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Assessing Attitudes of Worcester Residents Towards Their Municipal Water Quality

Worcester Project Center D02

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Abstract

Our project assessed the attitudes of Worcester residents toward the quality of their municipal tap water. We used a convenience sample to survey 169 Worcester residents at Worcester area grocery stores. Our survey was divided into four category themes: awareness, behavior, attitudes and demographics. We found that 36% of the residents we surveyed were not very satisfied with the quality of their tap water. Through the analysis of the data collected we were able to determine relationships between the amount of awareness a resident had and their rating of overall water quality. We also found that some relationships were not supported, for example the geographical location on the residents in the city and the rate they assigned to the water. We hypothesized that residents receiving water from un-cleaned pipes or living on dead end water mains would rate the water worse than other residents who lived near clean water mains. However we found this to be a null hypothesis. From our data analysis we were able to recommend to the DPW that programs for increasing awareness of improved water quality would improve the attitudes of the residents. We also included ideas on future MQP and IQP projects for the DPW.

Executive Summary

In cooperation with the Worcester Department of Public Works (DPW), our project team determined the attitudes of 169 Worcester residents toward the quality of their municipal tap water. Through our survey, we determined that 36% of the residents are not satisfied with the quality of the water even after all the improvements the DPW has made to the quality of the water. After analysis of the trends discovered in the data, we have provided the DPW with recommendations on how to improve the attitude of the residents.

In the preparatory phase of the project, we conducted background research on other municipal water quality studies that would be beneficial to our project, and we researched how to conduct a valid survey. We also looked at the background history of Worcester regarding its water history and problems that the DPW had encountered in the years prior to the construction of the $31 million purification plant. Our primary research goal was to assess the attitudes of Worcester residents towards the quality of their municipal tap water. Therefore, our objective was to complete a valid survey of Worcester residents and to perform data analysis to discover trends within the data obtained. The trends allowed our team to gain insight into the attitudes of the residents that we surveyed. Our secondary research goal was to use measurements of the data collected to provide recommendations to the DPW on the available options for improving residents' attitudes.

Our survey, the WPI / DPW Water Quality Survey, was conducted at four supermarkets within the city of Worcester. We collected, through an in-person survey, a convenience sample consisting of 169 respondents. There also were 402 non-respondents to our

survey. The survey consisted of four question themes; demographics, behaviors, attitudes and awareness. The demographic questions gathered data that was compared to the census data for Worcester; this supported our convenience sample as a representative sample of Worcester. We also established hypothesized relationships between demographics and other variables on the survey, based on trends we found in other studies from our literature review. The behavior questions we asked enabled our team to establish the residents' drinking water habits. We found whether they drank tap, bottled, or filtered water and how much they drank of each. Awareness questions from the survey helped us to find out how informed the residents are toward their tap water. We also established whether or not they received information distributed by the DPW and if they knew about the purification plant. Finally, our most important questions established their attitudes and perceptions of the water quality in Worcester. We asked the residents to rate the taste of the water and then explain why they liked or disliked the water. Through all of the questions asked, we were able to generate tables, graphs and cross tabulations that were used as visual representations of our data.

After collecting all of our data, we conducted analyses using SPSS software. We used the demographic data to support that our survey respondents were representative of the demographic population distribution found in Worcester as compared to the 1990 and 2000 census data. We looked for many relationships between variables such as length of residency, age, income, education or location and compared all of these items to how the residents rated the quality of the water. However, we found that there were no relationships between the demographic variables and the attitudes in our study except when we looked at homeownership. We discovered from trends in the data that people

who owned their own homes were more aware of Worcester's Municipal water supply. We have hypothesized that this is because more of the homeowners receive and pay their water bill, which contains the information distributed by the DPW. Trends in our data supported that awareness affected the taste rating residents gave the water. This was a positive relationship because the more aware a resident was, the higher they tended to rate their water. Another discovery we made is that residents would be willing to buy Worcester's water if it was bottled. However they would not be interested in receiving free bottles that they would have to fill up themselves at the tap. These were 2 methods that the DPW wanted our team to address for the possibility of initiating a water pride campaign.

Based on our findings, we recommended that the DPW try to increase the awareness of all Worcester residents towards their water supply. They could accomplish this by disseminating information that is clear and easy to understand to as many residents as possible. Another recommendation we had for the DPW was to further explore the option of bottling and marketing water from Worcester's purification plant. This would include future research into the bottled water market in Worcester and the creation of a business plan to effectively bottle the water. We recommend that the DPW bring in a consulting group such as a team from WPI to help them accomplish these recommended tasks.

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1 Introduction

1.1 Introduction

The goal of our project was to assess the attitudes of Worcester residents towards the quality of their municipal water supply. Worcester's Department of Public Works (DPW) is interested in an enhanced understanding of the current attitudes of Worcester residents. The DPW wanted our team to discover if the public is aware of the work that they perform, or if a lack of trust is hindering the attitudes of the residents.

Our project has looked at alternative solutions of improving the attitudes of Worcester residents by investigating overall attitude trends in the U.S. and then comparing these to attitudes in Worcester. "While expenditures by the U.S. water industry are rising rapidly to meet more stringent quality regulations, U.S. public investments in the purchase of bottled water is growing even more rapidly" (Jardine, 1999). Utilities must somehow account for this decreasing consumption pattern.

The DPW along with other public water utilities are reaching out to their customers, through surveys and other studies to determine residents' level of satisfaction. The current project was designed and conducted scientifically and used a convenience sample of 169 residents. The residents were asked questions from the following categories: knowledge, behaviors, and perceptions/attitudes of the water quality. We also asked demographic questions, so that we could plot information on maps and compare our sample to Worcester census data. All of the information was then presented to the DPW in charts, graphs, and frequency tables, which provided a visual representation of our findings. Our results will help the DPW make more

informed decisions when considering alternatives to current procedure that concern consumer relations.

1.2 Problem Statement

Worcester residents have not always had the high quality drinking water they currently enjoy. Throughout the years Worcester's municipal water supply has encountered many problems: fairy shrimp, coliform bacteria, high levels of lead, copper, and chlorine, in addition to concerns about arsenic and cryptosporidium. Before 1997, Worcester's only method of disinfecting and safeguarding the water from bacteria and parasites was by the addition of chlorine. Chlorine however, did not reduce the turbidity, amount of dissolved solids in the water, or protect the water from all bacterial incursions. Also the four dilapidated chlorine pumps did not always work properly and occasionally allowed untreated water to enter into the city's distribution system. Therefore in 1983, due to the problems encountered with the chlorine pumps, Worcester failed to meet federal standards for turbidity, levels of copper, lead, chlorine, and coliform. The city had failed to meet the federal standards a few times in the years before 1983 as well. Finally, as a result of repeatedly not meeting the federal standards, the Federal Safe Water Drinking Act of 1986 required Worcester to build a water purification plant to treat all municipal water (Koury, 1993).

Construction of the water purification plant had been in the planning process since 1983, after the city water had failed to meet the Environmental Protection Agency's (EPA) standards. The EPA placed a ban on Worcester's water which forbade the city to allow the water to leave Worcester in any way. The ban remained in effect for two years while Worcester made major and costly improvements.

In 1983, a $140 million program to improve water quality and the reservoirs was unanimously approved by city officials. This ambitious project called for the building of a $60 million purification plant within five years. Another $3.5 million per year was to be distributed for relining the water main pipes, a third of which dated back to 1852 (Kotsopoulos, 1983). Funds were also allocated to repair and improve the four chlorination pumps, while the purification plant was being constructed. The only problem with the proposal was the lack of funding, which impeded the advancement of the project (Bliss, 1985).

In 1986 and 1987, the city began planning and designing the water filtration facility. The Department of Environmental Protection (DEP) approved the new construction schedule and the city only needed to sign a consent order agreeing to the timetable. City Manager William J. Mulford was reluctant to sign the consent order because it was not clear where the funding was going to come from. The state, to offset the construction costs for the city, commissioned $14 million in grants, which the city had to match. However, the project still required $37 million, in financing by the city, which was funded through a thirty-nine percent water tax increase of the residents over four years (Koury, 1993).

By 1989, the state pushed for the water purification plant when it ordered the city of Worcester to raise the quality of its water. A $53 million plant was proposed for a site owned by the city of Worcester in Holden, Massachusetts off Reservoir Road (O' Connor, 1989). The plant was intended to be brought online by March of 1992, but again due to lack of funding the city failed to meet this date. The State government granted an extension for the project until appropriate funds were raised. In 1993, the

city had already spent $6 million on construction work and laying underground pipes at the future site of the plant. Funding for the purification plant continued to accumulate between 1993 and 1995 due to the water tax increase. Finally in 1997, the new state-of-the-art purification plant was fully operational, after the city of Worcester had spent $31 million. Plant financing worked out much better than expected because of $14 million from the state and changes in the Federal Drinking Act of 1996 making the city eligible to receive federal reimbursement for part of the construction. The city also saved approximately 15 % from the original estimate because of the economic downturn during the bidding process (Monahan, 1997).

Since 1997, when the purification plant went online, tremendous improvements have been made to the quality of the water. Now, instead of only chlorine, there are a series of treatments and filters that the water undergoes including deep sand, charcoal filter beds, and chemical treatments such as ozone, aluminum sulfate, and lime (Monahan, 1997). There are no longer any residual suspended solids in the water due to the filtering. Ozone is a pre-disinfectant that eliminates dangerous organisms such as giardia and cryptosporidium; because of ozone less chlorine is needed (Kotsopoulos 1996). Tests were run by the city and the Telegram and Gazette before and after the plant opened. The results have shown that the levels of turbidity, coliform, lead and copper have all decreased to almost non-existent levels. Even EPA officials believe the city "could bottle the (drinking) water and sell it" (Monahan, 1997). Despite the tremendous improvements, validation from the EPA and the evidence from laboratory tests concluding that the water quality has been raised, the DPW is uncertain of the residents' perceptions towards the water.

The DPW would like our team to determine how Worcester residents perceive the quality of the city's drinking water. Anecdotal evidence exists that suggests negative perceptions towards the water quality remain, even though the city of Worcester has spent more than $31 million on improving the quality of the water by cleaning water mains and building the purification plant. Tests have shown that the water quality has improved, but if the residents are not satisfied with the water then more marketing may need to be done. Therefore, our goal is to assess the attitudes and perceptions that Worcester residents have towards their tap water quality. Through a series of questions on our survey we have been able to make correlations based on the residents' knowledge and behavior. Using the survey we also have investigated if the residents drink the water or if old perceptions of the water still hinder the residents' attitude towards the safety and quality of their water.

In the next chapters, we explain the different literature sources we found while researching for the project as well as their significance to our research. In chapter 2, we explain the pre and post-1997 background history of Worcester's Department of Public Works (DPW) division of water operations. Highlighted in this chapter are the problems the DPW has encountered with the water through the years and the plan of action that they formulated to resolve these problems. Next, we discuss other surveys that have been conducted in the United States and Canada that we used as references for designing and conducting our survey. In chapter 3, the methodology for our project is explained in full detail from the research design to the sample size and frame. Then in chapter 4, we explain the data analysis including visuals of graphs, frequency charts, and cross tabulations tables. These were generated by examining different variables

from our survey and inferences we made based on observable relationships and trends. Finally in chapter 5 we will explain the conclusions and recommendations that we have determined would be the most effective for the DPW along with ideas for future projects.

2 Background History

2.1 Worcester Background History

2.1.1 Pre 1997

Throughout the years Worcester has dealt with a number of water quality issues, many related to public health. One of the main health issues was lead being leached into the household water supply. Lead, in drinking water, is a terrifying issue to residents because it can cause irreversible damage to infants, children, and adults. Lead enters a resident's home as "an invisible, odorless, and tasteless toxic pollutant in their plumbing" (Monahan, 1992). The EPA's standards for the amount of lead allowed in water is 15 parts per billion (ppb); anything exceeding that level is unsafe and the EPA requires a letter to be sent to the public anytime the standards have been exceeded (DPW, 2000). Worcester residents have received many warning letters, mandated by the EPA, from Worcester's DPW pertaining to the high levels of lead in their municipal water supply. Some Worcester homes that were tested for lead contamination contained levels as high as 145 ppb. This amount reflects the concentration of lead in water left stagnant overnight in household plumbing (Astell, 1992).

Lead levels higher than 15 ppb can have adverse effects on the physical and mental development of pregnant women and children. Lead can cause premature birth, low birth weight, mental retardation, and hinder overall physical development. It can also have adverse effects on the physical functions of adults. For example, in adults it can cause increased blood pressure, hearing damage, or anemia. In severe cases lead can cause damage to the kidneys or permanent mental retardation. The issue of lead in the water and the effects that it can have on the population, caused many residents to be concerned with the safety of their municipal water (Monahan, 1992 and Monahan,

2001). However, the lead was not naturally occurring in the municipal water supply but was leached out of the solder in copper pipes within resident's homes. (Astell, 1992)

In 1986, the federal government banned the use of lead solder in copper household plumbing. The ban came immediately after approximately 1,500 homes were built in Worcester between 1983 and 1985. These homes have been more susceptible to lead contamination of their water because of the lead solder used in the copper pipes. However, older homes in Worcester are less susceptible to lead contamination, because lead corrosion diminishes over time as mineral deposits build up on the pipes, creating a barrier between the solder and the water. It was easy to stop the use of lead for solder but the reason the lead is leached out of the pipes is Worcester's main problem: the water's acidity level.

Due to the amount of chlorine that was used to treat the water, it was too acidic and leached lead from the pipes. Chlorine was the only treatment method for the municipal water supply prior to the purification plant. Chlorine was used to disinfect and eliminate any parasites and bacteria in the municipal water supply. Coliform, a bacterium that is found in water was used as a detector organism. This means, that if coliform was detected in the water, then the amount of chlorine used to disinfect the water would have to be increased. If coliform is present, then the water may harbor more harmful bacteria and parasites, such as giardia which can "cause headaches, diarrhea, low grade fevers and weight loss" (Koury, 1993). The chlorine was used to eliminate parasites and bacterial problems, but in turn it created acidic and poor tasting water.

In 1981, *The Gazette* (now the *Telegram and Gazette*), Worcester's daily newspaper, ran a "taste testers" survey that included nine participants, who taste tested the water. The samples, which came from four local municipal water supplies and one private well were placed in cups, labeled A through E. Participants were asked to rate each sample on aroma, flavor, and color. The mayor at the time, Jordan Levy, who participated in the survey, stated that Worcester's water had a chemical taste and was not very transparent. The City Manager Francis J. McGrath, also a participant, said Worcester's water "tastes like cologne and had a metallic aftertaste". The article, in The Gazette, containing these quotes did not leave a good impression, of the drinking water quality, on residents (Connolly, 1981). Not only had the mayor and the city manager found the water inadequate, but the participants also rated Worcester's water as the worst in each category. More over it was rated the worst of all the samples tested by Werby Lab Inc of Chelsea, Massachusetts, who tested for pH, softness/hardness, chlorine, iron and lead. The lab results were also printed in the newspaper, displaying once again that Worcester had failed to meet standards.

In contrast to the 1981 survey, which had only nine participants, we have surveyed 169 Worcester residents' about their attitudes and behaviors towards the current state of Worcester water. Unlike 1981, the residents were not asked to taste the water, but were tested on their current knowledge about the water system and their perception of the water quality made evident by their water habits. Through the survey we determined what the residents thought of the clarity, odor, and taste of their water. From the questions we were able to make correlations between their answers, and their perceptions of the water. We also compared the validity of their perceptions with their

actual behaviors. In addition, we were curious to see what types of resources the residents rely on for their information. What they believed was contained in the water and if there were health risks involved.

2.1.2 Post 1997

In 1997, Worcester opened its state-of –the-art water purification system, which provided purified water to Worcester and the surrounding towns who purchase Worcester water. Prior to 1997, there was no purification plant and the water was treated with chlorine, but not filtered. The purification plant cost the city of Worcester $31 million, which was approximately half of the original estimate of $65 million. The plant is located on Worcester owned land in Holden, Massachusetts next to Holden Reservoir No.2. The plant's purpose is to provide better quality and safer water to the residents of the city of Worcester and the surrounding towns, who buy their water from Worcester. To provide safer and higher quality water, the plant uses a series of treatment methods including filtering and chemicals (See Figure 1 pg 12).

The plant adds seven different chemicals, which are EPA approved, to the water "before and after the filtration process to enhance the quality of the supply" (Kotsopoulos, 1996). These chemicals are also used in other purification plants across the United States. The first chemical process used is ozonation, which disinfects the water and breaks down organic matter making the following filtering process more efficient. Next the water is coagulated and flocculated; in these steps alum and cationic polymers cause tiny particles in the water to stick together to form larger more complex particles, which are trapped in the filters. These processes remove particle matter in the water that can harbor harmful pathogens and microorganisms such as giardia and

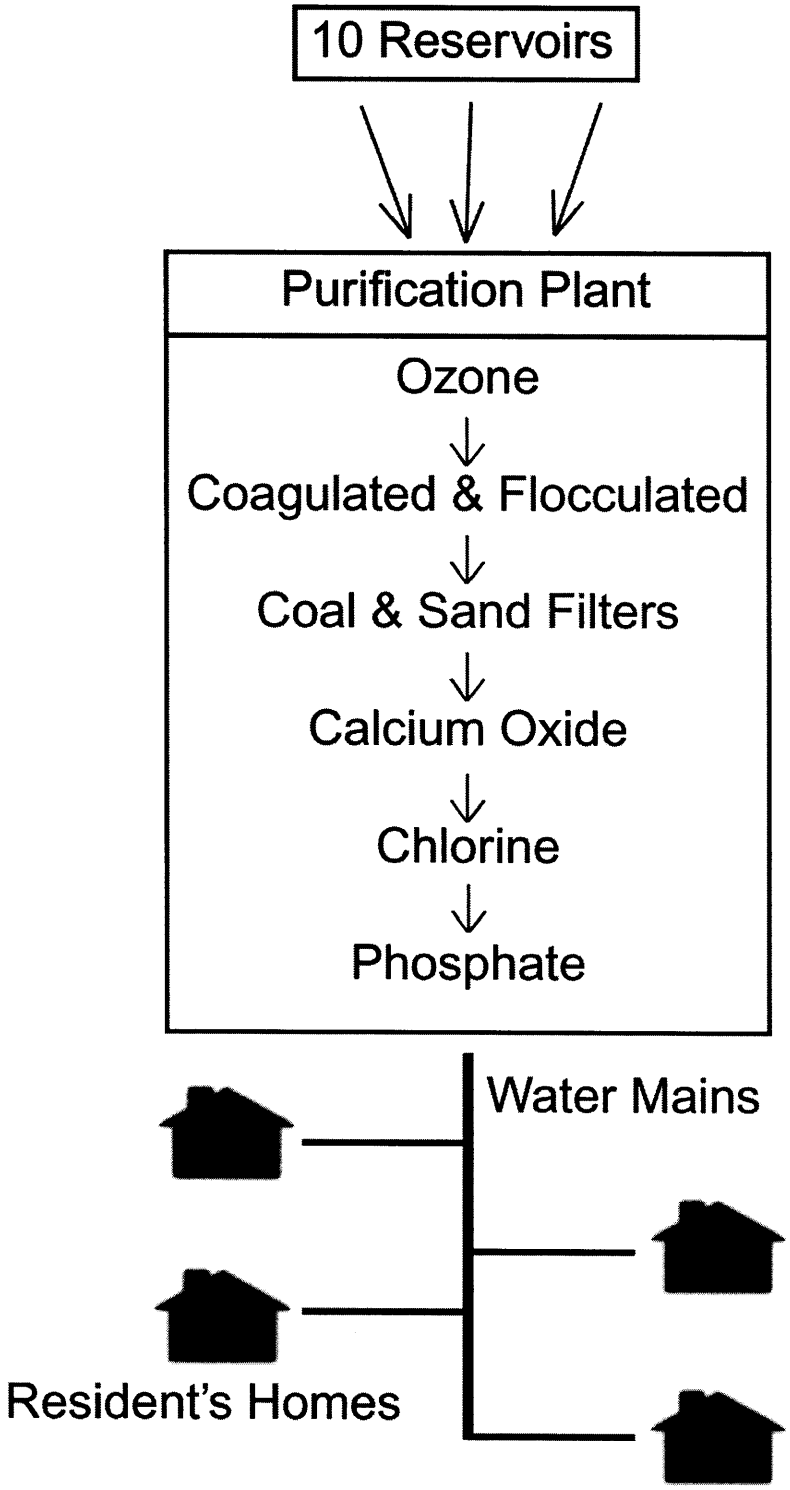
cryptosporidium (http://www.ci.worcester.ma.us/dpw/filtrationplant). After that, the water goes to direct filtration by coal and sand filters, which remove more particles.

The next process adjusts the pH of the water by using calcium oxide. Calcium oxide makes the water less acidic and less corrosive by raising the pH until it is slightly alkaline (basic). After the calcium oxide has been added, the water is again disinfected with chlorine, Worcester's previous method of treating and disinfecting the water.

However, the original amount of chlorine that was used has been reduced by 23%, because now the water is first disinfected with ozone. Chlorine is only added into the water as it is leaving the purification plant. The chlorine insures that the water remains safe from parasites and bacteria as the water travels through the water mains before it enters a resident's home.

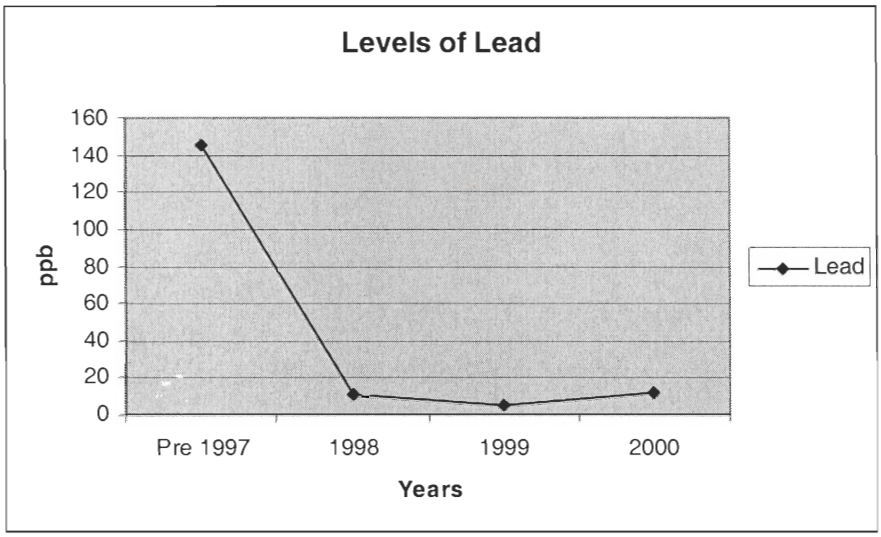
Finally, the water goes through a corrosion control step in which a blended phosphate corrosion inhibitor is added to the water. Phosphate, like chlorine, remains in the water, to provide a protective coating for the inside of water mains and plumbing. Using phosphate reduces the amount of lead and copper that is leached into the water and also reduces the corrosion of the pipes by chlorine. All of the processes and chemicals that are added to the water help to make the water cleaner and safer.

Figure 1: The Water Process from Reservoirs to the Resident's Homes



When the plant first opened in 1997, the DPW offered free tours of the purification plant and free samples of the improved water. The DPW was trying to educate the residents about the plant and the higher quality of water the residents would now be receiving. As tests have shown, an improvement in the quality has been made since the purification plant went online. The amount of lead and copper in the water has decreased (See Figure 2) (Monahan, 2001). The water is now the highest quality water that Worcester has ever had. After building the plant, continued relining, and addition of new water mains, the DPW wants to ascertain if the residents of Worcester notice the improved quality of their water. Therefore, the goal of our project was to assess the attitudes of Worcester residents' towards their tap water and provide recommendations to the DPW for improving the attitudes of residents.

Figure 2: Visual of Lead Prior to and after Purification Plant



2.2 Perception of Risk:

We measured resident's attitudes with our survey, which are related to their perceptions. The residents' perceptions of what is healthy and safe shape their behaviors and attitudes toward their drinking water supply. Whether or not something is perceived to be safe or a health concern is relevant to our study because these are factors that affect people's attitudes. These specific factors are called risk perceptions. Risk perceptions have many societal consequences because of their direct psychological effects (Keller, 2000). Therefore measuring the residents risk perceptions and finding their effects on the use of tap water is vital to our study.

German sociologist Beck hypothesized that we are becoming a risk society in lieu of an industrial society meaning that people act based on their perceptions of an activity's level of risk (Keller, 2000). We have now realized and accepted that technology carries with it many risks. We also realize that the scientific community may not know all of the risks or understand their consequences. To account for this, people "anticipate the occurrence of residual risks as the normal case" (Keller, 2000). It is believed the media "has created a very deep societal feeling that 'residual risks' exist and arrive"(Keller, 2000). This means that the average person believes residual risks, which in reality have a low probability of occurring, have a higher probability. These people believe that the event they are afraid of will occur. Combating residual risk perception has become a public relations problem for many governmental agencies. The government and risk experts often blame the "media presentation of environmental and health damages" as the reason for the publics high level of risk perception towards

catastrophic events (Keller, 2000). Through our survey we received data that allowed us to investigate if this was the case in our community.

Risk analysts and managers commonly define risk as "combining probabilities and some simple quantitative expressions of consequences" (Vertinsky, 1991). They tend to define anything that strays from this definition as 'risk perception'. It has been found that the general population uses these things to calculate and define risk

> "'dread risk', i.e., perceived lack of control, dread, catastrophic potential, fatal consequences and the inequitable distribution of risks and benefits, and 'unknown risk,' i.e., the degree to which hazards are not observable, unknown, new and delayed in their manifestation of harm"(Vertinsky, 1991).

Lay people do not often have the time to invest in researching all of the scientifically substantiated risks to themselves or the knowledge base to understand and interpret this information (Johnson, 1993). Therefore, a gap is created between the attitudes of experts and lay residents towards risks.

2.2.1 Significance for Our Study

People's lack of trust and understanding in the claims of a risk expert is significant for our study. This lack of trust in the expert's knowledge leads to a loss of trust in the public utilities that use their claims to express risk compliance to the public. For example, a cryptosporidium outbreak seems more likely to occur and produce adverse health affects in the mind of the public when it only has a low chance of occurring in contrast to being involved in a common traffic accident with a probability of one accident occurring every 5 seconds in the US (http://www.car-accidents.net/). To the water utility the concern of a cryptosporidium outbreak may seem extreme; the water utility companies are more concerned with everyday hazards such as lead ingestion. This is a common conflict, which erupts

> "because low probability, but very harmful, risks tend to be judged by the public in terms of their consequences rather than their probabilities. In contrast, regulators tend to focus upon the expected values of consequences and discount the risks with very small probabilities" (Vertinsky, 1991).

In our study we determined what information the public receives and from which institutions. What information they get about their tap water and from whom, can make a large difference in how they perceive their tap water. For example if they receive information from a governmental agency then they will get more accurate factual information, whereas the newspaper will contain the opinion and attitude of the author as well as facts on the matter. In our survey, we have made correlations between this information and the residents' attitudes and behaviors. Residents' attitudes and behaviors are indicators of their perceived risk of drinking the tap water. For example, health concerns stated by residents would fall under the risk perception category whereas dislike of chlorinated taste would not. The information provided by the Worcester residents has helped us understand how and why they perceive tap water risks.

2.3 Introduction

While conducting background research for our project, we identified many surveys performed all over North America. These surveys have been helpful to us in research, development and analysis of our own survey. In addition, we contacted a Clark University professor who performs a yearly survey in Worcester. We have been able to use the results of one of the questions on his survey to help support our research. Throughout the course of our survey, we were able to use the other studies as beneficial

tools to our research. The following sections will discuss surveys that we found along with their significance to our project.

2.3.1 Annual Worcester Study

Dr. John Blydenburgh, of Clark University, is the director of the Annual Worcester Citizen Survey. This survey asks Worcester residents several questions regarding their attitudes towards and opinions of municipal services in the city of Worcester. Blydenburgh study is similar to ours because he is assessing the attitudes of Worcester residents. However the goal of the Annual Citizens Survey is,

> "to gauge Worcester residents' attitudes and opinions about specific programs and activities of City Government, to assess public views of new or recent activities of several municipal departments, and to identify areas of citizen satisfaction or dissatisfaction with current or potential public policy." (Blydenburgh, 2001)

The questions in the survey inquire about Worcester as a place to live. It examines the quality of municipal services, such as the police department, the fire department and the municipal water supply. The survey has been conducted on a yearly basis since 1994 with similar questions asked each year, allowing trends to be examined.

From Blydenburgh's data the most valuable trend pertaining to our study would be that of perceived water quality. Perceived water quality has made a remarkable increase over the years. In 1997, 56% of the people surveyed thought that the (See Table 1 on pg 18) water was "good" or "excellent". In 2001, 76% of the people surveyed thought that the water was "good" or "excellent". The data shows a clear trend that perceived quality of Worcester's water has steadily improved from 1997 to 2001. This improvement is likely due to the purification plant that opened in 1997. This

survey demonstrates that the positive perception of the water has followed the improvement in water quality.

Table 1: Rating Water Quality in Worcester

	Year	excellent	good	not to good	poor
Water	2001	23	53	12	9
Quality	2000	15	53	18	10
	1999	18	49	19	13
	1998	16	45	19	18
	1997	8	48	27	23

2.3.2 AWWA Survey

In 1993, the American Water Works Association (AWWA) measured the perceptions of 1,603 water utility clients nationwide. "The objective of this survey was to gather data that could be used to refine market strategies"(Grondin, 2000). One third of the respondents, who said they used bottled water, expressed worry over the health and safety of their tap water. 38% of the total respondents had seen or heard something in the media that made them doubt the quality of their tap water and 26% had experienced a local event or incident that threatened their water quality. One third thought that problems with treatment methods, things that are under the water utilities' control, were a major threat to their tap water quality. This shows that many residents perceived risks to their tap water out of their immediate control.

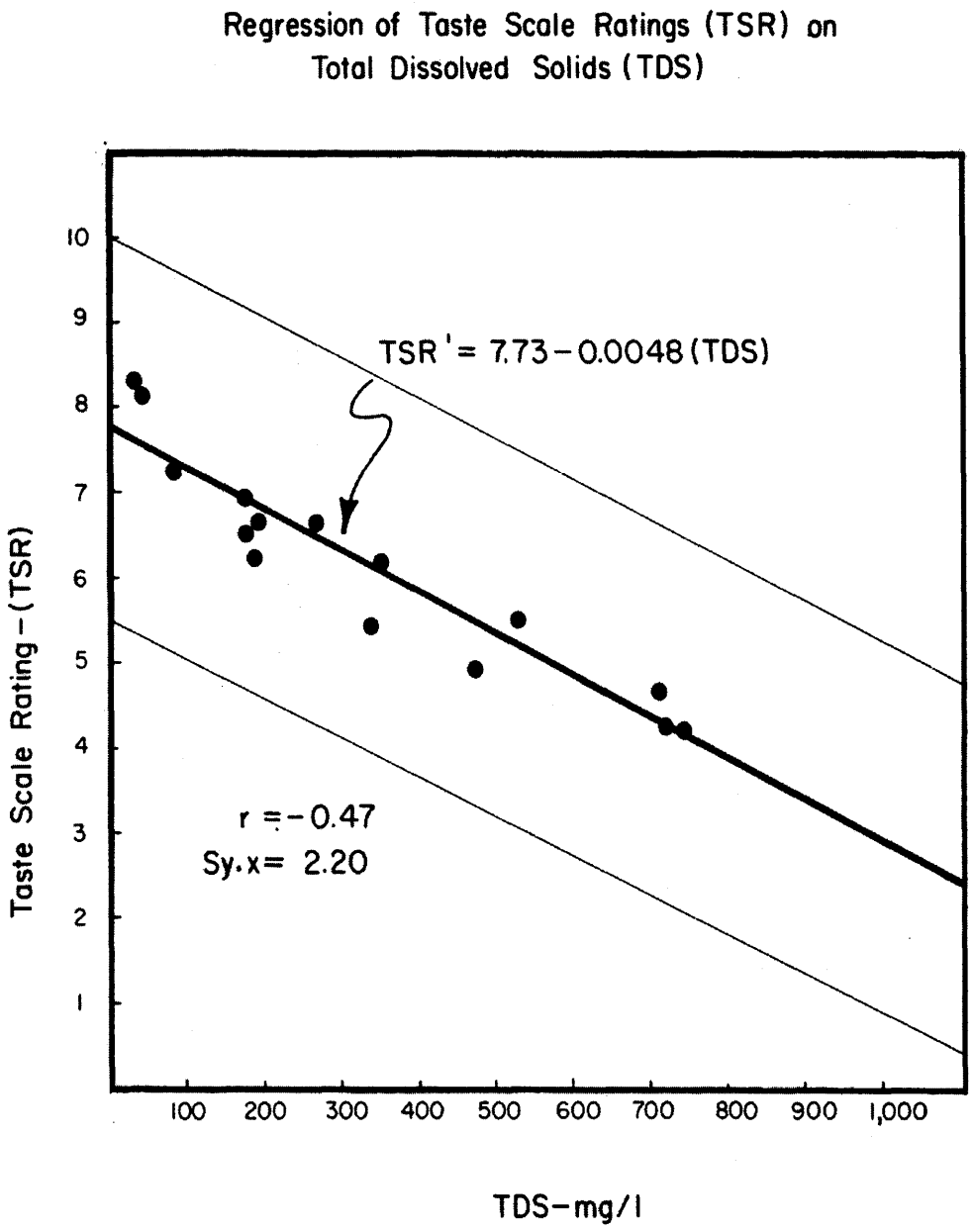
2.3.3 California Study

In 1976, the California Water Resources Center and the University of California Berkley conducted a survey to determine the public's attitude towards their drinking water. This survey was conducted in eight major California cities in which surveyors went door-to-door and asked 1,500 residents questions regarding their attitudes and

behaviors towards the drinking water (Bruvold, 1976). The eight cities were chosen because their drinking water quality varied from "very good to very bad", and because the income levels of the residents varied greatly.

The main goal of the survey was to find a relationship between the quality of the drinking water and the residents' attitudes and perceptions of their water. To determine the perceived quality, the researchers asked residents a series of questions about the taste, odor, clarity, and softness of their water. Then the researches had the participant try a glass of their tap water, and rate the overall quality on a scale of 1 to 9. The responses to all the questions were combined to obtain an overall quality rating. To determine the actual quality of the water, the researchers analyzed the total amount of dissolved solids in the water (Bruvold, 1976). When they compared the perceived water quality with the amount of dissolved solids in the water, they determined that the more dissolved solids in the drinking water, the more it was perceived by the residents to be terrible. They also concluded that the relationship is linear as seen in Figure 3 on page 20 (Bruvold, 1976).

Figure 2: Graph From California Study Bruvold, 1976



There was a wide range of water quality between the different cities in the survey. Oakland, California had the lowest amounts of dissolved solids in their water and received the best rating, while San Diego had the highest amounts of dissolved solids and received the lowest rating (Bruvold, 1976). The data from the other cities in the survey that also approximately fit the graph in Figure 3, demonstrated that there is a strong relationship between the total dissolved solids and the perceived taste.

The second goal of the California study was to determine the relationship between the water quality and residents' penalty costs for their water. Penalty costs are defined as the price residents pay for buying bottled water or paying for filters to filter their water. Again the researchers used the total dissolved solids as the measure of water quality. To determine the penalty costs of the residents, researchers asked a series of questions about bottled water and filtering behaviors. For example, there were questions that asked how much money residents spend on bottled water and how much money they spend on filtering and or softening their water. Then researchers added all of the results to get an average monthly cost. Again they found a strong correlation between the dissolved solids in the water and the amount of money residents spent on either purchasing bottled water or filtering their tap water. They compared the data with and without taking into account residents' income.

It was concluded that the amount residents spend on bottled and filtered water is dependent on both the total dissolved solids in their tap water and the resident's income. There are two areas in San Diego that have approximately the same water quality, but the per capita income per year is $3,200 in one section, and $6,400 in another. Their penalty costs are $3.20 and $6.00 per month respectively for each

section of the city. However, compared to Oakland, which has only 1/24 of San Diego's total dissolved solids in the water, the average monthly penalty cost is only $0.52, while the average per capita income is $7,500 (Bruvold, 1976). This shows that there is a correlation between resident's penalty cost, income, and the amount of solids in the water.

The third goal of the California study was to find a relationship between water quality and residents' willingness to pay more for their tap water. Willingness to pay more was defined as the amount the resident said that they were willing to pay for better tap water combined with how much they spent on bottled or filtered water (Bruvold, 1976). There were several questions that asked how much more residents would pay for cleaner tap water. The data showed that the willingness to pay more increased with both the average per capita income and the total dissolved solids in the water; but depended more with the total dissolved solids in the water (Bruvold, 1976). Unlike the amount spent on bottled water, the amount residents were willing to pay for better tap water was not as strongly related to income. This research is relevant to our project, because if Worcester residents perceive that their water is of poor quality, than they are more likely to complain about the cost of tap water. If the residents are uninformed about Worcester's new purification plant and improved water quality, then informing them of their higher quality water will make the residents aware of where their tax money has gone.

2.3.3.1 Significance to Our Study

The goal of our project was to assess the residents' attitudes and perceptions towards their tap water. The goal of the California study was to link residents' attitudes

and the actual quality of the water. However, the studies were similar because both studies used surveys as the method to assess the attitudes and perceptions that people have towards their tap water. We have determined if there are any correlations between the residents' attitude and perception and other variables. Other variables that affect the water quality could be things such as water mains, location in the city, taste and odor.

We also determined the water consumption habits of Worcester residents. We discovered how often residents consume bottled water and how often and why they filter their water. While we have not compared the solids in the water to the residents' attitudes we have discovered what the residents do and do not like about their tap water. Through analysis of the data obtained from the survey, we have made recommendations to the DPW on their next course of action, and how to improve perceptions of the drinking water.

2.3.3.2 Summary to California Study

The California study is a good model; the study determined the residents' attitudes regarding their drinking water, which directly relates to our study. We have determined Worcester residents' attitudes towards their drinking water, and then have devised possible solutions to improving their attitudes. We also ascertained why residents do not like their tap water, and what they think is in the water creating the problem. This information is valuable to the DPW because they will be able to see what problems/concerns the residents have with the water. It will also allow the DPW to make improvements to the water and to the marketing the water to the residents.

2.3.4 Quebec Study

In Quebec in 1995, Levallois, Grondin, and Gingras conducted a telephone survey asking residents about their attitudes and behaviors toward their drinking water. The survey randomly sampled 2,009 residents in the Quebec metropolitan area; these residents were picked randomly from telephone listings. Residents were surveyed from areas served by four different water sources in the city; two from the St. Lawrence River, and two from a neighboring lake. The survey evaluated: drinking water behaviors, satisfaction with tap water, perceived risks of drinking tap water, reasons for alternative forms of drinking water (bottled and filtered water), and knowledge of water source. The survey found that about half of the respondents drank water right from the tap, and slightly less than half of the respondents drank bottled water, the main alternative choice to tap water.

The survey concluded that taste was the most important reason for drinking alternative sources of water. The survey established, of the residents who used bottled water 71% used bottled water because of organoleptic reasons. Organoleptic is the perception on a sensory organ, such as an impression of bad tasting water or foul odor coming from the water. Only 21% of the residents consumed bottled water for health reasons. Additionally residents who had chlorine in their tap water were more likely to drink bottled water because of taste of the tap water. In the sector of the city where residents received chlorinated water from the St Lawrence River, 50% of the residents drank bottled water, and 80%of these drank it because of the taste. Of the residents who drank ozonated (un-chlorinated) tap water from the St Lawrence River, 49% of the

residents drank bottled water, and 69% drank it because of the taste. The statistical data illustrates that chlorine negatively affects the taste of the water for the residents.

In Quebec an average percentage was calculated to explain health concerns using data from four different municipalities. 26%of those surveyed who drank bottled water said they did not drink tap water because of health concerns such as cancer, gastro-intestinal disorders and infectious diseases (Levallois, 1999). However, the remaining 74% of bottled water drinkers had an overall low perception of risk regarding the consumption of tap water. They chose not to consume the water due to organoleptic reasons; odor and taste. Only 4% of the respondents from the entire sample thought there were high risks for drinking tap water. Regression analysis revealed that no significant correlation could be found between health concerns and use of alternatives to tap water in Quebec (Levallois, 1999).

This survey was valuable to our research project because it demonstrates that residents will buy bottled water because of the bad taste of tap water. One of the variables we determined with our survey was Worcester residents' perceptions towards their tap water. The DPW would like recommendations for which methods would work best to improve the residents' perceptions of the water. Shortly after the purification plant opened, the city of Worcester tried to market the purification plant by handing out bottled water from the plant. The DPW is again considering bottling the water straight from the purification plant and marketing the water to Worcester residents. If chlorine is the only factor that affects the taste of the water, then marketing the water straight from the purification plant, with no chlorine contained in the water, may help to improve the residents' perceptions of the water.

2.3.5 Other Canadian Studies

In contrast to the organoleptic reasons found in Quebec evidence from a survey in the city of Toronto points to health concerns as the main reason for consumer's rejection of tap water. The survey done by the Toronto Public Health Department found that health concerns were the reason given by 55% of consumers in 1990 for using an alternative to tap water (Grondin, 2000). 67% of subjects in Auslander and Langlois telephone survey, Toronto Tap Water: Perception of Its Quality and Use of Alternatives in 1993, gave health concerns as the main reason for use of tap water alternatives (Grondin, 2000). The survey by The Canadian Health Monitor undertaken in 1997, found that 23%of the respondents from Toronto "feel that tap water consumption is not very safe or not safe at all"(Grondin, 2000).

Since 1987, The Environics Research Group has been conducting a survey, The Environmental Monitor, polling the Canadian population (Grondin, 2000). In 1997, 32% of respondents used bottled water. The analysis of their data has suggested that most alternatives to tap water (bottled water, filtration, boiling water) were used by residents with health concerns. However, the authors believe that one specific question on the health perception is biased due to the way it was presented to the respondents "because of health concerns you might have about contaminants in your drinking water, do you regularly use either of the following in your home ..."(Grondin, 2000). This survey question constrained the respondents thought process by limiting them to health reasons only. It left no room for other reasons such as the clarity, odor or taste of the water, which might have been the primary reason for the respondent to not consume the water. After comparing all of the studies in the report A Review of Social Sciences

Data Relevant to Environmental Health in the Canadian Great Lakes by Grondin et al it is apparent that there is an increasing trend toward alternatives to tap water use.

This survey supported our team in the process of designing our survey, because we did not create questions that limited the respondents to answer a specific way. Our survey design started out with general questions then depending on the answers gradually went to more specific details. This allowed for the respondent to voice their opinion and concern, not what we believed their concern might be. Overall we learned how to construct a valid and reliable survey, by seeing bad examples of existing survey questions.

2.3.6 Water Reclamation Study

In 1979 the California Water Resources Center and University of California sponsored a survey to determine public attitudes toward water reclamation. While this study determined the attitudes of residents regarding wastewater, not drinking water, the study is still useful. The survey asked 1,400 residents in ten different cities across California. The survey asked residents a number of questions about their attitudes regarding reclamated water; waste water that is treated and reused for other purposes. When the data was analyzed, a number of trends were found for example, that younger, better educated, more affluent residents had a better attitude toward the reuse of water. It was also found that the more informed residents were about water reclamation, the better their attitude on the topic.

The study came to three major conclusions. Residents strongly opposed minimal wastewater treatment and discharge into the environment. Residents favored advanced treatment of wastewater and use in irrigation or industry that minimized

human contact. Residents' opposed advanced treatment and reuse for human consumption. When analyzing the data, the researchers found a number of socioeconomic trends in the data. Through the data it was illustrated that younger, more educated and more affluent residents were often open to the idea of using reclaimed water for different uses. In contrast to older, less educated, and less affluent residents were more reluctant to use reclaimed water for different purposes. Another variable influencing residents' attitude toward using reclamated water was the amount of time spent thinking about the subject. Residents who had thought about the reuse of water were more willing to use it. This indicates that a marketing campaign targeted at the elderly, less affluent and less educated, could increase the amount of time they spend thinking about water reuse, and positively influence their attitude toward the subject.

2.3.6.1 Significance to Our Study

One useful insight from the survey is the trend in the socioeconomic data. In our survey, we have looked for trends in the data that might guide the DPW in their decisions. The California Reclamation Study found that the more residents thought about water reclamation, the more they accepted the idea of using reclaimed water for different purposes. We need to market Worcester's municipal water in a positive light to make the residents think more positively about the drinking water. Positive thinking could assist in improving the residents' attitude towards the water quality. Support from the California Study, indicates that a marketing campaign undertaken by the Department of Public Works could be successful.

Another conclusion of the California Reclamation Study is that residents want to be involved in decision-making processes. If the DPW does bottle and sell Worcester

water, they will have to spend tax money to undertake the project and when there are tax dollars involved residents want to voice their opinions. While we will not deal with this topic in our survey, we may consider it in the recommendations.

2.4 Summary of Studies

In all of the surveys that we studied, we extrapolated the methods used to determine residents' attitudes and behaviors. In the Quebec survey, it was determined that half of the residents consumed bottled water and a majority of those who consumed bottled water, did so because of the taste of tap water. This is relevant to our survey because we want to determine if residents in Worcester buy bottled water and why. In the California Study, they determined the relationship between the dissolved solids in the water and residents' attitude. They also found that the water quality affected residents' behavior: the worse the water was, the more residents bought bottled water or filtered their water. Also, researchers found that income affected behaviors; generally more affluent residents spent more on bottled water and filtered water.

Because we are interested in determining Worcester residents' behaviors regarding their drinking water we too want to extrapolate what variables affect their behavior. In order to assess our survey, we need to determine how residents' perception of Worcester's water system affects their attitudes and behaviors. Any concerns over the health effects and safety of the water can negatively impact their use of it, especially as drinking water. Similarly to the water reclamation study where the amount of thought residents put into water reuse directly affected their attitudes. We determined there is a similar correlation between residents' knowledge of Worcester's drinking water system and their attitudes towards the drinking water.

3 Methodology

3.1 Introduction

Our first research goal was to assess the current attitudes of Worcester residents towards their public drinking water. To complete our objective an in-person survey of Worcester residents was completed. Then a statistical analysis of the data obtained gave us insight into their attitudes. For our second research goal we used these measurements to provide recommendations on the available options for improving resident attitudes. The DPW specifically asked our project to include "results and analysis of a community public attitudes survey on Worcester water." We determined a survey that reached as many residents as possible in the given time frame was the preferred option.

The following sections elaborate on the research methods we utilized to meet these goals. First we explain why we chose to do a survey. Next survey format development and design is described. Then we explain the data collection procedures that were implemented for obtaining measurements from the survey research. To conclude we explain why we chose our sampling procedure over other standard sampling techniques.

3.2 Research Design

We used survey research to obtain Worcester resident's attitudes. The Department of Public Works conducted a pilot phone survey in November of 1996, shortly before the new filtration plant came online in 1997. However, the phone survey was not scientifically valid therefore we did not use the results. A survey conducted by the University of California, Berkley that measured the attitudes of residents was

identified by our team. The University's survey helped us with the design of our Worcester survey. In California it has been observed that people's attitudes about their public drinking water are based on perceived physical characteristics of the water. Some of these characteristics are taste, smell, and clarity.

We identified behaviors and knowledge from these and other surveys that have been shown to have correlations with certain kinds of attitudes. We therefore asked if the respondents perform these specific behaviors, such as buying bottled water. Purchasing bottled water illustrates the respondents' perceptions of the tap water quality, by choosing a water alternative. We also asked them specific questions about the actual public water supply system to determine the extent of their knowledge on this subject. Then we examined how their knowledge about the public water supply affects their attitudes.

3.2.1 Survey Design

It was found that the two most important factors concerning the construction of any survey are the ability to obtain useful information from the questions asked and the length and complexity of the questionnaire. Using what Alwin (1992) calls "unfolding techniques," the survey was set up with the intent of separating attitude direction from attitude intensity. By using one question to determine a behavior or attitude and then another to find out how often a behavior is performed or the intensity of the attitude, it becomes easier to draw conclusions from the respondents' answers because the combination of aspects increases validity. With regard to survey length, Miller (1956) argues that the "span of absolute judgment and the span of immediate memory impose

severe limitations" on the reliability of lengthy survey interview scripts. With this in mind, our questionnaire was formulated so that the interviewee was able to complete it with little difficulty and in approximately five minutes. In summary, to design an effective survey the questions it contains must be clear, concise, valid, and reliable.

Our survey contains questions pertaining to each interviewee's demographics, behaviors, knowledge, and attitudes about their public water supply. We formatted these questions so we would obtain clear answers. This allowed the meaning of the response to easily be deduced therefore decreasing our interpretive error. It is extremely important to find the proper length and depth of the survey questionnaire in order to get reliable answers from the respondents (Alwin, 1992). The validity of our survey design depends upon the question relevance and formation.

3.3 Sample Size and Frame

A sample size of 400 residents to be randomly selected from the community at large was initially chosen for administering the survey when we were going to perform a simple random sample.

> "The margin of error for a sample of size of 400 is plus or minus 5%, with a confidence level of 95%. This means that, according to probability theory, 95 samples out of 100 of this size will produce estimates within 5% of the true population figure" (Blydenburgh, 2001).

With a city population of 172, 148 the large sample size would have given a relatively low standard error of 2.5% (Singleton, 1993 and U.S. Bureau of the Census 2000). A population the size of Worcester is considered an infinite population for statistical purposes (Singleton, 1993). This probability sample would have helped us to gather

data that reflects the range of attitudes' of current adult Worcester residents (18 and older), who use the Worcester public water supply (Singleton, 1993).

However due to time constraints we performed a convenience sample with a sample size of 169. Because we used a convenience sample, we were not able to perform the statistical analysis we originally planned but we generated graphs, charts, frequency tables and cross tabulation tables based on the data collected. To capture the average population we surveyed at different times of the day with weather permitting and during peak hours of operation. To ensure the best range we sampled on Monday, Tuesday, Thursday, and Friday, which happened to be the week of the Easter holiday. This sample reflected the attitude of Worcester residents, who are 18 years and older and were at those supermarkets during our sampling (See Figure 4 on pg 38).

3.3.1 Sample Location and Time

We conducted our community wide survey by approaching respondents at four local, highly trafficked supermarkets (ten different supermarkets were approached, but only four allowed us to survey at their stores). We decided that supermarkets were excellent sampling locations for our survey because of several reasons. First of all supermarkets have a wide geographic dispersion across the city. We obtained the addresses of all the supermarket chains in Worcester and then plotted them on a map of the city to choose the sampling locations with the best dispersion. To see a list and map of these supermarkets refer to Figure 4 (on pg 38). Secondly our sample had to contain a range of diverse ethnic and class backgrounds from the city's different neighborhoods. All social classes shop at supermarkets, especially in Worcester where

none of the major chains cater to specific social classes. Finally, supermarkets would allow us to approach a large number of respondents in a short amount of time because there is a nearly constant flow of customers. We were able to approach over 500 people at these supermarkets. This verifies that with our limited amount of time we were able to approach a large number of residents.

Our sample frame helped us to gather data that reflected the range of attitudes of current adult Worcester residents, who use Worcester's municipal water supply. The strength of a community wide survey lies in its ability to give quantifiable and reliable results. Each resident was approached by a member of the research team and asked if they would like to participate in the survey at the designated location. Since our survey was conducted in person the residents were able to visually see the questions and hear the questions being asked. If the residents did not understand a certain question, we were also able to explain it for more clarity. Through our research from the literature review, we found that people are more likely to participate and spend more time taking a survey when approached by a person rather than called on the telephone. Researchers found that people were more willing to do an in person survey because the people have more trust in the interviewer (Schuman, 1981). Also due to the complexity of some of the questions that contained multiple answers, the results received by a telephone survey might not have been reliable. These questions would have had to been simplified for a telephone survey, due to memory constraints of the respondent (Singleton, 1993).

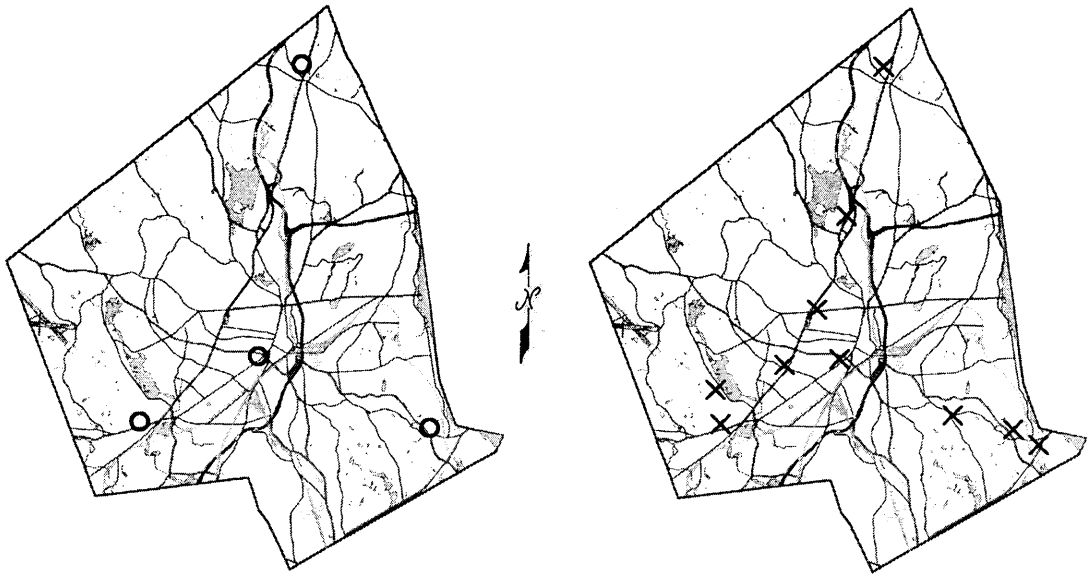
Another alternative that was not implemented was a focus group. A focus group based study was not an option because of the extensive resources needed to complete it

on a citywide scale. In order to get a representation of the city, many focus groups would have to be conducted. This is costly because an incentive would need to be given out to the participants. Time constraints must also be considered with focus groups due to the terms of WPI only consisting of 7 weeks. Also we would not obtain the large demographic dispersion of data that we were looking for, such as gender, age, and ethnicity. Finally the most important reason a focus group was not implemented was it produces qualitative results and we were looking for quantitative results that could be used to establish a database for the DPW (Berg, 2001).

We decided not to do a telephone survey for a number of reasons. Telephone surveys are the most widely used survey method in the United States because they cost less money than door-to-door surveys and they have a lower non-response bias than mail surveys (Singleton, 1993). Non-response bias refers to subjects in the sample population who either refuse to take a survey or answer a question and subjects who cannot be contacted (Holt, 1991). Both Singleton and Schuman agree that evidence points to a higher refusal rate with telephone surveys than with standard door-to-door survey techniques (Schuman, 1981). Although we are not doing a door-to-door survey, because of time constraints, we believe that the same reasons that lead people to refuse them less will be achieved with the face-to-face method of our survey. According to Holt and Elliot it is necessary to call back any one who you did not contact to reduce the non-response bias. "To minimize non-contact, survey organizations instruct interviewers to call back on selected households or individuals on a number of occasions, at different times and days of the week"(Holt, 1991).

We do not have enough time to call back all of the unanswered phone calls. People are also more impatient on the phone and are anxious for the interview to end (Schuman, 1981). It is difficult to obtain a random sample for a telephone survey without a random number dialer. In cities a significant number of residents are not listed in the phone book. Also the concentration of those with cell phones goes up. We considered but rejected the idea of doing a telephone survey because of the obstacles it imposed on our research. It is very difficult to do a telephone survey without acquiring a random number dialer and a list of all three digits that could begin a Worcester residential or cell phone listing. Lastly, many of our answers to our survey questions have a long list that would be difficult to use in a telephone survey. People have a limited memory and questions asked over the phone would have been lengthy making our "don't know" response bias higher.

Figure 4: Supermarkets in Worcester Area



Supermarkets Surveyed At

Santiagos on Main St.

Shaws on Stafford St.

Super Stop & Shop on W. Boylston St.

Super Stop & Shop on Grafton St.

Locations Visited

Price Chopper on Park Ave.

Price Chopper on Mill St.

Price Chopper on Sunderland Rd.

Big Y on May St.

Big Y on Sunderland Rd.

Shaws on W. Boylston St.

Shaws on Stafford St.

Super Stop & Shop on W. Boylston St.

Super Stop & Shop on Grafton St.

Santiagos on Main St.

4 Data Analysis

4.1 Introduction

For our data analysis, we examined the responses residents gave to the various questions on the survey. We analyzed the questions that were designed to determine attitudes to find out what residents think of their water. We then analyzed their behavior to see if their behavior matches their attitudes. We also looked at a number of relationships between the responses given to the demographics and perceptions questions. After reading all the data, we decided that charts and graphs were the best enhanced visual representation of our raw data. Using SPSS software we created a database containing the answers from the 169 surveys we collected. In the database, there were 169 rows, one representing each survey completed. Each column represents a question, and because of the multiple responses in our survey there were 85 columns in total. For each question asked, there were several possible responses. We made each response equal to a value, which we entered into columns in the database. The database enabled us to calculate percentages for each question. Finally, after entering all of the results into SPSS, frequency tables and cross tabulations were produced to show variations in attitude/perception and behavior measured by contingency factors from the demographics and knowledge data (Petruccelli, 1999). These results were turned into graphs using SPSS and Sigma Plot, which illustrate the relationships between attitude and other factors for the DPW.

We also used a map of the city of Worcester to try and locate problem areas of attitudes/perceptions of the respondents based on their geographical location in the city. On the maps we plotted where the residents, who took the survey, live in Worcester and

how they rated the water. We then color-coded the rating they gave the water on the map: yellow represents good, green represents neutral, and red represents bad. The municipal water system is very complicated it consists of pipes of different ages and sizes all dispersed throughout the city. It would be incredibly difficult to determine the exact flow pattern of water to a resident's home and due to the 7 week time frame it was impossible for our team to figure out the water pattern for each respondent. We focused on three locations in the city; one where the attitude was bad and two where the attitude was dispersed between good, bad, and neutral.

The problems that could be affecting the water quality are dead end pipes and unlined water mains. However, the water must also travel through the copper household pipes and there may be some problems that affect the quality of the water located in those pipes. While we have not determined the quality of household piping, some problems could exist there such as the metallic after taste many residents were concerned about. We focused primarily on changes that the DPW could make. We were not trying to find the solutions to problems contained within the residents' household.

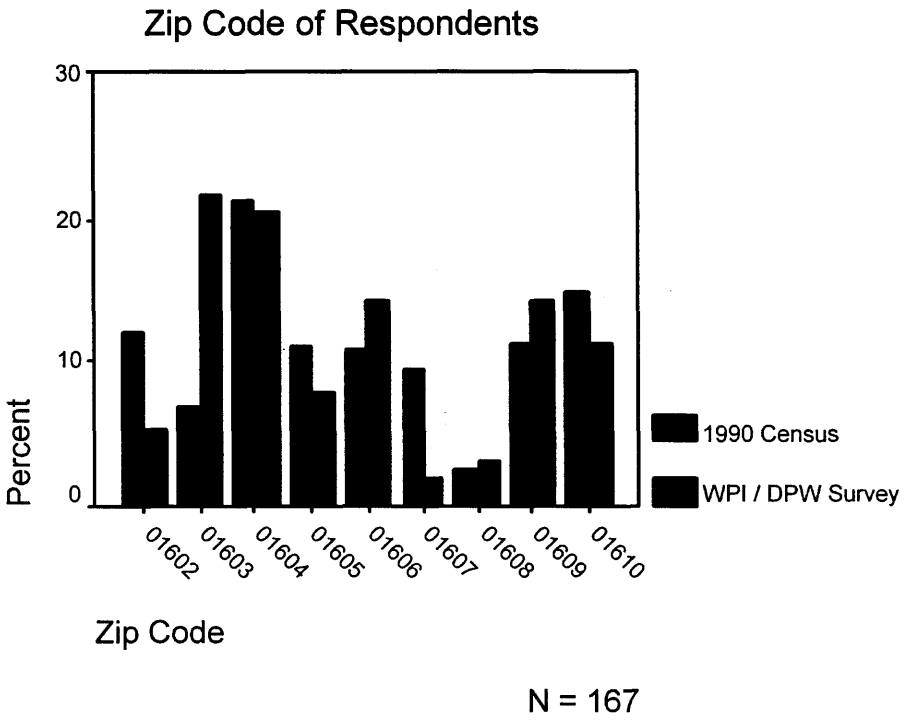
Through our survey we examined residents' attitudes and perceptions of the quality of Worcester's municipal water. We asked the respondents questions based on their behaviors regarding tap water because we wanted to determine if their behavior followed their attitude. The residents' perceptions should shape their behavior but we asked about their behavior to be sure that we did not make false assumptions. We also questioned them on the frequency of their habits. This helped our team distinguish how and why the residents used their water.

4.2 Graphs

4.2.1 Demographics

After collecting all of the surveys, we created a number of graphs comparing different demographic categories, such as age, gender, ethnicity, homeownership, and zip codes to Census data. The demographic questions we used in our survey to get all the information needed are located in section 1 and 5 of our survey (See Appendix E). We created visual representations comparing our data, the WPI/DPW Water Quality Survey, to the census data to show how closely our sample is representative of the entire population of Worcester. Contrasting our sample to the 1990 and 2000 Worcester census data helped support our sample as being representative of Worcester. As seen by figures A1 through A6 on the following pages, the gender, age, ethnicity, and homeownership distributions are very close to the actual population distributions found in Worcester. However our sample is not as representative for the geographical dispersion of residents in Worcester. Comparing our sample to data from the 1990 Census, the dispersion according to zip codes (see Figure A1) our sample is over representative of 01603, and underrepresented in 01602 and 01607.

Figure A1: Comparison of Zip Codes of Respondents

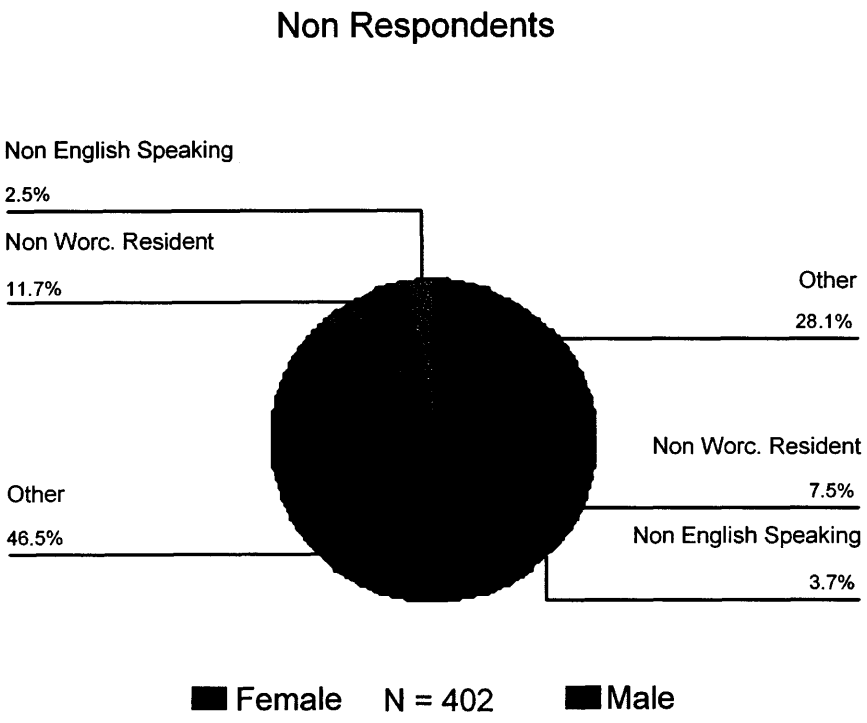


We believe that the uneven geographic distribution is due to our sampling technique. We were only allowed to conduct our survey at four of the ten major supermarkets locations in Worcester. We believe that we have an over representation of residents from 01603, because one of the supermarkets we surveyed at is in the center of 01603; while the majority of residents from 01602 and 01607 shop at supermarkets that we were not allowed to survey at.

Our sample represents 169 residents out of the 571 residents we approached; therefore our non response is 402 refusals. "Non-response bias is a very important component of survey bias. Response *rate* alone is not informative of the nature of response *bias* but it is indicative of the scope for bias." (Lynn, 1995) Due to our

surveying technique, we conducted a convenience sample not a random sample therefore we were able to calculate the non response rate, but not the non response bias.

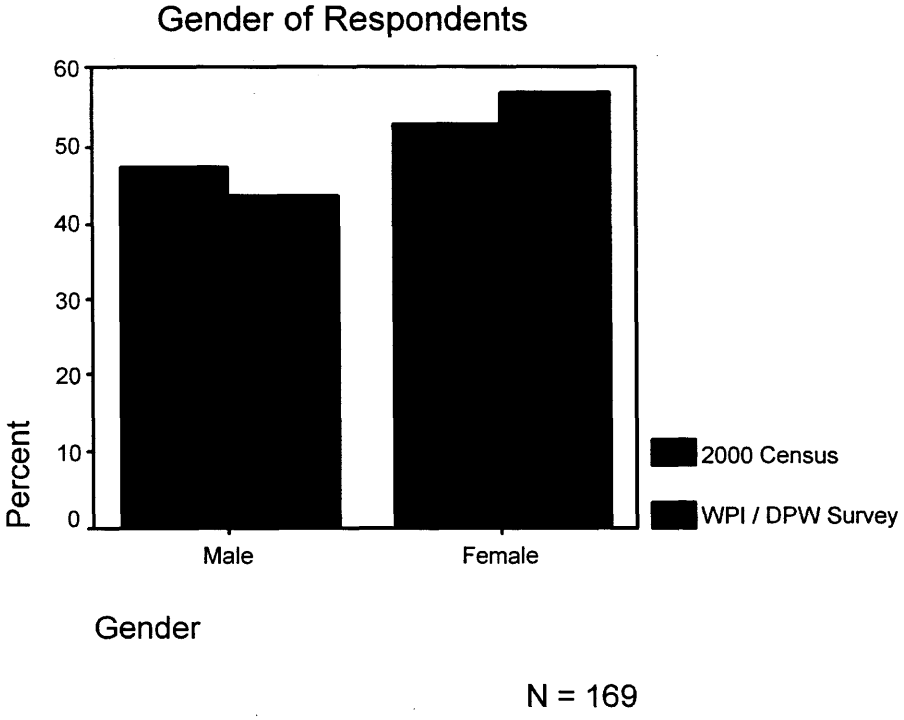
Figure A2: Non Respondent Analysis



Shown above in Figure A2 is a pie chart showing the non-respondents distribution based on their gender, their residence and the language barrier. Females make up 61% of the total non-respondents, while males make up 39% of the total non-respondents. This is close to the proportion of females and males who participated in the survey, 43% males and 57% females. Of the non-respondents, 4.1%of the females and 9.4% of males turned us down because of a language barrier. Another 19% of females and 19% of males turned our team down because they were not Worcester

residents. The remaining 77% of females and 71% of males turned our team down because they were in a hurry or did not want to participate. We did not interview people who lived outside of Worcester because they were not the focus of this study. We also decided that a translator was not essential to get the ethnic diversity we needed and because only a small fraction of the people we interviewed did not speak English.

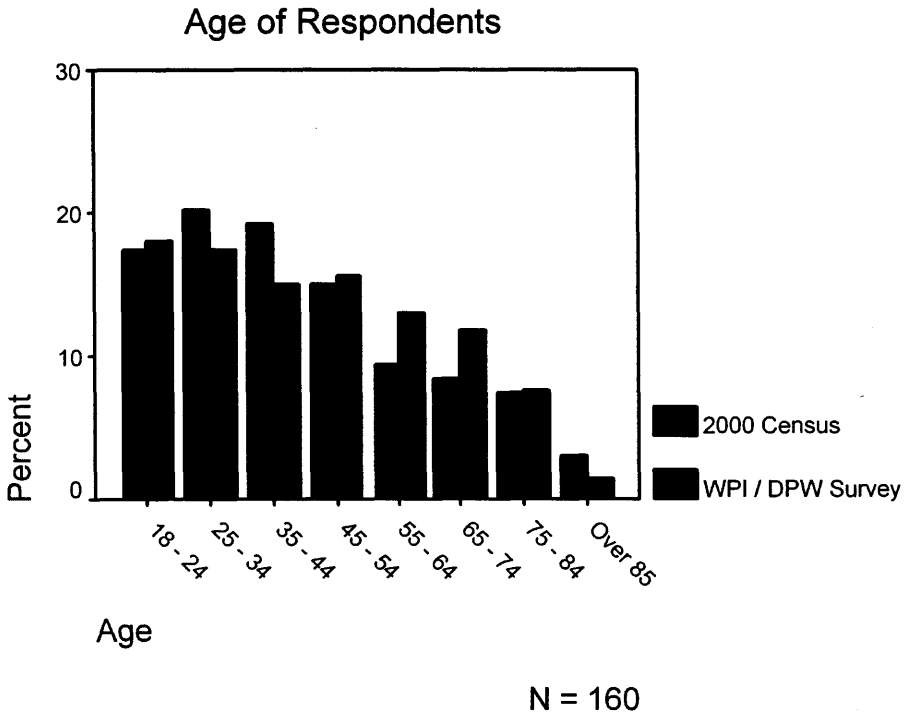
Figure A3: Comparison of the Gender of Respondents



We compared the gender of our respondents with the gender data from the 2000 Census. The results are show in figure A3. Shown in red is the dispersion of female and male residents that are over 18 years of age from the census, and shown in blue are the male and female respondents to our survey. In Worcester based on census data of residents 18 and older, the males of the city represent 47% of the population and

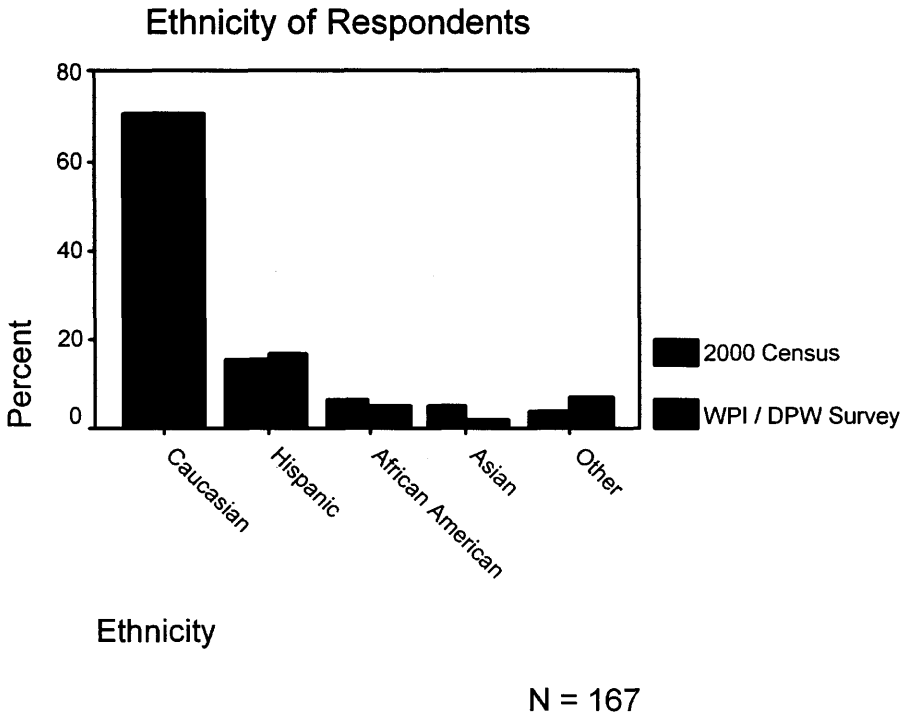
females represent the remaining 53% of the population. In our sample, 43% of the respondents were males and 57% of the respondents were females.

Figure A4: Comparison of the Age of Respondents



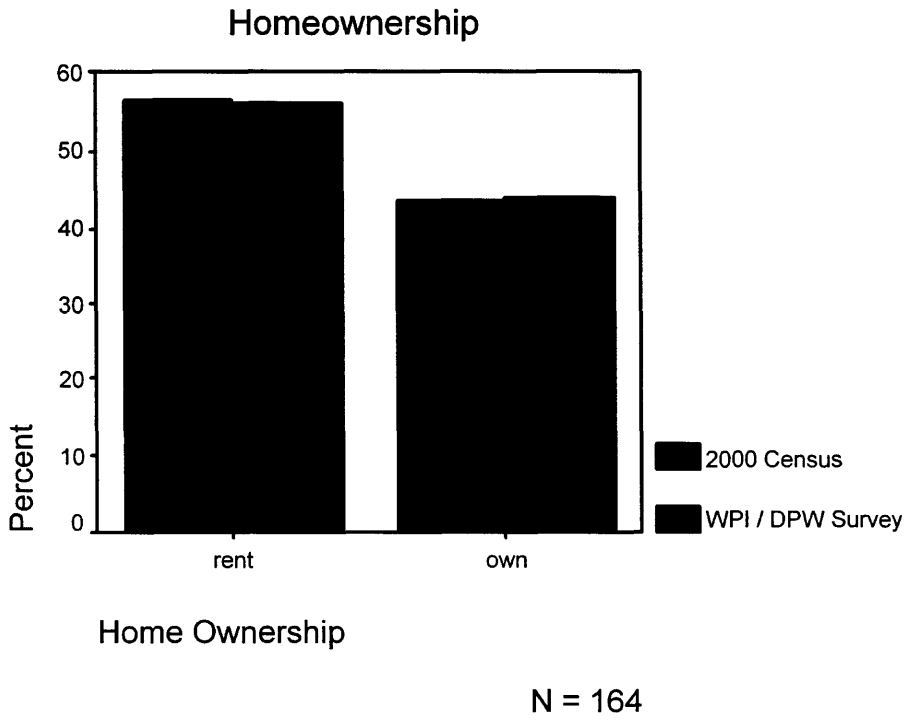
Next we compared the age of our respondents to the 2000 Census data, shown in figure A4. The graph illustrates that our sample encompassed the entire age distribution found in Worcester.

Figure A5: Comparison of the Ethnicity of Respondents



We also compared the Ethnicity of our sample to the ethnicity from the 2000 Census data of Worcester. Figure A5 illustrates the ethnic dispersion of Worcester residents from the Census data (red) compared to our study, WPI/DPW Water Quality Survey (blue). From the census data, Caucasian represents 70%, Latino/Spanish 16%, African American 7%, Asian 5% and Other as 7%. In our study we have representation of all the ethnic groups in Worcester: Caucasian 70%, Latino/ Spanish 16%, African American 5%, Asian 2% and Other as 7%.

Figure A6: Comparison of the Homeownership of Respondents



In comparing homeownership with the Census data, we found that our sample is a valid representation of Worcester, shown in figure A6. The census data from 2000 (red) has homeowners only representing 43% of Worcester's population and renters representing the remaining 57%. In our study (blue) we found that 55% of our respondents rent their homes and 43% own their homes. The homeownership data is valuable information and will be explained in further sections.

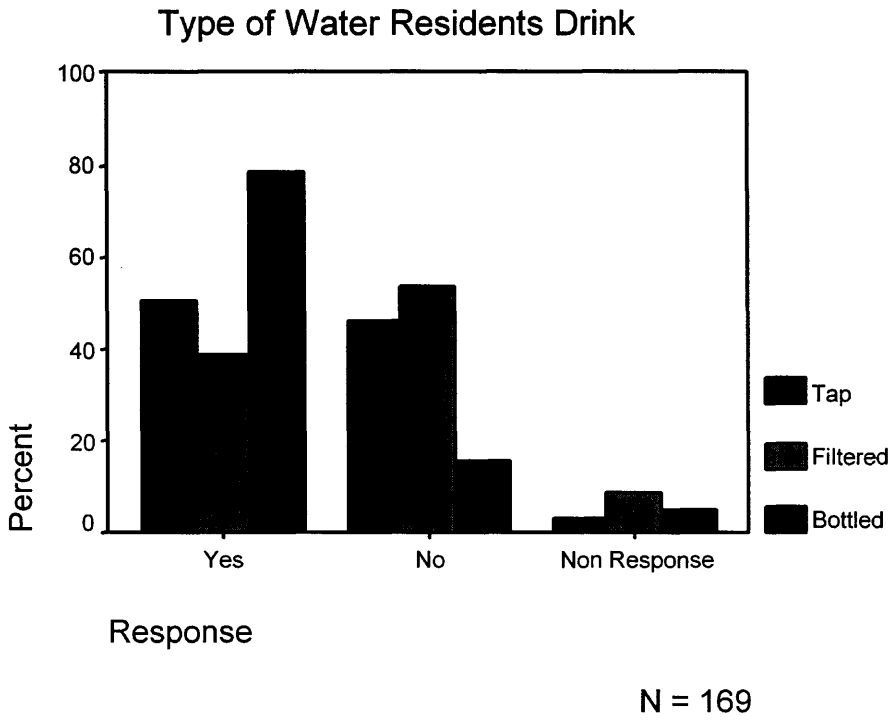
A lot of the demographic data we collected through our survey was compared to the1990 or 2000 census data to verify that our convenience sample is representative of Worcester as a whole. Given the 7 week time frame we could not collect an extensive sample of Worcester residents, but our 169 respondents reasonably represent

Worcester's population, with a similar distribution of gender, age, ethnicity, and homeownership.

4.2.2 Behaviors

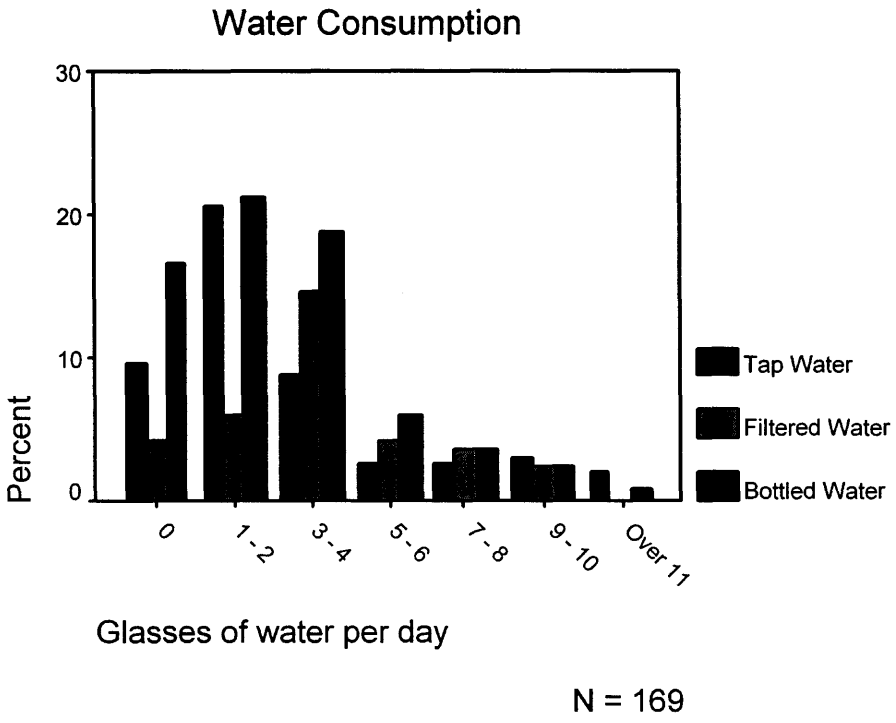
In order to distinguish between the resident's habits/behaviors and their perception, we asked them questions based on what they had done on the previous day. For example, question 3a from our survey, "Yesterday, how many times did you drink water from your faucet?" This type of question requires the respondent to recall specific information from the previous day therefore they are less likely to make up a number. Respondents have trouble recalling information that happens on a daily basis, therefore our survey needed to ask questions that make them recall a specific event that occurred recently (Singleton, 1993). Through a series of different questions asked in section 2 of the survey (See Appendix E) we established what type of water the residents drink and how many times a day they consume filtered, bottled and/or tap water. We also discovered specific reasons why the residents prefer one type of water compared to another.

Figure B1: Type of Water Residents Drink



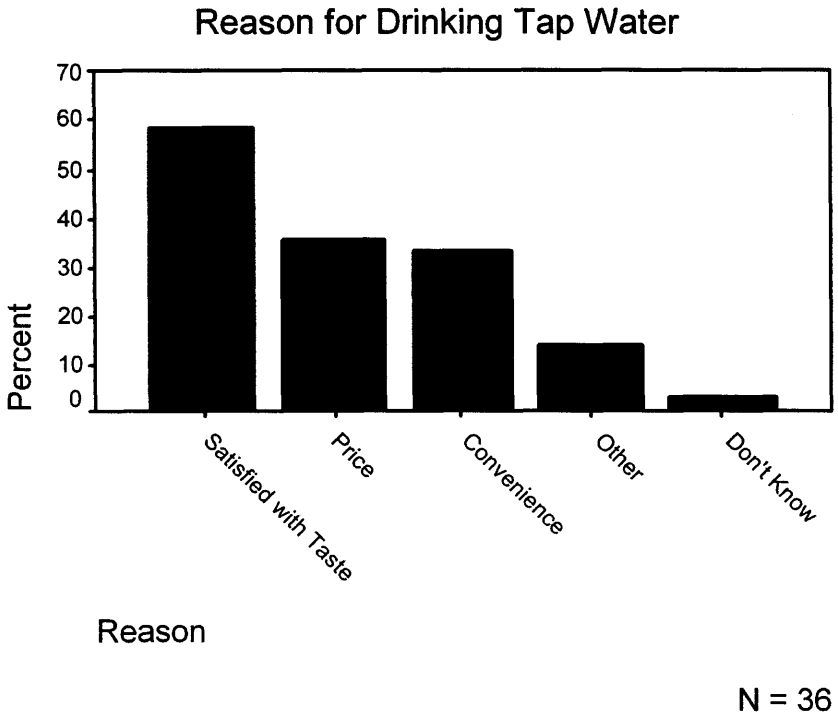
We examined what type of water resident's drink. In our survey we asked a series of yes/no questions on whether residents drink tap, filtered tap water, or bottled. The results are shown in figure B1. From the "yes" responses, people who said that they do drink that type of water, 51% drink tap water from their faucet, 39% filter their water, and 79% drink bottled water. In contrast, the "no" responses with 46% not drinking tap water from their faucets, 53% not filtering their water and only 15% not drinking bottled water. This data illustrates that residents generally drink bottled water more often than filtered or regular tap water. This is very important and will be elaborated on in the recommendations section (chapter 5).

Figure B2: How Much Water Residents Consume Per Day



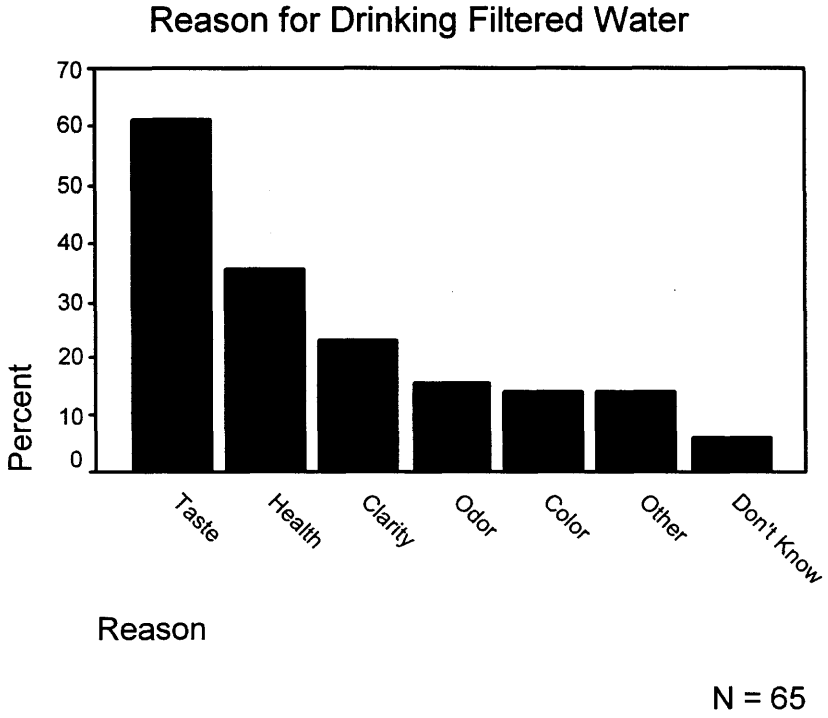
In our survey we asked some questions in a series for example this graph illustrates how many glasses (8ounces) of water per day the respondent drinks. To get this information, first we asked the residents what type of water they drink, and then we asked how much water they drank yesterday, to see if the responses coincide. Comparing figures B1 and B2, bottled water is more popular than tap or filtered water. More people said that they drink bottled water, seen in figure B1, and bottled water is the highest quantity in most of the categories in figure B2; demonstrating that the responses to the questions agree.

Figure B3: Reasons for Drinking Tap Water



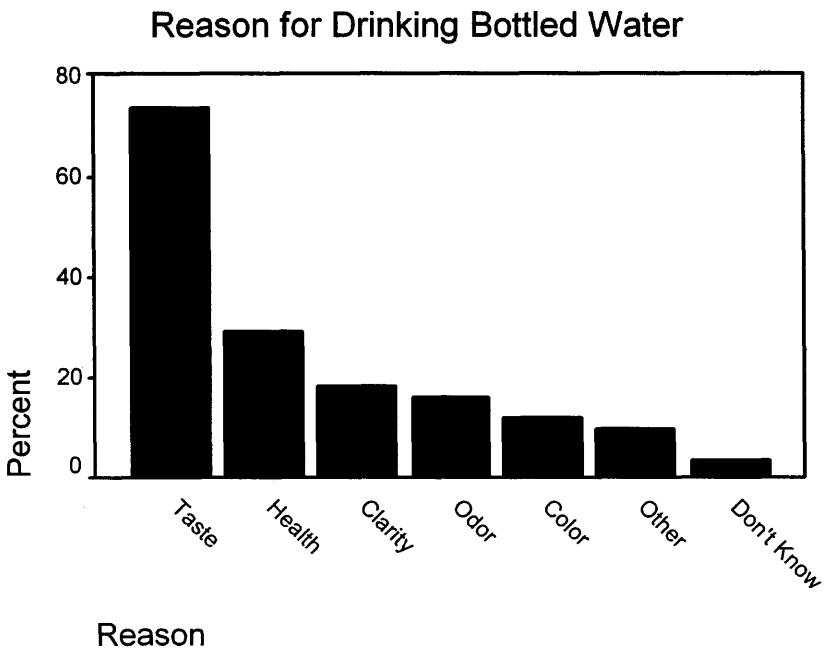
Then we asked the residents why they prefer to drink either tap, filtered, or bottled water. For each question, the residents were given a number of choices, and could answer as many as they wanted, including none. Therefore the percent does not add up to 100% for the responses to these questions. The choices given to the residents for tap water consumption are: convenience, satisfaction with taste, price, other, and don't know, see Figure B3. Satisfied with taste was the highest among all the responses with 58% of the residents. Price and convenience were next among the reasons with 39% and 33% respectively. Only 14% of the respondents had reasons other than the ones we listed.

Figure B4: Reasons for Drinking Filtered Water



We asked the residents why they filter their tap water. Again, we gave them a list of options to choose from: taste, clarity, color, odor, health, or other see Figure B4. 65% of the respondents filtered their water because of the taste of the water. 35% filtered their water because they believed there was a health risk associated with the water. 23% filtered their water because of the clarity of the water and approximately 14% filtered it for odor, color or other reasons not listed. This data helped our team to establish why the residents did not drink the water straight from the tap.

Figure B5: Reasons for Drinking Bottled Water



We then asked the residents who drink bottled water why they prefer to drink bottled water. Again we gave them the same options as residents who filtered their water: taste, health, clarity, odor, color, and other. The primary reason 73% of the respondent's preferred bottled water over tap water was because of the taste. The second most popular reason was health concerns with 30% of the respondents. The remaining respondent's preferred bottled water over tap water with 18% choosing clarity, 15% chose it because of odor, 12% because of color and 10% because of other reasons not listed.

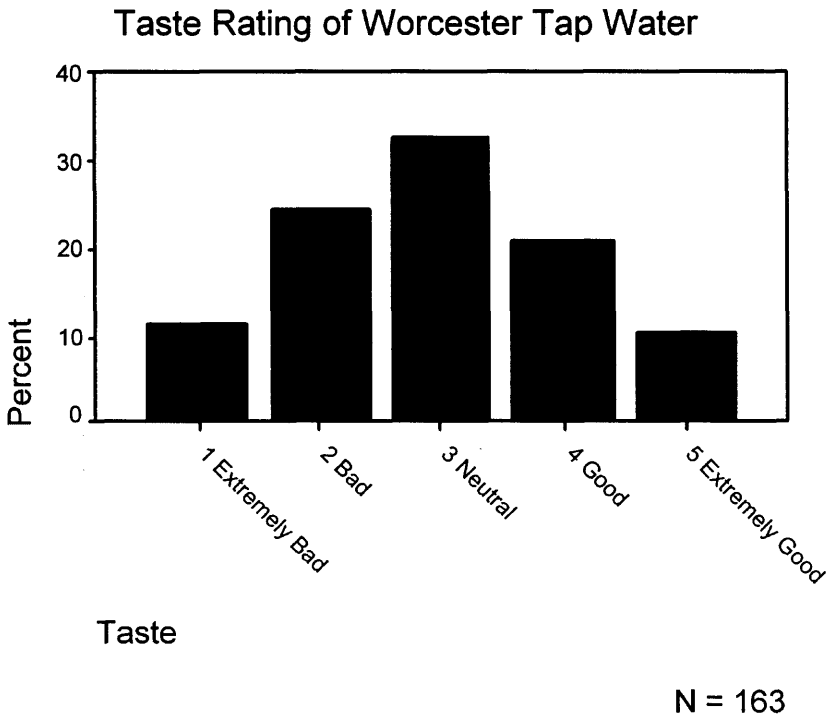
Among the 3 graphs showing reasons why people drink various types of water, taste is the predominate reason for each type of water consumption. Satisfaction with taste is the highest reason why people drink tap water. Taste is also the most important reasons why people drink filtered tap water or drink bottled water, with health being the

second most important reason. These findings coincide with our research of other water studies as explained in chapter two. The study conducted by Levallois, Grondin, and Gingras in Quebec during 1995 also concluded that taste was the most important reason for drinking bottled water. While health was the second most important reason for drinking bottled water (Levallois, 1999). Now that we have looked at the residents' behavior, the next section is going to focus on the graphs of residents' attitudes and perceptions.

4.2.3 Attitudes/ Perceptions

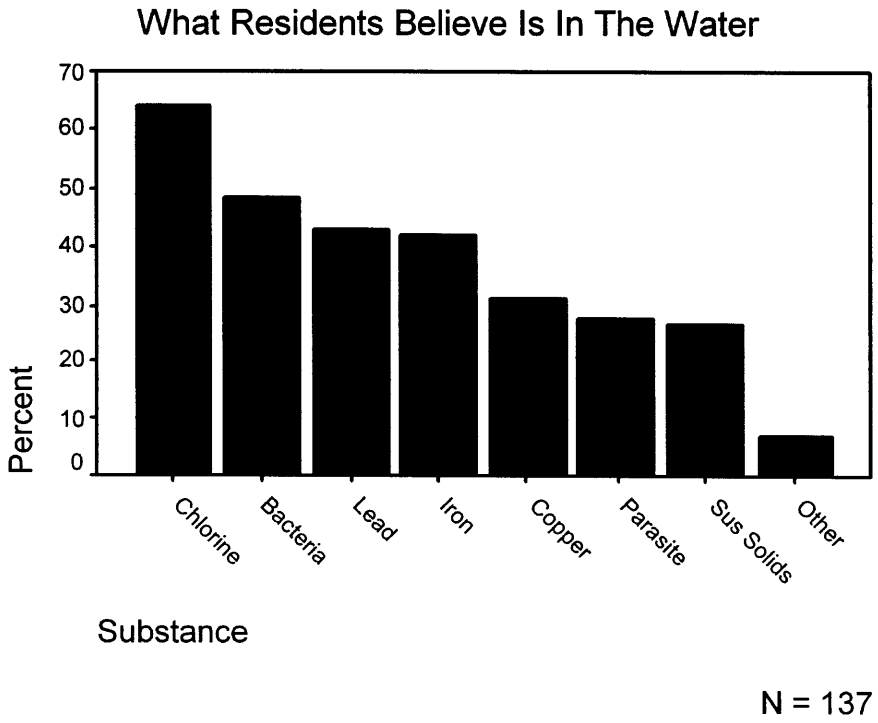
Once we determined the behaviors of the residents, we then needed to discover their attitudes and perceptions. What they think affects how they perceive the water and will also affect their usage of the water. For instance if they believe that the water is contaminated they are less likely to drink or use the water. In section 3 of our survey (see appendix for survey) we asked residents questions about their attitudes and perceptions of Worcester's municipal water quality.

Figure C1: Rate The Taste of Worcester Tap Water



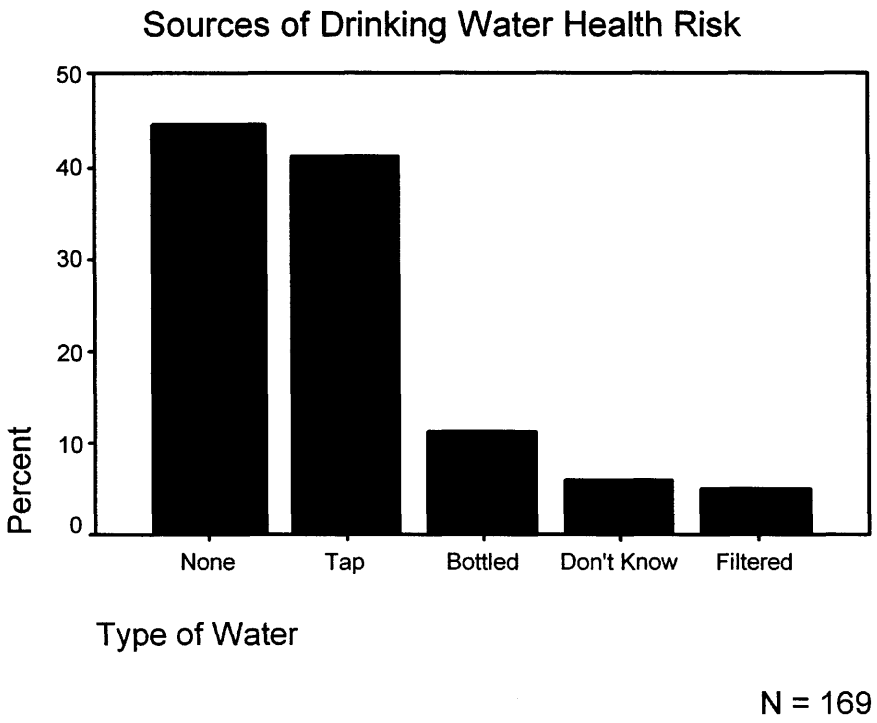
Out of the 163 residents that answered question 10 "rate the taste of your tap water..." from our survey, 32.5% rated the taste of the water as "neutral". 20.9% of the residents rated the taste of the water as "good" with 10.4% rating the taste of the water as "extremely good". In contrast to the 24.5% that rated the taste of the water as "bad" and the 11.7% who rated the water as "extremely bad" see Figure C1.The graph is symmetric around neutral, showing that there are approximately the same percentages of residents who do not like the water as there are residents who do like the water.

Figure C2: What Residents Believe is Contained in the Water



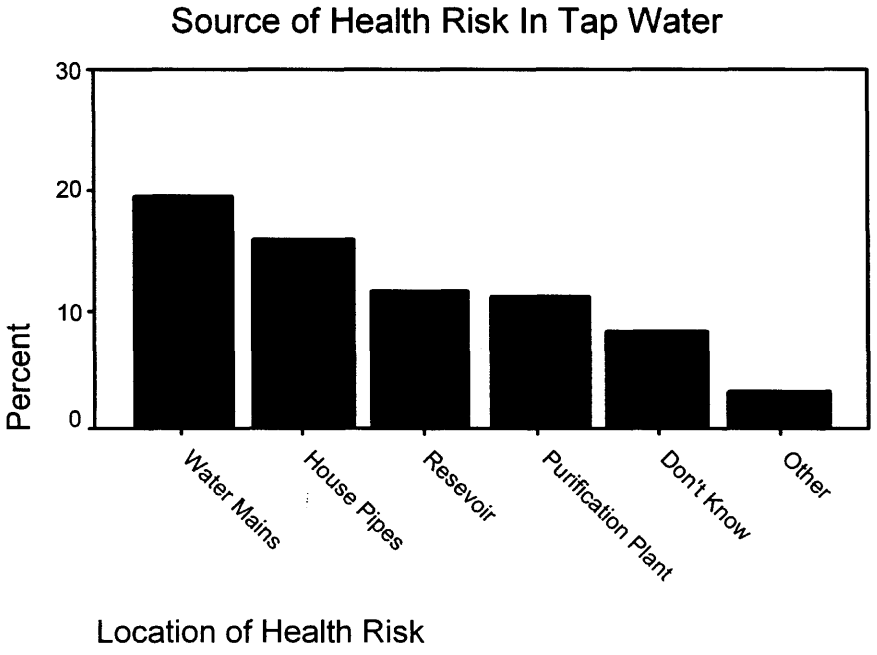
Then we needed to determine what the residents believed was in Worcester's municipal water supply (question 12). We gave them choices of substances we know have been or still are in the water (some in almost non-existent amounts) such as lead, copper, iron, and chlorine. Also we gave choices of substances that are not in the water or at least not in substantial amounts such as suspended solids, bacteria, and parasites. They were allowed to choose as many of the options as they wanted. The primary response to this question (question 12) was chlorine, which 52.1% of the respondents think is in the water. The other popular choices were bacteria with 39.1%, lead with 34.9%, and iron with 34.3%.

Figure C3: Where Residents Believe a Health Risk Posed, If Any



Next we determined what types of water residents believe are a health risk. We asked them to choose any or all of the choices given: tap water, filtered tap water, bottled water, or no health risk (none). Surprisingly 44% of the population believed that there was no health risk inherent in any of the choices. 41% believed that there is a health risk in drinking tap water. Of the residents that were surveyed, only 11% believe that bottled water poses a health risk. Even though bottled water has fewer and less strict regulations than municipal tap water.

Figure C4: Where Residents Think the Health Risk In Tap Water Is Located



If residents responded that there was a health risk in tap water, we asked a follow up question, "where is the health risk located"? Of the 70 respondents to this question, 20% chose the primary problem to be with the water mains, next were household pipes with 16% and then the reservoir and purification plant came close to each other with 12% and 11% respectively. This shows that the residents are somewhat informed of the problems because more the residents believe that there is a problem with the water mains than with the purification plant. In contrast, the AWWA findings from a national survey of how residents perceive their water, 36% believe that the greatest health risk comes from the purification plant, while only 13% believe that the greatest heath risk comes from the water distribution system (AWWA, 1993). Our results are almost exactly the opposite. Although our question (11a) asked residents "if

there is a health risk associated with tap water where in the system is it located?" (check all that apply), where the AWWA survey asked residents what was the greatest health risk (check only one).

In the AWWA survey, 13% of the respondents felt that the water distribution system was a health risk while 36% of the residents in our survey believed that the water mains and household pipes (the water distribution system) were a health risk. The water treatment method was thought to be a health risk to 34% of the AWWA survey respondents, while only 11% of the residents in our survey believed that the purification plant was a health risk. Also, water quality at the source (reservoir) was thought to be the greatest health risk by 34% of the respondents in the AWWA survey while in our survey only 12% of the respondents felt that the reservoir is a health risk. These percentages show that our respondents did not reflect the perceptions of the majority of the nation but reflected the problems that have been identified in Worcester.

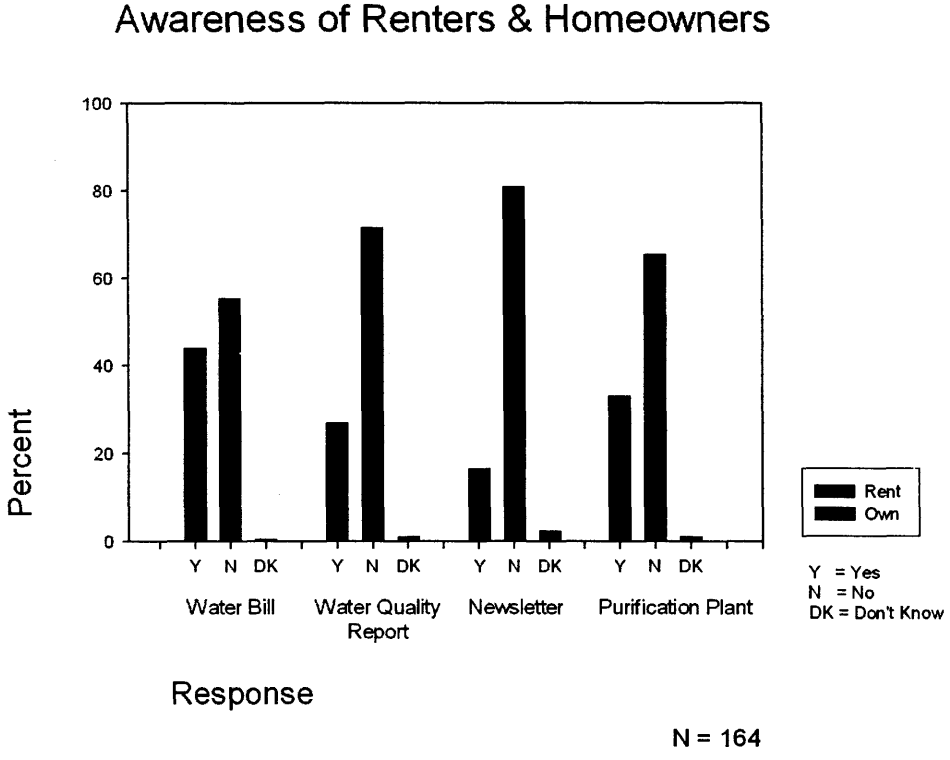
4.2.4 Awareness

We asked the respondents to the survey about their awareness of Worcester's purification plant and the information that is provided to residents by the DPW, the newsletter *On the Water Front* and the Water Quality Report. The newsletter is sent out quarterly with the water bill, and the Water Quality Report is sent out annually to the residents, who pay the water bill. Residents who rent their homes do not generally receive the water bill therefore they are less likely be aware that the newsletter even existed. This is supported by the graph in figure D1, almost all of the people that pay

the water bill are homeowners, and most the people that know about the newsletter are also homeowners.

The water quality report is also sent out by the DPW on a yearly basis, starting in1998; again this information is sent to people who pay their water bill, a majority of which are homeowners. This information is also available online on the DPW homepage which is linked to the City of Worcester homepage. Although we are not sure how many people are aware that those web pages even exist because we did not ask that question on our survey. Similar to the newsletter, a majority of the people who are aware of the Water Quality report are homeowners, and a majority of people who are not aware of it are renters (see figure D1).

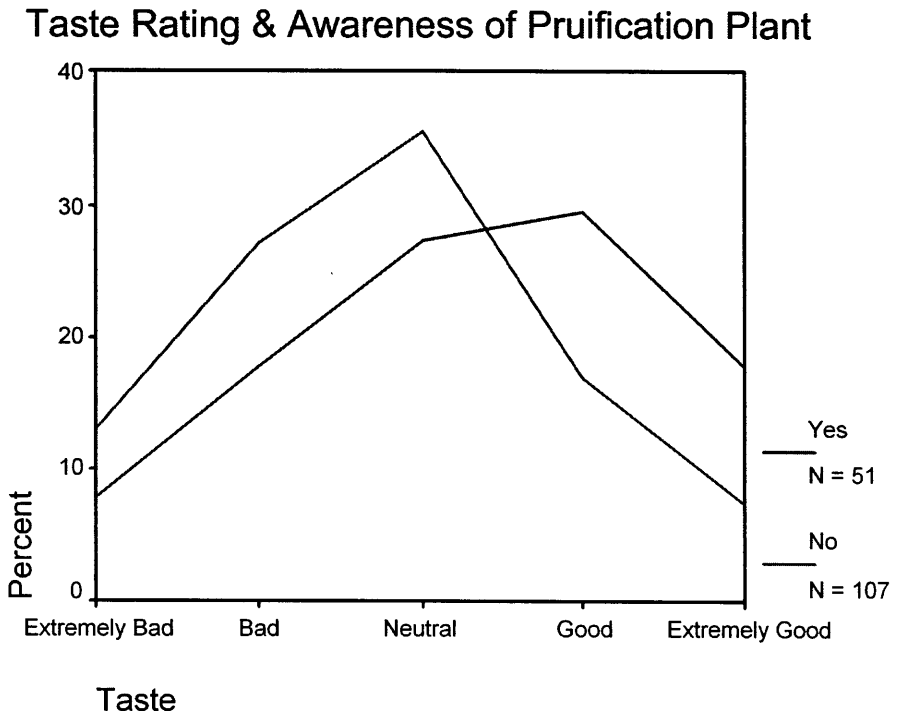
Figure D1: Awareness of Homeowners versus Renters



As seen in figure D1, there is a significant difference between the awareness of Worcester's Municipal Water Supply between residents who owned their own homes and those who rent. Of the 43% of people who owned their own homes (light blue), 51% knew about the water purification plant, 32% have seen the newsletter *On the Water Front,* and 42% have seen a *Water Quality Report.* In contrast to 54% of residents who rent their homes (dark blue), only 19 % knew of the water purification plant, 4% have seen the newsletter *On the Water Front,* and 15% have seen a Water Quality Report. This information demonstrates that not all the residents in Worcester are informed about the quality of the water or the improvements that have been made by building the purification plant. That generally, homeowners are more aware of the water system, and are more likely to have seen a Water Quality Report or seen the newsletter, *On the Water Front.*

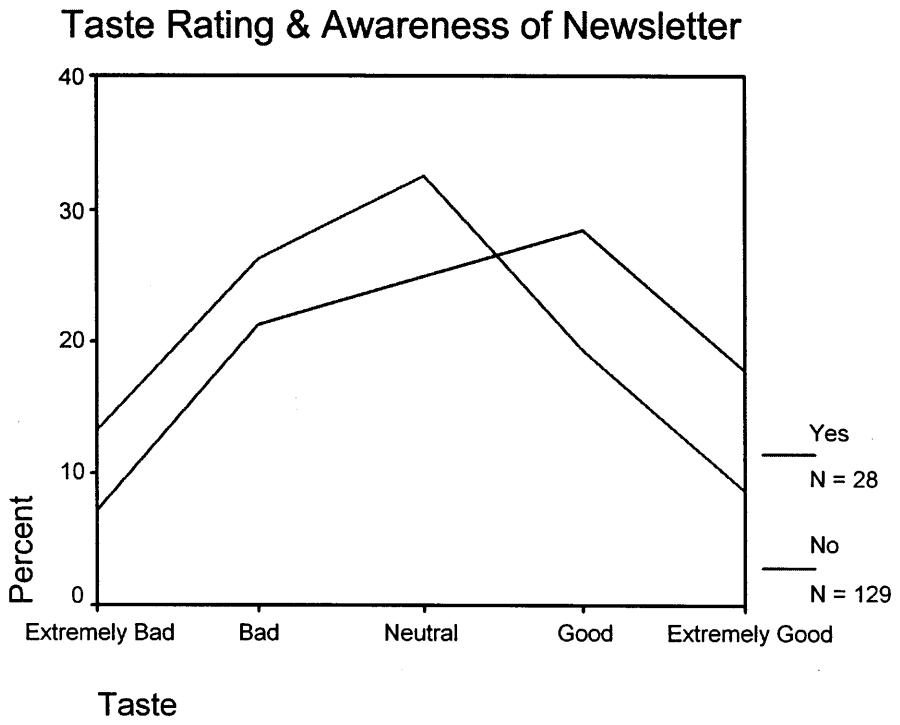
Next, we compared awareness with taste rating. We found that generally people who were more aware of the water system, know of the purification plant, or have seen the newsletter or a Water Quality Report, rate the taste of the water better. This can be seen in the next three graphs D2, D2, and D4.

Figure D2: Residents Taste Rating versus Their Knowledge of the Purification Plant



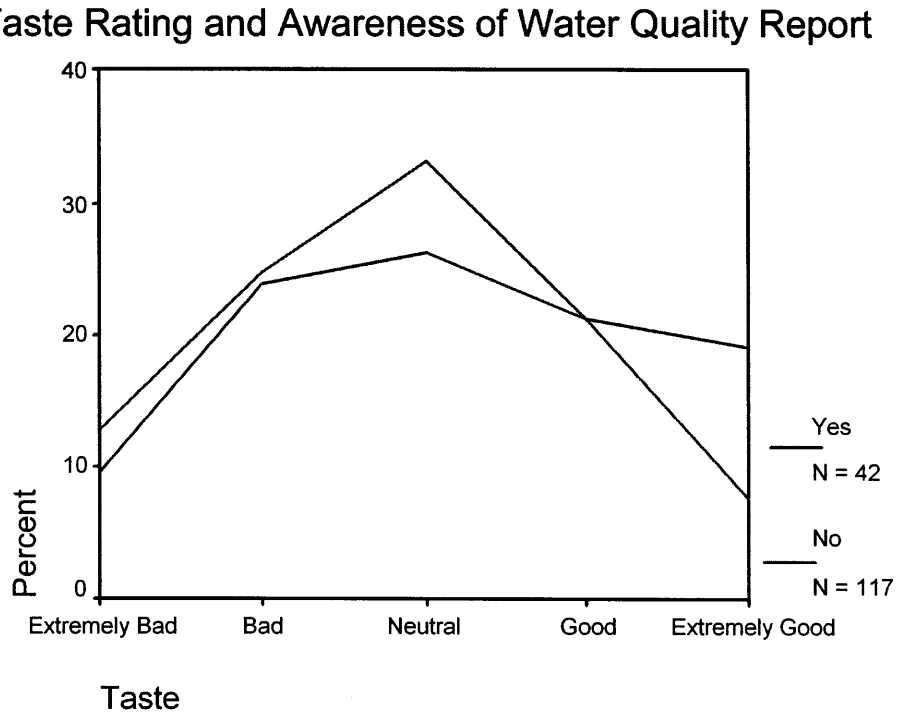
As seen in figure D2, people who are aware of the water purification plant generally rated the taste of the water better than people who are not aware of the purification plant. Of people who are aware of the plant, 47% rated the taste of the water as good or very good, while only 24% of the people that are not aware rated the taste of the water as good or very good.

Figure D3: Residents Taste Rating versus Their Awareness of the Newsletter



We also compared the taste rating with awareness of the newsletter, *On the Water Front*. The trend is similar to that of the relationship between awareness of the purification plant and taste rating. Residents who are aware of the newsletter generally rated the taste of the water better than those who are not aware of the newsletter. 46% of the resident who are aware of the newsletter rated the taste of the water as good or very good, while only 28% that are not aware rated the taste of the water as good or very good.

Figure D4: Residents Taste Rating versus Their Knowledge of the Water Quality Report

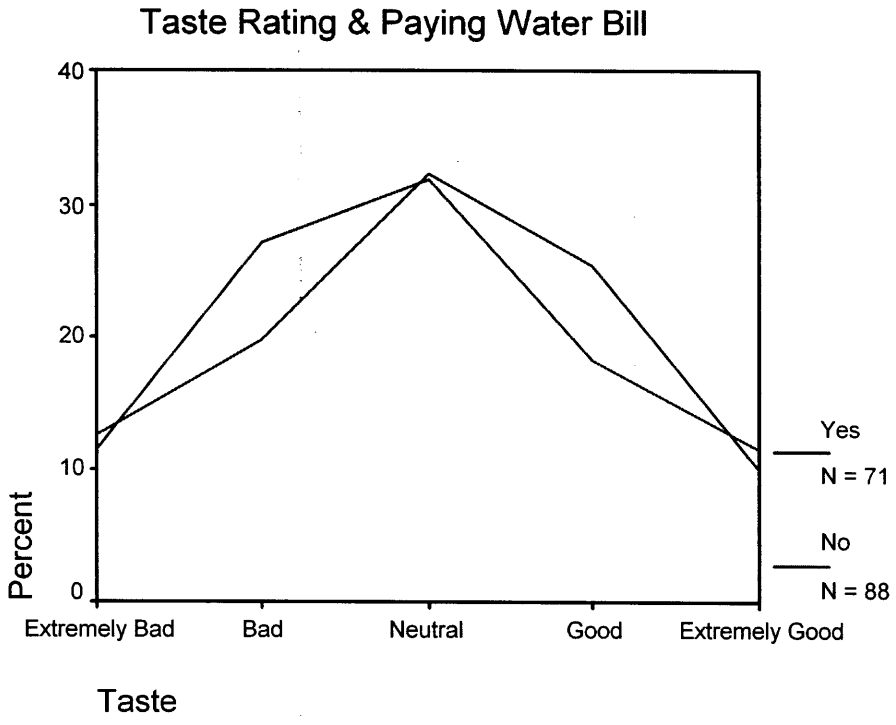


Finally, we compared the taste rating with the awareness of the water quality report. Again, we found that people are aware rated the taste of better. While the relationship isn't as strong as in the first two, awareness of the purification plant and newsletter, people who are aware still like the taste of the water better. With 40% of the residents who were aware rated the taste of the water as good or very good, and 29% of the residents who were not aware rated the taste of the water as good or very good.

The above three graphs show that there is a strong relationship between the residents' awareness and their perception of the water. Residents who are more aware of the water system, have seen a Water Quality Report, the newsletter *On the Water Front*, or are aware of the Purification Plant, rated the quality of the water higher than

those who were less aware. In contrast to the residents, who are not aware of the water system, generally do not like the taste of the water as much.

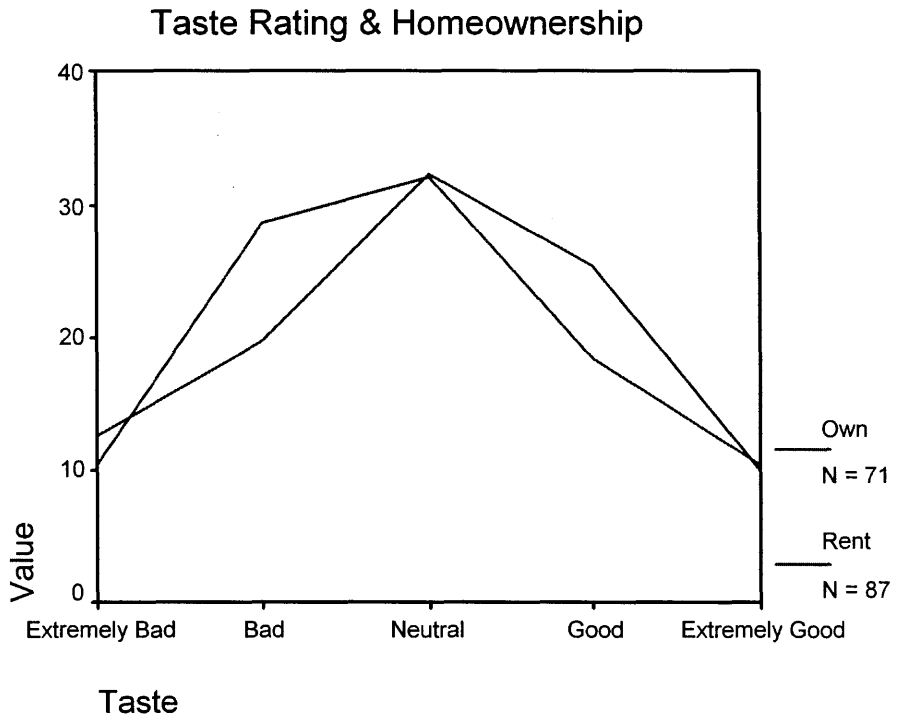
Figure D5: Residents Taste Rating versus Paying The Water Bill



Next we examined the relationship between homeownership, water bill payment, and rating the taste of the water. From our last conclusions we found that homeowners are more aware of the water system, and people who are more aware of the water system generally like the taste of the water more. Thus, we would expect that people who own their homes and pay the water bill to like their water more than those who do not own their home or do not pay the water bill. As seen in figure D5 and D6, this is not the case. Of people who pay the water bill, 35% rated the taste of the water as good or extremely good. While 30% of people who do not pay the water bill rated

the taste of the water as good or extremely good. Also, 35% of homeowners rated the taste of the water as good or very good whereas only 29% of the renters rated the taste of the water as good or very good.

Figure D6: Residents Taste Rating versus Homeownership

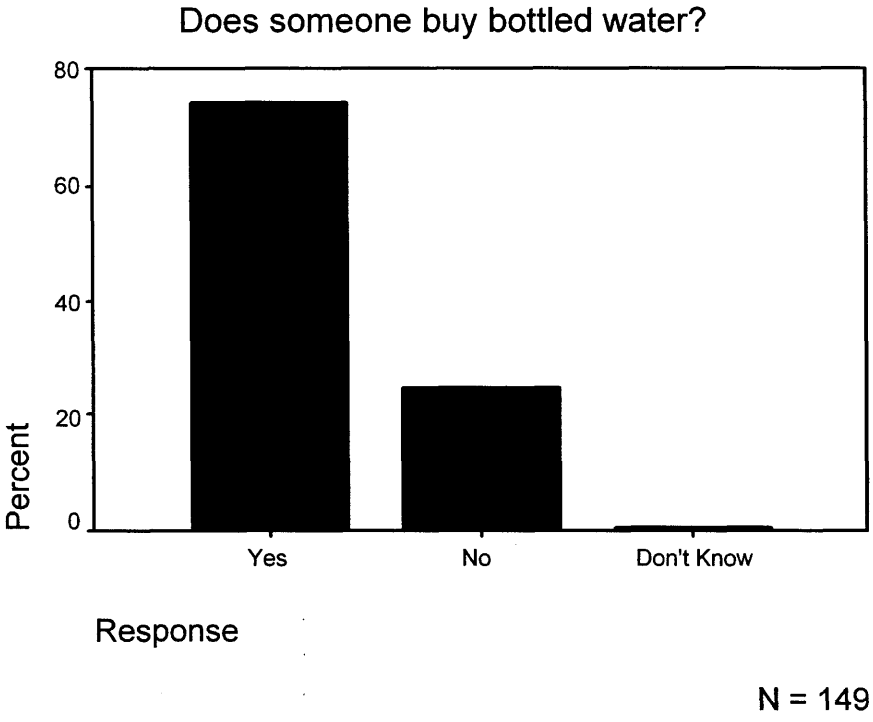


This almost seems to go against our first findings. However, from the homeownership and awareness relationship, only about half of the homeowners are aware of the purification plant or have seen a Water Quality Report. In contrast to the residents who rent, only15% and 20% were aware of the purification plant or have seen the Water Quality Report. The overall relationship, that homeowners like the taste of the water better than renters is very weak at best, and probably is not true.

4.2.5 Bottled Water

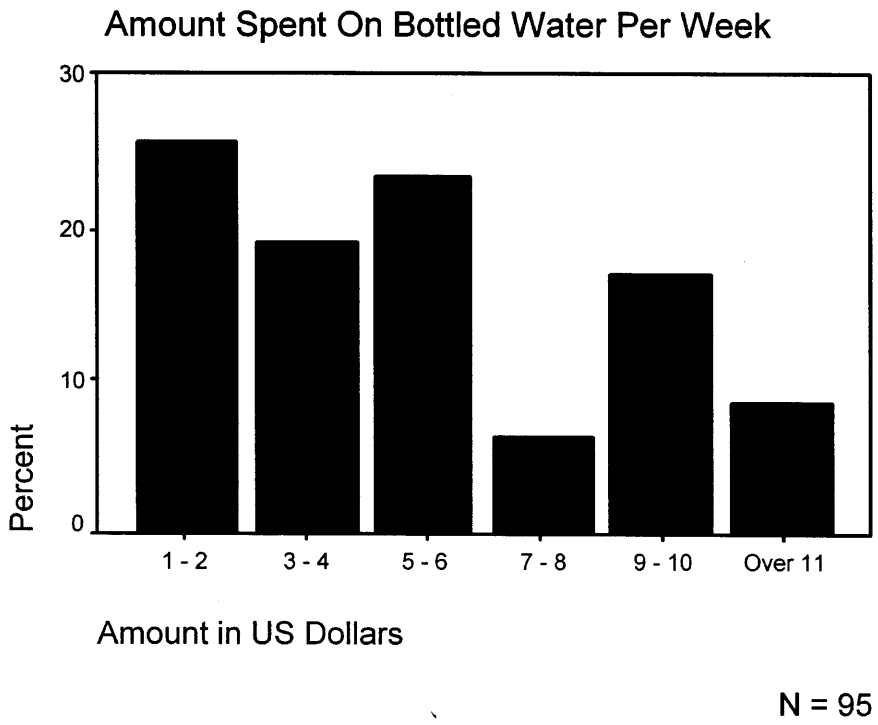
We specifically looked at bottled water behaviors and attitudes, in an effort to determine if Worcester could bottle and sell its water. We examined how many people buy bottled water, and how much they spend on it. We also looked at whether people would use free empty bottles, or whether they would purchase bottled water from Worcester's purification plant.

Figure E1: How many Worcester Residents Purchase Bottled Water



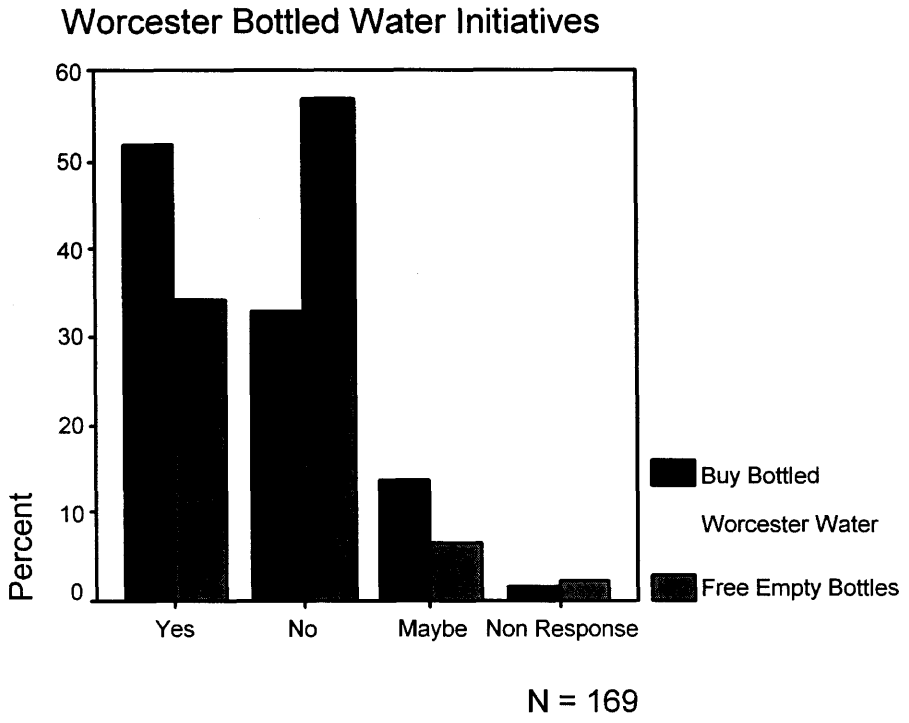
With this graph, Figure E1, our team was looking to establish what type of market for bottle water exists in Worcester. Illustrated in Figure E1, 75% of the residents we surveyed purchased bottled water and only 25% did not purchase bottled water. With approximately three quarters of the residents who responded buying bottled water, there is a market for bottled water in Worcester.

Figure E2: How Much Money Is Spent Per Week On Bottled Water



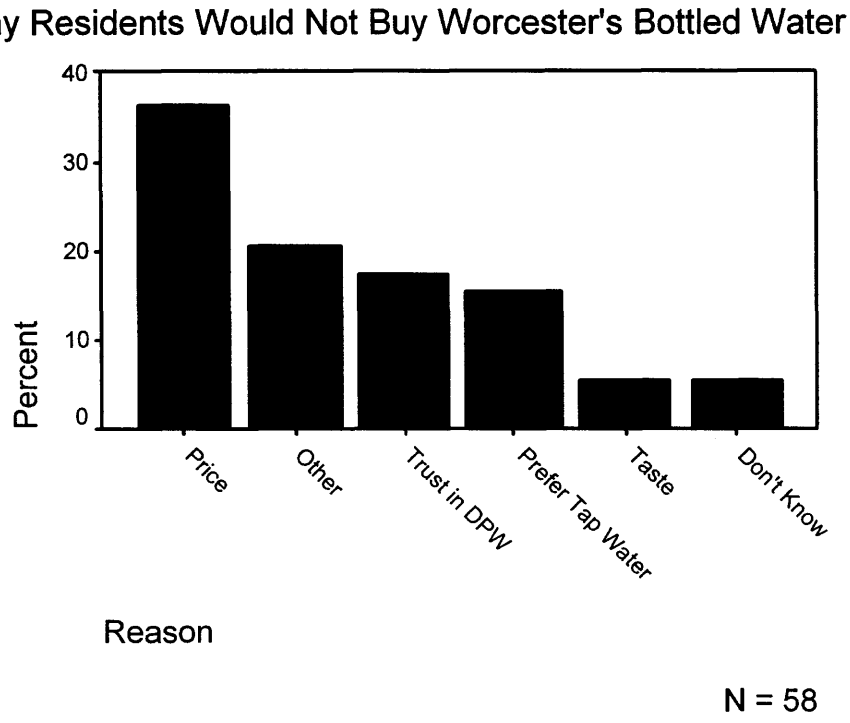
After asking whether the resident buys bottled water, we asked approximately how much is spent per week. In Figure E2, we graphed the amount of money Worcester residents spend on purchasing bottled water. The DPW would need to know what type of market they would have if they are going to continue with their bottled water campaign. This graph shows the distribution of the amount of money residents pay for their bottled water 25% are currently spending between $1-$2, 20% are currently spending$3-$4, 23% are currently spending $5-$6 then it drops down to 6% for $7-$8. 17% are currently spending between $9-$10, and only 8% of the respondents said they spend more than $11 per week. Of the 95 residents that responded, the average amount spent per household per week is about five dollars.

Figure E3: Worcester Water Initiatives



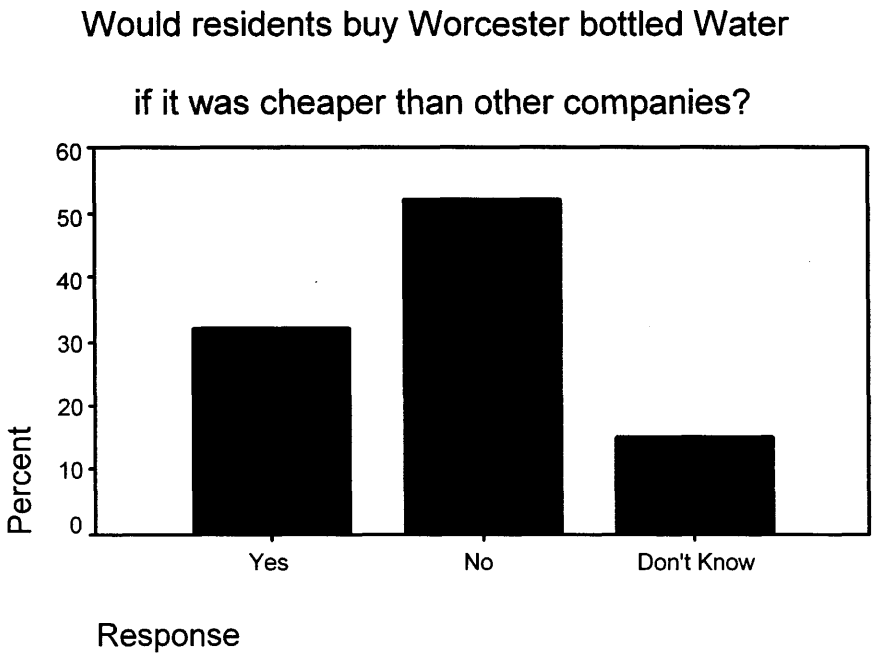
Next we examined whether Worcester could carry out a bottled water initiative. We were given two possible methods from the DPW at the beginning of our project. The first method would be to give out free empty bottles and encourage residents to fill them with tap water. The second method would be to bottle and sell Worcester water in and around Worcester. Figure E3 illustrates the attitudes that the residents have towards the two bottle water campaigns. As shown by the green bars, 58% of the residents were not interested in free empty bottles while only 34% were interested in using the free water bottles. However 52% of the residents said they would purchase Worcester's bottled water (red bars), while 33% of the residents said they would not purchase the Worcester's bottled water.

Figure E4: Why Residents Would not Buy Worcester's Bottled Water



For the residents who said that they would not purchase bottled water from the Worcester's purification plant, we asked the follow up question "why not?". Figure E4 illustrates why the 58 residents, who said no, would not be interested in purchasing Worcester's bottled water from the purification plant. 38% of the residents' primary concern was the price of the water. 21% were concerned with other issues that were not listed as options for them to pick. 18% of the residents would not purchase the water because of trust in public utilities, DPW. Only 16% of the residents preferred their tap water to purchasing bottled water. The remaining 10% was split evenly with 5% being concerned with the taste and 5% not knowing why they would not purchase Worcester's bottled water.

Figure E5: Would Residents Purchase the Water if it was Cheaper



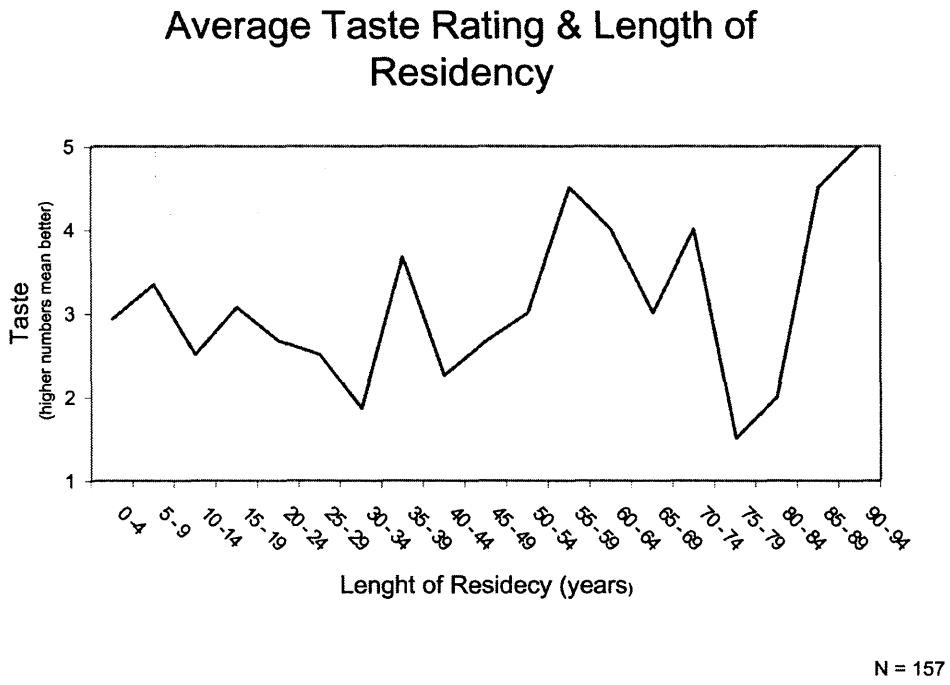
We also asked the residents who said that they would not purchase Worcester's bottled water, if they would purchase it if it was cheaper than other bottled water companies. As shown in figure 32% said "yes" they would purchase the bottled water if it was cheaper and 52% said "no" they would still not purchase the bottled water if it was cheaper. Still 15% did not know if they would purchase the water if it was cheaper. If Worcester bottled and sold its water, and if it was cheaper than other companies, then 65% of the residents we survey, would purchase it.

4.2.6 Hypothesized Relationships

Not only is it important to explain the relationships that we discovered exist through trends in our data, but also the hypotheses that we tested and discover do not

exist. Some of these hypotheses were made based on observations determined by other studies while researching for the literature review. The rest of the hypotheses were unique to our project, such as the relationship between geographical location and taste. The next series of graphs illustrate the null hypothesizes found in our study.

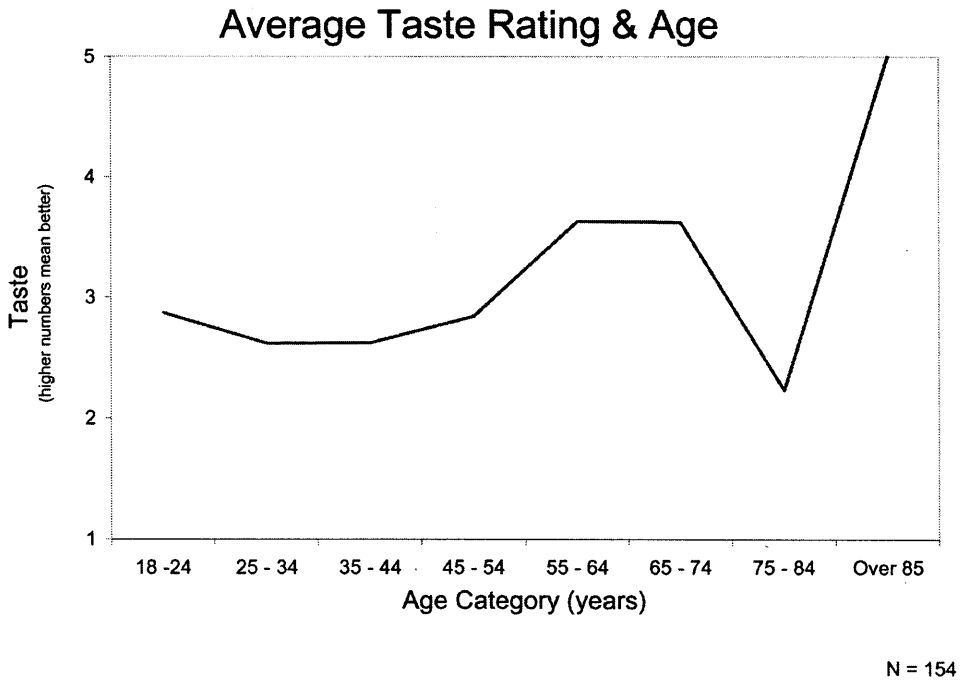
Figure F1: Taste Rating Versus the Length of Residency



We hypothesized that a relationship existed between residents who had lived in Worcester before the purification plant went online, and those that had a "bad" perception of the water because of all the problems encountered prior to the purification plant being built in 1997. We examined this hypothesis by plotting the average taste rating for each group, shown in Figure E1. We expected to find that residents, who have lived here longer, rated the water lower than the newer residents. This would be due to the fact that Worcester had many water quality issues back in the late 1970's and

early 1980's. However, after examining Figure F1, there was no observable relationship.

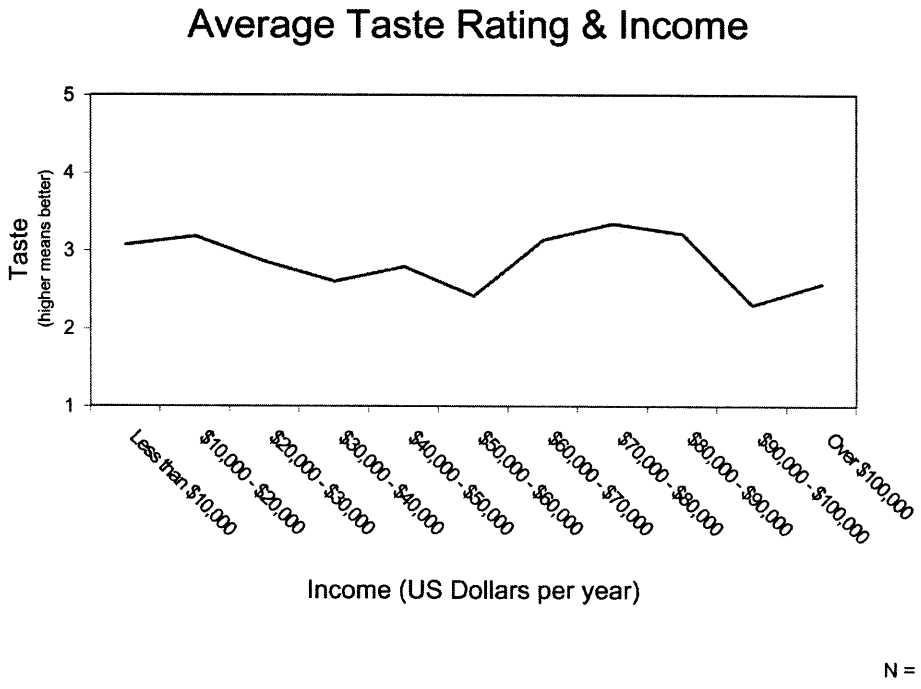
Figure F2: Average Taste Rating & Age



Another hypothesis that showed no relationship was the age of the respondents versus how they rated the taste of the water. At first it appears that older residents rated the taste of the water better that younger residents. However, each point on the graph is an average of all the residents in that category therefore each point represents a different number of residents. For example the last half of the graph, 55 and over only represents 30% of the population and the last point, over 85 is only 2 residents. Therefore because the older portion of the graph is made up of fewer residents and

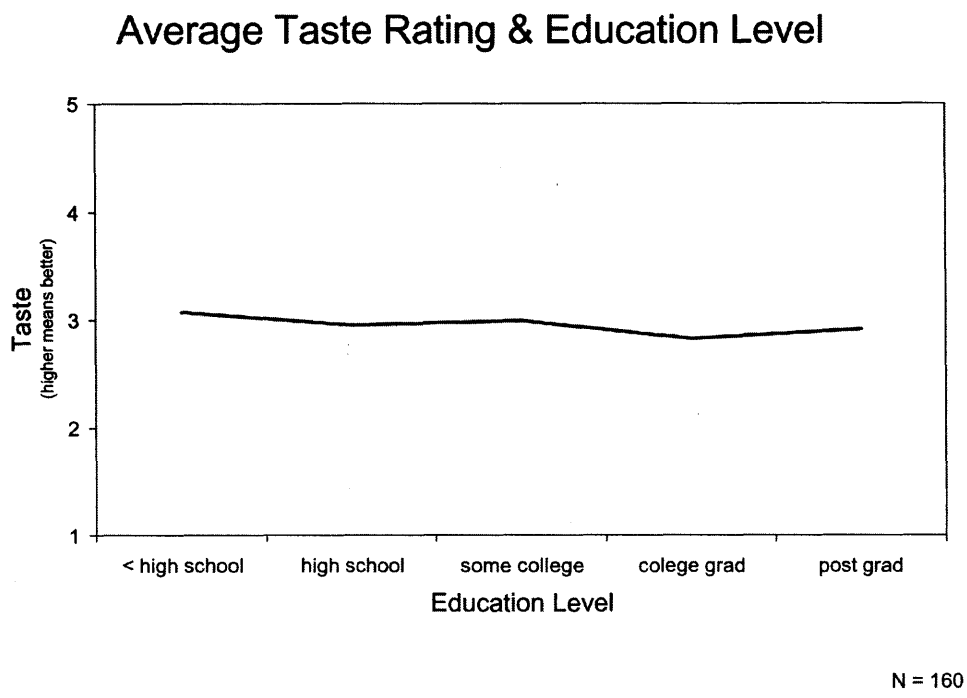
because our sampling technique was not random, we do not believe that the trend seen in the graph is strong enough to justify a definite relationship.

Figure F3: Average Taste Rating & Income



Next, we analyzed the relationship between income and taste rating. Seen in Figure F3, the average taste rating for each income group is approximately 3, or neutral. There is no discernable relationship between income and taste rating.

Figure F4: Average Taste Rating & Level of Education



We also looked at the average taste rating, and the level of education of the respondents. As seen in Figure F4, the line is flat, indicates that there is no relationship between education and taste rating.

Finally to integrate society with technology our team looked at the water mains and dead end pipes of Worcester. We hypothesized that the water mains could be contributing to resident's rating of the water. If residents live in an area where the water mains are excessively old and a build up of rust and minerals on the walls, or dead end pipes with very little water flow, then the quality of their water could be affected. Examples of problems the residents might encounter because of the water mains are: rust in their water, a metallic taste, low water pressure, or even stagnant water. However after our team plotted the ratings the residents gave the water on a road map of Worcester we did not discover a relationship. For example, respondents who lived

on the same road as another respondent gave the water opposite ratings on the survey on seen in Figure F5 and F6. Therefore the inconsistency of the ratings assigned by the residents made it harder to determine if a relationship existed between the quality of the water and the location of the residents in the city.

Figure F5: Worcester Map with Residents Taste Rating and Residency Plotted

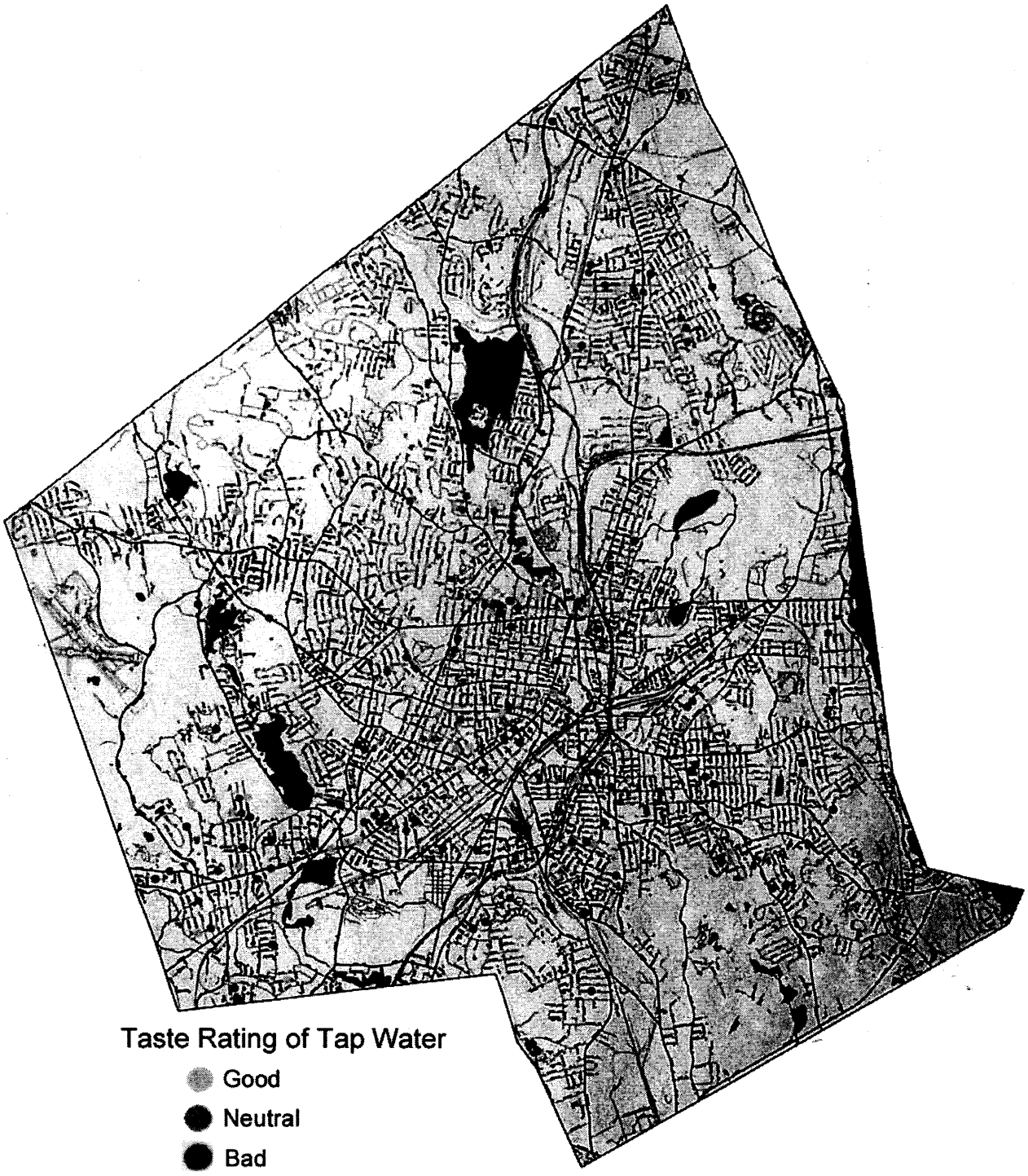
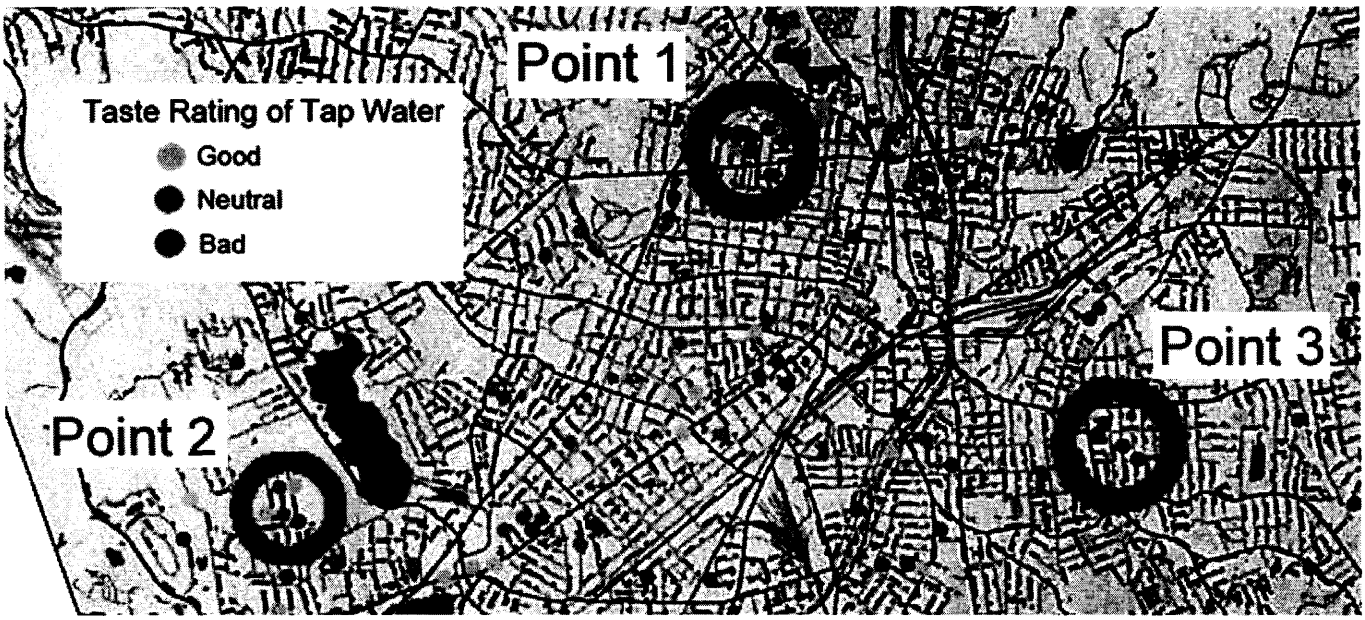


Figure F6: Close Up of Three Points On Taste Rating and Residency Map



Above, Figure F6, is an example of a cross section of the Worcester map we used to plot the location of the residents and the rate they assigned the water. Since we were unable to investigate the quality of all the water mains for each resident of our survey due to time, we decided to choose three points in the city to look at. We used maps from the DPW to determine the condition of the water mains. From 1860-1973 the city of Worcester used cast iron pipes which are not cemented. From 1973-present the city of Worcester has used and continues to use ductile iron pipes that are all cement lined.

The points on the map above (Figure F6) refer to different zip codes in the city and contain an assortment of attitudes for each point. For example point one refers to the zip code area 01609, where there are a variety of different opinions for the taste:

three good (yellow), three bad (red) and two neutral (green). We investigated the quality of the water mains on the roads that our respondents live on. We found that on Institute Road where there were two bad rates, the water mains have been cleaned and recently replaced (See Appendix I). In contrast to Einhorn Road where the water mains date back to 1899 and 1900 and the residents rated the quality of water as "good". These pipes are most likely tuberculated, that is the walls of the water mains are encrusted with rust and mineral deposits, yet the residents like the quality of the water. Institute Road, where the residents are not satisfied with the quality of water, has all new water mains with the oldest dating back to 1996. From these examples it is evident that there is no relationship between the rate the residents gave to the quality of water and the location of the resident in the city. To see the list of roads and dates of the water mains of all the other points see appendix I.

Our survey reached 169 residents of Worcester and through trends discovered in our data we have found relationships between data and have also found that some relationships do not exist. However, if more extensive data was collected and analyzed, hypotheses our team found to not exist may be found to exist. The WPI / DPW Water Quality Survey is only a scratch on the surface. From the data we collected and analyzed, the DPW could hire another consulting firm, an IQP team, or even an MQP team to come in and investigate any of the issues we have been able to bring to their attention through our project. The following chapter will discuss all of the recommendations we have been able to make based on the data analysis.

5 Conclusions

5.1 Introduction

Now that we have completed entering the raw data into a database and analyzing it by generating graphs, cross tabulations, and frequency charts, we are prepared to make recommendations to the DPW. We will use the graphs from our data analysis to support our recommendations for initiatives that the DPW could launch. We will also make recommendations for future groups based on the difficulties encountered throughout the course of our project. Difficulties such as the length of our survey being six pages discouraged some residents from participating in the survey. We also encountered problems when trying to map out the city's water mains without a database of their locations. Finally inexperience with the software and incompatibility between software packages created some more difficulties. However like anything in life, learning from errors and improving on strategy helps to eliminate further issues. In the following sections we have provided recommendations for the DPW, future project ideas, and also some recommendations to help avoid problems.

5.2 Recommendations to DPW

5.3.1 Improving Residents Awareness

Improving residents' awareness and understanding of the purification plant and water system is what we are recommending be the major marketing strategy for improving the attitudes and perceptions of Worcester residents. The dissemination of clear and easy to understand information is very important to the success of an attitude and perception campaign. The city has tried to increase public awareness of the water

quality with a newsletter, *On The Water Front,* and the Water Quality Report. However one issue that the city needs to address is providing all residents with information on the Worcester municipal water supply. Approximately 56% of Worcester's residents do not receive these documents because they rent their homes and they do not pay their water bill (See Figure D1 on pg 60). The newsletter *On The Water Front* is sent out quarterly with the water bill and the Water Quality Report is sent out yearly to the same residents. As illustrated in the data analysis section (chapter 4) with graphs on page 60, 56% of the people we surveyed rented their homes, and of the renters 85% have never seen a water quality report and 95% have not seen the newsletter. The information that is provided in these documents is helpful to residents, who may be unaware of the DPW's ongoing work to provide the city with improved water quality.

Therefore based on the trends discovered in our data analysis section (See Section 4.2.4), we have concluded that it would be beneficial for the city to mail out the newsletter and the Water Quality Report to every household in Worcester. However, there is no guarantee that sending out the information to all the residents will positively affect the attitudes and perceptions of the residents. Some of the residents we surveyed vocalized to our team that they do not read the newsletter they receive. To diminish the occurrence of residents ignoring the information provided in the newsletter the format of the newsletter may need to be improved. The newsletter must be clear, concise, and to the point. It must be presented in an easily understandable format that is not confusing to the residents and would not discourage them from reading it. To conclude the newsletter is a valuable tool that the DPW can use to communicate with the

residents. However the newsletter would be more beneficial, if it were formatted properly and easier to comprehend.

5.2.2 Water Pride Campaign

During our first meeting Robert L. Moylan, the Commissioner of the DPW, and Philip D. Guerin, Water Resources Coordinator mentioned to our team that the DPW was interested in a bottled water campaign that promoted pride in Worcester's water. With this water campaign in mind, we asked the residents during our survey their perception towards two different campaign methods that could help expand DPW public relations. The first method would be to hand out free water bottles (comparable to a 20 ounce Poland Springs bottle) each bottle would be labeled with a Worcester water pride sticker. The residents would fill these water bottles with their tap water. The second campaign method would entice residents to purchase bottled water that came from Worcester's purification plant. The bottles would again be comparable to a 20 ounce Poland Spring water bottle and would come with a sports cap. They would be labeled with a sticker that has a catchy graphic design and states that the water comes from Worcester's purification plant.

We discovered that many of the Worcester residents we surveyed would purchase water bottled by the city. As discussed in the data analysis 51% said yes they would purchase Worcester bottled water from the purification plant whereas only 34% said yes to the free bottle campaign. Also 56% of the residents surveyed said no, they would not use the free bottles in contrast to the 33% who said no, they would not purchase the bottled water from the purification plant (See Figure E3 on pg 69).

We concluded from this information that giving away free bottles to the residents that they would fill with tap water would not be a successful way to promote Worcester's water. Therefore based on the percentages of the residents we surveyed, the method that we believe that would work most effectively for the DPW's Worcester water pride campaign would be to market bottled water that came directly from the purification plant (See Figure E3 on pg 69).

However prior to starting the bottled water initiative, the DPW might want to hand out free samples of the bottled water from the purification plant at outdoor festivals and events that the city hosts. At the festivals, the DPW could also set up a tent with information available to all the residents who are stopping at the tent to get free water. By the city distributing free bottled water from the purification plant they are accomplishing 3 different things. First by the DPW setting up a tent or a booth they will be able to distribute information about Worcester's purification plant and the quality of Worcester's municipal water. This information would be available to anyone passing by. Secondly, they will establish a presence with the public and will be able to talk to residents, personally answering any question that the residents might have. Finally the most important reason to go to outdoor festivals is that the DPW will be able to hand out free samples of the bottled water from Worcester's purification plant to all the thirsty residents who are having fun in the sun. This would help the DPW establish a relationship with the residents, allow the residents to taste the quality of the water, and possibly persuade them to purchase it in the future.

Some of the events that we have identified that the city hosts are the

- The Annual Car Show (Summer Nationals), which is held at Green Hill Park and promoted by Robert J. Moscoffian of Oxford, Massachusetts
- The 4th of July fireworks, which is sponsored by the city
- Ethnic festivals such as the Latin American Festival, which has been directed by Ms. Carmen D "Dolly" Vazquez
- The Big Dipper Ice Cream and Frozen Yogurt festival, which has been organized by Kelsa Fuller and is held on the Common
- The Earth Day festival at Institute Park, sponsored by the Regional Environmental Council.

For more information, the DPW can contact the Parks Department to obtain the names of other festivals and organizers because in order for these events to be hosted in Worcester the organizers must receive permits.

To compliment the water pride campaign we considered other water pride campaign options. At our first meeting held with Commissioner Moylan, he explained one of his major concerns regarding Worcester water. That resident's may receive a bad impression of the city's water quality, when they walk into a public building in Worcester and see Poland Spring water dispensers. He believes that resident's receive the image that Worcester's water is not as high quality because the city offices purchase spring water for their employees. Our team has come up with a recommendation to solve this problem. Each public office should receive five gallon jugs of water from Worcester's purification plant for their dispensers. That way when residents enter public buildings and see the water coolers with labels stating that the water contained inside is water from Worcester's purification plant, the residents will be receiving a higher image of the water.

5.3.1 Recommendations for Future Groups

Some of the issues that our IQP team encountered throughout the course of our project were inexperience with software, lack of a database, and length of our survey. The length of our survey was 29 questions with some questions containing sub-questions. The survey took the respondent less than 5 minutes to complete. They could answer all the questions asked and they could refuse to answer any questions they did not feel were appropriate (e.g. income, race, or age). However some residents did not want to participate in the survey because they thought it was too lengthy. For a future team, we would recommend cutting down on the number of questions asked, but not the number of responses to the questions. We recommend quality over quantity of questions and as few open ended questions as possible to reduce problems with data analysis. We have also recommended that a team work on a database for the DPW (5.3.3.3 Databases). Although for the software problem we recommend that they communicate with someone who is proficient with the software and also they experiment with it during the preparatory phase of the project.

5.3.3.1 Marketing

With the data collected from our survey, we have determined that the attitudes and perceptions of Worcester residents need to be improved. Using our survey and data analysis as a starting point, future MQP/IQP groups may want to conduct focus groups to get more detailed information from residents concerning specific issues. One of the primary issues of concern for the DPW is how to introduce a water pride campaign. The DPW expressed in our first meeting a desire to start a water pride campaign (as discussed in the section above). Trends in our data show that selling bottled water from

the purification plant would be more successful than handing out free water bottles. Our data showed 51% of the residents would buy bottled water from Worcester's purification plant. During our data analysis (chapter 4) we identified that 57% of the residents we surveyed would not use an empty water bottle given out by the city (See Figure E3 on pg 69). Therefore, instead of giving out free bottles, the city could sell bottled water from the purification plant at social events or even in supermarkets. Interesting to note is that our team found an additional 13% said maybe they would buy Worcester's bottled water if it were cheaper than other bottled water, such as Poland Spring (See Figure E5 on pg 71).

Therefore to conduct a successful marketing campaign of Worcester bottled water the DPW must know about Worcester's bottled water market. A management MQP or another IQP team could determine how much bottled water is actually sold in Worcester. They would have to collect data from all of Worcester's supermarkets and convenience stores. The project team could then distinguish between bottled water brands and find out what niche is available for Worcester's bottled water in the Worcester market. Aside from determining a marketing strategy for the bottled water, this team would also need to find out how the DPW would get their bottled water on the shelves of local stores. To do this the supermarkets and convenience stores would have to be contacted in order to determine if they would cooperate with the DPW. Finally a working relationship with these stores would have to be established. This would be a great marketing project another WPI team to handle.

5.3.2.2 Database

Another potential computer science MQP, civil engineering MQP or even another IQP could help the DPW create a database, which catalogs the water mains of the city. During our project, our team had difficulty obtaining water main information because the DPW is currently working on a database. Presently the DPW has all of the water mains mapped out on several hundred paper maps. These maps correspond to a map of Worcester, which is divided into a grid system then even further sectioned off by streets. The GIS department of the DPW is working on creating a database however this is a long and tedious process that could benefit from the help of a project team. With all of the water main information entered into a database the DPW would save time and money and could find out quickly which water mains have been cleaned and relined. This database would help to make the DPW run more efficiently.

5.3.2.3 Online Survey

The DPW has a web page that contains copious amounts of information on their water system and ongoing projects to improve the quality of the water. However it was out of the scope of our project to investigate how many residents use the information on the web page and how useful it is to them. Since awareness is one of the greatest relationships we discovered through the course of our data analysis we think it would be important to investigate the effectiveness of the DPW's homepage. This page is set up to inform the residents of the Water Quality Report, the purification plant, the newsletter and other information that the DPW feels is necessary that the residents be aware of. An IQP team could work on evaluating the current arrangement of the web

page and adding to it an online survey that residents could take to comment on the information provided and how beneficial the information given is. This would give residents, who use the page, an outlet through which they could inform the DPW of their opinion of the web page. Based on the teams conclusions the DPW would be able to improve the effectiveness of their web page.

5.3.2.4 Educational Programs

Throughout the course of our study awareness of the technology and ongoing improvements to enhance the quality of Worcester's water is the relationship that we determined has the greatest influence on taste rating. As seen in section 4.2.4 Figures D2, D3, and D4 there is a strong relationship between how the residents rated the quality of their water and how informed they were about the quality of their water. Therefore we concluded that the DPW should establish an educational curriculum for the Worcester Public Schools. Currently the DPW operates a small educational program, which Philip Guerin is in charge of when he has time to go and visit the schools. However we propose that another IQP team takes the information that already exists, elaborate on it and then turn it into structured lesson plans. The IQP team could be the first ones to administer the lesson plan, work out the problems and then create improved plans. The lesson plans would be developed for science classes from kindergarten to the twelfth grade. Younger students would be able to channel the information on the water quality to their parents by receiving help with homework and bringing home information booklets. Whereas a high school chemistry class could utilize the purification plant for a first hand demonstration of how technology interacts with society.

5.4 Conclusions

In conclusion, we believe that the DPW could improve the attitudes and perceptions of the residents through more dissemination of information to all the residents in Worcester. Trends in our data suggest that the more aware a resident was towards the water system, the higher they rated the taste of the water. We also found trends in our data that suggest residents would support a potential bottled water campaign. Our data suggest that residents are more willing to purchase bottled water from the purification plant than they are to fill free empty bottles with tap water.

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Table of Appendix

Appendix A: DPW Letter to WPI

January 11, 2001

Dr. Lance Schachterle
WPI
100 Institute Road
Worcester, MA 01609-2280

Dear Dr. Schachterle,

The City of Worcester Department of Public Works is very enthused about the opportunity to develop a lasting relationship with WPI and its undergraduate projects program through the Worcester Community Projects Center. We believe this will be a mutually beneficial association. Students completing their IQP/MQP will benefit by involving themselves in "real world", community-based issues. DPW and the City of Worcester will benefit by having the enthusiasm and fresh ideas of WPI students applied to solving timely and complex problems. WPI will benefit by fostering a relationship that will unite students, faculty and local public officials in a cooperative effort to bring about positive, meaningful change in the community.

While there are many potential projects to consider for this initial effort, DPW is interested in kicking-off our collaboration with a focus on Worcester's drinking water. Specifically, we are interested in a student project that would assess and analyze public attitudes about Worcester's water system. Using this data, students would then investigate whether a program of bottling and distributing Worcester's water might have a positive impact on public perception. The project could then focus on developing a plan to implement a Worcester bottled water program by investigating how other communities have fared with such initiatives, assessing the technical aspects of this endeavor and determining the most effective business and marketing strategy to make this plan succeed. In the future, as the plan is implemented, project students could follow-up with measurements to determine the effectiveness this program has had in changing public attitudes about Worcester water. Deliverables from this project might include:

- Results and analysis of a community public attitudes survey on Worcester water
- A compilation of national data on municipal bottled water campaigns
- A review of technical issues relative to the bottling and distribution of Worcester water
- An implementation plan that includes recommendations on technical matters, distribution, marketing, costs, revenue potential and impact measurement

For the last few years DPW has been tinkering with this bottled water idea. While we have made some progress we have not had the staff, time or capabilities to move beyond the conceptual stage of the project. We believe that WPI students can answer many of

our questions and provide much needed guidance to a project that has the potential to make a lasting, visible impact on the Worcester community.

Worcester DPW looks forward to working with the Worcester Community Project Center and the students and faculty of WPI on this and many other projects. Please do not hesitate to call me at 508-799-1430 if I can be of further assistance.

Sincerely,

Robert L. Moylan, Jr., P. E.
Commissioner of Public Works

Appendix B: DPW Commissioner Moylan Interview Summary

Summary of Interview

Water Project group and DPW Commissioner, R. Moylan
01/23/2002

The following is a summary of the major points discussed during the meeting of the Water Project group and Department of Public Works Commissioner, Robert Moylan.

The need for the new filtration plant, which cost $65 million, went online in 1997, and currently produces 23 million gallons of potable water a day, was a series of contaminant violations ranging from the late 70's through the early 80's.

There were previous attempts at bottling and distributing Worcester's drinking water. One attempt was made with the Polar Bottling Company but there were some problems (set up for soda, not water) and there is no longer any dealings with that company. The other was with a bottling company in CT, but the water was shipped down in tanker trucks and there were bacterial contamination issues that couldn't be resolved. There was also a telephone survey performed 3 or 4 years ago by the DPW (results yet to be viewed by the group).

The issue of chlorine in the tapwater was brought up. It is a requirement to prevent contamination during transportation to residences. In the past, the water sent to the bottling plants was not chlorinated.

The DPW is looking to distributing to the Worcester area only. At the very least, they would like to provide Worcester government offices with water coolers containing public water.

Also would like to look into handing out empty bottles or pitchers to be filled by Worcester residents at their taps.

The DPW hasn't looked into distribution or bottling prices currently, but if that becomes necessary they would like to set up a "break even at least" pricing structure.

Finally, the expectations of the group were discussed.

- Find the attitude of the public [concerning the drinking water].
- Make recommendations as to which course of action would be best for the City of Worcester.

Appendix C: DPW letter to Supermarkets

DEPARTMENT OF PUBLIC WORKS

CITY OF WORCESTER
20 East Worcester Street
Worcester, Massachusetts 01604-3695

Robert L. Moylan, Jr., P.E.
Commissioner
(508) 799-1437 tel
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Andrew C. Murch, P.E.
Deputy Commissioner
(508) 799-1476

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Thomas H. Garr, Director
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Engineering
Edward J. Carrigan, P.E.
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Sewers
Matthew J. Labovites, Director
(508) 799-1480

Streets/Sanitation
Peter A. Paldino, Director
(508) 799-1418

Traffic Engineering
Joseph F. Borbone, Director
(508) 799-1468

Water/Reservoirs
Konstantin Eliadi, Director
(508) 799-1485

March 21, 2002

To Whom It May Concern:

In an effort to gain insight into Worcester resident's perceptions about the City's drinking water, Worcester DPW has teamed up with a group of undergraduates from WPI to conduct a consumer survey. Students Casandra Andersen, Kerri Coleman, and Jonathan Pesch have devised a scientifically valid survey that will assist DPW in making future decisions regarding Worcester's water system.

The survey of Worcester residents will be conducted over the coming week, including weekends, at supermarkets throughout the City. Residents arriving at the market will be asked a series of questions pertaining to drinking water and about their general background. Each survey is expected to take about ten minutes.

DPW believes this project will prove to be very useful in guiding future endeavors. We hope you will support their efforts. Please call Philip Guerin, Water Resource Coordinator at DPW, 508-799-1484 if you have any questions.

Sincerely,

ROBERT L. MOYLAN, JR., P.E.
Commissioner of Public Works

PDG/RLM/dn

cc: KONSTANTIN ELIADI, Director of Water Operations

(S:\WATER\PHIL\WPI Water Survey Letter. doc)

Printed on

"Measured By Success"

Appendix D: What was said before administering the survey

Hi my name is _____and I am a WPI student working with the Worcester Department of Public Works on a project that is a graduation requirement. I am conducting a survey for the Department of Public Works that will help benefit you, the consumer of Worcester water. The Survey contains questions on the quality of your water. Do you have 5 minutes to take this survey?

Appendix E: WPI / DPW Water Quality Survey

Number:_____Location:_____

Interviewer:_____Date:_____Time:_____

Section 1:

1. Do you live in Worcester?
   _____Yes
   _____No

2. Are you over 18?
   _____Yes
   _____No

Section 2:

3. Do you drink unfiltered water from your tap?
   _____Yes
   _____No *(go to 4)*
   _____Don't know *(go to 4)*

   3a. Yesterday, how many times did you drink water from your faucet?

   _____

4. Do you filter your tap water before you drink it?
   _____Yes
   _____No *(go to 5)*
   _____Don't know *(go to 5)*

   4a. Yesterday, how many times did you drink filtered tap water?

   _____

   4b. What type of filter do you use?
   _____A filter pitcher, such as a Britta
   _____A filter on the faucet
   _____A home filtration unit in the basement
   _____Other
   _____Don't know

   4c. Why do you filter your water?
   _____Taste
   _____Clarity
   _____Color
   _____Odor
   _____Health
   _____Other
   _____Don't know

5. Do you prefer to drink Worcester tap water or bottled water?

_____Tap water *(go to 5a)*
_____Bottled water *(go to 5b)*
_____No opinion *(go to 6)*

5a. (**tap water**) Why do you prefer tap water

_____Satisfied with taste
_____Convenience
_____Price
_____Other
_____Don't know

5b. (**bottled water**) Why do you prefer bottled water?

_____Taste
_____Clarity
_____Color
_____Odor
_____Health
_____Other
_____Don't know

6. Do you drink bottled water?

_____Yes
_____No *(go to 7)*
_____Don't know *(go to 7)*

6a. How many times did you drink bottled water yesterday?

_____

7. Does someone in your household purchase bottled water?

_____Yes
_____No *(go to 8)*
_____Don't know *(go to 8)*

7a. How much is spent on bottled water per week?

_____

8. When cooking, what type of water do you use?

_____Tap water
_____Filtered tap water
_____Bottled water
_____Other
_____Don't know

9. Do you make beverages with water, such as coffee, tea, or juice?

_____Yes
_____No *(go to 9)*
_____Don't know *(go to 9)*

9a. What type of water do you use to make these beverages?

_____Tap
_____Filtered
_____Bottled
_____Other
_____Don't know

Section 3:

10. Rate the taste of Worcester's tap water on a scale of 1 to 5 with 1 being extremely bad and 5 being extremely good?

1	2	3	4	5
extremely bad		neutral		extremely good

10a. Please explain why you don't like the taste the tap water.(*rated 1-2*: i.e. chemical taste, clarity, odor)

_____

_____

11. Do you think there is a health risk associated with drinking any of the following? (check if yes)

_____Tap water *(go to 11a)*
_____Bottled water *(go to 12)*
_____Filtered tap water *(go to 12)*
_____No health risk *(go to 12)*
_____Don't know *(go to 12)*

11a. If you think there is a health risk associated with tap water, where in the system is it located?

_____Water mains
_____House pipes
_____Purification plant
_____Reservoir
_____Other
_____Don't know

12. What do you think is in the water? Check all that apply

_____Iron
_____Lead
_____Copper
_____Chlorine
_____Suspended solids
_____Parasites
_____Bacteria
_____Other
_____Don't know

Section 4:

13. Have you seen or heard anything about the quality of Worcester's water?

_____Yes
_____No *(go to 14)*
_____Don't know *(go to 14)*

13a. If yes, can you recall the subject matter you heard or saw?

_____

13b. Do you remember where you got the information?

_____

14. In general, where do you get most of your daily news?

_____

15. Have you ever seen a water quality report?

_____Yes
_____No
_____Don't know

16. Have you ever seen the newsletter, *On the Water Front*?

_____Yes
_____No
_____Don't know

17. If the city gave out free water bottles, would you fill the bottles with tap water?

_____Yes
_____No
_____Don't know / maybe

18. Suppose you could buy bottled water directly from Worcester's purification plant. Water that did not contain chlorine and did not travel through Worcester's water pipes, would you buy it?

_____Yes *(go to 19)*
_____No
_____No opinion / maybe

18a. If not, why not *(one response only)*

_____Prefer tap water
_____Taste
_____Trust in public utilities
_____Price
_____Other
_____Don't know

18b. Would you buy it if it was cheaper than water bottled by other companies? (i.e. Poland Springs)

_____Yes
_____No
_____Don't know

19. Did you know that Worcester opened a state of the art water purification plant in 1997?

_____Yes
_____No

Section 5:

20. What street do you live on?

_____

21. What is your zip code?

_____

22. Do you own or rent your home?

_____Rent
_____Own
_____Don't know

23. Do you pay the water bill for your household?

_____Yes
_____No
_____Don't know

24. How long have you lived in Worcester? (in years)

25. What year were you born?

_____

26. What is your highest level of education?

_____Less than high school
_____High school gradate
_____Some college
_____College graduate
_____Post graduate
_____No answer

27. What is your gender?

_____Male
_____Female

28. Which of the following best describes your ancestry?

_____European American
_____Hispanic / Spanish American
_____African American
_____Asian American
_____Other

29. Which of the following best describes your total yearly household income?

_____Less than $10,000
_____$10,000 to $20,000
_____$20,000 to $30,000
_____$30,000 to $40,000
_____$40,000 to $50,000
_____$50,000 to $60,000
_____$60,000 to $70,000
_____$70,000 to $80,000
_____$80,000 to $90,000
_____$90,000 to $100,000
_____More than $100,000

Appendix F: SPSS Spreadsheet

	live	over18	unfilt_3	unfi#_3a	filt_4	filt#_4a	type_4b	f_taste	f_clarit	f_color	f_odor	f_health	f_other	f_dk
1	1	.	1	4.0	1	2.0	1	1	.	.	.	.	.	.
2	1	.	2	2.0	2	.	.	.	.	.	.	.	.	.
3	1	.	1	9.0	2	.	.	.	.	.	.	.	.	.
4	1	.	2	.	1	.0	2	.	.	.	.	.	1	.
5	1	.	2	.	2	.	.	.	.	.	.	.	.	.
6	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
7	1	.	1	4.0	2	.	.	.	.	.	.	.	.	.
8	1	.	2	.	2	.	.	.	.	.	.	.	.	.
9	1	.	2	.	2	.	.	.	.	.	.	.	.	.
10	1	.	2	.	2	.	.	.	.	.	.	.	.	.
11	1	.	2	.	.	.	.	.	.	.	.	.	.	.
12	1	.	1	7.0	2	.	.	.	.	.	.	.	.	.
13	1	.	2	.	1	4.5	4	1	.	.	.	.	.	.
14	1	.	2	.	1	4.0	1	1	.	.	.	.	.	.
15	1	.	2	.	1	9.0	1	1	1	.	1	1	.	.
16	1	.	1	12.5	.	.	.	.	.	.	.	.	.	.
17	1	.	1	1.0	2	.	.	.	.	.	.	.	.	.
18	1	.	1	1.0	.	.	.	.	.	.	.	.	.	.
19	1	.	2	.	1	3.5	1	1	.	.	.	.	1	.
20	1	.	2	.	2	.	.	.	.	.	.	.	.	.
21	1	.	.	.	1	5.0	1	1	.	.	.	1	.	.
22	1	.	2	.	1	4.0	1	.	.	.	.	1	.	.
23	1	.	1	2.0	1	1.0	1	1	.	.	.	.	.	.
24	1	.	1	.	1	.	1	1	.	.	.	.	.	.
25	1	.	2	.	2	.	.	.	.	.	.	.	.	.
26	1	.	2	.	.	.	.	.	.	.	.	.	.	.
27	1	.	1	1.0	1	2.0	1	.	1	.	.	.	.	.
28	1	.	2	.	.	.	.	.	.	.	.	.	.	.
29	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
30	1	.	1	8.0	2	.	.	.	.	.	.	.	.	.
31	1	.	2	.	2	.	.	.	.	.	.	.	.	.
32	1	.	2	.	.	.	.	.	.	.	.	.	.	.
33	1	.	1	3.0	2	.	.	.	.	.	.	.	.	.
34	1	.	2	.	1	2.5	1	1	.	.	.	.	.	.
35	1	.	2	.	1	8.0	1	1	.	.	.	.	.	.
36	1	.	1	10.0	1	10.0	1	.	.	.	.	.	1	.
37	1	.	1	5.0	2	.	.	.	.	.	.	.	.	.
38	1	.	.	.	.	.	.	.	.	.	.	.	.	.
39	1	.	.	.	1	4.0	2	1	.	1	.	.	.	.
40	1	.	2	.	1	3.0	1	.	.	.	.	1	.	.
41	1	.	1	10.0	2	.	.	.	.	.	.	.	.	.
42	1	.	1	10.0	2	.	.	.	.	.	.	.	.	.
43	1	.	2	.	2	.	.	.	.	.	.	.	.	.
44	1	.	2	.	1	10.0	1	.	.	.	.	1	.	.
45	1	.	2	.	1	3.0	1	1	.	.	.	.	.	.
46	1	.	2	.	2	.	1	.	.	.	.	1	.	.
47	1	.	2	.	1	.0	1	.	.	.	.	1	.	.
48	1	.	1	2.0	1	1.0	1	.	.	.	.	.	1	.
49	1	.	.	.	1	8.0	1	1	.	.	.	.	.	.
50	1	.	1	1.0	1	6.0	2	1	.	.	.	.	.	.
51	1	.	1	4.0	2	.	.	.	.	.	.	.	.	.
52	1	.	2	.	2	.	.	.	.	.	.	.	.	.
53	1	.	2	.	2	.	.	.	.	.	.	.	.	.
54	1	.	1	4.0	1	1.0	4	.	.	.	.	.	1	.
55	1	.	1	1.0	2	.	.	.	.	.	.	.	.	.
56	1	.	2	.	2	.	.	.	.	.	.	.	.	.
57	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
58	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
59	1	.	1	5.0	1	.	5	.	.	.	.	.	.	.
60	1	.	2	.	2	.	.	.	.	.	.	.	.	.
61	1	.	1	3.0	2	.	.	.	.	.	.	.	.	.
62	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
63	1	.	1	1.5	1	3.5	1	1	1	.	.	.	.	.
64	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
65	1	.	1	5.5	2	.	.	.	.	.	.	.	.	.
66	1	.	1	8.0	2	.	.	.	.	.	.	.	.	.
67	1	.	2	.	1	8.0	3	.	.	.	.	1	.	.
68	1	.	1	2.0	.	.	.	.	.	.	.	.	.	.
69	1	.	2	.	2	.	.	.	.	.	.	.	.	.
70	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
71	1	.	.	.	1	8.0	3	.	1	.	.	.	.	.
72	1	.	2	.	2	.	.	.	.	.	.	.	.	.
73	1	.	2	.	.	.	.	.	.	.	.	.	.	.

	prefer_5	t_sat	t_conv	t_price	t_other	t_dk	b_taste	b_clarit	b_color	b_odor	b_health	b_other	b_dk	bottled_6
1	3	.	.	.	.	.	.	.	.	.	.	.	.	2
2	2	.	.	.	.	.	.	.	.	.	.	1	.	1
3	1	1	.	.	.	.	.	.	.	.	.	.	.	2
4	3	.	.	.	.	.	.	.	.	.	.	.	.	1
5	2	.	.	.	.	.	1	.	.	.	.	.	.	1
6	2	.	.	.	.	.	.	.	.	.	.	1	.	1
7	1	.	.	.	1	.	.	.	.	.	.	.	.	2
8	2	.	.	.	.	.	.	.	.	.	1	.	.	1
9	2	.	.	.	.	.	1	.	.	.	.	.	.	1
10	2	.	.	.	.	.	.	.	.	.	1	.	.	1
11	2	.	.	.	.	.	.	.	.	.	1	.	.	1
12	2	.	.	.	.	.	1	.	.	.	.	.	.	1
13	2	.	.	.	.	.	1	.	.	.	1	.	.	1
14	2	.	.	.	.	.	1	1	.	.	1	.	.	1
15	2	.	.	.	.	.	1	.	.	.	.	.	.	1
16	1	1	1	1	.	.	.	.	.	.	.	.	.	1
17	2	.	.	.	.	.	1	.	.	.	.	.	.	1
18	2	.	.	.	.	.	1	.	.	.	.	.	.	1
19	1	1	1	.	.	.	.	.	.	.	.	.	.	.
20	2	.	.	.	.	.	1	1	1	1	.	.	.	1
21	2	.	.	.	.	.	1	.	.	.	1	.	.	1
22	2	.	.	.	.	.	.	.	.	.	1	.	.	1
23	1	.	.	1	.	.	.	.	.	.	.	.	.	.
24	2	.	.	.	.	.	1	.	.	.	.	.	.	1
25	2	.	.	.	.	.	.	.	.	.	1	.	.	1
26	2	.	.	.	.	.	1	.	.	.	.	.	.	1
27	1	1	.	.	1	.	.	.	.	.	.	.	.	1
28	2	.	.	.	.	.	1	.	.	.	.	.	.	1
29	3	.	.	.	.	.	.	.	.	.	.	.	.	1
30	1	1	1	.	.	.	.	.	.	.	.	.	.	2
31	2	.	.	.	.	.	.	.	.	.	.	1	.	1
32	2	.	.	.	.	.	1	.	.	.	.	.	.	1
33	1	1	1	1	.	.	.	.	.	.	.	.	.	1
34	1	.	.	1	.	.	.	.	.	.	.	.	.	.
35	2	.	.	.	.	.	1	.	.	.	.	.	.	.
36	1	1	1	.	.	.	.	.	.	.	.	.	.	2
37	1	.	1	.	.	.	.	.	.	.	.	.	.	1
38	2	.	.	.	.	.	1	.	.	.	.	.	.	1
39	.	.	.	.	.	.	.	.	.	.	.	.	.	2
40	2	.	.	.	.	.	.	.	.	.	1	.	.	1
41	2	.	.	.	.	.	1	.	.	.	.	.	.	1
42	3	.	.	.	.	.	.	.	.	.	.	.	.	1
43	2	.	.	.	.	.	.	.	.	.	.	1	.	1
44	1	.	.	1	.	.	.	.	.	.	.	.	.	2
45	3	.	.	.	.	.	.	.	.	.	.	.	.	1
46	2	.	.	.	.	.	1	.	.	.	1	.	.	1
47	3	1	.	.	.	.	.	.	.	.	.	.	.	1
48	1	1	.	.	.	.	.	.	.	.	.	.	.	3
49	2	.	.	.	.	.	1	.	.	.	.	.	.	1
50	2	.	.	.	.	.	1	.	.	.	1	.	.	1
51	3	.	.	.	.	.	.	.	.	.	.	.	.	1
52	2	.	.	.	.	.	1	.	.	.	.	.	.	1
53	2	.	.	.	.	.	.	.	.	1	.	1	.	1
54	2	.	.	.	.	.	1	.	1	.	.	.	.	1
55	2	.	.	.	.	.	.	1	.	.	.	.	.	1
56	2	.	.	.	.	.	1	.	.	.	.	.	.	1
57	2	.	.	.	.	.	1	.	.	.	.	.	.	1
58	2	.	.	.	.	.	.	.	.	.	1	.	.	1
59	2	.	.	.	.	.	.	.	.	.	.	1	.	1
60	2	.	.	.	.	.	.	.	.	.	.	.	1	1
61	2	.	.	.	.	.	1	.	.	.	.	.	.	1
62	2	.	.	.	.	.	1	.	.	1	.	.	.	1
63	1	.	.	.	.	1	.	.	.	.	.	.	.	1
64	2	.	.	.	.	.	1	.	.	.	.	.	.	1
65	1	1	.	.	1	.	.	.	.	.	.	.	.	2
66	3	.	.	.	.	.	.	.	.	.	.	.	.	1
67	1	1	.	.	.	.	.	.	.	.	.	.	.	1
68	2	.	.	.	.	.	1	.	.	.	.	.	.	1
69	2	.	.	.	.	.	1	.	.	.	.	.	.	1
70	2	.	.	.	.	.	1	.	.	.	.	.	.	1
71	2	.	.	.	.	.	1	.	.	.	.	.	.	1
72	2	.	.	.	.	.	.	.	.	.	.	.	1	1
73	.	.	.	.	.	.	.	.	.	.	.	.	.	.

	bot#_6a	buy_7	spend_7a	cook_8	bvg_9	type_9a	taste_10	exp_10a	hr_tap	hr_bot	hr_filt	hr_none	hr_dk	hrt_main
1	.	2	.	1	1	1	2.0	.	1	1	.	.	.	.
2	.0	1	5.00	1	1	1	4.0	.	1	.	.	.	.	1
3	.	1	1.00	1	1	3	4.0	.	.	.	.	1	.	.
4	.0	1	20.00	1	1	1	5.0	.	.	1	.	.	.	.
5	2.0	1	5.00	1	1	3	1.0	.	1	.	.	.	.	.
6	3.0	1	1.50	1	1	1	3.0	.	.	.	.	1	.	.
7	.	2	.	1	1	1	4.0	.	.	1	.	.	.	.
8	.0	1	5.00	1	1	1	4.0	.	.	.	.	1	.	.
9	3.0	1	.	1	1	1	3.0	.	.	.	.	1	.	.
10	5.0	1	6.00	1	1	1	1.0	.	1	.	.	.	.	1
11	2.0	1	2.00	3	1	1	3.0	.	1	.	.	.	.	1
12	5.0	1	10.00	1	2	.	2.0	.	.	.	.	1	.	.
13	1.0	1	2.50	2	1	2	2.0	.	1	.	.	.	.	.
14	1.0	1	4.50	3	1	1	1.0	.	1	.	.	.	.	.
15	2.5	1	20.00	1	1	1	3.0	.	1	.	.	.	.	1
16	1.0	1	3.00	1	1	1	4.0	.	.	.	.	1	.	.
17	.0	1	2.50	1	1	1	3.0	.	.	.	.	1	.	.
18	1.0	1	1.50	1	1	3	3.0	.	1	.	.	.	.	1
19	.	.	.	1	1	1	4.0	.	.	1	.	.	.	.
20	10.0	1	10.00	3	1	3	1.0	.	.	.	.	.	1	1
21	5.0	1	.	2	1	1	2.0	.	1	.	.	.	.	.
22	2.0	1	10.00	2	1	2	1.0	.	1	.	.	.	.	1
23	.	.	.	2	1	2	1.0	.	1	.	.	.	.	.
24	.	1	3.00	3	1	1	4.0	.	1	.	.	.	.	.
25	3.0	1	10.00	1	1	1	3.0	.	.	.	.	1	.	.
26	1.0	2	.	1	1	1	2.0	.	.	.	.	.	1	.
27	.	2	.	1	1	1	5.0	.	.	.	.	1	.	.
28	5.0	1	5.00	3	1	3	2.0	.	1	.	.	.	.	1
29	3.0	1	5.00	1	1	1	3.0	.	.	.	.	1	.	.
30	.	2	.	1	1	1	4.0	.	.	.	.	.	.	.
31	2.0	1	9.00	1	1	3	.	.	.	.	.	1	.	.
32	1.5	1	1.50	1	1	1	3.0	.	.	.	.	.	.	.
33	.	2	.	1	1	1	5.0	.	.	.	.	.	.	.
34	.	.	.	1	1	1	.	.	.	.	.	1	.	.
35	.	.	.	2	1	2	2.0	.	1	.	.	.	.	1
36	.	.	.	1	1	1	5.0	.	1	.	.	.	.	.
37	.0	1	10.00	1	1	1	4.0	.	1	1	.	.	.	.
38	6.0	1	10.00	2	1	2	2.0	.	1	.	.	.	.	.
39	.	.	.	2	1	2	5.0	.	.	.	.	1	.	.
40	.0	2	.	1	1	1	2.0	.	1	.	.	.	.	1
41	2.0	1	.	1	1	1	4.0	.	.	.	.	1	.	.
42	.	2	.	1	1	1	4.0	.	.	.	.	1	.	.
43	4.5	1	.	1	1	3	5.0	.	.	.	.	.	.	.
44	.	.	.	1	1	1	5.0	.	.	.	.	.	.	.
45	.0	2	.	1	1	1	3.0	.	1	.	.	.	.	1
46	3.5	1	5.00	1	2	.	1.0	.	1	.	.	.	.	.
47	.0	1	3.00	1	1	2	3.0	.	1	.	.	1	.	1
48	.	.	.	1	1	2	4.0	.	.	.	.	1	.	.
49	1.0	1	5.00	1	1	1	4.0	.	.	.	.	1	.	.
50	.0	1	1.00	2	1	2	4.0	.	1	.	.	.	.	1
51	.0	1	1.50	1	1	1	5.0	.	.	.	.	1	.	.
52	.0	1	1.50	1	1	1	2.0	.	1	.	1	.	.	1
53	4.0	1	.	1	1	1	2.0	.	.	.	.	.	1	.
54	.0	1	1.00	3	1	2	1.0	.	1	1	.	.	.	1
55	2.0	1	.	1	1	1	2.0	.	.	.	.	1	.	.
56	6.0	1	4.00	1	1	3	2.0	.	1	.	.	.	.	.
57	1.0	1	3.00	1	1	1	3.0	.	1	.	.	.	.	.
58	.0	1	5.00	1	1	3	5.0	.	.	.	.	.	1	.
59	3.0	1	17.00	1	1	3	4.0	.	.	1	.	.	.	.
60	9.0	1	8.00	1	2	.	.	.	1	.	.	.	.	.
61	.0	2	.	1	1	1	4.0	.	1	.	.	.	.	.
62	.	1	.	1	1	1	1.0	.	1	.	.	.	.	.
63	.	1	2.00	1	1	1	2.0	.	.	.	.	1	.	.
64	3.5	2	.	1	1	1	3.0	.	1	.	.	.	.	.
65	.	2	.	1	1	1	5.0	.	.	.	.	1	.	.
66	2.0	1	6.00	1	1	1	4.0	.	.	.	.	1	.	.
67	6.5	2	.	1	1	2	3.0	.	1	.	.	.	.	.
68	3.0	1	2.29	1	1	3	2.0	.	1	.	.	.	.	1
69	6.0	1	10.00	1	1	3	2.0	.	1	.	.	.	.	1
70	1.0	1	5.00	1	1	1	3.0	.	.	.	.	1	.	.
71	8.0	1	20.00	1	1	1	3.0	.	.	.	.	1	.	.
72	3.0	1	.	3	1	3	.	.	.	.	.	.	.	.
73	.	1	.	1	2	.	2.0	.	.	.	.	1	.	.

	hrt_hous	hrt_pur	hrt_res	hrt_othr	hrt_dk	w_iron	w_lead	w_cu	w_cl	w_ss	w_par	w_bact	w_other	w_dk
1	.	1	.	.	.	.	1	.	.	.	1	.	.	.
2	.	.	1	.	.	.	.	.	.	1	1	1	.	.
3	.	.	.	.	.	1	.	.	.	.	.	.	.	.
4	.	.	.	.	.	1	1	1	1	1	1	1	.	.
5	.	1	.	.	.	.	.	.	1	.	1	1	.	.
6	.	.	.	.	.	1	1	1	1	1	1	1	1	.
7	.	.	.	.	.	1	1	.	1	.	.	1	.	.
8	.	.	.	.	.	1	.	.	.	1	.	.	.	.
9	.	.	.	.	.	1	.	.	1	.	.	.	.	.
10	1	1	1	.	.	.	.	.	1	.	1	.	.	.
11	1	.	1	.	.	.	.	.	.	.	.	.	.	1
12	.	.	.	.	.	.	.	.	.	.	.	.	.	1
13	.	.	.	.	1	.	.	.	.	.	.	.	.	1
14	.	.	.	.	1	.	.	.	1	.	.	.	.	.
15	1	.	.	.	.	.	1	.	1	.	.	1	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	.	1	.	.	.	.	1	1	.	.
18	.	.	.	.	.	.	1	.	.	.	.	1	.	.
19	.	.	.	.	.	1	.	.	1	.	1	.	.	.
20	.	.	.	.	.	.	.	.	.	.	1	.	.	.
21	.	.	1	.	.	1	.	.	.	.	.	1	.	.
22	1	1	.	.	.	1	1	1	1	1	1	1	.	.
23	.	1	.	.	.	.	.	.	.	.	1	1	.	.
24	1	.	.	.	.	.	.	.	.	.	.	.	.	1
25	.	.	.	.	.	.	.	.	1	.	.	.	.	.
26	.	.	.	.	.	.	.	.	.	.	.	1	.	.
27	.	.	.	.	.	.	1	.	.	.	.	.	1	.
28	1	.	.	.	.	.	1	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	1	.	.	.	.	.
30	.	.	.	.	.	1	1	.	1	.	.	.	.	.
31	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	.	.	1	.	.	.	.	.	.	.	1
33	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	.	.	.	.	.	.	.	.	.	.	.	.	.	1
35	.	.	.	.	.	.	.	.	.	.	.	1	.	.
36	.	.	.	.	1	.	.	.	.	.	.	.	.	1
37	.	.	1	.	.	.	.	.	1	.	.	1	.	.
38	.	1	.	.	.	.	1	1	1	.	.	1	.	.
39	.	.	.	.	.	.	.	.	1	.	.	1	.	1
40	.	.	.	.	.	.	.	.	.	.	.	.	.	1
41	.	.	.	.	.	.	.	.	.	.	.	1	.	.
42	.	.	.	.	.	.	.	.	1	.	.	.	.	1
43	.	.	.	.	.	.	1	1	.	.	.	1	.	.
44	.	.	.	.	.	.	.	.	1	.	.	.	.	.
45	1	.	1	.	.	.	1	.	1	.	.	1	.	.
46	.	.	1	.	.	.	.	.	.	.	.	.	1	.
47	.	.	.	.	.	1	1	1	1	.	.	.	.	.
48	.	.	.	.	.	.	.	.	1	.	1	1	.	.
49	.	.	.	.	.	1	1	1	1	.	.	.	.	.
50	.	.	.	.	.	1	1	.	1	.	.	1	.	.
51	.	.	.	.	.	.	.	.	1	.	1	.	.	.
52	1	.	.	.	.	.	.	1	1	.	.	.	.	.
53	.	.	.	.	.	.	.	.	1	.	.	.	.	.
54	.	.	.	.	.	.	.	.	1	1	.	.	.	.
55	.	.	.	.	.	.	.	.	.	.	.	.	.	1
56	1	.	.	.	.	1	1	1	1	1	1	1	1	.
57	.	1	.	.	.	.	.	.	1	.	.	1	.	.
58	.	.	.	.	.	.	.	1	.	.	.	.	.	.
59	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	.	1	1	.	.	.	1	1	1	1	1	1	.	.
61	1	.	.	.	.	.	.	.	1	.	.	1	.	.
62	.	1	.	.	.	.	1	.	.	.	1	1	.	.
63	.	.	.	.	.	.	.	.	1	.	.	1	.	.
64	.	.	.	.	1	.	.	.	.	.	.	.	.	1
65	.	.	.	.	.	.	.	.	1	.	.	.	.	.
66	.	.	.	.	.	1	1	1	1	1	.	1	.	.
67	.	.	1	.	.	.	.	.	1	1	.	1	.	.
68	.	.	.	.	.	.	.	.	.	.	.	1	.	.
69	1	.	.	.	.	.	.	1	.	.	.	.	.	.
70	.	.	.	.	.	.	.	.	.	.	.	.	.	1
71	.	.	.	.	.	.	.	.	.	.	1	1	.	.
72	.	.	.	.	.	.	.	.	.	.	.	.	.	.
73	.	.	.	.	.	.	.	.	.	.	.	.	.	1

	seen_13	subj_13a	wher_13b	news_14	qua_15	water_16	botle_17	buy_18	not_18a	che_18b	plant_19	stret_20
1	1	.	.	.	1	2	1	1	.	.	2	college st
2	2	.	.	.	2	2	2	2	4	3	1	point rock dr
3	1	.	.	.	1	3	1	2	4	2	1	wildwood ave
4	1	.	.	.	1	1	1	1	.	.	1	brightwood ave
5	2	.	.	.	2	2	2	2	3	2	2	fairmont ave
6	1	.	.	.	2	2	2	1	.	.	1	alvarado ave
7	1	.	.	.	2	2	1	2	5	2	2	plantation st
8	1	.	.	.	2	1	2	2	4	2	1	camden ave
9	1	.	.	.	1	1	2	3	.	.	1	stoneham rd
10	1	.	.	.	2	2	2	1	.	.	2	jennings st
11	1	.	.	.	2	3	2	1	.	.	2	marble st
12	2	.	.	.	2	2	2	1	.	.	2	boyden st
13	1	.	.	.	2	2	2	2	4	.	2	harold st
14	1	.	.	.	2	1	2	1	.	.	1	primrose st
15	2	.	.	.	2	2	2	2	5	.	1	palisades st
16	2	.	.	.	2	2	1	1	.	.	2	main st
17	1	.	.	.	2	2	1	2	4	1	2	orient st
18	1	.	.	.	2	2	2	1	.	.	1	dallas st
19	1	.	.	.	2	1	1	2	3	.	3	trahan ave
20	3	.	.	.	2	2	2	1	.	.	2	granby rd
21	2	.	.	.	2	2	1	1	.	1	.	ames st
22	1	.	.	.	2	2	2	1	.	.	2	ingleside av
23	2	.	.	.	2	2	2	1	.	.	2	sterling ln
24	.	.	.	.	1	1	1	1	.	.	1	main st
25	2	.	.	.	2	2	2	1	.	.	2	main st
26	2	.	.	.	2	2	2	1	.	.	2	main st
27	1	.	.	.	1	1	1	1	.	.	1	delawanda dr
28	2	.	.	.	2	2	2	1	.	.	2	constitution ave
29	2	.	.	.	2	2	2	2	5	1	2	chandler st
30	1	.	.	.	2	1	2	2	1	2	2	dearborn st
31	1	.	.	.	2	2	2	2	4	1	2	harrington way
32	1	.	.	.	1	2	2	1	.	1	1	wyola dr
33	2	.	.	.	1	3	1	3	1	2	1	saybrook rd
34	2	.	.	.	2	2	2	2	4	2	1	caroline st
35	1	.	.	.	3	1	2	1	.	1	1	orient st
36	1	.	.	.	1	2	2	2	1	2	1	duncannon ave
37	2	.	.	.	1	2	1	1	.	.	2	king st
38	2	.	.	.	2	2	3	1	.	.	2	pattison st
39	2	.	.	.	2	2	3	1	.	.	2	wellington st
40	1	.	.	.	2	2	2	1	.	.	2	randall st
41	2	.	.	.	1	2	1	2	5	2	2	waban ave
42	2	.	.	.	2	1	1	1	.	3	1	viking terrace
43	1	.	.	.	1	1	3	2	5	2	1	crowningshield rd
44	1	.	.	.	1	2	1	2	1	2	1	ridge st
45	2	.	.	.	2	2	2	2	4	1	2	sunderland rd
46	1	.	.	.	2	2	2	1	.	.	2	bedford st
47	1	.	.	.	1	1	.	1	.	.	1	shoreham st
48	2	.	.	.	2	2	1	2	5	.	1	whittman rd
49	1	.	.	.	1	1	1	1	.	.	1	dell ave
50	2	.	.	.	2	2	1	1	.	.	1	lincoln st
51	2	.	.	.	2	2	2	1	.	.	2	euclid av
52	2	.	.	.	2	2	2	1	.	.	2	euclid av
53	2	.	.	.	2	2	3	1	.	.	2	
54	2	.	.	.	2	2	2	1	.	.	2	wellington st
55	.	.	.	.	1	1	2	1	.	.	2	green hill parkway
56	1	.	.	.	1	1	2	1	.	.	1	kosta st
57	1	.	.	.	2	2	1	2	5	2	2	richards st
58	2	.	.	.	1	2	1	1	.	.	1	pleasant st
59	2	.	.	.	2	2	1	1	.	.	1	millbury st
60	1	.	.	.	1	2	2	3	.	.	1	main st
61	2	.	.	.	2	2	2	1	.	.	2	main st
62	1	.	.	.	1	2	2	1	.	.	3	acushnet ave
63	3	.	.	.	2	2	1	1	.	.	2	forestdale rd
64	1	.	.	.	2	2	2	1	.	.	2	goldthwaite rd
65	1	.	.	.	2	2	3	1	.	.	2	haven ln
66	1	.	.	.	2	2	1	1	.	.	2	st nicholas ave
67	1	.	.	.	.	.	.	.	.	.	.	.
68	1	.	.	.	1	2	2	1	.	.	2	upland gardens dr
69	2	.	.	.	2	2	2	1	.	.	2	outlook dr
70	1	.	.	.	1	2	1	1	.	.	1	west lake st
71	1	.	.	.	1	3	3	1	.	.	1	everard st
72	2	.	.	.	2	2	2	2	.	.	2	country club blvd
73	2	.	.	.	2	2	2	3	.	.	2	princeton st

	zc_21	home_22	bill_23	long_24	age_25	edu_26	gendr_27	anstr_28	incom_29	location	intervie	date	time	number
1	2	2	1	78.0	1924	2	2	1	2	SS122	JP	03/25/02		1
2	4	2	2	8.0	1940	3	2	1	.	SS122	JP	03/25/02		2
3	3	2	1	71.0	1931	2	1	1	4	SS122	JP	03/25/02		3
4	4	2	1	50.0	1952	4	1	1	7	SS122	JP	03/25/02		4
5	4	1	2	14.0	1960	4	2	1	4	SS122	JP	03/25/02		5
6	4	2	1	40.0	1955	2	2	1	8	SS122	JP	03/25/02		6
7	4	1	2	2.0	1962	3	1	1	5	SS122	JP	03/25/02		7
8	4	2	1	48.0	1954	3	1	1	11	SS122	JP	03/25/02		8
9	4	2	1	70.0	1932	5	2	1	4	SS122	JP	03/25/02		9
10	4	3	2	21.0	1980	5	1	1	6	SS122	JP	03/25/02		10
11	4	1	2	38.0	1928	4	2	1	2	SS122	KC	03/25/02		11
12	10	2	1	5.0	1964	3	2	2	5	SS122	KC	03/25/02		12
13	4	1	2	12.0	1964	3	2	1	7	SS122	KC	03/25/02		13
14	4	2	1	82.0	1920	3	1	1	1	SS122	KC	03/25/02		14
15	4	1	1	35.0	1964	3	1	5	9	SS122	KC	03/25/02		15
16	8	1	1	.5	1979	4	1	1	4	SS122	KC	03/25/02		16
17	4	1	1	25.0	1976	3	2	1	4	SS122	KC	03/25/02		17
18	4	2	1	49.0	1952	2	2	1	6	SS122	KC	03/25/02		18
19	4	2	1	72.0	1930	4	1	5	5	SS122	KC	03/25/02		19
20	4	1	2	31.0	1970	3	2	1	5	SS122	KC	03/25/02		20
21	10	1	1	1.5	1975	4	2	4	1	SS122	KC	03/25/02		21
22	4	2	1	30.0	1964	4	2	1	4	SS122	KC	03/25/02		22
23	10	1	2	6.0	1959	2	1	2	4	Sant	KC	03/26/02		23
24	3	1	2	5.0	1935	1	2	2	2	Sant	KC	03/26/02		24
25	8	1	2	2.0	1973	4	1	1	4	Sant	KC	03/26/02		25
26	10	1	2	18.0	1961	1	2	1	2	Sant	KC	03/26/02		26
27	3	2	1	57.0	1945	5	1	.	9	Sant	KC	03/26/02		27
28	5	1	2	28.5	1973	4	2	2	4	Sant	KC	03/26/02		28
29	2	1	2	9.0	1956	2	2	1	.	Sant	KC	03/26/02		29
30	4	2	1	60.0	1941	5	2	1	3	SS122	CA	03/25/02		30
31	4	1	2	71.0	1931	2	2	1	3	SS122	CA	03/25/02		31
32	3	2	1	65.0	1929	4	1	1	4	SS122	CA	03/25/02		32
33	4	2	1	86.0	1916	4	2	1	.	SS122	CA	03/25/02		33
34	4	1	2	46.0	1925	3	2	1	2	SS122	CA	03/25/02		34
35	4	2	1	53.0	1949	1	1	1	2	SS122	CA	03/25/02		35
36	4	1	2	16.0	.	.	2	1	.	SS122	CA	03/25/02		36
37	10	1	2	3.0	1947	3	1	3	4	Sant	KC	03/26/02		37
38	4	1	2	10.0	1963	3	2	2	3	Sant	KC	03/26/02		38
39	10	1	2	7.0	1941	2	1	2	2	Sant	KC	03/26/02	2:00	39
40	6	1	2	40.0	1960	2	2	5	3	SS&SWB	KC	03/28/02		40
41	4	1	2	40.0	1962	4	2	1	10	SS122	CA	03/25/02		41
42	4	2	1	55.0	1942	3	1	1	8	SS122	CA	03/25/02		42
43	4	2	1	57.0	1945	2	2	1	.	SS122	CA	03/25/02		43
44	4	2	1	71.0	1931	3	2	1	5	SS122	CA	03/25/02		44
45	4	1	1	.6	1977	5	2	3	4	SS122	JP	03/25/02		45
46	4	1	1	21.0	1980	1	1	1	10	SS122	JP	03/25/02		46
47	5	2	1	.	1939	5	1	1	.	SS&SWB	KC	03/28/02		47
48	9	2	1	.	1936	4	2	1	.	SS&SWB	KC	03/28/02		48
49	4	2	1	15.0	1955	5	2	1	7	SS&SWB	KC	03/28/02		49
50	5	1	2	10.0	1976	4	2	2	3	Sant	JP	03/25/02		50
51	10	1	2	16.0	1947	1	2	2	2	Sant	JP	03/25/02		51
52	10	1	2	14.0	1966	2	2	2	2	Sant	JP	03/25/02		52
53	10	1	2	68.0	1934	1	2	1	.	Sant	JP	03/25/02		53
54	10	1	2	40.0	.	4	1	1	.	Sant	JP	03/25/02		54
55	5	1	3	18.0	1984	2	2	.	.	Sant	JP	03/25/02		55
56	7	2	1	15.0	1968	3	2	2	4	Sant	JP	03/25/02		56
57	3	1	2	24.0	1977	2	1	2	3	Sant	JP	03/25/02		57
58	9	1	2	16.0	1940	1	1	2	1	Sant	JP	03/25/02		58
59	10	1	2	2.0	1970	4	1	2	3	Sant	JP	03/25/02		59
60	8	1	2	20.0	1954	4	2	2	4	Sant	JP	03/25/02		60
61	10	1	1	14.0	1956	3	2	1	3	Sant	JP	03/25/02		61
62	6	2	1	80.0	1922	1	2	1	3	SS&SWB	JP	03/28/02		62
63	5	2	2	.	1957	3	2	1	.	SS&SWB	JP	03/28/02		63
64	5	1	2	5.0	1923	3	2	1	4	SS&SWB	JP	03/28/02		64
65	5	1	2	.	1932	1	1	1	2	SS&SWB	JP	03/28/02		65
66	6	2	1	2.5	1950	4	1	1	8	SS&SWB	JP	03/28/02		66
67	.	.	.	.	.	.	1	2	.	Sant	CA	03/26/02		67
68	7	1	2	5.0	1967	4	2	2	7	Sant	CA	03/26/02		68
69	2	1	2	12.0	1970	3	1	2	5	Sant	CA	03/26/02		79
70	3	2	1	3.0	1961	3	1	2	5	Sant	CA	03/26/02		70
71	5	2	1	6.0	1954	4	1	2	5	Sant	CA	03/26/02		71
72	5	1	2	14.0	1918	1	1	2	1	Sant	CA	03/26/02		72
73	10	2	1	40.0	1947	2	1	3	5	Sant	CA	03/26/02		73

	live	over18	unfilt_3	unfi#_3a	filt_4	filt#_4a	type_4b	f_taste	f_clarit	f_color	f_odor	f_health	f_other	f_dk
74	1	.	1	10.0	.	.	.	.	.	.	.	.	.	.
75	1	.	1	3.0	2	.	.	.	.	.	.	.	.	.
76	1	.	1	1.0	2	.	.	.	.	.	.	.	.	.
77	1	.	2	.	2	.	.	.	.	.	.	.	.	.
78	1	.	1	4.5	2	.	.	.	.	.	.	.	.	.
79	1	.	1	2.0	1	.0	2	.	.	.	.	1	.	.
80	1	.	2	.	1	.	1	.	1	.	.	1	.	.
81	1	.	2	.	1	4.0	1	.	.	.	.	.	.	1
82	1	.	2	.	2	.	.	.	.	.	.	.	.	.
83	1	.	2	.	1	8.0	2	1	1	1	1	.	.	.
84	1	.	1	4.0	2	.	.	.	.	.	.	.	.	.
85	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
86	1	.	2	.	1	.	1	.	.	.	1	1	.	.
87	1	.	1	3.5	.	.	.	.	.	.	.	.	.	.
88	1	.	1	3.0	2	.	.	.	.	.	.	.	.	.
89	1	.	2	.	1	4.0	1	1	.	.	.	1	.	.
90	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
91	1	.	2	.	1	4.0	4	1	.	.	.	.	.	.
92	1	.	1	12.0	2	.	.	.	.	.	.	.	.	.
93	1	.	2	.	1	2.0	2	1	1	.	.	.	.	.
94	1	.	1	2.0	1	10.0	3	1	1	1	.	1	.	.
95	1	.	1	3.0	1	4.0	3	.	.	.	.	.	1	.
96	1	.	2	.	2	.	.	.	.	.	.	.	.	.
97	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
98	1	.	2	.0	1	8.0	1	1	.	.	.	.	.	.
99	1	.	2	.	1	3.0	1	1	.	.	1	.	1	.
100	1	.	2	.	1	4.0	1	.	.	.	.	1	.	.
101	1	.	2	.	2	.	.	.	.	.	.	.	.	.
102	1	.	1	.	2	.	.	.	.	.	.	.	.	.
103	1	.	2	.	2	.	.	.	.	.	.	.	.	.
104	1	.	2	.	1	3.5	1	1	.	.	.	.	1	.
105	1	.	1	1.0	2	.	.	.	.	.	.	.	.	.
106	1	.	2	.	2	.	.	.	.	.	.	.	.	.
107	1	.	1	3.0	2	.	.	.	.	.	.	.	.	.
108	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
109	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
110	1	.	2	.	2	.	.	.	.	.	.	.	.	.
111	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
112	1	.	1	12.0	2	.	.	.	.	.	.	.	.	.
113	1	.	1	.	2	.	.	.	.	.	.	.	.	.
114	1	.	1	.	1	2.0	2	.	.	.	.	.	.	1
115	1	.	2	.	2	.	.	.	.	.	.	.	.	.
116	1	.	1	.	1	1.0	1	1	.	.	.	.	.	.
117	1	.	1	1.0	1	.	1	.	.	.	.	1	.	.
118	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
119	1	.	2	.	2	.	.	.	.	.	.	.	.	.
120	1	.	2	.	2	.	.	.	.	.	.	.	.	.
121	1	.	2	.	2	.	.	.	.	.	.	.	.	.
122	1	.	2	.	1	1.0	2	1	1	1	1	.	.	.
123	1	.	2	.	1	4.0	1	.	.	.	.	1	1	.
124	1	.	2	.	1	3.0	1	1	1	1	1	1	.	.
125	1	.	1	4.0	1	.0	1	.	.	.	.	.	.	1
126	1	.	2	.	1	.0	1	1	1	1	1	1	.	.
127	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
128	1	.	2	.	2	.	.	.	.	.	.	.	.	.
129	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
130	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
131	1	.	1	.0	1	4.0	3	.	.	.	.	.	.	1
132	1	.	2	.	1	3.0	2	1	.	.	.	.	.	.
133	1	.	2	.	2	.	.	.	.	.	.	.	.	.
134	1	.	1	8.0	2	.	.	.	.	.	.	.	.	.
135	1	.	1	1.0	2	.	.	.	.	.	.	.	.	.
136	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
137	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
138	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
139	1	.	2	.	1	4.5	2	1	1	1	1	1	.	.
140	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
141	1	.	2	.	1	4.5	1	.	.	.	.	1	.	.
142	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
143	1	.	1	1.0	2	.	.	.	.	.	.	.	.	.
144	1	.	1	5.0	.	.	.	.	.	.	.	.	.	.
145	1	.	2	.	.	.	.	.	.	.	.	.	.	.
146	1	.	1	3.0	2	.	.	.	.	.	.	.	.	.

	prefer_5	t_sat	t_conv	t_price	t_other	t_dk	b_taste	b_clarit	b_color	b_odor	b_health	b_other	b_dk	botled_6
74	2	.	.	.	.	.	.	.	.	.	.	1	.	.
75	1	.	.	1	.	.	.	.	.	.	.	.	.	.
76	3	.	.	.	.	.	.	.	.	.	.	.	.	2
77	2	.	.	.	.	.	1	.	.	1	.	.	.	1
78	1	1	.	.	.	.	.	.	.	.	.	.	.	2
79	2	.	.	.	.	.	1	.	.	.	.	.	.	1
80	3	.	.	.	.	.	.	.	.	.	.	.	.	1
81	3	.	.	.	.	.	.	.	.	.	.	.	.	2
82	2	.	.	.	.	.	1	.	.	.	.	.	.	1
83	2	.	.	.	.	.	1	1	1	1	.	.	.	2
84	2	.	.	.	.	.	1	1	1	1	1	.	.	1
85	2	.	.	.	.	.	1	.	.	.	.	.	.	1
86	1	.	.	.	.	.	.	.	.	.	.	.	.	.
87	1	1	1	1	.	.	.	.	.	.	.	.	.	1
88	3	.	.	.	.	.	.	.	.	.	.	.	.	1
89	2	.	.	.	.	.	1	.	.	.	.	.	.	1
90	2	.	.	.	.	.	1	.	.	.	.	.	.	1
91	2	.	.	.	.	.	1	.	.	.	.	.	.	1
92	2	.	.	.	.	.	1	.	.	1	.	.	.	1
93	2	.	.	.	.	.	.	.	.	.	.	.	1	1
94	2	.	.	.	.	.	1	1	1	.	.	.	.	1
95	2	.	.	.	.	.	.	.	.	.	1	1	.	1
96	2	.	.	.	.	.	1	.	.	.	.	.	.	1
97	1	1	.	.	.	.	.	.	.	.	.	.	.	1
98	2	.	.	.	.	.	1	.	.	.	.	.	.	1
99	2	.	.	.	.	.	1	.	.	1	.	.	.	1
100	2	.	.	.	.	.	.	1	.	.	1	.	.	1
101	2	.	.	.	.	.	1	.	.	.	.	.	.	1
102	1	1	.	.	1	.	.	.	.	.	.	.	.	1
103	1	.	.	1	.	.	.	.	.	.	.	.	.	1
104	2	.	.	.	.	.	1	.	.	.	1	.	.	1
105	2	.	.	.	.	.	1	.	.	.	.	.	.	1
106	2	.	.	.	.	.	1	.	.	.	.	.	.	1
107	3	.	.	.	.	.	.	.	.	.	.	.	.	1
108	1	1	.	1	.	.	.	.	.	.	.	.	.	2
109	2	.	.	.	.	.	1	.	.	.	.	.	.	1
110	2	.	.	.	.	.	.	1	.	.	.	1	.	1
111	1	1	1	1	.	.	.	.	.	.	.	.	.	1
112	1	1	.	1	.	.	.	.	.	.	.	.	.	1
113	2	.	.	.	.	.	.	.	.	.	.	1	.	1
114	1	.	1	.	.	.	.	.	.	.	.	.	.	1
115	2	.	.	.	.	.	1	1	1	1	1	.	.	1
116	1	.	.	1	.	.	.	.	.	.	.	.	.	2
117	2	.	.	.	.	.	.	1	.	.	.	.	.	1
118	1	.	.	.	1	.	.	.	.	.	.	.	.	2
119	2	.	.	.	.	.	1	.	.	.	.	.	.	1
120	2	.	.	.	.	.	1	.	.	.	.	.	.	1
121	2	.	.	.	.	.	1	.	.	.	1	.	.	1
122	2	.	.	.	.	.	.	.	.	.	1	.	.	1
123	2	.	.	.	.	.	.	.	.	.	1	.	.	1
124	2	.	.	.	.	.	1	1	1	1	1	.	.	1
125	1	1	.	.	.	.	.	.	.	.	.	.	.	1
126	2	.	.	.	.	.	1	1	1	1	1	.	.	1
127	1	.	1	.	.	.	.	.	.	.	.	.	.	2
128	2	.	.	.	.	.	1	1	.	.	1	.	.	1
129	2	.	.	.	.	.	1	.	.	.	.	.	.	1
130	2	.	.	.	.	.	1	1	1	1	1	.	.	1
131	2	.	.	.	.	.	1	.	.	.	.	.	.	1
132	1	.	1	.	.	.	.	.	.	.	.	.	.	2
133	2	.	.	.	.	.	.	.	.	.	1	1	.	1
134	1	.	.	1	.	.	.	.	.	.	.	.	.	2
135	2	.	.	.	.	.	.	.	.	.	.	.	1	1
136	2	.	.	.	.	.	1	.	.	.	.	.	.	1
137	1	.	1	.	.	.	.	.	.	.	.	.	.	2
138	3	.	.	.	.	.	.	.	.	.	.	.	.	1
139	3	.	.	.	.	.	.	.	.	.	.	.	.	1
140	2	.	.	.	.	.	1	1	.	.	.	.	.	.
141	2	.	.	.	.	.	1	.	.	.	.	.	.	1
142	2	.	.	.	.	.	1	.	.	.	.	.	.	1
143	2	.	.	.	.	.	1	.	.	.	.	.	.	1
144	1	1	.	.	.	.	.	.	.	.	.	.	.	2
145	2	.	.	.	.	.	1	1	.	.	.	.	.	1
146	2	.	.	.	.	.	1	.	.	.	.	.	.	1

	bott#_6a	buy_7	spend_7a	cook_8	bvg_9	type_9a	taste_10	exp_10a	hr_tap	hr_bot	hr_filt	hr_none	hr_dk	hrt_main
74	.	1	10.00	1	1	1	2.0	.	.	.	.	.	1	.
75	.	.	.	1	1	1	2.0	.	1	.	.	.	.	.
76	.	.	.	1	2	.	4.0	.	.	1	.	.	.	.
77	8.0	1	5.00	4	1	3	2.0	.	1	.	.	.	.	.
78	.	.	.	1	1	1	4.0	.	.	.	.	1	.	.
79	10.0	1	10.00	3	1	1	4.0	.	1	1	1	.	.	.
80	.	1	.	2	1	2	.	.	.	.	.	1	.	.
81	.	.	.	1	1	1	3.0	.	.	1	.	.	1	.
82	8.0	1	7.00	3	1	3	3.0	.	.	.	.	1	.	.
83	.	.	.	2	1	2	1.0	.	1	.	.	.	.	.
84	2.0	1	2.00	1	1	1	3.0	.	1	.	.	.	.	.
85	.	1	5.00	1	1	1	4.0	.	.	.	.	1	.	.
86	.	.	.	.	1	2	2.0	.	1	1	.	.	.	1
87	1.0	1	3.00	1	1	1	5.0	.	.	.	.	.	.	.
88	.	1	3.00	1	1	1	3.0	.	.	.	.	1	.	.
89	1.0	2	.	1	1	1	2.0	.	1	.	.	.	.	.
90	3.0	2	.	1	1	1	2.0	.	.	.	.	1	.	.
91	2.0	1	5.00	1	1	1	2.0	.	.	.	.	1	.	.
92	1.0	1	10.00	1	1	1	2.0	.	.	.	.	1	.	.
93	2.0	1	15.00	2	1	2	1.0	.	1	1	.	.	.	1
94	1.0	1	8.00	2	1	2	1.0	.	.	.	.	1	.	.
95	.0	1	10.50	3	1	2	1.0	.	1	.	.	.	.	.
96	5.0	1	5.00	3	2	.	1.0	.	1	.	.	.	.	1
97	1.0	1	5.00	1	1	1	5.0	.	1	.	.	.	.	.
98	4.0	1	10.00	2	1	2	2.0	.	1	.	.	.	.	1
99	6.0	1	2.00	2	1	2	2.0	.	1	.	.	.	.	.
100	.	2	.	1	1	1	3.0	.	1	.	.	.	.	1
101	8.0	1	12.00	1	1	1	1.0	.	1	.	.	.	.	.
102	.	1	2.00	1	1	1	5.0	.	.	.	.	1	.	.
103	4.0	1	3.50	1	1	1	4.0	.	.	.	.	1	.	.
104	3.0	2	.	1	1	2	3.0	.	1	1	1	.	.	.
105	.	1	2.00	1	1	1	2.0	.	.	.	.	1	.	.
106	4.0	1	3.00	1	1	3	3.0	.	.	.	.	1	.	.
107	2.0	2	.	1	1	1	4.0	.	1	.	.	.	.	1
108	.	2	.	1	1	1	5.0	.	.	.	.	1	.	.
109	1.0	1	2.50	1	1	1	3.0	.	1	.	.	.	.	1
110	4.0	1	3.00	1	1	1	3.0	.	1	.	.	.	.	1
111	.0	2	.	1	1	1	5.0	.	.	.	.	1	.	.
112	.	1	.	1	1	1	4.0	.	.	.	.	1	.	.
113	4.0	2	2.00	1	1	1	4.0	.	1	.	.	.	.	1
114	.	1	.	1	1	1	4.0	.	.	.	.	1	.	.
115	8.0	1	15.00	1	1	1	3.0	.	.	.	.	1	.	.
116	.	.	.	1	1	2	4.0	.	.	.	.	1	.	.
117	.	1	.	1	1	1	3.0	.	.	.	.	.	1	.
118	.	.	.	1	1	1	3.0	.	.	.	.	1	.	.
119	3.0	1	6.00	1	1	3	1.0	.	.	1	.	.	.	.
120	.	1	1.00	1	1	1	3.0	.	.	.	.	1	.	.
121	3.0	1	8.00	1	1	3	3.0	.	.	.	.	1	.	.
122	2.0	2	.	.	1	2	2.0	.	.	.	.	1	.	.
123	1.0	1	5.00	1	1	2	1.0	.	.	.	.	.	1	.
124	4.0	1	3.00	1	2	.	2.0	.	1	1	1	.	.	1
125	.0	2	.	1	1	1	4.0	.	1	1	.	.	.	1
126	4.0	1	2.00	1	1	1	3.0	.	1	.	1	.	.	.
127	.	2	.	1	1	1	3.0	.	.	.	.	1	.	.
128	4.0	1	4.00	1	1	1	1.0	.	1	.	.	.	.	1
129	1.0	1	4.00	1	2	.	4.0	.	.	.	.	1	.	.
130	2.0	1	.	1	1	1	3.0	.	1	1	1	.	.	.
131	1.0	2	.	1	1	1	4.0	.	1	.	.	.	.	.
132	.	2	.	1	1	1	2.0	.	.	.	.	1	.	.
133	4.0	1	4.00	1	1	1	3.0	.	1	.	.	.	.	.
134	.	2	.	1	1	1	3.0	.	.	.	1	.	.	.
135	.0	2	.	5	1	1	4.0	.	.	.	.	1	.	.
136	.0	2	.	1	1	1	2.0	.	.	.	.	1	.	.
137	.	.	.	1	1	1	5.0	.	.	.	.	1	.	.
138	.0	1	2.00	1	1	1	3.0	.	.	.	.	1	.	.
139	9.0	1	10.00	2	1	2	2.0	.	1	.	.	.	.	1
140	.	.	.	1	1	1	3.0	.	.	.	.	1	.	.
141	3.0	1	7.50	1	2	.	4.0	.	.	.	.	1	.	.
142	.0	1	.	1	1	1	3.0	.	.	.	.	1	.	.
143	.0	1	.	1	1	1	3.0	.	.	.	.	1	.	.
144	.	1	10.00	1	1	1	5.0	.	.	.	.	1	.	.
145	8.0	1	5.00	3	1	3	3.0	.	1	1	1	.	.	.
146	.0	1	2.50	1	1	1	3.0	.	1	.	.	.	.	.

	hrt_hous	hrt_pur	hrt_res	hrt_othr	hrt_dk	w_iron	w_lead	w_cu	w_cl	w_ss	w_par	w_bact	w_other	w_dk
74	.	.	.	.	.	.	.	.	.	.	.	.	.	.
75	.	.	.	1	.	1	.	.	.	.	.	.	.	.
76	.	.	.	.	.	.	.	.	.	.	.	.	.	.
77	.	.	.	.	1	.	.	.	.	.	.	.	.	1
78	.	.	.	.	.	.	1	1	.	.	.	.	.	.
79	.	1	.	.	.	.	1	.	1	.	.	1	.	.
80	.	.	.	.	.	.	1	.	.	.	.	.	.	.
81	.	.	.	.	.	1	1	1	1	1	1	1	.	.
82	.	.	.	.	.	.	.	.	.	.	.	.	.	1
83	.	.	.	.	1	.	1	.	.	1	.	1	.	.
84	2	.	.	.	.	.	1	.	1	1	.	1	.	.
85	.	.	.	.	.	.	.	.	.	.	.	.	.	1
86	1	.	.	1	.	1	1	1	1	.	.	.	.	.
87	.	.	.	.	.	1	.	.	.	.	.	.	.	.
88	.	.	.	.	.	.	.	.	1	1	.	.	.	.
89	.	.	.	.	1	1	.	.	1	.	.	.	.	.
90	.	.	.	.	.	.	.	.	.	.	.	.	.	1
91	.	.	.	.	.	.	.	.	.	.	.	.	.	1
92	.	.	.	.	.	.	.	.	1	.	.	.	.	1
93	1	1	1	1	.	.	1	.	.	1	.	1	.	.
94	.	.	.	.	.	1	1	.	1	.	.	.	.	.
95	.	.	1	.	.	1	.	.	.	.	1	1	.	.
96	.	.	.	.	.	.	.	.	1	.	.	.	.	.
97	1	.	.	.	.	1	1	1	1	1	1	1	.	.
98	.	1	1	.	.	.	1	.	.	1	.	1	.	.
99	.	.	1	.	.	1	1	1	1	1	1	1	.	.
100	.	.	.	.	.	.	1	1	.	.	1	1	.	.
101	.	.	.	.	1	1	.	.	.	.	.	.	1	.
102	.	.	.	.	.	1	1	1	.	.	.	.	.	.
103	.	.	.	.	.	.	.	.	.	.	.	.	.	1
104	.	.	1	.	.	.	.	.	1	.	.	.	.	.
105	.	.	.	.	.	1	1	1	1	1	1	1	1	.
106	.	.	.	.	.	.	1	.	1	.	.	.	.	.
107	1	1	1	1	.	.	.	.	.	.	.	.	.	1
108	.	.	.	.	.	1	1	1	1	1	.	1	1	.
109	1	.	.	.	.	.	.	1	.	.	.	.	.	.
110	1	1	1	1	.	1	1	1	1	1	1	1	1	.
111	.	.	.	.	.	1	.	1	1	.	.	.	.	.
112	.	.	.	.	.	1	1	.	1	.	.	.	.	.
113	1	.	1	.	.	1	.	1	1	1	.	.	.	.
114	.	.	.	.	.	.	1	.	1	.	.	.	.	.
115	.	.	.	.	.	.	1	1	.	.	.	1	.	.
116	.	.	.	.	.	.	.	.	1	.	.	.	.	.
117	.	.	.	.	.	.	.	.	.	1	.	1	.	.
118	.	.	.	.	.	1	.	.	1	.	1	1	.	.
119	.	.	.	.	.	.	.	.	1	.	1	.	.	.
120	.	.	.	.	.	.	.	.	.	.	.	.	.	1
121	.	.	.	.	.	.	.	.	.	.	.	.	.	.
122	.	.	.	.	.	.	.	1	1	.	.	.	.	.
123	.	.	.	.	.	.	1	.	.	.	.	1	.	.
124	1	1	1	.	.	1	1	1	1	1	1	1	.	.
125	1	.	.	.	.	1	.	1	1	1	.	.	.	.
126	.	.	.	.	1	1	1	1	1	1	1	1	.	.
127	.	.	.	.	.	1	.	1	1	1	.	.	.	.
128	1	1	1	.	.	1	.	.	1	1	1	1	1	.
129	.	.	.	.	.	.	.	.	1	.	.	.	.	.
130	.	.	.	.	1	1	1	1	1	.	.	.	.	.
131	1	1	.	.	.	.	1	.	1	.	.	1	.	.
132	.	.	.	.	.	1	1	1	1	1	1	1	.	.
133	.	.	.	.	1	1	.	1	1	1	1	1	.	.
134	.	.	.	.	.	1	1	1	1	1	1	1	1	.
135	.	.	.	.	.	1	.	.	1	.	.	.	.	.
136	.	.	.	.	.	1	1	1	1	1	1	1	.	.
137	.	.	.	.	.	.	.	.	.	.	.	.	.	1
138	.	.	.	.	.	1	1	1	1	1	1	1	.	.
139	1	.	.	.	.	.	1	1	.	.	.	1	.	.
140	.	.	.	.	.	.	.	.	1	.	.	.	.	.
141	.	.	.	.	.	.	1	.	1	.	.	.	.	.
142	.	.	.	.	.	1	.	.	.	.	.	.	.	.
143	.	.	.	.	.	.	.	.	.	.	.	.	.	.
144	.	.	.	.	.	.	.	.	.	.	.	.	.	1
145	1	1	.	.	.	.	.	.	1	.	1	.	.	.
146	1	1	.	.	.	1	1	.	.	.	.	1	.	.

	seen_13	subj_13a	wher_13b	news_14	qua_15	water_16	botle_17	buy_18	not_18a	che_18b	plant_19	stret_20
74	1	.	.	.	2	2	2	2	3	3	2	gaylord blvd
75	2	.	.	.	2	2	1	2	4	2	2	charlton st
76	2	.	.	.	2	2	1	2	1	2	1	copperfield rd
77	2	.	.	.	2	2	2	1	.	.	2	acushnet ave
78	2	.	.	.	2	2	1	1	.	.	1	sylvan st
79	1	.	.	.	2	2	3	1	.	.	2	main st
80	2	.	.	.	1	2	2	2	5	.	1	paris ave
81	1	.	.	.	1	2	3	2	.	.	2	healy rd
82	2	.	.	.	1	1	2	3	.	.	1	blanche st
83	2	.	.	.	2	2	2	3	.	.	1	fielding st
84	2	.	.	.	2	2	2	1	.	.	2	chathham
85	1	.	.	.	2	2	2	1	.	.	2	uncantena ave
86	2	.	.	.	2	2	.	.	.	.	.	harley dr
87	2	.	.	.	2	1	1	2	1	.	2	oneida ave
88	1	.	.	.	2	2	1	2	4	1	2	stratton rd
89	2	.	.	.	2	2	2	1	.	.	2	park ave
90	2	.	.	.	2	2	2	1	.	.	2	mountainshire dr
91	1	.	.	.	1	1	2	1	.	.	2	eunice ave
92	1	.	.	.	1	2	2	1	.	1	1	june st
93	1	.	.	.	2	1	2	1	.	.	1	lovell dr
94	1	.	.	.	2	2	2	1	.	.	2	mill st
95	1	.	.	.	1	2	2	2	2	2	2	parsons hill dr
96	2	.	.	.	2	2	2	2	6	2	2	keen st
97	2	.	.	.	2	2	1	2	5	1	2	kingsburry st
98	2	.	.	.	2	2	2	3	2	3	2	brookline st
99	1	.	.	.	1	1	2	3	.	3	1	south ludlow st
100	2	.	.	.	2	2	2	1	.	.	2	salisbury st
101	2	.	.	.	2	2	2	1	.	.	2	santoro rd
102	1	.	.	.	2	2	1	2	1	2	2	west boylston st
103	1	.	.	.	1	2	2	1	.	.	2	blue bell rd
104	1	.	.	.	2	2	2	2	6	3	2	longfellow rd
105	2	.	.	.	2	2	2	2	3	2	2	upland gardens dr
106	2	.	.	.	2	2	2	3	.	.	2	burncoat st
107	2	.	.	.	2	2	1	2	3	2	2	greendale ave
108	1	.	.	.	1	1	1	3	.	.	1	cowden st
109	2	.	.	.	2	2	1	1	.	.	1	wentworth st
110	2	.	.	.	2	2	2	2	5	2	2	main st
111	1	.	.	.	2	2	1	1	.	.	2	algonquin rd
112	2	.	.	.	2	2	1	3	.	.	2	dean st
113	1	.	.	.	1	2	1	1	.	.	2	dean st
114	1	.	.	.	2	2	1	1	.	.	2	brattle st
115	2	.	.	.	1	2	2	1	.	.	2	west boylston st
116	1	.	.	.	1	1	1	2	4	1	1	malden st
117	2	.	.	.	2	1	1	1	.	.	2	whittman rd
118	2	.	.	.	1	2	1	.	.	1	2	fales st
119	2	.	.	.	1	2	2	1	.	.	1	tyson rd
120	2	.	.	.	2	2	1	1	.	.	2	fairhaven rd
121	1	.	.	.	1	2	2	2	2	2	2	beverly rd
122	2	.	.	.	2	2	2	3	.	3	2	accommodation st
123	2	.	.	.	2	2	2	2	4	2	2	marble st
124	1	.	.	.	1	2	2	1	.	.	1	cohasset st
125	1	.	.	.	1	1	1	2	4	1	1	fremont st
126	1	.	.	.	1	1	2	1	.	.	2	brookshire rd
127	2	.	.	.	2	2	2	2	4	2	1	park ave
128	1	.	.	.	1	2	2	3	3	2	2	bourne st
129	1	.	.	.	2	2	1	1	.	1	1	bourne st
130	1	.	.	.	2	2	2	3	.	1	2	forest st
131	2	.	.	.	2	2	1	1	.	1	2	belmont st
132	1	.	.	.	1	1	1	2	5	2	1	lanark st
133	1	.	.	.	2	2	2	2	3	2	2	wyola dr
134	1	.	.	.	2	2	1	2	4	2	2	einhorn rd
135	2	.	.	.	2	2	1	2	4	2	2	einhorn rd
136	1	.	.	.	2	2	1	2	4	3	2	west st
137	2	.	.	.	2	2	2	2	1	.	1	main st
138	1	.	.	.	2	2	2	3	.	2	2	jaques ave
139	1	.	.	.	1	2	2	3	.	.	1	harding st
140	1	.	.	.	2	2	1	3	.	1	2	haven ln
141	2	.	.	.	2	2	2	3	.	1	2	belmont st
142	2	.	.	.	2	2	2	1	.	.	2	austin st
143	2	.	.	.	2	2	2	1	.	.	1	chatanika ave
144	1	.	.	.	2	2	2	1	.	.	2	farmington st
145	1	.	.	.	3	1	2	2	3	.	1	apricot st
146	1	.	.	.	2	2	1	1	.	.	2	benefit tr

	zc_21	home_22	bill_23	long_24	age_25	edu_26	gendr_27	anstr_28	incom_29	location	intervie	date	time	number
74	8	1	2	2.5	1953	2	2	2	1	Sant	CA	03/26/02		74
75	.	1	2	11.0	1946	1	1	2	2	Sant	CA	03/26/02		75
76	2	2	1	55.0	1946	5	1	5	.	SS&SWB	CA	03/28/02	3:45	76
77	6	2	1	15.0	1955	2	1	1	5	SS&SWB	CA	03/28/02	3:50	77
78	3	2	1	67.0	1934	2	1	1	2	Shaws	CA	03/29/02		78
79	3	1	2	22.0	1960	1	2	1	5	Shaws	CA	03/29/02		79
80	3	2	1	62.0	1922	2	2	1	2	Shaws	CA	03/29/02		80
81	3	2	1	10.0	1963	4	2	1	7	Shaws	CA	03/29/02		81
82	2	1	2	83.0	1919	2	1	1	1	Shaws	CA	03/29/02		82
83	3	2	1	42.0	1959	2	2	1	5	Shaws	CA	03/29/02		83
84	6	1	2	2.0	1983	2	1	3	1	SS&SWB	KC	03/28/02		84
85	6	2	1	18.0	1983	2	2	5	.	SS&SWB	KC	03/28/02		85
86	6	.	.	80.0	.	4	1	1	.	SS&SWB	KC	03/28/02	3:10	86
87	6	2	1	74.0	1928	2	1	1	.	SS&SWB	KC	03/28/02		87
88	6	1	2	31.0	1970	4	2	1	5	SS&SWB	KC	03/28/02		88
89	5	1	2	3.0	1981	3	2	1	1	SS&SWB	KC	03/28/02	3:20	89
90	6	2	1	3.0	1971	5	2	4	4	SS&SWB	KC	03/28/02		90
91	6	2	1	15.0	1960	4	2	1	5	SS&SWB	KC	03/28/02	3:40	91
92	2	1	2	1.0	1935	4	1	1	3	SS&SWB	KC	03/28/02		92
93	3	2	1	45.0	1948	4	1	3	6	Shaws	JP	03/29/02		93
94	2	2	2	18.0	1984	2	1	1	10	Shaws	JP	03/29/02		94
95	3	2	1	76.0	1926	4	2	1	3	Shaws	JP	03/29/02		95
96	3	1	2	34.0	1968	4	2	3	5	Shaws	JP	03/29/02		96
97	10	1	2	17.0	1969	1	2	1	2	Shaws	JP	03/29/02		97
98	3	2	1	8.0	1969	5	2	1	11	Shaws	JP	03/29/02		98
99	3	2	1	25.0	1954	3	2	1	8	Shaws	JP	03/29/02		99
100	9	2	2	18.0	1973	4	2	1	11	SS&SWB	JP	03/28/02		100
101	6	2	1	10.0	.	4	2	1	10	SS&SWB	JP	03/28/02		101
102	6	1	2	5.0	1960	3	1	5	2	SS&SWB	JP	03/28/02		102
103	4	2	1	5.0	1930	4	1	1	2	SS&SWB	JP	03/28/02		103
104	2	1	2	30.0	1971	5	2	1	10	SS&SWB	JP	03/28/02		104
105	8	1	2	25.0	1976	2	2	1	2	SS&SWB	JP	03/28/02		105
106	6	1	2	2.5	1977	5	2	1	7	SS&SWB	JP	03/28/02		106
107	6	2	1	4.0	1947	3	1	2	6	SS&SWB	JP	03/28/02		107
108	3	2	1	39.0	1939	2	2	1	.	SS&SWB	JP	03/28/02		108
109	3	2	2	18.0	1983	3	1	1	4	SS&SWB	JP	03/28/02		109
110	3	1	2	3.0	1975	4	2	1	4	SS&SWB	JP	03/28/02		110
111	9	.	2	4.0	1980	4	2	1	.	WPI	CA	04/01/02		111
112	9	1	2	4.0	1980	3	1	1	1	SS&SWB	CA	03/28/02		112
113	9	1	2	6.0	1979	3	2	5	1	SS&SWB	CA	03/28/02		113
114	6	2	2	22.0	1979	4	2	1	3	SS&SWB	CA	03/28/02		114
115	6	2	1	20.0	1970	5	2	1	10	SS&SWB	CA	03/28/02		115
116	6	2	1	.	1936	2	1	1	9	SS&SWB	CA	03/28/02		116
117	9	2	1	28.0	1944	5	1	1	10	SS&SWB	CA	03/28/02		117
118	6	2	2	.3	.	.	1	1	.	SS&SWB	CA	03/28/02		118
119	6	2	1	20.0	1946	3	1	1	11	SS&SWB	CA	03/28/02		119
120	6	2	1	2.0	1953	2	2	1	7	SS&SWB	CA	03/28/02		120
121	5	2	1	20.0	.	4	2	1	.	SS&SWB	CA	03/28/02		121
122	7	1	2	17.0	1944	1	1	2	3	SS&SWB	CA	03/28/02		122
123	3	1	2	32.0	1970	2	2	5	4	SS&SWB	JP	03/28/02		123
124	4	1	2	40.0	1944	4	2	1	4	WPI	CA	04/01/02		124
125	3	1	2	7.5	1982	3	1	2	4	WPI	JP	04/01/02		125
126	9	2	1	1.0	1969	5	2	1	.	WPI	CA	04/01/02		126
127	9	1	2	8.0	1977	3	1	1	4	WPI	CA	04/01/02		128
128	6	1	2	22.0	1954	5	2	1	4	WPI	CA	04/01/02		129
129	6	1	2	20.0	1958	3	1	1	4	WPI	CA	04/01/02		130
130	9	2	1	20.0	1959	4	2	1	8	WPI	CA	04/01/02		131
131	4	1	2	13.0	1981	3	2	5	3	WPI	CA	04/01/02		132
132	3	2	1	50.0	1951	4	1	1	9	SS&SWB	JP	03/28/02		133
133	3	2	1	45.0	1936	2	2	1	.	SS&SWB	JP	03/28/02		134
134	9	1	2	3.0	1981	4	1	1	7	WPI	JP	04/01/02		135
135	9	1	2	3.0	1981	4	1	1	1	WPI	JP	04/01/02		136
136	9	1	2	4.0	1980	4	2	1	5			.		137
137	3	1	2	90.0	1912	3	2	1	1	Shaws	CA	03/29/02		139
138	10	1	2	51.0	.	2	2	1	2	Shaws	CA	03/29/02		140
139	10	2	1	18.0	1952	5	2	2	9	Shaws	CA	03/29/02		141
140	5	1	2	30.0	1941	1	1	1	2	Shaws	CA	03/29/02		142
141	5	1	1	3.0	1966	1	2	1	1	Shaws	CA	03/29/02		143
142	9	1	2	4.0	1980	1	2	2	1	Shaws	CA	03/29/02		144
143	2	2	1	83.0	1918	2	2	5	4	Shaws	CA	03/29/02		145
144	3	1	2	7.0	1957	2	1	1	5	Shaws	KC	03/29/02		146
145	3	2	1	49.0	1952	5	2	1	11	Shaws	KC	03/29/02		147
146	10	1	2	10.0	.	3	2	3	.	Shaws	KC	03/29/02		148

	live	over18	unfilt_3	unfi#_3a	filt_4	filt#_4a	type_4b	f_taste	f_clarit	f_color	f_odor	f_health	f_other	f_dk
147	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
148	1	.	2	.	1	6.0	1	1	1	1	1	1	.	.
149	1	.	2	2.0	.	.	.	.	.	.	.	.	.	.
150	1	.	2	.	2	.	.	.	.	.	.	.	.	.
151	1	.	1	.0	1	.0	1	.	.	.	.	1	.	.
152	1	.	2	.	1	.	1	1	.	.	.	.	.	.
153	1	.	2	.	2	.	.	.	.	.	.	.	.	.
154	1	.	1	1.0	1	3.0	1	1	.	.	.	.	.	.
155	1	.	1	.0	2	.	.	.	.	.	.	.	.	.
156	1	.	2	.	1	4.0	2	1	1	.	.	.	.	.
157	1	.	2	.	1	3.5	4	1	.	.	.	.	.	.
158	1	.	1	1.5	2	.	.	.	.	.	.	.	.	.
159	1	.	1	4.0	2	.	.	.	.	.	.	.	.	.
160	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
161	1	.	2	.	1	.0	1	1	1	1	1	1	.	.
162	1	.	2	.	1	1.0	1	1	.	.	.	.	.	.
163	1	.	1	2.0	2	.	.	.	.	.	.	.	.	.
164	1	.	1	.0	1	5.5	1	1	.	.	.	.	.	.
165	1	.	1	.	2	.	.	.	.	.	.	.	.	.
166	1	.	1	1.0	1	3.0	1	1	.	.	.	.	.	.
167	1	.	2	.	1	3.0	1	1	.	.	.	.	.	.
168	1	.	2	.	2	.	.	.	.	.	.	.	.	.
169	1	.	2	.	1	3.0	1	1	.	.	.	.	.	.

	prefer_5	t_sat	t_conv	t_price	t_other	t_dk	b_taste	b_clarit	b_color	b_odor	b_health	b_other	b_dk	bottled_6
147	2	.	.	.	.	.	1	.	.	.	1	.	.	1
148	2	.	.	.	.	.	1	1	1	1	1	.	.	1
149	3	.	.	.	.	.	.	.	.	.	.	.	.	2
150	2	.	.	.	.	.	1	.	.	.	.	.	.	1
151	1	1	.	.	.	.	.	.	.	.	.	.	.	1
152	2	.	.	.	.	.	1	.	.	.	.	.	.	1
153	2	.	.	.	.	.	1	1	1	1	1	.	.	1
154	3	.	.	.	.	.	.	.	.	.	.	.	.	1
155	2	.	.	.	.	.	1	1	1	1	1	.	.	1
156	2	.	.	.	.	.	1	1	1	1	1	.	.	1
157	2	.	.	.	.	.	1	.	.	1	.	.	.	1
158	2	.	.	.	.	.	.	.	.	.	1	.	.	1
159	3	.	.	.	.	.	.	.	.	.	.	.	.	1
160	2	.	.	.	.	.	1	.	.	.	.	.	.	1
161	3	.	.	.	.	.	.	.	.	.	.	.	.	1
162	2	.	.	.	.	.	1	.	.	.	.	.	.	2
163	3	.	.	.	.	.	.	.	.	.	.	.	.	2
164	3	.	.	.	.	.	.	.	.	.	.	.	.	2
165	3	.	.	.	.	.	.	.	.	.	.	.	.	2
166	2	.	.	.	.	.	1	.	.	.	.	.	.	1
167	2	.	.	.	.	.	1	.	.	.	.	.	.	1
168	2	.	.	.	.	.	.	.	.	.	1	.	.	2
169	2	.	.	.	.	.	1	.	.	.	.	.	.	1

	bot#_6a	buy_7	spend_7a	cook_8	bvg_9	type_9a	taste_10	exp_10a	hr_tap	hr_bot	hr_filt	hr_none	hr_dk	hrt_main
147	3.0	1	6.50	1	1	1	3.0	.	.	.	.	1	.	.
148	1.0	1	16.00	1	1	2	2.0	.	1	.	.	.	.	.
149	.	.	.	1	1	1	3.0	.	.	.	.	1	.	.
150	4.0	1	8.00	1	1	3	.	.	.	.	.	.	1	.
151	4.0	1	4.00	1	1	3	3.0	.	1	.	.	.	.	1
152	1.0	1	2.50	2	1	2	3.0	.	1	.	.	.	.	1
153	3.0	1	4.00	1	1	1	3.0	.	.	.	.	1	.	.
154	1.0	1	4.00	1	2	.	3.0	.	.	.	.	1	.	.
155	3.0	1	10.00	3	1	3	2.0	.	1	.	.	.	.	.
156	11.0	1	11.00	2	1	2	2.0	.	1	.	.	.	.	.
157	2.0	1	.	1	1	2	3.0	.	.	.	.	1	.	.
158	4.0	1	5.00	1	1	1	3.0	.	.	.	.	1	.	.
159	.0	.	.	1	1	1	4.0	.	.	.	.	1	.	.
160	3.0	2	.	1	1	1	3.0	.	.	.	.	1	.	.
161	.0	2	.	1	2	.	2.0	.	.	.	.	1	.	.
162	.	2	.	1	1	1	1.0	.	.	.	.	1	.	.
163	.	3	.	1	2	.	2.0	.	.	.	.	.	1	.
164	.	2	.	1	1	1	4.0	.	.	.	.	1	.	.
165	.	2	.	1	1	1	2.0	.	.	.	.	1	.	.
166	.0	2	.	1	1	1	3.0	.	.	.	.	1	.	.
167	.0	2	.	1	1	1	3.0	.	.	.	.	1	.	.
168	.	2	.	1	1	1	3.0	.	1	.	.	.	.	1
169	.0	1	5.00	1	1	2	2.0	.	.	1	.	.	.	.

	hrt_hous	hrt_pur	hrt_res	hrt_othr	hrt_dk	w_iron	w_lead	w_cu	w_cl	w_ss	w_par	w_bact	w_other	w_dk
147	.	.	.	.	.	.	.	.	.	.	.	.	.	1
148	.	.	.	.	1	.	.	.	.	.	.	.	.	1
149	.	.	.	.	.	.	.	.	.	.	.	1	.	.
150	.	.	.	.	.	.	.	.	.	.	.	.	.	1
151	.	.	.	.	.	.	.	.	.	.	.	.	.	1
152	.	.	.	.	.	.	.	.	.	.	.	.	.	1
153	.	.	.	.	.	1	1	1	1	1	1	1	.	.
154	.	.	.	.	.	.	.	.	1	.	.	.	.	.
155	.	.	.	.	1	1	1	1	1	1	1	1	.	.
156	.	.	.	.	1	1	.	.	1	.	.	1	.	.
157	.	.	.	.	.	.	.	.	1	.	.	1	.	.
158	.	.	.	.	.	.	.	.	.	.	.	.	.	1
159	.	.	.	.	.	.	.	.	.	.	.	.	.	1
160	.	.	.	.	.	.	.	.	.	.	.	.	.	.
161	.	.	.	.	.	1	1	1	1	1	.	1	.	.
162	.	.	.	.	.	1	.	.	1	.	.	.	.	.
163	.	.	.	.	.	1	1	1	1	1	1	1	.	.
164	.	.	.	.	.	1	.	.	1	.	.	.	.	.
165	.	.	.	.	.	.	.	.	1	.	.	.	.	.
166	.	.	.	.	.	.	.	.	.	.	.	.	.	.
167	.	.	.	.	.	.	.	.	.	.	.	.	.	.
168	1	.	1	.	.	1	1	.	1	.	.	.	.	.
169	.	.	.	.	.	1	1	.	1	.	.	.	.	.

	seen_13	subj_13a	wher_13b	news_14	qua_15	water_16	botle_17	buy_18	not_18a	che_18b	plant_19	stret_20
147	2	.	.	.	2	2	2	1	.	.	1	agawam st
148	2	.	.	.	2	2	2	1	.	.	2	tallawanda dr
149	2	.	.	.	2	2	1	2	6	.	2	marble st
150	2	.	.	.	2	2	2	3	.	.	2	henshaw st
151	2	.	.	.	2	2	2	3	.	.	2	lovell dr
152	2	.	.	.	2	2	2	3	.	.	2	cleveland ave
153	2	.	.	.	2	2	2	1	.	.	2	abington st
154	1	.	.	.	2	1	1	2	3	.	2	downing st
155	2	.	.	.	2	2	2	1	.	.	1	hacker ct
156	1	.	.	.	2	2	2	3	3	2	2	vernon st
157	2	.	.	.	2	2	2	1	.	.	2	pleasant st
158	2	.	.	.	2	2	1	1	.	.	2	crest circle
159	2	.	.	.	2	2	1	1	.	.	2	brookline st
160	.	.	.	.	.	.	.	1	.	.	2	algonquin rd
161	1	.	.	.	2	2	2	1	.	1	1	trowbridge rd
162	2	.	.	.	2	2	2	2	4	2	2	institute rd
163	1	.	.	.	2	2	3	2	4	2	2	institute rd
164	1	.	.	.	2	2	1	2	4	3	1	fairhaven rd
165	2	.	.	.	2	2	1	2	4	3	2	park ave
166	1	.	.	.	2	2	3	3	.	1	2	park ave
167	1	.	.	.	2	2	3	2	5	2	2	park ave
168	1	.	.	.	2	2	1	1	.	1	2	park ave
169	1	.	.	.	2	2	2	2	1	2	2	trowbridge rd

	zc_21	home_22	bill_23	long_24	age_25	edu_26	gendr_27	anstr_28	incom_29	location	intervie	date	time	number
147	3	2	1	43.0	1958	3	1	1	11	Shaws	KC	03/29/02		149
148	3	2	1	4.0	1977	4	2	1	4	Shaws	KC	03/29/02		150
149	3	1	2	5.0	1920	2	2	1	2	Shaws	KC	03/29/02		151
150	3	1	2	2.5	1960	2	1	1	7	Shaws	KC	03/29/02		152
151	3	1	2	70.0	1932	2	1	3	.	Shaws	KC	03/29/02		153
152	3	2	1	50.0	1933	3	1	1	6	Shaws	KC	03/29/02		154
153	3	1	2	1.5	1952	2	1	1	4	Shaws	KC	03/29/02		155
154	10	.	.	1.0	1982	3	2	1	1	Shaws	KC	03/29/02		156
155	3	1	2	45.0	1952	1	2	1	1	Shaws	KC	03/29/02		157
156	10	1	2	2.0	1975	5	2	1	4	Shaws	KC	03/29/02		158
157	9	1	2	25.0	1956	2	2	2	2	Shaws	KC	03/29/02		159
158	3	2	1	52.0	1925	3	2	1	2	Shaws	KC	03/29/02		160
159	3	2	1	85.0	1939	5	1	1	5	Shaws	KC	03/29/02		161
160	9	1	2	5.0	1978	4	1	1	11	WPI	JP	04/01/02		162
161	9	1	2	1.0	1981	3	1	1	11	WPI	JP	04/01/02		163
162	9	1	2	3.0	1981	3	1	1	2	WPI	JP	04/01/02		164
163	9	1	2	3.0	1981	3	1	1	2	WPI	JP	04/01/02		165
164	6	2	2	20.0	1981	3	1	1	8	WPI	JP	04/01/02		168
165	9	1	2	3.0	1981	3	2	1	1	WPI	CA	04/01/02		171
166	9	1	2	4.0	1980	3	2	1	2	WPI	CA	04/01/02		173
167	9	1	2	4.0	1980	3	1	1	2	WPI	CA	04/01/02		174
168	9	1	2	1.5	1971	5	2	5	1	WPI	CA	04/01/02		175
169	9	1	2	3.0	1981	3	1	1	11	WPI	JP	04/01/02		176

Appendix G: Survey Responses

Question	Response	Frequency	Percent	Valid %
Do you drink unfiltered water from you tap?	Yes	86	50.9	52.4
	No	78	46.2	47.6
	No Response	5	3.0	n/a
Yesterday, how many times did you drink water from you faucet?	0	16	9.5	19.3
	1 - 2	35	20.7	42.2
	3 - 4	15	8.8	18
	5 - 6	4	2.4	4.8
	7 - 8	4	2.4	4.8
	9 - 10	6	3.6	7.2
	11 - 12	3	1.8	3.6
	No Response	86	50.9	n/a
Do you filter your tap water before you drink it?	Yes	65	38.5	41.9
	No	90	53.3	58.1
	No Response	14	8.3	n/a
Yesterday, how many times did you drink filtered tap water?	0	7	4.1	11.9
	1 - 2	10	6	17
	3 - 4	25	14.8	42.4
	5 - 6	7	4.1	11.9
	7 - 8	6	3.6	10.2
	9 - 10	4	2.4	6.8
	No Response	110	65.1	n/a
What type of filter do you use?	Filter pitcher	45	26.6	68.2
	Filter on the faucet	11	6.5	16.7
	Home filtration unit	5	3.0	7.6
	Other	4	2.4	6.1
	Don't Know	1	0.6	1.5
	No Response	103	60.9	n/a
Why do you filter your water? (Check all that apply)*	Taste	40	23.7	61.5
	Clarity	15	8.9	23.1
	Color	9	5.3	13.9
	Odor	10	5.9	15.4
	Health	23	13.6	35.4
	Other	9	5.3	13.9
	Don't Know	4	2.4	6.2
	No Response	104	61.5	n/a
Do you prefer to drink Worcester tap water or bottled water?	Tap Water	36	21.3	21.6
	Bottled Water	109	64.5	65.3
	No Opinion	22	13.0	13.2
	No Response	2	1.2	n/a
Why do you prefer tap water? (Check all that apply)*	Satisfied with Taste	21	21.4	58.3
	Convenience	12	7.1	33.3
	Price	13	7.7	36.1
	Other	5	3.0	13.9
	Don't Know	1	0.6	2.8
	No Response	133	78.7	n/a

*These questions asked residents to check all answers that applied. Residents checked as many responses as they wanted, including none. Therefore the percentages do not always add up to 100 %

Question	Response	Frequency	Percent	Valid %
Why do you prefer bottled water? (Check all that apply)*	Taste	80	47.3	73.4
	Clarity	20	11.8	18.3
	Color	13	7.7	11.9
	Odor	13	7.7	11.9
	Health	32	18.9	29.4
	Other	11	6.5	10.1
	Don't Know	4	2.4	3.7
	No Response	60	35.5	n/a
Do you drink bottled water?	Yes	133	78.7	83.1
	No	26	15.4	16.3
	Don't Know	1	0.6	0.6
	No Response	9	5.3	n/a
How many times did you drink bottled water yesterday?	0	28	16.6	23.9
	1 - 2	36	21.3	30.9
	3 - 4	32	19.0	27.4
	5 - 6	10	6	8.5
	7 - 8	6	3.6	5.1
	9 - 10	4	2.4	3.4
	11 - 12	1	0.6	0.9
	No Response	52	30.8	n/a
Does someone in your household purchase bottled water?	Yes	111	65.7	74.5
	No	37	21.9	24.8
	Don't Know	1	0.6	0.7
	No Response	20	11.8	n/a
How much is spent on bottled water per week?	$1 - $2	24	14.3	25.5
	$3 - $4	18	10.6	19.1
	$5 - $6	22	13.1	23.2
	$7 - $8	6	3.6	6.4
	$9 - $10	16	9.5	16.9
	over $10	8	5.4	9.7
	No Response	74	43.8	n/a
When cooking, what type of water do you use?	Tap	135	79.9	80.8
	Filtered Tap	17	10.1	10.2
	Bottled	13	7.7	7.8
	Other	1	0.6	0.6
	Don't Know	1	0.6	0.6
	No Response	2	1.2	n/a
Do you make beverages with water, such as coffee, tea, or juice?	Yes	157	92.9	92.9
	No	12	7.1	7.1
	No Response	0	0.0	n/a
What type of water do you use to make these beverages?	Tap	106	62.7	67.5
	Filtered Tap	29	17.2	18.5
	Bottled	22	13.0	14.0
	Other	0	0.0	0.0
	Don't Know	0	0.0	0.0
	No Response	12	7.1	n/a

*These questions asked residents to check all answers that applied. Residents checked as many responses as they wanted, including none. Therefore the percentages do not always add up to 100 %

Question	Response	Frequency	Percent	Valid %
Rate the taste of Worcester's tap water on a scale of 1 to 5 with 1 being extremely bad and 5 being extremely good?	1 Extremely Bad	19	11.2	11.7
	2	46	27.1	28.4
	3 Neutral	53	31.4	32.5
	4	27	15.9	16.7
	5 Extremely Good	17	10.1	10.4
	No Response	7	4.1	n/a
Do you think there is a health risk associated with drinking any of the following? (Check all that apply)*	Tap Water	70	41.4	n/a
	Bottled Water	19	11.2	n/a
	Filtered Tap Water	8	4.7	n/a
	Well Water	4	2.4	n/a
	Don'k Know	10	5.9	n/a
If you think there is a health risk associated with tap water, where in the system is it located? (Check all that apply)*	Water Mains	33	19.5	20.4
	House Pipes	27	16.0	38.6
	Purification Plants	19	11.2	27.1
	Reservoir	20	11.8	28.6
	Other	5	3.0	7.1
	Don't Know	14	8.3	20.0
	No Response	99	41.4	n/a
What do you think is in the water? (Check all that apply)*	Iron	58	34.3	n/a
	Lead	59	34.9	n/a
	Copper	43	25.4	n/a
	Chlorine	88	52.1	n/a
	Suspended Soilds	37	21.9	n/a
	Parasites	38	22.5	n/a
	Bacteria	66	39.1	n/a
	Other	10	5.9	n/a
	Don't Know	32	18.9	n/a
Have you seen or heard anything about the quality of Worcester's water?	Yes	83	49.1	50.0
	No	81	47.9	48.8
	Don't Know	2	1.2	1.2
	No Response	3	1.8	n/a
Have you ever seen a water quailty report?	Yes	44	26.0	26.3
	No	121	71.6	72.5
	Don't Know	2	1.2	1.2
	No Response	2	1.2	n/a
Have you ever seen the newsleter, *On the Water Front*?	Yes	28	16.6	16.8
	No	135	79.9	80.8
	Don't Know	4	2.4	2.4
	No Response	2	1.2	n/a
If the city gave out free water bottles, would you fill the bottles with tap water?	Yes	58	34.3	35.2
	No	96	56.8	58.2
	Don't Know	11	6.5	6.7
	No Response	4	2.4	n/a
Suppose you could buy bottled water directly from Worcester's purification plant. Water that did not contain chlorine and did not travel through Worcester's water pipes, would you but it?	Yes	87	51.5	52.4
	No	56	33.1	33.7
	Don't Know	23	13.6	13.9
	No Response	3	1.8	n/a

*These questions asked residents to check all answers that applied. Residents checked as many responses as they wanted, including none. Therefore the percentages do not always add up to 100 %

Question	Response	Frequency	Percent	Valid %
If not, why not?	[redacted]			
	Taste	3	1.8	5.2
	[redacted]			
	Price	21	12.4	36.2
	[redacted]			
	Don't Know	3	1.8	5.2
	[redacted]			
Would you buy it if it was cheaper than water bottled by other companies? (i.e. Poland Springs)	Yes	21	12.4	32.3
	[redacted]			
	Don't Know	10	5.9	15.4
	[redacted]			
Did you know that Worcester opened a state of the art water purification plant in 1997?	Yes	54	32.0	32.5
	No	110	65.1	66.3
	Don't Know	2	1.2	1.2
	No Response	3	1.8	n/a
What is your zip code?	01602	9	5.3	5.4
	01603	36	21.3	21.6
	01604	34	20.1	20.4
	01605	13	7.7	7.8
	01606	24	14.2	14.4
	01607	3	1.8	1.8
	01608	5	3.0	3.0
	01609	24	14.2	14.4
	01610	19	11.2	11.4
	No Response	2	1.2	n/a
Do you rent or own your home?	Rent	92	54.4	55.8
	Own	72	42.6	43.6
	Don't Know	1	0.6	0.6
	No Response	4	2.4	
Do you pay the water bill for your household?	Yes	72	42.6	43.4
	No	93	55.0	56.0
	Don't Know	1	0.6	0.6
	No Response	3	1.8	n/a
How long have you lived in Worcester?	0 -4	40	23.7	24.1
	5 - 9	18	10.7	10.8
	10 -14	13	7.7	7.8
	15 - 19	16	9.5	9.6
	20 - 24	13	7.7	7.8
	25 - 29	6	3.6	3.6
	30 - 34	7	4.1	4.2
	35 - 39	3	3.6	3.6
	Over 40	47	27.8	28.3
	No Response	3	3.6	n/a

Question	Response	Frequency	Percent	Valid %
What year were you born? (Age)	1984 - 19[illegible] (18 - 24)	30	[illegible]	[illegible]
	1977 - 1968 (25 - 34)	29	16.9	17.50
	1967 - 19[illegible] (35 - 44)	25	[illegible]	[illegible]
	1957 - 1948 (45 - 54)	25	15.0	15.60
	1947 - 19[illegible] (55 - 64)	20	[illegible]	[illegible]
	1937 - 1928 (65 - 74)	19	11.5	11.90
	1927 - 19[illegible] (75 - 84)	[illegible]	[illegible]	[illegible]
	Before 1917 (Over 85)	2	1.3	1.30
	No Response	0	[illegible]	n/a
What is your highest level of education?	< Than High School	18	10.7	10.8
	High School Graduate	[illegible]	[illegible]	[illegible]
	Some College	46	27.2	27.7
	College Graduate	47	[illegible]	[illegible]
	Post Graduate	21	12.4	12.7
	No Response	3	[illegible]	n/a
What is your gender?	Male	73	43.2	43.2
	Female	96	56.8	56.8
	No Response	0	0.0	n/a
Which of the following best describes your ancestry?	European American	118	69.8	70.7
	Hispanic / Spanish American	28	16.6	16.8
	African American	8	4.7	4.8
	Asian American	2	1.2	1.2
	Other	11	6.5	6.6
	No Response	2	1.2	n/a
Which of the following best describes your total yearly household income?	Less than $10,000	18	10.7	12.4
	$10,000 - $20,000	26	15.4	17.9
	$20,000 - $30,000	14	8.3	9.7
	$30,000 - $40,000	28	16.6	19.3
	$40,000 - $50,000	18	10.7	12.4
	$50,000 - $60,000	5	3.0	3.4
	$60,000 - $70,000	9	5.3	6.2
	$70,000 - $80,000	6	3.6	4.1
	$80,000 - $90,000	5	3.0	3.4
	$90,000 - $100,000	7	4.1	4.8
	Over $100,000	9	5.3	6.2
	No Response	24	14.2	n/a
Location of the Survey	Santiago's Plaza	31	18.3	18.3
	Shaws (Stafford st)	36	21.3	21.3
	Super Stop & Shop (West Boylston st)	45	26.6	26.6
	Super Stop & Shop (Grafton st)	35	20.7	20.7
	WPI	21	12.4	12.4
Interviewer	Cassandra Andersen	59	34.9	34.9
	Jonathan Pesch	59	34.9	34.9
	Kerri Coleman	51	30.2	30.2

Question	Response	Frequency	Percent	Valid %
Date	[redacted]			
	March 26, 2002	19	11.3	11.3
	[redacted]			
	March 29, 2002	36	21.4	21.4
	[redacted]			

Appendix H: SPSS Cross Tabulations

Homeownership & Awareness

Do you pay the water bill * Do you own or rent your home Crosstabulation

Count

		Do you own or rent your home			
		Rent	Own	Don't Know	Total
Do you pay the water bill	Yes	8	64		72
	No	83	8	1	92
	Don't Know	1			1
Total		92	72	1	165

Have you seen a water quality report? * Do you own or rent your home Crosstabulation

Count

		Do you own or rent your home			
		Rent	Own	Don't Know	Total
Have you seen a water quality report?	Yes	14	30		44
	No	77	40	1	118
	Don't Know		2		2
Total		91	72	1	164

Have you seen On the Water Front? * Do you own or rent your home Crosstabulation

Count

		Do you own or rent your home			
		Rent	Own	Don't Know	Total
Have you seen On the Water Front?	Yes	4	23		27
	No	86	46	1	133
	Don't Know	1	3		4
Total		91	72	1	164

Worcester opened a new purification plant * Do you own or rent your home Crosstabulation

Count

		Do you own or rent your home			
		Rent	Own	Don't Know	Total
Worcester opened a new purification plant	Yes	17	37		54
	No	74	33	1	108
	Don't Know		2		2
Total		91	72	1	164

Awareness & Taste Rating

Rate the taste of tap water * Have you seen a water quality report? Crosstabulation

Count

		Have you seen a water quality report?			
		Yes	No	Don't Know	Total
Rate the taste of tap water	Extremely Bad	4	15		19
	Bad	10	29	1	40
	Neutral	11	39	1	51
	Good	9	25		34
	Extremely Good	8	9		17
Total		42	117	2	161

Rate the taste of tap water * Have you seen On the Water Front? Crosstabulation

Count

		Have you seen On the Water Front?			
		Yes	No	Don't Know	Total
Rate the taste of tap water	Extremely Bad	2	17		19
	Bad	6	34		40
	Neutral	7	42	2	51
	Good	8	25	1	34
	Extremely Good	5	11	1	17
Total		28	129	4	161

Rate the taste of tap water * Worcester opened a new purification plant Crosstabulation

Count

		Worcester opened a new purification plant			
		Yes	No	Don't Know	Total
Rate the taste of tap water	Extremely Bad	4	14	1	19
	Bad	9	29		38
	Neutral	14	38		52
	Good	15	18	1	34
	Extremely Good	9	8		17
Total		51	107	2	160

Homeownership & Taste Rating

Rate the taste of tap water * Do you own or rent your home Crosstabulation

Count

		Do you own or rent your home			
		Rent	Own	Don't Know	Total
Rate the taste of tap water	Extremely Bad	9	9	1	19
	Bad	25	14		39
	Neutral	28	23		51
	Good	16	18		34
	Extremely Good	9	7		16
Total		87	71	1	159

Rate the taste of tap water * Do you pay the water bill Crosstabulation

Count

		Do you pay the water bill			
		Yes	No	Don't Know	Total
Rate the taste of tap water	Extremely Bad	9	10		19
	Bad	14	24	1	39
	Neutral	23	28		51
	Good	18	16		34
	Extremely Good	7	10		17
Total		71	88	1	160

Appendix I: Location of Street & Age of Pipes Versus Taste Rating List

Listed below are the roads, the taste rates the residents assigned the water, and the date each water main was constructed, cleaned, and or replaced. Pipes cleaned after 1943 have been lined with cement. Pipes added after 1973 are made from ductile iron and lined and pipes from 1860-1973 are cast iron and unlined.

- Point 1 01609
  - Institute Rd. (2 Bad)
    - 1996,1998, 1999
  - Hackfield St. (Neutral)
    - 1900
  - Einhorn Rd (Good & Neutral)
    - 1899, 1900,
  - West St. (Bad)
    - 1892, 1975, 1977
  - Dean St. (2 Good)
    - 1888, 1974

- Point 2 01603 All contain dead end pipes
  - Brookline(Good & Bad)
    - 1912, 1946, 1950
  - Wyola (Neutral)
    - 1928, 1932, 1963, 1995
  - Delawanda Dr (Good)
    - 1956, 1963
  - Tallawanda (Bad)
    - 1913, 1914, 1922, 1949, 2000

- Point 3 01604
  - Fairmont Ave (Bad)
    - 1901, 1905
  - Bedford (Bad)
    - 1905, 1922
  - Caroline (Bad) (dead end pipe)
    - 1916, 1962, 1966, 1991
  - Cohasset (Bad)
    - 1917, 1926, 1928, 1991,