Assessing Boroondara's Water Use and Stormwater Quality

An Interactive Qualifying Project

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Submitted to:

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Abstract

Water shortages due to drought and climate change are severely impacting various places all over the world, including Australia, which has a history of drought. The government has used many different methods to lessen their effects. Even with all of these in place, the City of Boroondara is unsure of how their citizens are responding. One of the Council's main concerns is their community's impact on stormwater quality. We addressed this problem by interviewing members of the community to determine the most effective method to promote the awareness of stormwater quality and becoming more water conscious. Our recommendation is for the Council to partner with Melbourne Water and implement a program promoting raingardens as part of "A Future towards Swimming in the Yarra River".

Acknowledgements

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Executive Summary

Water is one of life's most important and basic resources, but currently the supply of potable water is in danger in many parts of the world with the threats of population growth and climate change. While the demand for clean water is on the rise, the supply and access are decreasing. The shortfalls between supply and demand are particularly salient in Australia, which is the driest continent in the world. Over the years, Australia has been in and out of several states of severe drought. Another problem facing Australia is the pollution of its rivers and creeks. The main source of this issue is from excess rainwater runoff from streets and footpaths, also known as stormwater. The City of Boroondara, located in Victoria, Australia in the inner-eastern suburbs of Melbourne, has adopted several water management plans to promote conserving water and educate their residents. We chose a target behavior and recommend a possible program to improve the health of the waterways and promote water conservation by assessing their community's current understanding of water consumption and stormwater.

Background

Droughts are a main cause of water shortages and Australia has had nine major and fifteen less severe droughts since 1840. The most recent drought in Australia, known as “The Big Dry”, was the worst drought in over 100 years, but has recently ended. During "The Big Dry" Australia’s economy suffered with fewer crops to sell to other countries, as well as the local price of grains increasing. Also citizens can be faced with social effects because of droughts as they can cause food shortages, which can lead to health problems.

The different levels of government all have their own respective programs to counter the effects of drought. The Australian Government has their water related policies grouped under the program “Water for the Future” with key goals to take action on climate change, improve the water infrastructure, secure water supplies, and support healthy rivers. The Victorian Government is promoting Water Sensitive Urban Design (WSUD) with key objectives to reduce the impact of stormwater runoff, improve water infrastructure stability and implement water conservation education and incentive programs. The City of Boroondara has implemented the "Stormwater Environmental Management Plan" with the key objective to “Identify strategies to improve the environmental management of urban stormwater and protect the environmental

values and beneficial uses of receiving environments". But now that the drought has ended, the water shortage problem is not as prevalent and their focus has shifted towards changing the behavior of the community to be more conscious of stormwater management and quality.

The study of behavioral change is effective in dealing with the application of stormwater management within the community. Psychologists have created many different theories of behavior change, such as the Theory of Planned Behavior, Stages of Change Model, and the Social Learning Theory. All of these theories share the idea that motivation and persuasive information are vital for a successful change. The most important aspect in creating a change is defining a target behavior and identifying what determines that behavior, whether it is emotion or social pressure. After this, behavioral change tools, such as incentives and education, can be implemented to help instigate a change.

An effective method of bringing about these changes is social marketing, which is a common practice in behavioral change. Other cities' programs show three main types of social marketing strategies used to promote conserving water: economic incentives, educational programs, and laws on different levels of various government. Many different countries and cities around the world are encouraging their residents to make changes in their lifestyles to become more conscious of the amount of water they use and of ways to conserve water. We worked with the City of Boroondara to help assess how residents feel about different behavior change programs that focus on conserving water and improving the health of the waterways through stormwater quality.

Methodology

Our initial task was to determine the past and current strategies undertaken by the City of Boroondara and other agencies to engage the community on issues of water conservation and stormwater quality. The other agencies that were interviewed were Yarra Valley Water (YVW), one of the local water retailers for the Melbourne area, and Melbourne Water, the Victorian Water Authority. During the interviews and focus groups we discussed their past programs and their effectiveness in educating the community.

Our second task was a preliminary assessment of the current attitudes of the residents of Boroondara towards water saving and knowledge of stormwater's impact on the health of

waterways. We conducted face-to-face interviews in several local shopping centers to get a diverse pool of participants and asked each person who passed if they were willing to answer a few questions. Most of the questions were multiple-choice with a few open-response questions to get further ideas of the gap in knowledge between the residents and the Council.

Once this data was compiled, we conducted a focus group with Team Leader of Environmental Planning Michaela Skett, Principal Environmental Sustainability Officer Nicola Hoey, and the Sustainability Educational Officer, Jenny Bicknell, to determine three target behaviors that could be the focus of a future initiative. The selected behaviors were the installation of rain tanks, the installation of raingardens, and the reuse of water bottles. Focused interview questions were then made targeting these behaviors. We carried out these focused interviews at local shopping centers, Swinburne University of Technology and the Boroondara Sustainable Living Festival 2012. All questions were open response to get unguided opinions from the residents on what behavior program they would most likely participate in.

Our final task was to examine the responses of the residents and determine which target behavior they would like to see implemented. Once the behavior was chosen, we conducted a literature review of similar behavior change programs undertaken by other cities and water authorities. This combined with the knowledge gained from the local water experts was used to propose a recommended strategy targeting the desired behavior for the City of Boroondara.

Results

Water experts

Melbourne Water

At Melbourne Water, we spoke with Sarah Eggleton, Program Leader of Stormwater Development, who went over the "Living Rivers" program, which reaches out to the different city councils to run community projects to promote wetlands and WSUD. We also spoke with Keysha Milenkovic who is in charge of a more community based stormwater project called "10,000 Raingardens". A raingarden is a specially prepared garden designed to receive and filter rainwater runoff from roofs or impermeable surfaces such as driveways or paving. This program's targets are to engage community on the importance of stormwater and to have 10,000 registered raingardens by 2013

Yarra Valley Water

We spoke with Guy Pritchard, a Local Government Customer Relationship Manager from Yarra Valley Water, who discussed the current programs YVW has in place. This includes the "Showerhead Exchange Program", “Home and Gardens Rebate Program”, and the “SmartAccount” program. In the future he would like to collaborate with the local governments and incorporate water with health in some type of health program. He would also like to see a program dealing with water attitude shift around using drinking fountains instead of buying bottled water.

Environment and Sustainable Living Team

In our interviews with the Environment and Sustainable Living department, we spoke with the team and discussed past initiatives that they have implemented including the "Living for our Future” program. This research project had residents monitor their water and electricity bills, and also offered different workshops on saving water in the home and garden. This included a course focused on stormwater and the installation of raingardens. They also participated in the "Lower Yarra Litter Strategy", which includes many municipalities, state government, and non-profit organizations. This focused on coming up with engineering solutions to the issues with litter polluting the area and local waterways.

Residents

Preliminary Interviews

During the interviews with residents we noticed many patterns in their responses. Most residents thought that water conservation continues to be important even though the "Big Dry" has ended. Almost all residents used a bucket in the shower and used this water on their garden or stopped watering their garden all together during the drought. Furthermore, about 30% of people interviewed installed one or two rainwater tanks to save water. The questions dealing with stormwater showed that about 80% of people interviewed made a connection between water going from roads to rivers. A lot of residents also suggested street litter traps as a creative way to prevent pollution in rivers and creeks.

Focused Interviews

The focused interviews with residents were about raingardens, rainwater tanks, and tap water versus bottled water. We found that almost everyone did not know what a raingarden was

so there were a lot of misconceptions and opportunities for education. As far as rainwater tanks, a little under half of the people interviewed had already installed them and the remainder either rented, did not have enough space to install one, or were not interested. In regards to drinking tap water instead of bottled water, we found that all residents primarily drink tap and only buy bottled water when there is no tap readily available or they forgot their reusable water bottle at home. Based on their opinions and the answers we received, we decided that the strongest program would be one on raingardens and their benefits and effects on the health of the waterways.

Other Cities and Countries

Based on the target behavior of installing raingardens, we conducted a literature review of different raingarden programs around the world. The cities we researched included, Kansas City, Fort Wayne, Los Angeles, Seattle and Portland. They all used similar methods of financial incentives and educational workshops.

Conclusions

We found that projects that were co-sponsored with another agency were more effective. Also the Council found that newer, more innovative programs tend to grab the attention of residents more. These kinds of initiatives are more likely to be successful because people will be more interested in them as opposed to programs they have seen before.

The first option for a future program would be one that promotes the use of raingardens to regulate stormwater quality. Overall, the benefits of a raingardens program far outweigh the negative factors. The target audience of the program would be suburban areas because people in the suburbs typically own their properties and have enough space. This program is a great way to educate the residents of Boroondara and have them contribute in maintaining the health of their local waterways.

Another program would be one that encourages residents to install rainwater tanks and connect them to the toilet and laundry system. Although we feel this program is not as strong as the raingarden campaign, it is still a viable option. Water saving is an issue that is always going to be prevalent in Boroondara and using rainwater for one's toilet and laundry is an excellent method of doing this. Basically, the program would entail focusing on the problem of using

potable water for the toilet and laundry, which hopefully will resonate with enough residents to consider installing a rainwater tank or connecting their pre-existing tank to their toilet and laundry system.

The last possible program would be the installation of more water fountains in public areas. The City of Boroondara should collaborate with YVW on this program by having signs next to newly installed fountains educating the residents on the negative effects plastic water bottles have on the environment and how they pollute the streets and ultimately, the waterways.

Based on our literature review of other cities' programs on raingardens, we discovered two main methods to promote the installation of raingardens. The possibility to use either educational campaigns or financial incentives to change the behaviors of the residents is feasible. An educational campaign on the benefits of installing a raingarden and its effects on waterway health would be effective. An economic incentive would be to have discounts on the specific plants that can be used for raingardens or small rebates for people who install one.

Recommendations

We recommend that the City of Boroondara implement the program "A Future towards Swimming in the Yarra River." This program will educate residents on ways they adversely affect stormwater, which leads to pollution of the Yarra River. The target audience for this program will be people who live in suburban areas and own their homes. One of the main components of the program would be to promote the installation of raingardens as a way residents can improve their impact on the health of the waterways. This will promote Melbourne Water's "10,000 Raingardens" initiative, which will allow the Council to gain access to more financial resources. "A Future towards Swimming in the Yarra River" is a great program that will not only help the City of Boroondara become more water sensitive, but it will also lead to a more sustainable lifestyle.

Authorship Page

Each team member has contributed equally to the writing and editing of all the section in this report.

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1 Introduction

Access to one of life's most important and basic resources, water, is being put in jeopardy by the threat of population growth and climate change in many parts of the world. Increases in temperature are contributing to drought in many places and dry regions are being seriously affected by these droughts, both socially and economically (Hansen et al. 2006). For instance, agriculture relies directly on the amount of rainfall, so drought can seriously harm the economy and availability of food. Other factors that affect the demand of water include an increase in population and industries that rely on water. While the demand for clean water is on the rise, the supply and access are decreasing (Colebatch 2010). Clearly this is detrimental to future populations as the supply will diminish if changes are not made.

The shortfalls between supply and demand are particularly salient in Australia, which is the driest continent in the world. Over the years, Australia has been in and out of states of severe drought (Ryebuck 2003). With global climate change, each drought has impacted the surrounding areas more because of the decrease in rainfall. Australia's most recent and worst drought, "The Big Dry", began in 2002, but by 2010 the severity of the drought decreased immensely and they are no longer in a state of drought. When the drought was at its peak, the Australian government implemented new programs, such as "Water for the Future", to promote water conservation (Australian Government 2011). This program outlined several practical methods on dealing with climate change, securing water supplies, improving the water infrastructure, and supporting healthy rivers. The state of Victoria created Recycled Water Use projects to decrease their impact on water supply (Radcliffe 2004). On a more local scale, the City of Boroondara, located in Victoria in the inner-eastern suburbs of Melbourne, has adopted several of their own water management plans (Boroondara 2011). Their 2004 Water Strategy Plan focuses on the city's water use and how they have been able to reduce water consumption.

The City of Boroondara has been trying to connect with their community in order to promote water conservation. To set an example for its residents, the city itself has taken many steps towards reducing its water consumption (Boroondara 2003). All of the council-owned properties and facilities were evaluated on the amount of water they use and based on the results several plans were put in place. For instance, in four of their community recreational centers they installed flow control valves in all taps, showers, and sinks. This has saved around 21,000

kiloliters per year (Boroondara 2004). Other methods the government has used to tackle this issue include economic incentives and educational programs. For example, Yarra Valley Water offers a rebate program for residents who purchase water-saving technologies. They distributed 19,008 rebates in Melbourne over the past year. Other countries and cities across the globe have set up similar programs to counter their water shortage issues (Carmona 2011). Typically these programs involve some kind of economic incentive for citizens to purchase water saving products, educational programs on how to conserve water, and laws that promote water conservation.

Although the local efforts to reduce water use have been successful, the City of Boroondara is now looking to improve stormwater quality to restore the health of the local waterways, such as the Yarra River. They are unsure of whether their residents make the connection between stormwater and the health of the waterways. In the past, stormwater has been overlooked and even discouraged by many as a viable water resource. Now, stormwater management seems to be the best option to conserve potable water as well as reduce stormwater's negative effects on rivers and bays. Assessing the community's understanding of stormwater and its effects will help the City of Boroondara determine the best method of implementing a successful program.

The goal of this project was to help the City of Boroondara choose a target behavior and recommend a program to improve the health of the waterways and promote water conservation by assessing their community's current understanding of water consumption and stormwater. Through the use of interviews and focus groups, we gauged the opinions of Boroondara's residents and different branches of water officers on these issues. We informed the City of Boroondara on the opinions and attitudes of the community and provided recommendations on the best method to promote a specific program that will educate the residents on how they can improve the health of the waterways based on case studies of similar programs.

2 Background

Victoria has adopted different policies on water management. We present some, as well as behavioral change theories, and local and global practices of water consumption behavior change.

2.1 Overview of Drought in Australia

Water shortages are a problem faced by many places all over the world. This problem suggests that there is a mismatch between supply and demand of water. Droughts are a main cause of water shortages, along with population growth and economic pressures. Drought is defined as a prolonged dry period where there is not enough water for the population's needs (Commonwealth 2011). Australia has learned to live with drought, having nine major and fifteen less severe droughts since 1840. Each drought affects Australia negatively and leaves the residents with limited amounts of water to survive (Ryebuck 2003). In this section we will discuss the history and causes of drought in Australia as well as the social and economic effects on its residents.

2.1.1 History of Drought

Australia is the driest continent due to its unequal distribution of rainfall between years and across locations, as well as being the lowest continent in the world making rain passage into the rivers slow (Watermark 2007). Australia has dealt with nine major droughts over the span of about 120 years, but the most destructive type of drought is when there are at least two very dry years followed by several years of below-average rainfall. An example of this is the "Federation Drought" which lasted from the late 1890's to about 1902 (Windram 2009). This drought wiped out all the sheep in Queensland and almost dried out the rivers. The 1914-15 and the World War II drought brought on bush fires which led to the failure of wheat crop and killed off more sheep (Windram 2009). The most recent drought in Australia, known as "The Big Dry", was the worst drought in over 100 years, but has recently ended. (Vidal 2006).

2.1.2 Causes of Drought

Water shortages occur when there is a loss of water in water storage resources like reservoirs and basins because the demand is too high for the given supply. Another cause of the water shortage is rainfall deficiency, which can be divided into two categories: serious and severe. Serious rainfall deficiency is when the rainfall is between the lowest five and ten percent of previous records for at least three months, and severe rainfall deficiency is when rainfall is among the lowest five percent of historical records. (Ryebuck 2003)

Droughts are caused by a change in climate, which can be a result of emission of greenhouse gases. In Australia, the natural climate change is caused by two major elements: the changes in the pressure of air in the atmosphere circulating between Tahiti and Darwin (measured by the Southern Oscillation Index-SOI) and the temperature of currents moving across the equator from South America to north of Australia over periods of years (Ryebuck 2003).

The cold-water currents that run along the west coast of South America move toward the equator where they are heated by the sun. With global warming, these currents become too warm, which interrupts the air circulation of Australia. When the climate is warmer, there is a negative effect of higher air pressure, which creates dry conditions for the country. As the currents gradually become warmer, the trade winds change direction leading to less moisture, weaker winds, and a higher probability that Australia will be drier. This effect is known as the "El Niño", which typically lasts a year to a year and a half (Ryebuck 2003).

National Climate Centre in the Bureau of Meteorology records the rainfall for Australia and they have about 800 locations nationally. The Bureau has been recording the annual rainfall since 1860, and their findings of severe and serious rainfall which are both related and unrelated to "El Niño" shown in *Figure 1*.

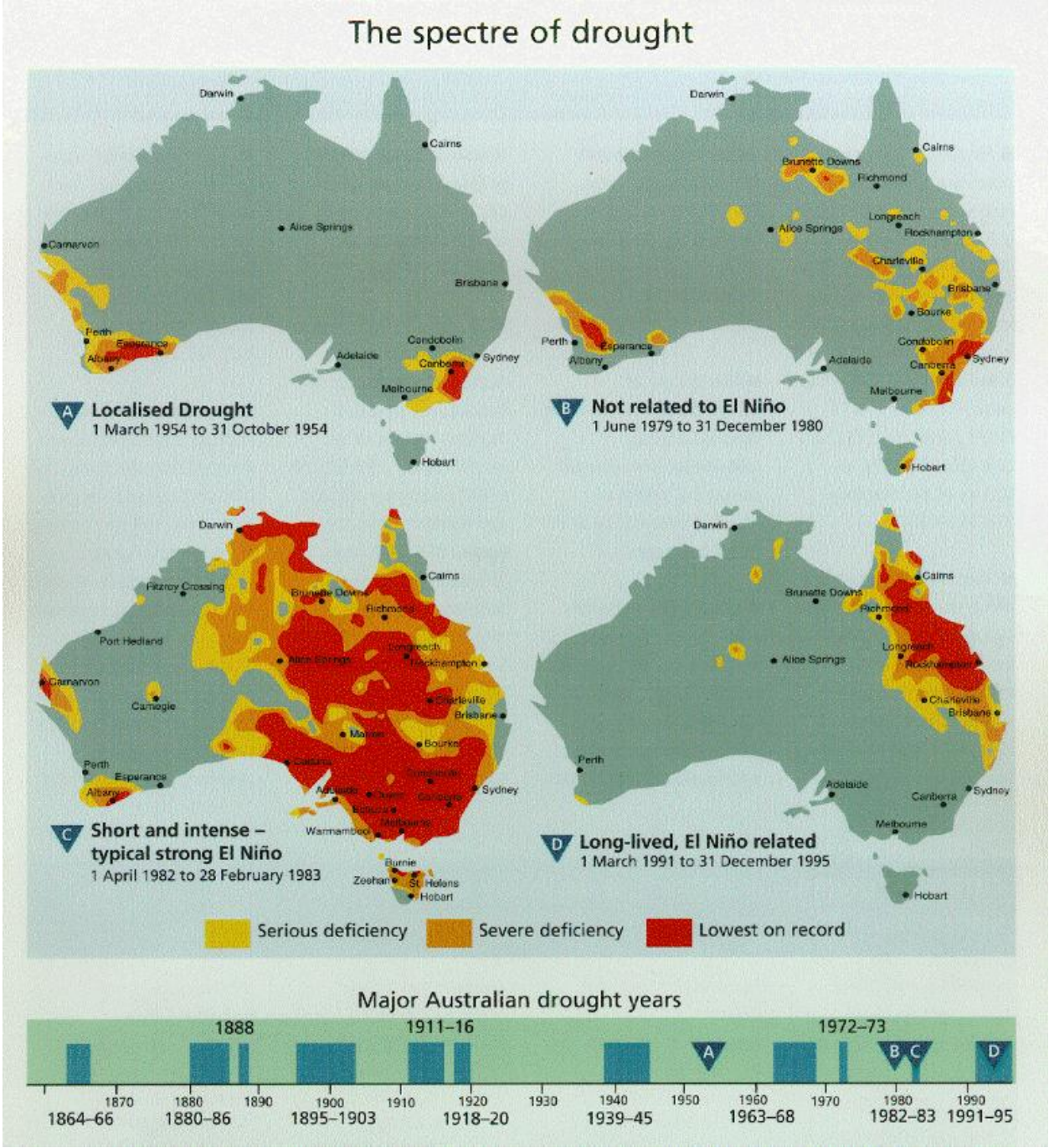

Figure 1: Spectrum of Drought based on Severe and Serious Rainfall Deficiency (Image from http://www.bom.gov.au/climate/images/spectres.gif)

Figure 1 shows the most serious and severe rainfall deficiency the country had seen over the past 110 years. There have been short and intense droughts, as well as long-lived drought, most of which appear to be in the Queensland, New South Wales, and Victoria areas. However, parts of Victoria hold the lowest, from 1860 - 1990, on record of annual rainfall. The most severe water shortage seems to be between the 1982 and 1983, when the effects of the "El Niño" were the strongest Australia had experienced.

Many people say that the water shortage issue is not solely caused by global warming but rather the mismanagement of water resources (Vidal 2006). The lack of education on water usage has prevented the country from dealing with drought in the most efficient way possible. With the country having water shortages, there are many social and economic effects that result.

2.1.3 Effects of Drought

With droughts come serious economic and social problems. Agriculture produces one of Australia's biggest exports and is directly affected by having a plentiful water supply. During "The Big Dry" Australia's economy suffered with fewer crops to sell to other countries, as well as the local price of grains increasing. Also citizens can be faced with social effects because of droughts. Droughts cause food shortages, which can lead to health problems. "The Big Dry" not only affected the people of Australia socially but also the countries that depend on their crops.

2.1.3.1 Economic effects

Being affected by "The Big Dry" for so long affected the Australian production of wheat and barley, some of Australia's main exports. "The Big Dry" was detrimental to Australia's economy especially in areas such as Victoria. Australia is typically the world's third or fourth largest exporter of wheat (Smith 2008). Because of the lack of rainfall, many of the wheat crops died, which caused the Australian cost of wheat per ton to increase from $269 to $381 (Smith 2008). Other countries that purchase crops from Australia began doubting whether to continue to do business with them considering the increased prices and shortages (The New Zealand

Herald 2011). According to a New Zealand newspaper, "The Australian Bureau of Statistics (ABS) said that while overall crop production had risen in 2007-08, there were falls in cotton production and a near complete suspension of rice production" (The New Zealand Herald 2011). Even in the past couple of years, when the situation has become better with Australia no longer being in a state of drought, there are still concerns about whether another drought will cause crop production to diminish and prices to skyrocket again.

2.1.3.2 Social effects

Drought can affect many aspects of people's lives. Severe and prolonged drought can contribute to food shortages and famine (Endfield et al 2006). Australia was not the only place directly impacted by the drought. Countries such as Egypt depended on their wheat and barley from Australia and because of the food shortage dealt with starvation and riots over bread prices. "The Big Dry" caused some political problems in Australia in respect to how the federal government decided to handle the issue. Public dissatisfaction with the government's response to the drought is an effect that was felt in Australia (Botterill 2003).

Changes needed to be made by the Australian Government to deal with the issues of the drought. Some of the changes that were made initially, such as economic support being given to farmers, faced serious opposition. The Government had been working hard to minimize the effects of drought on farmers wherever they could. Farmers received taxpayer support during the drought, to help pay for water so that they could grow crops. There was some criticism of this initiative towards the beginning of the drought, but as people began to feel the effects, they voiced less concern to farmers receiving taxpayer support (Botterill 2003). This opposition to the way the government chose to handle the drought was just one social effect of "The Big Dry".

Many countries depend on the wheat that Australia harvests every September and October, especially in the Middle East and Southeast Asia (Smith 2008). People in some of these locations could not afford the higher prices of wheat, which led to starvation and even death in some cases. In Egypt, for example, riots broke out over rising bread prices and shortages, depending on Australia for the majority of their wheat. At least 10 deaths occurred

due to the rise in the price of wheat (Smith 2008). Zimbabwe experienced a similar situation to Australia in the early 1990s. They were in the midst of their worst drought in over 100 years, which led to a serious famine. Food-seeking mobs besieged shops and food delivery trucks and riot police had to be called (Manthorpe 1992). It can be seen that drought and famine can cause very serious social issues for the country where the drought is taking place, as well as for countries that depend on their crops.

2.2 Australian Water Management Policies

To deal with the effects of drought, Australia has put into place different policies and legislation, on both national and local scale, to help regulate the supply and demand of water. This section will provide an overview of the efforts on a national, state-wide and local scale of water management.

2.2.1 Australian Policies

There has been a long history of different drought management policies implemented by the Australian Government. Before 1989, drought was considered to be a natural disaster and the Natural Disaster Relief Arrangements (NDRA) would provide aid where it was needed. But in May of 1989, the Drought Policy Review Task Force was appointed to spearhead Australia's new drought management policy. They implemented support for drought-affected families on a loan basis, rather than a grant basis as the NDRA had done before. Eventually a new National Drought Policy was formed and adopted in 1993. The new policy focused on more sustainable water use, clearly defined the lines between the farming businesses and families, and was geared towards helping businesses rather than individual families (Botterill 2003).

There are also a handful of programs and regulations that the Australian Government has put in place to help promote conservative water use under the administration of the Department of Sustainability, Environment, Water, Population and Communities. All water related policies are grouped under the program "Water for the Future" with the key goals to take action on

climate change, improve the water infrastructure, secure water supplies, and support healthy rivers. Under this program there are five different sections of policies and programs: rural water, water in the environment, water in cities and towns, water quality, and water information (Australian Government 2011).

- The rural water section of the program mainly dealt with the water infrastructure and management. The Murray-Darling Basin is a large portion of this section as it spans across a large part of Southeastern Australia and is the main water source for that area. The infrastructure and irrigation systems are being maintained or upgraded to ensure maximum efficiency.
- The water in the environment section dealt mostly with preserving natural habitats and distributing "environmental water" which is clean water held in reservoirs and dams and released into nearby rivers and marshes when needed.
- The water quality section provided specific, efficient and cost-effective examples in the Water Quality Improvement Plans (WQIPs) on how different groups of people, such as state and local governments and communities, can improve their water quality. There are various different projects that the WQIPs outlined, such as Water Sensitive Urban Design, Water Quality Monitoring, Agricultural Best Management Practice, and Acid Sulfate Soil Mapping. Water Sensitive Urban Design is discussed in the next section. Agricultural Best Management Practice outlines agricultural practices that reduce impacts on water quality. Acid Sulfate Soil Mapping determines where there are Acid Sulfate Soils in order to avoid them and as the soils react with oxygen to form sulfuric acid which will contaminate waterways.
- The water information program is an on-going research initiative that attempts to monitor current and future water usage. Through a series of different monitoring and forecasting techniques, the program maps out the current water usage in Australia with different contributing facilities across the country. In addition, the initiative forecasts the weather so the country can make preparations when there is a drought on the horizon.

2.2.2 Victorian Policies

On a state scale, the Victorian Government has adopted the "Melbourne 2030: Planning for Sustainable Growth" with the goal to provide Melbourne with a more sustainable future. The report predicts that Melbourne's population will increase by one million by the year 2030 and to help with this, the government plans to carry out different objectives all designed to help "manage growth and change across metropolitan Melbourne and the surrounding region" (Victoria 2002). One of these objectives is to make Melbourne a greener city. To accomplish this they plan to promote water efficient practices, prepare guidelines of alternative water resources (rainwater tanks, stormwater and recycled water) and support business opportunities dealing with wastewater treatment.

In 2009, the Victorian Government adopted the "Target 155" campaign for Melbourne, which encouraged residents to reduce their water use to 155L per day per person. There were advertisements on newspapers, radio, and television. Similar programs were run with high success in south-east Queensland and Ballarat.

An Integrated Water Management Plan has also been implemented by Melbourne Water and other retail water companies along with local governments following a state government report, to help reduce the consumption of water (Boroondara 2004). The mission of the program is, by 2050, to reduce current water demand per person by an average of 23%. The proposed steps needed to achieve this goal were the:

- regulation of AAA showerheads (starting 2005), AAAA washing machines (starting 2010) and water pricing;
- education on water use outside the home;
- incentives for the purchase and use of water saving devices; and
- education and assistance to decrease water use in open space and industry.

Furthermore, there are two large overarching design systems that different states across Australia have implemented: Water Sensitive Urban Design (WSUD) and Total Water Cycle Management (TWCM).

The key objectives of WSUD are to reduce the impact of stormwater runoff, improve water infrastructure stability and implement water conservation education and incentive programs. To help accomplish these goals, WSUD adheres to a few essential principles outlined below in *Table 1* (McAuley et al 2009).

Key Principles of Water Sensitive Urban Design
Protect existing natural features and ecological processes
Maintain natural hydrologic behavior of catchments
Protect water quality of surface and ground waters
Minimize demand on the reticulated water supply system
Minimize wastewater discharges to the natural environment
Integrate water into the landscape to enhance visual, social, cultural and ecological values

Table 1: The key principles of Water Sensitive Urban Design

TWCM focuses more on the social and environmental aspects of water management. It also recognizes that every decision with water will influence the entire water cycle so the design aspect of TCWM is more overarching and inclusive. Instead of focusing on reduction on a simple cause-effect basis, TCWM focuses on a lateral, cyclic solution that involves every aspect of the water cycle. Because of this, the implementation of a successful TCWM system is arguably more difficult as the entire inter-linked system of the water cycle must be identified. A conceptual diagram of community's water cycle is shown in *Figure 2* (Queensland 2010).

Figure 2: A conceptual diagram of a community's water cycle (Queensland 2010)

Both WSUD and TCWM have already been implemented in different states and regions of Australia, and Boroondara is studying whether these strategies will work in their community.

2.2.3 Boroondara Water Policies

With so many supporting policies already implemented on a national and state-wide scale, local governments have adopted different initiatives that apply to their own areas.

Boroondara is one such local government, located in the inner-east suburb of Melbourne as illustrated in *Figure* 3, that has developed several programs that are relevant to local needs: the 2004 Water Strategy Plan and the 2003 Stormwater Environmental Management Plan. These reports detail what the City of Boroondara has implemented within the buildings and public facilities they own as a first step towards water conservation.

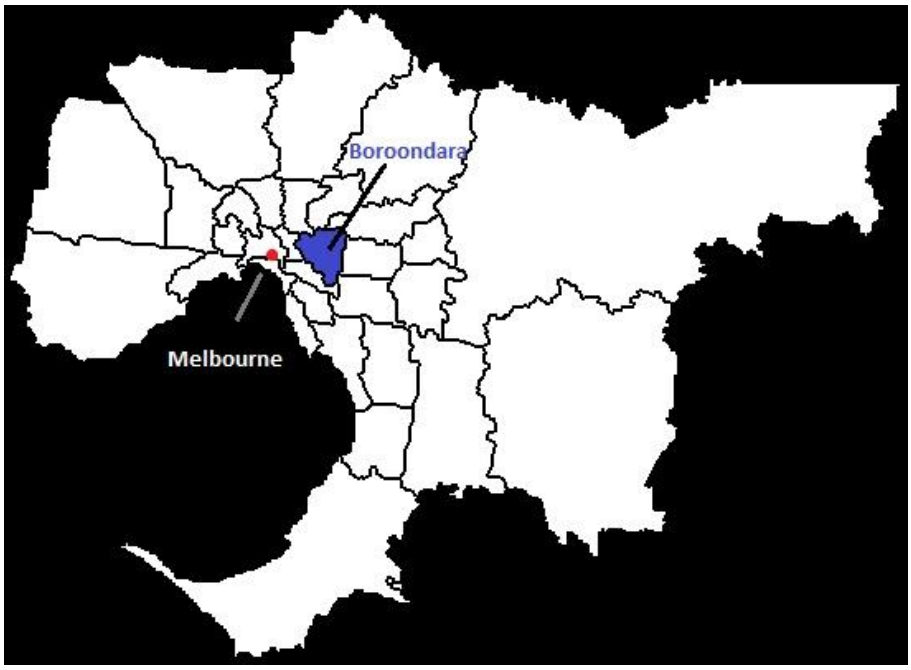

Figure 3: Map of Boroondara (Image adapted from http://upload.wikimedia.org/wikipedia/commons/d/db/Australia-Map-MEL-LGA-Boroondara.png)

First, after analyzing their water consumption, the City determined that in 2003, 61% of their water use went to parks and gardens. *Table 2* summarizes a few of the initiatives they have taken to reduce municipal water use, such as implementing water audits at various government-owned locations, as well as installing different water conserving devices. The most prominent water saving plan seems to be installing flow control valves in all the showers and taps at four different leisure centers, which have saved an estimated 20,655 kiloliters of water a year (Boroondara 2004).

Action	Status	Expected annual savings (kL)
306 flows control valves installed at four different community leisure centers	Completed March 2003	20,655
16 flow control valves installed at the Camberwell Market	Completed December 2003	288
Termination of irrigation services to 10 parks	Commenced 2001, ongoing	14,000
Installation of timing devices on all manual systems	Commenced end of 2002	Individually difficult to quantify, but will contribute to total reduction
Installation of centralized water control at 21 sports fields and parks	Ongoing, focus since 2002	Individually difficult to quantify, but will contribute to total reduction
Dual flush toilets in all council buildings	Completed 2009	Difficult to quantify, 5 liters saved per flush
10,000L rainwater reuse tank system installed at Camberwell Central Bowls Club	Installed June 2004	220
Reuse of Hawthorn Aquatic Center pool water for tree watering, irrigation, and street sweeping	Completed May 2003	1800

Table 2: Summary of actions taken by the Council to reduce water consumption. (Adapted from Boroondara 2004)

Second, the City of Boroondara Stormwater Environmental Management Plan was created to help deal with the problem of stormwater runoff. The plan's key objective was to "Identify strategies to improve the environmental management of urban stormwater and protect the environmental values and beneficial uses of receiving environments" (Boroondara 2003). Stormwater runoff is a potential environmental threat as the rain water flows from urban rooftops and roads into the nearest body of water, taking with it pesticides and other chemical residues harmful to natural habitats. Most urban settings have a system of pipes and drains to prevent flooding, but unlike wastewater, stormwater is untreated, so the runoff has a direct impact on water quality.

Third, under the Port Phillip and Westernport Regional Catchment Management Authority (PPWCMA), Boroondara has implemented “The Yarra Catchment Action Plan” (1999) (Boroondara 2004). The plan requires all stakeholders, including local government, to reduce the quantities of diffuse pollutants entering the waters of the catchment, which is an area of land that drains naturally to its lowest point (PPWCMA 2004). Furthermore in their most recent Regional Catchment Strategy (RCS) in 2004, the PPWCMA outlined several key principles to maintaining catchment health. In terms of urban lifestyle and design, the RCS states that "the design and operation of urban areas should minimize off-site environmental impacts, conserve natural resources and maximize opportunities for partnership" (PPWCMA 2004).

Fourth, the council has also created many different initiatives to help educate and promote more environmentally friendly habits. These programs range from educational classes to helping mechanics identify how certain oils and fuels may be dangerous to the environment to changing local laws to restrict the amount of waste industries can dispose of. *Table 3* below summarizes a few of these initiatives, such as educational programs and advertisements regarding littering and vehicle maintenance.

Action	Extent of Application	Lead Agency
Undertake a review of the existing side entry pit baskets installations. Evaluate if these structures are effective in addressing litter problems and if maintenance regimes are sufficient. Based on this assessment, consider further application of side entry pit baskets at key locations such as commercial shopping strips	Local	City of Boroondara
Undertake education and provision of best practice stormwater management equipment to contractors and Council staff involved in street cleaning, emergency response, road construction and maintenance.	City	City of Boroondara
Undertake education initiatives on drivers regarding litter and driving practices. This may include a) targeting major street intersections with stormwater advertising, b) advertising the EPA hotline for littering offenses at intersections or vehicle stickers c) encourage drivers to maintain vehicles both to reduce oil leaks but also improve air quality.	City	City of Boroondara
Install an inline Gross Pollutant Trap (GPT) at Grace Street Car park on the Melbourne Water drain. Location captures drainage from major road intersection and commercial strip	Local	Melbourne Water
Install an inline GPT at the drain opening at the National Guide Dog Center	Local	City of Boroondara
Workshops for waste management and street cleaning personnel, parks, gardens and maintenance staff (particularly new staff) for the purpose of improving their skills and setting performance objectives.	City	City of Boroondara
Through street sweeping program, identify if additional parking restrictions are warranted to ensure litter is effectively removed from streets	City	City of Boroondara
Encourage police enforcement of anti-littering regulations. Consider developing joint anti-littering strategies	City	City of Boroondara
Develop guidelines for sediment and erosion control plans for new developments.	Local	City of Boroondara
Conduct workshops for waste management, parks and gardens and street cleaning personnel regarding best practice	Local/City	City of Boroondara
Incorporate stormwater management principles into management planning for open spaces such as parks, sporting facilities and reserves	City	City of Boroondara

Table 3: Initiatives Boroondara has taken to help reduce their impact on the environment (Adapted from Boroondara 2003)

Figure 4 below illustrates that the water consumption in Boroondara has been trending down for the past decade, a result of the Council's hard work in encouraging water conservation. But now that the drought is over, saving water is not as important as restoring the health of the waterways, such as the Yarra River, by improving stormwater runoff. All before mentioned programs are effective in dealing with the threat of stormwater runoff, but all of them are on Council owned properties. The next step for the City of Boroondara is to encourage their residents to manage their stormwater and take the steps necessary in becoming a more water sensitive city. Changing its residents' opinion on this subject is a difficult task that will require behavioral change which can be used to influence an individual's actions to see and understand the threat stormwater has in the health of the local waterways.

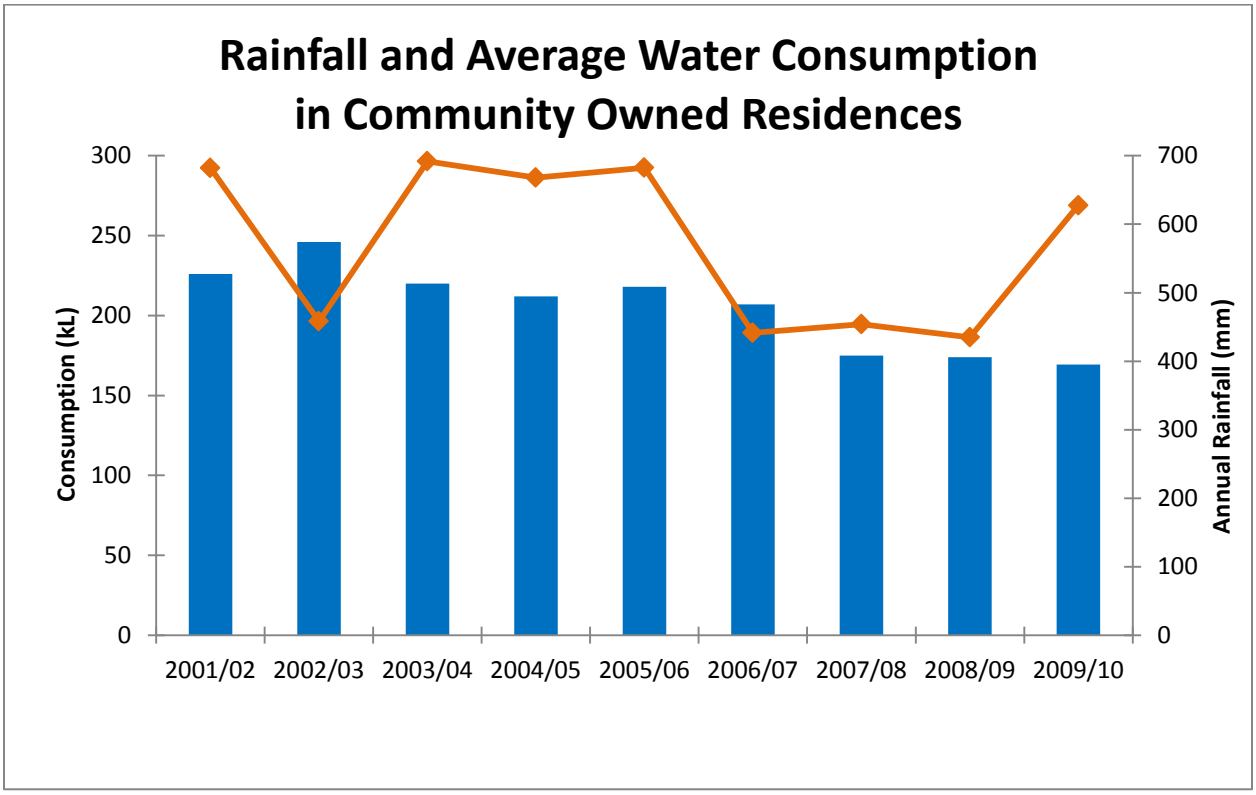

Figure 4: Graph summarizing past decade of rainfall and average water consumption on community owned residences. (Boroondara 2011)

2.3 Behavior Change Theories

Behavior can be defined as an organism's interaction with its environment (CommGap 2009). Many psychologists have studied behavior, theorizing several models based on behavioral change. In the section, we will discuss the three models that relate to our project: Planned Behavior, Stages of Change, and Social Learning Theory. This section will discuss the steps that must be taken to influence behavior as well as tools like social marketing that can be used to make behavioral change possible.

2.3.1 Models of Behavioral Change

The Planned Behavior model states that attitudes and the intention to change behavior will influence behavior. Intention is dependent on attitude and subjective norms (CommGap 2009). Subjective norms are the beliefs of what a person should do, and intention is important when looking at behavior change because it is directly related to motivation. People have to be motivated in order to change their ways of living. A way to boost motivation is to present the change of behavior in a way that will shape positive attitudes to allow for an actual change in behavior. The Planned Behavior model is based on the concept of self-efficiency, in which people must believe that they have the capability to change (CommGap 2009).

When one is trying to change a specific behavior, the theory of Planned Behavior offers four steps to follow. The first step is to define the target behavior and audience to influence. The second step includes identifying the determinants of behavior. Some categories that determine behavior are emotions, attitudes, social pressure, habits and other external constraints. Once one identifies which behavior they want to influence and some behavioral determinants, the next step is to select behavioral change tools and strategies to promote a change in behavior (Boulet 2011). Some tools include coercion, incentives, education, training, and social modeling. These strategies allow for people to think about making a change in behavior which is modeled in the Stages of Change.

A second model about behavioral change is known as Stages of Change. This model consists of six stages that lead to a change in behavior:

1. Precontemplation
2. Contemplation
3. Preparation
4. Action
5. Maintenance
6. Termination

The first step is known as *precontemplation*, where people are not intending to make a change in behavior. The second stage, *contemplation*, is where people actually intend to change and usually become aware of the pros and cons. The third stage, *preparation*, is when people will make a plan of action which they intend on taking in the future. The fourth stage, *action*, is when people actually make a change and *maintenance*, the fifth stage, is when people will work to prevent a relapse. Finally, the last stage, *termination*, is where people maintain their behavior change without a conscious effort because it becomes a part of their everyday lives

The Stages of Change model is essential when studying behavior change. Again, the method of presentation of information is important to promote positive attitudes so progress through the stages can be achieved. If the individual only reaches the third stage and loses motivation to change behavior, one must have a planned intervention. A consciousness-raising intervention provides educational materials to increase the awareness of the causes and reasons to change behavior (CommGap 2009). For example, to promote awareness of stormwater, a city can provide educational material on what stormwater is and how residents impact the quality of their stormwater. Another intervention is known as the environmental re-evaluation intervention, which consists of personal stories that will address how the presence or absence of the person's behavior will impact one's environment. The concept of using personal stories or a social context is applied through the social learning theory.

The Social Learning theory states that people can learn a behavior through observation of others doing the desired behavior (Ormrod 1999). Social learning does not always lead to a change in behavior; however, our environment does reinforce certain behaviors. If one is rewarded for doing a behavior modeled by someone, he or she is more likely to continue this behavior in the future. An example of social learning is the community engagement program, Catchment Crawl, put in place by the council and Melbourne Water to show how to keep the waterways healthy and to protect the freshwater invertebrates. It was a

full day program that allowed for kids and adults to interact with the water, and to model ways the community can impact the waterways. By showing people how they can help the environment, they will be more conscious about how they act.

In order for social learning to be effective, there are four conditions that must be met. The first condition is that the person must pay attention to the model, and they must also be able to remember the behavior that is being observed. The third condition is that the observer must have the ability to replicate the action. The last condition states that the person must be motivated and have a desire to demonstrate what they have learned. Motivation is a key aspect for behavioral change and is present in all of the behavioral change theories mentioned.

Another point mentioned in all models is the importance of presenting information on an issue in an influential manner. While looking at how a city can change the behavior of their residents to be a desired way, it is important to test different approaches. The three models mentioned above should be considered when trying to promote awareness of water conservation and use of stormwater in order to change the behavior of Boroondara's residents to be more water conscious. In many cases, a change in behavior cannot occur without a change in attitude, which can be influenced by many things, whether it is internal feelings or external causes.

According to Zanna and Rempel, attitudes are generated from three main sources: cognition, affect, and past (Zanna 1988). Cognition is a source of information, affect is the emotional connection, and past is the past behaviors that have already taken place or behaviors that have become habits. A technique called "priming" can be used to prime people to be more likely to change their attitude (Herek 1986). One can ask about a related issue that the person may have a positive attitude about which will allow them to be more receptive to the issue one is trying to address. When considering a change in attitude, it may not always lead to a behavioral change (Kim 1993). To persuade people to change their behavior one must present the information in a pleasing way and stress the benefits of changing their behavior. A technique used to do this is known as social marketing.

2.3.2 Social Marketing

Social marketing is a technique used in all models mentioned above and has been used for years to promote behavioral change. Social marketing can be defined as the application of commercial marketing tools to influence the voluntary behavior of a target population to improve their personal well-being and that of the societies that they belong to (Lefebvre 2008). It uses the tools and techniques of commercial marketing strategies and applies them to social issues.

There are eight components of social marketing:

1. A consumer orientation to realize organizational (social) goals

2. An emphasis on the voluntary exchanges of goods and services between providers and consumers

3. Research in audience analysis and segmentation strategies

4. The use of formative research in product and message design and the pretesting of these materials

5. An analysis of distribution (or communication) channels

6. Use of the marketing mix-utilizing and blending product, price, place and promotion characteristics in intervention planning and implementation.

7. A process tracking system with both integrative and control functions

8. A management process that involves problem analysis, planning, implementation and feedback functions. (Lefebvre 2008)

A main tool used by social marketers is the "social change campaign" which is an organized effort conducted by one group which attempts to persuade others to accept, modify, or abandon certain ideas, attitudes, practices, or behavior. Australia was originally known for implementing these social campaigns in the 1980's. The Victoria Cancer Council started their first campaign, "Quit", in 1988 to promote the idea of quitting tobacco and their "SunSmart" campaign to promote awareness of skin cancer (Lefebvre 2008).

More recent applications of social marketing include the "Water for Life" campaign created by the Peach Social Marketing Company in Australia. Their main goal was to present facts about the drought in Sydney and ways residents could conserve water (Peach 2009). In this case, the campaign offered rebates to those who bought rainwater tanks and water-efficient washing machines. By offering benefits to people, it was more likely that the residents would actually change their behavior. They also used a video to show the drought and all the water that was being wasted, which changed the attitudes of the people because it allowed for an emotional connection and motivated them to make a change.

Overall, social marketing can be an effective strategy to persuade the community to change their behavior to be more beneficial to the environment. Whether one uses a social change campaign to change the attitudes of society or offers rebates as a benefit to change one's way of living, social marketing can help in changing behavior.

2.4 Local and Global Practices of Water Behavior Change

Many different countries and cities around the world are encouraging their citizens to make changes in their lifestyles to become more conscious with the amount of water they use and on ways to conserve water. An effective method of bringing about these changes is social marketing, as detailed above. This section covers strategies of social marketing, including the economic incentives, educational programs, and the laws on different levels of various governments put in place to promote water sensitivity.

2.4.1 Economic Incentives

Many different cities' governments, like several cities in Arizona, Michigan and the Victorian Government owned Yarra Valley Water in Australia, use economic incentives as a way to try and help change residents' regular water use and attitude towards water conservation. Governments can offer rebates to residents who switch to more water-efficient appliances. Residents may also receive financial rebates for replacing grass and other landscape with turf or similar materials that do not need to be watered. Other incentive programs try to promote conserving water through collecting stormwater and using it as a

resource. These incentives have proven to be an effective way for many cities to change the behaviors of their citizens as seen in Yarra Valley Waters initiative (Carmona 2011).

For example Arizona, one of the driest states in the United States, has many cities that have taken initiatives to encourage water conservation with rebates. Buckeye, AZ has both a "Toilet Rebate Program" and a "Water-Efficient Appliance Rebate Program" in place; these rebate programs include rebates on (Beckwith 2010):

- High-efficiency toilets ($75 per toilet for replacing pre-1994 models and $50 for replacing post-1994) models.
- Clothes washing machines ($100 for an efficient front-load model).
- Hot water re-circulators ($75 if it includes a timer, an additional $50 is available for insulating pipes, and the $33 building permit fee is waived).
- Smart irrigation controllers ($50-$100 per year for replacing high-water-use landscaping with Xeriscape or artificial turf).
- Automatic water shut-off devices ($75 and must stop flow from water main in case of major water leak).

These incentives counter residents' personal use of water and are an effective way of changing attitudes on water use.

In Australia they are facing a similar problem of dwindling water supplies and a need to conserve water. In 2003, the Victorian Government's "Water Smart Gardens and Homes Rebate Scheme" was introduced and "Banyule residents have claimed 10,244 rebates on water-saving products to the end of last year" (Carmona 2011). Some of the water-efficient products that have been used for the rebate include (Carmona 2011):

- Trigger nozzles
- Flow-control valves
- Mulch
- Soil moisture and rain sensors
- Drip-water systems
- Temporary greywater and rainwater diverters

The State Government's "Water Smart Gardens and Homes Rebate Scheme" clearly has been effective in changing the attitudes of its residents to become more aware of the amount of water they use and how they can reduce their consumption. This rebate program is also in effect in Boroondara. The residents of Boroondara were able to collect even more rebates than Banyule with 12,780 rebates (Carmona 2011).

In Washtenaw County, Michigan they do not experience the water shortage issues like the before mentioned cities, but they do have a program that incorporates using stormwater as a resource with the 2005 "Washtenaw County Rain Garden Assistance Program" to decrease flooding and river pollution. Raingardens are gardens that capture stormwater runoff from a roof or a driveway before it can pollute local waters as illustrated in *Figure 5*. The county's Water Resource Commissioner and staff work with homeowners to design and install rain gardens on their property. The County has very strict stormwater regulations and this program is one way to meet the specifications. Also for the City of Ann Arbor, residents will receive a stormwater rate credit it they construct a garden. The program has been very successful overall and over 70 rain gardens have been installed in the County (Washtenaw 2012).

Figure 5; Raingarden diagram (Adapted from Melbourne Water)

As shown by the success of the "Water Smart Gardens and Homes Rebate Scheme" in both Banyule and Boroondara, as well as the "Washtenaw County Rain Garden Assistance Program", economic incentive programs can help residents decrease their water usage.

2.4.2 Education of Ways to Conserve Water

Governments around the world are creating educational programs that show their residents how to conserve water in hopes that they will change their behavior. Some examples of these educational programs are discussed in this section.

In Buckeye, Arizona, the government is trying to educate their youth about conserving water. "Project WET K-12" is an initiative that gives educational materials to teachers to introduce the concept of water conservation. This program can also be used for town-sponsored educational events such as the annual "Public Works Week" education program, where about 130 children attended and learned about water conservation (Beckwith 2010). The results of these educational programs could be seen in the future as the youth of the city ages.

Buckeye uses other methods to promote decreasing the amount of water its residents use. To endorse public awareness they use "water bills, water bill inserts, brochures, messages on the town's webpage, newsletters, articles or messages in local newspapers, participation in EPA's Water Sense program, and various public service announcements" (Beckwith 2010). Also on the town of Buckeye webpage are links to its "Water Conservation Plan", the economic incentive programs that are in place, landscaping information, and tips on how to conserve water. Buckeye has reduced its in system-wide per capita water use by 77% since programs like these have been in place (Beckwith 2010).

In Hong Kong, China there are a few public education programs on water conservation geared towards all residents, but similar to Buckeye most of the programs are typically directed at the youth of the community. The government is weaving in concepts and knowledge on water conservation into programs in their schools (Hong Kong Water Supplies Department 2008). With presentations and assemblies addressing the issue of water conservation, it is the government's hope that the future of Hong Kong will grow up with the idea that they should monitor their water usage. Some of the typical education programs in place in Hong Kong are public service announcements on the television, the radio, informational leaflets, seminars, and exhibitions (Hong Kong Water Supplies Department 2008).

In the future, the Hong Kong government would like to increase their public education programs by launching television documentaries and websites that introduce tips on water conservation and give information about water scarcity around the world (Hong Kong Water Supplies Department 2008). Another initiative in place is the Water Efficiency Labeling Scheme (WELS). "WELS will inform consumers of the level of water consumption and efficiency of plumbing fixtures and appliances used in bathrooms, toilets, kitchens, and laundries" (Hong Kong Water Supplies Department 2008). This program is actually based

off of the “Water Rating Labeling” in Australia, which is mandatory on all appliances that use water. Most of the programs in place in Hong Kong are relatively new and changes are still being made to them so their success is currently inconclusive.

2.4.3 Laws That Promote Conserving Water

Educational programs and economic incentives can be effective ways to promote water conservation, but government regulations tend to be the most forceful and direct method of behavior change. Implementing restrictions on water use is one of the best ways to have citizens change their perspective on water and become more conscious of the amount of water that they use.

Buckeye, Arizona has added a water conservation regulation to change their town code to include water conservation provisions (Beckwith 2010). These ordinances touch on many different aspects of water conservation. For example, a regulation has been added that no natural turf is to be used in medians or public right-of-ways built by the city, but only artificial turf should be used. Medians made out of turf do not need to be watered and the town will save water by eliminating the natural turf medians. Another new regulation is that all town-owned buildings constructed after January 1st 2010 must have high efficiency urinals installed in the buildings (Beckwith 2010). Regulations were also added that affect residents’ home water use such as potable water being prohibited for washing one’s driveway or sidewalk, and leaks or overwatering runoff from one’s property to the street or a neighbor’s property must be repaired within seven days from when the town is notified or the resident will be fined (Beckwith 2010).

California is another state that is currently facing a water crisis, so they have approved a “Recycled Water Policy” to help conserve water. The goal of the “Recycled Water Policy” is to increase the use of recycled water from municipal wastewater sources in a way that implements state and federal water quality laws. "The State Water Board hereby establishes a mandate to increase the use of recycled water in California by 200,000 [gallons] ... by 2020 and by an additional 300,000 [gallons]... by 2030. These mandates shall be achieved through the cooperation and collaboration of the State Water Board, the Regional Water Boards, the environmental community, water purveyors and the operators of publicly owned treatment works." (Recycled Water Policy, 2009) This government policy is a great way for the state

of California to save water supplies. The policy is being reviewed and revised in 2012 to see how effective it has been in conserving water.

These strict water conservation regulations are encouraging residents to be more aware of their own water usage. Regulation changes like these are a great way to improve overuse of water supplies. As previously mentioned, Buckeye has drastically lowered their total water usage. Their single-family residential per capita water use went from 140 Gallons per Person per Day (GPCD) in 2003 to 90 GPCD in 2008 (Beckwith 2010). This decrease in the amount of water used by residents is in part because of the new regulations initiated by the town of Buckeye.

2.5 Chapter Summary

Due to Australia's highly variable rainfall and low elevation, it suffers from serious water shortages. Drought is a major cause of these water shortages and Australia has dealt with nine major droughts within the past 120 years. With the most recent drought, "The Big Dry", there have been many initiatives put in place on a national, state-wide, and local scale. Whether it was hosting educational programs, providing financial incentives, or promoting the installation of water-efficient products, Australia implemented various strategies to counteract the effects of the water shortage. Now, they are considering the management of stormwater to help reduce pollution in the local waterways. While in Boroondara, we assessed the knowledge of the residents on stormwater and its effects. Utilizing the theory of Planned Behavior, we then chose a target behavior we wanted to influence. After assessing the attitudes of the residents, identifying a target behavior, and researching initiatives from other cities, we made a suggestion on the best method for the City of Boroondara to engage its residents and promote a program to help restore the health of the waterways.

3 Methodology

Our project is aimed to deal with the issue of water shortage in Australia, specifically that of Boroondara, by measuring the community's understanding of stormwater and its effect on waterways, as well as their attitude towards water conservation. The Council's previous focus was on what the council could do to become more water-efficient and improve stormwater quality, but now they are trying to incorporate how residents can contribute to the total reduction of water use and their effect on waterways. The goal of this project was to help the City of Boroondara choose a target behavior and recommend a possible program to improve the health of the waterways and promote water conservation by assessing their community's current understanding of water consumption and stormwater. We achieved this goal by completing the following objectives:

1. Determined past and current strategies from the City of Boroondara and other agencies on engaging the community on issues of water conservation and stormwater.
2. Assessed the current understanding, attitudes, and behavior of Boroondara's residents regarding issues of water conservation and stormwater
3. Determined 3 target behaviors that could be future initiatives and assessed the community's opinions on these behaviors.
4. Conducted literature review of other behavior change programs and campaigns conducted by other relevant authorities to determine key success factors.
5. Combined outcomes of objective one, three, and four to analyze options and propose recommended behavior change tools and strategies for achieving behavior change targets.

Once we gained a better understanding of the community's view on stormwater and water conservation through interviews, we picked a target behavior and audience to influence with the use of a behavioral change program. With the data gathered and a target behavior chosen, we made recommendations on the best method for the City of Boroondara to promote a specific program that advocates improving the health of the waterways through water conservation and stormwater quality.

3.1 Objective 1

We contacted three main agencies in regards to finding out about past and current water strategies: Melbourne Water, Yarra Valley Water, and the Boroondara Environment and Sustainable Living Team. We asked each of the agencies a basic set of questions which can be found in Appendix A. At each agency, one member of our team facilitated the meeting, introduced our project and asked questions, while another kept minutes of the meeting.

3.1.1 Melbourne Water

An interview was set up with two stormwater planners from the Stormwater Quality Team at Melbourne Water. Each interview lasted thirty minutes and the different programs they initiated dealing with use and reuse of stormwater were discussed. The questions were emailed to both prior to the interview to allow for preparation.

3.1.2 Yarra Valley Water

An interview was set up with the Local Government Customer Relationship Manager at Yarra Valley Water. The interview took place in a meeting room at the Boroondara Council office and lasted about 45 minutes. The questions were emailed prior to the interview for any needed specific facts or statistics that the questions entailed.

3.1.3 Boroondara Environment and Sustainable Living Team

A focus group was set up within our department to get the opinions of the team on past programs put in place dealing with water conservation and stormwater quality. This gave us new information and perspective on what aspects worked and could be used again in the future. The group consisted of seven members of the team and lasted two hours. The meeting was an open round table discussion about the projects they, as well as other councils, have put in place.

All of the relevant past programs and initiatives discussed during the interviews and focus groups can be found in the Results and Discussion chapter.

3.1 Objective 2

In order to assess the current understanding and attitudes of Boroondara's residents on water conservation and stormwater, we conducted interviews at various shopping strips around the district. These places include: Camberwell, Ashburton, and Balwyn. Prior to our interviews, we contacted the local Trader's Associations to inform them of our presence. The variety of locations helped us reach a wide pool of participants that would be representative of Boroondara's total population. We asked each person who passed by if they were willing to answer a few questions, which can be found in Appendix B. We also tracked the number of people who accepted or refused our interview request.

We prefaced each interview by asking which suburb each person resides in and we inferred gender and age group. Most of the questions dealt with the understanding of stormwater, personal water use, and water pollution. There were fourteen questions in total and most interviews lasted about three minutes. Twelve of the questions were multiple-choice and two were open-response. At the end of the interview, we gave each participant a four minute shower timer as a thank you gift (*Figure 6*).

Figure 6 Four-Minute shower timer thank you gift from Yarra Valley Water

In total we asked 304 residents of whom 43 accepted and 261 rejected. Overall, we had 14 % success rate. All the data collected was put into an Excel spreadsheet where the information was analyzed.

3.2 Objective 3

After analyzing the results of objective 2, we brainstormed possible target behaviors and awareness. This was done during a focus group between our IQP group and five members of the Environment and Sustainable Living team. The meeting lasted an hour and ideas were mentioned based on the interviews as well as observations of team members. We ranked all the ideas from the brainstorming session based on how realistic, relevant, and helpful each would be for the community. After scheduling another focus group with the same team members, we were able to pick three target behaviors to focus our research on.

After the target behaviors were chosen, our team developed a new set of interview questions focused on these topics based on the Behavioral Change program created by Mark Boulet and Liam Smith of the Monash Sustainability Institute. We then conducted our focused interviews at three locations: Swinburne University, Camberwell Junction, and the Sustainability Festival hosted by the city of Boroondara. This interview process was very similar to that described in Objective 2. Most of the questions assess residents' willingness to participate in proposed programs based on the target behaviors identified. At the end of the interview, we gave each participant a bag filled with various water-saving products. All data was put into an Excel spreadsheet and then analyzed to see which method would be the most effective based on what the residents knew and what previous actions they had taken.

3.3 Objective 4

Upon receiving feedback from residents on specific behaviors, we compared methods and campaigns of other cities and countries on their raingardens programs. The information was gathered via available websites, newspapers, and scholarly publications. The case studies were chosen depending on the different methods they used to promote the installation of raingardens. Each case was then evaluated based on feasibility of local implementation and similarities in governmental operations. The most applicable methods were recommended to the City of Boroondara.

3.4 Objective 5

As a final analysis, we compared the results of all of our interviews, focus groups, and research to determine a specific behavior or awareness that can be influenced with a new program. With the data gathered from the interviews with Melbourne Water, Yarra Valley Water, and the Environment and Sustainable Living team as well as the focused interviews with residents, we found similarities in the need for a program promoting the installation of raingardens. From there, we researched other cities and countries that have implemented similar programs and assessed the effectiveness of their strategies. After our analysis was complete, we suggested the most successful method for the City of Boroondara to change the behavior of its residents based on their opinions and past programs in Boroondara and other locations.

3.5 Deliverables

The main deliverable was a suggestion of the most successful method for the City of Boroondara to restore the health of the local waterways. All data collected was put into Excel Spreadsheets and Word documents. We extracted relevant information from the data and summarized some results into graphs. Based on the data collected, we made graphs and charts that can be found in the Results and Discussion chapter.

4 Results and Discussion

There were three main sources of our findings. The first was through our interviews and focus groups with different water experts. These responses provided us with a better understanding of past initiatives dealing with water as well as ideas for new ones that can be implemented in the future. The second source of findings was through interviewing the general public of Boroondara. There were two rounds of interviews collected. With the first, we gained a more preliminary basis of information about people's behaviors during the drought and thoughts on water conservation and knowledge of stormwater. The second half of interviews was more focused, asking about specific behaviors that can be changed within the community. The last source of our findings came from research on other cities' and countries' strategies dealing with the before mention behaviors.

4.1 Water Experts

To gain a better understanding of some of the programs that have already been on going in the area, we spoke with three separate branches of water administration. First we spoke with two employees from Melbourne Water, which is the Victorian Water Authority. They discussed their current strategies and campaigns dealing with stormwater quality. We also spoke with someone from Yarra Valley Water, one of the water retailers for the Melbourne area, to discuss the education and incentive programs they have in place. Lastly we held a focus group with the Environment and Sustainable Living team, the unit we worked with, discussing initiatives that Boroondara has implemented and participated in. All three water experts were also asked about goals and ideas that they would like to see in the future.

4.1.1 Melbourne Water

At Melbourne Water, we spoke with Sarah Eggleton, Program Leader of Stormwater Development, who went over the "Living Rivers" program which reaches out to the different city councils to run community projects to promote wetlands and WSUD. They work with the 38 local councils in Melbourne to promote sustainable stormwater management through

education and awareness. They do not deal with the community directly, but they identify an individual council's needs and help them with their community programs. This promotes the importance of stormwater management and strengthens the relationship between the state and local governments.

We also spoke with Keysha Milenkovic, the Project Leader of the Raingardens Program, who is in charge of a more community based stormwater project called "10,000 Raingardens". A raingarden is a specially prepared garden designed to receive and filter rainwater runoff from roofs or impermeable surfaces such as driveways and paving. This program's targets are to engage the community on the importance of stormwater and to have 10,000 raingardens registered by 2013. Melbourne Water also provides instructions on how to build different types of raingardens such as in-ground, planter box, infiltrated, and swale. After extensive social research, they grouped residents into six categories: Not Interested, Disengaged, Uninformed, Mainstream, Everyday Environmentalist, and Environmental Enthusiast. They decided to target only two of these categories: Everyday Environmentalists and Environmental Enthusiasts, because these two groups of people would be the most likely to change their behavior. In the future, she would like to see more integration with councils.

We were also able to get some good insight and ideas on a program that could be started in the City of Boroondara. One very useful item that was discussed was the social research they have done on choosing a target audience. Their focus on the Everyday Environmentalists and the Environmental Enthusiasts is targeting the kinds of people who would be most likely to install a raingarden. This is a great target audience, but the only problem is how to find or target this type of person. When people are being targeted based on personality or beliefs, there is no effective way to find and campaign directly towards them. Melbourne Water has been trying to reach out to these types of people by speaking and setting up booths at local sustainability festivals, including the one in Boroondara, because typically their target audience would be present.

4.1.2 Yarra Valley Water

At Yarra Valley Water, we spoke with Guy Pritchard, a Local Government Customer Relationship Manager, who discussed the current programs YVW has in place. This includes the "Showerhead Exchange Program", which allows residents to exchange their old

showerheads for more water-efficient ones free of charge. The program has been in place since 2006 and they have since given out 174,318 water efficient showerheads. The cumulative water savings from this program is estimated to be 2.1 GL.

Similarly, the "Home and Gardens Rebate Program" offers rebates to homeowners for upgrading various appliances to water-efficient ones. In fiscal year 2010/2011, 19,008 rebates were given out all over Melbourne. The rebates given in each year are estimated to save about 350 ML/yr. Specific details on the rebates can be found in *Table 4* below.

Type of Rebate	Number of Rebates Given
3-Star shower roses	420
Dual Flush Toilets	4,633
Permanent Greywater Systems	95
Water Conservation Audits	138
Rain Water Tanks	2,463
Tanks Connected to Toilet	84
Large Rain Water Tanks Connected to Toilet and Laundry	1,172
Basket Water Conservation Goods	9,983
Hot Water Recirculators	20

Table 4: Summary of specific rebate information

Another program is "SmartAccount", which displays the average amount of water used per person per day alongside a suggested goal at the bottom of the home water bill. In the future Guy would like to collaborate with the local governments and incorporate water with health in some type of health program. He would also like to see a program dealing with water attitude shift around using drinking fountains instead of buying bottled water.

Based on the research that YVW has done on their past programs, the most effective ones are those that are simple and require little effort by residents. The "SmartAccount" is a perfect example of this. The amount of water used per person per household was an effective way for people to see exactly how much water they use because it is so easily accessible. Through our interviews we saw that people do pay attention to this and this is why most people knew how much water they typically use per day. Based on their analysis on how effective their own programs are they have also discovered that initiatives that work the best

are ones that are inexpensive or are even free for residents. The YVW “Showerhead Exchange Program” was very effective in large part because it was free for people to get a new water-efficient showerhead just by handing in their old one. These simple and cost effective programs are the ones that residents are most likely to partake in.

4.1.3 Environment and Sustainable Living Team

Within the Council, we spoke with the Environment and Sustainable Living team and discussed past initiatives that they have implemented including the "Living for our Future Program." This community education program delivers workshops with practical tips, demonstrations and hands-on activities to encourage sustainable behaviors by residents. Workshops include a variety of topics, but have included helping residents monitor their water and electricity bills, providing tips on saving water in the home and garden, and promoting the installation of raingardens. The raingardens workshops have been run in partnership with Melbourne Water. Most of the recent workshops did not deal with saving water because the drought has broken, but have included stormwater and the installation of raingardens. Gardening workshops promoted composting and using fewer chemicals in the garden.

They also participated in the "Lower Yarra Litter Strategy", which includes many municipalities, state government, and non-profit organizations. This focused on coming up with engineering solutions to the issues with litter polluting the area and local waterways. The face of the campaign was to improve the Yarra River and target litter “hot spots” and provide more bins and ashtrays in those areas. The most common and harmful form of pollutant are cigarette butts because animals mistake them for food and they are too small to be caught by the gross pollutant traps so they end up in the waterways.

Projects that were co-sponsored with another agency were more effective. Also they found through their experiences, programs that are new and innovative tend to grab the attention of residents more. These kinds of initiatives are more likely to be successful because people will be more interested in them as opposed to programs they have seen before.

4.2 Residents

To assess the current understanding and behavior of the residents of Boroondara on water conservation and stormwater, we conducted two sets of interviews. The first set of interviews were preliminary questions to get a general knowledge of what the community understands about stormwater and its effects on the waterways, as well as how their water use behavior has changed since the drought has ended. After these responses were analyzed three target behaviors were chosen based on the responses. A focused set of interview questions were then asked to the residents.

4.2.1 Preliminary Interviews

During the interviews with residents we noticed many similarities in their responses. About 72% of people interviewed thought that water conservation continues to be important even though the "Big Dry" has ended (*Figure 7)*. When asked about their water habits during the drought and what they did to change their water use, almost all residents reported the use of a bucket in the shower to catch water for their gardens; some residents even stopped watering their garden all together (*Figure 9*). About 80% of the people interviewed were aware of The Target 155 Campaign and their daily use per person was either at or below the suggested 155 L/day. Also during the drought, about 30% of people interviewed installed one or more rainwater tanks to save water (*Figure 8*). The questions dealing with stormwater showed that about 80% of people interviewed made a connection between water going from roads to rivers (*Figure 10*). Once given options of where the water goes, most interviewees were able to make the connection, but before the choices were given, most seemed to have no idea. A lot of residents also suggested street litter traps as a creative way to reduce pollution in the local waterways. Currently there are some traps on the drains in urban areas, but it could be considered to put more in the residential areas. Unfortunately, a lot of rubbish is too small to be caught by these traps. A lot of people interviewed who were middle aged to elderly suggested an education program targeting a “younger” audience. They felt that a lot of the issues with pollution and litter came from the youth. Other suggestions included recycling and having more rubbish and cigarette disposal bins on suburban streets. A suggestion was also made to start a can recycling program, similar to the one in South Australia, to decrease the amount of cans and bottles on the streets. This initiative is

currently being considered on a statewide scale and is outside of the Council's jurisdiction. Lastly a couple of people mentioned educating residents about raingardens and their benefits.

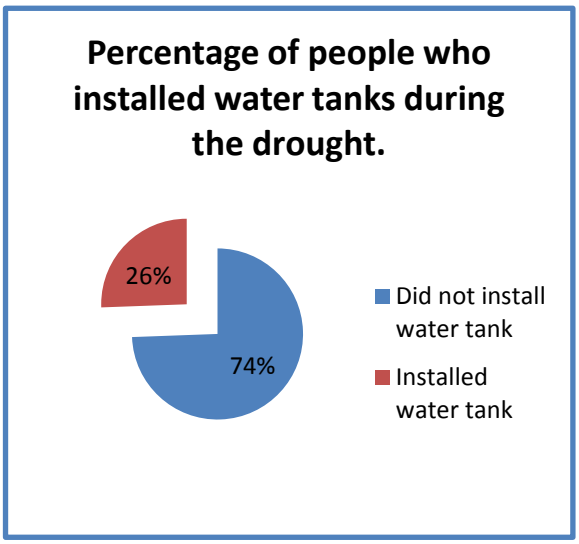

Figure 8: Graph of the percentage of residents who installed a rainwater tank during the drought.

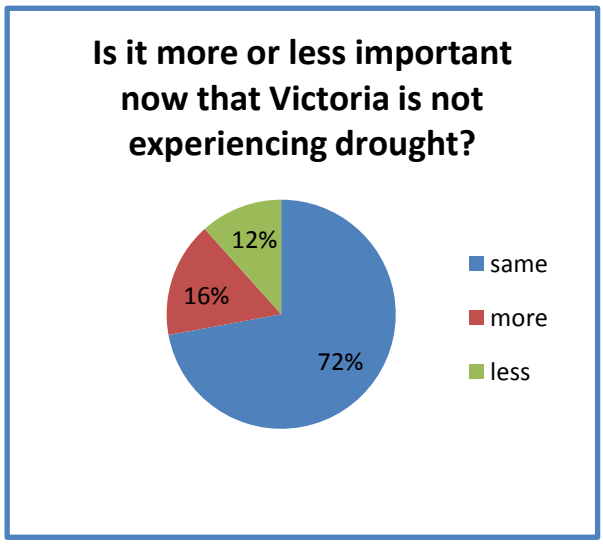

Figure 7: Graph of residents answer to the question "Is saving water more or less important now that Victoria is not experiencing drought?"

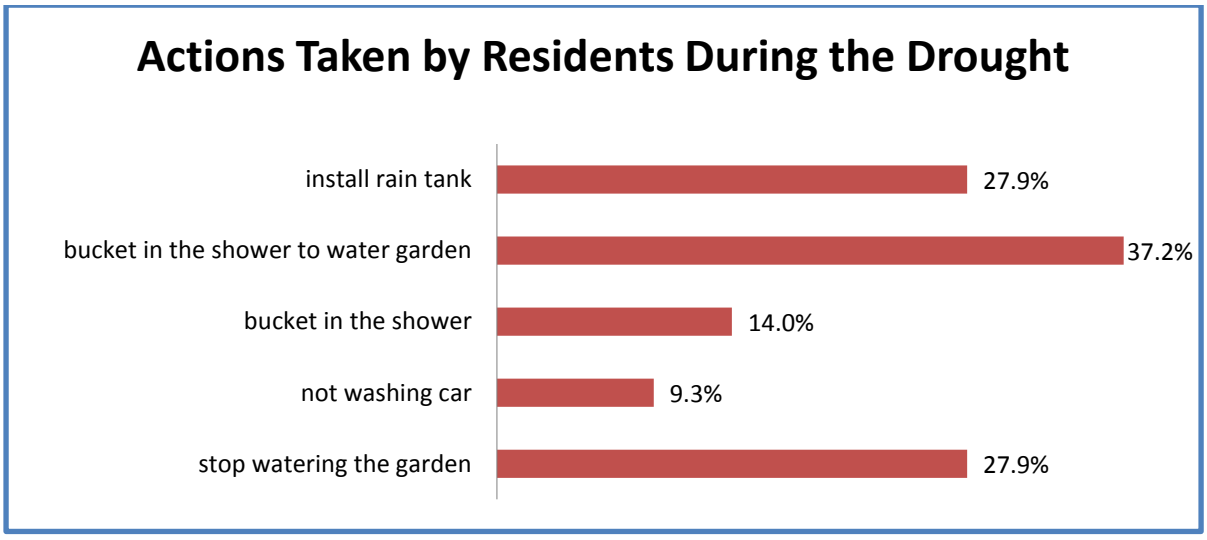

Figure 9: Graph of what actions residents took to save water during the drought.

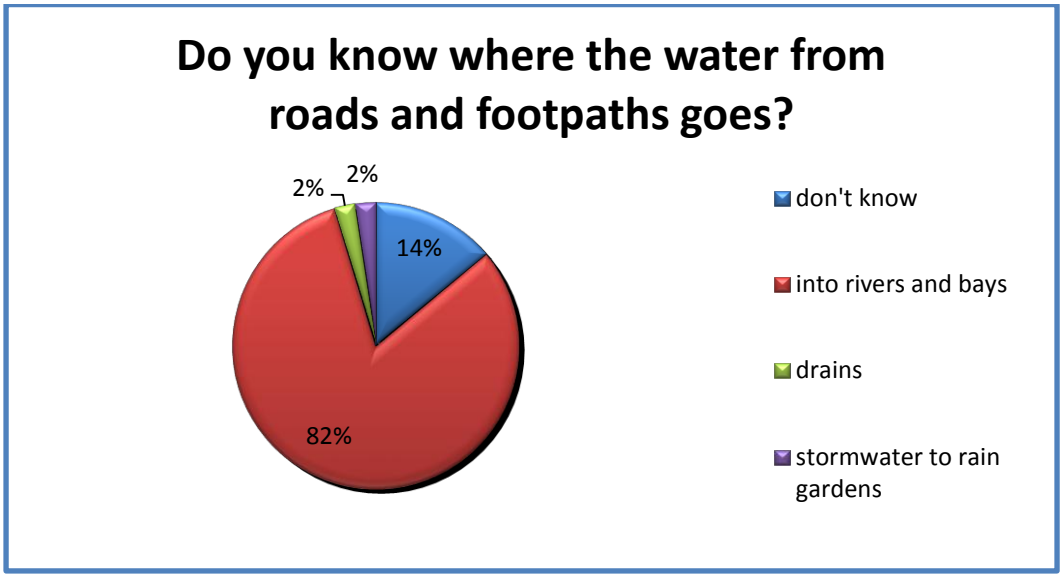

Figure 10: Graph of where residents thought water from the roads and footpaths goes.

4.2.2 Focused Interviews

Three sets of focused interview questions were asked to residents. All of the questions were based off of the same behavioral change model. The target behaviors that the interviews were focused on were raingardens, rainwater tanks, and drinking tap water instead of bottled water.

4.2.2.1 Raingardens

During our focused interviews, the main observation we made during our questions on raingardens was that 95% of the residents interviewed did not know what they were. Once a brief explanation was given, most people thought of a few reasons on why they would be beneficial to install, such as saving water and decreasing the amount of stormwater runoff. The main disadvantages residents could think of were initial cost, lack of space, and maintenance. Typically, most people thought that being environmental and installing a raingarden would be approved by everyone or they did not care about others' opinions. People also felt that it would be easier for them to install a raingarden if someone could install it for them, if the instructions were easy-to-follow, and if there was more information readily available. Some factors that would hinder people from installing a raingarden are the

cost of supplies and installation, having enough space and time, already having a rain water tank, not owning their own property, and what it would do the appearance of their homes and yards.

Based on the answers we received it seemed that the main reason residents did not have a raingarden at home was that they simply did not know they existed. An advertising campaign focusing on raingardens and their benefits could be possible program for the City of Boroondara to consider.

Figure 11: Picture of a raingarden in Hawthorne East, Melbourne, Victoria

Figure 12: Picture of Melbourne Water's raingarden table at the Boroondara Sustainable Living Festival

4.2.2.2 Rainwater Tanks

As opposed to raingardens, all residents knew about rainwater tanks and 46% of them already own one (*Figure 9*). The people interviewed who did not have a rainwater tank did not have one because they rented and did not own their property. But if given the opportunity, they said they would install one and connect it to their toilet and laundry. 24% of the people who owned rainwater tanks connected them to their toilet and laundry. The remaining owners only used the water from their tanks on their gardens. The main reason people did not connect their tank to their toilet and laundry was the cost. They also thought it was more important to use the

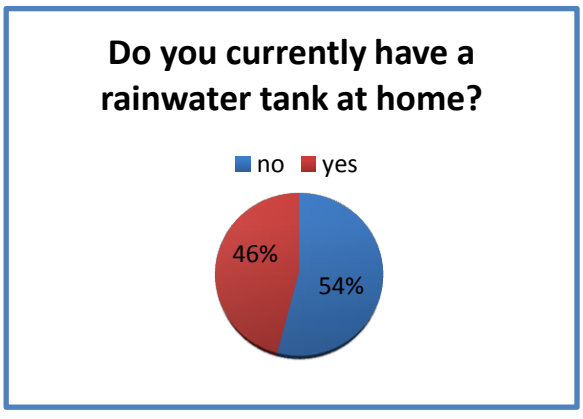

Figure 13: Graph of the percentage of residents interviewed who own a rainwater tank at home.

water for their gardens. The disadvantages of installing tanks are its appearance, the cost, perceived possibility of breeding mosquitoes, and lack of available space. Residents felt that everyone would approve because rainwater tanks are so well known, the only possible people who would disapprove would be neighbors if the tanks were unsightly. Some factors that would make it easier for residents to install one would be if they were easy to install, all the supplies were in one location, and it was reasonably priced. Some factors that would make it difficult to install are the amount of space available, property ownership, retrofitting small houses, and aesthetics.

Figure 14: A picture of a typical rainwater tank (Image from superiorwatertanks.com.au)

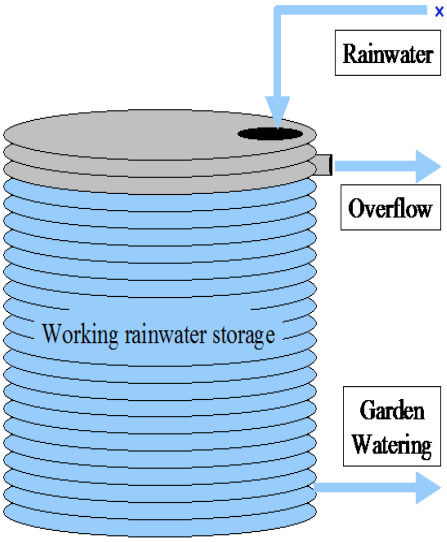

Figure 15: A schematic of how a rainwater tank works (Image from qldwater.com.au)

A possible campaign for installing rainwater tanks that can be connected to the laundry and toilet is one that focuses on the negative of using potable water to flush one's toilet. From the interviews we have conducted, even though the drought has ended people still understand the importance and value of potable water.

Figure 17: A picture from the Boroondara Sustainable Living Festival

Figure 16: A picture of the different informational stands at the Boroondara Sustainable Living Festival

Figure 18: A picture of the stands for children at the Boroondara Sustainable Living Festival

4.2.2.3 Tap Water vs. Bottled Water

All interviewees said that they typically drink tap water instead of bottled water. People only bought bottled water if they forgot their reusable water bottle or if there were no taps available. Most people are impressed and proud of the water quality in Melbourne, but there are still some people who filter their tap water. Residents saw the advantages of drinking tap water as opposed to bottled water because it is cheaper, more convenient, uses fewer resources, and tastes good. Some saw disadvantages because there is not always a tap available to refill their water bottles and the possibility of pollutants and chemicals, especially fluoride, in the water as well as old pipes. Most people thought that no one would care if they drank tap water over bottled water or that everyone would approve. Only one person interviewed said that they had people disapprove of them drinking tap water because of its poor quality.

Figure 19: Water from the tap (Image from 3.bp.blogspot.com)

Figure 20: Bottled Water (Image from aquatecuk.files.wordpress.com)

The only major difficulty in drinking tap water was the lack of a fountain where they can refill their reusable water bottles. A possible program that can be started could be to add more fountains in public places and to also post a sign to promote drinking tap water and explain all the environmental problems plastic bottles are causing.

Based on the responses from the residents, it seems that the best type of program to initiate would be one that deals with raingardens. Very few people had any idea what a raingarden was and when it was explained they had a few misconceptions on the problems they could cause. Finances seem to be one of the deciding factors when people are installing

a water device and raingardens are less expensive than rainwater tanks. A program dealing with either education on what raingardens are and their positive effects on stormwater runoff which in turn leads to healthy rivers and bays or an incentive program for installing a raingarden are both possible ideas for the Council.

4.3 Other Cities and Countries

There are several raingarden programs that have been implemented in different cities that want to improve the health of their waterways and stormwater quality. From our research the only countries we have found that have started such programs are the United States and Australia. Some of the programs involve educational campaigns while others provide financial incentive for residents to install raingardens.

The "10,000 Rain Gardens" program in Kansas City, Missouri, effective since mid-2005, encourages residents to build raingardens to reduce the amount of stormwater runoff which is polluting their waterways. This is a public-private initiative that involves residents, corporations, educators, nonprofit organizations, and some government agencies (Kansas City's Dream). Melbourne Water actually based their raingarden program off this one. The purpose of the program is to improve the water quality of sewers and stormwater by encouraging green solutions like raingardens (Cahail, 8). To promote the initiative there was a huge education campaign that included television, newspaper, and radio advertisements, as well as bill and mail inserts. Before and after the campaign, residents were surveyed on their knowledge of the program and there was a 30% increase in knowledge after six months (Kansas City's Dream).

The Green Infrastructure initiative taken by the city of Fort Wayne, Indiana is a program that offers incentives to its residents for installing a raingarden on their properties. "Catching Rain" will give direct payment to the residents if they purchase certain plants for their raingarden. There is a long process residents must take before installing a raingarden: they must apply for the program, attend an instructional workshop, sign an agreement, and register their raingarden. Once all steps are completed, the city of Fort Wayne offers residents technical assistance in installing their raingarden, and will send them reimbursements. Their goal is to reach 1,000 registered raingardens (City of Fort Wayne 2011). Also in Milwaukee, Wisconsin they have a financial incentive program for residents

to install raingardens. The Milwaukee Metropolitan Sewerage District (MMSD) has a grant that people can apply for that provides plants for one's raingarden at a reduced price. The plants are about 50% discount compared to retail price and the MMSD will also give residents a five pound bag of Milorganite Garden Care if they receive the grant (MMSD 2012 Rain Garden Plant Program).

The Los Angeles Department of Water and Power, TreePeople, and the Generation Water team worked together to create a raingarden program for the city of Los Angeles. The program offers the residents of Northeast San Fernando Valley a free raingarden installation, and up to $1000 in reimbursements for raingarden construction. The residents must apply and have their site assessed based on the layout of their home, space available, downspout availability, and soil drainage. Residents can choose between installing the raingarden themselves and getting reimbursed, or having a member of the Generation Water team install it for them, free of charge (Generation Water 2011).

In Seattle, Washington there is the "Rain Wise" program in place that encourages residents to manage their on-site stormwater to reduce flooding, protect property and restore waterways through the use of raingardens or rainwater tanks. They have also identified certain areas where flooding is more common and offer rebates of up to $4USD per square foot of area controlled to residents in those locations. In addition to encouraging stormwater management utilities, the program also promotes other environmentally friendly habits including using less pesticides and fertilizers and managing pet and car waste (Seattle Public Utilities). There is also a program in Portland, Oregon run by the Environmental Services department called the "Clean River Rewards". This program started on October 31st, 2006 and gives residents a monthly discount on their stormwater utility fee based on the amount of stormwater each property regulates. The City offers this discount in hopes of decreasing the effects of stormwater runoff in stream pollution and habitat destruction. They also hope to reduce their own spending on the maintenance of the runoff (City of Portland).

From our research it appears that most cities use educational campaigns or financial incentives to promote the installation of raingardens at home. Some of these programs could be implemented in the City of Boroondara, such as those that had small-scale financial incentives (discounts on plants for the garden or small amounts of money taken off the price). Also an education program that displays the raingardens the city has already installed and

talks about their benefits could be implemented. As illustrated by the interviews, very few people knew what a raingarden was, let alone its positive influence on waterway health.

5 Conclusions and Recommendations

Based on our interviews and focus groups with water experts, interviews with residents, and literature review of other cities' programs, we have come up with a few programs that the City of Boroondara should put in place. From these, we decided on one program that we believe is the most effective method to promote water saving and the health of waterways through stormwater quality.

5.1 Water Experts

Following the interviews and focus groups with the different water authorities we offer these suggestions for a new program in Boroondara.

5.1.1 Melbourne Water

Since Melbourne Water and the City of Boroondara have a good working relationship, we suggest a partnership between the two to promote the "10,000 Raingardens" campaign in Boroondara. Melbourne Water has also expressed a desire to work with the Council because they have the direct contact with the community. With an educational program about raingardens and their positive effect on stormwater runoff and waterway health, the Council will be inadvertently promoting the "10,000 Raingardens" campaign. Also by working with Melbourne Water, they have more financial resources than that of the Council alone. With these resources they can have a larger and more effective educational campaign that would include ads and announcements. We recommend that the Council also have economic incentives for raingardens but they would most likely need funding or help from Melbourne Water.

5.1.2 Yarra Valley Water

By installing more water fountains in public areas, Yarra Valley Water hopes to encourage residents to drink tap water as opposed to bottled water. They also want more joint projects with the local councils. We think this program would be an excellent joint effort for the City of Boroondara. At these new water fountains, we recommend signs that educate residents about how plastic water bottles adversely affect the environment, including the waterways.

5.1.3 Environment and Sustainable Living Team

We recommend that the City of Boroondara partner with other councils or water authorities. Based on all of our interviews and focus groups with the different water authorities, we have decided on a few key ideas that can be used for a new program. Everyone we spoke to was interested in a joint program that can use the resources of both authorities. Boroondara has the ability to reach out to their community and get them involved, which is what both Melbourne Water and Yarra Valley Water are looking for, and Boroondara can use the resources that Melbourne Water and YVW possess to have a more effective educational campaign.

5.2 Residents

After conducting our focused interviews, we have determined three possible programs, one for each of the target behaviors chosen, that we recommend to be implemented by the Boroondara Council. The pros and cons of each of the programs are discussed below, and we then decided on the best program for the City to put in place based on an opportunity to co-sponsor, how responsive residents were to the ideas, and room for education on the issue.

5.2.1 Raingardens

Our focused interviews with residents show that a program dealing with raingardens would be effective. There is a need for education on them as most people we spoke to had no idea what a raingarden was or the positive effects that it has on the waterways. Even after we gave people a brief explanation of what a raingarden was, there were misconceptions about the disadvantages of having one. A campaign that would encompass installing raingardens could be "A Future towards Swimming in the Yarra". This is new, important to residents, and would grab their attention. Everyone we interviewed knew how polluted the Yarra River is, and a campaign that focuses on the possibility of a future where people can actually swim in the river would be attention-worthy. This is the best way to help residents make the important connection between stormwater runoff and the health of waterways. Raingardens are something that residents can build to help improve the quality of stormwater runoff. With an educational campaign, residents can see how their change in behavior can one day make the Yarra swimmable.

As before mentioned, there is also the possibility of making this program a joint effort with Melbourne Water, which already has a raingarden program in place and has expressed interest in partnering with the Council. A part of the program would also have an agreement with either a few specific green plumbers or the Green Plumber's Association to have a set or discounted price for residents that are installing a raingarden. This would bring more business to the plumbers and make it less expensive for the residents.

There are a variety of types of raingardens. This is beneficial because residents care about their gardens and the appearance of their yards. With multiple options they are more likely to find a raingarden that enhances the aesthetics of their yard. Along with the multiple options of raingardens, the costs range from $150 to $500 (excluding the cost of a plumber) so residents can find the raingarden that best fits their budget.

Although there are many possibilities for a program about raingardens, there are also some concerns. The main issue we found was that residents already owned rainwater tanks and saw no need for raingardens. Another factor to consider is that residents who rent would need permission from their landlord to install a raingarden. This would mean that our target audience for this program would exclude people who do not own their own homes. Lastly,

residents who have small properties feel that there is not enough space to install a raingarden, which decreases the size of our target audience.

Overall, the benefits of this program far outweigh the negative factors. The target audience of the program would be suburban areas because people in the suburbs typically own their properties and have enough space. This program is a great way to educate the residents of Boroondara and have them contribute in restoring the health of their local waterways.

5.2.2 Rainwater Tanks

Installing a rainwater tank has been an ongoing action since the start of the drought to conserve water. Based on our interviews, many people installed one for the purpose of saving water, especially to use on their gardens. Since the drought has ended, a new program focused on the installation of rainwater tanks seems unoriginal and not overly useful. But showing how rainwater tanks can be effective in a new way, such as greywater for the toilet and laundry, can breathe new life into an old program. The residents of Boroondara have not forgotten the value and importance of saving potable water. Having a campaign that questions the use of potable water to flush toilets would gain attention and cause residents to consider connecting their tanks to their toilet and laundry. Another benefit of this connection is that it removes water from the stormwater system as the toilet is connected to the wastewater system. This reduces the amount of water flowing unnaturally into the waterways and will reduce the risk of erosion and flooding.

Although many people have already installed a rainwater tank, for those who have not, it can be an expensive process. The price to install a rainwater tank ranges from $400 to $2,000 (excluding the price of a plumber) depending on the size of the tank. Also, for those who already have a tank, there is an additional cost for connecting the tank to their toilet and laundry. Many residents have also voiced concerns about the appearance of the tank on their property. Typically people find them very unsightly, which would make them hesitant to install one. Similar to raingardens, the installation of a rainwater tank requires ownership of the property. Many residents said that they do not see the point of installing a rainwater tank now because the drought has ended and the costs will outweigh the future benefits.

Although we feel this program is not as strong as the raingarden campaign, it is still a viable option. Water saving is an issue that is always going to be prevalent in Boroondara

and using rainwater for your toilet and laundry is an excellent method of doing this. Basically, the program would entail focusing on the problem of using potable water for the toilet and laundry, which hopefully will resonate with enough residents to consider installing a rainwater tank or connecting their pre-existing tank to their toilet and laundry system. Another advantage of a program like this is that Boroondara can have the cooperation of YVW which already has a rebate program for people who connect their tanks to their toilets and laundry.

5.2.3 Tap Water vs. Bottled Water

In general, all residents we surveyed drink tap water as opposed to bottled water. The only times that they drink bottled water is if they forget to bring their reusable bottle or if there is no water fountain nearby. This information directly supports the initiative that YVW would like to put in place by adding more public drinking fountains to promote drinking tap water. The City of Boroondara should collaborate with them on this program by having signs next to the newly installed fountains educating the residents on the negative effects plastic water bottles have on the environment and how they pollute the streets and ultimately, the waterways.

After reviewing all three possible programs, we feel that the best one to implement in the City of Boroondara is the program involving raingardens. There is the most room for education and also an opportunity to partner with Melbourne Water and their "10,000 Raingardens" campaign. The connection between residents, their effect on stormwater quality and its effects on the health of rivers and bays allows for a more personal program, which makes it more likely for residents to change their behavior. The second best option is the "Drinking Tap Water" campaign, which would be done in partnership with YVW. The signs next to the fountain would be a great educational tool and the availability of more taps would help residents with drinking tap water more often. Lastly, the third option for a new program is promoting the connection of rainwater tanks to toilets and laundry to save potable water. We believe this campaign will be the least effective of the three options because of cost, pre-existing tanks, and priority of watering personal gardens.

5.3 Other Cities and Countries

Based on our decision that a program focused on raingardens would be the most effective, we did a literature review on other cities' raingarden programs. All of the programs we researched are from the United States and either concentrated on education or used economic incentives.

The possibility to use either of these methods to change the behaviors of the residents is feasible, but the Council does not have the funds to support the free installation of raingardens. A more plausible economic incentive would be to have discounts on the specific plants that can be used for raingardens or small rebates for people who install one.

Educational campaigns also seem to be effective ways for people to learn about what raingardens are and their effects on the waterways. In Kansas City, they had an educational campaign to spread word on their "10,000 Rain Gardens" program. This turned out to be very successful with a 30% increase in awareness of the program.

Either of these options are feasible ways to change the behaviors of residents and spread the word on the importance of regulating stormwater quality.

5.4 Recommendation

In conclusion, we recommend that the City of Boroondara implement the program "A Future towards Swimming in the Yarra River." This program will educate residents on ways they adversely affect stormwater, which leads to pollution of the Yarra River. The target audience for this program will be people who live in suburban areas and own their homes. One of the main components of the program would be to promote the installation of raingardens as a way residents can improve their impact on the health of the waterways. Part of the program will include a tour of the city-installed raingardens around Boroondara to further educate residents and show that they can be aesthetically pleasing. This will promote Melbourne Water's "10,000 Raingardens" initiative, which will allow the Council to gain access to more resources. Another aspect of the program should include discounts on the specific plants that are needed for raingardens. "A Future towards Swimming in the Yarra River" is a great program that will not only help the City of Boroondara become more water sensitive, but it will also lead to a more sustainable lifestyle.

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Appendices

Appendix A – Questions for Water Experts

1. What type of programs has your agency run in the past to engage community on issues of water conservation and/or stormwater management?
2. Which individual behaviors were the programs described in question 1 aimed at changing?
3. What methods did you use to influence the behavior of people?
4. Which of these programs/methods do you think were effective and why?
5. Has any research been conducted by your organization to determine the effectiveness of these programs/ refine programs to ensure better success?
6. Was research used to determine the target audience for any of these programs? What are you currently working on to promote water conservation/protect stormwater?
7. What types of programs would you like to see more of?
8. What types of people are participating in the rain gardens program? Is it typically residential? (Melbourne Water)
9. How do you plan on increasing the number of residents installing rain gardens? (Melbourne Water)
10. Do you offer an education program or ad campaign to promote the use of rain gardens? (Melbourne Water)
11. What specific role can local government play in influencing their local community conserve water and help manage stormwater?
12. How effective do you feel your current rebate programs are? (Yarra)

Appendix B – Preliminary Interview Questions

We're working with Boroondara Council to learn a bit about what locals think about water. Do you have just three or four minutes to talk? As a thank you we've got a four minute shower timer provided by Yarra Valley Water.

A. Yes

B. No

If yes: great, thank you so much. We just have 14 questions. The first 8 questions are about water conservation in the home, and then another few about the water in waterways and bay.

1. Firstly, can you tell me which suburb you live in? (we may want to have list for ease of selecting)

2. Do you think saving water is important?
    a. Yes
    b. No
3. Is it more or less important now that Victoria is not experiencing drought?
    a. More
    b. Less
    c. The Same

    Why (do you think so)?
4. Do you think we are likely to have more droughts like the one we have just experienced?
    A. Very
    B. Possible
    C. Unlikely
    D. Don't know
    E. Why?
5. The 'Target 155' campaign encouraged households to reduce their water use to 155 litres per person a day. Were you aware of this campaign?
    A. Yes
    B. No

6. On average, how much water do you *think* you typically use each day?
    A. 100-120 litres
    B. 120-150 litres
    C. 150-175 litres
    D. More than 175 litres

7. Did you do anything to save water during the drought? If so, what?
    a. Bucket in the shower to collect water for use in the garden
    b. Stop watering the garden

c. Not washing the car
d. Install a rainwater tank (connected to your toilet? Laundry? For use in the garden?)
e. Buying water efficient washing machine or dishwasher?
f. Changing to a dual flush toilet?
g. Switching to a water efficient showerhead(s)?
h. Other:: (may include subsurface irrigation, greywater use etc)

8. Now that the drought has broken in Victoria, has your water use behavior changed?

A. Yes. If so, How?
B. No

The last few questions are about the water that flows from our homes.

9. How important do you think it is that our local waterways (like the Yarra River and the Bay) are healthy?

A. Very Important
B. Relatively Important
C. Not that Important

10. Where do you think the water from your household goes?
    a. Rainwater from the roof?
    b. Toilet water?
    c. Shower?

The options include i) into the rivers and bays ii) into a wastewater treatment plant and then into the rivers and bays iii) into a wastewater treatment plant and then reused

11. Do you know where the water from roads and footpaths goes?

The options are i) into the rivers and bays ii) into a wastewater treatment plant and then into the rivers and bays iii) into a treatment system and then used to irrigate parks and gardens

12. Can you think of any creative ways to:
    a. Reduce pollution in our rivers and creeks?
13. Do you think that it is a good thing that there is lots of water in our creeks and rivers right after it's rained? Why?
    a. Yes
    b. No

14. What, if anything, do you think is the role of local government in water management?

Appendix C – Focused Interview Questions

We are working with the council, do you have any time for questions?

We are doing research on community opinion for potential future programs on water management and stormwater quality.

Target Behaviors:

Raingardens

Raingardens collect water from your roof to filter it before discharging back into stormwater.

1. Do you have a raingarden at home?
2. What do you think are the advantages of installing a raingarden at home?
3. What do you think are the disadvantages of installing a raingarden at home?
4. Who do you think would approve of you installing a raingarden?
5. Who do you think would disapprove of you installing a raingarden?
6. What factors or circumstances enable or make it easy for you to install a raingarden?
7. What factors or circumstances hinder or make it difficult for you to install a raingarden?

Rainwater Tanks

1. Do you currently have a rainwater tank at home?
2. If so, is it hooked up to your toilet and/or laundry? What do you think are the advantages of installing a rainwater tank and plumbing it to your toilet and laundry ?
3. What do you think are the disadvantages of installing a rainwater tank and plumbing it to your toilet and laundry?
4. Who do you think would approve of you doing this (installing a rainwater tank and plumbing it to your toilet and landry)?
5. Who do you think would disapprove of you doing this (installing a rainwater tank)?
6. What factors or circumstances enable or make it easy for you to do this (install a rainwater tank)?

7. What factors or circumstances hinder or make it difficult for you to do this (install a rainwater tank)?

Bottled Water

1. Do you generally drink tap water or buy bottled water?
2. What do you think are the advantages of drinking tap water instead of buying bottled water?
3. What do you think are the disadvantages of drinking tap water instead of buying bottled water?
4. Who do you think would approve of drinking tap water instead of buying bottled water?
5. Who do you think would disapprove of drinking tap water instead of buying bottled water?
6. What factors or circumstances enable or make it easy for you to drink tap water instead of buying bottled water?
7. What factors or circumstances hinder or make it difficult for you to drink tap water instead of buying bottled water?

Appendix D – Meeting with Yarra Valley Water

Guy Pritchard, Customer Relationships Manager

13. What type of programs has your agency run in the past to engage community on issues of water conservation and/or stormwater management?

- 2002/3 The restrictions came into place
- 2005/6 Showerhead Exchange Program- pushed heavily through Australia Post
- SmartAccount- shows how many litres per person per day at the bottom of your water bill. It was effective in creating awareness on how much water each household uses. It was the most effective because it was linked to the account and accessible for people to see how they can make a change.
- Home & Garden Rebate Program: one applies for it. The government gives the money but YVW runs the program.
- Our Water Our Future: 3 retailers (City West, City East, and YVW) Oversaw grants, advertising Target 155, showerhead exchange flyers.

14. Which individual behaviours were the programs described in question 1 aimed at changing?

-It is hard with the drought subsided, that it is getting harder to persuade people to conserve water

-Hardship Program: for people who cant pay their bills, put in the flow restrictions. Targets the elderly and those who cannot speak English.

Water Management Plan: targets the small business and encourages them to use pre wash spray guns, etc. Rebates and grants.

Garden Program: 2010 Summer

-info packet, education program, people apply for it, retailers enforced the restrictions, gardens are the largest use of water.

15. What methods did you use to influence the behavior of people?
16. Which of these programs/methods do you think were effective and why?
    -The most effective method is restrictions because people have to do it.
    -The most effective program was the Showerhead program
        450,000 showerheads in the last 5 years
        Successful because of SmartAccount
        They can track now and see how much they can change
17. Has any research been conducted by your organization to determine the effectiveness of these programs/ refine programs to ensure better success?
    -Some studies have been done on business rebates, but not so much on residential
    -Customer Satisfactory Survey twice a year
18. Was research used to determine the target audience for any of these programs? What are you currently working on to promote water conservation/protect stormwater?
    -Showerhead Program:
        Looked at areas with older housing (Boroondara one of them) and mailed out info
    -Also, saw which households had larger water users and sent letters about Garden program, showerheads, and flow restrictors.
    -Residential End Use study- Peter Roberts
        Mapped out where water was used in the household

Data logged at 300 houses for a year
Downloads every 30 seconds- can tell if it's a toilet flush or shower in use

19. What types of programs would you like to see more of?
-Programs finding out about people's attitudes of water
Campaign to increase perception of water as valuable
Water drinking fountains-message not to buy bottled water
Water prices will go up

20. What specific role can local government play in influencing their local community conserve water and help manage stormwater?

- To be close to the community and get across that water is essential for health, and use their health plans to promote awareness

21. How effective do you feel your current rebate programs are?

- They are effective with a high take up rate
- Incentives aren't big enough for a major change
- People have been doing the small things
- Its better to use rebates with restrictions, rather than rebates on it own

Stormwater:
Use stormwater to water sport gardens, parks
Recycled water plants

Appendix E – Melbourne Water

Sarah Eggleton, Program Leader of Stormwater Delivery

- Living Rivers: 2006 $20 million
    - Working with local governments running community projects
    - Stormwater treatment
    - Wetlands and urban design
    - Talked with mayors and councils, sometimes local newspapers

- Needs Analysis Research
    - Benchmark every two years
    - Ask questions to see if knowledge has increased
- Education & Awareness
- Networking Sessions with councils
    - Being involved with design of projects is effective
    - Stormwater team
        - Stakeholder relationship is important
- 38 councils
    - Other projects are being built at the ground
- Like to see more strategies and targets being reviewed
    - 10 years ago strategies need to be reviewed
    - New research of stormwater going into ground and not down the drain
    - Window-creek
    - Getting communities to do treatment in homes and yards
- More council jobs
    - We try to change the behavior of councils- getting them to promote WSUD

Keysha Milenkovic, Project leader of 10,000 Raingardens

- 10,000 Raingardens Program
    - Understand where stormwater goes
    - Importance of managing on a home scale
    - 2008- $2 million
- Residential housing creates a lot of stormwater
- Education
    - Tools for people to utilize
        - How to build a raingarden- can be picked up or downloaded
        - Capacity building and stormwater
- Target of 10,000 raingardens with MW
- Based of of Kansas City Raingarden Program
- All stormwater goes into rivers and creeks
- Problems with combined systems in the US
- WSUD- Water Sensitive Urban Design
- Focus of keeping waterways clean
- About prevention-before something happens
    - People don't see the problem yet
- Targets:
    - Engage the community of importance of stormwater

    - Raingardens reaching 10,000 by mid 2013
- Raingardens:
    - Swale, infiltration, inground, down pipe, down pipe diversion, green roof, porous paving, rainwater tank diversion, planter box
- Social research in 2008
    - Find the target audience
    - Broke it into 6 groups:
        - Not interested, disengaged, uninformed, mainstream, everyday environmentalist, environmental enthusiasts
    - Focused on: Everyday Environmentalist, and Environmental Enthusiast
    - It will take several years to get other groups
- Work with local government water retailers
    - Sustainability events
        - 2 to 3 big events each year
        - Sustainability Living Festival in Federation Square
- Raingardens is usually just figured WSUD for your home
- Community marketing strageties
    - With councils, non profits, water retailers
- All water comes from catchments
- Offer workshops for councils
- Marketing Campaign- get an ambassador to promote, but there has been a change in government
- Love to see the program integrated with every council
    - Need help of councils and water retailers
    - Wants to be completely integrated- only 15-17 out of the 38 helping to engage the community
- Melbourne Water is the caretaker of the rivers and creeks
- Behavioral change is a long term project
- Thought about incentive programs, but then did the social research
    - After talking to target groups, decided it was not necessary- not driven by incentives
- Have done small competitions- build one and write why yours is the best raingarden
    - People just don't want to register- sceptical of the government
    - Competitions have tended to work

Appendix F – Environment and Sustainable Living

- Living for the Future
    - Sustainability, 2006
    - Research project- people to monitor their water and electricity bills
    - 4 modules
    - Water in the home and garden
    - Had workshop with MW talk to residents, contractor, David Crow, head of parks and gardens
    - Workshops in different wards
    - Workshop based on climate at the time
    - Did a stormwater one in November, worked with MW
        - Gardening workshop- promote composting and less chemicals in garden
- Catchment
    - Waterway health
    - Not promoting the idea that they should go
    - Showerhead exchange-YVW
        - Distribution source
- Lower Yarra Litter Strategy
    - All municipalities here to bay, state govt, and non -profits meet regularly to talk about how to prevent water pollution
    - Focus on engineering solutions
        - Cigarette butt bins
    - Swap Card Series
    - Effect on animals because of pollution
    - Targeted at all ages
    - Will be at festival on the 18th
    - "hot spots" for litter and popular pollutant is cig butts
        - Fire is an issue
        - Put cigs out on top of bins and still gets in the water
        - Bins can cause a focal point where people would smoke
- Street Cleaning
    - Helps prevent litter from getting into waterways
- Depot- recycling factory
    - Lots of indigenous plants and added signs
    - Can take oils and paints there
- Rainwater use
    - At parks and gardens
    - Depot uses tanks of stormwater
    - Big underground tanks
- Expos
    - Have products for retailers
        - Stickers that promote water use
- Clean up Australia Day
    - Parks & Gardens in charge of the event
- Friends of Group
    - Test quality of water- water watch testing kit for kids
    - Go out with school groups

    - Internal education
- Selection Bias of who is familiar with raingardens and who is informed of what they do
- Pet ownership
    - Local law to pick up poo
        - Posts with bags in dog parks
    - Lease laws
- Built a lot of wetlands
    - Cleans river water
- Building an Eco Home
    - Education on having a more sustainable home
    - Appliances, rain tanks
- Evaluation of Living for the future
    - Various levels of evaluation
    - Green cleaning ones can be responded to quickly
    - People who sent in evals got a free gift
- Supplementary Rebates
    - Rejected
    - Cost shifting
    - Would like to do financial incentives
- Infrastructure/Engineering initiatives
- Cheaper solution for raingarden
- Residential Bad Behaviors
    - Long showers
    - Hosing down pavement
    - Local dumping
    - Carwashing on streets/footpaths
- Possible Projects
    - 40 years and you could swim in the yarra
    - Water fountain project- partner with YWV

Appendix G – Preliminary Interviews

	Suburb	Age Group	Gender	Important to save water?	More or less Important	More droughts in the future
1	3000	40-50s	female	yes	same	very
2	3124		male	yes	same	possible
3	3123	20s	female	yes	same	possible
4	3124	40s	female	yes	same	possible
5	3126	20s	female	yes	same	possible
6	3146	50s	female	yes	more	very
7	3103	40s	male	yes	same	possible
8	3123	60s	female	yes	same	possible
9	3124	60s	male	yes	same	very
10	Surrey Hills	60s	female	yes	less	very
11	3124	40s	male	yes	same	very
12	3125	30s	female	yes	more	very
13	Montreu	36	male	yes	more	very
14	3124	40s	male	yes	less	very
15	3104	40s	male	yes	same	very
16	Surrey Hills	40s	female	yes	same	very
17	3104	40-50s	female	yes	same	very
18	3104	70s	male	yes	same	very
19	3104	70s	female	yes	same	very
20	mount evelyn	70s	male	yes	same	very
21	Nunawading	40s	female	yes	same	very
22	Narre Warren	20s	male	yes	same	don't know
23	east bentley	60s	female	yes	same	very
24	clinton olives	70s	female	yes	same	very
25	jackson	68-72	male	yes	same	very
26	glen iris	40s	female	yes	less	possible
27	glen iris	68	male	yes	more	possible
28	glen iris	40s	male	yes	same	very
29	glen iris	70s	female	yes	more	very
30	east burwood	40s	female	yes	same	very
31	3087	30s	male	yes	same	very
32	thorhbumy	30s	female	yes	same	very
33	blaey	60s	female	yes	same	very
34	ashburton	50s	male	yes	same	very
35		30-40s	male	yes	less	very
36	Canterbury	75	female	yes	more	very
37	Camberwell	30s	female	yes	same	very
38	Hawthorne	40-50s	male	yes	more	very
39	Camberwell	20-30s	female	yes	same	very
40	surry hills	40s	female	yes	same	possible
41	glen iris	30s	female	yes	same	very
42	glen iris	50s	female	yes	less	possible

43	Camberwell	50s	female	yes	same	very

	Aware of "Target 155"	Estimated daily water use	How did you save water during drought	Changed water use after drought	Importance of waterway health
1	yes	don't know	stop watering the garden; not washing car	yes	very important
2	no	don't know	used minimum amount of water	no	very important
3	yes	80	put hose in apartment in water saving bins	no	very important
4	yes	150-175	bucket in the shower to collect water for use in gardens; install rain tank	no	very important
5	no	150-175	bucket in the shower to collect water for use in gardens	kind of	very important
6	yes	129	install a rainwater tank; dripper systems; flush with shower water	yes (water garden more)	very important
7	yes	don't know	install a rainwater tank	no	very important
8	yes	150-175	bucket in the shower to collect water for use in the garden; greywater use	yes	very important
9	yes	150-175	didn't water garden	yes (water garden more)	very important
10	yes	150-175	install a rainwater tank; washed dishes less	no	very important
11	yes	< 225	install a rainwater tank; didn’t water garden; didn't wash car	yes	very important
12	yes	150-175	switching to a water efficient showerhead	no	very important
13	yes	120	shorter showers; only used dishwasher when full; stopped watering the garden	no	very important
14	vaguely	don't know	water from washing used to water garden	yes	very important
15	yes	150-175	bucket in the shower to collect water for use in garden; install rainwater tank	no	relatively important
16	yes	120-150	install a rainwater tank	no	very important
17	yes	100-120	bucket in the shower to collect water for use in the garden	yes (water garden more)	very important

18	yes	150-175	bucket in the shower to collect water for use in garden	no	very important
19	yes	100-120	stop watering the garden	yes	very important
20	yes	120-150	bucket in the shower to collect water to use in the garden	no	very important
21	yes	100-120	bucket in the shower to collect water; stop water garden; didn't use dishwasher	yes (no bucket in shower)	very important
22	no	don't know	stop watering the garden; not washing the car	no	very important
23	yes	100-120	bucket in the shower to collect water for use in the garden; install a rain tank; greywater	no	very important
24	yes	100-120	bucket in the shower to collect water for use in the garden; install a rain tank; greywater	no	very important
25	yes	100-120	stop watering the garden; shower every other day	no	very important
26	yes	100-120	bucket in the shower; stop watering the garden	yes (water garden more)	very important
27	yes	100-120	bucket in the shower to collect water for use in the garden	yes	very important
28	yes	don't know	bucket in the shower to collect water for use in the garden	yes	very important
29	yes	100-120	bucket in the shower to collect water for use in the garden; install a rain tank	no	very important
30	yes	100-120	bucket in the shower to collect water for use in the garden; install a rain tank	no	
31	yes	120-150	installed 2 rainwater tanks	yes	very important
32	no	don't know	shorter shower	yes	very important
33	yes	100-120	bucket in the shower to collect water for use in the garden	no	

34	yes	120-150	stop watering the garden; not washing the car; shorter showers	no	very important
35	yes	120-150	stop watering the garden; not washing the car; shorter showers	yes (water garden more)	very important
36	no	120-150	stop water garden	no	very important
37	no	120-150	switching to a water efficient showerhead; didn't shower every day; didn't do dishes everyday	no	very important
38	yes	<175	didn't use sprinkler	no	very important
39	yes	120-150	bucket in the shower	no	very important
40	yes	155	bucket in the shower; buying water efficient washing machine	yes (water garden more)	very important
41	yes	120-150	bucket in the shower; leave hose in the garden for drips; turned off tap while brushing teeth	no	very important
42	yes	150-175	bucket in the shower; used shower water to flush toilet	yes (water garden more and no bucket in the shower)	very important
43	yes	152	no	no	very important

	Where does water from roof go	from Toilet	from shower	roads and footpaths	Creative Ways to reduce pollution
1	into rivers and bays from sewage	into rivers and bays from sewage	into rivers and bays from sewage	into rivers and bays from sewage	educate young people on pollution
2	into the rivers and bays			don't know	behave responsibly, corporations must do things the right way
3					work together
4	tanks	sewage	sewage	into rivers and bays	education on chemica in the home
5	into the rivers and bays	into the rivers and bays	into rivers and bays	into rivers and bays	no
6	sewage	sewage	sewage	stormwater to rain gardens	rain gardens; grid system with stormwat filter before going int drains
7	sewage	sewage	sewage	into rivers and bays	rubbish catchment
8	into the rivers and bays			into rivers and bays	stop cigs and napkins from going into the river

9	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into rivers and bays	pick up rubbish; tight control on mission
10		into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	drains keep flooding	not letting rubbish ge into the drains
11	into the rivers and bays	into the rivers and bays	into the rivers and bays	into rivers and bays	tanks before it gets to rivers; filter it
12	into the rivers and bays			don't know	more engaging campaigns
13		into the rivers and bays	into the rivers and bays	into rivers and bays	Catch water before it leaves water wells, be careful letting oil go down the drain
14	into the rivers and bays	sewage	sewage	into rivers and bays (stormwater)	filter before it gets to the river
15	into the rivers and bays			into rivers and bays (stormwater)	no
16	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into rivers and bays	stop smoking
17	into the rivers and bays	into the rivers and bays	into the rivers and bays	into the rivers and bays	no
18				into the rivers and bays	stop littering
19				into the rivers and bays	no
20	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	more filtration and street drains
21	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	catchment for rubbish before drains
22	don't know	don't know	don't know	into the rivers and bays	stop throwing garbag in there
23	into the rivers and bays	into the rivers and bays	into the rivers and bays	into the rivers and bays	recycled water; don't waste water from rain
24	sewage	sewage	sewage	into the rivers and bays	stop plastic bags and rubbish from going in

25	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	destroy population
26	sewage	sewage	sewage	into the rivers and bays	clean streets more oft
27	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	no
28				into the rivers and bays	no
29	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	do away with plastic bags; education
30	sewage	into the rivers and bays	into the rivers and bays	no, if it is from runoff	don't litter; dog poo
31		sewage	into the rivers and bays	into the rivers and bays	no
32	into the rivers and bays	into the rivers and bays	into the rivers and bays	into the rivers and bays	planting plants that filter
33	into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	recycle cans
34	into the rivers and bays	into the rivers and bays	into the rivers and bays	into the rivers and bays	vandalism; get rid of shopping bags and damages
35		sewage		into the rivers and bays	regular clean ups
36	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	don't know	something to stop people from throwing rubbish in; make it th you can't smoke by th river
37		into the rivers and bays	into the rivers and bays	into the rivers and bays	natural flora or fauna help maintain balance
38	into the rivers and bays	into the rivers and bays	into the rivers and bays	into the rivers and bays	massive fines for peo who dump rubbish
39	into the rivers and bays	into the rivers and bays	into the rivers and bays	into the rivers and bays	what detergent you us less chemicals

40	into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	collecting stormwater more raingardens; gut water directed into street trees
41	don't know	don't know	don't know	don't know	don't know
42	into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into a wastewater treatment plant and then into the rivers and bays	into the rivers and bays	having more rubbish bins on suburban streets; more butt thin for cigarettes
43	into the rivers and bays	into the rivers and bays	into the rivers and bays	into the rivers and bays	shut down factories; can recycle reimbursements

	Is it good that there's lots of water in rivers after rain	What is the role of local government in water management
1	yes	education; get groups of young people to volunteer and help out
2	don't know	don't know
3	don't know	encourage people to put heads together
4	yes but more pollutants	education; inform the public; maintain pipes and water mains
5	yes	more restrictions
6	don't know	education; Boroondara does a real good job
7	don't know	keep it clean
8	yes; washes rubbish off chemicals	lobbying more about climate change
9	yes; local ecology benefits	don't know
10	no	to be pro-active remind about tank education and what problems cause it
11	yes	educate
12	yes	promoting awareness and education
13	yes; flushing of system but washes pollutants into waterways	more important is state gov; controls drainage systems, roadways pollutants, police industry buildings
14	yes	positive approach; rules and guidelines
15	yes	stop people pouring waste into stormwater drainage
16	yes; cleans it out	big role
17	don't know	no
18	don't know	need to be sensible
19	don't know	don't know
20	no; should be catching it somewhere else	public awareness

21	don't know	look after public drains
22	yes	no idea -government is sneaky
23	yes; adds to life of river	encourage tank water use; introduce ways to not waste water; harvest water
24	yes	rain gardens
25	yes; flushes rivers and goes into sea	very little; state gov more important
26	don't know	ability to influence stakeholders and use marketing
27	yes	water shortage
28	don't know	talk with federal government about making programs to save water
29	don't know	immature people
30	keeping waterways clean; fix pipes	
31	yes; flushes out	not sure
32	no; flushing waste isn't good	keep showers short
33	yes; flushed it out	educate
34	yes; drains water and washes off pollution	ensuring leaking water mains are fixed; planning sewage system based on population
35	yes	look after waterways
36	yes; needs a flush out	not good; drains being blocked; don't know look after drains enough; Grange Ave. flooded
37	depends on ecosystem	don't know
38	yes	big role with promoting water tanks and stuff
39	yes; keep it full	very important
40	depends on how natural it is	gutters, streets, stormwater, local runoff
41	yes; better to have more than none	education, settling up water saving practices
42	yes; good more of a flowing through	making sure water in city is used efficiently; encourage businesses to save water
43	no	be able to recycle water and cut down own water use

Appendix H – Focused Interviews Data

	Suburb	Age Group	Gender	Tap or bottled water?	Advantages of drinking tap water
1	Hawthorne	40-50	F	tap water	tap water is environmentally friendly; plastic bottles are a problem
2	Glen Iris	40-50	F	tap water	free; there for you to drink; good water; bottled water expensive
3	Camberwell	40-50	F	tap water	cheaper; nasty stuff is taken out but good is in; tastes good; water is the best
4	Hawthorne	40-50	M	tap water	convenience
5	Deep Deep	40s	F	tap water	cheaper
6	Canterbury	50-60	F	tap water, but bottled when I am in the car	convenience; water is so good here
7	Blackburn	40-50	F	tap water	cheaper
8	Glen Iris	20s	F	tap water	in plastic bottles chemical can go through; easier
9	Ashburton	40-50	F	tap water with a filter but if out will buy a bottled water	cheaper; have really good quality water and it is easy to put it a filter
10	Glen Iris	18-20s	F	tap water	easier and not buying plastic
11	Canterbury	50-60s	F	tap water unless I forget to bring water bottle	water here is pure and tastes good; and it is there
12	Baldwin	40s	M	tap water	decreases the waste of resources
13	Surry Hill	50-60s	F	tap water	water tastes so good here; fluoride
14	Baldwin	40-50s	F	tap water	Melbourne water is the best in the world; waste of energy
15	Cheston	50s	couple	tap water (purified)	wouldn't have it just from the tap; removing contaminates is good
16	Northkit	40s	F	tap water (purified) 20% of the time use bottled water	ridiculous that bottled water takes so much energy; Melbourne water is so good
17	Elthen	30-40s	F	tap water (purified)	waste of bottles
18		40s	F	tap water	bottled water is a scam
19	Camberwell	50-60s	M	tap water	don't use as much plastic
20	Hawthorne	40s	M	tap water	readily available and tastes ok
21	Ashburton	60s	M	tap water	cheaper
22	Hawthorne	60s	F	tap water (purified)	tastes better, no fluoride
23	Glen Iris	30s	F	tap water	fluoride
24	Camberwell	60s	M	tap water (purified)	bottle water isn't good; plastic isn't good

25	Camberwell	60s	M	tap water	cheaper, better for the environment
26	Surry Hill			tap water	cheaper, available, high quality
27	Hawthorne East	40s	F	tap water	saving money; not using plastic bottles
28	Noan Kit	40s	F	tap water	plastic reduction
29	Hawthorne East	40s	F	tap water	stops wastic plastic
30	Richmond	50s	F	both (depends where I am)	bottles are a problem
31	Kew			tap water (purified)	use less plastic bottle
32	Glen Iris	40s	M	tap water (sometimes bottle)	much better for environment
33	Glen Iris	70s	F	tap water	waste of money and good quality
34	Camberwell	40s	M	tap water	better for the environment
35	Hawthorne East	40s	M	tap water	plain water
36	Hawthorne	20s	F	tap water	cheaper
37	Thornbum	40s	M	tap water	cheaper; not using plastic

	Disadvantages of drinking tap water	Who approves	Who disapproves	What makes it easier	What makes it harder
1	none in this area	anyone environmentally conscious	no one	it is convenient and cheap	nothing
2	rusty pipes; people could be allergic to minerals in the water and it would make you ill; cloudy water is not good	myself	people who sell it	have it right there; fill it when you need it	depends where you are; at restaurants; outside of Melbourne will boil water 1st to make sure clean
3	none	I don't know	I don't know	it is right there	nothing
4	none	everyone / no one	everyone / no one	cheaper and easier	none it is from the tap
5	none	I don't know	I don't know	readily available; convenience	nothing
6	if water tastes different; might need to buy a filter for it	N/A	N/A	convenience	when I forget my bottle and when I am in the car I will buy bottled water
7	none	N/A	N/A	cheaper and easier; don't have to worry about adding to all the bottled water	nothing
8	none	N/A	N/A	convenience	none; you can just buy a reusable bottle
9	no; unless decelenation and cost with not having a lot of water	N/A	N/A	convenience	none; we don't waste our water
10	not that I know of	N/A	N/A	convenience	not really
11	old pipes effect taste	N/A	N/A	convenience and taste	none; just remembering to bring a water bottle
12	in Melbourne no	a lot of people	an elite few	it is there	no
13	no	husband; same opinions	no	no; it is the best already	no
14	not in Melbourne	a lot of people	people at work (Swinburne)	money	places water aren't always clean
15	none	I don't care if they do or don't	I don't care if they do or don't	awareness and education	have to prioritize in your spending
16	don't see many	yea people are fine with it	no	money	places that don't have water fountains
17	fluoride and crap in the water	people don't care	people don't care	water is good here	no

18	there is in the water; needs to be filtered	don't care	don't care	plastic is a waste	none buyer beware
19	old pipes; taste can be effected	I do	no one	convenient	no; taste is the best
20	no	doesn't matter	doesn't matter	access	no
21	none	no one things about it	no one things about it	convenient and cheap	better if we could get exchange on water bottles; no
22	none	who cares	who cares	cheaper	fill up the bottle
23	pollutants	council	Anti-fluoride groups	freely available	lack of water stations in public areas
24	no, health	no one cares	no one cares	easier; cheaper	no
25	none	family	no	cost, convenience	no
26	no	everybody	brother-in-law	access	no
27	no	everybody	no one	access	no
28	no	N/A	N/A	easy access	no
29	not always on hand	more people are starting to reduce	no	cheaper	not always available
30	no	everybody	no	it's there	it is gross in Richmond
31	buy filter	N/A	N/A	cheaper; convenient	no
32	no	my mother, my wife	no	accessibility	filter in fridge so water is cold
33	fluoride	don't care	don't care	easier than buying	finding a tap
34	no	N/A	N/A	access	water fountains
35	no	N/A	N/A	access	no
36	no	I don't know	I don't know	tastes good	no
37	no	N/A	N/A	access	really drunk and can't get to a tap

	Suburb	Age Group	Gender	Own raingarden	What do you think are the advantages of installing a raingarden at home?
1	Hawthorne	40-50	F	no	it will keep your garden alive during the water restrictions
2	Glen Iris	40-50	F	no	I rent so it would be impossible for me to have a raingarden
3	Camberwell	40-50	F	no	good effect for buildings but not for the home
4	Hawthorne	40-50	M	no	conserve water; using water
5	Deep Deep	40s	F	no	I rent so it would be impossible for me to have a raingarden
6	Canterbury	50-60	F	no	reuse of water; capturing of water; water is best run off
7	Blackburn	40-50	F	no	conserve water
8	Glen Iris	20s	F	no	flushes out the water
9	Ashburton	40-50	F	no	it waters your plants for you
10	Glen Iris	18-20s	F	no	using water; water conservation
11	Canterbury	50-60s	F	no	collecting water for garden is good
12	Baldwin	40s	M	no	can't see any advantage because I have a water tank
13	Surry Hill	50-60s	F	no	not really; water is clean off roof
14	Baldwin	40-50s	F	no	have a tank and don't see the point
15	Cheston	50s	couple	no	saving water from going into the drain
16	Northkit	40s	F	no	issue with water security
17	Elthen	30-40s	F	no	saving water
18		40s	F	no	less work, energy, time, and saves water
19	Camberwell	50-60s	M	no	considered one but went against it; used capture water for garden
20	Hawthorne	40s	M	no	catch stormwater runoff
21	Ashburton	60s	M	no	doesn't want one
22	Hawthorne	60s	F	no	N/A
23	Glen Iris	30s	F	no	cleaning water before stormwater
24	Camberwell	60s	M	no	treat water quality
25	Camberwell	60s	M	no	better quality for stormwater
26	Surry Hill			no	reduce runoff; saves garden
27	Hawthorne East	40s	F	no	saving water
28	Noan Kit	40s	F	no	save water
29	Hawthorne East	40s	F	no	water for garden
30	Richmond	50s	F	no	environmental
31	Kew			no	keeps from runoff
32	Glen Iris	40s	M	no	better garden

33	Glen Iris	70s	F	no	makes use of water that goes into storm drains
34	Camberwell	40s	M	no	using water for a purpose
35	Hawthorne East	40s	M	no	saving water
36	Hawthorne	20s	F	no	N/A
37	Thornbum	40s	M	no	save water

	Disadvantages	Who approves	Who disapproves
1	the initial cost	no idea	neighbors maybe
2	N/A	N/A	N/A
3	mosquitos, upkeep	I don't know	I don't know
4	cost of installation	no one would care	no one would care
5	N/A	N/A	N/A
6	cost and site; if the building is tall; aesthetics	N/A	N/A
7	I don't know	I don't know	I don't know
8	how much room you have on your property and cost	N/A	N/A
9	cost; space and can you afford it and is it safe if you have small children	N/A	N/A
10	space	N/A	N/A
11	none	N/A	N/A
12	cost	I don't care	subsidize
13	probably not	the people who want it installed; green people	neighbors if ugly
14	N/A	N/A	N/A
15	all the plastic that is being manufactured is very bad; creating more and more rubbish	I don't think anyone	I don't think anyone
16	let it go to reck if you forget about it	everyone	no one
17	I don't know how attractive they are	people would approve	no
18	none; everyone should have one	no interested in approval	no interested in approval

19	not sure	neighbors like it	no
20	no	neighbors	no one
21	no room for it	N/A	N/A
22	none	who cares	who cares
23	none	everyone	none
24	maintenance	everyone	no one
25	heavy downpour; technical side	most people	no one
26	takes up space, cleaning	myself	neighbors
27	space	everyone	no one
28	none	don't care	don't care
29	no	N/A	N/A
30	setting it up	some friends	no one
31	no, effort to create	no one would care	no one would care
32	cost of hooking it up	friends/ family	no
33	have to set it up	don't care	don't care
34	cost	me	no
35	no	council	no one
36	flood with too much	lots of people	no
37	no	friends/ family	no one

	What makes it easier	What makes it harder
1	having enough land for it	can't think of any
2	N/A	N/A
3	N/A	N/A
4	if someone else installed it	if I had to install it myself
5	N/A	N/A
6	subsidization	cost
7	I don't know	I don't know
8	I don't know	I don't know
9	space and time	do you own your property; if you have enough space for it and enough time to install it
10	is someone installed it for you	I don't know

11	if someone did it for free	cost and I already have a rain tank
12	can be installed easily	no
13	I don't know what it involves	husband
14	N/A	N/A
15	no if I want one	no if I want one
16	if someone came and told them how to do it	no
17	if they were free	I don't know enough about them
18	money/cost	money/cost
19	technical expertise to talk through; need someone to explain to residents to make it easier	no
20	town urban designer help	no
21	N/A	N/A
22	rebate off	taxed you
23	low cost	consent from landlord
24	space	no
25	understanding mechanics	ignorance
26	greener neighbors	diff views on lifestyle
27	more info	cost
28	easier access	no
29	already have a tank feel I don't need one	already have a tank feel I don't need one
30	space	land
31	someone did it for me	effort/ cost
32	if owned own house	rent and don't own house
33	have rain tanks don't see the point	have rain tank don't see the point
34	instructions	cost
35	don't know	have in-ground sprinklers

36	rent makes it difficult	rent makes it difficult
37	price	no

	Suburb	Age Group	Gender	Have tank?	Connected to laundry? Advantages
1	Hawthorne	40-50	F	yes	no because of the Blue State Foundation it cannot be done
2	Glen Iris	40-50	F	no	no because I rent; if I could yes; water cleansed and reusing water
3	Camberwell	40-50	F	yes	yes; for the water; did it during the drought
4	Hawthorne	40-50	M	no (no room for it - unit home)	N/A
5	Deep Deep	40s	F	no	no because I rent
6	Canterbury	50-60	F	no	maybe; grey water recycle
7	Blackburn	40-50	F	no	yeah; saves water
8	Glen Iris	20s	F	no	no because I rent
9	Ashburton	40-50	F	no; can't do it where they are; but do have a greywater system	N/A; good if you have a big garden; or have a lot of kids that use water
10	Glen Iris	18-20s	F	yes (will be installed soon)	yes; water conservation and reuse
11	Canterbury	50-60s	F	yes	no; not using up water; taking advantage of stormwater; saving money and saving the environment
12	Baldwin	40s	M	yes	no just to garden; yes; save water
13	Surry Hill	50-60s	F	no	possibly; cut down on water usage
14	Baldwin	40-50s	F	yes	can't with house design; have water when we need it
15	Cheston	50s	couple	no	no; don't believe in storage tanks
16	Northkit	40s	F	no	yes; but haven't done it and have talked about it; have a pond system to laundry; be more self-efficient
17	Elthen	30-40s	F	no	yes, ideally if money was no object; recycling / saving water
18		40s	F	no	no; yes; likes sticking it to the man
19	Camberwell	50-60s	M	yes	no it goes to garden; don't need to worry about water for garden during restrictions
20	Hawthorne	40s	M	yes	no; fresh water
21	Ashburton	60s	M	no	no, considered it but there is no room in their unit; saves water
22	Hawthorne	60s	F	no (thought about it)	yes; not draining on dams
23	Glen Iris	30s	F	no (has apt)	yes; saves water
24	Camberwell	60s	M	no	no; save water
25	Camberwell	60s	M	yes	no, use it for garden and pool; saves water
26	Surry Hill			yes (2)	yes; saves water, reducing stormwater runoff, raises awareness, more frugal
27	Hawthorne East	40s	F	no	yes; handy in drought; saves water usage

28	Noan Kit	40s	F	yes (2)	no; saves water and money
29	Hawthorne East	40s	F	yes	no; water for garden
30	Richmond	50s	F	yes	yes; saves water
31	Kew			yes	no; water for garden
32	Glen Iris	40s	M	no	yes; self sufficient
33	Glen Iris	70s	F	yes (2)	yes; sustainability of water
34	Camberwell	40s	M	yes	no; using water
35	Hawthorne East	40s	M	no	yes; saving on water bill
36	Hawthorne	20s	F	no (rent)	yes; lower water bill
37	Thornbum	40s	M	yes	no; cheaper

	Disadvantages	Who approves	Who Disapproves	What makes it easier	What makes it ha
1	N/A	N/A	N/A	N/A	N/A
2	money	person who sells it; me and my family; people that believe in global warming	no one's business - no	no idea	Renting; impossib where I live; how are they to remov are moving?
3	none	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	not a lot; we managed without it during the drought; now there is lots of water and enough	N/A	N/A	not really; lives on a small plot of land	cost; proof that it advantageous cou one under their la
7	cost	N/A	N/A	if it were cheaper	feels that they don one because they small garden
8	N/A	N/A	N/A	N/A	N/A
9	none	N/A	N/A	N/A	N/A
10	no	greener people	not necessarily	people who are doing the garden are also installing it so it was easier	none
11	none	N/A	N/A	drought made watering the garden difficult and she didn't want her garden to die	not really; paid fo and was worthwh environmentally
12	I don't know how clean it is; will it leave stains in toilet	I don't care	I don't care	need help doing it	no
13	could take up space outside could be a problem	husband; community	no	more info and costing	can't imagine
14	no if the house is designed for it	not really	don't think so	happens to be environmentally friendly	cost
15	N/A	N/A	N/A	N/A	N/A
16	takes up space	everyone	dogs	if we were more decisive people and would follow through	if our personalitie different
17	quite ugly	everyone	no	space; more info about it	cost/money
18	none	don't care	don't care	money	lazy attitude, complacency, apa
19	mosquitos	no	no	could do it myself	age
20	occasional mosquitos	family	no	roof/space	no

21	cost	everybody	no, neighbors might	someone to put it in	no
22	runs out	who cares	who cares	rebates	no
23	no	everyone	no one	cost	consent from land
24	no	everybody	no one	space	no
25	not worthwhile cost wise, no difference on bill	family and friends	thinks its unsightly	got it for nothing	no
26	takes up space, difficult to retrofit	neighbors and friends	no one	one stop shop for supplies, was difficult when trying to get everything to install it	retrofitting small
27	no	everybody	no one	reasonable price	space available
28	no	yes people do	no	cost	no
29	no	yes people do	no	already there we bought the house	no
30	none	everyone is doing it	no	none	no
31	no	I don't know	I don't know	drought	cost
32	cost set up	N/A	N/A	if owned own house	rent don't own ho
33	cost	city council	no	for garden; better for everything	space
34	no	everybody	no one	having space	cost
35	no	no one cares	no one cares	space	no
36	maintenance	everybody	no one	more info	renter
37	no	no one	no one	space	no

Appendix I – Swinburne University Data

	Gender	Do you know what a raingarden is?	Do you generally drink tap water or buy bottled water?	Advantages
1	M	no	tap water	Cheaper
2	M	no	tap water	Cheaper
3	F	no	tap water	Cheaper and easier
4	F	no	filtered tap water; but do buy bottled water sometimes	Cheaper and easier
5	F	no	tap water	Cheaper and easier
6	M	no	filtered tap water	Tastes better, cheaper, and easier
7	F	no	tap water	Tastes better, cheaper, and easier
8	F	no	filtered tap water	Tastes better, cheaper, and easier
9	F	no	tap water	Tastes better, cheaper, and easier
10	F	no	tap water	Tastes better, cheaper, and easier
11	M	no	tap water	Cheaper
12	M	no	tap water	Cheaper
13	M	no	tap water	Cheaper
14	M	no	tap water	Convenient
15	M	no	tap water	no reason
16	M	no	tap water	Cheaper
17	M	no	tap water but will buy bottled water if they have to	Cheaper and convenient
18	M	no	tap water but will buy bottled water if they have to	Cheaper and convenient
19	M	no	tap water but will buy bottled water if they have to	Cheaper and convenient
20	M	no	tap water but will buy bottled water if they have to	Cheaper and convenient

	Disadvantages	What makes it easier	What makes it harder
1	no	convenience	none
2	no	easy	none
3	no	convenience	none
4	no	convenience	none
5	no	convenience	none
6	no	cheaper	none

7	no	cheaper	none
8	no	cheaper	none
9	no	cheaper	none
10	no	cheaper	none
11	no	convenience and cheaper	none
12	no	convenience and cheaper	none
13	no	convenience and cheaper	none
14	no	convenience and cheaper	none
15	no	convenience and cheaper	none
16	no	convenience and cheaper	none
17	no	convenience and cheaper	none
18	no	convenience and cheaper	none
19	no	convenience and cheaper	none
20	no	convenience and cheaper	none