

Supporting-E
Water Utilization Survey

SUPPORTING-E WATER UTILIZATION SURVEY

1. SURVEY DESIGN

1.1 OBJECTIVES

The water utilization survey has two (2) objectives. One is to understand the actual water utilization, and the other is to estimate people's willingness to pay (W/P). Furthermore, estimation of people's willingness to pay is designed to analyze both the proper tariff level for the water supply service and the economic benefits of the proposed master plan.

In this survey the whole water users are categorized as follows.

- Domestic users of SANAA
- Non-domestic users of SANAA
- Nonusers of SANAA

The non-domestic users include commercial, industrial, public, and agricultural users.

Nonusers of SANAA mean the people without piped water supply service. It should be noted that the nonusers of SANAA include the user of SANAA's water tank lorry.

1.2 SURVEY METHOD

Questionnaires were prepared and an interview method was applied for each of the above categories.

1.3 SAMPLING DESIGN

1.3.1 DOMESTIC USERS OF SANAA

It is said that the water utilization widely varies by socioeconomic class of the users. According to SANAA, it is common to classify all neighborhoods into the following socioeconomic classes:

- S: Superior
- A: High
- M: Middle
- B: Low
- C: Central (downtown)
- P: Programmed (Large scale housing development)
- T: Developing community

Based on the existing population estimated in the present study, the proportion of class population among SANAA user is as follows.

- Class S: 1.6 %
- Class A: 3.3 %
- Class M: 9.3 %
- Class C: 2.3 %
- Class B: 8.2 %
- Class P: 23.3 %
- Class T: 52.3 %

We followed this idea and applied stratified random sampling by neighborhood. 17 neighborhoods listed in *Table E.1.1* were selected considering their socioeconomic classes and availability of detailed map, and 40 households were interviewed randomly in each selected neighborhood. In total, 680 households were sampled.

Table E.1.1 Selected Neighborhoods for Domestic User Samples

Neighborhood	Existing population*	Socioeconomic class
Col. Florencia Norte	1,089	S
Col. 15 de Septiembre	1,945	A
Col. Altos de Miramontes	1,643	A
Col. Bella Oriente	2,049	M
Col. El Hogar	2,178	M
Col. Satelite	2,633	M
Bo. Perpetuo Socorro	4,341	B
Bo. La Concordia	317	C
Bo. Punta Caliente	733	P
Col. San Angel	4,247	P
Col. Victor F. Ardon	1,653	P
Col. Res. Guaymuras	1,272	P
Col. Res. Los Girasoles	1,634	P
Col. Estados Unidos	2,218	T
Col. La Pradera	4,203	T
Col. La Rosa	2,257	T
Col. El Japon	1,332	T

*) Estimated by the present study

1.3.2 NON-DOMESTIC USERS OF SANAA

90 non-domestic users were randomly sampled.

1.3.3 NONUSERS OF SANAA

From the neighborhoods without piped water supply, three (3) neighborhoods listed in *Table E.1.2* were selected, and 40 households were interviewed randomly in each selected neighborhood. In total, 120 households were sampled.

Table E.1.2 Selected Neighborhoods for Non-user Samples

Neighborhood	Existing population*	Socioeconomic class
Col. Nueva Danli	2,985	T
Barrio Brisas del Norte	1,906	T
Col. Brisas del Suyapa	1,213	T

*) Estimated by the present study

1.4 DESIGN OF QUESTIONNAIRES

Three (3) types of questionnaires were prepared corresponding to three (3) sample categories. General frame of the questionnaire is common to all of them. They consist of questions concerning respondent's attributes, actual water utilization conditions, and respondent's willingness to pay (W/P).

1.4.1 QUESTIONNAIRES FOR DOMESTIC USERS

The questionnaires for domestic users are shown in Appendix 1.

(1) Attributes

As attributes of respondent, ages, occupation, sex were asked, and as attributes of household of respondent, family size, electricity expense, and household income were asked.

(2) Actual Water Utilization Conditions

Actual water utilization conditions were surveyed in the following items.

- Source of cooking and drinking water
- Expense for bottle water
- Duration of water service
- Possession and capacity of water storage tank
- Satisfaction to the water pressure, color, and taste
- Water consumption
- Water charge

To study actual water consumption and water charge, surveyors were instructed to ask respondents to show SANAA's invoices for last three (3) months, and to check whether they were invoiced based on metered rate or not.

(3) Willingness to Pay (W/P)

To ask respondents' willingness to pay (W/P), this survey applied a single-bound dichotomous choice method, in which respondents were asked to vote 'yes' or 'no' to pay a certain amount for the water supply improvement. It is said that this method can minimize various biases pertaining to the elicitation process.

To improve accuracy of estimation, samples divided into three (3) groups and asked different amount to pay, *i.e.* 30, 45, and 60 Lempiras. These three (3) amounts were determined based on the result of a pre-test.

The estimation of W/P has two (2) objectives, one is to determine proper tariff level, and the other is to evaluate the economic benefits of the proposed master plan. For the latter, a situation after the water supply improvement should be precisely described for making respondents easily understand what is the benefit of the improvement. In the Study, the expected benefit of the master plan is that people can enjoy 24-hour continuous water supply service with adequate pressure and quality. Thus, W/P to realize the 24-hour continuous water supply service with adequate pressure and quality was asked.

In the Study, an economic analysis to be done for the additional economic cost and the additional economic benefits born by the proposed master plan. The abovementioned W/P represents whole economic benefits consisting of the benefit for the existing service and that for the additional service improvement. Therefore, W/P to maintain the water supply service at the current level was also asked in the questionnaires in order to estimate the benefit for the existing service.

1.4.2 QUESTIONNAIRES FOR NON-DOMESTIC USERS

The questionnaires for non-domestic users are shown in Appendix 2.

(1) Attributes

Type of industry, number of employees, electricity expense, and annual sales were asked.

(2) Actual Water Utilization Conditions

Actual water utilization conditions were surveyed in the following items.

- Source of water
- Duration of water service
- Possession and capacity of water storage tank
- Satisfaction to the water pressure, color, and taste
- Effect of water shortage on the sales
- Water consumption
- Water charge

Same instruction as in the domestic user survey was given to surveyors.

(3) Willingness to Pay (W/P)

Same as in the domestic user survey, a single-bound dichotomous choice method was applied. Here, the W/P is expressed as how many times more than the existing tariff, considering the range of water charge is very wide in case of non-domestic user. In this non-domestic user survey, respondents were asked to increase the water service tariff twice, three (3) times, and five (5) times than the existing tariff.

Due to the same reason as the domestic user survey, both the W/P to realize the 24-hour continuous water supply service with adequate pressure and quality, and the W/P for the existing service were asked.

1.4.3 QUESTIONNAIRES FOR NONUSERS

The questionnaires for nonusers are shown in Appendix 3.

(1) Attributes

As attributes of respondent, ages, occupation, sex were asked, and as attributes of household of respondent, family size, electricity expense, and household income were asked.

(2) Actual Water Utilization Conditions

Actual water utilization conditions were surveyed in the following items.

- Source of water
- Water consumption and expense
- Expense for bottle water
- Satisfaction to the water quantity, color, and taste

(3) Willingness to Pay (W/P)

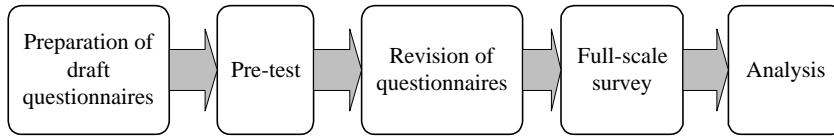
Same as in the domestic user survey, a single-bound dichotomous choice method was applied.

1.5 SURVEY PROCEDURE

Before a full-scale survey, a pre-test and a revision of questionnaires based on the result of the pre-test were conducted. As a pre-test two (2) pilot field surveys with 10 samples each were

conducted. Based on the result of the pre-test, the presented amounts for the W/P were determined and a design of the questionnaires was verified.

The following schematic drawing shows survey procedure applied in the Study.



2. FIELD SURVEY

Field survey was conducted during May 27 to June 10, 2000. Collected samples were carefully reviewed and inappropriate samples were rejected. As a result, the number of available samples is as shown in *Table E.2.1*.

Table E.2.1 Availability of Collected Samples

User Category	Class	Collected Sample Number	Available Sample Number	Availability
Domestic User	Class S	40	36	90.0 %
	Class A	80	62	77.5 %
	Class M	120	111	92.5 %
	Class B	40	37	92.5 %
	Class C	40	39	97.5 %
	Class P	200	184	92.0 %
	Class T	160	147	91.9 %
Non-domestic user		90	82	91.1 %
Nonuser		120	118	98.3 %

3. ANALYSIS OF DOMESTIC USERS OF SANAA

3.1 MAJOR ATTRIBUTES OF EACH CLASS

Table E.3.1 summarizes the major attributes of each class.

Table E.3.1 Major Attributes

Class	HH size (person/HH)	HH income (Lps/month)	Electricity expense (Lps/month)
S	5.11	23,250	947
A	4.61	13,818	491
M	4.66	10,033	455
B	5.03	4,690	227
C	5.13	7,578	287
P	4.76	5,962	205
T	5.85	2,618	186
Average*	5.36	5,224	246

*) Average of class data is weighted by the proportion of class population.

Based on the result, the average household size for whole the city is estimated 5.36 persons/household, which is 8% bigger than 4.95 persons/household used for the population projection in the Study.

Monthly household income and electricity expense are closely correlated as expected. Also the amount of these two (2) items is as expected by the characteristics of each class. The result of average household income and electricity expense bucks up the idea to categorize neighborhoods by social class. The average household income is estimated at Lps. 5,224 per month.

3.2 WATER UTILIZATION

3.2.1 WATER SUPPLY SERVICE DURATION AND POSSESSION OF STORAGE TANK

Table E.3.2 shows the duration of water supply service and possession of storage tank.

Table E.3.2 Water Supply Service Duration and Possession of Storage Tank

Class	Average supply duration per day (hrs)		Average supply days per week (days)		Possession of Storage Tank	Capacity of Storage Tank*
	Dry season	Rainy season	Dry season	Rainy season		
S	7.3	8.8	6.6	6.7	86 %	8.5 days
A	11.2	11.7	6.6	6.8	65 %	4.7 days
M	11.7	12.4	6.8	6.9	32 %	8.3 days
B	9.8	9.9	6.7	6.7	14 %	2.8 days
C	16.5	16.9	6.8	6.8	13 %	4.2 days
P	7.7	9.9	6.5	6.8	20 %	6.5 days
T	7.1	7.4	4.5	4.6	6 %	4.0 days

*) Average of samples which possess a storage tank.

The possession ratio of water storage tank is lower than we expected. Except the classes S and A, majority of inhabitants does not have a water storage tank. The average capacity of tank varies by the class.

The result of supply duration shows that almost everyday people can receive water supply service, however daily rationing is significant, normally only 7 hours to 12 hours people can receive water. Considering the majority of people do not have water storage tank, this rationing may have significant negative effects on people's daily life.

3.2.2 DRINKING WATER SOURCE AND BOTTLE WATER EXPENSE

Table E.3.3 shows drinking water source and monthly expense for bottle water.

Except the classes C and T, bottle water is the main drinking water source. However, as a whole city, raw tap water is the largest drinking water source, and the second is boiled tap water. Filtration of tap water is applied only by the classes S, A, and M.

The range of average expense for bottle water by class is much less than that of household income. In case of the class T, average expense for bottle water, 130.8 Lempiras/household/month, reaches 5 % of average household income. The figure shows that the cost for bottle water for the class T is unbelievably heavy burden for the household finance.

Table E.3.3 Drinking Water Source and Bottle Water Expense

Class	Raw tap water	Boiled tap water	Bottle water	Filtered tap water	Reply ratio to bottle water expense	Average expense for bottle water* (Lps/month)
S	5.6 %	19.4 %	41.7 %	33.3 %	38.9 %	204.6
A	0.0 %	25.8 %	58.1 %	16.1 %	58.1 %	189.0
M	5.5 %	31.2 %	54.1 %	9.2 %	53.2 %	148.8
B	24.3 %	29.7 %	45.9 %	0.0 %	43.2 %	112.0
C	5.1 %	61.5 %	33.3 %	0.0 %	25.6 %	186.2
P	12.1 %	34.6 %	53.3 %	0.0 %	49.5 %	136.9
T	64.5 %	26.2 %	9.2 %	0.0 %	10.2 %	130.8
Average	38.1 %	31.5 %	28.5 %	1.9 %	27.3 %	-

*) Average of samples which answered bottle water expenditure.

3.2.3 WATER PRESSURE AND QUALITY

Tables E.3.4 to E.3.6 show how people evaluate the water supply service by SANAA.

Table E.3.4 Water Pressure

Class	Satisfied		Accepatble		Not acceptable	
	Dry	Rainy	Dry	Rainy	Dry	Rainy
S	27.8%	69.4%	52.8%	19.4%	19.4%	11.1%
A	16.1%	29.0%	66.1%	61.3%	17.7%	9.7%
M	22.5%	48.6%	70.3%	50.5%	7.2%	0.9%
B	18.9%	21.6%	62.2%	64.9%	18.9%	13.5%
C	15.4%	23.1%	71.8%	74.4%	12.8%	2.6%
P	14.7%	69.0%	56.5%	28.8%	28.8%	2.2%
T	27.2%	55.8%	44.9%	40.1%	27.9%	4.1%
Average	22.4%	54.1%	53.3%	42.2%	24.3%	3.8%

Table E.3.5 Color of Water

Class	Satisfied		Accepatble		Not acceptable	
	Dry	Rainy	Dry	Rainy	Dry	Rainy
S	25.0%	13.9%	52.8%	47.2%	22.2%	38.9%
A	1.6%	0.0%	87.1%	62.9%	11.3%	37.1%
M	15.3%	5.4%	75.7%	56.8%	9.0%	37.8%
B	0.0%	0.0%	97.3%	64.9%	2.7%	35.1%
C	0.0%	0.0%	100 %	74.4%	0.0%	25.6%
P	37.5%	7.1%	48.9%	53.3%	13.6%	39.7%
T	25.9%	7.5%	63.9%	55.8%	10.2%	36.7%
Average	24.1%	6.3%	65.8%	57.1%	10.1%	36.6%

Table E.3.6 Taste of Water

Class	Satisfied		Acceptable		Not acceptable	
	Dry	Rainy	Dry	Rainy	Dry	Rainy
S	22.2%	11.1%	44.4%	38.9%	33.3%	50.0%
A	4.8%	1.6%	83.9%	66.1%	11.3%	32.3%
M	8.1%	5.4%	82.0%	52.3%	9.9%	42.3%
B	0.0%	0.0%	97.3%	70.3%	2.7%	29.7%
C	0.0%	0.0%	100 %	79.5%	0.0%	20.5%
P	26.1%	6.5%	57.1%	42.4%	16.8%	51.1%
T	22.4%	6.1%	68.7%	54.4%	8.8%	39.5%
Average	19.0%	5.4%	70.5%	54.0%	10.4%	40.6%

Table E.3.4 shows that during rainy season 54.1 % is satisfied with the water pressure and only 3.8 % replies “not acceptable”, however during dry season only 22.4 % is satisfied and 24.3 % feels “not acceptable”. It tells that a water shortage during dry season is very severe.

On the other hand, Tables E.3.5 and E.3.6 show that the water quality is worse during rainy season. It is remarkable that during rainy season nearly 40 % feels that color and taste of water are not acceptable. During dry season the situation might be far better. During dry season nearly 20 % replies “satisfied” and only 10 % replies “not acceptable”.

3.2.4 WATER CONSUMPTION

Estimation of water consumption requires invoiced based on micrometer measurement. Table E.3.7 shows the micrometer coverage.

Table E.3.7 Micrometer Coverage

Class	Total sample number	Metered sample number	Micrometer coverage
S	36	4	11.1 %
A	62	26	41.9 %
M	111	60	54.1 %
B	37	12	32.4 %
C	39	14	35.9 %
P	184	37	20.1 %
T	147	56	38.1 %
Average	-	-	34.7 %

Average coverage for the whole city is estimated at 34.7 %. This figure well corresponds to SANAA’s estimation of 30 to 40 %.

Since the number of samples with metered invoice is very small, water consumption was analyzed with combining the classes S and A as one group and the classes M, B, and C as one group. The result of water consumption estimation is shown in Table E.3.8.

Table E.3.8 Water Consumption

Class	Water consumption (l/c/d)	Water expense (Lps/month)	Sample number
S and A	262.8	89.5	30
M, B, and C	200.5	51.5	86
P	176.1	36.4	37
T	130.2	29.7	56
Average	161.1	38.4	-

3.3 WILLINGNESS TO PAY

3.3.1 ESTIMATION METHOD

As mentioned before, the samples were divided into three (3) sub-groups. As a result of sample division, the sample size of one group in each class becomes small. Thus, as applied for the water consumption analysis mentioned in the former section, willingness to pay (W/P) was analyzed with combining the classes S and A as one group and the classes M, B, and C as one group.

Based on the acceptance to pay at 30, 45, and 60 Lempiras, the relation between present amount (X_i) and acceptance to pay (P_i) was estimated with a logit model, and a median of W/P was calculated. Logit model utilizes the following logit transformation.

$$\text{Logit } P_i = \ln \left(\frac{P_i}{1 - P_i} \right)$$

Then, the relation between present amount (X_i) and acceptance to pay (P_i) can be described as follows.

$$\text{Logit } P_i = a \log_{10}(X_i) + b$$

where a, b are regression coefficients.

Once regression coefficients a and b are obtained, a median of W/P is calculated by the following equation.

$$\text{Median} = 10^{(\ln 1 - b)/a}$$

3.3.2 W/P FOR THE BETTER SERVICE

Table E.3.9 shows the result of acceptance to pay for the 24-hour continuous service with adequate water pressure and quality.

Table E.3.9 Acceptance to Pay for the Better Service

Class	Lps 30	Lps 45	Lps 60
S and A	86.7%	77.8%	78.1%
M, B, and C	84.7%	70.0%	69.1%
P	86.7%	71.2%	67.7%
T	83.0%	72.9%	69.2%

Table E.3.10 shows the result of willingness to pay estimation.

Table E.3.10 Estimation of Willingness to Pay for the Better Service

Class	a	b	R ²	Median (Lps/month/HH)
S and A	-2.0895	4.8845	0.8072	217.6
M, B, and C	-3.1453	6.2688	0.8588	98.4
P	-3.8746	7.5114	0.9179	86.8
T	-2.6212	5.4172	0.9597	116.6

Table E.3.11 shows the comparison of the estimated present water expense and estimated W/P.

Table E.3.11 Comparison of the Present Water Expense and W/P

Class	Present Water Expense* (A) (Lps/month/HH)	W/P (B) (Lps/month/HH)	B/A
S and A	89.5	217.6	2.4
M, B, and C	51.5	98.4	1.9
P	36.4	86.8	2.4
T	29.7	116.6	3.9

*: Estimated value by this survey

Tables E.3.11 tells that W/Ps of any classes are higher than the present water expenses. Especially W/P of the class T is nearly four (4) times higher than the present water expense. It is also noted that the W/P of the class T is higher than those of the classes M, B, C, and P.

3.3.3 W/P FOR THE EXISTING SERVICE

Table E.3.12 shows the result of acceptance to pay for maintaining the current level of water supply service.

Table E.3.12 Acceptance to Pay for the Existing Service

Class	Lps 30	Lps 45	Lps 60
S and A	23.3%	13.9%	6.3%
M, B, and C	11.9%	6.7%	5.9%
P	5.0%	1.7%	1.5%
T	4.3%	2.1%	1.9%

Table E.3.13 shows the result of willingness to pay estimation.

Table E.3.13 Estimation of Willingness to Pay for the Existing Service

Class	a	b	R ²	Median (Lps/month/HH)
S and A	-4.9498	6.1913	0.9636	17.3
M, B, and C	-2.6177	1.8106	0.9328	4.9
P	-4.1855	3.1269	0.8806	5.6
T	-2.8145	0.9732	0.8919	2.2

Then, the additional W/P accrued by the proposed master plan can be calculated as follows.

$$\text{Additional W/P} = [\text{W/P for the better service}] - [\text{W/P for the existing service}]$$

Table E.3.14 summarizes the result of W/P estimation.

Table E.3.14 Result of W/P Estimation

Class	W/P for the Better Service (Lps/month/HH)	W/P for the Existing Service (Lps/month/HH)	Additional W/P (Lps/month/HH)
S and A	217.6	17.3	200.3
M, B, and C	98.4	4.9	93.5
P	86.8	5.6	81.2
T	116.6	2.2	114.4

4. ANALYSIS OF NON-DOMESTIC USERS OF SANAA

4.1 GENERAL CHARACTERISTICS

Table E.4.1 shows industrial categories of samples.

Table E.4.1 Industrial Category of Samples

Type of Industry	Number of Samples
Cattle breeding	1
Other agriculture	1
Manufacturer	19
Supermarket	7
Restaurant	10
Hotel	3
Others	41
Total	82

Average monthly sale is 945,000 Lempiras, and average number of employees is 30. Average monthly electricity charge is 7,049 Lempiras.

4.2 WATER UTILIZATION

4.2.1 WATER SOURCE

More than 95 % replied the main water source was piped water supply system of SANAA.

4.2.2 WATER SUPPLY SERVICE DURATION AND POSSESSION OF STORAGE TANK

Table E.4.2 shows the duration of water supply service and possession of storage tank. The service duration is 13.0 hours during dry season and 15.4 hours during rainy season. Possession ratio of water storage tank is 73.2 %. Average capacity of water tank is 7.2 days.

Table E.4.2 Water Supply Service Duration and Possession of Storage Tank

Average supply duration per day (hrs)		Average supply days per week (days)		Possession of Storage Tank
Dry season	Rainy season	Dry season	Rainy season	
13.0	15.4	6.2	6.7	73.2 %

4.2.3 WATER PRESSURE AND QUALITY

Tables E.4.3 shows how people evaluate the water supply service by SANAA.

Table E.4.3 Water Pressure and Quality

	Satisfied		Acceptable		Not acceptable	
	Dry	Rainy	Dry	Rainy	Dry	Rainy
Water pressure	40.2%	65.9%	39.0%	22.0%	20.7%	12.2%
Color	40.2%	11.0%	47.6%	31.7%	12.2%	57.3%
Taste	26.8%	7.3%	42.7%	34.1%	30.5%	58.5%

Similar to the domestic user survey, non-domestic users feel that during rainy season water pressure is better but water quality is worse.

4.2.4 WATER CONSUMPTION

Estimation of water consumption requires invoiced based on micrometer measurement. The micrometer coverage is estimated at 70.7 %. Average water consumption of non-domestic users is estimated at 216.2 m³/month, and average water charge is 1,060 Lempiras/month.

4.2.5 EFFECT OF WATER SHORTAGE ON SALE

45.1 % and 35.4 % reply there is negative effect of water shortage on sales during dry season and rainy season, respectively. In term of type of industry, agriculture, hotel, and others are severely affected but manufacturer, supermarket, and restaurant are less affected.

Average magnitude of the effect is 53.2% during dry season and 47.7% during rainy season.

4.3 WILLINGNESS TO PAY

4.3.1 ESTIMATION METHOD

Willingness to pay was estimated by the same method as the domestic user survey. However, because the range of water expense is very wide in non-domestic users, the increment of water service tariff was expressed as how many times higher than the existing tariff, instead of expressing as a fixed amount used in the domestic user survey.

4.3.2 WILLINGNESS TO PAY FOR THE BETTER SERVICE

Table E.4.4 shows the result of acceptance to pay for the better service.

Table E.4.4 Acceptance to Pay for the Better Service

Twice higher	3 times higher	5 times higher
63.6%	60.0%	42.1%

Table E.4.5 shows the result of willingness to pay estimation.

Table E.4.5 Estimation of Willingness to Pay

a	b	R ²	Median (times)
-2.2515	1.3241	0.9170	3.87

4.3.3 WILLINGNESS TO PAY FOR THE EXISTING SERVICE

Table E.4.4 shows the result of acceptance to pay for the existing service.

Table E.4.6 Acceptance to Pay for the Existing Service

Twice higher	3 times higher	5 times higher
18.2 %	16.7 %	10.5 %

Table E.4.5 shows the result of willingness to pay estimation.

Table E.4.7 Willingness to Pay for the Existing Service

a	b	R ²	Median (times)
-1.632	-0.9477	0.9115	0.26

5. ANALYSIS OF NONUSERS OF SANAA

5.1 MAJOR ATTRIBUTES

Table E.5.1 summarizes the major attributes. Average size and income of household are correspond to those of the class T in domestic user survey, but the electricity expense is 40 % smaller than that of the class T.

Table E.5.1 Major Attributes

HH size (person/HH)	HH income (Lps/month)	Electricity expense (Lps/month)
5.82	2,415	109

5.2 WATER UTILIZATION

5.2.1 WATER SOURCE

Water sources of SANAA nonusers are as follows.

Water tanker	5.1 %
Private water vender	28.0 %
Community system	66.1 %
Others	0.8 %

Community system is a small-scale water supply system operated by the community organization (“patronato” in Spanish). SANAA often provides technical assistance to community systems and in some cases SANAA sells water to community system.

Sources of drinking water are as follows.

Boiled well water	11.0 %
Raw well water	13.6 %
Boiled water tanker water	41.5 %
Raw water tanker water	28.8 %
Bottle water	5.1 %

5.2.2 WATER CONSUMPTION AND EXPENSE

It is difficult to estimate water consumption from community systems in quantitative manner, because the community systems apply fixed water charge. Therefore, for the user of community systems only monthly water charge for the systems was asked in the questionnaires. According to the survey result, the monthly charge is 35 to 40 Lempiras.

Consumption of water from private water vendors and SANAA water tank lorries was asked in the questionnaires, by means of asking how many gallons of water they purchase per once and how often they purchase water. The result is summarized in *Table E.5.2*.

Table E.5.2 Consumption of Water from Private Vender and SANAA Tank Lorry

User group	Purchase Quantity (gallons/once)	Frequency (times/week)	Water Consumption (l/c/d)	Water Expense (Lps/month)
With Community System	184.0	2.0	26.7	261.4
Without Community System	201.4	2.0	41.1	377.6
Average	190.1	2.0	31.6	300.8

The people without community system spend 378 Lempiras/month, which is 16 % of estimated household income.

5.2.3 WATER QUANTITY AND QUALITY

Tables E.5.3 shows how people evaluate the quantity and quality of available water for them.

Table E.5.3 Water Quantity and Quality

	Satisfied		Acceptable		Not acceptable	
	Dry	Rainy	Dry	Rainy	Dry	Rainy
Quantity	38.1%	46.6%	47.5%	48.3%	14.4%	5.1%
Color	15.3%	5.1%	79.7%	83.1%	5.1%	11.9%
Taste	13.6%	5.1%	53.4%	55.9%	33.1%	39.0%

During rainy season more water is available but water quality is worse.

5.3 WILLINGNESS TO PAY

Willingness to pay analysis applies the same method as in the domestic user survey.

Table E.5.4 shows the result of acceptance to pay for the better service.

Table E.5.4 Acceptance to Pay

Lps 30	Lps 45	Lps 60
97.4 %	92.3 %	92.9 %

Table E.5.5 shows the result of willingness to pay estimation.

Table E.5.5 Estimation of Willingness to Pay

a	b	R ²	Median (Lps/month/HH)
-3.759	9.0461	0.7801	255.0

APPENDIX 1 THE QUESTIONNAIRES FOR DOMESTIC USERS

Introduction

This questionnaire survey aims to understand the actual situation of domestic water usage and estimate benefits of the project to improve water supply service in Tegucigalpa. It is guaranteed that your personal information will never be disclosed.

Section I General Information

Q1: What is your age?

1	15 – 19 years
2	20 – 29 years
3	30 – 44 years
4	45 – 59 years
5	60 years and over

Q2: What is your occupation?

1	professional, technician or similar
2	director, manager, or general administrator
3	employee of the state offices, public institutes or private companies
4	services employee, merchant
5	farmer, cattleman, agricultural worker
6	drivers or similar
7	worker in textile industry, masonry, mechanics, or electricity
8	worker in graphic field, chemistry, foods and drinks, leather, tobacco, ceramic
9	cargo operator, stockman or dock worker
10	service occupation

Q3: Sex

Male	1	Female	2
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Q4: How many family members live together? Persons

Q5: How many years do you live here? Years

Q6: How much did you pay for electricity in the last month?

Lempiras/month

Q7: How much was your household income in the last month?

Lempiras/month

Q8: What kind of damage did your house suffer due to Hurricane Mitch?

1	Totally destroyed, and constructed new house in same territory
2	Severely damaged
3	Was flooded above floor level
4	Was flooded under floor level
5	No damage

Section II Actual Situation of Water Usage

Q9: Do you receive piped water supply service?

Yes	1
No	2

Q10: How do you get water to drink?

Tap water without boiling	1	➡ Skip to Q12a
Tap water with boiling	2	➡ Skip to Q12a
Bottle water	3	

Q11: How much you spend for bottle water monthly? |_|_|.|_|_|_| Lempiras

Q12a: How many hours in a day you can receive water during **dry** season? |_|_|.|_| hours

Q12b: How many hours in a day you can receive water during **rainy** season? |_|_|.|_| hours

Q13a: How many days in a week you can receive water during **dry** season? |_| days

Q13b: How many days in a week you can receive water during **rainy** season? |_| days

Q14: Do you have a water storage tank?

Yes	1
No	2

➡ Skip to Q16a

Q15: For how many hours or days can the storage tank serve water?

|_|_| hours or |_|_| days

Q16a: During **dry** season, are you satisfied with water service in following aspects?

(1) Pressure | Satisfied | 1 | Acceptable | 2 | Not acceptable | 3

(2) Color | Satisfied | 1 | Acceptable | 2 | Not acceptable | 3

(3) Taste | Satisfied | 1 | Acceptable | 2 | Not acceptable | 3

Q16b: During **rainy** season, are you satisfied with water service in following aspects?

(1) Pressure | Satisfied | 1 | Acceptable | 2 | Not acceptable | 3

(2) Color | Satisfied | 1 | Acceptable | 2 | Not acceptable | 3

(3) Taste | Satisfied | 1 | Acceptable | 2 | Not acceptable | 3

➡ *Surveyor: For the following questions (Q17-Q22), ask to show invoice for water supply service for last three month.*

Q17: Are you invoiced based on metered water quantity?

Yes	1
No	2

➡ Skip to Q19a

Q18a: How much water did you use **last month**?

|_|_|.|_| m³/month

Q18b: **In average**, how much water did you use **for last 3 months**?

||_|. |_| m³/month

Q19a: How much did you pay for the water service in the **last month**?

||_|. |_| Lempiras/month

Q19b: **In average**, how much did you pay for the water service **for last 3 months**?

||_|. |_| Lempiras/month

Q20: What type of toilet do you use?

1	Flush toilet
2	Toilet with manual flushing
3	Latrine
4	No toilet

Section III Willingness to Pay

Currently SANAA has a big financial difficulty. The present tariff covers only a part of the operation cost (chemicals, staff salary, electricity, daily repair, etc.). Due to lack of financial source, SANAA can neither invest new installation which is indispensable for service improvement, nor maintain the existing facility in good condition. This is one of the main reasons of inefficient water supply service such a ration of water and frequent water failure. Because of high inflation rate in Honduras, this situation is getting worse and worse. Therefore, the following two (2) scenarios we can foresee.

Scenario 1: Tariff level will increase so that present financial problem can be solved.

Scenario 2: Tariff level will remain at the present level, and the water supply service will collapse, or drastically deteriorate.

Q21a: Please imagine that it is necessary to increase the water tariff up to 30 Lps/month for realization of the scenario 1. If you accept it, you can receive the same water supply service as you receive now. Do you accept it?

Yes	1
No	2

Q21b: Please imagine that it is necessary to increase the water tariff up to 30 Lps/month for realization of the scenario 1. If you accept it, you can receive drinkable water for 24 hours, with adequate pressure. Do you accept it?

Yes	1
No	2

Thank you for your work! Please read the following sentence and then sign up.

I declare I realized this interview according to the interviewing door to door instructions with a respondent selected according to the sampling instructions.

Signature _____

Date _____

APPENDIX 2 THE QUESTIONNAIRES FOR NON-DOMESTIC USERS

Introduction

This questionnaire survey aims to understand the actual situation of domestic water usage and estimate benefits of the project to improve water supply service in Tegucigalpa. It is guaranteed that your personal information will never be disclosed.

Section I General Information

Q1: What type of industry?

1	Horticulture
2	Cattle raising
3	Other type of agriculture
4	Energy industry
5	Manufacture
6	Supermarket
7	Restaurant
8	Hotel
9	Bottling
10	Others ()

Q2: In average, how much did you sale for the last three (3) years?

|_|_|_|.|_|_|_| million Lempiras/year

Q3: Number of employees |_|_|_|.|_|_|_| Persons

Q4: How much did you pay for the electricity last month?

|_|_|_|_|.|_|_|_|_| Lempiras/month

Q5: What kind of damage did your house suffer due to Hurricane Mitch?

1	Totally destroyed, and constructed new house in same territory
2	Severely damaged
3	Was flooded above floor level
4	Was flooded under floor level
5	No damage

Section II Actual Situation of Water Usage

Q6: Which is the principal source of water?

Public water supply service (SANAA)	1
Private well	2
River water	3
Others ()	4

Q7a: How many hours in a day you can receive water during **dry** season? |_|_|_|.|_| hours

Q7b: How many hours in a day you can receive water during **rainy** season? || hours

Q8a: How many days in a week you can receive water during **dry** season? days

Q8b: How many days in a week you can receive water during **rainy** season? days

Q9: Do you have a water storage tank?

Si	1
No	2

➡ Skip to Q11a

Q10: For how many hours or days can the storage tank serve water?

|| hours o || days

Q11a: During **dry** season, are you satisfied with water service in following aspects?

(1) Pressure

Satisfied	1	Acceptable	2	Not acceptable	3
-----------	---	------------	---	----------------	---

(2) Color

Satisfied	1	Acceptable	2	Not acceptable	3
-----------	---	------------	---	----------------	---

(3) Taste

Satisfied	1	Acceptable	2	Not acceptable	3
-----------	---	------------	---	----------------	---

Q11b: During **rainy** season, are you satisfied with water service in following aspects?

(1) Pressure

Satisfied	1	Acceptable	2	Not acceptable	3
-----------	---	------------	---	----------------	---

(2) Color

Satisfied	1	Acceptable	2	Not acceptable	3
-----------	---	------------	---	----------------	---

(3) Taste

Satisfied	1	Acceptable	2	Not acceptable	3
-----------	---	------------	---	----------------	---

Q12a: How much the lack of water or restriction of water supply affect on your sales during the **dry** season?

||| %

Q12a: How much the lack of water or restriction of water supply affect on your sales during the **rainy** season?

||| %

➡ *Surveyor: For the following questions (Q14-Q15), ask to show invoice for water supply service for last three month.*

Q13: Are your invoices based on the metered consumption?

Yes	1
No	2

Q14a: How much water did you spend last month?

|||| m³/months

Q14b: **In average**, how much water did you spend in the last three (3) months?

|||| m³/months

Q15a: How much did you spend for water last month?

|||| Lempiras/months

Q15b: In average, how much did you spend for water in the last three (3) months?

||. |_|_|_|_|_|_|_|_| Lempiras/months

Section III Willingness to Pay

Currently SANAA has a big financial difficulty. The present tariff covers only a part of the operation cost (chemicals, staff salary, electricity, daily repair, etc.). Due to lack of financial source, SANAA can neither invest new installation which is indispensable for service improvement, nor maintain the existing facility in good condition. This is one of the main reasons of inefficient water supply service such a ration of water and frequent water failure. Because of high inflation rate in Honduras, this situation is getting worse and worse. Therefore, the following two (2) scenarios we can foresee.

Scenario 1: Tariff level will increase so that present financial problem can be solved.

Scenario 2: Tariff level will remain at the present level, and the water supply service will collapse, or drastically deteriorate.

Q16a: Please imagine that it is necessary to increase the water tariff up to 5 times more expensive than the present tariff for the realization of the scenario 1. If you accept it, you can receive the same water supply service as you receive now. Do you accept it?

Yes	1
No	2

Q16b: Please imagine that it is necessary to increase the water tariff up to 5 times more expensive than the present tariff for the realization of the scenario 1. If you accept it, you can receive drinkable water for 24 hours, with adequate pressure. Do you accept it?

Yes	1
No	2

Thank you for your work! Please read the following sentence and then sign up.

I declare I realized this interview according to the interviewing door to door instructions with a respondent selected according to the sampling instructions.

Signature _____

Date _____

APPENDIX 3 THE QUESTIONNAIRES FOR NONUSERS

Introduction

This questionnaire survey aims to understand the actual situation of domestic water usage and estimate benefits of the project to improve water supply service in Tegucigalpa. It is guaranteed that your personal information will never be disclosed.

Section I General Information

Q1: What is your age?

1	15 – 19 years
2	20 – 29 years
3	30 – 44 years
4	45 – 59 years
5	60 years and over

Q2: What is your occupation?

1	professional, technician or similar
2	director, manager, or general administrator
3	employee of the state offices, public institutes or private companies
4	services employee, merchant
5	farmer, cattleman, agricultural worker
6	drivers or similar
7	worker in textile industry, masonry, mechanics, or electricity
8	worker in graphic field, chemistry, foods and drinks, leather, tobacco, ceramic
9	cargo operator, stockman or dock worker
10	service occupation

Q3: Sex

Male	1
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Female	2
--------	---

Q4: How many family members live together? Persons

Q5: How many years do you live here? Years

Q6: How much did you pay for electricity in the last month?

Lempiras/month

Q7: How much was your household income in the last month?

Lempiras/month

Q8: What kind of damage did your house suffer due to Hurricane Mitch?

1	Totally destroyed, and constructed new house in same territory
2	Severely damaged
3	Was flooded above floor level
4	Was flooded under floor level
5	No damage

Section II Actual Situation of Water Usage

Q9: How do you get water?

Own well	1	☛ Skip to Q13
SANAA water tanker	2	
Private water vender	3	
From the community	4	☛ Skip to Q14
Others ()	5	☛ Skip to Q13

Q10: How often you purchase water? times/week

Q11: How many gallons of water you purchase once? gallons/once

Q12: How much do you pay for purchasing water once? Lempiras/once

Q13: How do you get water for drinking and cooking?

Well water with boiling	1
Well water without boiling	2
Water from truck with boiling	3
Water from truck without boiling	4
Bottle water	5
Others ()	6

☛ Skip to Q15

Q14: How much do you pay to the community to get water per month? Lempiras/month

Q15: How much you spend for bottle water monthly? Lempiras

Q16a: During **dry** season, are you satisfied with water in following aspects?

(1) Quantity	Satisfied	1	Acceptable	2	Not acceptable	3
(2) Color	Satisfied	1	Acceptable	2	Not acceptable	3
(3) Taste	Satisfied	1	Acceptable	2	Not acceptable	3

Q16b: During **rainy** season, are you satisfied with water in following aspects?

(1) Quantity	Satisfied	1	Acceptable	2	Not acceptable	3
(2) Color	Satisfied	1	Acceptable	2	Not acceptable	3
(3) Taste	Satisfied	1	Acceptable	2	Not acceptable	3

Q17: What type of toilet do you use?

1	Flush toilet
2	Toilet with manual flushing
3	Latrine
4	No toilet

Section III Willingness to Pay

Q18: Currently SANAA has a big financial difficulty. The present tariff covers only a part of the operation cost (chemicals, staff salary, electricity, daily repair, etc.). Due to lack of financial source, SANAA can not invest for service area expansion.

Please imagine that you should pay the water tariff at 30 Lps/month when you connect to the water supply network. If you connect to the network, you can receive drinkable water for 24 hours, with adequate pressure. Do you accept to pay that tariff?

Yes	1
No	2

Thank you for your work! Please read the following sentence and then sign up.

I declare I realized this interview according to the interviewing door to door instructions with a respondent selected according to the sampling instructions.

Signature _____ Date _____