៣ (   )]

២. រដូវប្រាំង [ទី១ (   ), ទី២ (   ), ទី៣ (   )]

(២) ដាំស្លរ

១. រដូវវស្សា [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២. រដូវប្រាំង [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

(៣) បោកគក់

១. រដូវវស្សា [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២. រដូវប្រាំង [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

(៤) ផ្សេងៗ

១. រដូវវស្សា [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២, រដូវប្រាំង [ទី១ ( ), ទី២ ( ), ទី៣ ( )]

២៨). ប្រសិនបើគ្រួសារលោកអ្នកមិនប្រើប្រាស់អណ្តូងស្នប់របស់ផែកា សំរាប់ផឹក, ហេតុអ្វី ?

[ ]

២៩) តើក្នុងមួយថ្ងៃប៉ុន្មានដង ដែលគ្រួសារលោកអ្នកទៅ<u>ប្រភពទឹកបុរាណ</u>ដើម្បីដួសទឹក ?

រដូវប្រាំង [ដង / ថ្ងៃ]

រដូវវស្សា [ដង / ថ្ងៃ]

៣០) តើក្នុងមួយថ្ងៃប៉ុន្មានដងដែលគ្រួសារលោកអ្នកទៅដួសទឹកពី<u>អណ្តូងស្នប់របស់អង្គការផែកា</u> ?

រដូវប្រាំង [ដង / ថ្ងៃ]

រដូវវស្សា [ដង / ថ្ងៃ]

៣១). តើអ្នកណាជាអ្នកទទួលដួសទឹក និង យួទឹក ?

<u>មុនពេលអណ្តូងស្នប់ផែកាបានជីក</u> [អាយុ :][ប្រុស : ស្រី]

ក្រោយពេលអណ្តូងស្នប់នៃការបាជនីក [អាយុ :   ][ប្រុស   :   ស្រី]

៣២) តើអ្នកគិតថា បន្ទាប់ពីអណ្តូងនៃកាតំឡើងហើយ ស្ត្រីនៅតែដងទឹកដដែលរឺ?

បាទ ( )

ទេ ( )

ប្រសិនបើបាទ/ចាស់ តើអ្នកគិតថា វានៅតែជាបន្ទុករបស់ស្ត្រីថែមទៀតរឺ?

បាទ ( )

ទេ ( )

៣៣) តើចំងាយប៉ុន្មានទៅអណ្តូងនៃកា (នាទី)? (នាទី)

៣៤) តើចំងាយប៉ុន្មានទៅប្រភពទឹកដីទៃ (នាទី)? (នាទី)

៣៥) តើលោកអ្នកនៅតែទិញទឹកទេ បន្ទាប់អណ្តូងនៃកាសាងសង់ហើយ?

(បាទ : ទេ)

ប្រសិនបាទ ហេតុអ្វី? (   )

៣៦) សំនួរទី ១២. តើលោកអ្នកគិតថា អណ្តូងស្នប់របស់អង្គការនៃកា បានធ្វើឱ្យលោកអ្នកមានជីវិតប្រសើរឡើង ដូចជាការប្រើប្រាស់ទឹក និងបញ្ហាផ្សេងទៀត ? (បាទ : ទេ)

១). ប្របើឆ្លើយ ចាស់/បាទ, តើអ្វីដែលល្អ ?

[   ]

២). ប្រសិនបើឆ្លើយ ទេ, តើអ្វីដែលមិនល្អ ?

[   ]

៣). ប្រសិនបើឆ្លើយ ទេ, តើលោកអ្នកគិតថាវាធ្វើឱ្យប្រសើឡើងដែរឬទេ ?

[   ]

៣៧) តើគ្រួសារលោកអ្នកគិតថា គណៈកម្មាធិការអណ្តូងទឹក និង គណៈកម្មាធិការចំណុចអណ្តូង មានដំណើរការល្អទេ?

បាទ (   ) ទេ(   )

ប្រសិនបើទេ តើបញ្ហាអ្វី? (   )

៣៨) តើមានយោបល់ណាមួយចំពោះអណ្តូងស្នប់ ឬ គំរោងនេះដែរទេ ?

The Study on Groundwater Development in Southern Cambodia

Questionnaire for Monitoring (2) on VWC and WPC

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1)Date: / / / 2)Name of Village: 3)Commune:

4)District: 5)Province:

6)Name of VWC and WPC members:

a. Chairperson (VWC): Name( )[M/F] Age( ) Occupation( )
b. Secretary(VWC): Name( )[M/F] Age( ) Occupation( )
c. Accountant(VWC): Name( )[M/F] Age( ) Occupation( )
d. Caretaker 1(WPC): Name( )[M/F] Age( ) Occupation( )
e. Caretaker 2(WPC): Name( )[M/F] Age( ) Occupation( )
f. Caretaker 3(WPC): Name( )[M/F] Age( ) Occupation( )
g. Caretaker 4(WPC): Name( )[M/F] Age( ) Occupation( )

7)Name of Monitors:

1.User registration (check the notebook)

1)Actual number of households registered as hand pump user ( )

2)Actual number of population registered as hand pump user ( )

If increased, why ( )

If decreased, why ( )

3)Total number of households in the village ( )

4)Total population of the village ( )

2. Have activities been appropriately recorded? Yes ( ) (Check the notebook)
No ( )

3. Have VWC/WPC collected money for repair from users?

If yes, how much/family? ( )
How many times ? ( )
How did you collect? ( )

How did you use them? ( )

How do/did you keep money?( )

How much money do you keep now? ( )

4. What is your opinion about collecting money regularly for future repair from hand pump users? Do you agree to pay?

Yes( ) No ( )

If no, why? ( )

5. If money is collected for future repair, how much are you willing to pay?

( ) Riel per month

6. When did you collect money from users, what kind of problems did you have?

7. How many times did you hold meetings among VWC/WPC and with users in the past one year?

VWC ( ) time(s)

WPC ( ) time(s)

Users ( ) time(s)

8. How often do you hold meetings?

VWC ( ) time(s) per __month(s)

WPC ( ) time(s) per __month(s)

Users ( ) time(s) per __month(s)

9. How is the attendance situation of the committee members?

Chairperson __time(s)/___time(s)

Secretary __time(s)/___time(s)

Accountant __time(s)/___time(s)

Caretaker 1 __time(s)/___time(s)

Caretaker 2 __time(s)/___time(s)

Caretaker 3 __time(s)/___time(s)

Caretaker 4 __time(s)/___time(s)

10. **How many percent of attendants were users in the last meeting?** (%)

11. **How many percent of attendants are women in the last meeting?** (%)

12. What is the major topic discussed in last meeting? (multiple answers are acceptable.)

( )problems of daily operation & maintenance ( )user fee

( )price of user fee ( )others (what?)

13. What is the major opinions or complaints of men's users and women's users?

Men:

a. b. c.

Women:

a. b. c.

14. Do you hope that more women become members of VWC/WPC?

Yes (reason :)

No (reason :)

15. If "Yes", what are your desirable charges for women?

Chairperson(Yes or No), Secretary(Yes or No), Accountant(Yes or No), Caretaker(Yes or No)

And how many women should be joining in VWC/WPC?

1 person 2 persons 3 persons 4 persons more than 5 persons

16. Do you know where to contact in case that hand pump is broken?

Yes( ) No ( )

17. What kind of activities have you been doing in the past one year? Were you actively engaged in those activities?

No.	Name	Activities	Participation
1	**Chairperson**		( )Very active ( )Active ( )Average ( )Not active If case you are not active, why? ( )
2	**Secretary**		( )Very active ( )Active ( )Average ( )Not active If case you are not active, why? ( )
3	**Accountant**		( )Very active ( )Active ( )Average ( )Not active If case you are not active, why? ( )
4	**Caretaker 1**		( )Very active ( )Active ( )Average ( )Not active If case you are not active, why? ( )
5	**Caretaker 2**		( )Very active ( )Active ( )Average ( )Not active If case you are not active, why? ( )
6	**Caretaker 3**		( )Very active ( )Active ( )Average ( )Not active If case you are not active, why? ( )
7	**Caretaker 4**		( )Very active ( )Active ( )Average ( )Not active If case you are not active, why? ( )

18. What kind of good things did you do for hand pump maintenance?

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

19. What are/were the problems you have/had faced in terms of hand pump maintenance?

No.	Name	Response	How are you going to solve those problems?	Request to PDRD
1	**Chairperson**			Are there any requests to the PDRD? Yes(reason:) No(reason:)
2	**Secretary**			Are there any requests to the PDRD? Yes(reason:) No(reason:)
3	**Accountant**			Are there any requests to the PDRD? Yes(reason:) No(reason:)
4	**Caretaker 1**			Are there any requests to the PDRD? Yes(reason:) No(reason:)
5	**Caretaker 2**			Are there any requests to the PDRD? Yes(reason:) No(reason:)
6	**Caretaker 3**			Are there any requests to the PDRD? Yes(reason:) No(reason:)
7	**Caretaker 4**			Are there any requests to the PDRD? Yes(reason:) No(reason:)

20. Do you think users are getting more cooperative for the hand pump maintenance than before?

Chairperson ( ) more cooperative ( ) less cooperative ( ) no change
( ) others ( )

Secretary ( ) more cooperative ( ) less cooperative ( ) no change
( ) others ( )

Accountant ( ) more cooperative ( ) less cooperative ( ) no change
( ) others ( )

Caretaker 1 ( ) more cooperative ( ) less cooperative ( ) no change
( ) others ( )

Caretaker 2 ( ) more cooperative ( ) less cooperative ( ) no change
( ) others ( )

Caretaker 3 ( ) more cooperative ( ) less cooperative ( ) no change
( ) others ( )

Caretaker 4 ( ) more cooperative ( ) less cooperative ( ) no change
( ) others ( )

21. What kind of support did you receive from users and/or other organizations (commune, district, province and central government)?

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

22. Do you think that you have changed, in any sense, since you have been selected as VWC/WPC members?

No.	Name	Response
1	**Chairperson**	( ) more responsible for the activities of the village ( ) more confident about myself ( ) villagers respect me more ( ) no change ( ) others
2	**Secretary**	( ) more responsible for the activities of the village ( ) more confident about myself ( ) villagers respect me more ( ) no change ( ) others
3	**Accountant**	( ) more responsible for the activities of the village ( ) more confident about myself ( ) villagers respect me more ( ) no change ( ) others
4	**Caretaker 1**	( ) more responsible for the activities of the village ( ) more confident about myself ( ) villagers respect me more ( ) no change ( ) others
5	**Caretaker 2**	( ) more responsible for the activities of the village ( ) more confident about myself ( ) villagers respect me more ( ) no change ( ) others
6	**Caretaker 3**	( ) more responsible for the activities of the village ( ) more confident about myself ( ) villagers respect me more ( ) no change ( ) others
7	**Caretaker 4**	( ) more responsible for the activities of the village ( ) more confident about myself ( ) villagers respect me more ( ) no change ( ) others

23. Are/were there any problems in the village or among hand pump users in terms of JICA hand pump?

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

24. Any other opinions, if any.

No.	Name	Response
1	Chairperson	
2	Secretary	
3	Accountant	
4	Caretaker 1	
5	Caretaker 2	
6	Caretaker 3	
7	Caretaker 4	

ការសិក្សាដើម្បីការអភិវឌ្ឍន៍ទឹកក្រោមដីភាគខាងត្បូងនៃប្រទេសកម្ពុជា

តារាងសំនួរសំរាប់អង្កេតលើ គណៈកម្មាធិការទឹកភូមិ និង គណៈកម្មាធិការចំណុចអណ្តូង

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១) ថ្ងៃទី : / / / ២) ឈ្មោះភូមិ : ៣) ឃុំ :

៤) ស្រុក : ៥) ខេត្ត :

៦) ឈ្មោះរបស់គណៈកម្មាធិការទឹកភូមិ និង ជាសមាជិក :

-ប្រធាន (គណៈកម្មាធិការទឹកភូមិ) ឈ្មោះ( ) ប្រុស-ស្រី អាយុ ( ) មុខងារ ( )

-លេខា (គណៈកម្មាធិការទឹកភូមិ) ឈ្មោះ( ) ប្រុស-ស្រី អាយុ ( ) មុខងារ ( )

-គណនេយ្យ (គណៈកម្មាធិការទឹកភូមិ) ឈ្មោះ( ) ប្រុស-ស្រី អាយុ ( ) មុខងារ ( )

-អ្នកថែរក្សា ១ (គណៈកម្មាធិការចំណុចអណ្តូង) ឈ្មោះ ( ) ប្រុស-ស្រី អាយុ ( ) មុខងារ ( )

-អ្នកថែរក្សា ២ (គណៈកម្មាធិការចំណុចអណ្តូង) ឈ្មោះ( ) ប្រុស-ស្រី អាយុ ( ) មុខងារ ( )

-អ្នកថែរក្សា ៣ (គណៈកម្មាធិការចំណុចអណ្តូង) ឈ្មោះ( ) ប្រុស-ស្រី អាយុ ( ) មុខងារ ( )

-អ្នកថែរក្សា ៤ (គណៈកម្មាធិការចំណុចអណ្តូង) ឈ្មោះ( ) ប្រុស-ស្រី អាយុ ( ) មុខងារ ( )

៧). ឈ្មោះអ្នកអង្កេត :

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១) បញ្ជីឈ្មោះអ្នកប្រើប្រាស (ពិនិត្យក្នុងសៀវភៅកំណត់ត្រា)

១.១ ចំនួនគ្រួសារពិប្រាកដដែលបានចុះឈ្មោះជាអ្នកប្រើប្រាស់ ( )

១.២ ចំនួនប្រជាជនពិប្រាកដដែលបានចុះឈ្មោះជាអ្នកប្រើប្រាស់ ( )

ប្រសិនកើន ហេតុអ្វី ( )

ប្រសិនថយចុះ ហេតុអ្វី ( )

១.៣ ចំនួនគ្រួសារសរុប ( )

១.៤ ចំនួនប្រជាជនសរុប ( )

២) សកម្មភាពទាំងនេះត្រូវបានកត់ត្រាត្រឹមត្រូវឬទេ ? បាទ ( ) (ពិនិត្យក្នុងសៀវភៅកំណត់សំគាល់)

ទេ ( )

៣) តើ គ.ទ.ភ/គ.អ.ទ បានប្រមូលថវិកាពីអ្នកប្រើប្រាស់ឬទេ ?

ប្រសិនបើទេ ហេតុអ្វី	(	)
ប្រសិនបើបាន, ចំនួនប៉ុន្មាន/១គ្រួសារ ?	(	)
ប៉ុន្មានដង?	(	)
ប្រមូលដោយវិធីណា ?	(	)
ប្រើប្រាស់ថវិកានេះរបៀបណា ?	(	)
រក្សាថវិការនេះយ៉ាងដូម្តេច ?	(	)
បច្ចុប្បន្នអ្នករក្សាថវិកាបានចំនួនប៉ុន្មាន ?	(	)

៤) តើលោកអ្នកមានមតិយ៉ាងណា អំពីការប្រមូលថវិកាអោយបានទៀងទាត់ ពីអ្នកប្រើប្រាស់សំរាប់ការជួសជុលស្នប់ ពេលខូចខាងមុខ? តើលោកអ្នកយល់ព្រមបង់ថវិការឺទេ?

( ) បាទ-ចាស់ ( ) ទេ

៥) តើលោកអ្នកនឹងអាចបង់បានប៉ុន្មានក្នុងមួយខែ? ប្រសិនបើថវិកានេះ ប្រមូលសំរាប់ការជួសជុលស្នប់ពេលខូចខាងមុខ?

( ) រៀល/ខែ

៦) តើលោកអ្នកមានបញ្ហាអ្វី ពេលលោកអ្នកប្រមូលថវិកាពីអ្នកប្រើប្រាស់?

៧) តើអ្នកបានប្រជុំជាមួយ គ.ទ.ភ /គ.អ.ទ ព្រមទាំងអ្នកប្រើប្រាស់ ប៉ុន្មានដងកាលពីមួយឆ្នាំមុន ?

គ.ទ.ភ	(	) ដង
គ.អ.ទ	(	) ដង
អ្នកប្រើប្រាស់	(	) ដង

៨) តើអ្នកបានប្រជុំជាញឹកញាប់ទេ?

គ.ទ.ភ	(	) ដង-ក្នុង	ខែ
គ.អ.ទ	(	) ដង-ក្នុង	ខែ
អ្នកប្រើប្រាស់	(	) ដង-ក្នុង	ខែ

៩) តើក៏រិតចំនួនសមាជិកគណៈកម្មការចូលរួមមានប៉ុន្មាន ?

-ប្រធាន ( ) ដង/ ដង

-លេខា ( ) ដង/ ដង

-គណនេយ្យ ( ) ដង/ ដង

-អ្នកថៃរក្សា ១ ( ) ដង/ ដង

-អ្នកថៃរក្សា ២ ( ) ដង/ ដង

-អ្នកថៃរក្សា ៣ ( ) ដង/ ដង

-អ្នកថៃរក្សា ៤ ( ) ដង/ ដង

១០) តើអ្នកប្រើប្រាស់ចំនួនប៉ុន្មានភាគរយ បានចូលរួមក្នុងអង្គប្រជុំចុងក្រោយ? (%)

១១) តើស្ត្រីចំនួនប៉ុន្មានភាគរយ បានចូលរួមក្នុងអង្គប្រជុំចុងក្រោយ? (%)

១២) តើក្នុងអង្គប្រជុំចុងក្រោយបាននិយាយអំពីបញ្ហាអ្វី?

( )បញ្ហាប្រើប្រាស់ និងថែក្សោប្រចាំថ្ងៃ ( )អំពីតំលៃប្រើប្រាស់( )តំលៃប្រើប្រាស់ប៉ុន្មាន

( )ផ្សេងៗ (អ្វី)

១៣) តើមតិភាគច្រើនរបស់បុរស និងស្ត្រីដែលជាអ្នកប្រើយ៉ាងដូចម្តេច?

បុរស

ក- ខ- គ-

ស្ត្រី

ក- ខ- គ-

១៤) តើលោកអ្នកគិតថាស្ត្រី នឹងក្លាយជាសមាជិករបស់គ.ទ.ភ/គ.អ.ទ ថែមទៀតរឺ?

បាទ (មូលហេតុ)

ទេ (មូលហេតុ)

១៥) ប្រសិនបើ ចាស់ តើការចំណង់របស់លោកអ្នកចំពោះស្ត្រីគឺអ្វី?

ប្រធាន(បាទ ចាស់) លេខា (បាទ ចាស់) បេឡា(បាទ ចាស់) អ្នកថែរក្សា (បាទ ចាស់)

១៦) តើមានស្ត្រីចំនួនប៉ុន្មានអ្នកនឹងចូលរួមក្នុង គ.ទ.ភ/គ.អ.ទ?

១នាក់ ២នាក់ ៣នាក់ ៤នាក់ ច្រើនជាង៥

១៧) ក្នុងករណីស្នប់ខូច លោកអ្នកដឹងទេ តើត្រូវទាក់ទងនៅឯណា?

បាទ / ចាស់( ) ទេ ( )

១៨) តើសកម្មភាពអ្វីខ្លះ ដែលអ្នកបានធ្វើកាលពីមួយឆ្នាំកន្លងមក ? តើលោកអ្នកចូលរួមយ៉ាងសកម្មក្នុងការងារនេះរឺទេ?

លេខរៀង	ឈ្មោះ	សកម្មភាព	ការចូលរួម
១	ប្រធាន		( )សកម្មខ្លាំង ( )សកម្ម ( )ធម្មតា ( )គ្មានសកម្មភាព ប្រសិនមិនចូលរួម ហេតុអ្វី? ( )
២	លេខា		( )សកម្មខ្លាំង ( )សកម្ម ( )ធម្មតា ( )គ្មានសកម្មភាព ប្រសិនមិនចូលរួម ហេតុអ្វី? ( )
៣	បេឡា		( )សកម្មខ្លាំង ( )សកម្ម ( )ធម្មតា ( )គ្មានសកម្មភាព ប្រសិនមិនចូលរួម ហេតុអ្វី? ( )
៤	អ្នកថែរក្សា ១		( )សកម្មខ្លាំង ( )សកម្ម ( )ធម្មតា ( )គ្មានសកម្មភាព ប្រសិនមិនចូលរួម ហេតុអ្វី? ( )
៥	អ្នកថែរក្សា ២		( )សកម្មខ្លាំង ( )សកម្ម ( )ធម្មតា ( )គ្មានសកម្មភាព ប្រសិនមិនចូលរួម ហេតុអ្វី? ( )
៦	អ្នកថែរក្សា ៣		( )សកម្មខ្លាំង ( )សកម្ម ( )ធម្មតា ( )គ្មានសកម្មភាព ប្រសិនមិនចូលរួម ហេតុអ្វី? ( )
៧	អ្នកថែរក្សា ៤		( )សកម្មខ្លាំង ( )សកម្ម ( )ធម្មតា ( )គ្មានសកម្មភាព ប្រសិនមិនចូលរួម ហេតុអ្វី? ( )

១៩) តើអ្នកបានធ្វើអ្វីខ្លះ ដែលល្អចំពោះការថែរក្សាស្តប់?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

២០) តើមានបញ្ហាអ្វីខ្លះដែលអ្នកបានជួបប្រទះក្នុងការថែរក្សាស្នប់ ?

លេខរៀង	ឈ្មោះ	ចំលើយ	តើដោះស្រាយបញ្ហានេះដូចម្តេច?	ការស្នើសុំទៅ PDRD
១	ប្រធាន			តើមានស្នើសុំទៅPDRDទេ? បាទ(មូលហេតុ) ទេ(មូលហេតុ)
២	លេខា			តើមានស្នើសុំទៅPDRDទេ? បាទ(មូលហេតុ) ទេ(មូលហេតុ)
៣	បេឡា			តើមានស្នើសុំទៅPDRDទេ? បាទ(មូលហេតុ) ទេ(មូលហេតុ)
៤	អ្នកថែរក្សា ១			តើមានស្នើសុំទៅPDRDទេ? បាទ(មូលហេតុ) ទេ(មូលហេតុ)
៥	អ្នកថែរក្សា ២			តើមានស្នើសុំទៅPDRDទេ? បាទ(មូលហេតុ) ទេ(មូលហេតុ)
៦	អ្នកថែរក្សា ៣			តើមានស្នើសុំទៅPDRDទេ? បាទ(មូលហេតុ) ទេ(មូលហេតុ)
៧	អ្នកថែរក្សា ៤			តើមានស្នើសុំទៅPDRDទេ? បាទ(មូលហេតុ) ទេ(មូលហេតុ)

២១) តើលោកអ្នកគិតថាអ្នកប្រើប្រាស់កាន់តែចូលរួមក្នុងការថែរក្សាស្ទប់ថែមទៀតរឺ?

ប្រធាន ( )ចូលរួមជាង ( )តិចជាង ( )មិនផ្លាស់ប្តូរ ( )ផ្សេងៗ ( )

លេខា ( )ចូលរួមជាង ( )តិចជាង ( )មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )

បេឡា ( )ចូលរួមជាង ( )តិចជាង ( )មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )

អ្នកថែរក្សា ១ ( )ចូលរួមជាង ( )តិចជាង ( )មិនផ្លាស់ប្តូរ ( )ផ្សេងៗ ( )

អ្នកថែរក្សា ២ ( )ចូលរួមជាង ( )តិចជាង ( )មិនផ្លាស់ប្តូរ ( )ផ្សេងៗ ( )

អ្នកថែរក្សា ៣ ( )ចូលរួមជាង ( )តិចជាង ( )មិនផ្លាស់ប្តូរ( )ផ្សេងៗ ( )

អ្នកថែរក្សា ៤ ( )ចូលរួមជាង ( )តិចជាង ( )មិនផ្លាស់ប្តូរ( )ផ្សេងៗ ( )

២២) តើការផ្គត់ផ្គង់អ្វីខ្លះអ្នកបានទទួលពីអ្នកប្រើប្រាស់ ឬ អង្គការផ្សេងទៀត? ដូចជា ថ្នាក់ឃុំ ថ្នាក់ស្រុក មន្ទីរអភិវឌ្ឍន៍ខេត្ត ឬ ថ្នាក់ជាតិ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

២៣) តើអ្នកគិតថាមានការផ្លាស់ប្តូរ ក្នុងគំនិតណាមួយឬទេ ចាប់តាំងពីអ្នកបានត្រូវជ្រើសរើសជា សមាជិក គ.ទ.ភ/គ.អ.ទ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	( ) ទទួលខុសត្រូវថែមទៀតលើសកម្មភាពក្នុងភូមិ ( ) គាត់តែមានការទុកចិត្តចំពោះខ្លួនឯង ( ) អ្នកភូមិកាន់តែគោរព ( ) មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )
២	លេខា	( ) ទទួលខុសត្រូវថែមទៀតលើសកម្មភាពក្នុងភូមិ ( ) គាត់តែមានការទុកចិត្តចំពោះខ្លួនឯង ( ) អ្នកភូមិកាន់តែគោរព ( ) មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )
៣	បេឡា	( ) ទទួលខុសត្រូវថែមទៀតលើសកម្មភាពក្នុងភូមិ ( ) គាត់តែមានការទុកចិត្តចំពោះខ្លួនឯង ( ) អ្នកភូមិកាន់តែគោរព ( ) មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )
៤	អ្នកថែរក្សា ១	( ) ទទួលខុសត្រូវថែមទៀតលើសកម្មភាពក្នុងភូមិ ( ) គាត់តែមានការទុកចិត្តចំពោះខ្លួនឯង ( ) អ្នកភូមិកាន់តែគោរព ( ) មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )
៥	អ្នកថែរក្សា ២	( ) ទទួលខុសត្រូវថែមទៀតលើសកម្មភាពក្នុងភូមិ ( ) គាត់តែមានការទុកចិត្តចំពោះខ្លួនឯង ( ) អ្នកភូមិកាន់តែគោរព ( ) មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )
៦	អ្នកថែរក្សា ៣	( ) ទទួលខុសត្រូវថែមទៀតលើសកម្មភាពក្នុងភូមិ ( ) គាត់តែមានការទុកចិត្តចំពោះខ្លួននឯង ( ) អ្នកភូមិកាន់តែគោរព ( ) មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ( )
៧	អ្នកថែរក្សា ៤	( ) ទទួលខុសត្រូវថែមទៀតលើសកម្មភាពក្នុងភូមិ ( ) គាត់តែមានការទុកចិត្តចំពោះខ្លួននឯង ( ) អ្នកភូមិកាន់តែគោរព ( ) មិនផ្លាស់ប្តូរ ( ) ផ្សេងៗ ( )

២៤) តើមានបញ្ហាអ្វីខ្លះនៅក្នុងភូមិ ក្នុងចំណោមអ្នកប្រើប្រាស់អណ្តូងស្នប់របស់អង្គការរ៉ៃកា?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

២៥) តើមានមតិអ្វីខ្លះទេ?

លេខរៀង	ឈ្មោះ	ចំលើយ
១	ប្រធាន	
២	លេខា	
៣	បេឡា	
៤	អ្នកថែរក្សា ១	
៥	អ្នកថែរក្សា ២	
៦	អ្នកថែរក្សា ៣	
៧	អ្នកថែរក្សា ៤	

JICA Hand Pump Participatory Monitoring Sheet

(To be filled in by Provincial Staff, VWC / WPC with the participation of users)

Date: **Name of Village:** **Commune:**

District: **Province:** **Well No:**

Population of Village: **No. of users (No. of family):**

Construction Date: / / **HP Type:** **Mark III (   )** **Afridev (   )**

Names of Monitors:

1. **Hand Pump :**

Items	Good	Not Good	Remarks
Pump Condition			
Yield			
Function			
Lubrication			
Easiness of use			
Hand pump tool kit			
Water Use Purpose			Dry season Drinking ( ) Washing ( ) Cooking ( ) Others ( )
			Rainy season Drinking ( ) Washing ( ) Cooking ( ) Others ( )
Accessibility (physical and social)			
Overall evaluation by users			
Additional Observation:			

2. **Platform :** (The height of embankment: 0cm 10cm 20cm 30cm)
(No. of entrance: 2 3)

Items	Good	Not Good	Remarks
Platform Condition			
Drainage			
Wall			
Entrance			
Easiness of maintenance			
Overall evaluation by users			
Additional Observation			

3. **Iron Reduce Device (IRD):** (Existence of IRD: Yes No)

	Items	Good	Not Good	Remarks
OLD IRD	IRD condition			
	Function			
	Easiness of use			
	Easiness of maintenance			
	Does old IRD satisfactorily remove iron?			
	Overall evaluation by users			
NEW IRD	IRD condition			
	Function			
	Easiness of use			
	Easiness of maintenance			
	Does new IRD satisfactorily remove iron?			
	Overall evaluation by users			
	Overall evaluation between Old and New IRD: Which is better?			
	Additional Observation			

4. **Well Environment:**

Items	Good	Not Good	Remarks
Around the drainage			
Inside of the platform			
Around the platform			
Overall evaluation by users			
Additional Observation			

5. **Water Quality:**

	Items	Good	Not Good	Remarks
Hand pump	Taste			If not good: Iron ( ) Salty ( ) Flat taste ( )
	Smell			
	Color			
Old IRD	Taste			If not good: Iron ( ) Salty ( ) Flat taste ( )
	Smell			
	Color			
New IRD	Taste			If not good: Iron ( ) Salty ( ) Flat taste ( )
	Smell			
	Color			
Additional Observation				

6. **Operation and Maintenance (O&M):**

Items	Good	Not Good	Remarks
O&M system in place			
Availability of funds for O&M			
Availability of spare parts			
Function and skills of Water Point Committee			
Additional Observation			

7. **Technical Intervention by Level:**

Levels	Date	Activities	Remarks
Central (MRD)			
Provincial (PDRD)			
District			
Commune			
Additional Observation			

8. **Other Opinions and/or Comments on JICA Hand Pump**

តារាងត្រួតពិនិត្យអង្កេតមើលអណ្តូងស្នប់របស់អង្គការ JICA ដែលបានចូលរួម(បំពេញដោយបុគ្គលិកខេត្ត, VWC/WPC ជាមួយអ្នកប្រើប្រាស់ដែលបានចូលរួម)

ថ្ងៃ.ខែ.ឆ្នាំ : ឈ្មោះភូមិ : ឃុំ :

ស្រុក : ខេត្ត : លេខអណ្តូង :

ប្រជាជនក្នុងភូមិ : ចំនួនអ្នកប្រើ :

ថ្ងៃ.ខែ តំលើងស្នប់ : / / ប្រភេទស្នប់ : ឥណ្ឌាម៉ាក III ( ) អាហ្វ្រីដែហ្វ ( )

ឈ្មោះអ្នកអង្កេត :

១. ស្នប់ :

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
លក្ខខណ្ឌស្នប់			
ទិន្នផល			
មុខងារ			
ការដាក់ខ្ទាញ់			
ស្រួលប្រើ			
ឧបករណ៍សំរាប់ដោះស្នប់			
គោលបំណងនៃការប្រើប្រាស់ទឹក			ផឹក ( ) បោកគោក ( ) ដាំស្លរ ( ) ផ្សេងៗ ( )
ដំណើរការទៅបាន			
ការវាយតំលៃជាទូទៅរបស់អ្នកប្រើប្រាស់			

ការត្រួតពិនិត្យបន្ថែម :

២. ផែនអណ្តូង : (កំពស់ដីសំរាប់ធ្វើផែនអណ្តូង : 0cm 10cm 20cm 30cm)

(ចំនួនច្រកចូល : ២ ៣)

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
លក្ខខណ្ឌនៃផែនអណ្តូង			
ចង្អូរ			
ខឿនអណ្តូង			
ច្រកចូល			
ភាពងាយស្រួលនៃការថែទាំ			
ការវាយតំលៃជារួមរបស់អ្នកប្រើប្រាស់			
ការត្រួតពិនិត្យបន្ថែម :			

៣. អាងច្រោះជាតិដែក (មានរឺ អត់ បាទ ទេ)

	បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
អាង ច្រោះ ជាតិ ដែក ចាស់	លក្ខខណ្ឌនៃអាងច្រោះជាតិដែក			
	មុខងារ			
	ភាពងាយស្រួលក្នុងការប្រើប្រាស់			
	ភាពងាយស្រួលនៃការថែទាំ			
	តើអាងច្រោះថ្មី ល្អក្នុងការបំបាត់ជាតិដែកទេ?			
	ការវាយតំលៃជារួមរបស់អ្នកប្រើប្រាស់			
អាង ច្រោះ ជាតិ ដែក ថ្មី	លក្ខខណ្ឌនៃអាងច្រោះជាតិដែក			
	មុខងារ			
	ភាពងាយស្រួលក្នុងការប្រើប្រាស់			
	ភាពងាយស្រួលនៃការថែទាំ			
	តើអាងច្រោះថ្មី ល្អក្នុងការបំបាត់ជាតិដែកទេ?			
	ការវាយតំលៃរបស់អ្នកប្រើប្រាស់			
	ការវាយតំលៃរវាងអាងច្រោះ ចាស់និង ថ្មី តើណាមួយប្រសើជាង?			
	ការពិនិត្យបន្ថែម			

៤. បរិស្ថានជុំវិញអណ្តូង ៖

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
ជុំវិញចង្អូរទឹក			
នៅខាងក្នុងផែនអណ្តូង			
ជុំវិញផែនអណ្តូង			
ការវាយតំលៃជារួមរបស់អ្នកប្រើប្រាស់			
ការត្រួតពិនិត្យបន្ថែម ៖			

៥. គុណភាពទឹក ៖

	បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
ស្នប់	រស់ជាតិ			ប្រសិនមិនល្អៈ ជាតិដែក( ) ភ្លាវ ( ) ល្វីង ( )
	ក្លិន			
	ពណ៌			
អាងច្រោះចាស់	រស់ជាតិ			ប្រសិនមិនល្អៈ ជាតិដែក( ) ភ្លាវ ( ) ល្វីង ( )
	ក្លិន			
	ពណ៌			
អាងច្រោះថ្មី	រស់ជាតិ			ប្រសិនមិនល្អៈ ជាតិដែក( ) ភ្លាវ ( ) ល្វីង ( )
	ក្លិន			
	ពណ៌			
ការពិនិត្យបន្ថែម				

៦. ការអនុវត្តន៍ និង ការថែទាំ :

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
ប្រព័ន្ធនៃការអនុវត្តន៍ និង ការថែទាំនៅកន្លែង			
ការរកថវិកាសំរាប់ ការអនុវត្តន៍ និង ការថែទាំ			
ការរកគ្រឿងបន្លាស់			
មុខនាទី និងជំនាញរបស់គណៈកម្មការ អណ្តូងទឹក			
ការត្រួតពិនិត្យបន្ថែម :			

៧. កំរិតនៃការធ្វើអន្តរាគមន៍ផ្នែកបច្ចេកទេស :

បញ្ជីរាយមុខ	ល្អ	មិនល្អ	កំណត់សំគាល់
មជ្ឈមណ្ឌលកណ្តាល(ក្រសួងអភិវឌ្ឍន៍ជនបទ)			
មន្ទីរអភិវឌ្ឍន៍ជនបទ			
ស្រុក			
ឃុំ			
ការត្រួតពិនិត្យពន្ថែម :			

៨. ទស្សនះ និង មតិផ្សេង ៗ ស្តីអំពីអណ្តូងស្នប់របស់អង្គការ JICA

The Study on Groundwater Development in Southern Cambodia

WID Survey

Question:

1. Are there any problems about water quantity of JICA Hand-pump?
   (Yes or No, and if "yes" what is the reason?)

2. Are there any problems about water quality of JICA Hand-pump?
   (Yes or No, and if "yes" what is the reason?)

3. What is a difference of rainwater and JICA Hand-pump water?

4. Are there any inconvenience points when you are using JICA Hand-pump?
   (Yes or No, and if "yes" what is the reason?)

5. How about for children?
   (Yes or No, and if "yes" what is the reason?)

6. Do you feel a fetching water is a burden to small girls?
   (Yes or No, and if "yes" what is the reason?)

7. Are there any improvement points for JICA Hand-pump including the platform and other facilities？
   (Yes or No, and if "yes" what is the reason?)

8. Do you think that more women should become members of VWC/WPC?
   (Yes or No, and what is the reason?)

9. Do you know why you need to pay water user fee?
   (Yes or No, and if "yes" what is the reason?)

10. If you pay, how much your family can pay it per month?

(Riel per month)

11. When you find a broken point in JICA Hand-pump, do you know how to inform it?

12. Do you know about waterborne diseases?

(Yes or No, and if "yes" what is the major disease?)

13. When you use water of JICA Hand-pump for drinking, do you try to boil it or not?

(Yes or No, and if "no" what is the reason?)

14. Did you attend any training courses for hygiene and sanitation?

(Yes or No)

15. Do you want to attend a training course for hygiene and sanitation?

(Yes or No, and if "yes" what is the reason?)

16. Do you take care of your baby's drinking water?

(Yes or No, and if "yes" what is the reason?)

17. Are there any differences of water quantity for washing in dry season and rainy season?

(Yes or No)

18. How about before JICA Hand-pump installation?

(Yes or No)

19. What is the most important problem related to water?

a.

b.

c.

20. What is the most difficult problem in Operation & Maintenance of JICA Hand-pump?

a.

b.

c.

ការពិនិត្យអង្កេតអំពីការអភិវឌ្ឍន៍ស្ត្រី (នារីរតនៈ)

<u>អ្នកចូលរួម :</u> ស្ត្រី (អ្នកប្រើប្រាស់អណ្តូងស្នប់នៃកា)

<u>គោលបំណង :</u> ការទ្រទ្រង់ចំពោះគំរោង និងប្រយោជន៍នៃអណ្តូងស្នប់នៃកា

<u>សំនួរ :</u>

១. តើមានបញ្ហាអ្វីខ្លះអំពីបរិមាណទឹកនៃអណ្តូងស្នប់នៃកា?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

២. តើមានបញ្ហាអ្វីខ្លះអំពីគុណភាពទឹកនៃអណ្តូងស្នប់នៃកា?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

៣. តើទឹកភ្លៀង និងទឹកអណ្តូងស្នប់នៃកា ខុសគ្នាយ៉ាងណា?

៤. តើមានលក្ខណៈ លំបាកណាខ្លះ នៅពេលលោកអ្នកប្រើប្រាស់អណ្តូងស្នប់នៃកា?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

៥. ចុះចំណែកក្មេងៗវិញ មានលក្ខណៈលំបាកណាខ្លះទេ?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

៦. តើលោកអ្នកគិតថា ការទៅដងទឹកជាបន្ទុករបស់ក្មេងស្រីតូចៗរឺទេ?

(បាទ / ចាស់ ឬទេ, អ្វីជាមូលហេតុ?)

៧. ចំពោះឧឿនអណ្តូង និងស្នប់អណ្តូងនៃកា តើមានចំនុចណាខ្លះដែលធ្វើឱ្យប្រសើរឡើង?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

៨. តើលោកអ្នកគិតថា កាន់តែមានស្ត្រីចូលរួមជាសមាជិករបស់ គ.ទ.ភ និង គ.អ.ទ បន្ថែមទេ?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

៩. តើលោកអ្នកដឹងពីមូលហេតុអ្វីទេ ដែលលោកអ្នកចាំបាច់ត្រូវតែបង់ថវិកា អំពីការប្រើប្រាស់ទឹក?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

១០. ប្រសិនបើលោកអ្នកបង់ប្រាក់, តើគ្រួសាររបស់លោកអ្នកអាចបង់ប្រាក់ប៉ុន្មានក្នុងមួយខែ?

(រៀល /ខែ)

១១. នៅពេលដែលលោកអ្នកដឹងថាអណ្តូងស្នប់ដៃកាខូច តើលោកអ្នកដឹងទេថា តើធ្វើយ៉ាងណាដើម្បីផ្តល់ដំណឹងនេះ?

១២. តើលោកអ្នកដឹងឬទេអំពីទឹកមានមេរោគ?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " តើជំងឺអ្វីដែលមានច្រើនជាងគេ?)

១៣. តើលោកអ្នកដាំទឹកហូបដែរឬទេ? នៅពេលដែលលោកអ្នកប្រើប្រាស់ទឹកអណ្តូងស្នប់ដៃកាសំរាប់ផឹកនោះ?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

១៤. តើលោកអ្នកធ្លាប់បានចូលរួមវគ្គបណ្តុះបណ្តាលណាមួយ អំពីការអប់រំសុខភាពអនាម័យទេ?

(បាទ / ចាស់ ឬ ទេ)

១៥. តើលោកអ្នកចង់ចូលរួមវគ្គបណ្តុះបណ្តាល អំពីការអប់រំសុខភាពអនាម័យនេះថែមទៀតទេ?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

១៦. តើលោកអ្នកគិតអំពីទឹកផឹកសំរាប់កូនរបស់លោកអ្នកឬទេ?

(បាទ / ចាស់ ឬ ទេ, ប្រសិនបើ " បាទ / ចាស់ " អ្វីជាមូលហេតុ?)

១៧. តើបរិមាណទឹកសំរាប់បោកគក់នៅរដូវប្រាំង និងរដូវវស្សាខុសគ្នាយ៉ាងណា?

(បាទ / ចាស់ ឬ ទេ)

១៨. តើមុនការសាងសង់អណ្តូងស្នប់ដៃកាយ៉ាងដូម្តេច?

(បាទ / ចាស់ ឬ ទេ)

១៩. តើអ្វីជាបញ្ហាសំខាន់ដែលទាក់ទងនឹងទឹក?

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២០. តើអ្វីដែលជាបញ្ហាលំបាកបំផុត ក្នុងការថែរក្សាអណ្តូងស្នប់ដៃកា?

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