Willingness to pay for sanitation services in Dagupan City, Philippines
D. S. Harder, A. J. U. Sajise and E. M. Galing

ABSTRACT
Using the Contingent Valuation Method (CVM), the study looks at the septage management and sewerage services demand of households with latrines in Dagupan City, Philippines vis-à-vis the cost of providing these services. The survey covers a total of 1,200 respondents for the septage and sewerage demand study. For the septage and sewerage studies, income was shown to significantly influence willingness to pay (WTP). WTP was also found to increase across income groups, indicating the plausibility of implementing a socialized pricing scheme for the septage and sewerage fees. Another important implication of the results is that increased demand for sanitation facilities would only take place as general income levels of Dagupan City improve. Under certain assumptions, the individually rational and financially viable Septage Fee is around PhP 46/month with optimal desludging frequency of 3 yrs. This means that a self-financed Septage Program is possible for the city. However, the case is different for the Sewerage Program since none of the proposed fees (including the average WTP of PhP 102/month for the whole sample) is sufficient to cover the huge investment costs associated with a self-financed sewerage infrastructure. Thus, the Local Government Unit (LGU) has to source funds elsewhere.

Key words | sanitation, septage, sewerage, willingness to pay (WTP)

BACKGROUND
This study on household sanitation behavior and demand for sanitation services in Dagupan City is part of the continuing activity under the Program for Sustainable Sanitation for South Asia (SuSEA). This is implemented in six pilot provinces nationwide that include the municipalities of Bauco, Alabel, Guiuan and Polomolok as well as the cities of Dagupan and General Santos. The overall objective of SuSEA is to increase the access for poor Filipinos to sustainable sanitation services. It is composed of two national components: (1) Establishment of a national sustainable sanitation program (NSSP); and (2) Formulation of a national sustainable sanitation communications and hygiene promotion program (NSSCHPP).

Among the objectives of the NSSP is for all provinces and cities and half of the municipalities to come up with a sustainable sanitation program, as well as a 100% increase in sustainable sanitation investments by 2016. This links closely with the objectives of the study that aims to understand the sanitation decisions households make and the amount they are willing to pay for sanitation services.

In particular, using the Contingent Valuation Method (CVM), the study looks at the septage management and sewerage services demand of households with toilets in Dagupan City vis-à-vis the cost of providing these services. It reveals what people say they would do given the hypothetical scenario of providing sanitation services in their area.

The CVM has been a popular and valuable tool in determining private preferences for public goods. It has had extensive applications in the valuation of environmental and natural resource goods, such as forests, biodiversity, and air to name a few. In the water and sanitation sector, CVM has been mainly applied to the study of consumer preferences for improved sanitation (Whittington et al. 1993; Altaf & Hughes 1994) and construction of a sewerage infrastructure.
system and wastewater treatment facilities (Whittington et al. 1995, 1995, 1997; Fujita et al. 2005). There are only a few studies that dealt with household preferences for a septage treatment program, which can be a short to medium term alternative to a fully functional sewerage system. This study covers both the septage and sewerage alternatives to improving sanitation. It is perhaps closest to the study of Altaf & Hughes (1994) that dealt with improved sanitation. The novelty of their study is that they offered improved sanitation in terms of attributes rather than technologies. The attributes that were considered were (a) waste water treatment, (b) on-site treatment, and (c) off-site treatment. Thus, including the attribute for on-site treatment partly covers the septage option for sanitation.

### THE CONTINGENT VALUATION METHOD (CVM)

#### The CV design

Contingent valuation, a method used to study household preference and behavior, directly asks people in a survey how much are they willing to pay (or willing to accept) for a good or service. It is referred to as ‘contingent’ because people’s willingness to pay (WTP) values are anchored on a specific hypothetical scenario and description of the good/service to be provided. The hypothetical market includes a statement of the proposed change (i.e. sanitation services) and an institutional mechanism in which the proposed change is to be provided and financed (i.e. water bill).

#### The contingent valuation scenario

The two hypothetical CV scenarios presented in the survey include the septage and sewerage management plans. This is compared to the existing practice or status quo (Table 1).

#### Elicitation method

In framing the WTP question, the referendum dichotomous choice (DC) elicitation format was used. This format uses bids that are randomly assigned to respondents and asking them whether they would vote to pay the assigned amount that will be added to their monthly water bill. They could either accept or reject the bid offer.

This type of elicitation format is realistic since individuals typically make purchase decisions based on fixed market prices (‘take it or leave it’). This also minimizes if not totally eliminates the incentive for respondents to lie or to engage in strategic behavior in order to influence the

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Contingent Valuation (CV) scenario for septage and sewerage study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coverage of the plan</strong></td>
<td>Septage management plan</td>
</tr>
<tr>
<td></td>
<td>Sewerage plan</td>
</tr>
<tr>
<td><strong>Where sludge/wastewater is brought</strong></td>
<td>Septage management plan</td>
</tr>
<tr>
<td></td>
<td>Sewerage plan</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td>Septage management plan</td>
</tr>
<tr>
<td></td>
<td>Sewerage plan</td>
</tr>
<tr>
<td><strong>Payment scheme</strong></td>
<td>Septage management plan</td>
</tr>
<tr>
<td></td>
<td>Sewerage plan</td>
</tr>
<tr>
<td><strong>Frequency of desludging</strong></td>
<td>Septage management plan</td>
</tr>
</tbody>
</table>

provision of the good. The hypothetical scenario further includes a script that reminds respondents of their budget constraint to get more valid WTP responses.

Certainty corrections were further applied to WTP responses. In particular, respondents who said that they are willing to pay for the sanitation service but are unsure of their response are re-classified as ‘no’ respondents. This is usually done in contingent valuation analysis to correct for hypothetical bias. Overall, ‘no’ responses increased from 781 to 831 after the WTP responses to the offered bid were adjusted for certainty. The data was also subjected to protest vote screening. The study only considered valid ‘no’ responses if the reason for voting no was due to lack of preference for the good or income constraint.

**Setting of bid prices**

One of the crucial decisions to make in any CVM study is the selection of bid prices. The research team did an initial focus group discussion with households. The initial bids were then pre-tested to 151 randomly selected households from 4 barangays in Dagupan, namely: Barangays 2 and 4 (within the Central Business District), Barangay Lomboy (island barangay) and Barangay Mangin (interior/river barangay). The choice of pre-test sites took into account the income disparities between zones or barangay classification. The final bids used for the survey are PhP 50, PhP 100, PhP 150, PhP 200 and PhP 250.

**General empirical strategy: CVM and the random utility model (RUM)**

The random utility model is the overall framework used to analyze the survey data. The model posits that given two choices \( i = 1,2 \), a household chooses the first alternative over the other if the utility gained from the first alternative is higher than the utility derived from the other. If we let \( V_i \) be the indirect utility gained from choosing alternative \( i \), then rationally choosing alternative 1 means that:

\[
V_1(x_1, m_1) > V_2(x_2, m_2)
\]

where \( m_i \) is the income under each alternative, \( x_i \) are other determinants of utility level.

Note that the choice problem falls under the class of discrete or DCs. Since the analyst only observes the actual choice and some but not all variables that affect the choice, a random error term \( \varepsilon_i \) is included and \( V_i \) is considered as the deterministic component. The probability of observing choosing alternative 1 can be written as:

\[
\Pr(y_1 = 1) = \Pr(V_1(x_1, m_1) > V_2(x_2, m_2))
\]

An interesting application of this model is a hypothetical scenario used to analyze and explain the stated preferences of households for the proposed sanitation programs in Dagupan City (i.e. Septage and Sewerage Management Plans). These services will be available for a household in exchange for a reduction in income. Suppose that the household is offered a price or bid \( b \) in exchange for the hypothetical service. Agreeing to pay the bid or price implicitly implies that:

\[
\Pr(\text{yes}) = \Pr(v_1(y_i - t_i, z_i, \theta_i, \varepsilon_1)) > (v_0(y_i z_i, \theta_i, \varepsilon_0))
\]

where \( v_0 \) is the status quo utility, \( v_1 \) is the utility after the proposed change, \( t_i \) is the bid offered, \( z_i \) is a vector of demographic variables (e.g. education, age, gender, etc.), \( y_i \) is respondent \( i \)'s income level, \( \theta_i \) is a vector of other control variables (e.g. classification).

Assuming a linear utility function we can restate the earlier probability statements. Specifically, we can rewrite the status quo indirect utility and decompose it to its deterministic and random components \( \varepsilon_{ij} \) for \( j = 0,1 \):

\[
v_{10}(y_i) = \beta_0^0 + \beta_1^0 z_i + \beta_2^0 y_i + \beta_3^0 \theta_i + \varepsilon_{i0}
\]

Similarly the indirect utility function for the proposed change is expressed as:

\[
v_{11}(y_i) = \beta_0^1 + \beta_1^1 z_i + \beta_2^1 (y_i - t_i) + \beta_3^1 \theta_i + \varepsilon_{i1}
\]

Notice that in the previous equation we are subtracting the bid from the income level. This is how we capture the trade-off from reducing income but paying some amount \( t_i \). Using Equations (2) and (3), we can alternatively write
Equation (1) as:

\[ \Pr(\text{yes}_j) = \Pr\left[ \beta_0 + \beta_z z_i + \beta_{yi} y_j + \beta_{t} t_i + \varepsilon_{j0} + \varepsilon_{j1} > 0 \right] \]

or

\[ \Pr(\text{yes}_j) = \Pr\left[ \epsilon_{j1} + \epsilon_{j0} > \beta_0 - \beta_{t} t_i + (\beta_0 - \beta_{t} t_i) z_i + (\beta_0 - \beta_{t} t_i) \theta_1 + (\beta_{yi} - \beta_y) y_i + (\beta_{z} - \beta_z) z_i \right] \]

Simplifying difference terms for the coefficients yields:

\[ \Pr(\text{yes}_j) = \Pr\left[ \epsilon_{j} > \beta_0 + \beta_{z} z_i + \beta_{yi} y_j - \beta_y t_i + \beta_{t} \theta_1 \right] \]

The next step would be to estimate the simplified \( \beta \) coefficients. This involves assuming a specific functional form for the probability distribution \( \Pr(\cdot) \). A common assumption is the logistic function. The log likelihood function is derived through taking the summation the log of the logistic function for each observation or respondent. The usual estimation procedure for obtaining the estimated coefficients \( \hat{\beta}_i \) is the Maximum Likelihood Estimation (Greene 2002). Finally the Mean WTP is calculated using the following formula:

\[ \text{Mean WTP} = E(WTP/\alpha, \beta, z) = \frac{\hat{\beta}_0 + \hat{\beta}_z z + \hat{\beta}_{yi} y + \hat{\beta}_t t + \hat{\beta}_\theta \theta}{\hat{\beta}_y} \]

Some econometric issues

There are two econometric issues associated with the nature of the data for the study. The first one involves the nature of the CVM data for the Septage Management Plan (SMP). In particular, different hypothetical scenarios were offered to households with and without water connections. Connected households were offered the hypothetical scenario of whether they would be willing to pay some bid amount for the SMP. Non-connected households, on the other hand, were offered a hypothetical scenario of whether they would want to be connected or not. This was followed by the same hypothetical scenario offered to connected households.

We conjecture that there is a potentially larger hypothetical bias for non-connected households because they essentially face two hypothetical scenarios. The likelihood of actually experiencing the septage infrastructure is less real for this subgroup of respondents. A consequence of this is that the probability of being offered a two-staged scenario is conditional on the household being connected at the time of the interview. Since, the choice of being connected could be linked to certain household characteristics; we expect that some will be more predisposed to having water connections. This leads us to the potential problem of sample selection. Simply pooling connected and non-connected households and following the specification outlined above for the septage sample can lead to inconsistent estimates and hence biased WTP values. To address this issue we first estimate an endogenous switching regression model where both the selection and outcome variables are discrete or dichotomous.

Consider first the selection mechanism. A household chooses to connect to Dagupan City Water District (DCWD) water system if:

\[ \Pr(\text{connection} = 1) = \Pr(\text{\( V_{\text{connected}}(\rho) + \varepsilon_{\text{connected}} \) > \( V_{\text{not connected}}(\rho) + \varepsilon_{\text{not connected}} \))} = \Pr(\varepsilon' > V_{\text{not connected}}(\rho) - V_{\text{connected}}(\rho)) \]

where

\[ \varepsilon' = \varepsilon_{\text{connected}} - \varepsilon_{\text{not connected}} \]

The outcome variable on the other hand, pertains to the household’s answer to the CV scenario. The household agrees to pay the offered bid if:

\[ \Pr(\text{yes}) = \Pr(\text{\( V_{\text{yes}}(\rho) + \eta_{\text{yes}} \) > \( V_{\text{status quo}}(\rho) + \eta_{\text{status quo}} \))} = \Pr(\eta' > V_{\text{status quo}}(\rho) - V_{\text{yes}}(\rho)) \]

where

\[ \eta' = \eta_{\text{yes}} - \eta_{\text{status quo}} \]
Since, the error terms of the selection and outcome are hypothesized to be correlated we can observe the conditional choice of agreeing to a bid as:

$$\Pr(\text{yes}|\text{connection}=1) = \frac{\Pr(\eta V_{\text{status quo}}(\rho - V_{\text{yes}}(\rho)) - V_{\text{connected}}(\rho))}{\Pr(\epsilon > V_{\text{not connected}}(\rho) - V_{\text{connected}}(\rho))}$$

Instead of estimating the conditional probability of observing an agreement to a bid, we can opt to estimate the joint probability. To do this we can assume that both error terms are normally distributed and estimate a bivariate probit expressed in equation terms as follows:

$$\Pr(\eta > V_{\text{status quo}}(\rho), \epsilon > V_{\text{not connected}}(\rho)) = \int_{\eta, \epsilon} \phi(\eta, \epsilon, \rho) d\eta d\epsilon$$

where $\phi$ is the bivariate normal density function.

Looking at whether $\rho$ is significant or not at an assumed confidence level easily tests the presence of sample selection. If $\rho$ is statistically different from zero then the decision to connect is necessarily related to the decision of agreeing to a bid offer. A simple application of the econometric model in the previous section to a pooled sample of connected and non-connected households will lead to biased estimates of WTP.

**Variables used in the various analyses**

The covariates used in the implementation of the empirical strategy are shown in Annex Table 1, available online at [http://www.iwaponline.com/washdev/003/064.pdf](http://www.iwaponline.com/washdev/003/064.pdf). This includes socio demographic variables such as income, education, age, civil status, house ownership and years lived in current dwelling. Other relevant variables considered are knowledge on sanitation, diarrheal incidence in the past 3 months, age of the septic tank and village classification (i.e. business district, coastal/inland, island).

**Sampling frame**

For the septage and sewerage study, a total of 1,200 respondents were sampled, distributed between 850 and 350 respondents, respectively. The total sample takes into account cost and time considerations in doing the survey. A 12% non-response rate was noted for the whole sample.

The allocation of the sample is based on the following formula:

$$n_i = N \left( \frac{N_i \sigma_i}{\sum_k N_k \sigma_k} \right)$$

where $N$ is the total sample size, $N_i$ is the total population in the $i$th income strata, $\sigma_i$ is the income variance for the $i$th income strata, $c_i$ is the cost of obtaining a sample from the $i$th income strata.

The above equation provides the least cost allocation for a fixed sample size given the variability in income. We assume that cost differences are insignificant since Dagupan’s terrain is homogeneous and its land area (4,446 ha) is not that large. Thus, this variable can be ignored in the computation.

Variability in income is based on barangay clusters, which is the only available disaggregated information from the 2007 SuSEA Dagupan City baseline study. However, for the sewerage study, a simple proportional allocation was used because barangays under this scenario belong to the same type/cluster. Thus, the ‘income variability’ cancels out in the equation.

For the septage study, sample allocation for each barangay was further categorized into households connected and not connected to the DCWD. Considering all this, the sample size allocation for the septage management and sewerage options are shown in Tables 2 and 3, respectively.
The discussion of survey results is divided into two parts. First is a qualitative description of the data in terms of environmental and health hazards that relate to the design, construction and maintenance of existing household sanitation facilities. The second part outlines the results of the econometric strategy discussed in the methodology section.

**Overview of current sanitation in Dagupan City**

**Environmental problem/priorities**

Base on household ranking, the more visible environmental threats that the local government should give priority to include solid waste (36%) and flooding (30%). It is common knowledge that the majority of the barangays in Dagupan are vulnerable and susceptible to the disturbing effects of inundation.
Poor sanitation (26%) only ranks third among the top environmental problems of Dagupan City from the perspective of households’ respondents. This is not only in terms of lack of access to latrines but also by the threat posed by badly designed sanitation facilities including the lack of proper sludge and wastewater disposal systems. Receiving water bodies often absorb the pollution load coming from households. Thus, it is not surprising that the Department of Environment and Natural Resources-Environment and Management Bureau (DENR-EMB) included Dagupan River as one of the rivers nationwide that pose contact risk to public health and the environment. It has shown a very high total and fecal coliform level, about 30 times higher than the DENR standard.

**Current sanitation facilities and the environment**

Survey results show that 43% of households have single vault septic tanks that do not conform to the standard design prescribed under the Sanitation Code of Dagupan City. These vaults provide only minimal treatment and limited sludge storage compared to two or three chambered septic tanks. Although most of households reported that their septic tanks are water sealed (at least for one chamber), 15% of the remaining septic tanks are bottomless or do not have concrete flooring. This could lead to wastewater seepage.

In terms of location and access, the Sanitation Code of Dagupan City further stipulates that septic tanks ‘should not be constructed under any building and shall be located such that desludging equipment can have convenient access to the manhole’. Nonetheless, almost half of the respondents interviewed had septic tanks located inside the house, with some directly under their toilets. A third further reported that their septic tanks are more than 20 m away from the nearest access road. This concern however, can be addressed by using longer vacuum pumps (e.g. vacuum pumps of Manila Waters which have a maximum length of 80 m). The only constraint is the width of the access road that should be able to accommodate the desludging truck. This could be a problem particularly for the island barangays.

Another disturbing observation is the 13 m average distance of the nearest water source to the latrine, which is lower than the specified distance of 25 m and above under the Clean Water Act. However, the survey shows that only 6% of the respondents are familiar with this provision under the Act. In general, the close proximity of toilets and water sources coupled with poorly constructed septic tanks could lead to groundwater contamination that is hazardous to public health. A faulty septic tank can also lead to hydraulic overloading or waste being forced out through the septic tank before it receives adequate treatment, particularly during flooding.

Most respondents perceive that water from the septic tank goes underground (48%) or stays inside the tank (38%). Only 9% believed that wastewater from septic tanks eventually finds its way into the water bodies. More than three quarters of the respondents still had the misconception that septic tanks can provide 100% treatment for sludge and wastewater, thus controlling for water pollution.

For a septic tank to function as designed, it has to undergo regular maintenance through the removal of built up solids. However, the survey shows that only 13% of households have desludged their septic tanks in the past 10 yrs. This is despite the majority of respondents agreeing to the statement that septic tanks should be desludged once every 3–5 yrs as required under the Sanitation Code of Dagupan City. Desludging is done mainly as a response to emergency situations such as septic tank overflow, clogging or damage caused by flooding, earthquakes, etc. Poor maintenance reduces the effectiveness of septic tanks to treat waste before it is discharged to the environment.

Also, there is no existing sludge treatment and disposal facility within Dagupan. The nearest DENR approved composting facility is in Sual, Pangasinan. This has resulted in indiscriminate disposal of untreated or poorly treated sewage into the environment. The survey shows that of those that had their septic tanks emptied, 40% do not know where the septage is brought while 30% buried their waste in a pit (i.e. manual desludging). The rest disposed of the waste in nearby water bodies (13%), in a farm (5%), or anywhere (7%). This practice is prohibited under the Sanitation Code of Dagupan City, which stipulates that, ‘no discharge of septage or sludge shall be allowed in manholes, drainage areas, canals, creeks, rivers or other receiving bodies of water or land’. Unceremonious discharge of untreated sewage into vacant spaces and receiving water
bodies provides a vector for pathogens that could transmit disease to humans.

In terms of health impacts, 10% of the respondents reported incidences of diarrhea in the past 3 months while 3% reported diarrheal incidence in the past week of the survey. On average, respondents spent PhP 604 for treatment. Meanwhile, occurrences of other waterborne diseases are negligible and no reported outbreaks were observed during the duration of the study.

**Econometric results**

This section covers the WTP value of Dagupan City households for the SMP, and WTP of the Central Business District (CBD) households for the Sewerage Plan. The final models used are corrected for both uncertainty and protest votes (Certainty Corrected/Protest Corrected models).

In particular, the discussion includes characteristics of the respondents and results of the CV analysis, including simulation exercises that helped identify some important provisions of a potential Septage Management Program and Sewerage Plan. For instance, we determine the most efficient desludging frequency (only for the SMP) and pricing policy. Efficiency is referred to in the context of an intertemporal decision wherein discounting or time preference plays an important role. Likewise it also refers to that which is rational for the individual household as well as financially feasible to the Local Government.

**Implementing a Septage Management Program and a Sewerage Plan in Dagupan City**

After screening for protest votes, 790 useable responses were used for the WTP analysis under the SMP. This includes both households connected and not connected to the DCWD. For the Sewerage Plan, the useable sample for the analysis is 322 after protest screening.

It should be noted that the CBD area is estimated to generate 2,772 cubic meters of wastewater per day, necessitating the need for a maximum design capacity of 6,000 cubic meters/day for the wastewater treatment plant. This takes into account population growth and the corresponding increase in wastewater generation. The projected cost of the STF would be around PhP 250–300 million. Nonetheless with additional construction of sewer lines/pipe networks, total investment could increase up to PhP 500–600 Million to fully address the sanitation problems of Dagupan City (SuSEA 2008).

**Respondent characteristics (pooled sample)**

Based on the socio-economic profile of households, those that are willing to pay for the SMP are relatively younger. Also, nearly a third are married with an average of six members per family. In addition, the majority of these respondents are relatively well off in terms of assets and income. Nearly a quarter earn monthly income greater than PhP 20,000 compared to 16% of those who are not willing to pay. Households who support the Plan are likewise better educated. In terms of location, a higher percentage of septage respondents from the CBD and island barangays are willing to support the SMP while a greater number of refusals to pay were observed from coastal/inland and river barangays.

Similarly, respondents who are willing to pay have older houses and septic tanks and have lived longer in their current residence. In general, septic tanks have a mean age of 16 yrs for both subgroups.

On the other hand, households who are willing to pay for the Sewerage Plan are more mature in age, have older houses and septic tanks and have lived longer in their current residences relative to respondents who are not willing to support the Sewerage Plan. Both, however, have almost the same number of household members per family, number of families living in the house and number of houses owned within Dagupan City. A higher percentage of WTP respondents also had income under brackets 4 and 5 or income greater than PhP 20,000/month (28%) compared to those who are not willing to pay (16%).

For both subgroups, nearly three quarters are female and married. Respondents who are willing to pay are also more educated as two thirds have reached college. Thus, they may be more familiar with sanitation issues and can better appreciate the Sewerage Plan presented to them.

**Bid distribution**

Cursory evidence shows that in general, the percentage of respondents saying ‘yes’ or those willing to pay the
amount for the SMP and the Sewerage Plan, decreases with the offered bid (Figures 1(a) and 1(b)), thus conforming to theoretical expectations.

Similarly, the percentage of those saying ‘yes’ to the offered bid increases with income for respondents in both groups (Table 4).

Willingness to Pay
(A) Septage Management Program
As elaborated earlier, a bivariate probit model was used to test whether the error terms in the selection mechanism and the outcome decision (i.e. probability of agreeing to the offered bid) are correlated. A simple likelihood ratio test shows that the correlation parameter ($\rho$) is not significantly different from zero. Thus, we can run a logit regression on the pooled sample of connected and non-connected households.

The results of the logit regression for the septage study are shown in Annex Table 2. The negative and significant coefficient for the bid offer indicates that respondents are less likely to pay for higher bids. Younger respondents are also more likely to pay for the sanitation service. Besides this, ones’ knowledge on sanitation issues increases the probability of saying ‘yes’ to the bid offer. In particular, knowledge regarding the provisions of the Sanitation Code of Dagupan City as well as general knowledge on wastewater hazards and sanitation can increase the probability of agreeing to a bid offer by 13 percentage points. The probability of agreeing to a bid is also positively related to the level of education. This implies

![Figure 1](https://iwaponline.com/washdev/article-pdf/3/2/165/384624/165.pdf)

*Figure 1* | (a) Bid distribution of ‘yes’ responses for the septage management plan, (b) Bid distribution of ‘yes’ responses, for the sewerage plan.

<table>
<thead>
<tr>
<th>WTP Distribution by Income Bracket, Septage and Sewerage Respondents</th>
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<tbody>
<tr>
<td><strong>Willingness to Pay (WTP)</strong></td>
</tr>
<tr>
<td><strong>SEPTEAGE MGT. PLAN</strong></td>
</tr>
<tr>
<td>Income bracket</td>
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<tr>
<td>----------------</td>
</tr>
<tr>
<td>Income 1</td>
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<tr>
<td>Income 2</td>
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<td>Income 3</td>
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<tr>
<td>Income 4</td>
</tr>
<tr>
<td>Income 5</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

*Excludes one ‘don’t know’ response for income.
that well-informed households tend to agree more to the offered bid, perhaps, because these households can comprehend the scenario better. We can see this because all the categorical variables for education (educ 2 to educ 8) are significant and exhibit positive signs. Another determinant of the probability of agreeing to an offered bid is the age of the house. The variable is negatively related with the probability of paying the bid offer. That is, households with older houses have a lower probability of supporting the SMP. This is not surprising since old houses are prone to abandonment.

The information obtained from the logit analysis is used to compute for the amount that households on average are willing to pay (WTP) for septage service improvements (Table 5). Calculations show that the mean WTP of Dagupan City residents is around PhP 73. Note that WTP increases with income. For instance, households with monthly income in excess of PhP 35,000 would be willing to add PhP 121 to their monthly water bill to avail of the improved septage services. While households in the lowest monthly income bracket (below PhP 4,999) are willing to pay an additional PhP 67/month. Furthermore, the WTP for each income bracket are significantly different from each other at 5% level of confidence. The variability in the WTP across income brackets is suggestive that a ‘socialized’ pricing scheme can be implemented.

However, not all of the WTP amounts shown in Table 5 would pass a referendum. Estimates show that for the whole sample and across income brackets, only 50% on average would vote for a referendum that will add the Septage Fee to the existing water bill. The calculated bid or proposed price and the probability of a ‘yes vote’ are shown in Table 6. In order to have at least 60% of households across income brackets agreeing to a new septage ordinance, the proposed Septage Fee should only be around PhP 46.

(B) Sewerage Program

Results of the logit regression for the Sewerage Program are shown in Annex Table 3. For the final model used, only the bid, knowledge, and Income 4 estimates were found to significantly differ from zero. The bid variable shows a theoretically predicted sign. Specifically, the probability of a ‘yes vote’ decreases with the increasing bid offer. Income 4 is the only significant income bracket. This means that compared to the relatively poorest households in the CBD, households with income between PhP 20,000 and PhP 35,000 have a higher probability of agreeing to the bid offer. All other income brackets have the same probability of agreeing to an offered bid relative to Income 1. The knowledge variable is also significant but it does not have the predicted sign. This counterintuitive result indicates that households with more knowledge on sanitation issues are less likely to pay. One explanation would be that these households might have already been carrying out actions to improve their level of sanitation. Hence, they may be reluctant to pay more for a new program. Since, we have no information on the specific sanitation decisions of households other than what is associated with decisions affecting their septic tanks, we were not able to control for this in the regression model.

The computed WTP for the Sewerage Program for the whole sample and for each income bracket is shown in

<table>
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<tr>
<th>Table 5</th>
<th>Calculated willingness to pay values for the septage and sewerage program, by income bracket and for the whole sample</th>
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<tbody>
<tr>
<td>Income bracket (N = 790)</td>
<td>WTP/mo</td>
</tr>
<tr>
<td>Income 1</td>
<td>67</td>
</tr>
<tr>
<td>Income 2</td>
<td>55</td>
</tr>
<tr>
<td>Income 3</td>
<td>73</td>
</tr>
<tr>
<td>Income 4</td>
<td>102</td>
</tr>
<tr>
<td>Income 5</td>
<td>121</td>
</tr>
<tr>
<td>Whole sample</td>
<td>73</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Probability of paying/voting for different proposed fees, septage and sewerage programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of paying (%)</td>
<td>Proposed fee (PhP/mo)</td>
</tr>
<tr>
<td>Septage mgt. program</td>
<td>Sewerage program</td>
</tr>
<tr>
<td>30</td>
<td>133.80</td>
</tr>
<tr>
<td>40</td>
<td>101.60</td>
</tr>
<tr>
<td>50</td>
<td>73.00</td>
</tr>
<tr>
<td>60</td>
<td>46.00</td>
</tr>
<tr>
<td>70</td>
<td>23.00</td>
</tr>
<tr>
<td>80</td>
<td>7.00</td>
</tr>
<tr>
<td>90</td>
<td>0.50</td>
</tr>
<tr>
<td>99</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Table 5. Computed WTP per income bracket are significantly different from each other at 5% level. The mean WTP for the whole sample using the certainty and protest corrected model is PhP 102. What is interesting to note, is that unlike the trend observed for the WTP for septage, the WTP for sewerage increases with income for the first four brackets and then declines with further rise in income (bracket 5).

Going back to Table 5, the mean WTP for the whole sample has a 50% chance of being voted and is therefore expected to pass the referendum. Table 6 shows the proposed fee and the corresponding probability of payment. If 60% of households will vote for the Sewerage Program, then the proposed legislation should charge a sewerage fee of PhP 73. The sewerage fees households would be willing to pay range from PhP 2 to PhP 102/month. Note that these values are higher than the resulting fees for the Septage Management Program.

The efficient price and desludging frequency
We now address the question on the relevant price to charge households and the optimal desludging frequency. To answer this, we will use the Benefit Cost Analysis (BCA) approach. The BCA assumptions are outlined in Annex Table 4.

Under the Septage Management Program, the welfare gains households derive from different fees and desludging frequencies are shown in Table 7. The figures are welfare gains in present value (PV) terms of different pricing schemes and household desludging frequency. The status quo represents the PV of paying the average commercial desludging price of PhP 2,500.

The first thing to notice is that the range of Septage Fees widens as the desludging frequency is shortened. For example, if the Dagupan Local Government Unit (LGU) imposes that households desludge their septic tanks once in every 10 yrs, then households will only rationally participate in that scheme if the Septage Fees are between PhP 0.50 and PhP 7. This is because they will be better off with the status quo of hiring a commercial desluder and paying him an average of PhP 2,500 (or PhP 1,060 in PV terms) every 10 yrs. On the other hand, if the mandated desludging is every 3 yrs, then the Septage Program will be more appealing to households. We expect, given the current
cost assumptions that households will participate if the Septage Fees are between PhP 0.50 and PhP 46. Fees falling between these ranges are shown to be superior to the status quo.

What drives the results of the BCA analysis is the discounting or assumptions on households’ time preferences. Increasing the interval between desludging (i.e. reducing desludging frequency) favors the status quo because these costs become smaller in PV terms.

An attendant question is which of these proposed Septage Fees would be feasible to implement? Earlier, we have answered the question on which fees and desludging frequency are rational for the household. We found out that the 3- yrs interval will yield the largest gains for the households. Given this, we will analyze which of these Septage Fees would be financially viable to implement along with the 3- yrs desludging plan. Another BCA was conducted using the same assumptions in Annex Table 4.

Given the assumptions, results show that the financially viable Septage Fees are PhP 46/mo and PhP 73/mo (Table 8). By financial viability, we mean that the initial investment costs are recovered (fully paid) within 10 yrs and that yearly operation and maintenance (O&M) expenses are also recovered within the lifetime of the project, which is set at 25 yrs. These are the only Septage Fees that will result in a positive Net Present Value (NPV). Given this, the only rational and financially viable Septage Fee is PhP 46. Thus, with the current information at hand, a Septage Fee of PhP 46/mo is recommended. Households in turn will receive regular scheduled desludging of their septic tanks every 3 yrs.

For the Sewerage Program, given the referendum-passing fees on Table 6, BCA results show that the prospects for an LGU financed Sewerage Program for Dagupan is less optimistic following assumptions in Annex Table 5. With huge investment outlays, none of the proposed fees are financially viable (Table 9).

### Comparison of the proposed programs with other existing programs

(A) Septage Management Program

The recommended Septage Program would charge PhP 46/mo or approximately PhP 2/m³ if the average household water consumption were 24 m³/month. These charges are similar to the computed price by the Local Initiatives for Affordable Wastewater Treatment (LINAW) project in Dumaguete City. In terms of monthly water bill, the proposed fee is close to the partial charges of Manila Water. It roughly constitutes 11% of the average household water bill of PhP 416.20 (Table 10).

All in all, the proposed SMP is not far from existing and planned Septage Programs in the country. The innovation is that the numbers obtained came from a more rigorous methodology. Furthermore, we are sure that the recommendations are based on household stated behavior or preferences.

(B) Sewerage Program

The bleak scenario for a self-financed Sewerage Program begs the question of whether the estimates are indeed far off from other studies. The only other study on household’s WTP values was conducted in 1993. (The date of the original study was cited in the Philippine Environment Monitor 2003. However, there were no citations of the exact study in the publication.) Table 11 shows that in general, the WTP for Sewerage is in the range of the values obtained by the study. However, even if we use the estimates for Dagupan from this 1993 study, it would still not be

### Table 8 | Financial viability of different proposed septage fees

<table>
<thead>
<tr>
<th>Bid/price (PhP/mo)</th>
<th>NPV (3 yrs desludging)</th>
</tr>
</thead>
<tbody>
<tr>
<td>73</td>
<td>103,152,095.48</td>
</tr>
<tr>
<td>46</td>
<td>28,591,923</td>
</tr>
<tr>
<td>23</td>
<td>–34,922,297.86</td>
</tr>
<tr>
<td>7</td>
<td>–79,106,103.73</td>
</tr>
<tr>
<td>0.5</td>
<td>–97,055,775</td>
</tr>
</tbody>
</table>

### Table 9 | NPV of different referendum passing fees, sewerage program

<table>
<thead>
<tr>
<th>Additional fee/month</th>
<th>Price/cu. m.</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>4.3</td>
<td>–151,422,433</td>
</tr>
<tr>
<td>73</td>
<td>3</td>
<td>–187,779,355</td>
</tr>
<tr>
<td>45</td>
<td>1.9</td>
<td>–222,882,591</td>
</tr>
<tr>
<td>18</td>
<td>0.8</td>
<td>–256,732,139</td>
</tr>
<tr>
<td>2</td>
<td>0.1</td>
<td>–276,791,131</td>
</tr>
</tbody>
</table>
sufficient to cover the huge investment requirements for the proposed self-financed Sewerage Program.

**Household perceptions on the hypothetical scenario for the septage and sewerage plans**

**Payment vehicle**
Respondents were asked of their opinion regarding the hypothetical elements contained in the CV scenario, particularly the payment vehicle. The water bill was chosen due to its wider coverage, mandatory nature (i.e. disconnection as effective sanction against nonpayment), credibility, and close link with sanitation services. However, the disadvantage of using this payment mechanism is the timing of increase in water rates before the survey period. The DCWD is also supportive of the Plan and is willing to collect sanitation charges from its customers. Overall, respondents from the two subgroups agree with the idea that they will pay for the septage and sewerage fees through their monthly water bill. The major reason why some households did not agree to the current payment vehicle is the continuous increase in the water rates. We learned that the DCWD increased its rate per cubic meter months before the survey thereby creating a negative impact on the respondents’ decision making.

An alternative payment vehicle considered by some respondents includes a separate bill for septage and sewerage fees that will be handled by a private collector, so that the computations of the charges will be clear to them. Another suggestion would be to add these charges to the garbage fee (PhP 30/mo) collected by each barangay. Respondents find the barangay solid waste management program successful and the collection of fees efficient. The idea of collecting the sewerage and septage fees through community tax certificates was also forwarded (Table 12).

**Belief in the success of the program/plan**
The majority of the respondents believe that the Septage and Sewerage Management Plans, once implemented, will succeed in attaining the goal of reducing environmental pollution and health hazards associated with poor sanitation. In fact, some are already curious as to the design, location and actual start of the project. Those that remained skeptic on the plausibility of the Plans gave three major reasons: (a) distrust of the LGU due to possible corruption of funds; (b) impact to others who may not be able to afford the fees and; (c) failure of other people to cooperate (Table 13).

**Effect on water connection to DCWD**
Table 14 shows that 95 and 88% of sewerage and septage respondents respectively would retain their DCWD connection even if the majority will vote for the septage/sewerage fee to be added to the water bill. One of the main reasons for keeping their piped water connection is the difficulty of

---

**Table 10 | Charges for septage and sewerage programs in the Philippines**

<table>
<thead>
<tr>
<th>Location</th>
<th>Sewer connection (PhP/mo/hh)</th>
<th>Sewer connection + treatment (PhP/mo/hh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manila water</td>
<td>124</td>
<td>103</td>
</tr>
<tr>
<td>Dumaguete city</td>
<td>62</td>
<td>92</td>
</tr>
<tr>
<td>Zamboanga city</td>
<td>169</td>
<td>207</td>
</tr>
</tbody>
</table>


**Table 11 | Other WTP estimates, Philippines**

<table>
<thead>
<tr>
<th>Location</th>
<th>Sewer connection (PhP/mo/hh)</th>
<th>Sewer connection + treatment (PhP/mo/hh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calamba</td>
<td>124</td>
<td>103</td>
</tr>
<tr>
<td>Davao</td>
<td>62</td>
<td>92</td>
</tr>
<tr>
<td>Dagupan</td>
<td>169</td>
<td>207</td>
</tr>
</tbody>
</table>

Table 12 | Respondent's perception to the payment vehicle & alternative schemes

<table>
<thead>
<tr>
<th></th>
<th>Septage</th>
<th></th>
<th>Sewerage</th>
<th></th>
<th>All</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Agreement to using water bill as payment vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>242</td>
<td>30.63</td>
<td>82</td>
<td>25.47</td>
<td>324</td>
<td>29.14</td>
</tr>
<tr>
<td>Yes</td>
<td>548</td>
<td>69.37</td>
<td>240</td>
<td>74.53</td>
<td>788</td>
<td>70.86</td>
</tr>
<tr>
<td>Reasons for not agreeing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water bill is continuously increasing</td>
<td>140</td>
<td>57.85</td>
<td>58</td>
<td>70.73</td>
<td>198</td>
<td>61.11</td>
</tr>
<tr>
<td>Not all have water connection</td>
<td>29</td>
<td>11.98</td>
<td>4</td>
<td>4.88</td>
<td>33</td>
<td>10.19</td>
</tr>
<tr>
<td>Don't like mandatory payment</td>
<td>39</td>
<td>16.12</td>
<td>15</td>
<td>18.29</td>
<td>54</td>
<td>16.67</td>
</tr>
<tr>
<td>Prefers annual rather than monthly collection</td>
<td>10</td>
<td>4.13</td>
<td>1</td>
<td>1.22</td>
<td>11</td>
<td>3.40</td>
</tr>
<tr>
<td>Don't like DCWD service</td>
<td>1</td>
<td>0.41</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>0.31</td>
</tr>
<tr>
<td>Other people will not understand how the fee will be computed</td>
<td>6</td>
<td>2.48</td>
<td>4</td>
<td>4.88</td>
<td>10</td>
<td>3.09</td>
</tr>
<tr>
<td>All fees should be shouldered by the gov't</td>
<td>6</td>
<td>2.48</td>
<td>–</td>
<td>–</td>
<td>6</td>
<td>1.85</td>
</tr>
<tr>
<td>Will migrate soon</td>
<td>2</td>
<td>0.83</td>
<td>–</td>
<td>–</td>
<td>2</td>
<td>0.62</td>
</tr>
<tr>
<td>Separate bill instead of adding to water bill</td>
<td>9</td>
<td>3.72</td>
<td>–</td>
<td>–</td>
<td>9</td>
<td>2.78</td>
</tr>
<tr>
<td>Alternative payment proposed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don't know</td>
<td>14</td>
<td>5.79</td>
<td>3</td>
<td>3.66</td>
<td>17</td>
<td>5.25</td>
</tr>
<tr>
<td>Monthly electric bill</td>
<td>5</td>
<td>2.07</td>
<td>2</td>
<td>2.44</td>
<td>7</td>
<td>2.16</td>
</tr>
<tr>
<td>Community tax</td>
<td>8</td>
<td>3.31</td>
<td>11</td>
<td>13.41</td>
<td>19</td>
<td>5.86</td>
</tr>
<tr>
<td>Land tax</td>
<td>1</td>
<td>0.41</td>
<td>3</td>
<td>3.66</td>
<td>4</td>
<td>1.23</td>
</tr>
<tr>
<td>Barangay collection</td>
<td>35</td>
<td>14.46</td>
<td>15</td>
<td>18.29</td>
<td>50</td>
<td>15.43</td>
</tr>
<tr>
<td>Garbage fee</td>
<td>20</td>
<td>8.26</td>
<td>11</td>
<td>13.41</td>
<td>31</td>
<td>9.57</td>
</tr>
<tr>
<td>Government fund</td>
<td>2</td>
<td>0.83</td>
<td>4</td>
<td>4.88</td>
<td>6</td>
<td>1.85</td>
</tr>
<tr>
<td>None</td>
<td>116</td>
<td>47.93</td>
<td>15</td>
<td>18.29</td>
<td>131</td>
<td>40.43</td>
</tr>
<tr>
<td>Own separate bill</td>
<td>41</td>
<td>16.94</td>
<td>18</td>
<td>21.95</td>
<td>59</td>
<td>18.21</td>
</tr>
</tbody>
</table>

Table 13 | Respondent's belief in the success of the septage & sewerage plans

<table>
<thead>
<tr>
<th></th>
<th>Septage</th>
<th></th>
<th>Sewerage</th>
<th></th>
<th>All</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Belief in the success of the program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>166</td>
<td>21.01</td>
<td>63</td>
<td>19.57</td>
<td>229</td>
<td>20.59</td>
</tr>
<tr>
<td>Yes</td>
<td>624</td>
<td>78.99</td>
<td>259</td>
<td>80.43</td>
<td>883</td>
<td>79.41</td>
</tr>
<tr>
<td>Reasons for no response</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money will be used for other purposes</td>
<td>1</td>
<td>18</td>
<td>7</td>
<td>11.11</td>
<td>8</td>
<td>3.85</td>
</tr>
<tr>
<td>Lack of trust in the LGU due to corruption</td>
<td>70</td>
<td>42.17</td>
<td>22</td>
<td>34.92</td>
<td>92</td>
<td>44.23</td>
</tr>
<tr>
<td>LGU lack technical skill to operate a Septage Treatment Facility (STF)</td>
<td>4</td>
<td>2.41</td>
<td>2</td>
<td>3.17</td>
<td>6</td>
<td>2.88</td>
</tr>
<tr>
<td>Water district may not agree to collect payment</td>
<td>8</td>
<td>4.82</td>
<td>2</td>
<td>3.17</td>
<td>10</td>
<td>4.81</td>
</tr>
<tr>
<td>Project difficult to implement</td>
<td>10</td>
<td>6.02</td>
<td>8</td>
<td>12.7</td>
<td>18</td>
<td>8.65</td>
</tr>
<tr>
<td>Other people may not cooperate</td>
<td>19</td>
<td>11.45</td>
<td>12</td>
<td>19.05</td>
<td>31</td>
<td>14.90</td>
</tr>
<tr>
<td>Others cannot afford add’l fee</td>
<td>32</td>
<td>19.28</td>
<td>11</td>
<td>17.46</td>
<td>43</td>
<td>20.67</td>
</tr>
</tbody>
</table>
finding alternative water sources in their area. On aggregate, 5% of those who choose to disconnect from the DCWD opt to get water from hand pumps, neighbors with piped connection and from water vendors.

**CONCLUSIONS AND POLICY DIRECTIONS**

This study has looked at the stated preference for two hypothetical programs namely: (a) SMP that would affect households in Dagupan City; and (b) Sewerage Program for households in the CBD area of Dagupan City. Several quantitative methodologies were employed to formulate policy recommendation that would be helpful in crafting a Sanitation Management Plan for the City. The empirical evidence provided in this study serves as a relevant input into the regulatory process of establishing fees for septage management and sewerage services based on consumer demand.

Specifically, the results point to the following:

1. Income plays an important role on respondents’ WTP values. For the septage and sewerage studies, the variability of WTP across income groups indicates the plausibility of implementing a socialized pricing scheme for the fees. However, actual implementation of these fees would require a strong public consultation for the target to be met. Another important implication of the results is that increased demand for sanitation facilities would only take place as the general income levels of Dagupan City improve. The success of any sanitation initiative goes hand in hand with improvements in income levels and distribution.

2. The individually rational and financially viable Septage Service Fee, given the assumptions outlined in Annex Table 4, is around PhP 46/mo. This corresponds to the optimal desludging frequency of 3 yrs. The Septage Fees are found to be similar to existing arrangements elsewhere in the country. This Septage Fee further allows recovery of investment costs within 10 yrs as well as cover operating and maintenance (O&M) expenses of the Septage Program within a project lifetime of 25 yrs. This means that a self-financed Septage Program is possible for the city.

3. The story for the Sewerage Program, however, is not as optimistic. There is a range of bids or prices that households would agree to pay (with an average of PhP 102/
month for the whole sample). These bids are slightly higher than that of the WTP for the Septage Program. However, none of these can cover the huge investment costs associated with a self-financed Sewerage infrastructure based on BCA assumptions outlined in Annex Table 5. Thus, it would be prudent for the LGU to look for other sources of funds.

4. To implement the Septage Management and Sewerage Plan, the water bill can be used as a payment vehicle since its mandatory nature allows more efficient collection of fees unlike voluntary payment schemes such as community tax certificate and garbage fees. However, the computation of fees must be made transparent on the bill to allay the fear for customers of any hidden charges. If a private contractor will make a separate collection of septage and sewerage fees from the water bill, this needs to be studied carefully for cost implications.

REFERENCES


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