I N F O R M A T I O N D O C U M E N T

THE WILLINGNESS TO PAY FOR CHANGES IN WATER, WASTEWATER AND ELECTRICITY SERVICES IN TRINIDAD AND TOBAGO

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Preface

This document discusses the quality of water and electricity utility services, and the willingness to pay for changes in the level of service offered by these utilities, in Trinidad and Tobago. The data for the study were collected in a collaborative effort between the Regulated Industries Commission (RIC) and Kameel Virjee, a PhD Candidate of McGill University. Analysis of the data set arising from this collaborative effort was conducted by Kameel Virjee.

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Exchange Rate

1 US$ = 6.12 TT$
1 CAN$ = 4.71 TT$

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Abbreviations

CSO – Central Statistical Office

CSSP – Continuous Survey Sample of Population

CVM – Contingent valuation method

DCE – Discrete choice experiments

CM – Choice modelling

FSE – Full service equivalent

IIA – Independence from irrelevant alternatives

NHA – National Housing Authority

RIC – Regulated Industries Commission

RUM – Random utility maximization

T&TEC – Trinidad and Tobago Electricity Commission

WASA – Water and Sewerage Authority

WTP – Willing/willingness to pay

Executive Summary

This report discusses the results of a willingness to pay (WTP) survey conducted in Trinidad and Tobago in 2003. The survey sought to ascertain domestic consumers' perceptions of the quality and price of utility services, and of service providers in the water and electricity sectors. Water and wastewater services are supplied by the Water and Sewerage Authority (WASA), while electricity services are provided by the Trinidad and Tobago Electricity Commission (T&TEC). The objectives of the survey were two fold:

- Assessing current service levels for the two sectors for residential consumers; and
- Estimating the willingness to pay for changes in these service levels.

The survey sampled 1,419 households throughout the two islands using a sampling design based on the Central Statistical Office's (CSO) Continuous Survey Sample of Population (CSO, 1987). Overall, the non-response rate to the survey was 12.5%, most of which was due to errors in listing records and difficulty in accessing some remote areas.

To estimate the willingness to pay for changes to water supply, wastewater and electricity services, the contingent valuation method (CVM) was used. An iterative bidding game was employed as the monetary elicitation tool. The starting point of the bidding game was based on a review of the literature and set at the median current bill amount for the particular utility service being investigated.

In addition to the CVM, the survey utilized discrete choice experiments (DCE) to value attributes of water supply options. Two different designs were employed for those with in-house piped connections and for those without. The selection of the attributes was based upon a survey of the CV literature and consultation with sector experts, as there is little precedent in the DCE literature of its application in valuing water supply improvements. It was imperative that the attributes selected were of practical relevance to respondents but also that they were tractable from a policy standpoint and, therefore, reliability, pressure and quality were chosen to represent the level of water service to customers. For non-piped users, two additional attributes were included in each choice set; a binary variable for whether the supply was a standpipe or an in-house connection and a connection cost. In both user classes, choice sets also included a price variable, to allow for estimation of compensating variation, or WTP. In all, each respondent answered 12 choice sets with 4 alternatives, including a status quo option, in each. The combination of levels utilised was set using an experimental design for generic choice sets (Kuhfeld, 2003).

The questionnaire was administered during May and June, 2003 to the pre selected respondents. Thirty enumerators conducted the fieldwork in Trinidad and six were hired for the Tobago sub sample. All supervisors and enumerators were required to attend a

one-day training session led by the survey design team. Three data entry clerks were engaged to digitize paper responses.

The socioeconomic profile departed slightly from population characteristics, in that the surveyed respondents were mostly female. About 80% of those surveyed had primary or secondary education as their highest level of education. The average income of the respondents in the sample was $2,900.00, which compares with population values when income excludes informal sources.

The survey found that awareness of the Regulated Industries Commission (RIC), was minimal. Only 8% of respondents indicated awareness of the RIC.

About 80% of the survey respondents relied on a WASA water supply as their primary water supply. The remainder used water supplied by neighbours, rainwater or some other water supply. This figure is less than the coverage figures suggested by WASA (92%) since coverage, as defined by WASA, is the percentage of the population, under a utility's nominal responsibility, with easy access to water services either through a direct service connection or residing within 200m of a standpipe. This definition may be further extended to include communities with no access to pipe lines but are supplied by WASA with communal storage tanks facilities. The reliability of supply was found to be rather low; with only 27% of the surveyed respondents have a 24-hour water supply. Another result of the low reliability is the heavy investment in local storage facilities, and 68% of the sampled households had such water tanks installed at their properties. About half the respondents found that the pressure of their water supply was adequate, though this could be as a result of the installation of water tanks and pumps. Water quality was reported to be acceptable with only 8% of the respondents finding the overall quality to be poor. Despite this 45% of the respondents to this survey treated their water, mostly by boiling.

Sanitation services were mostly self-provided by the household. Septic tank systems were the most frequently encountered sanitation system with almost 60% of the surveyed households relying upon such systems. Seventeen percent of the respondents had access to central sewerage facilities while about a quarter of the sample relied upon pit latrines for sanitation services. Residents of Tobago, particularly, had little access to sewerage systems and relied heavily upon septic tanks and pit latrines as sanitation facilities. However, there is a single sewerage system that serves residents of Scarborough and surrounding areas.

Electricity coverage was found to be very high, with 92% of the sample having access. Generally, the respondents felt the service level was high, though infrequent outages and power fluctuations do occur. In cases where compensation was claimed for damaged goods, respondents felt that the compensation paid by the utility was unfair. On average, surveyed households pay $216.00 bi-monthly for electricity service.

Willingness to Pay

The willingness to pay for changes in water supply was measured using two different methods, the contingent valuation method and discrete choice experiments, for each respondent.

The contingent valuation method described an ideal system to the respondent, where pressure, quality of water and reliability of supply would all be at their maximum levels. Logit models were used to analyse the resulting bids and it was found that income was correlated with WTP for all the respondents. Users who depended upon only a piped in-house connection were willing to pay more for an ideal water supply when their current bill was high. Variation in the willingness to pay for an improved water system by non-piped users was influenced by geography as well as by storage supplies.

The choice models provided estimates of the value associated with changes in the levels of attributes defining a water supply system. It was found that reliability changes, in terms of the number of days per week where water would flow in the system for at least some part of the day, were more important to users currently using an in-house piped connection. Increases in pressure and quality increased the value of the water supply for all users.

Table I shows the maximum WTP for changes to the ideal situation for an average piped and non-piped user as derived from econometric models based upon data from both the CVM and CM (or DCE).

Table I
Mean WTP predicted by contingent valuation method and choice models

	Mean WTP – Contingent Valuation method (per quarter)	Mean WTP – Choice Models (per quarter)
Piped Users	$144	$461
Standpipe Users	$186	$575

The wide variation in the WTP for changes between the two methods is most likely due to different sources of bias associated with each method. The CVM is subject to bisas arising from the media and the context of the question. The value of WTP given by the CVM is depressed in this case due to a lack of confidence by the respondents in the potential for utility to effect the described change. The CV scenario was, perhaps, insufficiently believable. The CM, however, by de-emphasizing the payment variable and allowing choices on the basis of attribute bundles alone, may reflect the WTP were the change to actually happen. In any case, the two estimates can be regarded as bounds of the true WTP for an increase in the water level service to the ideal situation.

Table II shows the mean WTP, by current service level, for upgraded sanitation facilities; where each household will have a central sewer connection.

Table II
Average WTP for wastewater service upgrades

Sanitation System	Average WTP (per quarter)
Central sewerage system	$85.82
Septic tank	$81.34
Latrine	$82.10

As can be noted, WTP does not vary across current sanitation service levels. A logit model explaining the variation in the WTP bids, however, implied that the satisfaction with the current sanitation services was a significant factor in explaining the WTP for connections to a central sewerage facility.

The respondents in the sample were, on average, willing to pay less for an improved electricity supply than the current average bill reported in the survey. This can be explained by the extremely high satisfaction with current service levels. As users are mostly satisfied with their electricity service, the only change that we would to see is a lowered monthly bill. A logit analysis of the bids did show that the ownership of electric appliances was indicative of a higher WTP implying that customers are aware of the volumetric nature of electricity pricing. Also, users who experienced fewer outages were less likely to accept an improved electricity supply at a given increased price than an otherwise similar customer with more frequent outages.

The survey concluded that there is not full water coverage in Trinidad and Tobago, with lower income groups suffering from poor access more frequently than upper income groups. Another feature of these results was that they depart from estimates given by the utility, WASA, implying that system information at the utility may be lacking. Respondents to the survey were WTP for changes in water supply. The amount they are willing to pay is confounded with a lack of confidence in the WASA's ability to effect the changes described, as suggested by the divergence in the estimates of WTP given by the CV and CM methods. It is recommended that any increase in water rates be linked to improved service levels as the results from the attribute based valuation methods, DCE, provide evidence of significant WTP for changes to, particularly, reliability. This WTP is corroborated with the prevalence of local storage facilities installed at the users' expense. The results suggest that tariff increases can be justified on the basis that users want change to the current system and are willing to pay for it. This, however, is dependent upon the realization of those changes. It is to be noted that more accurate system information is required regarding the quality of water and service coverage of WASA.

The findings of the survey found that in Trinidad and Tobago there is a lack of infrastructure to carry waste away from households, and treat it before its release as effluent into the environment. The negative impacts associated with this untreated disposal of residential wastewater poses significant environmental threats. The low WTP for access to wastewater services observed in this research implies that private solutions are sufficient for the current users' needs. This further implies that those users, in evaluating their WTP, consider only the private benefits that accrue in wastewater upgrades, rather than the public benefits. Increased environmental awareness is required to underscore the necessity of wastewater treatment and, in turn, stimulate demand for enhanced sanitation facilities. This would increase the WTP for wastewater services and increase the potential for cost recovery in the sector. As a further policy initiative, demand may be further stimulated through the provision of subsidies for connection to centralised sewerage systems.

The willingness to pay for changes in the electricity was measured using CV. Based on the survey results the majority of surveyed users felt that the electricity supply is adequate in Trinidad and Tobago, with the elimination of infrequent outages being the only service upgrade demanded by respondents. The survey has found that since service levels generally meet the demands of users, there is a low WTP for service changes. Therefore any increase in rates cannot be justified on the basis of improved service levels.

Introduction

Trinidad and Tobago has an estimated total population of 1.25 million in 340,000 households, with 1.2 million residing in Trinidad and the balance in Tobago according to the CSO. The country's residents are supplied water by the Water and Sewerage Authority (WASA), which is mandated to provide universal access to potable water supply in the country. Electricity is transmitted and distributed by the Trinidad and Tobago Electricity Commission (T&TEC), while electricity is generated by Powergen and Trinity Power Management Ltd. (formerly Inncogen). The Regulated Industries Commission (RIC) is responsible for the regulation of these two network industries, broadly in terms of price setting and quality of service standards.

WASA was formed in 1965 by the enactment of the WASA Act and is currently accountable to the minister with responsibility for public utilities. Under the Act the Authority is responsible for expansion and maintenance of waterworks supplying residential, commercial and industrial customers, as well as water resources management. Private developers and the National Housing Authority (NHA) are required to provide for sanitation in their housing developments but WASA must first grant approvals for those systems.

Historically, the performance of WASA has been inadequate. Water coverage has not been universal, and where customers have network access, the supply of water has been erratic despite an abundance of water resources in the country. Numerous changes were made in the 1990s to the utility, such as the initialization of a two-stage privatization program (Nankani, 1997). Despite such efforts WASA continues to receive numerous complaints from the public concerning the level of service offered. WASA estimates suggest that 92% of the population is served with a water supply through 240,000 connections, at either an in-house level of service or through standpipe service. Sewerage coverage is lower with only 20% of the population having access to sewerage mains operated by the utility. A further 10% of the population is serviced by private treatment plants and plants owned by the NHA (RIC, 2003a). System leakages have been reported in many sources as being over 50% (see e.g. WASA, 2002)

Tariffs charged by the utility are dependent upon the Annual Taxable/Rateable Value (ATV/ARV) of the property, and are not based on the volume of water consumed and were historically set by the Public Utilities Commission (PUC) with much political interference (Mycoo, 1996). The RIC Act of 1998 created a new regulatory body to regulate natural monopoly industries through the setting of both rates and quality of service standards among other things. The RIC is currently moving towards incentive regulation, from the rate-of-return regulatory model that was used prior to the RIC's existence. In 2002, WASA's operating deficit amounted to $450 million, which was about equal to the revenues over the same period. This is in part due to insufficient rate adjustments, resulting in a decreasing real tariff.

T&TEC is the service provider for transmission and distribution of electricity in Trinidad and Tobago. Prior to 1994, T&TEC was responsible for generation, but in December of that year the generation facilities were divested to a consortium, PowerGen, including T&TEC as the major shareholder. In 1998, a power purchase arrangement was established with then Inncogen. T&TEC buys bulk power from these power generators and then transmit and distributes that power to retail customers. T&TEC is responsible for procuring the natural gas used in electricity generation as well as conducting all the planning for demand and generation capacity. Tobago is supplied via two submarine cables and there is a diesel fuel backup generating station.

The utility supplies a total of 330,000 (residential, commercial and industrial) customers and this coverage amounts to over 97% of the population (RIC, 2003c). Reliability of supply has frequently been highlighted as a problem whit T&TEC, though there has been an increasing trend in reliability over the past seven years. The proportion of outages not restored within four hours dropped from 54% in 1996 to 9% in 2001 (RIC, 2003b). In the seven year period, 1995-2001, the utility generated an operating surplus for three of those years. Rates are set below cost to ensure equitable access by poor residential customers and rate adjustments for changes in costs, other than exchange rate fluctuations, are done only periodically. The effect of this is that the real tariff is eroded by inflation and infrequent tariff adjustments are not sufficiently responsive to meet the costs of the utility.

This document discusses the results of a national survey aimed at assessing domestic customers satisfaction with WASA and T&TEC. The survey sought to quantify consumers' willingness to pay (WTP) for changes in the level of service offered by the two utilities. The following section discusses the design of the survey research. First, theoretical issues pertaining to willingness to pay measurement are discussed. The practical issues, including sample design issues and field procedures, are then presented. The paper then discusses, in two separate sections, the results arising from the survey and policy applications of those results. Appendix A contains a schedule of field activities, Appendix B shows a time line of field activities, and Appendix C is the questionnaire used to conduct this survey.

Methodology

As noted above the survey conducted had two main objectives:

- Understanding the level of utility service experienced by residential water and electricity customers; and
- Ascertaining the willingness to pay for changes in the level of service experienced by residential customers.

In attempting to measure current levels of service, some general understanding of the existent levels of service is required. The following section considers the theoretical issues pertaining to benefit estimation for service level changes.

As tariffs are based upon the ATV of the property, customers pay one rate or a discrete number of rates for differing levels of service. For instance, customers of WASA classified as having an unmetered in-house connection will pay a flat fee, regardless of whether there is any service available, or what the current level of service is. Further, the utilities under consideration (WASA and T&TEC) are monopolies. Accordingly, observed customer behaviour is not reflective of internal preference structures associated with the utility customers. The effect of a change in the level of service on social benefits cannot therefore be estimated from observed customer behaviour.

Given that customer preference structures are not directly observable in a real market, one of numerous hypothetical methods for the assessment of these preference structures must be used. Such hypothetical methods can be further classed into direct methods and indirect methods. Direct methods seek to evaluate the preference, or equivalently the willingness to pay (WTP), of the consumer by asking the respondent to value a particular change. Indirect methods observe the choice behaviour in artificial markets and infer the preference structure of the respondents. One of the two methods used in this survey is the contingent valuation method (CV), a hypothetical direct valuation method to value changes in the service levels of water, wastewater and electricity. The other method, choice models (CM), is an indirect hypothetical method, which is used to estimate the welfare functions of respondents with regard to changes in water services. The two methods are employed as it is hypothesized that the indirect method will capture WTP apart from any bias associated with perceived feasibility of the suggested changes.

Consumer choice and benefit estimation

In attempting to estimate the WTP for changes in utility services, it is first necessary to understand how users would participate in improved systems. Random utility maximization (RUM) theory has been used as the underlying theory explaining consumer choice. Fundamental in RUM is the notion that a consumer chooses an alternative which maximizes his utility from a set of available alternatives. That is, the consumer is a utility maximizer. Further, the utility obtained from a particular alternative is composed of two parts; a systematic, observable, one (V) and a stochastic, unobservable one (ε). So the utility of an alternative can be represented as in (1):

$$U = V + \varepsilon \qquad (1)$$

If two alternatives, i and j, are available, a consumer will choose i if and only if

$$U_i > U_j \qquad (2)$$

That is if,

$$V_i + \varepsilon_i > V_j + \varepsilon_j \quad (3)$$

As the ε values are unobserved, equation (3) cannot be evaluated exactly. Depending upon the distribution taken by the ε values, a probability that alternative i is chosen can be evaluated. The probability that i is chosen, P_i will therefore be

$$P_i = P(V_i - V_j > \varepsilon_j - \varepsilon_i) \quad (4)$$

Further, the systematic portion of the utility is a function of the attributes of the option. Therefore,

$$V_i = \beta_k X_i \quad (5)$$

where X is a vector of k attributes and β is a vector of coefficients.

As specified thus far, the model in (4) assumes respondents are homogeneous. Modifications are possible to the model to account for respondent heterogeneity. McFadden (1974) shows that by using the assumption that the ε values are distributed according to a Gumbel or extreme value type 1 distribution, the model in (4) is consistent with a conditional logit choice model. If the ε portions of utility are assumed to be normally distributed, the model reduces to a multinomial probit model (Maddala, 1983).

From a policy standpoint, it is beneficial to estimate the model in (4) as it then provides the analyst with the ability to examine participation in a policy change, by varying the values in the vector X.

Contingent Valuation

The contingent valuation method seeks to ascertain the value placed on a discrete policy change by an individual. A change in policy is described, often using visual aids, and the value for the change is elicited. This method has been widely applied in studies, internationally, attempting to investigate the WTP for changes in water supply and sanitation service (see for example: Whittington *et al*., 1993; Briscoe *et al*., 1990; Altaf *et al*., 1992; and Griffin *et al*., 1995).

Due to the hypothetical nature of the inquiry, bias may arise if the scenario is improperly constructed. For example, bias may arise as a result of a misspecification of the scenario. That is, if the scenario is insufficiently anchored in possibility, responses to WTP questions may not be sufficiently representative of internal preference relations. Measures invoked to ensure sufficient control of bias are discussed in the Field Procedures section.

Numerous methods are available in the literature, to elicit respondents' WTP, given the presentation of scenario. The study opted for an iterative bidding game. In such a situation respondents are offered a series of bids, with the value of each bid determined by the series of preceding bids, and asked to answer the dichotomous question of whether they would participate in the described scenario or not at that price. The result is an interval estimate of their maximum WTP. The bidding game elicitation method was engaged due to the relatively large amount of information obtained given a sufficient level of control of bias. This method is analogous to the dichotomous choice method suggested in Arrow *et al*. (1993). This method of value elicitation is more familiar to respondents as it replicates a familiar market auction format (Mitchell and Carson, 1989).

The time taken to develop and present the scenario to survey respondents restricts the process to, normally, one scenario. As such, the analyst is able to develop an estimate of the welfare effects of one discrete change in the level of service or policy available. The effects on welfare given fractional changes of those assumed in the scenario are not estimable and as such the method is subject to some variability where the scenario is mis-specified.

The development of the scenarios for use in the present study was iterative and aimed at reflecting the ideal situation with regard to water, wastewater and electricity supply. Initial scenarios were drafted and revised by the survey design team. The scenario was then presented to sector experts, in order to assess its applicability to the Trinidad and Tobago case. Finally, a pilot test led to further modifications of the wording of the scenario in the case of the water sector and thus two scenarios for water were developed; one for those already with in house connections and another for those lacking such facilities, that is, standpipe users. For the wastewater and electricity CV questions, one scenario was used for all the respondents.

The values used in the bidding game for water were derived from information about current water tariffs and the tariffs required for cost recovery in the utility (London Economics, 1998). A starting point for the bidding games was set to $200 per quarter as this was considered a median level at present for in-house customers. The maximum and minimum values offered in the bidding game were $500 and $50 per quarter respectively. The billing frequency was set to quarterly, as this is the current billing schedule for residential customers. The bidding game method fixed the number of dichotomous questions that needed to be answered by each respondent in order to control for respondent fatigue.

Discrete Choice Experiments (DCE) or Choice Modelling (CM)

CM is a stated preference technique offering hypothetical changes to respondents and using indirect choice behaviour to estimate the WTP and welfare of policy changes. The method has developed out of conjoint analysis (e.g. Louviere, 1988) and has been applied in environmental valuation exercises (e.g. Blamey *et al*., 1999) and, in one case, water supply valuation (Anand, 2001).

In CM, sets of choice situations are presented to the survey respondent. The sets are composed of different alternatives, and the attributes that define them. A multitude of choice scenarios are presented to the respondent and in each case the respondent is required to indicate the alternative that is most preferred within the set. The choices made, therefore, are independent between sets. One alternative, normally, is set to the status quo situation to provide measures of utility relative to the present situation. Should this status quo alternative not be included, valuations would only be relative to one another. That is, in preferring one alternative to the next, no inference can be made, in the absence of a status quo alternative, of whether the chosen alternative would have been chosen at all in a real situation. The inclusion of a cost attribute allows for the modelling of household willingness to pay, and by including the cost of service as an attribute amongst others, the method does not overstress the importance of cost and so minimizes the tendency to agreement. CM requires the presentation of multiple-choice sets and so substitutes must necessarily be considered. This results in a richer understanding of household willingness to pay in that it gives the analyst the ability to evaluate WTP for multiple policy alternatives.

The structuring of choice sets as composed of alternatives, defined by attributes, presents further theoretical benefits. If alternatives are considered to be composed of attributes that can be manipulated by the researcher, then an understanding into the WTP for the inclusion of different levels of those attributes in a policy or project can be estimated. In the case of water supply, for instance, it is possible to define alternatives, in part, by the reliability of the supply. By varying the level of the attribute, reliability, across choice sets, and modelling the data using discrete choice models, the WTP for improvements to the reliability attribute can be assessed. The inclusion of other attributes of water supply improvements would allow for a prioritization of improvements by attribute, and so would facilitate the design of demand responsive interventions. Further, the method allows for the measurement of the marginal rate of substitution between different attributes. For instance, the utility benefits associated with a change in one attribute can be developed, equivalently, through a change in another attribute. This method allows for the estimation of the amounts of change in the two attributes to lead to an equivalent change in utility. This information can be further used, by combining cost information to estimate the most cost effective policy, in terms of net utility gains.

Alternative Selection

This survey utilized an iterative method to develop the choice sets to be delivered to respondents in the final survey. First proposed choice sets were designed and discussed with experts in the water sector. Attributes to be included, as well as the levels which they should take, were discussed. The pilot scale survey was used to verify the workability of the design, from a respondent cognitive standpoint. Two versions of the choice sets were developed, the first for respondents with in house piped connections and the other for those not connected. For the two, different attributes were included to reflect the different policy and choice situations that were relevant.

Table 1 shows a list of the attributes used to describe each alternative in the two versions of the choice sets. Table 2 gives an example of a choice set shown to survey respondents.

Table 1 - Attributes used in choice experiments

Attribute	Number of levels	Expected sign of parameter	Justification
Reliability: days per week	3	Positive	The availability of water was considered to be the most significant factor impacting on the WTP of respondents. If water was available for some time every day lifestyle may change to cope with available water. This attribute was an integer value between 0 and 7.
Reliability: hours per day	3	Positive	The number of hours per day water is available impacts upon the ability to do water intensive activities such as car washing and laundry. This attribute was an interval categorical variable.
Pressure	3	Positive	The pressure, if insufficient, requires that coping mechanisms, with financial implications, be effected. If pressure is low many activities take longer and so such an attribute would have an economic impact on the respondent. This attribute was a subjective categorical variable.
Quality	3	Positive	The quality of water has impacts on the standard of living. Coping costs, such as for treating water to potable quality have economic impact and as such this attribute was included for all choice sets as a subjective categorical variable.
Level of Service	2	Positive	This factor impacted only choice sets designed for non-piped users. The binary variable described two states. The first with a continued standpipe level of service and the second with a higher in-house level of service.
Connection Cost	3	Negative	This attribute applied to non-piped users, and took three values from $0 to $600. The connection cost may impact as a deterrent in the choice to upgrade supply to a higher level of service.
Price	5	Negative	Price would necessarily impact the utility gained from a particular policy change. Also, marginal rates of substitution between different attributes and price are calculated to assess the WTP for the policy change.

Table 2 - Example choice set: piped users

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	one	seven	four	I prefer my current service level
	Hours/day	twelve	two	twenty-four	
Pressure		medium	low	high	
Quality		medium	low	high	
Price	TT$/quarter	50	150	250	
Which alternative do you prefer?		☐	☐	☐	☐

Experimental design

In developing the combinations of attributes to appear in the choice sets an experimental design was used. The SAS macros in Kuhfeld (2003) were used for this purpose. The use of an experimental design is required to efficiently select the combinations of attributes that maximize the efficiency of the resulting models. As the full factorial (the choice sets arising from all possible combinations of the attribute levels and resulting alternatives) would be infeasible to present to each respondent, a fractional factorial was selected. An ideal fractional factorial is both orthogonal and balanced, where the model effects can be estimated independent of one another and the levels of each attribute appear equally often in the group of choice sets. The generic design used allows for smaller choice sets, as compared to a labelled design. A labelled design is used to estimate alternative specific effects, and is relevant where the alternatives in each choice set have specific characteristics throughout all choice sets. For example, should the alternatives used be ‘car’ or ‘bus’, there is an intrinsic difference between them. In this case, alternative ‘1’ and ‘2’ were used to denote different policy bundles of water supply service, and so there is no alternative specific effect that needs to be estimable.

In the survey 12 choice sets, each with four alternatives, were offered to each respondent. Increasing the number of choice sets increases the confidence in the resulting model parameters subject to maintenance of data quality. The pilot testing of the choice models found this number of choice sets to be at about the limit of respondent capability. Increased complexity, through the addition of alternatives in one choice set, or through increased choice sets, had significant impact on the willingness of respondents to engage in the process. As respondents can be expected to experience fatigue in extended choice set scenarios the number of sets was restricted to allow only a main effects model to be estimated from the resulting data. Hensher *et al*. (2001) found that the errors in estimates resulting from experiments with up to 16 choice sets tend to be consistent.

Sampling Methodology

The design of an appropriate sample is critical to ensure that the data collected through the survey process is sufficiently representative of population characteristics. Particularly, as this survey had to be relevant for the entire national population, ability to generalize the results required a sufficient sample size that was correctly selected. As one of the main purposes of the survey was to study water and sewerage service characteristics in the population, stratification of the sample along service level would be ideal. Since the information regarding level of service is inaccurate and the use of a representative sample would not be beneficial because in the inherent bias that would be introduced. Therefore the survey team decided to utilize the sample frame and methodology used by the Continuous Sample Survey of Population (CSSP) of the Central Statistical Office (CSO, 1987). This methodology uses the national population as a sample frame and a two-stage stratification scheme. The first stratum is by geographic region. This is appropriate for this study given a presupposed variation in water and electricity service level by geographic region. The second stratum is by labour characteristics of the population as the CSSP is primarily a labour force survey. Such stratification may introduce bias if the level of utility service is not correlated with the characteristics of the labour force at the cluster level. Finally clusters or enumeration districts (EDs) are sampled proportional to size from the strata and random clusters of households selected in the sampled EDs. It was felt that the costs and timesavings associated with the choosing of the CSSP sample design justified its use over a purpose built sample frame. This choice was reinforced by the fact that to construct a sample frame would entail the introduction of significant bias in that current levels of service are only roughly known by the utilities. That is, a purpose built sample frame would reduce only marginally, if at all, the bias in the sample design.

The total sample size for the survey was 1419 households in both Trinidad and Tobago. In Trinidad 1281 households were selected, giving a sample fraction of 0.4% and in Tobago 138 households were selected amounting to a sampling fraction of 0.9%. The unit non-response rates, including vacant buildings and non-existent buildings, for Trinidad was 12% and 16% in Tobago. For the entire study the non-response rate amounted to 12.5%. This can be attributed to errors in the listing records, and constraints on the number of callbacks possible. In certain remote regions of the country, unit non-response was inevitable given the difficult access. Figure 1 shows a map of the sample distribution in Trinidad. Figure 2 shows the same for Tobago.

Figure 1 below indicates that households in all the wards of Trinidad were surveyed, with the exception of three wards. Those not selected in the sample selection process were Trinity, Turure and Matura. One parish in Tobago also was not selected in the sampling process, the Parish of St. John. In Trinidad the sample sizes were larger in the North-West and South, due to the higher population densities in these areas. Similarly, the South-West corner of Tobago has a larger sample size due to its higher population density.

Figure 1 - Sample distribution in Trinidad

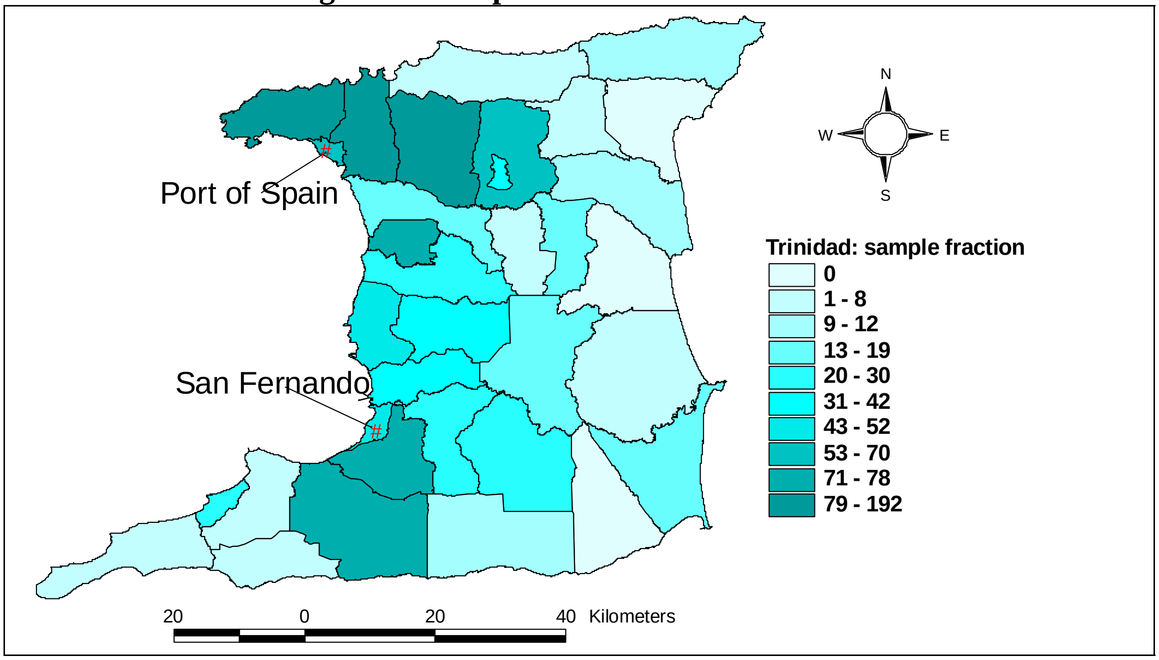
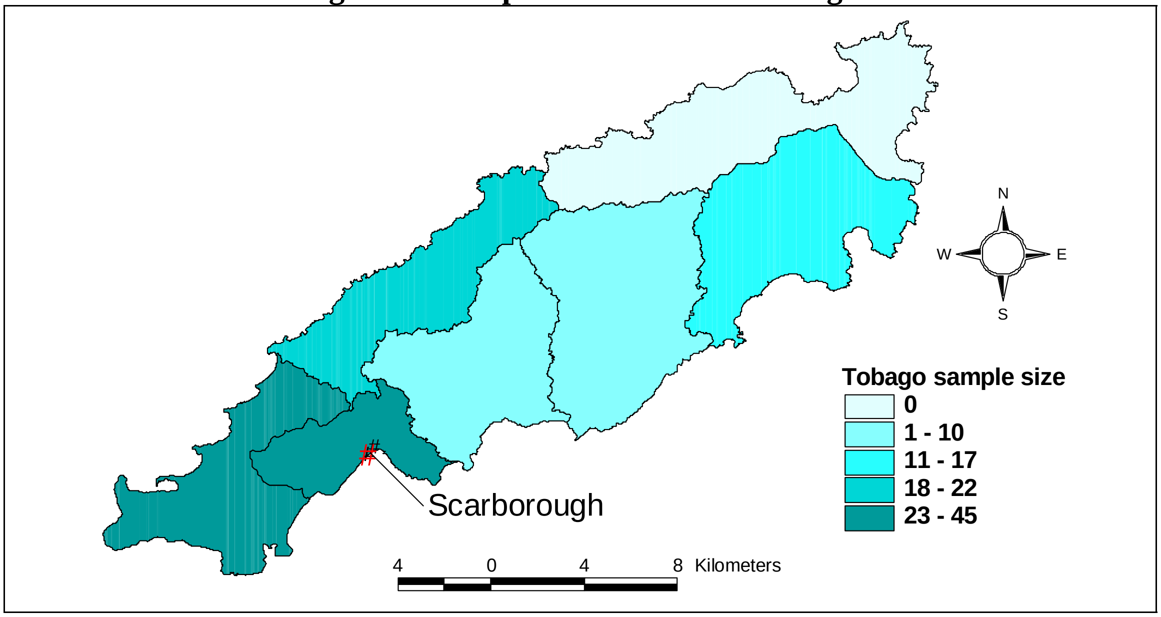


Figure 2 - Sample distribution in Tobago



Errors in the collected data can be attributed to sampling errors and non-sampling errors. Sampling errors include errors due to the random variation in sample means. Higher proportions of respondents, who answer a particular question, decrease the sampling error. In cases where a small sub-sample is taken to measure a phenomenon, the sampling error is higher. Therefore, in estimating the percentage of households which obtain water primarily from river or pond sources, the estimates in this survey will be more uncertain, due to the small number of such households, than the similar estimates for the proportion of households depending upon an in-house water connection for their primary source.

Non-sampling errors are associated with errors arising from strategic action of the respondents, partial non-response of questionnaires, and gross error, such as mistaken exclusion of particular questions, by enumerators.

Non-sampling errors are controllable through strict supervision and field controls whilst sampling errors are a structural feature of the process. As the primary constraint on sample design was cost, the sample was not designed for specific levels of sampling error in specific questions but rather an efficient level of error is expected by maximizing the sample size subject to a fixed budget. Non-sampling error, however, was under the direct control of the survey management team and was restricted through the tight control of data collection, with callbacks made by supervisors where data was uncertain. Additionally, there was thorough survey verification by both field supervisors and in office managers.

Questionnaire Design and Implementation

There were four sections in the questionnaire:

- Household water supply characteristics;
- Wastewater/ sanitation facilities;
- Electricity characteristics; and
- Household socio-economic variables.

The first three sections attempt to meet the objectives outlined above, concerning utility services, and the final section seeks to add context to estimates derived in the preceding sections. Each of the water, wastewater, and electricity sections have both a revealed preference section and a stated preference section, though as has been noted, the monopoly effects of the utility franchise restrict choice sufficiently that the revealed preferences of the respondents are reduced to a measure of the state of the utility service. The stated preference sections in all of the utility sections utilize the CV method to estimate the WTP for service changes of respondents. The water section, in addition, has choice models to ascertain the same for water.

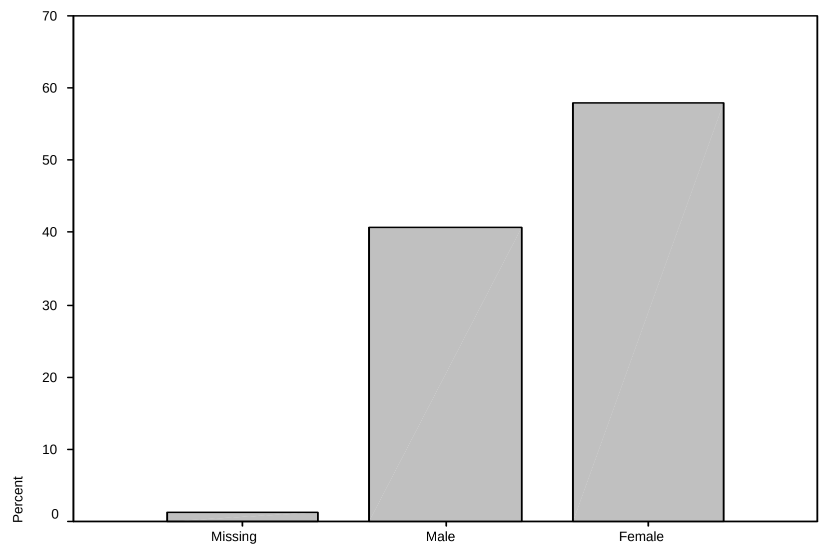
The questionnaire was designed by the survey team and then reviewed by sectoral experts with the aim of maximizing relevance. The tool was then tested in a pilot scale survey nationally. The pilot survey used 60 questionnaires and the enumerators hired for the full survey to assess the relevance of the questionnaire content. Out of this exercise, the choice models were simplified as many respondents in the pilot experienced difficulty in answering the choice models, given the complexity of the process. Flashcards were also designed, to act as a visual aid for the choice models during the field exercise.

The questionnaire was administered over the May 7, 2003 to June 14, 2003 period in Trinidad and from June 1, 2003 to June 8, 2003 in Tobago. The Trinidad portion of the survey was implemented by 30 enumerators hired from the pool of enumerators used by the Central Statistical Office (CSO). The enumerators, whilst experienced in general survey techniques required extra training in the technical aspects of this survey and so a one-day training session was held in Port of Spain at the RIC offices on April 22, 2003. The country was divided into six regions and each region was supervised by one supervisor who had also received training in the specifics of the questionnaire. The training of supervisors took place on April 21, 2003. Three data entry clerks were trained separately in the use of proprietary data entry interface. Raw data entry was completed by June 27, 2003. A full timeline of activities is shown in Appendix A.

Sample characteristics

The distribution of males and females in the group of respondents is shown in Figure 3.

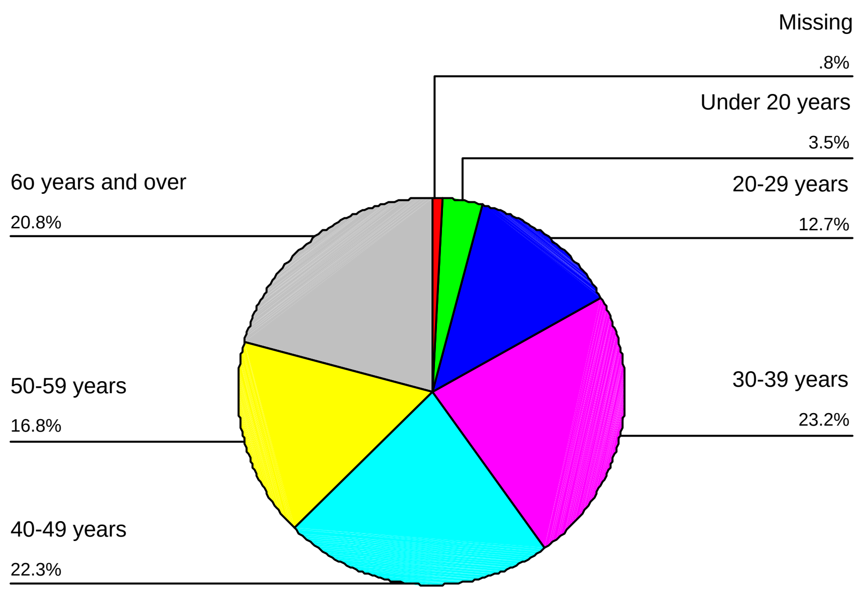
Figure 3 - Gender of Respondents



The gender of respondents was skewed towards female respondents with over half of the respondents being female. This was due to the fact that most of the fieldwork was carried out during the day, and hence, enumerators visited households when male residents were at work. Trinidad and Tobago has a near even split in the population, between males and females (CSO, 2003). It is unfortunate that there was this gender bias in the sample, given that about half of the females surveyed were responsible for utility bill payment in their household, whilst about 80% of the males surveyed were the utility bill payers in their households. The ramification of such a bias is that the information about bill payment amounts and willingness to pay for changes to supply may not be fully representative of household perceptions and realities as those responsible for paying the bill would presumably have better information about status quo prices and so be more able to communicate their willingness to pay accurately. That is, this structural bias may have increased the measurement uncertainty in certain questions. However, questions regarding service level may have been more accurately answered as respondents who were home during normal working hours most likely experienced utility service levels more fully.

Figure 4 shows the age groups of the respondents to the survey. As the enumerators were told to seek the head of the household, or his/her spouse, and to ensure that the respondent was an adult, the proportion of respondents under 20 years of age amounts to 3.5% of the total sample.

Figure 4 - Age groups of respondents



The education level of the sample is represented in Figure 5. Education should affect the WTP for utility service changes, as many of the public implications of such changes would be stressed at higher levels of education. As can be noted, the majority of respondents in this exercise had primary or secondary education as their highest level of education.

The status of land tenure of the respondent also will affect the WTP for services. If tenure is uncertain, the investment required to secure a formal connection to a utility service, that is the connection cost, may be avoided. For instance, the WASA Act does not permit the installation of a formal in-house connection to squatters and so this too would have implications on service levels. Tenants may also have different perceptions with regard to service changes, as the cost associated with utility services is often included in the rent. Figure 6 shows a profile of the tenure associated with respondents' residences.

Figure 7 shows a profile of income groups of the respondents of this survey. The high proportion of non-reported values, 12%, is consistent with this type of question (see for example CSO, 2002). It is expected that income would be related to willingness to pay for water and electricity changes. The average household income reported in this sample is $2,900 per month, which is considerably lower than other population estimates (e.g. CSO, 2002), which place the average at $4,400 per month. This was anticipated given the sensitive nature of the question and the imprecision of the measurement (intervals of $1,000) used in the survey. When compared to the average household income coming from formal wages, however, the difference between other surveys and the results presented here decreases considerably to an average of $270. It is likely that the income measured in this survey is representative of formal wages, and neglects any self-employment in the informal sector, regular transfers, and part time or windfall revenues. This seems reasonable given the simplicity of the question design.

Figure 5 - Maximum education level attained by respondents

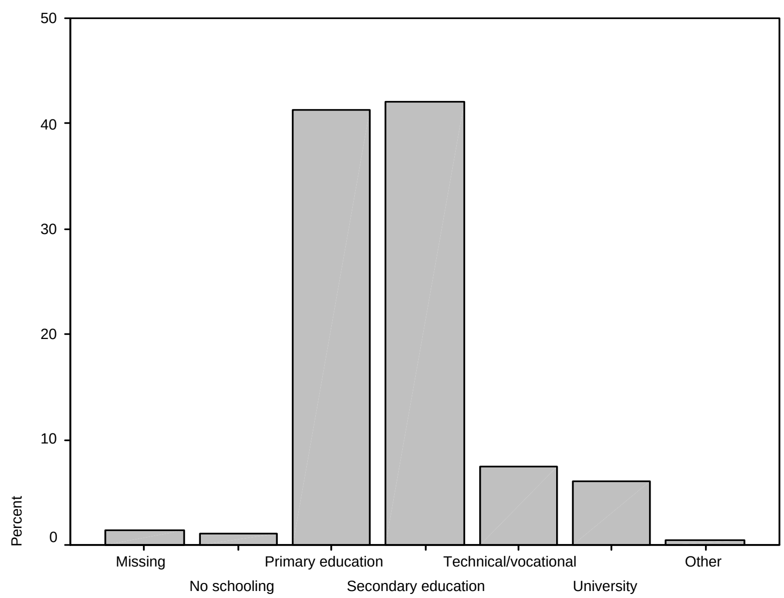


Figure 6 - Tenure of housing

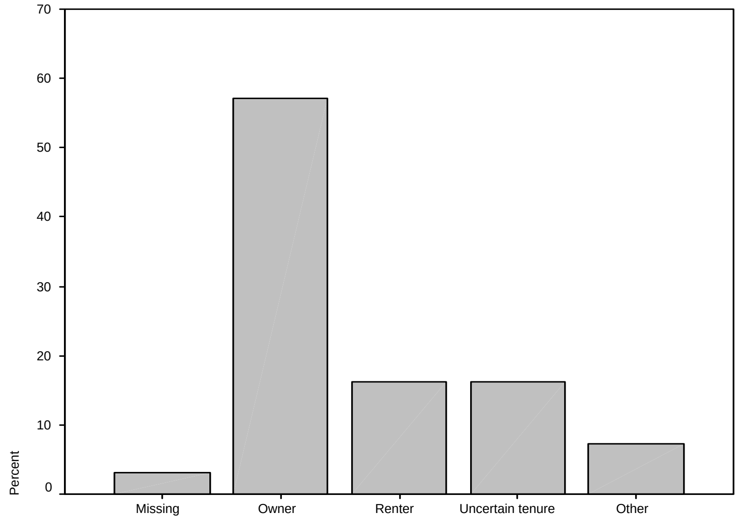
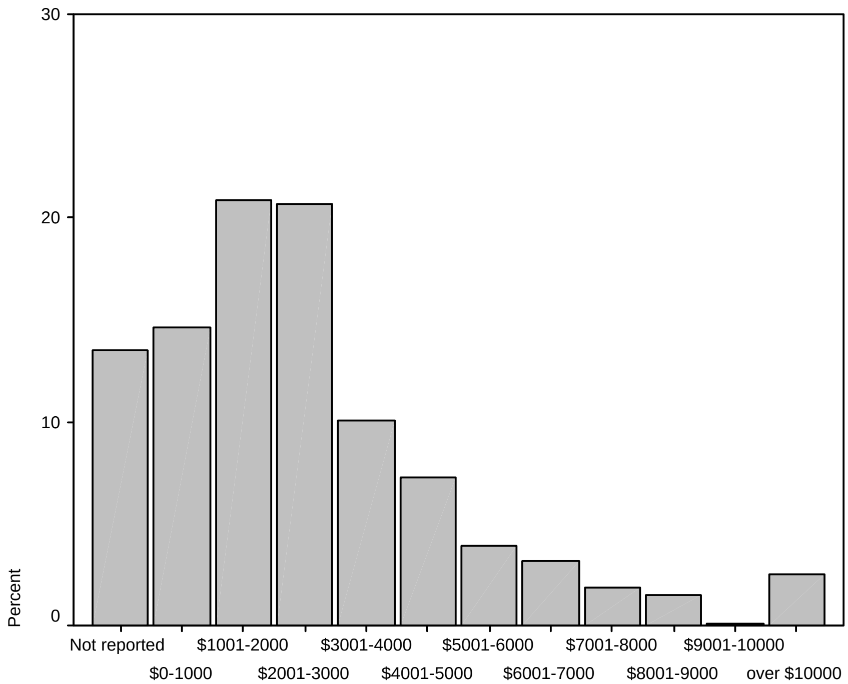


Figure 7 - Respondents' income groups



Awareness of the RIC

The respondents in the survey were mostly unaware of the RIC and its functions. Only 8% of the respondents had heard of the RIC, and 47% of those considered themselves as knowing the functions of the RIC. Of those who knew of the responsibilities of the RIC, almost 40% saw the RIC's job as being to monitor the performance of the utilities, whilst one quarter of the survey population thought that the responsibility of the RIC included either rate fixing or the handling of customer complaints. Of the RIC functions surveyed, the least awareness was shown of the RIC's mandate to develop quality of service standards, with only 10% percent of the respondents who claimed to know the functions of the RIC listing this as a purpose of the Commission.

Part 1

Survey Results – Quality of Service

Water supply

Service Coverage

WASA reports that 92% of the population of Trinidad and Tobago have access to water supplied by the utility (RIC, 2003b). This includes those supplied with water in their homes via an in-house piped connection, and those users within 200m of a standpipe. However, the proportion of those surveyed that have access to water, by these criteria, is lower than WASA's estimates. Figures 8 and 9 are maps of Trinidad and Tobago showing the percentages of respondents in each ward or parish relying upon a WASA in-house connection or standpipe as their primary water source. As can be observed in inspecting the two figures, coverage is higher, on the whole, in Tobago. Trinidad has higher levels of coverage in the North, with the South-West peninsula having service coverage of less than half. The major urban areas in Trinidad, Port of Spain, San Fernando and Arima, all have very high service coverage, and it is in the more rural areas, in the South of the country, and the East, where inhabitants must supplement their primary WASA water supply with secondary sources.

For the sample as a whole, a total of 83% of the respondents stated that their household's primary water source was either an in-house connection or a standpipe. Seventy two percent of the total sample relied upon in-house piped supplies whilst 11% used standpipes as their primary water source. The indication of a primary source, however, is unreliable without further investigation into any coping mechanisms. For instance, where users obtain a sub-standard supply from the primary water source a secondary source may be invoked. In this survey, 27% of the respondents use such secondary sources. Users with piped water as a primary source who required a secondary source used standpipes (36%) and rainfall (44%) for this need. Rainwater collection served as a primary or secondary water supply for 16% of the sample population and almost 10% of this population utilize truck borne water. Additionally, ten percent of the surveyed respondents rely upon their neighbours for water. Of those depending upon standpipes as a primary supply, 30% used standpipes at a distance further than the mandated maximum of 200m. Table 3 shows a summary of primary water sources by geographic location.

Table 3 - Percentage of households using different water sources by geography

Water Source (% of users)	Port of Spain	San Fernando	Arima and environs	Rest of Trinidad	Tobago
In-house connection	**85**	**81**	**78**	**61**	**88**
Standpipe	**13**	**19**	**13**	**10**	**7**
Truck borne	2	-	2	5	-
Neighbour	-	-	4	10	5
Rainwater	-	-	2	13	-
Other	-	-	1	1	-

Notes:
Bold type indicates water supplied by WASA

Figure 8 - Map of proportions of respondents with WASA supply as primary

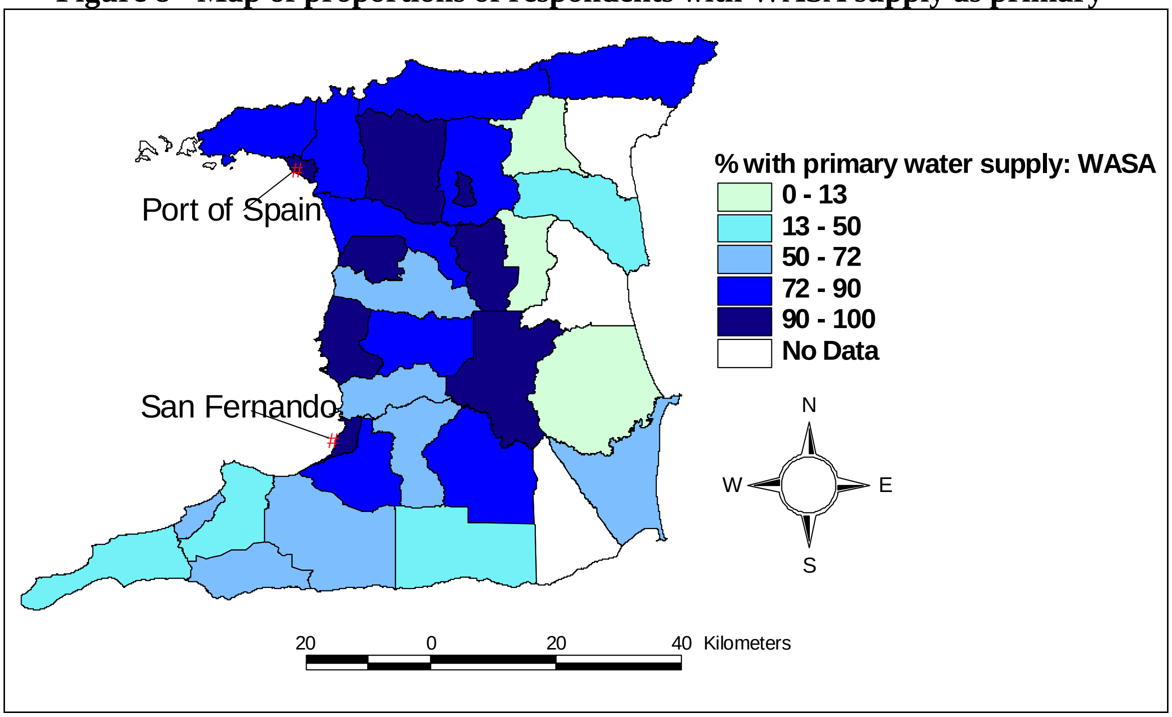
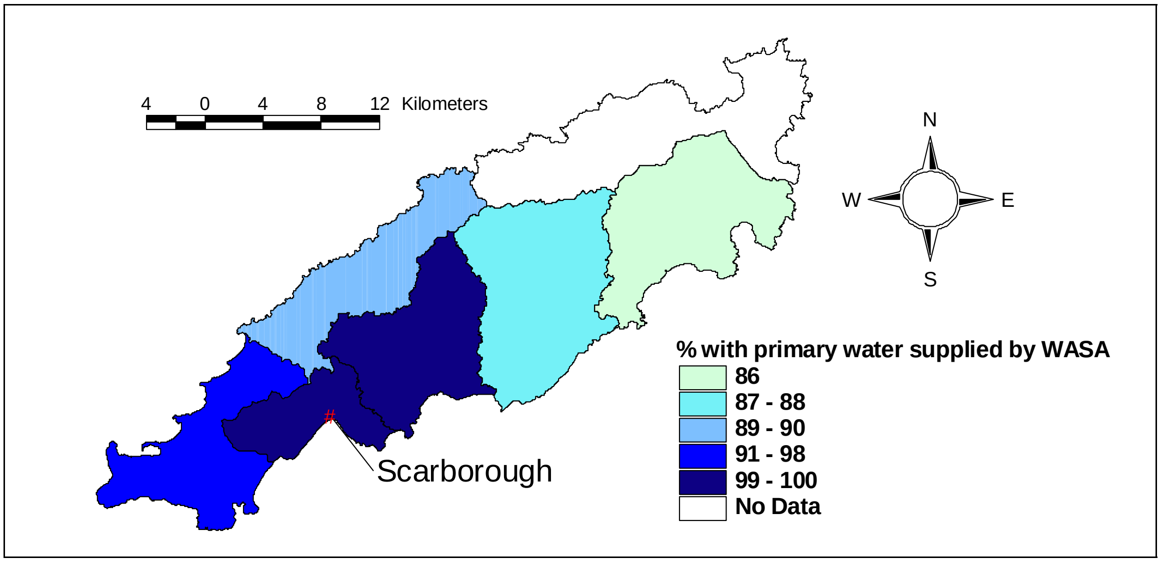


Figure 9 - Map of proportions of respondents with WASA supply as primary



Cost of water supply

Only 55% of the respondents in the survey indicated that they were responsible for paying the households' water rates. Included among the remaining 45% who do not pay bills are renters, those not aware of their responsibility, and others who are obtaining water illegally. Sixteen percent[1] of those who owned both the land and dwelling units indicated that they are not responsible for paying their water bills, despite the legal requirement that owners of property are to be billed for water rates. Ninety one percent of the tenants surveyed were not responsible for paying water rates, but, oddly, 75% of those who were squatting were responsible for paying water rates. Standpipe users were largely unaware of their responsibility (70%) to pay water rates.

Table 4 shows a comparison of the average bill reported in the survey by customer class, with the official tariffs as provided by WASA (RIC, 2003a). All water tariffs in table 4 are given per quarter.

[1] It is likely that some respondents may have mis-interpreted this question, in light of the fact that many of the respondents were not themselves responsible for bill payment.

Table 4 - Average billing by customer class

Customer class	Number of Respondents	Average Billing (Survey)	Water tariffs (WASA)
A1 – Standpipe	27	$53	$33.75
A2 – Externally Serviced	67	$100	$67.50
A3 – Internally Serviced (no metering)	465	$169	Varies[a]
A4 – Internally serviced (metered)	6	$272	Varies[b]

Notes:

a. – A3 rate depends on the Annual Taxable Value of the building (ATV) and varies between $108 and $270 per quarter

b. – A4 rate is a two block volumetric rate: $1.75/m^3 for the first 150 m^3, $3.50/m^3 after.

The survey reveals that the mean rates for customers are different from the statutory water tariffs. For fixed rate classes, A1 and A2, the variance between the rate found in the survey and the tariff is, most likely, attributable to errors in reading bills as bill payments can often be late, arrears may be included in the bills and would serve to inflate the rates reported. The average bill for A3 class customers seems more reasonable. The average billing for A4 customers as given by WASA is $931 per quarter as of 2001 (RIC, 2003a). The considerable difference between this figure and the one reported in Table 4 is attributable to three factors: two years have elapsed giving time for customers to change behaviour in response to volumetric prices; poor water supply reliability during the survey may have constrained the amount of water available to be used; and most significantly, the sample of such customers is very small (n=6) making the reliability of such an estimate questionable.

Tardiness in paying bills affects the utility's cash flow and so the survey sought to assess the delay in payment of bills. The majority of respondents (74%) pay their water bills within one month of receiving the bill. A small proportion pays yearly, perhaps due to the change in billing frequency, which was effected in the past. Others do not pay their bill in protest against poor service levels.

In addition to the water tariff levied by the utility some households incur other water charges, to cope with inadequate service levels. Eight percent of the survey respondents pay, in addition to their water rates, for a coping source. The majority of these pay for private water trucks to fill private local storage tanks at an average cost of $160 per month. There were also cases in the survey where respondents indicated that they had paid for water delivered by WASA-contracted water trucks, despite the requirement that WASA deliver such water as part of the normal tariff. Others paid for water supplied by neighbours and other private vendors.

Quality of water service

Since the reliability (as defined in terms of hours of available supply) of the water service is of concern, the survey sought to investigate this aspect of service quality. WASA for the most part offers a scheduled water supply service, and many residents do not receive water for 24 hours a day, seven days a week. WASA publishes a proprietary statistic, the full service equivalent (FSE), sporadically, which represents the reliability of supply. The survey sought to understand how reliability of supply varied in space as well as to verify the degree of service as expressed by WASA through its FSE.

Twenty seven percent of the respondents to the survey indicated that water was available 24 hours a day, seven days a week. This value is debatable, due to the effect of local storage, which is widespread in the country. The effect of storage facilities located on private property is discussed below. Forty four percent of the respondents, however, indicated that they had service for between 0 and 48 hours per week and 29 % of the total sample indicated that they received no water at all. Figure 10 shows the geographic distribution of respondents with full service. It is apparent that there is a wide variation in the proportion of households within a ward with class I service. The East-West corridor, running from Port of Spain to Arima, has relatively high levels of service, while the Southern part of the country is underserved.

Figure 11 shows the distribution of users with full service in Tobago. In Tobago, the proportion of households with class I service is even fewer. Full service is more prevalent in the more built up areas, such as the parish of St. Andrew, in which the capital, Scarborough, is located, and in the South-West areas of the island where the concentration of tourism plants are located. The generalization over the entire parish, however, masks the significant variation within each parish, with the two noted displaying very concentrated high service level areas in the urban areas. Also, it is notable that in the parish of St. David, the highest level of service encountered was class V. Table 5 shows classes of water reliability and the percentage of survey respondents in each class of service. Table 6 shows the percentage of low, middle and upper income groups in each service class. It is notable that the reliability of water service is very much associated with income of the respondent. The implication is that the poor, who are least able to cope through the installation of tanks and pumps, are most affected by the poor reliability of water supplies.

Figure 10 - Percentage of respondents with Class I (168 hours per week) in Trinidad

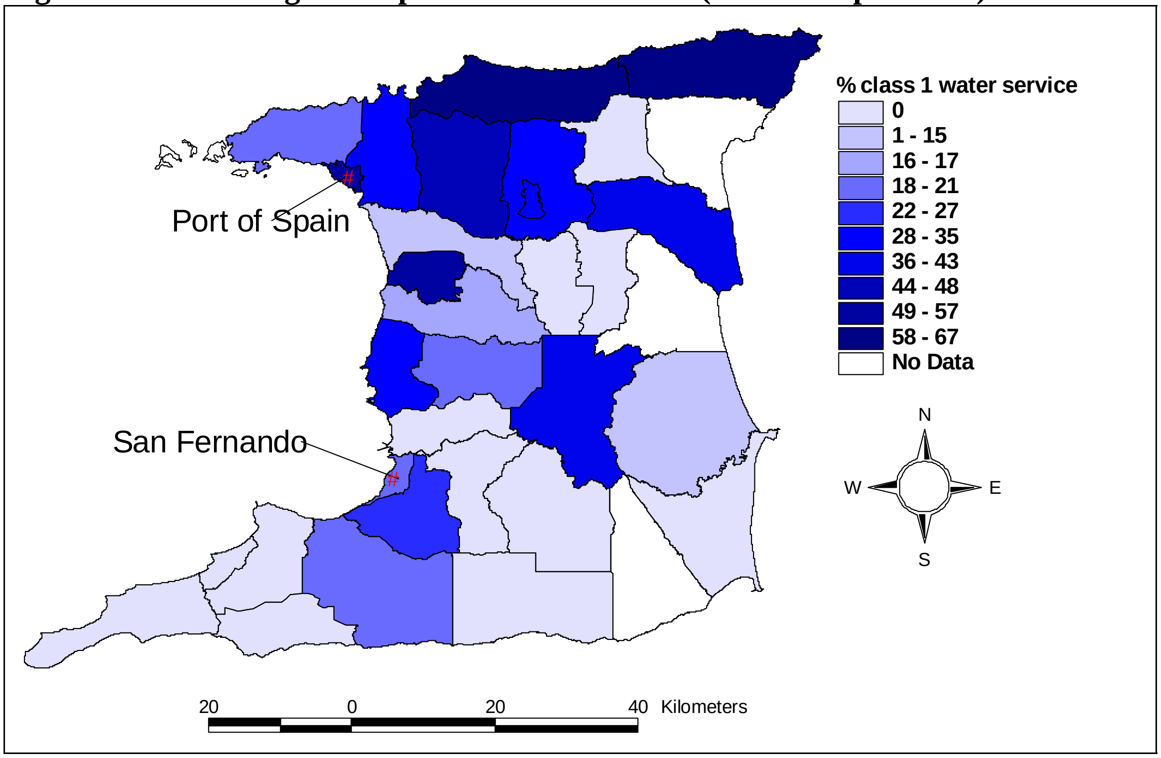


Figure 11 - Percentage of respondents with Class I (168 hours per week) in Tobago

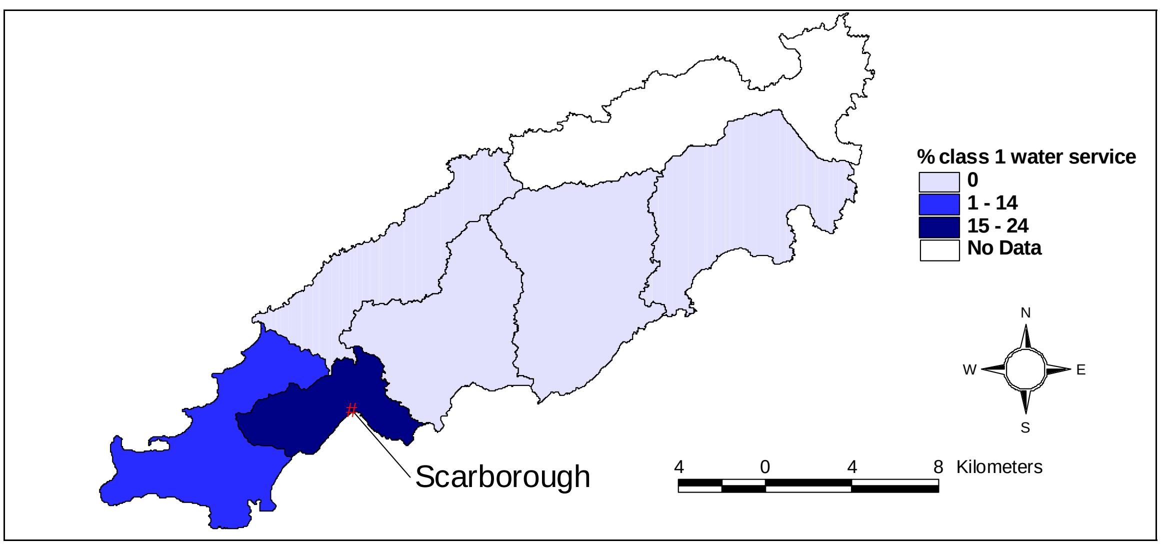


Table 5 - Respondents in different service classes

Class of Supply	Hours per week in which water is available	Percentage of respondents in class
Class I	168	27
Class II	120 – 168	7
Class III	84 – 120	11
Class IV	48 – 84	11
Class V	0 – 48	44

Table 6 - Service class by income group

Income group	Class I	Class II	Class III	Class IV	Class V
Low	24 %	6 %	10 %	10 %	50 %
Middle	26 %	8 %	13 %	13 %	40 %
Upper	45 %	7 %	14 %	5 %	29 %

Notes:
Low income - less than TT$ 1500 per month
Middle income – TT$ 1500 to TT$ 5500 per month
Upper income – greater than TT$ 5500

The impact of reliability is also of interest in this study. Customer impressions concerning the acceptability of the reliability of water supply were sought and only 23 % of the respondents felt that service was poor or very poor. This, most likely is due to coping mechanisms, the most important of which is local storage facilities.

Due to the unreliability of water supply in Trinidad and Tobago, many residents install local storage tanks. The survey attempted to assess the prevalence of such installations. Sixty eight percent of those surveyed had storage tanks either connected to the water mains or filled manually from hosepipes running from standpipes, neighbours, or mains supplies. On average the installed storage capacity per household, where storage existed, was found to be 610 gallons. Eighty two percent of the respondents were able to enjoy a continuous supply as a result of the installed storage. This result implies that the proportion of those who have class I service may be smaller than reported in the survey given that many respondents would be unaware of service cuts as installed tanks allow for a continuous supply. Inferences from the survey reveal that on average local storage allows for 5.5 days of storage.

Another attribute investigated by the survey was water pressure. Almost half (47%) of the respondents felt that the water pressure was good to excellent, which implied that they saw no difficulties in washing dishes, showering or other similar activities simultaneously. Fourteen percent felt the water pressure was poor or very poor. Dissatisfaction with the water pressure in the mains was higher amongst standpipe customers, with 22% indicating that the water pressure was poor to very poor. As the survey did not enquire about water pumps and elevated storage tanks, it is difficult to estimate the effect of coping mechanisms on users' satisfaction with the water pressure.

With respect to water quality, generally this attribute was found to be acceptable. A small percentage (8.4%) found the quality on the whole to be poor. Almost 20% of the respondents reported the colour of the water as being poor to very poor, and almost 15% of the respondents took issue with the taste of the water supplied by WASA. Forty five percent of the respondents indicated that they treat their water, and the most popular form of treatment being boiling implying that users are coping with perceived health risks associated with the quality of the water supply.

When customer service was enquired into, the majority of respondents indicated that they were satisfied with the level of customer service offered by WASA, although almost 20% were either dissatisfied or very dissatisfied.

The survey also found that overall service levels, as perceived by respondents, were relatively static over the time respondents resided in their current dwelling. Over 40% of surveyed households stated that the service had not changed since they had lived at that location. However, 45% of the respondents found the service levels to have improved over their period of residence.

Bottled water consumption

Since there are some cases of poor water quality and the appearance of bottled water in the market, the survey attempted to enquire whether WASA customers are also consumers of bottled and the reasons for its consumption. Thirty percent of the survey respondents indicated that they use bottled water, primarily for drinking. Respondents further indicated that the main reason for using bottled water was on account of the presumed safety of bottled water, relative to piped sources. Additionally, convenience and taste also influenced their decision to purchase bottled water. The survey found that on average, households spent $10 per week on bottled water.

Service levels: non-piped customers

In an attempt to gain some perspective on the accessibility of water, the survey attempted to capture the distance to the nearest public standpipe from non-piped residents and the time spent in collecting water. Understandably, such information would be indicative of a quality of life issue and provide a better understanding of the hardships non-piped residents face.

It was estimated that 60% of the respondents who do not have access to an in-house piped connection are more than 200m away from the nearest standpipe and 20% are more than 800m away from the nearest standpipe. Because of this and variable reliability of supply, non-piped water users spend considerable time in collecting water. Of the surveyed non-piped water users, over 75% spend more than 30 minutes per day collecting water and

30% spend more than 60 minutes. When asked what was the main reason for not having an in-house connection, the majority of respondents indicated that a connection was not available to them since water mains were not located nearby.

Wastewater services

The survey enquired into the level of wastewater service coverage currently being offered. Seventeen percent of the survey respondents commented that they had access to a central sewerage system. This figure is relatively close to estimates provided by WASA, which suggests that it provides approximately 20% of the population with wastewater services (RIC, 2003a). Almost 60% of the respondents rely on septic tanks for sewerage disposal. In such cases, open drains would be used to dispose of greywater. Interestingly, about 23% of the households surveyed uses pit latrines for waste disposal. Figure 12 shows the geographic distribution of central sewerage access in Trinidad and Figure 13 shows the same for Tobago.

Figure 12 - Access to central sewerage: Trinidad

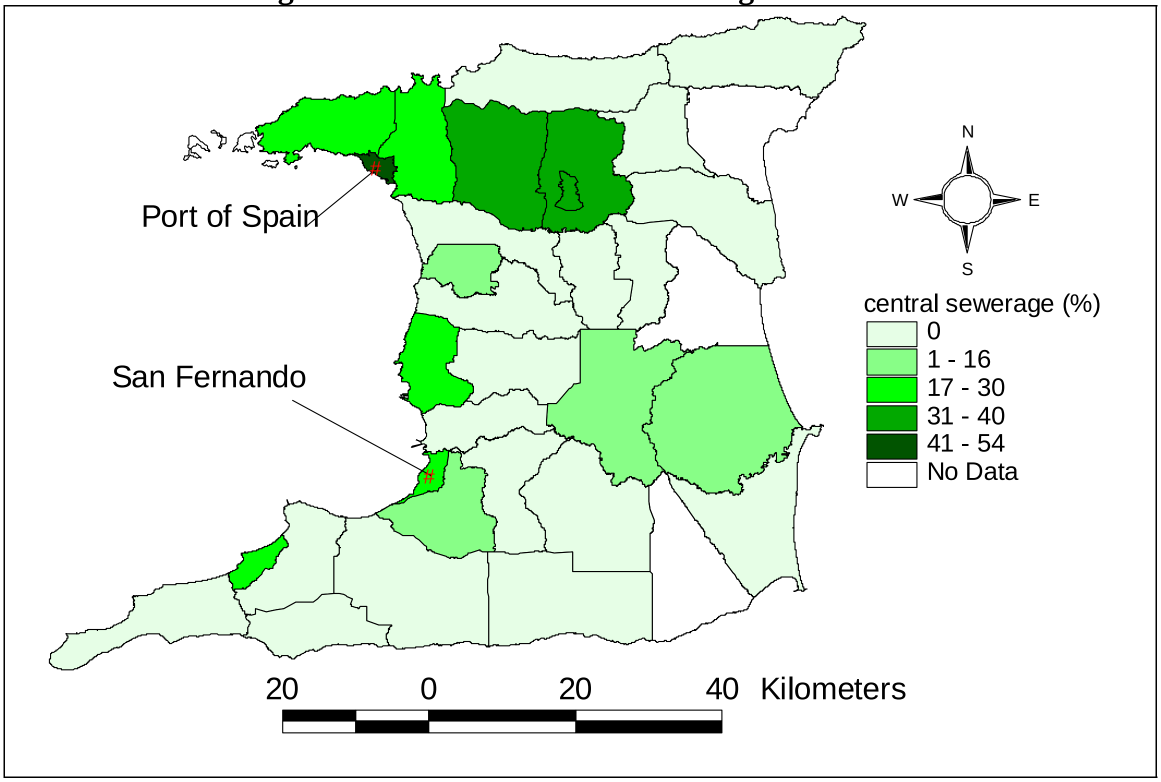
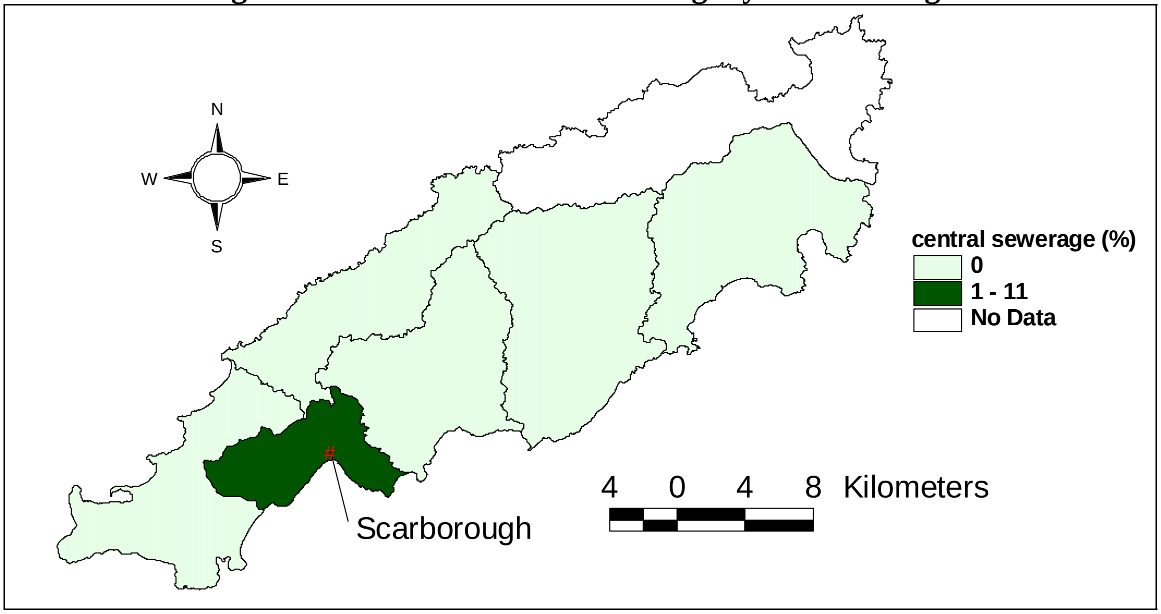


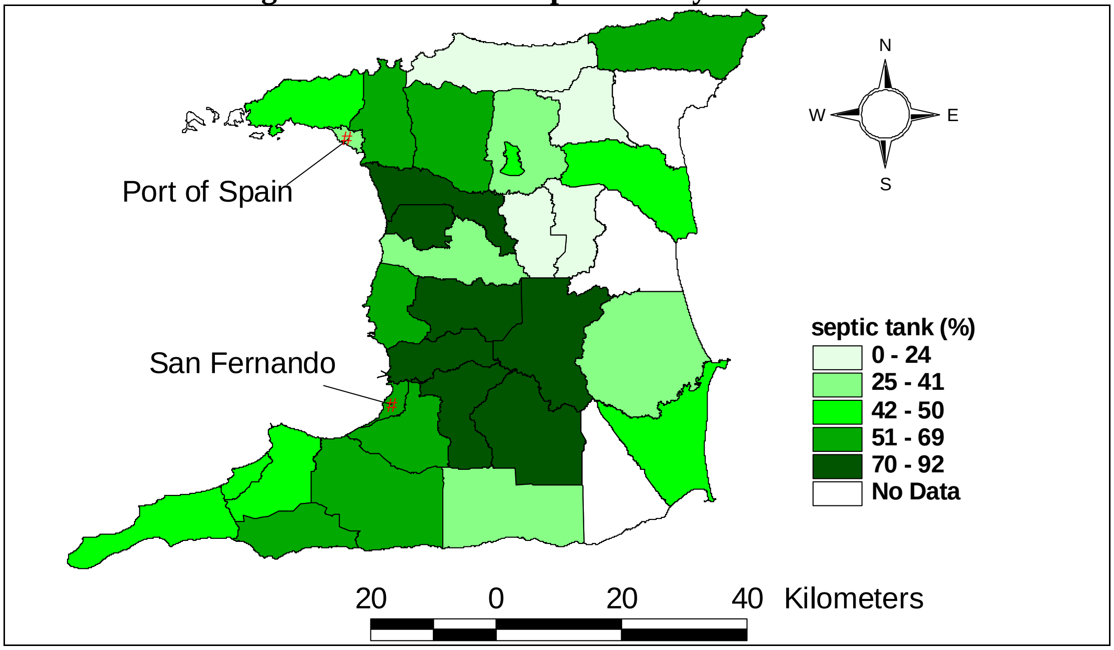
Figure 13 - Access to central sewerage systems: Tobago



As can be observed in Figures 12 and 13, households with access to central sewer systems are located around urban areas. In Tobago, the only sewerage service that exists is in Scarborough, as can be seen in Figure 13. Figure 12 shows that the largest access to sewerage facilities lie in the East-West corridor. Access to WASA sewerage systems includes the Port of Spain system, which serves a catchment area from Pt. Cumana and Diego Martin in the west to Petit Bourg in the east with a separate facility that services the Borough of Arima and the adoption by WASA of a treatment plant in Trinicity. There are other WASA sewerage systems serving different parts of the country and these include the city of San Fernando and the Boroughs of Chaguanas and Point Fortin.

As housing developments are required to install package treatment plants in some cases, sewerage access is not only found in the urban areas served by WASA. The survey found that almost 18% of the sample with access to sewerage facilities relied upon a private operator. A small percentage (<1%) also had sewerage systems managed by the National Housing Authority (NHA), which is below the national, 10%, coverage by the NHA. Preference by currently seweraged households was for sewerage facilities to be under the operation and maintenance of WASA. The average amount paid for sewerage facilities was found to be $90 per quarter, though only 15% of those with central sewerage facilities reported any payment. As the bill for WASA provided sewerage services is contained within the water bill, it is quite possible that this obscured the price paid by households for the service and led to an under reporting of payment.

Figure 14 - Access to septic tank systems: Trinidad



Based on the survey findings, septic tanks form the primary sewage disposal method in the country. As can be seen in Figure 14, septic tanks serve a significant proportion of the population in most wards in Trinidad. Tobago sees a concentration of septic tank installations in the southwestern region. This is most likely due to significant development in the area, and higher incomes and population densities in the region. The survey found that the there is a very wide variation in the frequency of tank cleanings. Whilst over 40% of the sample had their tanks cleaned at least once in four years, a significant proportion (43%) had never had their tanks cleaned. Of those that had their tanks cleaned, an average cost for cleaning was found to be $258.

Figure 15 - Access to septic tank systems Tobago

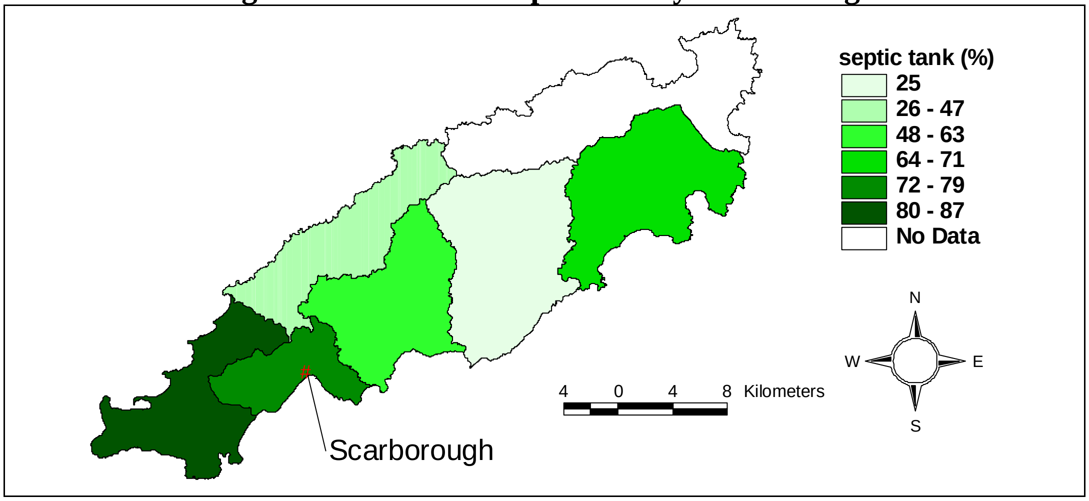
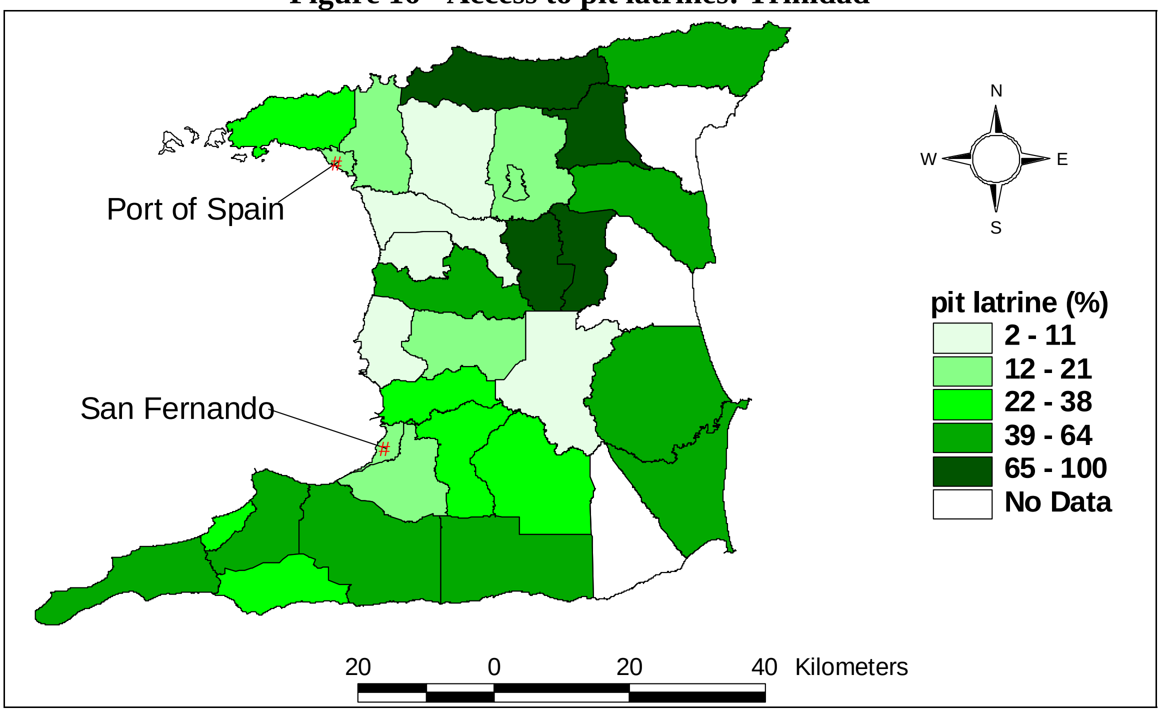
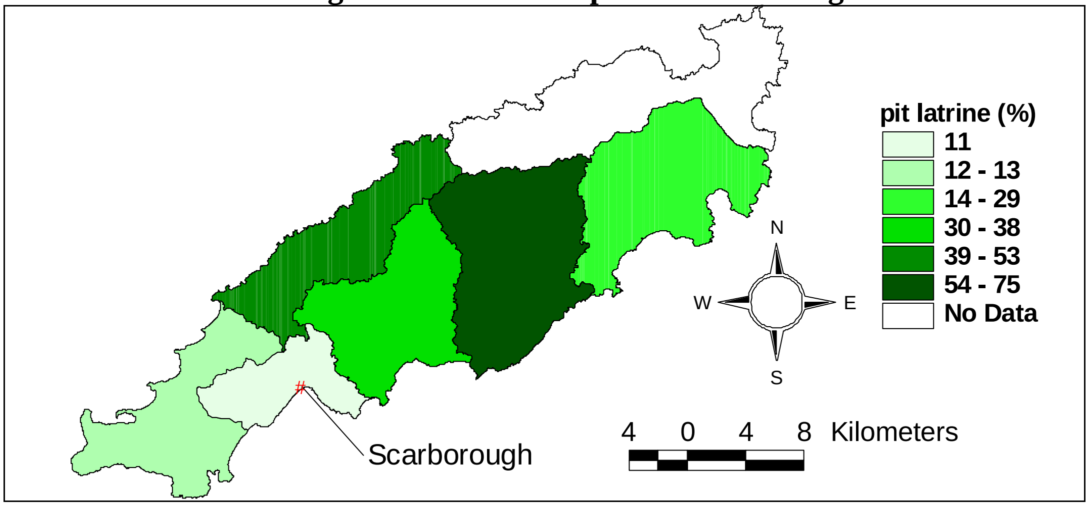


Figure 16 - Access to pit latrines: Trinidad



Perhaps the most outstanding finding, with regard to wastewater services, is the significant proportion of surveyed households with only pit latrines for waste disposal. Figure 16 shows a distribution of pit latrine users in Trinidad. Again, rural households in the Southern portion of the country rely on this low level technology disproportionately to households in Northern, more urban and sub-urban areas. Inhabitants in Tobago, in Figure 17, also rely upon latrines to a large degree, again with exception of the South-West parishes.

Figure 17 - Access to pit latrines: Tobago



Over 75% of the sample was satisfied to very satisfied with their current level of wastewater service. This aggregate finding, however, masks dissatisfaction with particular technologies. Only 44% of latrine users were satisfied with their wastewater disposal, and over 30% were actively dissatisfied. Eighty seven percent of septic tank users were satisfied with their sanitation service. Users of sewerage facilities expressed higher levels of satisfaction with services provided by WASA, as opposed to private operators.

Though a large proportion of the sample was satisfied with their current wastewater disposal system, almost 40% indicated that an improved system was preferred. Again the aggregate disguises the variation in preference for service level change. Latrine users were considerably more interested in an improved wastewater disposal system than those already with a central sewerage system. And though septic tank users were the most satisfied group, they, more than central sewer users, preferred a service change.

Most surveyed households preferred a central sewerage system be accessible at their household but almost half of current latrine users preferred septic tanks to central sewerage as their waste disposal mechanism.

Electricity

The RIC's investigation into electricity coverage indicates that 92% of survey respondents benefited from a supply of electricity. Given sampling error, this number is not statistically different from the 97% coverage reported by T&TEC. The survey found that the average bi-monthly electricity bill was $216. This figure may have included arrears from previous bills, which inflated the readings abstracted when enumerators reviewed the respondents' bills. When punctuality of bill payment was looked at, it was found that 70% of respondents pay their electricity bills within 2 weeks and 97% pay their bills within a month. Table 7 below provides an indication of the customer profile in terms of the appliances currently possessed by respondents.

With regard to the reliability of supply most respondents, in fact 83%, considered the electricity supply to be good to excellent. Outages were infrequently experienced by 75% of the respondents, while about 6% of the respondents experienced outages with at least a weekly frequency. When outages did occur, they were, most often between 2 and 4 hours in duration.

As a measure of the quality of supply the survey examined the respondents' experiences with voltage fluctuations. Seventy percent of the respondents rarely experienced voltage fluctuations, however, 17% of the respondents do experience voltage fluctuations frequently. The voltage fluctuations have led to damaged appliances for at least 8% of the respondents, but less than 2% of the respondents reported making a compensation claim for damaged appliances. Of those who have made compensation claims, 79% have found the level of compensation to be either unfair or very unfair.

The survey also sought to glean insight into the response time of the service provider to customer trouble reports. Twenty percent of the respondents indicated that they have made a trouble report in the past, regarding service interruptions. The survey found that in the majority of cases such reports were resolved within 4 hours. In terms of the time customers waited for a new connection to be installed, about 36% of the respondents waited at least 1 working day for a new connection.

When it came to assessing the treatment of the service provider to its customers, it was found that 85% of respondents were satisfied to very satisfied with the level of customer service offered by T&TEC.

Table 7: Ownership of electrical appliances

Appliance	Percentage of respondents owning (%)
Water heater	19
Washing machine	64
Clothes dryer	13
Refrigerator	85
Cooking range	13
Television	86
Stereo/radio	81
A/C unit	6

Part 2

The Willingness to Pay for Service Changes

One of the primary objectives of this survey was to evaluate water and wastewater and electricity customers' attitudes towards changes in levels of service. This evaluation was done using the concept of willingness to pay as explained above. This section summarizes the main findings from the contingent valuation and choice model sections of the survey questionnaire. Models explaining the variation in WTP are presented and the effect on WTP is discussed using these models

Water Services

Water services in Trinidad, as shown in both this survey and other sources, are less than ideal. This ideal level is assumed to be a 24 hour supply of water with adequate pressure and quality for drinking. The investigation of WTP for changes to the status quo has centred upon this concept of the ideal as service expansion plans have traditionally aimed at providing services closer to this ideal. This section discusses estimates of WTP from both the CVM and CM method. A qualitative comparison is made between the two methods.

Contingent valuation analysis of willingness to pay

The contingent valuation method presents a scenario to the respondent, which is assumed to be different to the status quo, and the respondent indicates the acceptability of the service change at some price. The assumption in the method is that the new scenario offer increased utility to the surveyed household and so there is a net willingness to pay for the change. Further, as the method assumes that the WTP indicated by users is representative of non-observable preference structures, even where the utility of the service level is the same as at current, but the price of the service is below the WTP of the user, an increased WTP would be noted. The measurement of this consumer surplus is contingent upon a lack of strategic bias on the part of the respondent, which can in turn be controlled only through well designed scenarios and very stringent field procedures.

This survey used a bidding game to elicit the WTP of water users. The result of such a method is an interval in which the maximum WTP of the respondent truly lies. Whittington *et al*. (1989) have shown that the mid-point of the interval can be used in modelling exercises to yield consistent estimates of the WTP of users and thus this survey uses the interval mid-point to represent the maximum WTP of a particular household. Table 13 shows the average willingness to pay for an upgrade in the (water) service level from the current status quo level to the ideal level described above for users of different current primary sources.

Table 8: Average willingness to pay by primary water use

Primary water source	Mean willingness to pay (Per month)
WASA in house piped connection	$48
Standpipe	$62
Truck borne	$57
Supply from neighbour	$46
Rainwater	$43
Natural sources	$78

The WTP by primary water source, shown in Table 8, has illustrative merit. For instance, the WTP for those depending on in-house piped connections for a primary source is lower than the WTP for users depending upon standpipes for their main water supply. This is reasonable as the service upgrade associated with a move to the ideal from the standpipe level of service is larger than from the in-house connection. That is, the move from the standpipe status quo to the ideal includes an upgrade to an in-house connection, whereas the upgrade for an already connected household only implies changes in the reliability, quality and pressure of the existent connection.

The sample size of users depending upon natural sources is very low, and so the reliability of the mean WTP for that class of customer is questionable. However, the estimate mean WTP of $78 is in line with expectations, given the fact that the utilization of natural sources would provide none of the enhanced reliability, quality, or pressure specified in the ideal scenario.

Two particular classes are of interest in Table 8, rainwater users and those depending upon neighbours for their water supplies. While both classes of users are coping with an inadequate supply, perhaps, their current situation appears to be of only minimal inconvenience. In the case of those relying on rainfall as a primary source, this class tends to cope reasonably well with this supply mechanism since there is considerable rainfall during the rainy season and the installation of water tanks enhances their ability to cope with minor temporal variations in water availability. Additionally, as users depending upon rainfall are mostly (85%) residing outside of the main urban centres, increased land space affords them the opportunity to increase on-site storage capacity. Thus, the suitability of collecting rainwater as a coping mechanism makes the 'ideal' scenario posed in the contingent valuation exercise less appealing and serves to depress the WTP for changes to that level of service. Neighbour supplied water sources also provide a low cost coping mechanism. Such users would require less storage facilities, as the neighbour (with the WASA connection) will often take this reliability coping strategy upon himself or herself. Further, the cost of utility service is shared between multiple households reducing the binning costs per household. These two factors serve to lower the benefits accruing to a household in converting to a private connection.

Table 9 presents a model of demand for the change in service proposed in the contingent valuation scenario presented to the survey respondents. The model applies only to the users who utilize a WASA connection as their primary and only water source. This amount to about 58% of the households sampled. A logistic regression is used for the data due to the discrete nature of the choices. That is, the acceptance or rejection of each bid during the elicitation process results in binary response data. The model assumes that each observation of binary response is independent of one another. In this case, this is not strictly true as one respondent will have furnished multiple responses and so errors in observations will be correlated. The effect of this is to inflate the significance, and so precision, of the estimated parameters (Briscoe *et al*., 1990). A bootstrapping procedure can be applied to obtain representative estimates of the significance statistics, by sampling a portion of the data and running a regression on that sub-sample. Such a treatment has not been included here, due to the preliminary nature of the results. It should be noted that the error introduced is only in the significance of the parameters, which themselves remain unbiased.

Logit models allow for the modelling of a probability of acceptance of the new scenario rather than explicit willingness to pay. As the response variable is binary and discrete, the assumptions in continuous regression methods are violated and so logit or probit methods are required to transform the response function into a continuous one (see for example Maddala, 1983). The immediate ramification of such transformations is that the interpretation of parameters becomes more difficult.

The model in Table 8 can be written as in equation (6):

$$V = 0.331 - 0.009[PRICE] + 0.004[BILL] + 0.055[Y] - 0.201[TREAT] \qquad (6)$$

Where the variables in (6) are explained in Table 9.

Table 9: Logit model: Users whose primary and only source of water is WASA mains

Parameter	β - value	Odds ratio	Wald Statistic
Price of supply (*PRICE*)	-0.009	0.991	169.83
Current bill amount (*BILL*)	0.004	1.004	51.42
Income (in 1000TT$) (*Y*)	0.055	1.057	5.17
Whether the household treats its water presently (1 – no; 0 – yes) (*TREAT*)	-0.201	0.818	3.07
Constant	0.331		5.62

The model in Table 9 has parameters of the anticipated sign. Price is inversely related to the probability of acceptance of the new scenario, as is implied by an odds ratio of less than unity. Users who currently are treating their water supply are willing to pay more for the change, as is indicated by the variable *TREAT*. This is likely due to the WTP for avoiding coping costs incurred as a result of treating local water sources. It is worth noting that the variable *TREAT* is significantly related to the probability of accepting a change in water service at a given price, whereas specific qualitative estimates of water quality, such as an assessment of taste or colour, are not. The WTP of users, given this, would be related to the degree to which users are risk adverse. That is, some users who perceive their water supply as poor quality would be willing to pay less than others who similarly perceive their water quality to be poor due to less fear about the consequences of a similar degree of poor water quality. Those who pay more for their water connection at present are willing to pay more for the improved supply, as are those who earn more. This would be expected given the reduced income effect of a price increase where income is large. The parameters included are all significant at the 10% level, as given by the reported Wald statistics.

The odds ratio assists with understanding the parameters in the above model. For categorical variables, the odds ratio represents the odds that an individual accepts an offer at one level of the variable relative to another (Powers and Xie, 2000). For the categorical variable *TREAT* the odds ratio is 0.82, which implies that the odds that a household not treating their water accepts the changed water service are 82% of the odds that a household treating its water accepts the change, all else being equal. As the probability function is non-linear, there is no constant marginal effect, as is the case with ordinary least squares regression, and so the marginal effect on probability is determined by the level of the independent variables. With continuous variables, the ratio of odds is dependent upon the step size chosen to distinguish one state of the independent variable from another. For example, the odds ratio could be conceived as the ratio of the odds of acceptance between households, whose income was $1000 apart from one another, again keeping all else constant. As such, the odds ratio for the income variable in Table 8 is 1.06, implying that for every increase in household income of $1000, the odds of accepting the idealized water service (as presented in the contingent valuation model) are increased by 6%, again keeping all else equal.

It would be anticipated that other factors would affect the WTP for changes to water services. Reliability of supply, for instance, would impact upon users' WTP. If reliability of the water source was low, a user would be required to invest in coping mechanisms such as storage tanks and water pumps to alleviate the shortfall in service. As has been noted above, the reliability in Trinidad and Tobago is extremely variable spatially. That is, there are numerous users who experience inadequate water reliability. This is shown by both the low levels of water availability in term of hours per week, as well as the significant degree to which households invest in local storage infrastructure.

The analysis provided in Table 9 attempts to ascertain the level to which shortfalls in reliability, and resulting coping strategies, affect the WTP of users. It could be hypothesized, for instance, that the investment in coping mechanisms would lower the WTP as the problem has been solved effectively. Alternatively, coping strategies may indicate a WTP to avert inconvenience caused by such work-a-rounds. In building the model presented above, no significant relationship was found between reliability and WTP, which seems counter intuitive. This is most likely due to bisas involved in the data collection process. Alternatively, the realism of the scenario presented to respondents may have been somewhat questionable. Whilst respondents may have believed that the quality of water could be increased, given a significant relationship with the variable *TREAT*, it may have been impossible to believe that reliability could be increased to levels proposed in the ideal scenario. Similar arguments can be used for variables regarding water pressure.

Table 10: Users whose primary source is WASA but who also rely upon secondary sources

Parameter	β - value	Odds Ratio	Wald Statistic
Price of supply *(PRICE)*	-0.009	0.991	66.55
Income (in 1000TT$) *(Y)*	0.110	1.116	6.874
Number of Bathrooms in Dwelling *(BATHROOM)*	0.803	2.233	13.021
Whether the household treats its water presently (1 – no; 0 – yes) (*TREAT*)	0.458	1.581	5.817
Whether HH incurs other water charges *(OTHERWAT) (0 – yes; 1 – no)*	-0.649	0.523	3.469
Constant	-0.453		3.005

Table 10 relates the logit model describing the structural relationship between the probability of acceptance of the ideal scenario and various independent variables for users whose primary source of water is a piped in house connection, but who also rely upon a secondary source (about 13% of the total sample). The form of the model is similar to that shown in equation (6) with the parameters and variables described in Table 10 replacing those from Table 9. Again, the price of the ideal scenario is related to the probability that a household accepts the new scenario. The odds that a household accepts the ideal scenario increase with increasing income as was the case for users who relied upon an in-house piped WASA connection exclusively. In this model, as the number of bathrooms in a household increases the probability that the household would connect to the ideal system also increases. This result is significant. In the case where users depended upon only WASA water, their total water demand, measured in proxy by the number of bathrooms in the household, was unrelated to their willingness to pay for a service upgrade. In this case, as the household engages in some coping mechanism, a secondary source of water supply, increased water use would increase coping costs. This is because the marginal cost of the secondary source is higher than the primary source (or else it would be used as a primary source), and in most cases is characterized by a significant variable cost where the primary source is defined by only a fixed cost. The effect, then, of this two source water supply is to increase the total cost to the household with increases in water demand. Therefore, the benefits of the improved system increase (through the avoidance of coping costs) with water quantity consumed.

The variable *TREAT* is significant in the model shown in Table 10. However in this case, the sign of the model is the opposite, implying that the odds of adoption are higher for those who do not treat their water. This is most likely due to the investment costs incurred in coping with poor quality water, where a secondary source is used. Fewer respondents depending on a secondary source feel that the overall water quality is good as compared to those depending exclusively upon a WASA piped connection. This may result in increased investment in coping strategies to circumvent the perceived poor quality of water. As quality issues have been addressed, then, the users are less likely to invest in a new service where one of the significant changes would be an improvement in water quality.

Table 10 also reveals that the odds of accepting the ideal scenario where the respondent pays only WASA rates for their total water supply are 50% of those for users paying extra for secondary sources of water. Again, this result is intuitive. The direct cost of coping is included as a cost of procuring a secondary source and it is the alleviation of this burden that translates into an increased WTP. As the costs of coping, where external suppliers are engaged, do not require 'lumpy' investment, the transition to new supply regimes does not involve a transfer cost and so the benefits of an improved system are not eroded by losses accrued through the abandonment of investment.

The probability of acceptance of an improved system, for users whose primary source of water is a WASA connection does not vary with geography or housing density. In estimating the model, a variable representing the different regional corporations, of Port of Spain, San Fernando, Arima and environs, and rural areas as well as a variable distinguishing between Trinidad and Tobago were found to be insignificant. That is, the distribution of water service preferences across the two islands is statistically homogenous for users who depend upon a WASA connection. This result applies to the models presented in Tables 9 and 10.

Table 11 shows a model describing the responses of users who did not rely upon a WASA piped connection for their primary water source. This class of customers includes all standpipe users, rainwater users and users who depend upon other water delivery mechanisms for their primary supply.

Table 11: Users who do not use piped supplies as primary

Parameter	β - value	Odds ratio	Wald statistic
Price of supply *(PRICE)*	-0.008	0.991	133.60
Income (in $1000) *(Y)*	0.141	1.152	10.41
Age group *(AGE)*:			
Under 20 years[a]			17.29
20-29 years	0.400	1.491	1.51
30-39 years	0.892	2.440	13.37
40-49 years	0.744	2.104	12.76
50-59 years	0.568	1.764	6.29
60 years and over	0.707	2.209	8.49

Parameter	β - value	Odds ratio	Wald statistic
Fraction of the week that storage lasts *(STORFRAC)*	-0.249	0.779	2.92
Geographic location of HH *(LOCATION)*			
Port of Spain[a]			18.05
San Fernando	0.945	2.573	3.11
Arima	0.331	1.392	0.36
Rest of Trinidad	0.776	2.172	3.95
Tobago	0.163	1.177	0.19
Constant	-0.187		0.205

The relationship between the price of the service upgrade and probability of acceptance is again inverse and as household income increases the probability that a household chooses to accept the hypothetical improvement increases. The education level of respondents also affected the probability of acceptance, with the 30-39 year old age group having the largest odds of acceptance of the new ideal water supply situation. The degree to which locally installed storage meets the needs of the surveyed households impacts the desirability of the suggested level of service change. As suggested by the parameter in Table 10, as local storage meets a larger proportion of the water needs, the odds of adopting the idealised water service are reduced with the odds of acceptance by those who have 24 hour storage being 78% of those with no storage whatsoever. This can be explained by the fact that installation of water storage infrastructure can be characterized by a large fixed cost and little on-going investment. Due to this, when storage allows for no interruption in water service, there is no benefit to the user in increasing the reliability of the mains supply as the cost savings are, in the short run, practically zero.

Interestingly, the analysis found that non-piped households' propensity to adopt the improved water supply situation varies with location. The odds of residents of San Fernando opting to increase their level of service at a given price were 150% higher than for Port of Spain residents at a similar price. Residents of Tobago showed an increased interest in increasing service. Most likely the geographic disparity in WTP is associated with differing service levels. Rural water users rely more heavily on lower levels of water service, such as rainwater, and so would experience a larger net benefit of a move to an improved water supply system. Inhabitants of the Port of Spain area generally have better water reliability and pressure.

Choice models to value changes in water supply services

Alongside the contingent valuation method (CVM) used in this survey was an alternate technique whereby users were presented with a series of hypothetical service bundles and asked to indicate their preferred alternative in each set of bundled attributes. Such choice sets offer the potential to value intermediate changes in service level, through the concept of compensating variation (see e.g. Louviere *et al*, 2000), where the CVM is confined to measuring the value of a change from the status quo to some alternate level. Choice model (CM) methods do allow for an estimate of the value placed on an upgrade to the ideal level of service, as specified in the CVM section above. As such, a qualitative comparison of the estimates of WTP offered by the two methods can be made. This section presents the results of the choice experiments conducted as a part of this survey and attempts to highlight the differences between results produced by this method and the standard practice contingent valuation method.

Two different choice sets were presented to respondents, depending upon their current primary water supply. Respondents who currently relied upon a piped supply as their major water source were presented with a reduced set of attributes, as noted above in Table 1. Those who had a lower level of service had additional attributes, the level of service and a connection cost, added to the definition of the alternatives.

The conditional logit (McFadden, 1974) models of choice behaviour are presented in Table 12.

Table 12: Conditional logit parameter estimates for piped and non-piped water users

Parameter	Model 1 – piped users	Model 2 – Non-piped users
Number of days per week supply is in system (RELDAYS)	0.3957 (33.09)	0.0502 (5.77)
Number of hours per day supply is in system (RELHOUR)	0.0692 (24.79)	0.0258 (9.88)
Pressure:		
Poor*		
Average	0.8929 (11.42)	0.1068 (1.76)
Good	1.4096 (27.43)	0.7215 (13.54)
Quality:		
Poor*		
Average	1.1428 (14.81)	0.4392 (7.13)
Good	1.8029 (29.81)	0.8815 (15.33)
Connection Cost ($):		
0*		
300	N/A	-0.1838 (-3.69)
600		0.1304

Parameter	Model 1 – piped users	Model 2 – Non-piped users
		(2.43)
Level of service: Standpipe[a] In house connection	N/A	 0.0919 (2.01)
Price (TT$/quarter)	-0.0073 (-32.01)	-0.0026 (-14.65)
ρ^2 Log likelihood	0.60 -5675	0.12 -4845
Notes: * Reference value for dummy coded variable Values in parenthesis are t-statistics for parameters		

The parameters presented in Table 12 describe the effect of a change in the model variables on the utility associated with the corresponding water supply service. The parameters describing the model variables all have the expected signs with the exception of the parameter associated with changing connection costs. The effect of an increase in connection cost to $600 from no connection fee in model 2 shows a positive relation with utility, which is counter intuitive. All the parameters in Table 11 are statistically significant at the 95% level with the exception of the parameter describing the utility impacts of a change from a poor to an average level in pressure for currently non-piped households. The model for piped users has a very high ρ^2 value, at 0.6. This is a measure of model fit, and can be considered as analogous to the R^2 coefficient of determination in ordinary least squares regression. This is most likely due to an increased degree of homogeneity in the group with piped access as their primary water supply. The value of ρ^2 for the non-piped households' model is lower, at only 0.12, implying that the degree to which the model explains the variation in choice set selection is lower than the model estimated for piped households. This value, however, is not very far outside of the range, 0.2 to 0.4, considered to be excellent in discrete choice models (Hensher and Johnson, 1981).

The two models presented in Table 12 can be considered as preliminary. Multinomial logit specification tests have not been conducted for adherence to the independent from irrelevant alternatives (IIA) property inherent in the model. The models do not incorporate any socioeconomic interactions. This is, most likely, the reason for the rather low ρ^2 value for model 2, describing the choice responses of non-piped users.

The parameters in Table 12 correspond to those in equation (5). That is, they describe the effect of a change in their associated variables on the utility that the average respondent experiences. As utility alone, does not provide easy analysis of various attributes, the conversion of the parameters into effects in terms of other measurement systems is valuable. Table 13 presents such conversion; the part worth values of a change in variable. Part worth values translate the utility change associated with a variable level change into a monetary equivalent, derived from the value placed upon money through the inclusion of a price variable in the choice sets. Part worth is calculated as in equation (6) (Bennett, 1999). The concept of part worth can be extended to find the marginal rate of substitution between non-commensurate variables.

$$part\ worth = -\left(\frac{\beta_{non-marketed\ attribute}}{\beta_{monetary\ attribute}}\right) \tag{6}$$

Table 13: Part worth of changes in variable levels

Change	Part Worth ($/quarter)	
	Piped users	**Non Piped users**
Increase in reliability: one extra day of availability per week	54.48	20.93
Increase in reliability: additional hour of availability per day	9.52	10.39
Increase in pressure: from poor to average	122.94	43.00
Increase in pressure: from poor to good	194.08	290.46
Increase in quality: from poor to average	157.35	176.81
Increase in quality: from poor to good	248.23	354.87
Increase in level of service: from standpipe to in-house connection	N/A	37.00
Increase in connection cost: from $0 to $300	N/A	-74.00
Increase in connection cost: from $0 to $300	N/A	52.50

The implications of the reported values in Table 13 will now be discussed. For piped users, every extra day, during which water is available, is worth an extra $54.48 per quarter added to the water bill. Every extra hour added in a given day to the reliability is worth an extra $9.52 added to the water bill. Non-piped users, however, value increases in the number of days water is available as less important than piped users, as indicated by the lower part worth of the variable. This could be for a number of reasons. Fundamentally, though, it is most probably due to increased uncertainty in the model caused by socioeconomic heterogeneity amongst non-piped users. If, indeed, the parameter is correct in assessing the part worth to non-piped users of a change in the number of days water is available, it would imply that the way that non-piped households use water does not require a daily supply. Relatively, changes in the number of hours per day that water is available are more important, with two extra hours per day being equivalent to having some water on an additional day. This could be due to significant storage facilities, which would require larger periods of flow but with less regularity. The implication of this is that the distance to standpipe is not a major constraint to the filling of tanks. This fact was observed during the field research where it was noted that users had attached rubber garden hoses on to many standpipes in order to bring water to their household presumably to fill storage facilities.

The value of changes in water pressure was also different between the two types of water users, piped and non-piped. The marginal value of water pressure decreased with increases in pressure for the piped user class. This is shown by the fact that the worth of a change from 'poor' pressure to 'average' pressure is worth more than the change to 'good' from 'average'. This could be explained, however, by higher expectations amongst the piped user class for 'average' water pressure. As the variable used in the choice models was subjective this bias of interpretation is difficult to control for. The value placed on pressure by the non-piped houses is significantly higher for a 'good' pressure than for an 'average' one. This is probably due to the fact that pressure has a direct time cost implication for non-piped users who must wait while storage containers are filled. Piped houses can let mediocre pressure fill storage tanks automatically, and so increases in pressure above the minimum required for filling storage tanks is of less value.

The value of changes in water quality was high for both user classes, though as most users surveyed stated that their present water quality was 'high'. The effects of increased water quality on revenue potential, therefore, would be quite small. Non-piped users placed a greater value on the change to a 'high' quality water supply from a 'poor' one than did the piped users for a similar change in quality. It should be highlighted that the assumption in the choice models, which was indicated to the respondents during the survey, was that the quality parameter dealt with aesthetic quality only, and for all levels it was required that the water be potable. The valuation then is perhaps confounded with the misconception that aesthetic quality is indicative of bacteriological quality amongst non-piped users, a reasonable assumption given the lower education levels of respondents with non-piped primary water sources.

The value placed by non-piped users on service level upgrades, from standpipe services was relatively low. The part worth for this change was the equivalent of making water available at the current level of service on two additional days per week. This result is interesting and can be explained in two different ways. It is possible that as non-piped users are often (60%) not served directly by the utility network, by rainfall for example, the upgrade from a standpipe to an in house connection does not include the upgrade from the current off-network supply to a network supply. That is, the part worth of an upgrade from the status quo to a piped connection for a non-water network user would be composed of value associated with a connection to the network plus a value associated with a high level of network service. The choice models, by design, only estimated the value of upgrading an already existent network connection. Alternatively, the value associated with the level of service upgrade may be low due to the ability of households to install interventions which make the practical level of service experienced higher than what would be implied by a standpipe level of service. For instance, standpipe users are able to install local storage and fill this with a rubber hose from a standpipe reducing the disbenefits of the standpipe level of service.

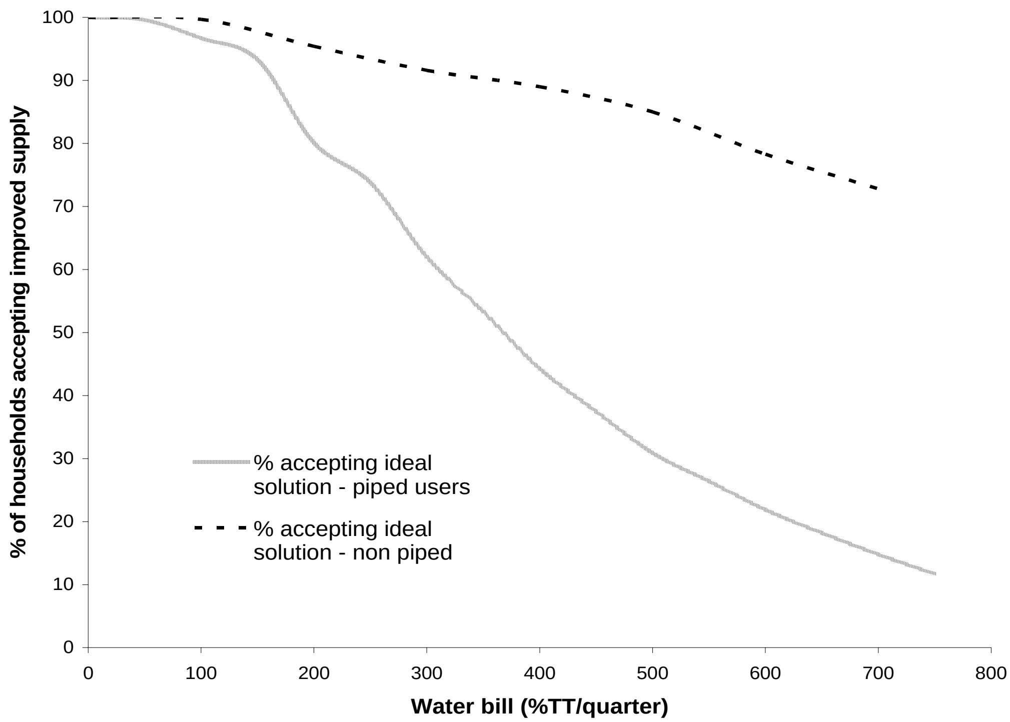
The parameters describing connection cost also showed results requiring further explanation. It should be noted that the connection cost variable was coded as a nominal variable rather than a continuous variable, as it truly is. This allows for the estimation of non-linear effects associated with changes in the level of the connection cost. In fact, the results in Table 13, corroborate this supposition in that the change in utility associated with a connection cost increase to $300 from $0 is negative whilst a further increase shows a positive utility effect. The implied non-linearity, however, leads to the counter intuitive result where there is positive price elasticity for the connection cost as the connection cost increases, the probability of connection does as well. This may be due to the fact that the decision to accept a particular water supply alternative may be based on a hierarchical assessment of the attributes. For instance, the level of water reliability may be important to the point where an alternative is accepted on the basis of only that attribute. It is possible that the inclusion of a connection cost for all attributes, even where the level of service was a shared level (i.e. standpipe), made the attribute nonsensical to respondents with the effect that it did not enter the choice process.

The models presented in Table 13 can be used to predict the proportion of the sample, and assuming this is representative, the proportion of the population which will vote for a new service given different tariffs. Figure 18 shows such a relationship. The figure shows the percentage of the sample that would vote for the new system at different price levels. The probability of connection, given different price levels, for each household in the two sub samples, piped and non-piped users, was calculated using the models presented in Table 12. It is immediately apparent that at a given price there would be more non-piped households who would vote for the ideal improved service than piped households. This is due to lower level of utility the current supplies offer. For instance, a household who had no water service, and depends upon a tanker supplied source will experience significant increases in utility with a full piped system and so their compensating variation (willingness to pay) will be much higher.

Two other features in Figure 18 are worthy of note. First, the slope, on average, of the two curves is different. Non-piped users are less responsive to changes in price of the ideal situation. This is due to the lower utility of their current supply system. Large disbenefits associated with high prices are balanced by the large benefits associated with the upgraded service. Piped users, however, have, on average, a much higher level of service than non-piped users. The value relative to current supply, therefore, of the upgrade is less and so demand is more price responsive.

The second notable feature in Figure 18 is the kink in the piped users' demand curve at a price level of about $180 per quarter. This price corresponds to the current average bill reported elsewhere in the survey. This feature is interesting as it suggests that there may have been factors outside of the specific alternatives in each choice set determining the choice made by respondents.

Figure 33: Household acceptance of ideal water supply solution with changing price



A comparison of willingness to pay: CVM vs. CM

The estimates of WTP produced by the two methods in this survey are necessarily different from one another. The CV method values the change of a single policy change whilst the CM method develops average effects associated with changes within the space of possible changes. Compounded with the structural differences of the two methods, modelling issues further exacerbate the difficulty in comparing WTP estimates generated by the two methods. As data in the CM method is aggregated to estimate the conditional logit model, there is an implicit assumption that the status quo is constant for all users. In other applications this is quite true. In the case of this application, the status quo varies person to person. A respondent with currently high levels of service, and a low price may opt to stay at the current situation across all alternatives. The utility change for such a person will be very low, given full reliability, pressure and quality, if the price is any more than currently billed. The parameters that describe that singular respondent would be different as compared to another respondent whose status quo service level is much lower. As such, ideally different models could be constructed at the individual level, accounting for the heterogeneous nature of water service status quos. The effect of pooling the data into one data set is to create ‘average’ parameters that describe the ‘average’ effect on utility of a change in variable. This then results in erroneous estimates of WTP. In any case, the two estimates can be regarded as bounds of the true WTP for an increase in the water level service to the ideal situation.

Further complicating the issue of establishing representative logit models is the issue of measurement of status quo values. Reliability, it has been noted, is to a large degree affected by the presence and volume of local storage. So, the status quo reliability of a rainwater supply might be, in practice, very high if supported by significant local storage.

Table 14 shows the predicted mean WTP for piped and standpipe users arising from the CV and CM methods of estimation. Immediately apparent is the wide disparity between WTP estimates derived from the two models. The estimates arising out of the choice models are about three times the size of estimates from the contingent valuation method. This difference is disturbing, given similar theoretical underpinnings of the two methods. A detailed analysis of the disparity is required though as a preliminary explanation it is likely that bias entered one or both methods, to result in a systematic adjustment to willingness to pay. It may be, therefore, advisable to assume that the true WTP of the classes of users presented in Table 14 is within the bounds provided by the two methods. It can be expected that the phrasing of the CV scenario, and the focus on price in that scenario, together with significant negative media attention paid to WASA in the months preceding the survey, resulted in WTP estimates that were biased downward. The choice models, by deemphasizing the price variable allowed respondents to consider bundles of attributes alone. Also, as the improved water supply situation was disassociated from the supplier, through the disaggregated attributes, negative bias associated with the aforementioned media attention may have been avoided. That having been said, it is possible that respondents did not consider price at the same level of decision making as other attributes. A hierarchical decision making structure would result in the selection of an alternative, irrespective of the values taken by other attributes lower down in the decision hierarchy. The choice models show considerably higher regression fit statistics as compared to the logit models built for the CV data. The implication here is that the variance within the WTP bids in the CV method is considerable relative to the variance seen in the choice models. This may further validate the parameters calculated in the choice set, however, it ought not to discredit the estimates derived from using the CV model.

Table 14: Mean WTP: Contingent valuation method and discrete choice experiments

Customer Category	**Mean WTP – Contingent Valuation method ($/quarter)**	**Mean WTP – Choice Models ($/quarter)**
Piped Users	$144	$461
Standpipe Users	$186	$575

Wastewater

The survey also attempted to elucidate the WTP for changes to the level of service experienced by users of wastewater/sanitation services. As such, a contingent valuation scenario described to respondents included the assumed characteristics of an ideal system. Such a system would facilitate the removal of all wastewater from the household by a sewer system and the wastewater collected would be treated in line with existing environmental regulations. Table 15 shows the average WTP by current sanitation service level.

Table 15: Average WTP for wastewater service upgrades

Sanitation System	Average WTP ($/quarter)
Central sewerage system	$85.82
Septic tank	$81.34
Latrine	$82.10

The differences between the reported averages in Table 15 are not statistically significant, and so it can be concluded that the determinants of the willingness to pay for sanitation improvements do not include current sanitation service levels. This result is somewhat tenuous as it would be reasonable to assume that the benefits of a service upgrade accruing to a household with a latrine level of service would be larger than the marginal change associated with the upgrade from a current sewerage connection. The implication of this result is that there may have been a starting point bias in the elicitation component of the survey. As there was only one starting bid used in the sample design, it is not possible to test whether, in fact, this starting point led to a bias in the measured WTP.

Despite the possibility of bias in the measured WTP, the construction of a statistical model to estimate the structure of the decision to accept upgraded service is of merit. The details of such a logit model are presented in Table 16.

Table 16: Logit model WTP for wastewater services - All respondents

Parameter	**β - value**	**Odds ratio**	**Wald statistic**
Price (TT$/quarter) *(PRICE)*	-0.007	0.993	382.86
Income (1000TT$/month) *(Y)*	0.099	1.105	36.52
Primary water source *(PRIMWAT)*			
WASA piped connection[a]			9.51
Standpipe connection	-0.041	0.960	0.08
Supply from neighbour	0.309	1.362	3.85
Rainwater	0.088	1.092	0.14
Other	-0.076	0.927	0.16
Whether HH is squatting (0 – Yes; 1 – No) *(SQUAT)*	0.235	1.266	3.01

Parameter	β - value	Odds ratio	Wald statistic
Whether HH has tanks connected to mains supply (0 – Yes; 1 – No) *(MAINTANKS)*	-0.197	0.822	7.27
Whether HH incurs other water charges (0 – Yes; 1 – No) *(OTHERWAT)*	0.243	1.276	3.32
Size of the HH *(HHSIZE)*	0.027	1.027	3.06
Constant	0.595		9.80

The probability of acceptance of the improved hypothetical scenario is positively correlated with the income of the respondent. Reasons for this are discussed above. As price increases, the probability of acceptance by a given respondent decreases. This is because wastewater services can be considered a normal good where the price elasticity of demand is negative. The demand for wastewater services is also dependent upon the current water service level that users experience. Users with standpipe connections are WTP less than those with piped connections, assumedly due to the fact that the quantity of water available affects the benefits of a wastewater system. If water availability should fall below a certain level, there would be insufficient water to carry waste from the house and the system would be redundant. Respondents relying upon rainwater and neighbours for their water supplies were WTP more than those with in house piped connections. This may be due to increased access to storage facilities and so ultimately higher levels of service, in terms of reliability. Households which had secure land tenure were also more likely to opt for an improved wastewater system, assumedly due to the security of investment in associated private infrastructure. Though, for those who were squatting, knowledge of the water service connection legalities may have acted to depress their WTP. If households are currently spending above their water bill on secondary water sources the odds that they would accept the improved wastewater service would be less than if they did not have such extraneous water procurement costs. This could be due to the increased budgetary constraint caused by spending on alternative water sources. Finally, the size of the household is related to the propensity to accept improved wastewater services. As size of household increases, the problem of waste management would also increase, thereby increasing the benefits accruing from a central sewer connection. This model treats the variable as linear and continuous, though it is possible that non-linearities exist, in that there is a threshold size above which WTP increases sharply.

Electricity

Though the level of electricity service is very high in Trinidad and Tobago, this study sought to understand attitudes towards changes in the level of service. Ideally the changes would be increases in reliability of the supply offered by the utility and the contingent valuation scenario offered this as the improved situation. The average WTP for the increased level of service was $98 per month. This value is less than the reported current bills, and the difference is statistically significant. This implies that there is little or no net WTP for changes to electricity services. Table 17 presents a logit model describing the demand for electricity services.

Table 17: Logit model for electricity services: All users

Parameter	β - value	Odds ratio	Wald statistic
Price (TT$/month) *(PRICE)*	-0.019	0.981	505.91
Income (1000 TT$/month) *(Y)*	0.136	1.145	45.67
Electric appliances owned			
Water heater *(WATHEAT)*	-0.378	0.685	12.72
Washing machine *(WASH)*	-0.260	0.771	7.03
Television *(TV)*	-0.396	0.673	3.62
Frequency of outages *(OUTFREQ)*			
Daily			8.89
Weekly	-0.311	0.733	1.24
Monthly	-0.337	0.714	2.03
Infrequently	-0.530	0.589	5.97
Number of Adults in HH *(NUMAD)*	0.061	1.063	5.92
Number of Bedrooms in HH *(NUMBED)*	0.086	1.090	6.66
Constant	1.687		36.61

The model in Table 17 shows that the WTP for changes in electricity is related to both socio-economic factors, such as income, and service factors, such as the frequency of outages. The degree to which a household owns electrical appliances affects its WTP for changes in electricity. The cost of poor service is two-fold. First, if voltage is unreliable equipment damage may ensue, leading to financial cost to the household. Also, poor service makes it impossible to use certain appliances, in effect reducing the equipment to idle capital. As such, it is in line with expectations that households owning electric equipment, or those suffering from frequent outages, as is shown by the significant variable, OUTFREQ, would be more likely to invest in an improved supply. As the number of adults and number of bedrooms increase, the demand for improved service also improves. Again, this is due to the larger cost associated with poor service event as it would affect more individuals in a large household than in a small one.

Conclusions

This survey collected a wide variety of data, at a considerable level of detail about the current levels of service experienced by consumers of water, wastewater and electricity in Trinidad and Tobago. The principal findings and policy implications are highlighted in this section.

Principal findings

Water

The study found two essential features characterizing the supply of water to residents of Trinidad and Tobago. First, the features of the supply vary considerably in both space and time. Residents in urban areas are connected to the mains network, either through an in house connection or a standpipe. Residents of more remote areas have lower access to network services and cope with this by increasing their dependence upon rainwater harvesting and sharing water supplies with neighbours. Also, the reliability of supply was found to be higher amongst wealthier households. Water quality was, on average, acceptable but many households treat their drinking water, primarily by boiling it. Non-piped households are often quite far from the nearest standpipe and spend considerable amounts of time acquiring basic levels of water.

This survey also found that the level of coverage and reliability of supply reported by the utility were slightly optimistic. Approximately 80% of the respondents to the survey were covered, with either an in-house connection or a standpipe within 200m of their dwelling, by the water utility.

Two methods to estimate the willingness to pay for water service change were employed in this survey; the contingent valuation method and discrete choice experiments. The estimates of WTP given by the two methods were not equivalent, though it is hypothesized that the estimates derived using the CV method suffered from increased bisas associated with an overemphasis on the price of the improvement and negative media attention associated with WASA. The survey shows that the WTP for change amongst piped users is small, as measured in the CV method. This is most likely due to significant investment in coping mechanisms. The nature of such investment, a large fixed cost and little operating costs, makes the service level improvements suggested in the CV scenario less important than would be otherwise the case. The higher WTP generated in the CM does imply that there is a net WTP for changes to the average status quo, when bisas attributable to the framing of the CV question are removed. It is suggested that the true WTP of survey respondents lies between the two bounds provided by the two methods and so in fact there is some net WTP for service increases amongst piped users. However, non-piped users exhibited significant WTP for in-house piped connections with, on average, these users willing to pay almost three times their current water bill for the upgraded service.

Wastewater

Sanitation services are delivered by three main methods. In the minority are central sewerage connections where users' waste is transported and disposed of by a networked system. The major sanitation system employed by respondents of the survey was septic systems, and the level of satisfaction with this solution was reported as quite high. A significant proportion of the sample indicated pit latrines were used for sanitation purposes with more respondents having this technology located in rural areas and Tobago. Users of this type of technology expressed the most dissatisfaction with their sanitation facilities.

The WTP, measured with the CV method, was uncorrelated to the current sanitation system. The WTP was, however, correlated to the satisfaction with current service levels implying that the bids were rational. The mean WTP for a sewerage connection was about $80/quarter.

Electricity

Electricity service was delivered to consumers in both Trinidad and Tobago at a high level. Service coverage amongst survey respondents was over 90% and generally users were content with the level of service. In some cases variations in the voltage had damaged respondents' electrical equipment but this was rare. Mostly satisfaction levels were high with the complaints, when existent, focussed upon the time taken to fix infrequent blackouts.

It is expected then that there be little net WTP for changes to the status quo as the service at present is adequate. This was observed in the CV measurement of WTP in the survey. Average WTP for changes was lower than the current bills paid by respondents indicating that service is adequate at present.

References

Altaf, M., Jamal, H., Whittington, D., Willingness to pay for water in rural Punjab, Pakistan, Water and Sanitation Report 4, UNDP-World Bank Water and Sanitation Program, International Bank of Reconstruction and Development, 1992

Anand, P., Consumer preferences for water supply? An application of Choice Models to Urban India, Discussion paper No. 2001/145, United Nations University, 2001

Arrow, K., Solow, R., Portney, P., Leamer, E., Radner, R., Schuman, H., Report of the NOAA Panel on Contingent Valuation, Federal Register, 58, pp 4602-4614, 1993

Bennett, J. W., Some fundamentals of environmental choice modeling, Choice Modelling Research Reports, Research Report No. 11, School of Economics and Management, University College, The University of New South Wales, 1999

Blamey, R., Gordon, J. an Chapman, R., Choice modelling: Assessing the environmental values of water supply options, *Australian Journal of Agricultural and Resource Economics*, Vol. 43, No. 3, pp 337-356, 1999.

Briscoe, J., Furtado de Castro, P., Griffin, C., North, J. and Olsen, O., Toward equitable and sustainable rural water supplies: A contingent valuation study in Brazil, *The World Bank Economic Review*, Vol. 4, No. 2, pp 115-134, 1990.

Central Statistical Office (CSO), Revised Design of the Continuous Sample Survey of Population (CSSP), Methodology Report, Ministry of Finance, Republic of Trinidad and Tobago, 1987

Central Statistical Office (CSO), 2000 Population and Housing Census, Preliminary Report, Ministry of Finance, Republic of Trinidad and Tobago, 2003

Central Statistical Office (CSO), Household Budget Survey 1997/8, Volume II, Household Income and Expenditure, Ministry of Planning and Development, Republic of Trinidad and Tobago, 2002

Griffin, C, Briscoe, J, Singh, B, Ramasubban, R, Bhatia, R, Contingent valuation and actual behavior: predicting connections to new water systems in the state of Kerela, India, World Bank Economic Review, 9 (3), pp 373-395, 1995

Hensher, D., Stopher, P., Louviere, J., An exploratory analysis of the effect of numbers of choice sets in designed choice experiments: an airline choice application, Journal of Air Transport Management, Vol. 7, pp 373-379, 200

Hensher, D., and Johnson, L., Applied Discrete Choice Modelling. Wiley, New York, 1981

Kuhfeld, W, Marketing Research Methods in the SAS System, Version 9.0 edition, SAS Institute, 2003

London Economics, WASA Tariff Study, Final Report, in association with Castalia, 1998

Louviere, J., Analyzing Decision Making: Metric Conjoint Analysis, Sage University Paper 67, 1988

Louviere, J., Hensher, D. and Swait, J., Stated Choice Methods: Analysis and Application, Cambridge University Press, Cambridge, UK, 2000

Maddala, G.S. Limited Dependent and Qualitative Variables in Econometrics, Econometric Society Monographs, Cambridge University Press, Cambridge UK, 1983

McFadden, D. Conditional logit analysis of qualitative choice behaviour, in Frontiers of Econometrics, Zarembka P. ed., Academic Press, New York, 1974

Mycoo, M. Water Provision Improvements: A Case Study of Trinidad, PhD Thesis, School of Urban Planning, McGill University, 1996

Nankani, H., Testing the waters – A phased approach to a water concession in Trinidad and Tobago, Note No. 103, Viewpoint, World Bank, Washington, DC, 1997

Powers, D. and Xie, Y., Statistical Methods for Categorical Data Analysis, Academic Press, San Diego California, 2000

Regulated Industries Commission (RIC), Review of the current state of the Water and Sewerage Authority (WASA), Information Document, Economics and Research Department, Draft, 2003a

Regulated Industries Commission (RIC), Performance Indicators for the Water and Sewerage Authority and the Trinidad and Tobago Electricity Commission, Information Document, Technical Operations Department, Draft, 2003b

Regulated Industries Commission (RIC), Review of the current state of the Trinidad and Tobago Electricity Commission (T&TEC), Information Document, Economics and Research Department, Draft, 2003c

Water and Sewerage Authority (WASA), State of the Utility, Status Report, 2002

Whittington, D., Lauria, D., Choe, K., Hughes, j., Swarna, V., Wright, A., Household sanitation in Kumasi, Ghana: a description of current practices, attitudes and perceptions, World Development, Vol. 21, No. 5, pp 733-748, 1993

Whittington, D., Muwahuzi, M., McMahon, G. and Choe, K., Willingness to pay for water in Newala District, Tanzania: Strategies for cost recovery, USAID Water and Sanitation for Health Project, Field Report No. 246, Washington DC, 1989

APPENDIX A – Schedule of Field Activities

Table A.1. – Schedule of field activities

Activity	Start Date	Finish Date
Development of draft questionnaire – Included sharing questionnaire with experts in regulation and water supply and sanitation and incorporating suggestions. Also, included statistical design of choice experiments involved in the questionnaire. This also included focus grouping of the draft questionnaire.	Feb 7, 2003	Apr 14, 2003
Sample selection – Including manual transcription of addresses from the central statistical office (CSO), and enumeration district (ED) map reproduction. Also including assignment of EDs to supervisors.	Feb 28, 2003	Apr 18, 2003
Preparation of Training Manual	Mar 31, 2003	Apr 18, 2003
Training of supervisors	Apr 21, 2003	
Training of enumerators	Apr 22, 2003	
Pilot survey and resulting changes	May 1, 2003	May 6, 2003
Survey implementation in Trinidad – 30 enumerators and five supervisors implemented the 1300 questionnaire survey throughout the country	May 7, 2003	Jun 14, 2003
Training of Data entry clerks	May 14, 2003	
Data entry – three data entry clerks were hired to input the 1450 surveys into a database using a purpose designed user interface	May 19, 2003	Jun 27, 2003
Survey implementation in Tobago – two supervisors and six enumerators conducted 150 surveys throughout the island	Jun 1, 2003	Jun 8, 2003
Data entry verification - a sample of the surveys were checked for completeness and accuracy in the electronic database	Jun 27, 2003	Jul 4, 2003

Appendix B – Survey Questionnaire

REGULATED INDUSTRIES COMMISSION

ELECTRICITY AND WATER AND SEWERAGE
QUALITY OF SERVICE AND WILLINGNESS TO PAY
SURVEY QUESTIONNAIRE

Name of
Enumerator________________________________

County____________________________________

Ward_____________________________________

Enumeration District #______________________

Building #_________________________________

	First Visit	Last Visit
Start Time		
Finish Time		
Date		

Address___________________________________

____

Phone No. ____________________________

INTRODUCTION

The Regulated Industries Commission, a statutory body responsible for regulating and monitoring the performance of Utilities in Trinidad and Tobago, is conducting a consumer survey on water, sewerage and electricity services in Trinidad and Tobago. We would like to interview you concerning your water supply, household sanitation systems and electricity supply. Your responses will enable us to suggest changes to WASA and T&TEC, in keeping with our mandate of ensuring the provision of efficient and high quality utility services. It is however important for you to answer accurately, to ensure that changes that may happen in the future most accurately consider your needs.

If respondent is unwilling to answer questionnaire, please give details for non-response:

____
____
____
____

Enumerator's Instructions

1. Before today were you aware of the existence of the Regulated Industries Commission?

Let the Interviewee provide the response

If no skip to question 4

- [ ] Yes
- [ ] No

2. Are you aware of the responsibilities of the Regulated Industries Commission?

Let the Interviewee provide the response

If no skip to question 4

- [ ] Yes
- [ ] No

3. Are you aware that the functions of the RIC include,

Read the pre-selected responses and check each affirmative response

- [ ] handling customer complaints
- [ ] fixing rates
- [ ] developing quality of service standards
- [ ] monitoring the performance of the utilities?

4. Within which category do you fall?

Try to get the person who is responsible for paying the Utility Bill

- [ ] Head of household
- [ ] Spouse/Partner
- [ ] Other (specify)____________________

5. Are you the person who is normally responsible for paying the utility bills?

- [ ] Yes
- [ ] No

Enumerator's Instructions

6. What is the gender of the interviewee?

Do not ask this question but select a response based on observation

- ☐ Male
- ☐ Female

7. What are your primary and secondary sources of water?

Read the pre-selected responses

Sources	Primary	Secondary
1. WASA service connection	☐	☐
2. Standpipe/ WASA community tank	☐	☐
3. Truck-borne	☐	☐
4. Supply from Neighbour	☐	☐
5. Rain	☐	☐
6. Pond/River	☐	☐
7. Dug Well	☐	☐

If primary source is:

1 Continue questionnaire and complete <u>Schedule A.</u>

2or 3 Continue questionnaire & complete <u>Schedule B</u>.

4 to 7 Skip to question 25 and complete <u>Schedule B</u>.

8. Is your household responsible for paying water rates for this building?

If No skip to question 12

- ☐ Yes
- ☐ No

9. What is your billing classification?

Let the Interviewee provide the response

- ☐ A1 – Standpipe: no connection but within1/4 mile radius of a public standpipe.
- ☐ A2 – Externally Serviced: Serviced by a yard tap connection.
- ☐ A3 – Internally Serviced: Fitted with internal plumbing.
- ☐ A4 - Internally Serviced (Metered): Fitted with internal plumbing.
- ☐ A5 – Charitable Institution & P/Worship: Schools, Churches & Social Services.
- ☐ A6 - Charitable Institution & P/Worship (Metered): Schools Churches & Social Services

Enumerator's Instructions

- ☐ Don't know
- ☐ Other (specify) ____________________

10. How much do you normally pay for water on a quarterly basis? $___________ — *Let the Interviewee provide the response*

- ☐ Don't know

11. How soon after receiving your water bill is it normally paid? — *Read the pre-selected responses*

- ☐ Within 2 weeks
- ☐ One month
- ☐ Two months
- ☐ Three months
- ☐ More than 3 months
- ☐ Other (specify) ________________________

12. Beside the water bill, does your household incur any other charges for water delivery?

- ☐ Yes
- ☐ No — ***If no skip to question 14***

Enumerator's Instructions

13.

From which of the following do you get your water?	Cost per household per month (TT$)
☐ Private vendor truck	
☐ WASA truck	
☐ Supply from neighbour	
☐ Private vendor	
☐ Other (specify) ____________________	

Read the pre-selected responses and tick each affirmative response. Let the interviewee indicate the cost per household per month for water from sources listed.

14. How many days per week do you receive water from piped system?

0	1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐	☐

Let interviewee provide the response. Include portions of one full day as a full day.

If the respondent receive water less than one day per week. Example, 1 day every two weeks. Enter this information in the "other" category

Enumerator's Instructions

Other (specify)

____

15. How many hours per day do you receive water from the piped system?

- ☐ 0-6
- ☐ 7-12
- ☐ 13-17
- ☐ 18-23
- ☐ 24

Read the pre-selected responses

Select by placing a tick in the relevant box.

16. How would you rate the reliability of supply of water from WASA?

- ☐ Excellent
- ☐ Good
- ☐ Average
- ☐ Poor
- ☐ Very Poor

Read the pre-selected responses

17. How many additional hours per day of water supply will be required to meet all your needs?

Hours: ____________

Let interviewee provide the response

18. How would you rate your water pressure?

- ☐ Excellent
- ☐ Good
- ☐ Average
- ☐ Poor
- ☐ Very Poor
- ☐ Not applicable
- ☐ Don't know

(Sufficient for showering/ washing dishes at the same time)

Read the pre-selected responses

If the respondent has indicated that their primary water supply is not a piped connection, record 'not applicable'

Enumerator's Instructions

(Cannot rinse dishes

properly/ shower only

trickles)

19. How would you rate the quality of the water delivered by WASA in terms of?

Start with the first quality characteristic and read the pre-selected responses.

	Excellent	Good	Average	Poor	Very Poor
a. Taste	☐	☐	☐	☐	☐
b. Odour	☐	☐	☐	☐	☐
c. Colour	☐	☐	☐	☐	☐
d. Overall		☐	☐	☐	

*For the second "Odour" you can say "**using the same response selection how would you rate the odour of the water."***

*For the third "Colour" you can say " **and how would you rate the colour of the water."***

*For the fourth "Overall" you can say **"and how would you rate the overall quality of the water."***

20. Within the last six months, has anyone in your household suffered from severe itchy skin after bathing, diarrhoea, or vomiting?

- ☐ Yes
- ☐ No
- ☐ Don't know

Let interviewee provide the response

Enumerator's Instructions

21. What do you normally do to your water supply to ensure that it is not contaminated?

Let interviewee provide the response

- ☐ Filter
- ☐ Boil
- ☐ Boil & Filter
- ☐ Treat with bleach
- ☐ Don't Treat
- ☐ Other (specify)____________________

22. How satisfied are you with the level of customer service provided by WASA?

Read the pre-selected responses.

- ☐ Very Satisfied
- ☐ Satisfied
- ☐ Indifferent
- ☐ Dissatisfied
- ☐ Very Dissatisfied

Explain that this includes WASA's reaction to complaints, billing enquiries/ discrepancies, etc.

23. How long have you lived in this building?________________________

Let interviewee provide the response in days months or years.

24. How has the water service changed since you have been living in this building?

- ☐ Greatly improved
- ☐ Improved
- ☐ No change
- ☐ Worsened
- ☐ Greatly worsened

Read the pre-selected responses and check each affirmative response.

Enumerator's Instructions

25. Do you possess any of the following accessories?

	Yes	No
a. Tanks not connected to WASA system. (e.g. for rainwater/gutter collection, filled with a rubber hose pipe run from a standpipe/house connection)	☐	☐
b. Tanks connected to WASA system.	☐	☐
c. Swimming Pool.	☐	☐

Let interviewee provide the response

If No to a., b. & c. skip to question 29

26. How many water tanks, by size, do you have at your property? (Please put in the number)

	Tank Size in gallons						
	200	400	500	600	800	1000	2000
Number of tanks							

27. Does your storage allow you a continuous supply?

☐ Yes
☐ No

Let interviewee provide the response ***(if 'yes' skip to question 29.)***

28. How many days per week does your storage last?

________________ days

Let respondent answer on his/her own, but suggest estimating by evenings/half-day units as well

29. Does your household use bottled water?

☐ Yes
☐ No

If No skip to contingent valuation

Enumerator's Instructions

30. What is your household's main use of bottled water?

Let the interviewee provide the response

- ☐ Drinking
- ☐ Cooking
- ☐ Bathing
- ☐ Other (specify)____________________

31. What is the main reason your household uses bottled water?

Let the Interviewee provide the response

- ☐ It tastes better
- ☐ It is safe
- ☐ It is very convenient
- ☐ Other (specify)____________________

32. How much does your household normally spend on bottled water per week?

Let the Interviewee provide the response

$ _______________

- ☐ Don't know

SCHEDULE A

CONTINGENT VALUATION - PIPED SUPPLY

In the previous section you have indicated that there are a number of problems with your current water supply. I want you to consider the following hypothetical change to your water supply situation. It is crucial that you answer honestly. If you and others say that you will not pay for changes, it may be impossible for changes to occur. If you and others suggest that you will pay more than you are able to, you may not be able to afford the changes, should they happen. Please, therefore, be truthful in stating your maximum willingness to pay.

<u>Bidding Game</u>

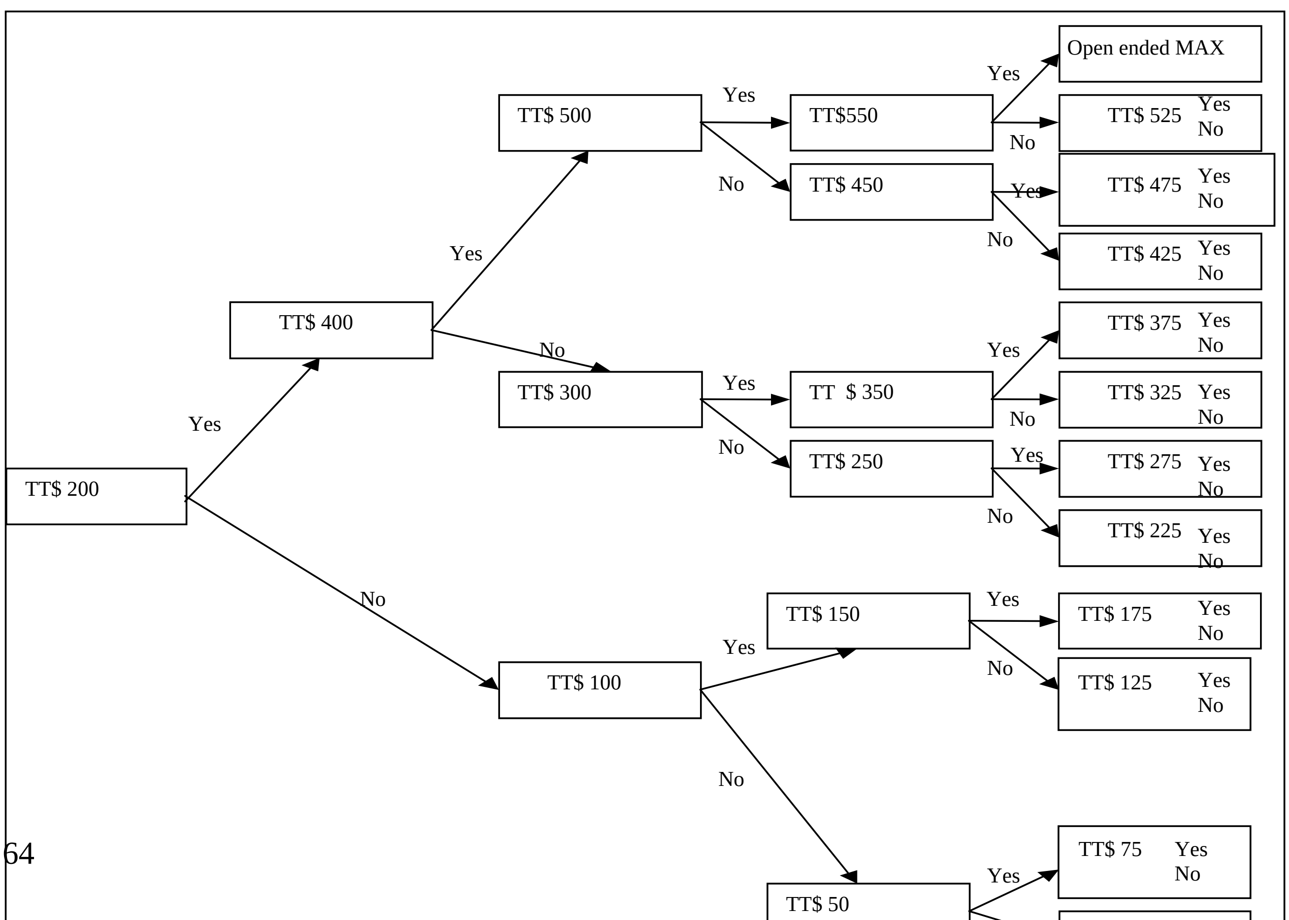
Suppose that the Water and Sewerage Authority, or WASA, was to make the following changes to the water supplied to your household:

- Water would be available in your house for 24 hours per day, everyday of the week;
- Water pressure would be sufficient for showering, washing dishes, doing laundry all at the same time;
- The water would have at least an acceptable taste, no significant odour, and be colourless;
- You would be required to pay bills quarterly for this increased service,

Would you be willing to pay $200 per quarter for this service change?

Follow the arrow depending on the response given. Circle the interviewee's response ("yes" or " no") as you go along and also circle the highest affirmative response. If Open-ended box is selected, circle it and ask the interviewee what is the maximum amount he/she is willing to pay. Fill in this response on the line below.

$__________________ (Use space for open ended answer provided by respondent)



Bidding game: Piped users(all) Quarterly Bill

SCHEDULE A
CHOICE MODELS – PIPED SUPPLY

This section aims to help us understand the changes to your current water situation which are most relevant to you. You will be presented with 12 choice sets, each of which has 4 alternatives. In each case we would like you to choose the alternatives that you most prefer. In each choice set, assume that the offered alternatives are all that is available. Disregard the alternatives you have seen in other choice sets. Some of the alternatives may seem counter intuitive or impossible in practice. We would like for you to consider these alternatives anyhow. All of the alternatives assume that the water will be piped into your house.

Choice Set **1**

Outcome of change:		Alternative A	Alternative B	Alternative C	Alternative D
Reliability	Days/week	one	seven	four	
	Hours/day	twelve	two	twenty-four	I prefer my current service level
Pressure		medium	low	high	
Quality		medium	low	high	
Price	TT$/quarter	50	150	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set **2**

Outcome of change:		Alternative A	Alternative B	Alternative C	Alternative D
Reliability	Days/week	seven	one	four	
	Hours/day	twelve	two	twenty-four	I prefer my current service level
Pressure		low	high	medium	
Quality		high	medium	low	
Price	TT$/quarter	450	250	50	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set **3**

Outcome of change:		Alternative A	Alternative B	Alternative C	Alternative D
Reliability	Days/week	seven	one	four	
	Hours/day	twelve	two	twenty-four	I prefer my current service level
Pressure		high	low	medium	
Quality		high	low	medium	
Price	TT$/quarter	350	450	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 4

Outcome of change:		A	B	C	D
		Alternative			
Reliability	Days/week	seven	one	four	I prefer my current service level
	Hours/day	two	twenty-four	twelve	
Pressure		medium	high	low	
Quality		high	low	medium	
Price	TT$/quarter	350	450	150	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 5

Outcome of change:		A	B	C	D
		Alternative			
Reliability	Days/week	seven	one	four	I prefer my current service level
	Hours/day	twelve	twenty-four	two	
Pressure		high	low	medium	
Quality		low	medium	high	
Price	TT$/quarter	50	350	150	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 6

Outcome of change:		A	B	C	D
		Alternative			
Reliability	Days/week	one	four	seven	I prefer my current service level
	Hours/day	twelve	twenty-four	two	
Pressure		low	high	medium	
Quality		high	low	medium	
Price	TT$/quarter	250	150	450	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 7

Outcome of change:		A	B	C	D
		Alternative			
Reliability	Days/week	four	seven	one	I prefer my current service level
	Hours/day	twelve	two	twenty-four	
Pressure		high	medium	low	
Quality		medium	low	high	
Price	TT$/quarter	350	250	50	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 8

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	one	one	four	
	Hours/day	two	twenty-four	twelve	I prefer my
Pressure		high	medium	low	current service
Quality		high	medium	low	level
Price	TT$/quarter	50	350	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 9

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	one	seven	four	
	Hours/day	twelve	twenty-four	two	I prefer my
Pressure		high	medium	low	current service
Quality		medium	high	low	level
Price	TT$/quarter	150	450	350	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 10

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	seven	four	one	
	Hours/day	twenty-four	two	twelve	I prefer my
Pressure		low	high	medium	current service
Quality		high	medium	low	level
Price	TT$/quarter	150	450	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 11

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	seven	four	one	
	Hours/day	two	twelve	twenty-four	I prefer my
Pressure		low	medium	high	current service
Quality		medium	high	low	level
Price	TT$/quarter	50	450	350	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set **12**

Outcome of change:		Alternative A	Alternative B	Alternative C	Alternative D
Reliability	Days/week	seven	four	one	I prefer my current service level
	Hours/day	twenty-four	two	twelve	
Pressure		high	low	medium	
Quality		medium	high	low	
Price	TT$/quarter	250	50	150	
Which alternative do you prefer?		☐	☐	☐	☐

SCHEDULE B

ONLY FOR CUSTOMERS WHO ARE NOT CONNECTED TO WASA'S MAINS
Respondents who answered 2-7 in Q.7

Enumerator's Instructions

B.1. How far is the nearest public standpipe from your premises?

Read the pre-selected responses.

Select by placing a tick in the relevant

Box.

- ☐ 1/8 mile (650 ft or 200m)
- ☐ ¼ mile (1300 ft or 400m)
- ☐ 3/8 mile (2000ft or 600m)
- ☐ ½ mile (2650 ft or 800m)
- ☐ Greater than 1/2 mile, please specify ______________

B.2. How much water does the household use per day?

Let interviewee provide the response in only one category. If bucket or drum size is known indicate both the number and the size.

Buckets	Drums	Gallons:	Litres:

B.3. How much time do you spend collecting water per day (including walking, waiting at the standpipe and filling your containers)?

Read the pre-selected responses.

Select by placing a tick in the relevant

Box

- ☐ 1-10 minutes
- ☐ 11-20 minutes
- ☐ 21-30 minutes
- ☐ 31-40 minutes
- ☐ 41-50 minutes
- ☐ 51-60 minutes
- ☐ greater than 60 minutes, please specify_______________

Let interviewee provide the response

B.4. What is the main reason for not having in-house connection?

- ☐ Connection fee too high

- [ ] Monthly/Quarterly charges too high
- [ ] Connection is not available/ no mains nearby
- [ ] Rented house
- [ ] Waiting connection from WASA
- [ ] Land tenure not secured
- [ ] Satisfied being a standpipe Customer
- [ ] Other (specify)____________________

SCHEDULE B

CONTINGENT VALUATION
ONLY FOR CUSTOMERS WHO ARE NOT CONNECTED TO WASA'S MAINS

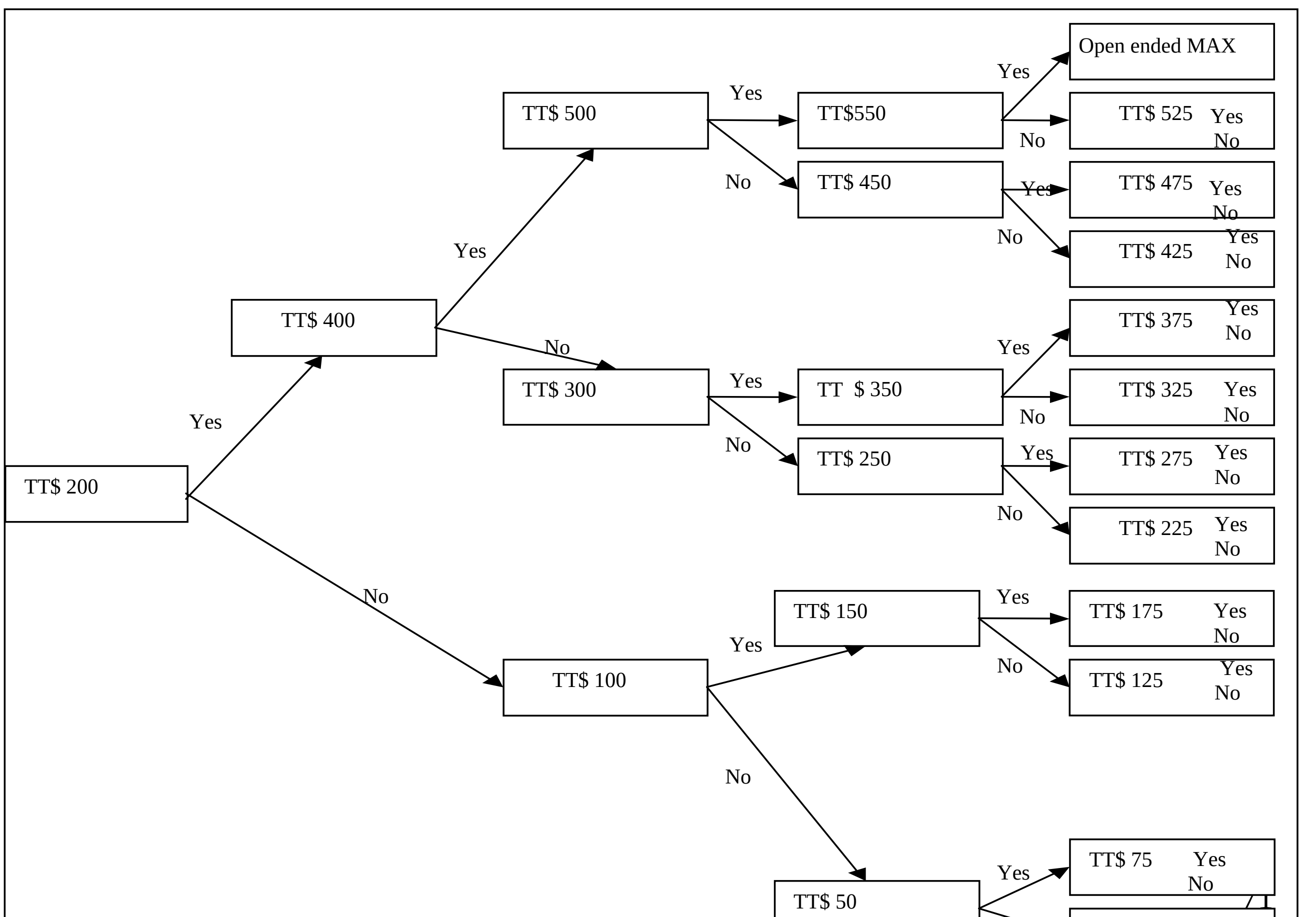
In the previous section you have indicated that there are a number of problems with your current water supply. I want you to consider the following hypothetical change to your water supply situation. It is crucial that you answer honestly. If you and others say that you will not pay for changes, it may be impossible for changes to occur. If you and others suggest that you will pay more than you are able to, you may not be able to afford the changes, should they happen. Please, therefore, be truthful in stating your maximum willingness to pay.

Bidding Game
Suppose that the Water and Sewerage Authority, or WASA, was to make the following changes to the water supplied to your household:

Water would be available in your house for 24 hours per day, everyday of the week;
Water pressure would be sufficient for showering, washing dishes, doing laundry all at the same time;
The water would have at least an acceptable taste, no significant odour, and be colourless
You would have private water connection allowing you to install plumbing in your house
Also suppose that you would be required to pay bills quarterly for this increased service.

Would you be willing to pay $200 per quarter for this service change?

Follow the arrow depending on the response given. Circle the interviewee's response ("yes" or " no") as you go along and also circle the highest affirmative response. If Open-ended box is selected, circle it and ask the interviewee what is the Maximum amount he/she is willing to pay. Fill in this response on the line below.
*TT$*_____________________



Bidding game: Piped users(all) Quarterly Bill

SCHEDULE B

CHOICE MODELS
ONLY FOR CUSTOMERS WHO ARE NOT CONNECTED TO WASA'S MAINS

This section aims to help us understand the changes to your current water situation which are most relevant to you. You will be presented with 12 choice sets, each of which has 4 alternatives. In each case we would like you to choose the alternatives that you most prefer. In each choice set, assume that the offered alternatives are all that is available. Disregard the alternatives you have seen in other choice sets. Some of the alternatives may seem counter intuitive or impossible in practice. We would like for you to consider these alternatives anyhow.

Choice Set 1

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	four	one	seven	I prefer my current service level
	Hours/day	two	twenty four	twelve	
Pressure		high	medium	low	
Quality		medium	low	high	
Connection Cost	TT$	300	600	0	
Level of Service		0	0	standpipe	
Price	TT$/quarter	150	350	50	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 2

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	one	four	seven	I prefer my current service level
	Hours/day	twelve	twenty four	twenty four	
Pressure		low	medium	high	
Quality		low	medium	high	
Connection Cost	TT$	300	0	600	
Level of Service		in house connection	standpipe	0	
Price	TT$/quarter	450	50	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set **3**

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	four	seven	one	
	Hours/day	twelve	twenty four	two	
Pressure		high	medium	low	I prefer my
Quality		low	high	medium	current service
Connection Cost	TT$	600	300	0	level
Level of Service		standpipe	0	in house	
Price	TT$/quarter	450	350	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set **4**

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	four	seven	one	
	Hours/day	two	twelve	twenty four	
Pressure		high	medium	low	I prefer my
Quality		medium	low	high	current service
Connection Cost	TT$	300	0	600	level
Level of Service		0	in house connection	standpipe	
Price	TT$/quarter	450	150	350	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set **5**

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	four	seven	seven	
	Hours/day	twenty four	two	twelve	
Pressure		high	medium	low	I prefer my
Quality		low	high	medium	current service
Connection Cost	TT$	0	0	300	level
Level of Service		in house connection	0	standpipe	
Price	TT$/quarter	50	450	150	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 6

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	one	seven	four	
	Hours/day	twelve	twenty four	twenty four	
Pressure		high	low	medium	I prefer my
Quality		high	low	medium	current service
Connection Cost	TT$	300	0	600	level
Level of Service		in house connection	standpipe	standpipe	
Price	TT$/quarter	50	150	450	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 7

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	seven	one	four	
	Hours/day	twenty four	two	twelve	
Pressure		medium	high	low	I prefer my
Quality		medium	low	high	current service
Connection Cost	TT$	300	600	0	level
Level of Service		in house connection	standpipe	0	
Price	TT$/quarter	50	350	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 8

Outcome of change:		Alternative A	B	C	D
Reliability	Days/week	seven	four	one	
	Hours/day	twelve	two	twenty four	
Pressure		high	medium	low	I prefer my
Quality		low	high	medium	current service
Connection Cost	TT$	300	600	0	level
Level of Service		standpipe	in house connection	0	
Price	TT$/quarter	250	150	450	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 9

Outcome of change:		A	B	C	D
Reliability	Days/week	seven	four	one	
	Hours/day	twenty four	twelve	two	
Pressure		high	low	medium	I prefer my
Quality		medium	low	low	current service
Connection Cost	TT$	600	600	300	level
Level of Service		in house connection	0	standpipe	
Price	TT$/quarter	450	350	250	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 10

Outcome of change:		A	B	C	D
Reliability	Days/week	one	one	seven	
	Hours/day	twenty four	twelve	two	
Pressure		high	medium	low	I prefer my
Quality		low	medium	high	current service
Connection Cost	TT$	0	600	300	level
Level of Service		0	0	in house connection	
Price	TT$/quarter	150	250	350	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set 11

Outcome of change:		A	B	C	D
Reliability	Days/week	seven	four	one	
	Hours/day	two	twenty four	twelve	
Pressure		high	low	medium	I prefer my
Quality		low	low	high	current service
Connection Cost	TT$	0	300	600	level
Level of Service		standpipe	in house connection	in house connection	
Price	TT$/quarter	350	250	150	
Which alternative do you prefer?		☐	☐	☐	☐

Choice Set **12**

Outcome of change:		Alternative			
		A	B	C	D
Reliability	Days/week	one	seven	four	
	Hours/day	twenty four	two	twelve	
Pressure		medium	low	high	I prefer my
Quality		high	low	medium	current service
Connection Cost	TT$	0	600	0	level
Level of Service		standpipe	0	in house connection	
Price	TT$/quarter	450	50	350	
Which alternative do you prefer?		☐	☐	☐	☐

SCHEDULE C

WASTEWATER SERVICES

ALL HOUSEHOLDS

Enumerator's Instructions

C.1. What type of toilet system do you use?

Let interviewee provide the response

- ☐ 1. Central sewerage system
- ☐ 2. Septic tank & soakaway
- ☐ 3. Latrines/outhouse
- ☐ 4. Other (specify)___________________

If 1 is selected go to C.2
If 2 is selected go to C.5

If 3 or 4 is selected skip to C.7

C.2. Who operates your sewerage system?

Read the pre-selected responses

- ☐ WASA
- ☐ Private Operator
- ☐ Don't Know
- ☐ Other ___________

C.3. Who would you prefer to operate and maintain your sewerage system?

Read the pre-selected responses

- ☐ WASA
- ☐ Private Operator

C.4. How much do you normally pay for sewerage treatment and disposal on a quarterly basis?

Let interviewee provide the response

___________________TT$ per month

Skip to C.7

C.5. How often do you get your septic tank cleaned?

Let interviewee provide the response

- ▢ Once per year
- ▢ Once every 2 years
- ▢ Every 3 years
- ▢ Every 4 years
- ▢ Never
- ▢ Other, please specify__________________

C.6. How much do you pay for each emptying of your septic tank?

Let interviewee provide the response

__________________TT$ per emptying

C.7. How satisfied are you with the current disposal of your wastewater?

Read the pre-selected responses

- ▢ Very Satisfied
- ▢ Satisfied
- ▢ Indifferent
- ▢ Dissatisfied
- ▢ Very Dissatisfied

C.8. Would you prefer to have an improved wastewater

Let interviewee provide the

disposal system?

- ☐ Yes
- ☐ No

response

If 'no' then skip to contingent valuation section

C.9. Which of the following improved wastewater disposal systems do you prefer?

- ☐ Central sewerage system
- ☐ Septic tank & soakaway
- ☐ Open drainage canals
- ☐ Other (specify)____________________

Read the pre-selected responses and check each affirmative response

SCHEDULE C

CONTINGENT VALUATION – WASTEWATER SERVICES

In the previous section you have indicated that there are a number of problems with your current wastewater disposal situation. I want you to consider the following hypothetical change to your wastewater disposal system. It is crucial that you answer honestly. If you and others say that you will not pay for changes, it may be impossible for changes to occur. If you and others suggest that you will pay more than you are able to, you may not be able to afford the changes, should they happen. Please, therefore, be truthful in stating your maximum willingness to pay.

Bidding Game

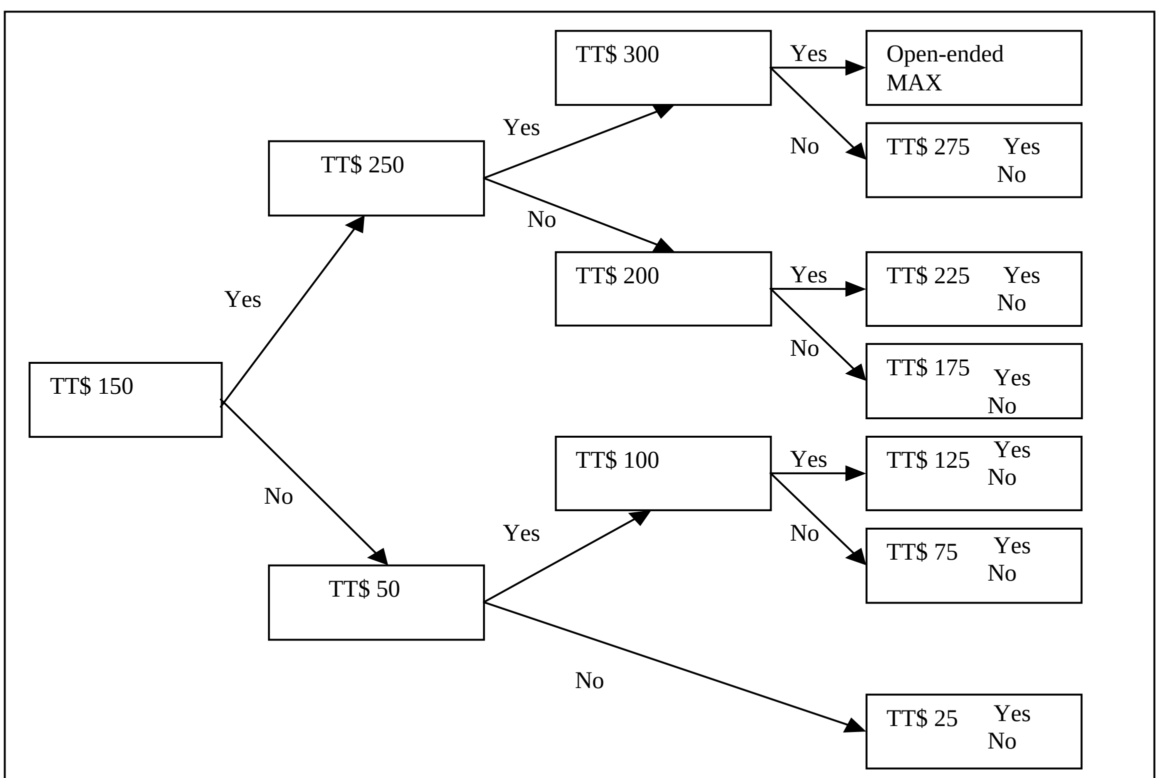
Suppose that WASA were to offer you a fully functional sewer system, including both waste from toilets and from bathing and kitchen activities. WASA would treat the waste to meet environmental regulations stipulated by the government, before releasing the waste into the environment.

Further suppose you would be required to pay for this service. The payment would be included as a separate item on your water bill, and would be a flat rate, not varying from one billing period to another. You would have to pay your water and sewerage bill once every three months, or quarterly. The amount you would pay would be for the entire household.

Would you be willing to pay $150 per quarter for this service change?

Follow the arrow depending on the response given. Circle the interviewee's response ("yes" or " no") as you go along and also circle the highest affirmative response. If Open-ended box is selected, circle it and ask the interviewee what is the Maximum amount he/she is willing to pay. Fill in this response on the line below.

$________________



Bidding game: Wastewater services Quarterly payments

SCHEDULE D

ELECTRICITY

ALL HOUSEHOLDS

Enumerator's Instructions

D.1. Does your household have electricity?

If 'no' skip to D.16.

☐ Yes

☐ No

D.2. What is your billing classification?

Ask the interviewee for a T&TEC Bill to verify information.

☐ Domestic Rate A
☐ General Commercial Rate B

D.3 How much do you normally pay for electricity?
$_______________(bi-monthly / monthly)

Get the information form the bill or
Let interviewee provide the response.
If bi-monthly bill circle BI-MONTHLY, if monthly bill circle MONTHLY

D.4. Would you consider this bill to be?

Read the pre-selected responses

☐ Low
☐ Average
☐ High

D.5. How soon after receiving your electricity bill is it normally paid?

Read the pre-selected responses

☐ Within 2 weeks
☐ One month
☐ Two months
☐ Three months
☐ More than 3 months

D.6. How would you rate the reliability of your electricity

Read the pre-selected

supply? ☐ Excellent ☐ Good ☐ Average ☐ Poor ☐ Very Poor	**responses**
D.7 How satisfied are you with the level of service provided by T&TEC? ☐ Very Satisfied ☐ Satisfied ☐ Indifferent ☐ Dissatisfied ☐ Very Dissatisfied	**Read the pre-selected responses**
D.8. Which of the following best describes your experiences with outages? ☐ Daily ☐ Weekly ☐ Monthly ☐ Infrequently ☐ Never ☐ Don't know	**Let interviewee provide the response for only one category** **If 'never' skip to D.10**
D.9. Within the last six months, what was the average duration of the outages? ☐ less than 1 hour ☐ 1 to 2 hours ☐ 2 to 4 hours ☐ 4 to 8 hours ☐ 8 to 12 hours ☐ more than 12 hours ☐ Don't know	**Read the pre-selected responses**
D.10. Have you ever made a trouble report?	**Let interviewee provide the**

- ☐ Yes
- ☐ No

response

If 'no' skip to D.12.

D.11 What was the average duration of time between the trouble report and the repair of fault?

Read the pre-selected responses

- ☐ less than 1 hour
- ☐ 1 to 2 hours
- ☐ 2 to 4 hours
- ☐ 4 to 8 hours
- ☐ 8 to 12 hours
- ☐ more than 12 hours
- ☐ Don't know

D.12. How often do you experience voltage fluctuations?

Read the pre-selected responses

- ☐ Frequently
- ☐ Rarely
- ☐ Never

D.13. Within the last year, have any of your electrical appliances been damaged as a result of voltage fluctuations?

Let interviewee provide the response

If no skip to question D .16

- ☐ Yes
- ☐ No
- ☐ Don't know

D.14. Within the last year, have you sought compensation from T&TEC for damaged appliances?

Let interviewee provide the response

If no skip to question D.16.

- ☐ Yes
- ☐ No

D.15. How would you rate the level of compensation?

Let interviewee provide the response

- ☐ Excellent
- ☐ Good
- ☐ Average
- ☐ Unfair
- ☐ Very unfair

D.16. What would you consider a maximum duration of time for new connections of electricity service?

Read the pre-selected responses

- ☐ Within 1 working day
- ☐ Within 3 working days
- ☐ Within 5 working days
- ☐ Within 7 working days
- ☐ Within 10 working days
- ☐ Other (specify)____________________

D.17. Do you possess any of the following electrical appliances?

Let interviewee provide the response

	Yes	No
a. Water heater	☐	☐
b. Washer	☐	☐
c. Dryer	☐	☐
d. Refrigerator	☐	☐
e. Cooking range	☐	☐
f. Television	☐	☐
g. Stereo/radio	☐	☐
f. A/C Unit	☐	☐

SCHEDULE D

CONTINGENT VALUATION
ELECTRICITY SUPPLY

In the previous section you have indicated that there are a number of problems with your current electricity supply. I want you to consider the following hypothetical change to your electricity supply situation. It is crucial that you answer honestly so that we can understand whether you really do want the changes suggested. If you and others say that you will not pay for changes, it may be impossible for changes to occur. If you and others suggest that you will pay more than you are able to, you may not be able to afford the changes, should they happen. Please, therefore, be truthful in stating your maximum willingness to pay.

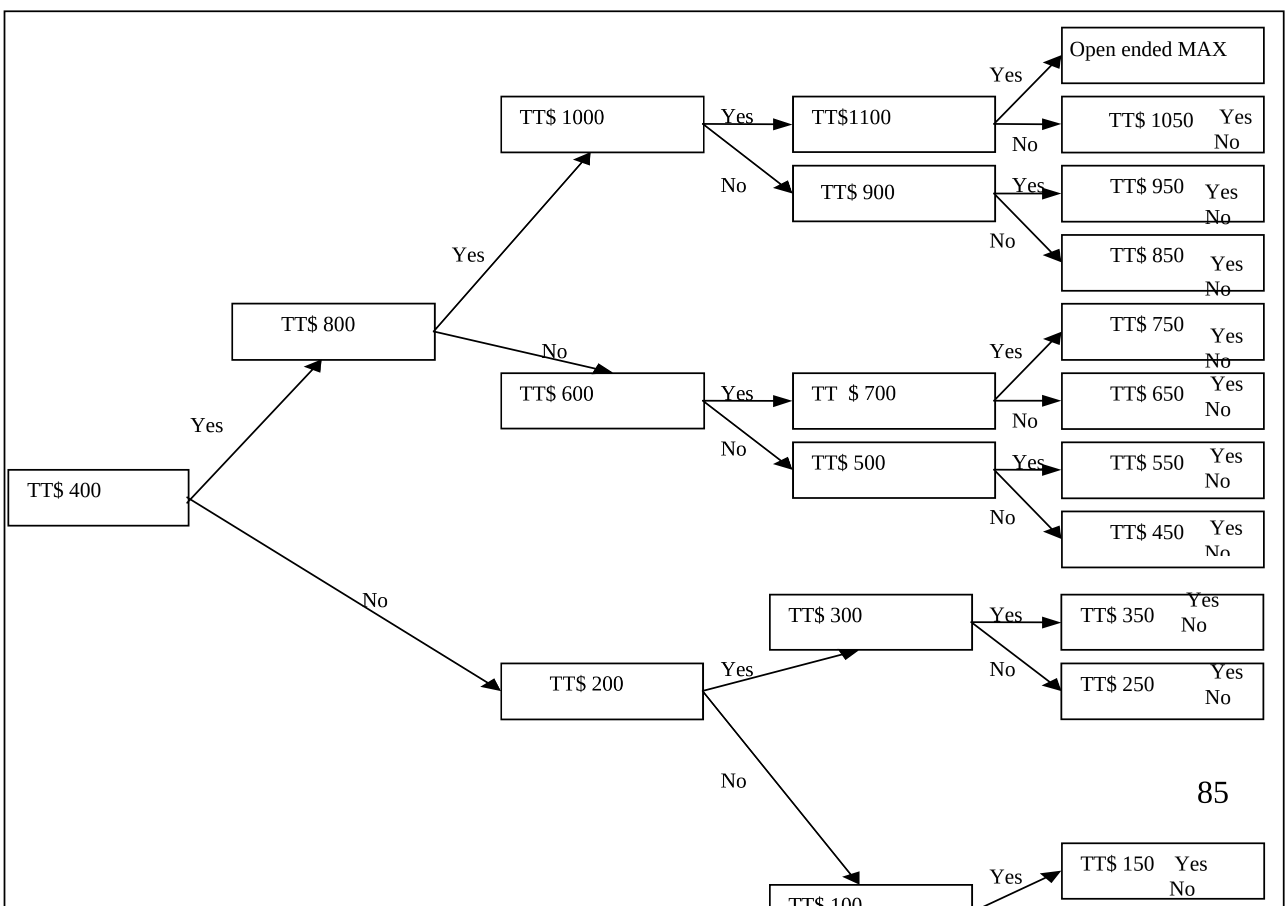
Bidding Game

If T&TEC's reliability of supply is improved, the voltage is supplied within legal limits (voltage fluctuations that don't cause damage to household appliances and equipment), response to trouble calls and time for restoration of supply are significantly improved and estimated bills are more accurate

Would you be willing to pay $400 bi-monthly for this service change?

Follow the arrow depending on the response given. Circle the interviewee's response ("yes" or " no") as you go along and also circle the highest affirmative response. If Open-ended box is selected, circle it and ask the interviewee what is the Maximum amount he/she is willing to pay. Fill in this response on the line below.

$_______________



SOCIOECONOMIC SECTION

Enumerator's Instructions

33. Which age group do you belong?
    - ☐ Under 20 years
    - ☐ 20 – 29 years
    - ☐ 30 – 39 years
    - ☐ 40 – 49 years
    - ☐ 50 – 59 years
    - ☐ 60 years and over.

Read the pre-selected responses.

34. What is the maximum level of education you have attained?
    - ☐ No Schooling
    - ☐ Primary Education
    - ☐ Secondary Education
    - ☐ Technical/Vocational
    - ☐ University
    - ☐ Other

Read the pre-selected responses.

35. What is your occupation? ___________________________________

Let the interviewee provide the response.

36. What is the main construction material of the house/building?
    - ☐ Concrete
    - ☐ Wood
    - ☐ Galvanize-shed
    - ☐ Other (specify)_____________________

Do not ask this question but enter a selection based on observation

37. Which of the following best describes your occupancy status?
    - ☐ You own the house/building and land
    - ☐ You are renting the house/building and land
    - ☐ You occupy the house/building and land rent free
    - ☐ You have leased the house/building and land
    - ☐ You are presently Squatting (do not own or rent land)
    - ☐ Other (specify)_____________________

Read the pre-selected responses.

Enumerator's Instructions

38. What is the main use of the building?

- ☐ Dwelling
- ☐ School
- ☐ Business
- ☐ Charitable Institution
- ☐ Agriculture
- ☐ Other (specify)____________________

Read the pre-selected responses

39. How many persons are living in the household?

No. of adults (16 years and over) ____________________

No. of minors (under 16 years) ____________________

Let interviewee provide the response

40. How many of the following rooms does the house have?

a. Bedrooms _______

b. Bathrooms _______

Let interviewee provide the response

41. What is the Annual Taxable value (ATV) of the building?

- ☐ $0 – $500
- ☐ $501 – $1000
- ☐ $1001 – $2000
- ☐ Over $2000
- ☐ Don't Know

Information can be obtained from WASA Bill

42. How many persons contribute to the household income? ____________

Let interviewee provide the response

43. What is the total household income per month?

- ☐ $0 – $1000
- ☐ $1001 – $2000
- ☐ $2001 – $3000
- ☐ $3001 – $4000
- ☐ $4001 - $5000
- ☐ $5001 - $6000
- ☐ $6001 - $7000
- ☐ $7001 - $8000
- ☐ $8001 - $9000
- ☐ $9001 - $10000
- ☐ Over $10000
- ☐ Don’t Know

Let interviewee provide the response

GENERAL COMMENTS

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Administered by______________________________

Checked by ___________________________________

Data entered by_________________________________