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From: Kelly O'Rourke, HDR

CC: Ronan Igloria and Joe Miller, HDR

Date: October 29, 2010 - FINAL

Subject: Joint Water Commission WaterSense Rebate Feasibility Study
HDR Project #134869

HDR performed a WaterSense Rebate Feasibility Study for the Joint Water Commission (JWC). The JWC is a group of four water utilities in the greater Portland, Oregon area. It is comprised of the Cities of Hillsboro, Beaverton, and Forest Grove, and the Tualatin Valley Water District. The study was contracted by the JWC, however it was scoped to focus only on the Hillsboro and Beaverton service areas. The JWC is considering offering a rebate program for WaterSense labeled products and is interested in an assessment of the associated water savings and costs.

This technical memorandum is presented in the following three sections:

1. **Conservation Background:** This section provides an overview regarding water conservation, which provides context for the analysis performed for this specific project. This section also provides background information regarding EPA's WaterSense program.
2. **Analysis Methodology:** This section describes the methodology used to analyze the conservation measures, describes the conservation measures analyzed, documents key assumptions, and documents demographic and consumption data inputs.
3. **Results and Conclusions:** This section provides results of the initial analysis for each individual conservation measure, results of conservation "packages", and conclusions regarding the analysis to support Hillsboro and Beaverton staff determine which packages to ultimately implement. *(Section 3.8 contains the conclusions; for readers interested primarily in the conclusions please refer that section, which begins on page 32.)*

1. Conservation Background

1.1. Conservation Overview

Water conservation is defined as the management of water resources so as to eliminate waste and maximize efficient use of the resource. Conservation can be divided into many categories, as shown in Table 1. It is helpful to understand these categories since the cost structure, longevity of savings, certainty of savings, and social impacts vary across the categories.

Table 1 - Conservation Categories

Measures (Saves water)		Incentives (Motivates Customers to save water)		
Hardware	Behavior	Educational	Financial	Regulatory
More efficient equipment. <i>Example: Install high efficiency toilets.</i>	More efficient behaviors. <i>Example: Take shorter showers.</i>	Explain why and how to save water. <i>Example: Conservation tips brochure.</i>	Make saving water financially attractive. <i>Example: Use inverted block rate structure.</i>	Require conservation actions. <i>Example: Require retrofit to code upon resale.</i>

Conservation is divided into two main categories: measures and incentives. Measures save water in and of themselves, while incentives motivate customers to save water. Measures are further divided into hardware and behavior. Hardware measures entail using more efficient equipment, while behavioral measures entail promoting behavior changes toward more efficient practices. Hardware measures tend to be more expensive, but have longer lasting savings and a higher certainty of savings, compared to behavioral measures. Incentives are further divided into three categories: educational, financial, and regulatory. Educational incentives explain why and how to save water. Financial incentives make saving water financially attractive. Regulatory incentives are mandatory requirements for conservation actions. Examples for each type of measure and incentive are provided in Table 1.

Conservation can be achieved on both the supply-side and demand-side. Supply-side conservation is associated with a utility’s conveyance and distribution infrastructure such as pipeline leak detection and repair. Demand-side conservation is associated with the water user such as homeowners installing high efficiency toilets.

A utility’s conservation program should reflect the reasons why the utility is implementing conservation and the utility’s water use patterns. Typical conservation drivers include: 1) meeting regulatory requirements, 2) demonstrating stewardship, 3) decreasing operating costs, 4) deferring/avoiding capital costs, and 5) extending available supplies. The utility’s conservation drivers and water use patterns shape which measures and incentives to implement, the saving goal, the appropriate budget, and whether to focus on supply-side or demand-side efforts.

Table 2 shows how a utility’s conservation driver determines its conservation program strategy.

Table 2 - Conservation Driver Determines Conservation Strategy

Conservation Driver	Conservation Program Strategy
Meet Regulatory Requirement	Implement the required level of conservation.
Demonstrate Stewardship	Implement more than the required level of conservation.
Decrease Operating Costs	Implement conservation that is more cost-effective than the variable cost of supplying water.
Defer/Avoid Capital Costs	Implement the amount of conservation necessary to obtain the savings required to defer/avoid capital costs.
Extend Available Supplies	Implement conservation that is more cost-effective than the cost of developing new traditional supply.

1.2. EPA WaterSense Program

WaterSense is a program of the U.S. Environmental Protection Agency (EPA) that promotes water efficiency by labeling consumer products and services that meet certain water efficiency and performance standards. The intent is to make it easier for consumers to identify high quality water efficient products. WaterSense is a relatively new program and is modeled on the more established Energy Star program that focuses on energy efficiency.

The JWC expressed interest in analyzing eight demand-side measures for the WaterSense Rebate Feasibility Study. Table 3 lists the eight measures, their WaterSense water use specification, and the status of the specification. Five of the measures have approved specifications. This includes the toilet, faucet, urinal, washing machine, and showerhead measures. Two of the measures have specifications that are under development. For the weather based irrigation controller measure, a draft specification has been released. For the pre rinse spray valve measure, a notice of intent to develop a specification has been released. The landscape irrigation services measure is unique in that it relates to a service rather than a product. The label applies to landscape contractors for designing, installing, and maintaining irrigation systems. The contractors are required to go through a training and certification process in order to obtain the WaterSense label.

Table 3 - WaterSense Measures

	WaterSense Measure	Water Use Specification	Specification Status
11	High Efficiency Toilets	Maximum 1.28 gallons per flush.	EPA approved specification in January 2007.
22	Bathroom Sink Faucets ¹	Maximum 1.5 gallons per minute.	EPA approved specification in October 2007.
33	Flushing Urinals	Maximum 0.5 gallons per flush.	EPA approved specification in August 2009.
44	Washing Machines ²	Maximum water factor of 6.0 (maximum 6 gallons per cycle per cubic foot capacity)	EPA approved specification in December 2009.
55	Showerheads	Maximum 2.0 gallons per minute.	EPA approved specification in March 2010.
66	Weather Based Irrigation Controllers	Various aspects related to programmability, operation, and performance.	Draft specification released November 2009.
77	Pre Rinse Spray Valves	TBD; however likely to be 1.25 gallons per minute.	Notice of Intent to develop a specification issued in July 2009.
88	Landscape Irrigation Services	No specification; rather a list of certified contractors and customer tips.	N/A since not a true specification.

1. Specification is only for residences and hotel/hospital rooms.

2. There is not a separate specification for washing machines. This is one component of a single family new home specification.

2. Analysis Methodology

2.1. Basic Method

The methodology for determining water savings and costs for Hillsboro and Beaverton is generally the same for all conservation measures. The basic method is to compile demographic information for Hillsboro and Beaverton's service areas, apply assumptions for customer participation rates for each conservation measure, calculate the savings achieved by shifting to more efficient hardware or behavior, and calculate the costs for those shifts.

HDR's proprietary Water Conservation Measure Analysis Model was used for this analysis. The model is an Excel-based tool that estimates the water savings and costs for various demand-side water conservation measures. The spreadsheet is pre-loaded with a set of commonly analyzed conservation measures. The spreadsheet is customized for clients by entering client-specific data (e.g., planning period, demographics, water consumption) and selecting which of the pre-loaded measures should be analyzed. The spreadsheet analyzes the measures and provides summary tables and graphs. Various program "packages" can also be created based on the analyzed measures to represent potential conservation scenarios.

The model is designed to incorporate both direct and indirect costs incurred by the utility. Direct costs include rebates paid to customers (e.g., clotheswasher rebates), purchasing fixtures to give to customers (e.g., efficient showerheads), and paying for professional audits (e.g., outdoor irrigation audits). Indirect costs are marketing and distribution costs that are necessary to implement the measures, such as graphic design, printing, postage, and advertising. The exact nature of the marketing and distribution techniques that will eventually be implemented is often unknown during the measure analysis work. The model typically includes general assumptions that effectively generate a pool of money designated for marketing and distribution.

For this project, Hillsboro and Beaverton preferred that only direct costs were included in the model and that indirect costs be shown separately. An exception was made for two measures that, due to their unique nature, include both direct and indirect costs. (Those measures are the spray valve and indoor audit measures.) Hillsboro staff anticipate their indirect costs will be approximately \$5,000 annually, based on the City's historical indirect costs. Beaverton staff anticipate their indirect costs will be approximately \$2,500 annually. Those indirect costs may need to be increased if future marketing and distribution techniques differ from historical techniques or if the Cities choose to implement the more aggressive "conservation potential assessment" packages.

Separate models were developed for Hillsboro and Beaverton so that the results could be examined separately for the two cities.

The initial results from the model are simply the outcomes of the analysis for each selected conservation measure. The initial results, by themselves, do not tell Hillsboro and Beaverton which measures should be implemented. The initial results must be coupled with Hillsboro and Beaverton's conservation drivers and screened through various criteria in order to determine which measures and/or groups of measures ("packages") are most appropriate for Hillsboro and Beaverton.

2.2. Measures Analyzed

The measures analyzed for the project are described below:

- **Clotheswashers - Efficient Residential Capacity (In Unit):** Provide partial rebates to replace less efficient residential-capacity clotheswashers (located in housing units) with more efficient models. The participation rate for this measure was set at 25%. The direct cost is a \$50 rebate per clotheswasher. The model assumes one rebate per participating household.
- **Clotheswashers - Efficient Residential Capacity (Common Area):** Provide partial rebates to replace less efficient residential-capacity clotheswashers (in common laundry areas) with more efficient models. The participation rate for this measure was set at 25%. The direct cost is a \$50 rebate per clotheswasher. The model assumes one rebate for every five multifamily households for participating multifamily accounts.
- **Clotheswashers - Efficient Commercial Capacity:** Provide partial rebates to replace less efficient commercial-capacity clotheswashers with more efficient models. The participation rate for this measure was set at 25%. The direct cost is a \$250 rebate per clotheswasher. The model assumes 12 rebates per participating non-residential account.
- **Faucets - 0.5 gpm Bathroom Aerators (Residential):** Provide free 0.5 gpm bathroom faucet aerators, which for the residential customer category is more efficient than the maximum of 2.5 gpm allowed under the plumbing code. The participation rate for this measure was set at 10%. The direct cost is \$1 per aerator. The model assumes 2.5 aerators per participating single family household and 1.5 aerators per participating multifamily household.
- **Faucets - 1.0 gpm Bathroom Aerators:** Provide free 1.0 gpm bathroom faucet aerators, which for the residential customer category is more efficient than the maximum of 2.5 gpm allowed under the plumbing code. The participation rate for this measure was set at 25%. The direct cost is \$1 per aerator. The model assumes 2.5 aerators per participating single family household and 1.5 aerators per participating multifamily household.
- **Faucets - 1.5 gpm Bathroom Aerators:** Provide free 1.5 gpm bathroom faucet aerators, which for the residential customer category is more efficient than the maximum of 2.5 gpm allowed under the plumbing code. The participation rate for this measure was set at 25%. The direct cost is \$1 per aerator. The model assumes 2.5 aerators per participating single family household and 1.5 aerators per participating multifamily household.
- **Showerhead 1.5 gpm:** Provide free 1.5 gpm showerheads, which is more efficient than the maximum of 2.5 gpm allowed under the plumbing code. The participation rate for this measure was set at 25%. The direct cost is \$3 per showerhead. The model assumes 2.0 showerheads per participating single family household, 1.5 showerheads per participating multifamily household, and 10 showerheads per participating non-residential account.
- **Showerhead 2.0 gpm:** Provide free 2.0 gpm showerheads, which is more efficient than the maximum of 2.5 gpm allowed under the plumbing code. The participation rate for this measure was set at 25%. The direct cost is \$3 per showerhead. The model assumes 2.0 showerheads per participating single family household, 1.5 showerheads

aerators per participating multifamily household, and 10 showerheads per participating non-residential account.

- **Spray Valves - 1.25 gpm Pre-Rinse Spray Valve:** Provide free, direct installation of 1.25 gpm pre-rinse spray valves, which is more efficient than the maximum of 1.6 gpm allowed under the plumbing code. Pre-rinse spray valves are used in commercial kitchens to rinse dishes prior to loading into dishwashers. The participation rate for this measure was set at 95%. The cost is \$130 per spray valve. Due to the direct install nature of this measure, that cost includes both direct and indirect costs. The model assumes 1.5 spray valves per participating non-residential account.
- **Toilets - 1.28 gpf High Efficiency Toilets (HET):** Provide partial rebates to install High Efficiency Toilets (HETs), which is better than the maximum of 1.6 gpf allowed under the plumbing code. HETs are defined as toilets flushing at a maximum of 1.28 gpf. HETs include both dual flush toilets and pressure assist tank style toilets. The participation rate for this measure was set at 10%. The direct cost is a \$75 rebate per toilet. The model assumes 2.3 rebates per participating single family household and 1.8 rebates per participating multifamily household. The number of toilets, and therefore rebates, per participating non-residential account is a function of the number of employees per account. For Hillsboro this results in 11.1 rebates and for Beaverton 2.5 rebates, per participating non-residential account.
- **Toilets - Leak Detection:** Provide free toilet leak detection dye tablets to determine if toilets leak and provide information on how to fix leaks. The participation rate for this measure was set at 25%. The direct cost is \$0.10 per packet of dye tablets. The model assumes 2.3 dye tablet packets per participating single family household and 1.8 dye tablet packets per participating multifamily household.
- **Urinals - 0.5 gpf Models:** Provide partial rebates to install 0.5 gpf urinals, which is better than the maximum of 1.0 gpf allowed under the plumbing code. The participation rate for this measure was set at 25%. The direct cost is a \$100 rebate per urinal. The number of urinals, and therefore rebates, per participating non-residential account is a function of the number of employees per account. For Hillsboro this results in 5.6 rebates and for Beaverton 1.2 rebates, per participating non-residential account.
- **Irrigation Controllers - ET Model:** Provide partial rebates for evapotranspiration (ET) based irrigation controllers, which link irrigation to weather conditions. The participation rate for this measure was set at 25%. The direct cost is a \$200 rebate per controller. The model assumes one rebate per participating single family household, multifamily account, and non-residential account.
- **Outdoor Audit:** This measure is intended to represent the WaterSense “Landscape Irrigation Services” measure. Provide free irrigation audits to improve the efficiency of irrigation systems. Efficiencies can be achieved through hardware improvements or operational changes. The audits are performed by a contracted professional landscape irrigation auditor. The participation rate for this measure was set at 25%. The direct cost is \$250 per audit for residential properties and \$1,000 per audit for non-residential properties. The model assumes one audit per participating single family household, multifamily account, and non-residential account.
- **Indoor Audit – Faucets – 1.0 gpm Bathroom Aerators:** This is one of three special measures set up to approximate part of a single family indoor audit program that Hillsboro and Beaverton will participate in. The audit is a program being implemented in Portland by an energy efficiency organization. The primary focus of the audit is energy

efficiency, however it also addresses certain water efficiency measures including faucet aerators, showerheads, and toilet leak detection tables. Rather than create one new “indoor audit” measure, three related pre-loaded measures were customized to represent the audit.

The audit has a total cost (direct and indirect) to the utility of \$50 per household. For simplicity, the \$50 was spread equally across the three measures and was applied as a direct cost. This may not be a fully accurate representation of how the actual costs would be allocated and may not result in accurate cost-effectiveness numbers. However, this approach is reasonable since the purpose of the costs for the three measures is simply to show the total cost to the utility and not the cost effectiveness. Hillsboro and Beaverton have already decided they will implement the audit; they do not need the cost-effectiveness information to decide whether to implement the measure.

This particular measure is the bathroom faucet aerator component. This measure will provide free 1.0 gpm bathroom faucet aerators, which for the residential sector is more efficient than the maximum of 2.5 gpm allowed under the plumbing code. The participation rate for this measure was set to obtain a pre-determined number of household audits. Hillsboro anticipates having approximately 190 audits and Beaverton anticipates having approximately 155 audits.

The model assumes one audit per participating single family household and the \$50 cost per household would include as many aerators as necessary.

- **Indoor Audit – Showerhead 1.5 gpm:** This is the second component of the special indoor audit measure described above. This measure will provide free 1.5 gpm showerheads, which is more efficient than the maximum of 2.5 gpm allowed under the plumbing code. The model assumes one audit per participating single family household and the \$50 cost per household would include as many showerheads as necessary.
- **Indoor Audit – Toilets – Leak Detection:** This is the third component of the special indoor audit measure described above. This measure will provide free toilet leak detection dye tablets to determine if toilets leak and provide information on how to fix leaks. The model assumes one audit per participating single family household and the \$50 cost per household would include as many dye tablet packets as necessary.

2.3. Key Assumptions

There are several key assumptions that are fundamental to the conservation analysis. Those assumptions are explained below.

- **Planning Period:** A planning period of 2010 to 2019 (ten years) was used. The planning period is the period of interest for analyzing water conservation savings and costs. The planning period is different than the initial implementation period (see below). For example, Hillsboro and Beaverton may distribute showerheads for five years (the initial implementation period), but may be interested in seeing how the savings and costs associated with those showerheads play out over ten years (the planning period).
- **Initial Implementation Period:** An initial implementation period of 2010 to 2014 (five years) was used. The initial implementation period is the period when the conservation program will be implemented (aside from any renewals, see below). The initial implementation period is for the entire conservation program (i.e., all measures), rather than for any individual measure. Therefore, the last year of the initial implementation

period is the last year that any one measure is initially implemented. A multi-year implementation period reflects the budgetary and administrative reality that Hillsboro and Beaverton would most likely not implement all measures immediately.

- **Implementation Schedule:** A steady, even-paced implementation schedule was assumed for all measures. The implementation schedule is the rate at which the measures are implemented during the initial implementation period. Since the initial implementation period is five years, this means that measures were applied to 20% of the potential customers each year until they reach full implementation in the fifth year. This means that the gallons per day savings increase over the first five years, then remain constant. An even implementation provides a consistent program budget for each year in the initial implementation period. (An exception to this is the ET controller measure which is steadily implemented from year two to year five. This one-year delay is due to a delay in the beginning of EPA's labeling of controllers.)
- **Renew Measure:** Measures were renewed if necessary to maintain savings over the planning period. Measure renewal is necessary if the measure lifespan is shorter than the planning period and if Hillsboro and Beaverton want to maintain the savings during the planning period. For example, the pre-rinse spray valve measure has a lifespan of five years, which means that since Hillsboro and Beaverton's planning period is 10 years, the savings from the pre-rinse spray valves will disappear after five years unless Hillsboro and Beaverton renew the measure and give customers another pre-rinse spray valve in five years. Measure renewal has the benefit of maintaining savings, however it means that Hillsboro and Beaverton pay to implement a measure more than once to the same customer. Note that for the packages, due to the nature of the measures selected for the packages and the chosen planning period, no renewals were necessary to maintain savings over the planning period.
- **Participation Rates:** Participation rates were selected to represent moderate program implementation levels. In the modeling analysis, participation rates represent the percent of target customers (those with the applicable hardware or behavior that have not already implemented the measure) that participate in the program. For example, for the HET toilet measure, the participation rate is the percent of customers that do not already have a HET toilet that are assumed to participate in Hillsboro or Beaverton's HET toilet program. Participation rates are dependent on many factors including marketing and distribution techniques. Moderate level marketing and distribution techniques were assumed for the analysis.

The participation rates are a subjective assessment of the relative attractiveness of the measures to customers. The rates were established using professional judgment based on HDR's experience with other communities. The following participation rates were used for the analysis:

- 5% = unattractive to customers
 - 10% = not very attractive to customers
 - 25% = fairly attractive to customers
 - 30% = very attractive to customers
- **Free Riders:** The concept of free ridership was addressed in the analysis. Free riders are customers that participate in Hillsboro or Beaverton's conservation program, even though they would have implemented the measure anyway. For example, a free rider is

a customer who takes a rebate for an efficient clotheswasher, but who was going to buy that clotheswasher regardless of whether Hillsboro or Beaverton offers a rebate program.

When free ridership is addressed in the analysis, the savings associated with free riders is excluded from the cost-effectiveness calculations, which provides a more accurate representation of the true cost-effectiveness of the conservation program. This impacts two numbers in the model: 1) “Savings For All Customers Over Measure Life (ccf)” and 2) “Cost per ccf Saved Over Measures Life.” Those two numbers do not include water savings from free riders. Aside from those two numbers, all other numbers in the model include effects from free riders.

The free ridership percentages are a subjective assessment of the relative level of free ridership for measures. The percentages were established using professional judgment based on HDR’s experience with other communities. The following free ridership percentages were used for the analysis:

- 5% = no reason to assume much free ridership
- 15% = higher level of free ridership is expected
- 25% = measures bringing customers up to current plumbing code

2.4. Consumption and Demographic Data Inputs

Consumption Data

The water consumption data required for the model are provided in Table 4 and Table 5, for Hillsboro and Beaverton respectively. Water consumption data is used to calculate the Peak Season Increased Use (PSIU), which is the annual amount of water used in the summer months above the base use (i.e., winter water average use). The PSIU is used in the savings formulas for outdoor measures. Graphical representations of that data are provided in Figure 1 through Figure 6. The figures show the distinction between base use and the PSIU. Note that the scale is the same on all three figures for each utility in order to show the relative amount of PSIU between the single family, multifamily, and non-residential sectors.

Table 4 - Hillsboro Water Consumption (gallons)

Month	Single Family			Multifamily			Non-Residential		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
Jan	111,558,844	153,427,157	113,919,203	26,892,994	27,791,641	33,384,362	147,423,290	166,583,998	190,016,011
Feb	102,086,322	101,701,132	106,915,829	31,806,419	32,624,319	30,236,217	182,061,711	186,965,233	161,771,942
Mar	106,353,243	106,844,021	125,982,828	26,742,234	29,009,871	28,830,314	164,144,015	170,621,156	159,696,923
Apr	94,694,825	76,420,407	87,349,465	30,284,687	26,641,217	31,227,541	166,988,823	158,564,092	177,108,141
May	116,840,024	129,831,916	120,860,733	27,329,639	33,128,284	30,743,062	180,297,778	196,848,744	213,492,761
June	112,807,316	122,840,599	135,997,470	35,341,579	37,420,757	33,296,098	207,295,469	204,993,028	190,492,936
July	234,804,112	212,428,799	216,106,984	44,154,964	41,386,354	44,284,330	281,066,281	266,182,480	294,680,786
Aug	205,454,776	219,726,466	223,811,773	51,868,040	53,644,727	56,288,496	275,131,260	290,510,851	330,928,215
Sep	273,286,827	256,679,790	228,238,886	47,332,393	48,687,133	51,214,251	303,413,993	331,397,249	326,031,171
Oct	118,892,595	140,777,789	138,664,223	43,982,662	42,515,198	43,695,457	217,190,275	261,093,065	270,563,365
Nov	92,318,040	155,235,193	152,904,571	32,432,121	36,180,124	37,184,516	207,691,707	224,071,755	232,199,227
Dec	62,585,639	100,657,223	99,146,007	35,026,746	30,620,427	31,470,477	178,242,536	157,742,070	163,463,649
Total	1,631,682,562	1,776,570,492	1,749,897,971	433,194,476	439,650,053	451,855,121	2,510,947,138	2,615,573,720	2,710,445,128

Table 5 - Beaverton Water Consumption (gallons)

Month	Single Family			Multifamily			Non-Residential		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
Jan	65,828,488	64,502,284	66,408,188	54,977,675	54,049,355	47,567,243	32,684,186	33,430,742	28,948,296
Feb	65,828,488	64,502,284	66,408,188	54,977,675	54,049,355	47,567,243	32,684,186	33,430,742	28,948,296
Mar	63,856,012	63,929,316	61,945,620	57,984,953	55,646,046	52,036,610	36,423,120	34,879,906	34,285,583
Apr	63,856,012	63,929,316	61,945,620	57,984,953	55,646,046	52,036,610	36,423,120	34,879,906	34,285,583
May	84,255,094	72,254,182	80,587,650	72,034,031	62,929,068	59,165,387	65,586,376	50,084,382	50,077,396
June	84,255,094	72,254,182	80,587,650	72,034,031	62,929,068	59,165,387	65,586,376	50,084,382	50,077,396
July	134,514,710	126,039,870	130,775,832	91,182,023	95,089,672	92,525,038	97,291,538	103,082,830	99,348,182
Aug	134,514,710	126,039,870	130,775,832	91,182,023	95,089,672	92,525,038	97,291,538	103,082,830	99,348,182
Sep	119,814,266	122,092,300	118,013,456	80,694,809	77,364,769	81,551,033	79,668,912	74,709,989	79,104,034
Oct	119,814,266	122,092,300	118,013,456	80,694,809	77,364,769	81,551,033	79,668,912	74,709,989	79,104,034
Nov	70,473,194	69,816,076	68,998,138	58,503,167	61,806,470	53,273,117	39,879,029	45,814,275	37,117,821
Dec	70,473,194	69,816,076	68,998,138	58,503,167	61,806,470	53,273,117	39,879,029	45,814,275	37,117,821
Total	1,077,483,528	1,037,268,056	1,053,457,768	830,753,311	813,770,758	772,236,852	703,066,317	684,004,246	657,762,620

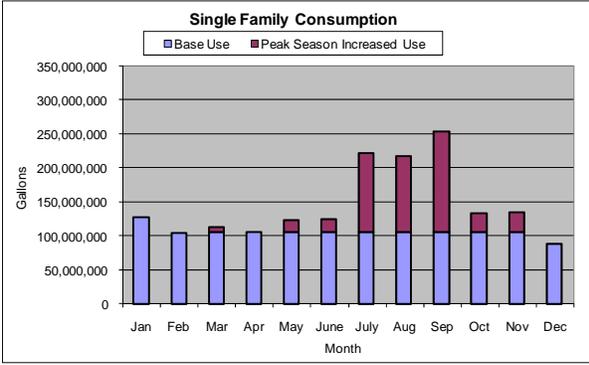


Figure 1 – Single Family Consumption (Hillsboro)

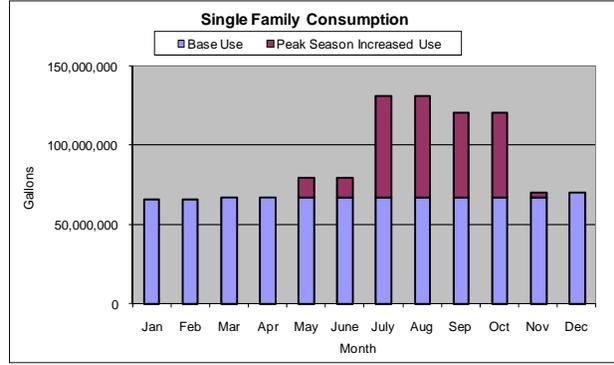


Figure 2 – Single Family Consumption (Beaverton)

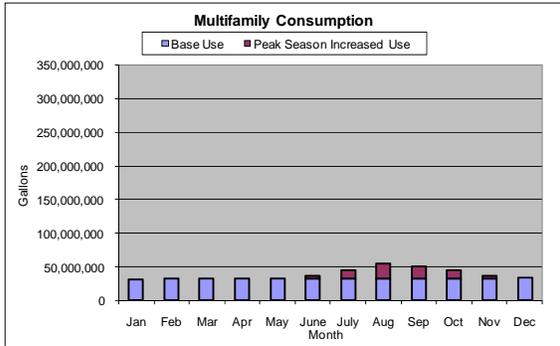


Figure 3 – Multifamily Consumption (Hillsboro)

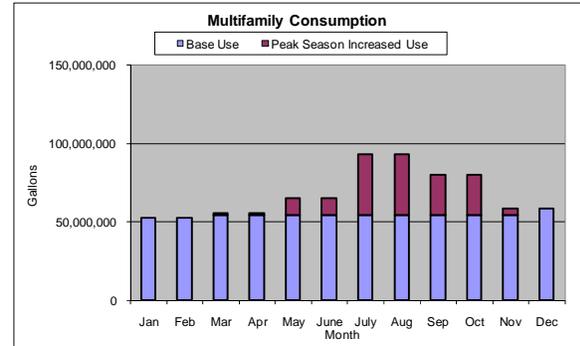


Figure 4 – Multifamily Consumption (Beaverton)

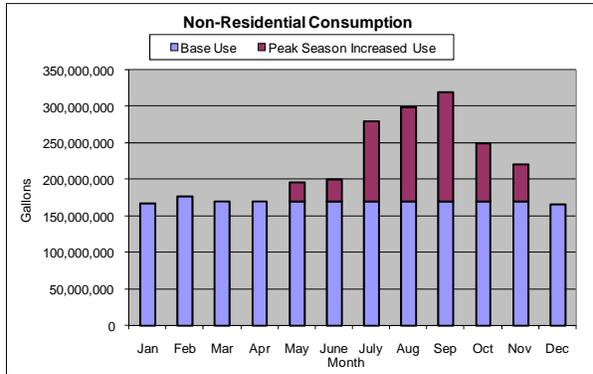


Figure 5 – Non Residential Consumption (Hillsboro)

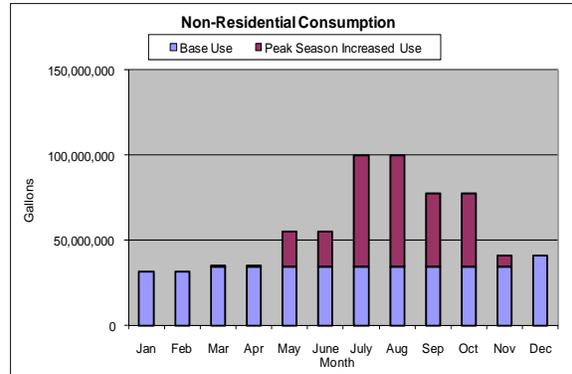


Figure 6 – Non Residential Consumption (Beaverton)

Demographic Data

The demographic data required for the Conservation Measure Analysis model are provided in Table 6 and Table 7, for Hillsboro and Beaverton respectively. These data were developed by staff from Hillsboro and Beaverton.

Table 6 – Hillsboro Demographics

Demographic Unit	First Initial Implementation Year ("Existing" Demographics)		Last Initial Implementation Year		Change Between First and Last Year ("Future" Demographics)	
	Year	Footnote	Year	Footnote	Change	Footnote
Year	2010	a	2014	a	5	h
Single Family Households (SF HH)	17,273	b	18,882	b	1,609	h
Persons Per SF HH	2.75	c	2.74	c	-0.01	h
Multifamily Households (MF HH)	10,046	d	10,846	d	800	h
Multifamily Accounts	269	e	290	e	21	h
Persons Per MF HH	2.75	c	2.74	c	-0.01	h
Non-Residential (NR) Accounts	1,528	f	1,675	f	147	h
Employees	56,632	g	62,060	g	5,428	h
Employees Per NR Account	37	h	37	h	0	h
Footnotes:						
a. Provided by client via Measure Selection worksheet.						
b. Based on data from the draft March 2009 City of Hillsboro Economic Opportunities Analysis and Long Term Urban Land Needs Assessment (EOA) pages 77, 81, and 87. The EOA data is for the entire City, while the water service area encompasses 75% of the City's boundary. Therefore used 75% of the EOA numbers.						
c. Based on data from EOA pages 75 and 79.						
d. Based on data from EOA pages 77, 81, and 87. The EOA data is for the entire City, while the water service area encompasses 75% of the City's boundary. Therefore used 75% of the EOA numbers.						
e. Based on 2008 data from utility billing system. Then extrapolated to other years using the 2008 ratio of MF HH to MF accounts and the number of MF HH in future years.						
f. Based on 2008 data from utility billing system. Then extrapolated to other years using the 2008 ratio of employees to NR accounts and the number of employees in future years.						
g. Based on data from EOA pages 38 and 70. The EOA data is for the entire City, while the water service area encompasses 75% of the City's boundary. Therefore used 75% of the EOA numbers.						
h. Calculation.						

Table 7 – Beaverton Demographics

Demographic Unit	First Initial Implementation Year ("Existing" Demographics)		Last Initial Implementation Year		Change Between First and Last Year ("Future" Demographics)	
	Year		Year			
Year	2010	a	2014	a	5	h
Single Family Households (SF HH)	14,685	b	15,449	b	764	h
Persons Per SF HH	2.51	c	2.51	c	0.00	h
Multifamily Households (MF HH)	12,879	d	13,549	d	670	h
Multifamily Accounts	1,379	e	1,451	e	72	h
Persons Per MF HH	2.51	c	2.51	c	0.00	h
Non-Residential (NR) Accounts	1,661	f	1,747	f	86	h
Employees	13,714	g	14,428	g	714	h
Employees Per NR Account	8	h	8	h	0	h
Footnotes:						
a. Provided by client via Measure Selection worksheet.						
b. Provided by client. Based on # of meters for single family residents from Utility Billing System for 2010. 2014 data is based on an expected population growth of 5.2% from 2010 to 2014. The number of accounts for 2014 was extrapolated using 2010 data at a 5.2% growth rate.						
c. Provided by client. Based on US Census, American Community Survey (2006-2008)						
d. Provided by client. GIS calculation.						
e. Provided by client. Based on # of meters for apartments and multi-family households from Utility Billing System for 2010. 2014 data is based on an expected population growth of 5.2% from 2010 to 2014. The number of accounts for 2014 was extrapolated using 2010 data at a 5.2% growth rate.						
f. Provided by client. Based on # of meters for Commercial, Fire and Public Facilities from Utility Billing System for 2010. 2014 data is based on an expected population growth of 5.2% from 2010 to 2014. The number of accounts for 2014 was extrapolated using 2010 data at a 5.2% growth rate.						
g. Provided by client. Based on # of employees reported on City business license data.						
h. Calculation.						

2.5. Developing Packages

The model's "package tool" was used to group subsets of measures that represent potential conservation scenarios for Hillsboro and Beaverton. The decision of which packages to create, and which measures to include in each package, is dependent on many factors including the following screening criteria:

- Available Program Budget:** The conservation program budget impacts program choices. Hillsboro currently has an annual conservation budget of approximately \$30,000 for direct costs for rebate-related measures and approximately \$20,000 for direct costs for giveaway-type measures. Beaverton is just initiating their conservation program and has established an annual conservation budget of approximately \$12,000 for direct costs for rebate-related measures and approximately \$8,000 for direct costs for giveaway-type measures.

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- **Magnitude of Annual Water Savings:** This is the annual savings in gallons per day at full implementation.
 - **Magnitude of Peak Season Water Savings:** This is the peak season savings in gallons per day at full implementation. Note that peak season savings are obtained from both measures that obtain year round savings (e.g. toilet rebates) and measures that only obtain savings during the peak season (e.g., irrigation system controllers).
 - **Cost Effectiveness:** The cost-effectiveness of measures can range widely. For Hillsboro, it ranges from \$0.03 to \$36.47 per ccf of saved water. For Beaverton, it ranges from \$0.03 to \$56.04 per ccf of saved water. Typically indoor measures are more cost-effective than outdoor measures.
 - **Customer Categories:** It may, or may not, be preferable to provide programs for each customer category (i.e., single family, multifamily, non-residential).
 - **Certainty of Savings:** Measures that focus on hardware have a higher certainty of savings compared to measures that focus on behavior. Once a customer installs a piece of hardware (e.g., high-efficiency showerhead), the savings are generally assured for the lifespan of that hardware. However, if a customer enacts a water saving behavior (e.g., taking shorter showers), it is easy for the customer to convert back to their non-conserving behavior. Nearly all of the measures analyzed for JWC for this WaterSense project are hardware measures.
 - **Administrative Complexity:** The impact on staff workload should be considered. Measures that could be implemented together (e.g., single family showerheads and single family bathroom faucet aerators) may have added value in workload efficiencies (as well as in cost efficiencies).
 - **Customer Acceptance:** Certain measures may have higher customer acceptance. For example, when measures with different flow rates are analyzed, typically the models with higher flow rates have higher customer acceptance.

Examples of conservation packages that are frequently developed for utilities to consider include the following:

- **Savings Package:** Designed to meet a specific saving goal (e.g., saves X gpd).
- **Cost Package:** Designed to meet a specific budgetary constraint (e.g., costs \$X per year).
- **Cost-Effectiveness Package:** Designed to include all measures that meet a certain cost-effectiveness threshold (e.g., measures that cost less than \$X per ccf of saved water).

The packages developed for Hillsboro and Beaverton are described below. There are three main packages: 1) conservation potential assessment, 2) current conservation budget, and 3) double current conservation budget. Each of those packages is further divided into a rebate-related package (the “a” version) and a giveaways and audits related package (the “b” version). Table 8 provides information regarding various budget constraints for Hillsboro and Beaverton, which relate to several of the packages.

Table 8 - Budget Constraints (Direct Costs)

Program	Conservation Potential Assessment Package <i>(Package #1)</i>	Current Budget <i>(Package #2)</i>	Double Current Budget <i>(Package #3)</i>
Hillsboro			
Rebates	\$821,000 for 5 yrs <i>(Package #1a)</i>	\$30,000 annual / \$150,000 for 5 yrs <i>(Package #2a)</i>	\$60,000 annual / \$300,000 for 5 yrs <i>(Package #3a)</i>
Giveaways/Audits	\$56,000 for 5 yrs <i>(Package #1b - also serves as Package #2b & #3b)</i>	\$20,000 annual / \$100,000 for 5 yrs <i>(Package #2b)</i>	\$40,000 annual / \$200,000 for 5 yrs <i>(Package #3b)</i>
Beaverton ¹			
Rebates	\$718,000 for 5 yrs <i>(Package #1a)</i>	\$12,000 annual / \$60,000 for 5 yrs <i>(Package #2a)</i>	\$24,000 annual / \$120,000 for 5 yrs <i>(Package #3a)</i>
Giveaways/Audits	\$52,000 for 5 yrs <i>(Package #1b - also serves as Package #3b)</i>	\$8,000 annual / \$40,000 for 5 yrs <i>(Package #2b)</i>	\$16,000 annual / \$80,000 for 5 yrs <i>(Package #3b)</i>

1. Beaverton's budget for direct costs is \$20,000. It was decided to allocate that number between rebates and giveaways/audits based on the ratio from Hillsboro, which is 60% to rebates and 40% to giveaways/audits.

- Package #1a: Conservation Potential Assessment - Rebates:** This package was designed to show the maximum water savings available for certain rebate-related measures, given certain assumptions such as participation rates. This package is intended to provide a bookend of the high end of potential savings for the selected measures. The particular measures included in this package were determined by Hillsboro and Beaverton staff based on a variety of factors, including some of the screening criteria described above.
- Package #1b: Conservation Potential Assessment - Giveaway/Audits:** This package was designed to show the maximum water savings available for certain giveaway and audit related measures, given certain assumptions such as participation rates. This package is intended to provide a bookend of the high end of potential savings for the selected measures. The particular measures included in this package were determined by Hillsboro and Beaverton staff based on a variety of factors, including some of the screening criteria described above.
- Package #2a: Current Conservation Budget - Rebates:** This package was designed to modify Package #1a to reflect the current budget. For Hillsboro, that means approximately \$30,000 annually and \$150,000 over the five-year initial implementation period. For Beaverton, that means approximately \$12,000 annually and \$60,000 over the five-year initial implementation period. Due to the nature of the selected measures and the chosen planning period, no renewals were necessary to maintain savings over

the planning period. Therefore, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period. The budgetary constraints were met by eliminating the multifamily clotheswasher measures (per the guidance of Hillsboro and Beaverton staff) and by reducing the participation rates of the remaining measures.

- **Package #2b: Current Conservation Budget - Giveaway/Audits:** This package was designed to modify Package #1b to reflect the current budget. For Hillsboro, that means approximately \$20,000 annually and \$100,000 over the five-year initial implementation period. For Hillsboro, since Package #1b (the conservation potential assessment package) costs less than Hillsboro's current budget, Package #1b also serves the purpose of Package #2b. For Beaverton, that means approximately \$8,000 annually and \$40,000 over the five-year initial implementation period. Again, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period. The budgetary constraints were met by reducing the participation rates of the measures.
- **Package #3a: Double Current Conservation Budget - Rebates:** This package was designed to modify Package #1a to reflect an enhanced level of conservation by doubling the current budget. For Hillsboro, that means approximately \$60,000 annually and \$300,000 over the five-year initial implementation period. For Beaverton, that means approximately \$24,000 annually and \$120,000 over the five-year initial implementation period. Again, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period. The budgetary constraints were met by eliminating the multifamily clotheswasher measures (per the guidance of Hillsboro and Beaverton staff) and by reducing the participation rates of the remaining measures.
- **Package #3b: Double Current Conservation Budget - Giveaway/Audits:** This package was designed to modify Package #1b to reflect an enhanced level of conservation by doubling the current budget. For Hillsboro, that means approximately \$40,000 annually and \$200,000 over the five-year initial implementation period. For Beaverton, that means approximately \$16,000 annually and \$80,000 over the five-year initial implementation period. For both Hillsboro and Beaverton, since Package #1b (the conservation potential assessment package) costs less than double their current budgets, Package #1b also serves the purpose of Package #3b. Again, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period. The budgetary constraints were met by reducing the participation rates of the measures.

3. Results and Conclusions

3.1. Initial Results for Individual Measures

The results of the initial analysis for each individual measure are provided in Table 9 and Table 10, for Hillsboro and Beaverton respectively. (The tables are located at the end of this Tech Memo since they are 11 x 17 in size.) The results represent the highest level of water savings (and associated costs) that can be expected from each analyzed measure, given certain assumptions such as participation rates.

The savings and costs in Table 9 and Table 10 cannot be totaled since there is some overlap due to mutually exclusive measures. For example, the analysis includes 0.5, 1.0, and 1.5 gpm faucet aerator measures. Those measures were analyzed independently of each other. Hillsboro and Beaverton would most likely choose to implement only one of those measures, therefore the savings and costs from the non-selected measures need to be disregarded. If all three measures were implemented, the participation rates (and thus savings and costs) for all three measures would need to be reduced. (See Section 3.2 for packages that omit overlapping measures.)

There are two sets of mutually exclusive measures, as described below:

- **Mutually Exclusive Set #1 – Residential Bathroom Faucet Aerators:** Three versions of residential bathroom faucet aerators were analyzed: 0.5 gpm, 1.0 gpm, and 1.5 gpm. All three versions are more efficient than the plumbing code of 2.5 gpm.
- **Mutually Exclusive Set #2 - Showerheads:** Two versions of showerheads were analyzed: 1.5 gpm and 2.0 gpm. Both versions are more efficient than the plumbing code of 2.5 gpm.

Key definitions related to Table 9 and Table 10 (as well as the similar tables for the packages) are provided below:

- **Participating Customers:** The number of customers with the applicable fixture or behavior that have not already implemented the measure and that participate in the program. For example, the number of single family households with showers that do not already have an efficient model that participate in the utility's showerhead program.
- **Savings Generating Customers:** The number of customers that generate savings. For measures that only require one step to achieve savings (e.g., toilet rebates), this is the same as the number of participating customers. For measures that require two steps to achieve savings, this is the number of customers that perform both steps and therefore achieve the savings. For example, the number of single family households that take the utility's showerhead and follow through and install it.
- **Devices / Rebates / Audits:** The number of devices, rebates, or audits that will be distributed or performed. For example, the number of toilet rebates. This number can be higher than the number of participating customers since often there are multiple fixtures per customer and due to renewals.

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- **Savings for All Customers At Full Implementation (gpd):** This is the gallons per day savings for all customers once the program has been fully implemented. This value is presented for both the average annual and peak season time periods.
 - **Savings for All Customers Over Measure Life (ccf):** This is the total savings, in 100s of cubic feet, that are obtained by the measure over the measure lifespan (or multiple lifespans if the measure is renewed). This is the savings number that is used to calculate the cost-effectiveness of the measure.
 - **Cost Over Planning Period:** This is the cost for a measure over the planning period. As explained previously, this mostly includes only the direct costs, however it does include indirect costs for two measures. This number is a key input to the measure cost effectiveness calculation.
 - **Cost per CCF Saved Over Measure Life:** This is the cost effectiveness of the measure. It is calculated by dividing the “Savings for All Customers Over Measure Life (ccf)” into the “Total Cost Over Planning Period.” This number can be used to compare measures to one another, or to compare conservation to other sources of supply.

3.2. Package #1a: Conservation Potential Assessment - Rebates

As described previously, this package was designed to show the maximum water savings available for certain rebate-related measures, given certain assumptions such as participation rates.

The results for Package #1a are shown in Table 11 and Table 12, for Hillsboro and Beaverton respectively. (The tables are located at the end of this Tech Memo since they are 11 x 17 in size.) For Hillsboro, the analysis estimates the package would save approximately 145,000 gallons per day (gpd) on an annual average basis and 167,000 gpd on a peak season basis. For Beaverton, the analysis estimates the package would save approximately 119,000 gallons per day (gpd) on an annual average basis and 125,000 gpd on a peak season basis. The cost of achieving those savings is estimated at approximately \$821,000 for Hillsboro and \$718,000 for Beaverton over the five-year initial implementation period. As discussed previously, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period.

Several pie charts convey information regarding the nature of the savings from this package. Figure 7 and Figure 8, for Hillsboro and Beaverton respectively, show that the majority of the savings are from the single family customer category, with the remaining savings attributed to the multifamily and non-residential customer categories. Figure 9 and Figure 10, for Hillsboro and Beaverton respectively, show the majority of the savings are associated with measures with year-round savings, compared to measures focused only on peak season savings.

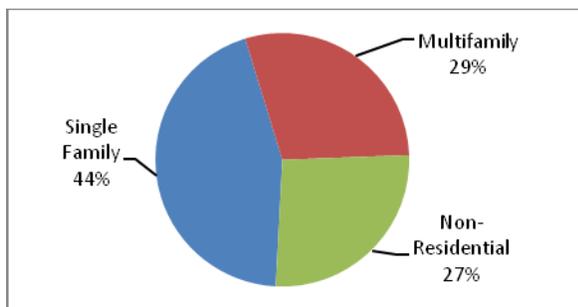


Figure 7 - Savings by Customer Category (Hillsboro Package #1a)

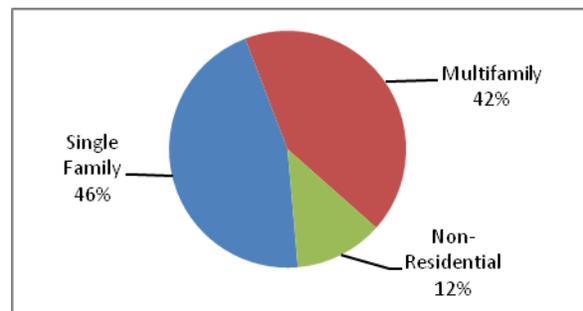
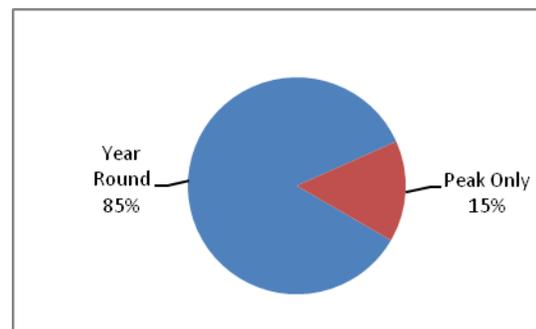
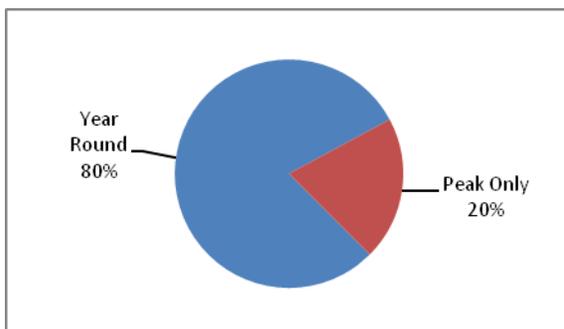


Figure 8 - Savings by Customer Category (Beaverton Package #1a)



**Figure 9 - Savings by Seasonality
(Hillsboro Package #1a)**

**Figure 10 - Savings by Seasonality
(Beaverton Package #1a)**

Figure 11 and Figure 12, for Hillsboro and Beaverton respectively, show the gallons per day savings for each year, on an average annual basis. The figures show how the gallons per day savings: 1) increase during the initial implementation period of 2010-2014, 2) reach their highest level by the last year of the initial implementation period, 3) stay at that level throughout the planning period until 2019, and 4) decline after the end of the planning period as the measures' lifespans expire and the measures are not renewed. Note that the savings could be preserved beyond the planning period, however that would require continued spending.

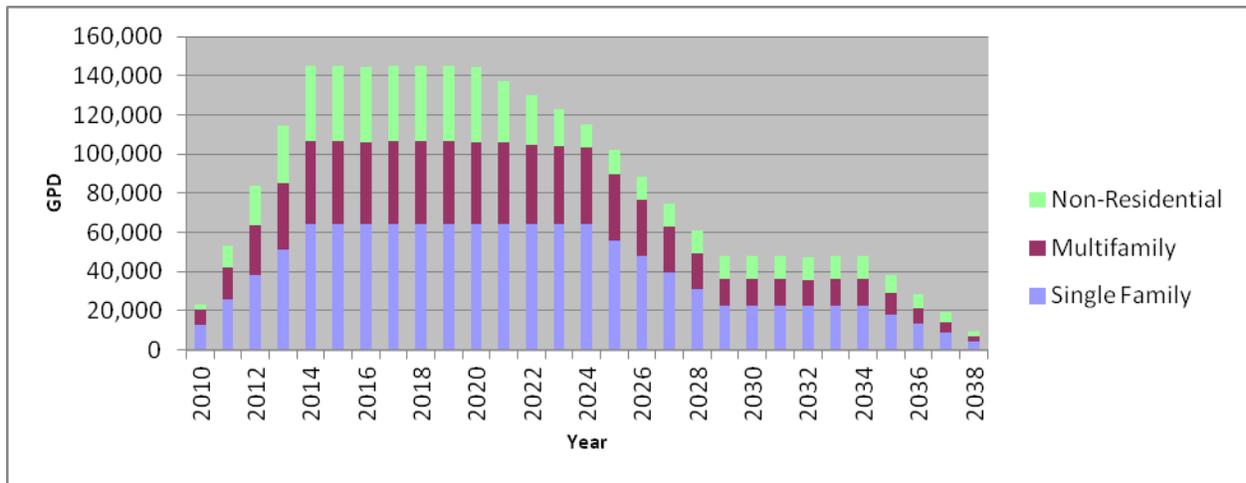


Figure 11 - Total Savings Each Year (Hillsboro Package #1a)

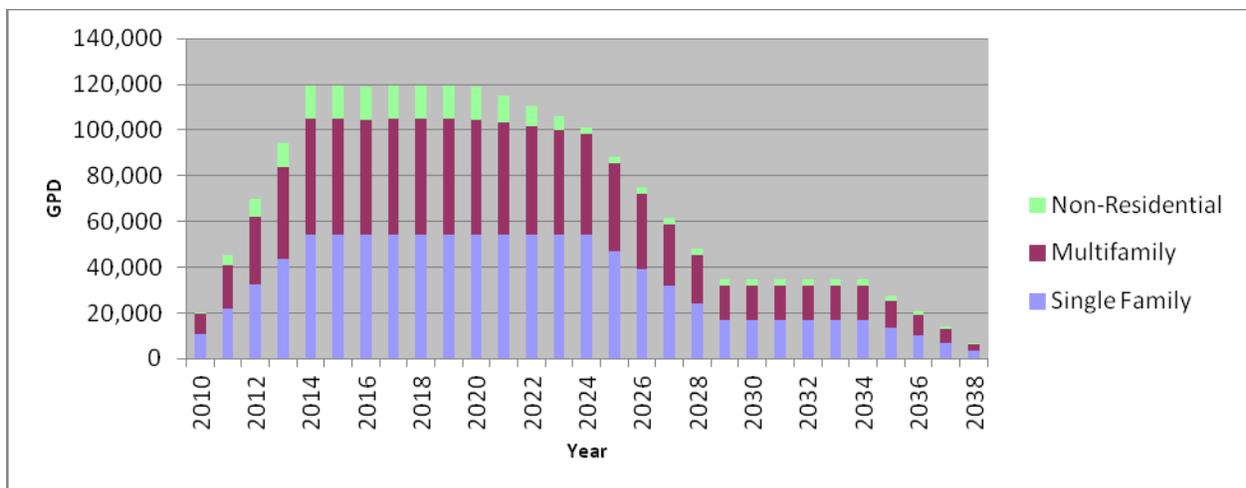


Figure 12 - Total Savings Each Year (Beaverton Package #1a)

Figure 13 and Figure 14, for Hillsboro and Beaverton respectively, show the costs for each year during the planning period for each customer category. As explained earlier, the costs are primarily direct costs. The figure shows how the costs only occur during the implementation period. Note that the slightly lower cost in the first year is due to the one-year delay in implementing the irrigation controller program, as described in Section 2.3 related to the implementation schedule.

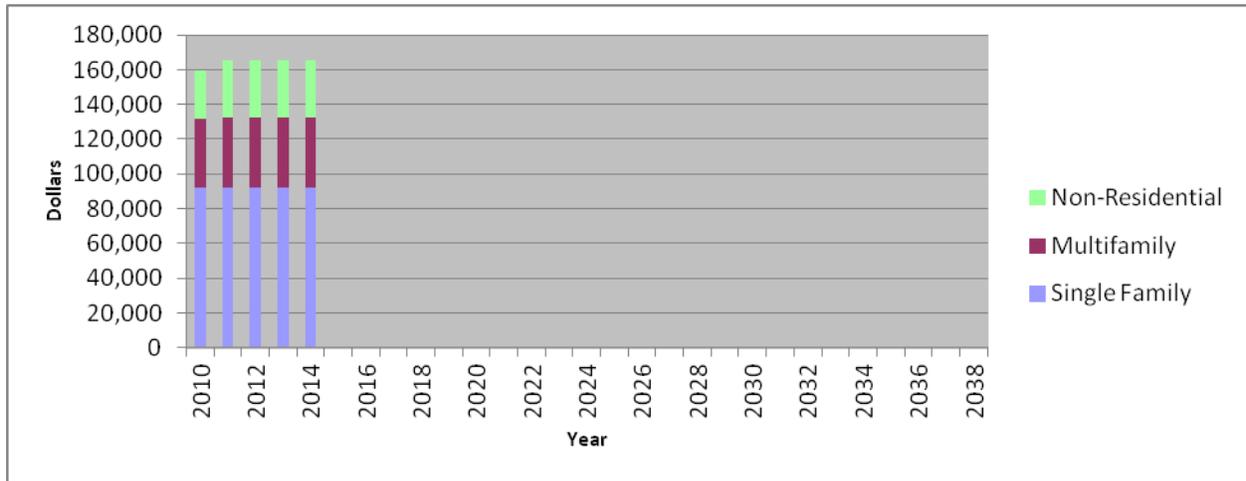


Figure 13 – Costs Each Year (Hillsboro Package #1a)

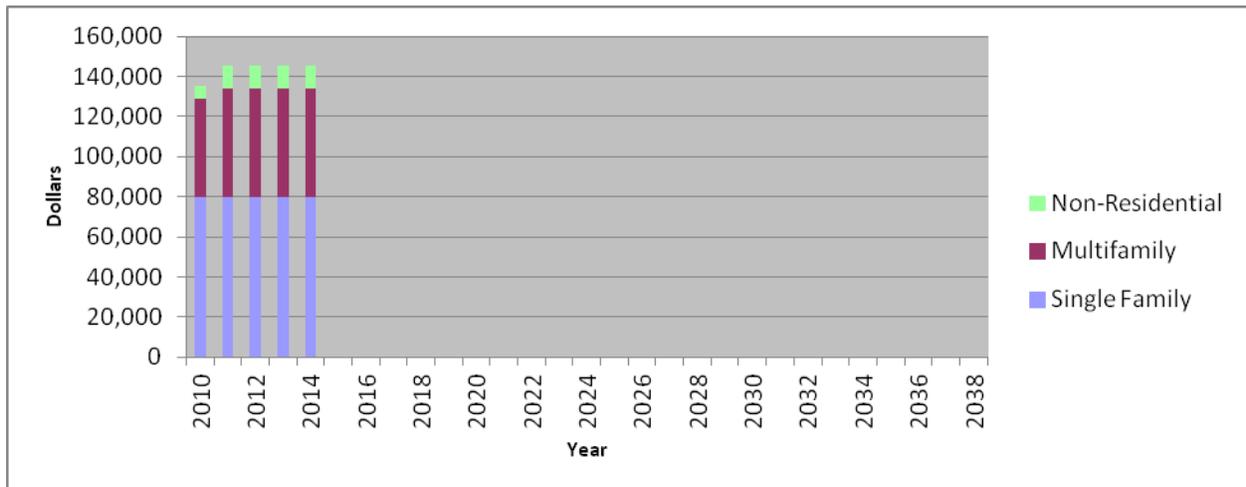


Figure 14 – Costs Each Year (Beaverton Package #1a)

3.3. Package #1b: Conservation Potential Assessment - Giveaways/Audits

As described previously, this package was designed to show the maximum water savings available for certain giveaway and audit related measures, given certain assumptions such as participation rates.

The results for Package #1b are shown in Table 13 and Table 14, for Hillsboro and Beaverton respectively. (The tables are located at the end of this Tech Memo since they are 11 x 17 in size.) For Hillsboro, the analysis estimates the package would save approximately 85,000 gallons per day (gpd) on both an annual average and a peak season basis. For Beaverton, the analysis estimates the package would save approximately 74,000 gallons per day (gpd) on both an annual average and a peak season basis. The cost of achieving those savings is estimated at approximately \$56,000 for Hillsboro and \$52,000 for Beaverton over the five-year initial implementation period. As discussed previously, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period.

Several pie charts convey information regarding the nature of the savings from this package. Figure 15 and Figure 16, for Hillsboro and Beaverton respectively, show that the majority of the savings are from the single family customer category, with the remaining savings attributed to the multifamily customer category and none to the non-residential sector. All of the savings are associated with measures with year-round savings, compared to measures focused only on peak season savings.

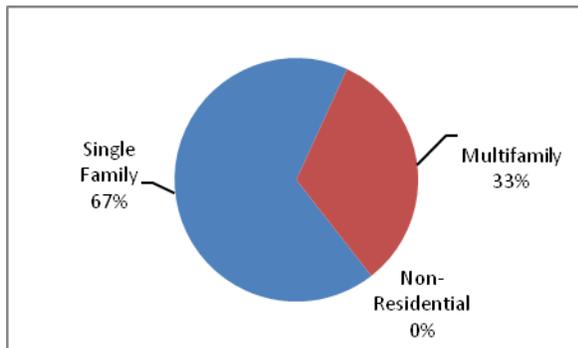


Figure 15 - Savings by Customer Category (Hillsboro Package #1b)

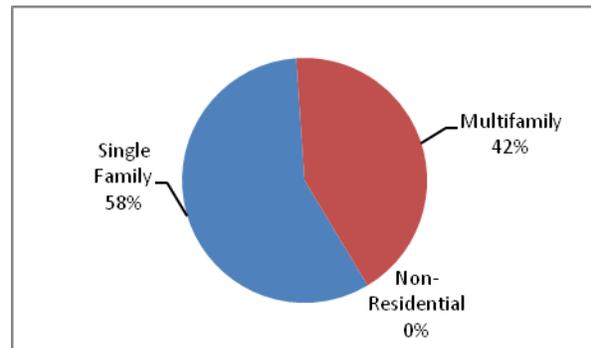


Figure 16 - Savings by Customer Category (Beaverton Package #1b)

Figure 17 and Figure 18, for Hillsboro and Beaverton respectively, show the gallons per day savings for each year, on an average annual basis. The pattern in the figure is similar to the pattern discussed under Package #1a.

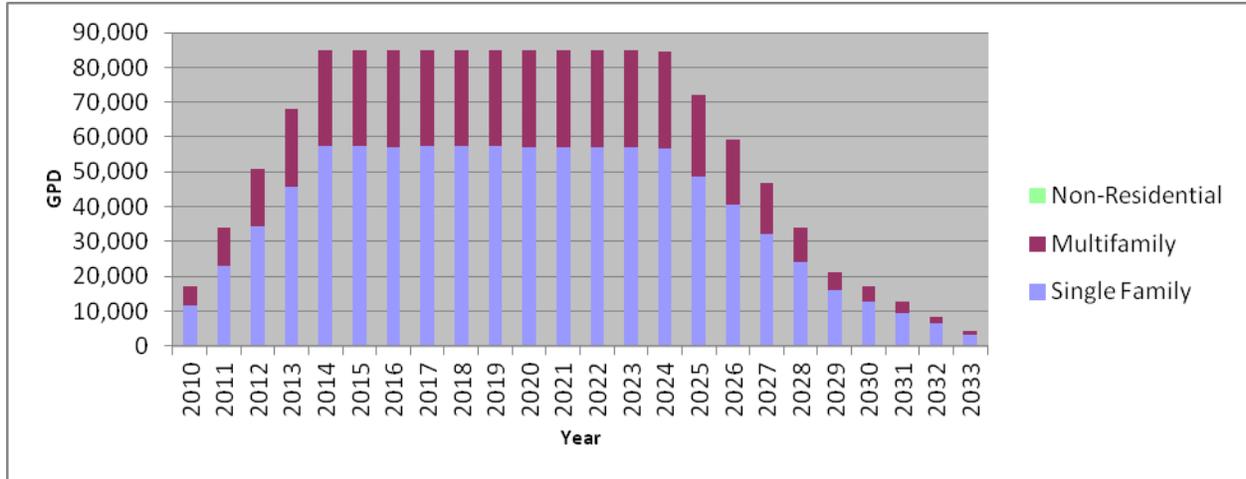


Figure 17 - Total Savings Each Year (Hillsboro Package #1b)

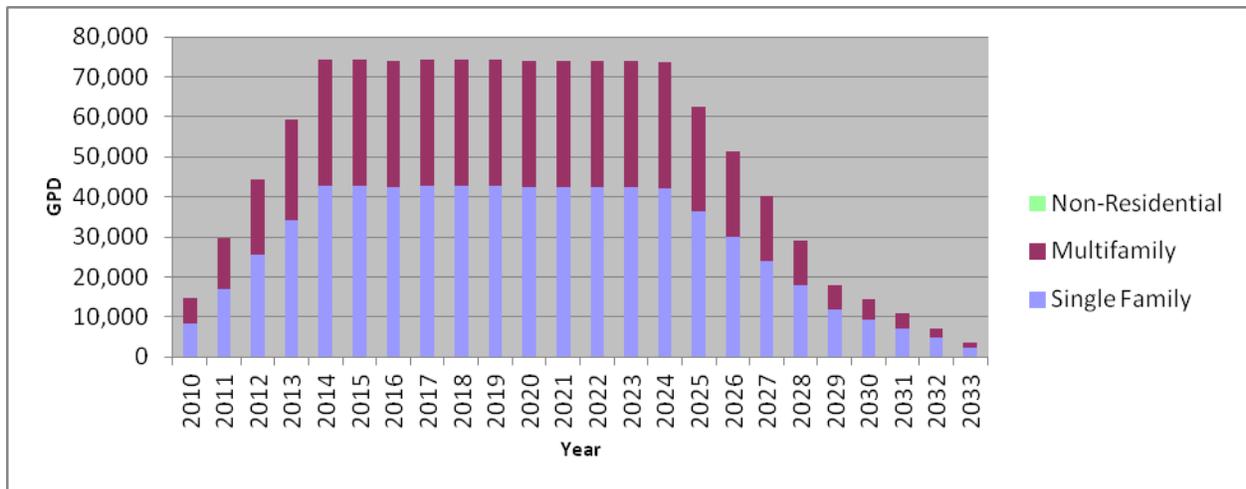


Figure 18 - Total Savings Each Year (Beaverton Package #1b)

Figure 19 and Figure 20, for Hillsboro and Beaverton respectively, show the costs for each year during the planning period for each customer category. As explained earlier, the costs are primarily direct costs. The figure shows how the costs only occur during the implementation period.

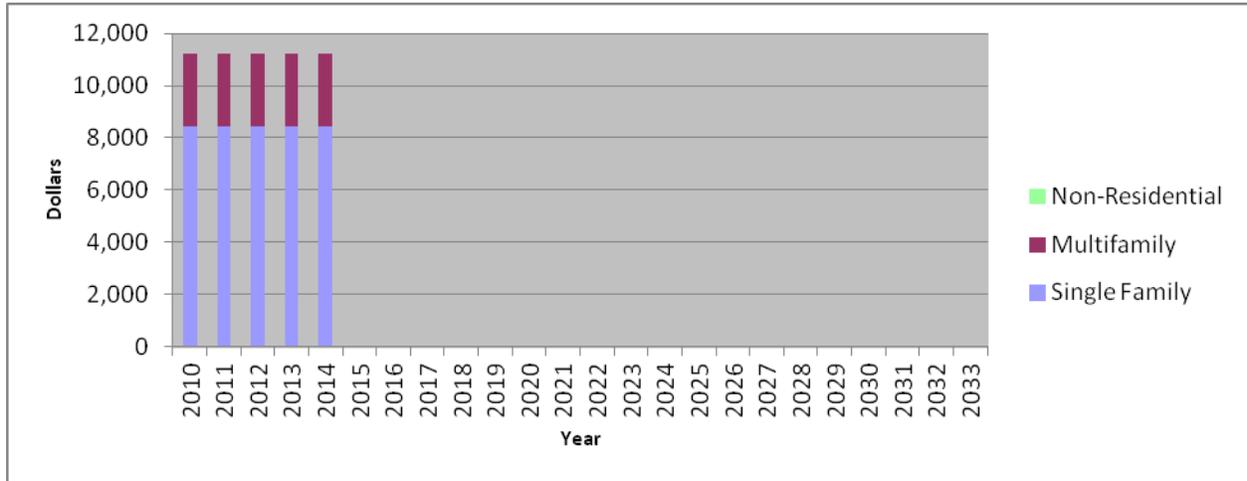


Figure 19 – Costs Each Year (Hillsboro Package #1b)

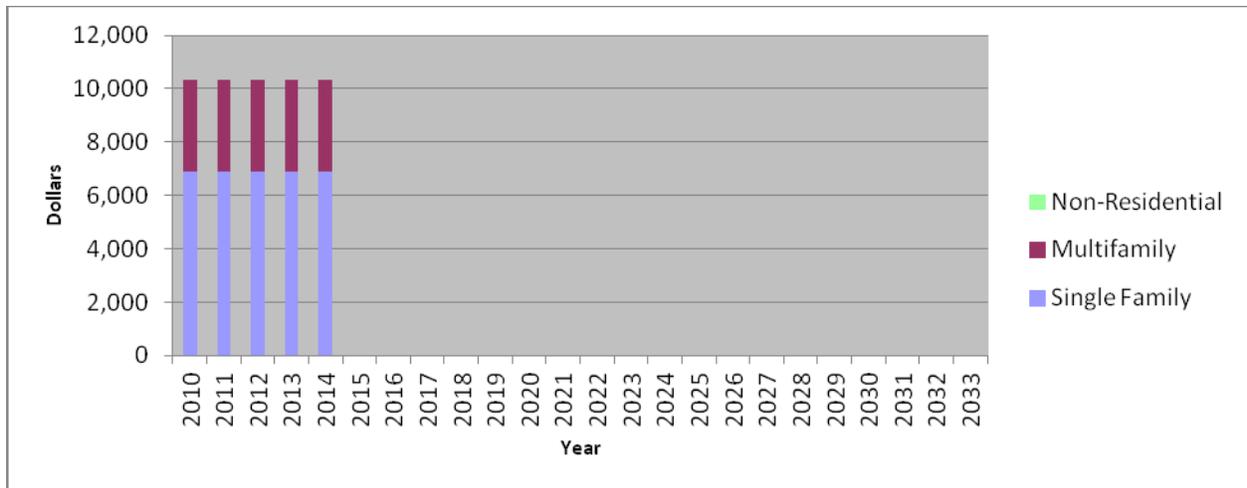


Figure 20 – Costs Each Year (Beaverton Package #1b)

3.4. Package #2a: Current Conservation Budget - Rebates

As described previously, this package was designed to modify Package #1a to reflect the Cities' current conservation budgets.

The results for Package #2a are shown in Table 15 and Table 16, for Hillsboro and Beaverton respectively. (The tables are located at the end of this Tech Memo since they are 11 x 17 in size.) For Hillsboro, the analysis estimates the package would save approximately 22,000 gallons per day (gpd) on an annual average basis and 26,000 gpd on a peak season basis. For Beaverton, the analysis estimates the package would save approximately 7,100 gallons per day (gpd) on an annual average basis and 7,400 gpd on a peak season basis. The cost of achieving those savings is estimated at approximately \$149,000 for Hillsboro and \$60,000 for Beaverton over the five-year initial implementation period. As discussed previously, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period.

Several pie charts convey information regarding the nature of the savings from this package. Figure 21 and Figure 22, for Hillsboro and Beaverton respectively, show that the majority of the savings are from the single family customer category, with the remaining savings attributed to the multifamily and non-residential customer categories. Figure 23 and Figure 24, for Hillsboro and Beaverton respectively, show the majority of the savings are associated with measures with year-round savings, compared to measures focused only on peak season savings.

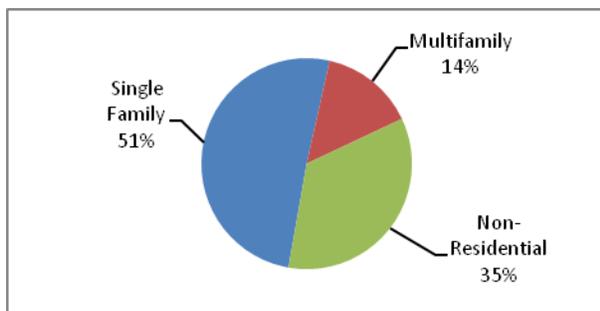


Figure 21 - Savings by Customer Category (Hillsboro Package #2a)

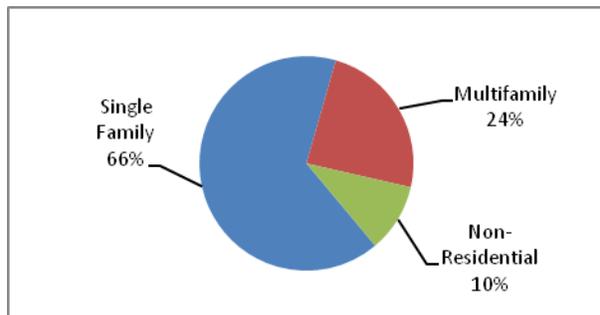


Figure 22 - Savings by Customer Category (Beaverton Package #2a)

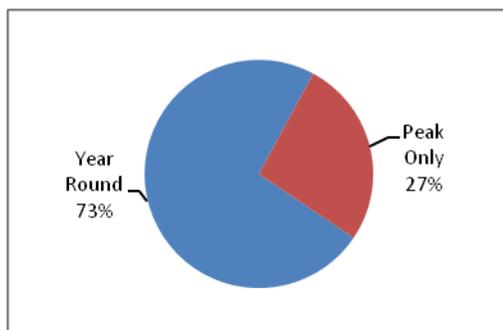


Figure 23 - Savings by Seasonality (Hillsboro Package #2a)

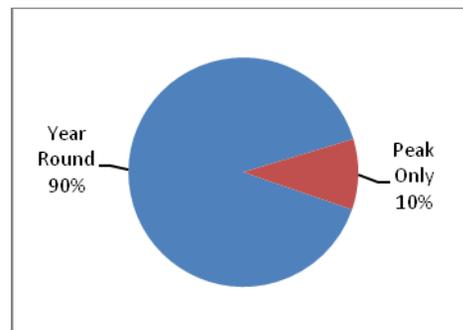


Figure 24 - Savings by Seasonality (Beaverton Package #2a)

Figure 25 and Figure 26, for Hillsboro and Beaverton respectively, show the gallons per day savings for each year, on an average annual basis. The pattern in the figure is similar to the pattern discussed under Package #1a.

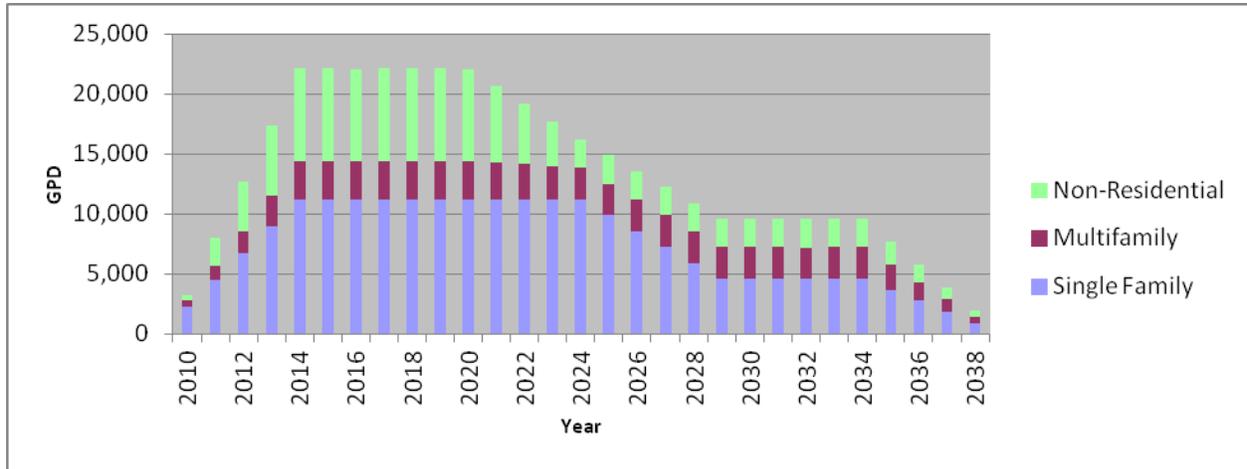


Figure 25 - Total Savings Each Year (Hillsboro Package #2a)

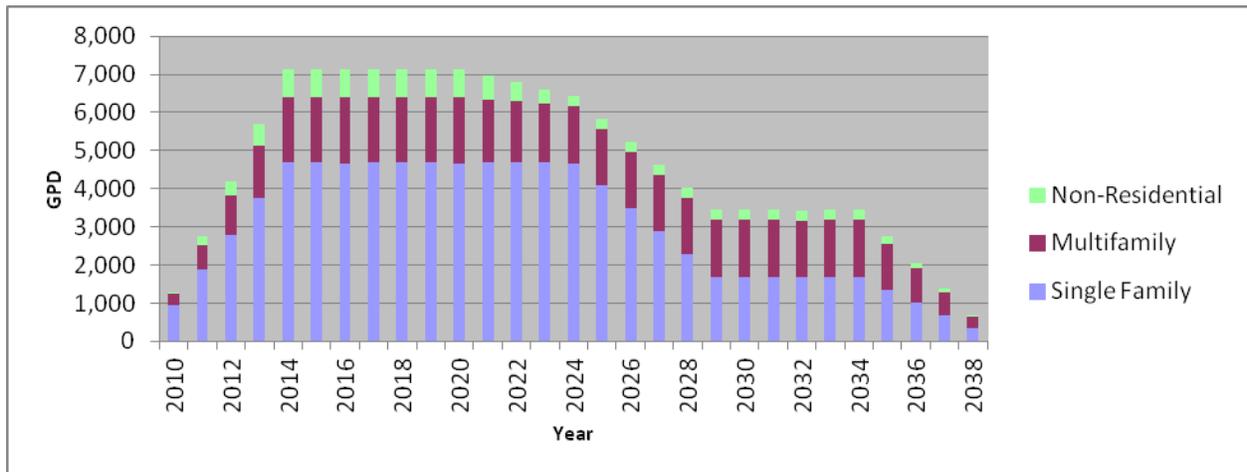


Figure 26 - Total Savings Each Year (Beaverton Package #2a)

Figure 27 and Figure 28, for Hillsboro and Beaverton respectively, show the costs for each year during the planning period for each customer category. As explained earlier, the costs are primarily direct costs. The figure shows how the costs only occur during the implementation period. Note that the slightly lower cost in the first year is due to the one-year delay in implementing the irrigation controller program, as described in Section 2.3 related to the implementation schedule.

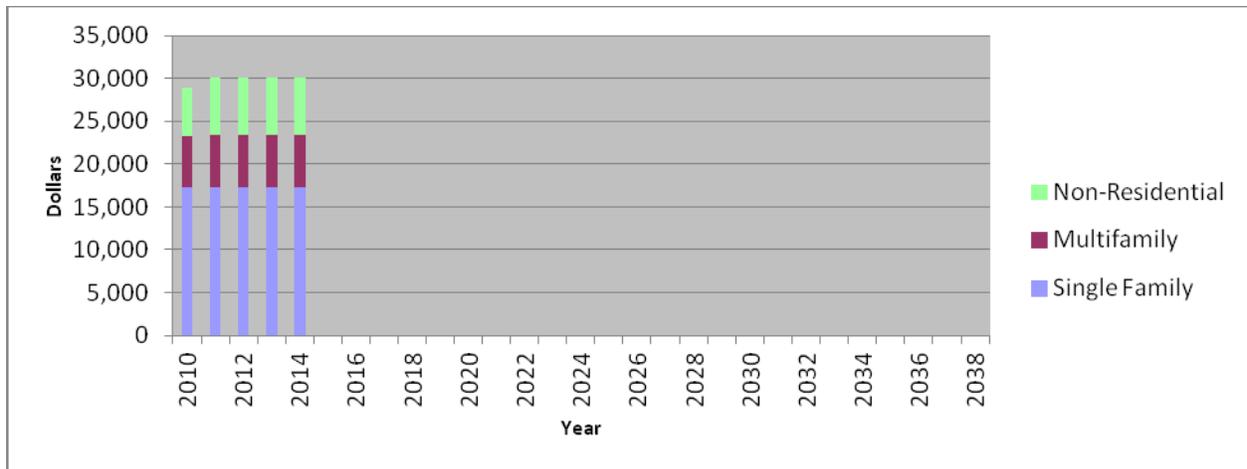


Figure 27 – Costs Each Year (Hillsboro Package #2a)

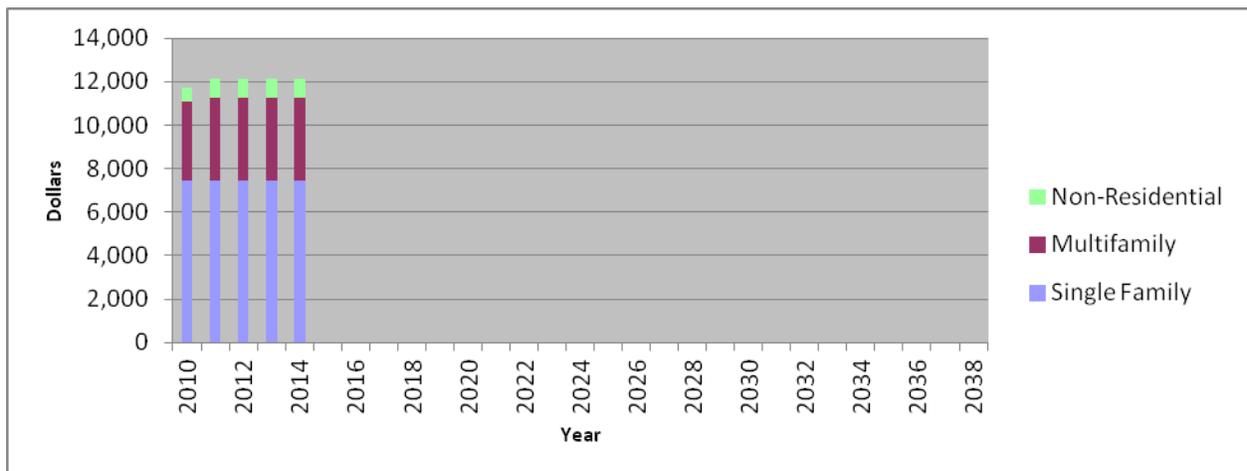


Figure 28 – Costs Each Year (Beaverton Package #2a)

3.5. Package #2b: Current Conservation Budget - Giveaways/Audits

As described previously, this package was designed to modify Package #1b to reflect the Cities' current conservation budgets. For Hillsboro, since Package #1b (the conservation potential assessment package) costs less than Hillsboro's current budget, Package #1b also serves the purpose of Package #2b. Therefore, this section only includes information for Beaverton.

The results for Package #2b are shown in Table 17. (The table is located at the end of this Tech Memo since it is 11 x 17 in size.) For Beaverton, the analysis estimates the package would save approximately 60,000 gallons per day (gpd) on both an annual average and a peak season basis. The cost of achieving those savings is estimated at approximately \$40,000 for Beaverton over the five-year initial implementation period. As discussed previously, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period.

Figure 29 shows that the majority of the savings are from the single family customer category, with the remaining savings attributed to the multifamily customer category and none to the non-residential sector. All of the savings are associated with measures with year-round savings, compared to measures focused only on peak season savings.

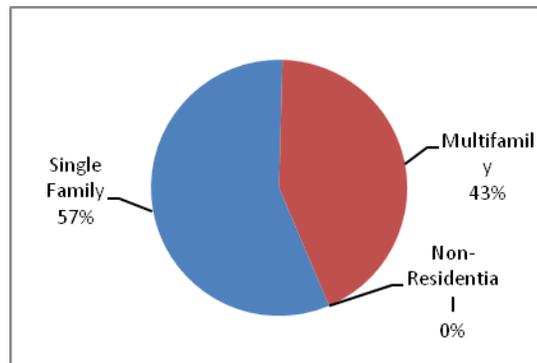


Figure 29 - Savings by Customer Category (Beaverton Package #2b)

Figure 30 shows the gallons per day savings for each year, on an average annual basis. The pattern in the figure is similar to the pattern discussed under Package #1a.

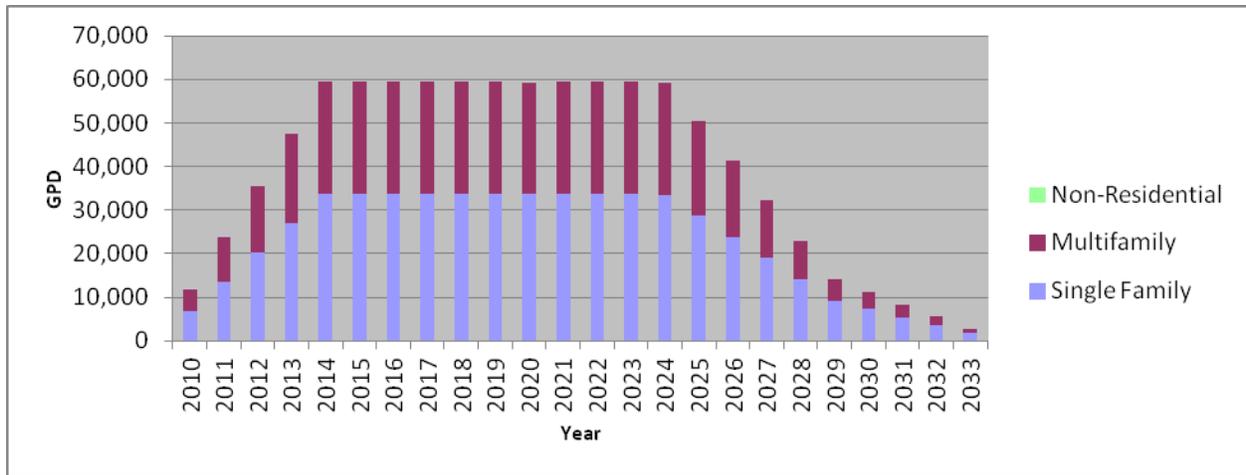


Figure 30 - Total Savings Each Year (Beaverton Package #2b)

Figure 31 shows the costs for each year during the planning period for each customer category. As explained earlier, the costs are primarily direct costs. The figure shows how the costs only occur during the implementation period.

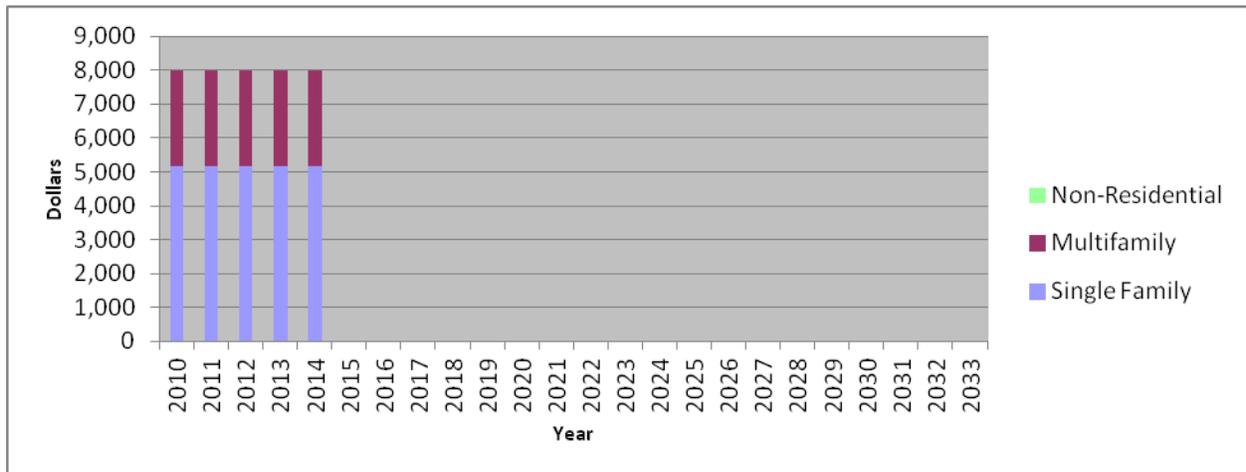


Figure 31 – Costs Each Year (Beaverton Package #2b)

3.6. Package #3a: Double Current Conservation Budget - Rebates

As described previously, this package was designed to modify Package #1a to reflect an enhanced level of conservation by doubling the Cities' current conservation budgets.

The results for Package #3a are shown in Table 18 and Table 19, for Hillsboro and Beaverton respectively. (The tables are located at the end of this Tech Memo since they are 11 x 17 in size.) For Hillsboro, the analysis estimates the package would save approximately 44,000 gallons per day (gpd) on an annual average basis and 53,000 gpd on a peak season basis. For Beaverton, the analysis estimates the package would save approximately 14,300 gallons per day (gpd) on an annual average basis and 14,800 gpd on a peak season basis. The cost of achieving those savings is estimated at approximately \$297,000 for Hillsboro and \$121,000 for Beaverton over the five-year initial implementation period. As discussed previously, the cost over the five-year initial implementation period also represents the cost over the entire 10-year planning period.

Several pie charts convey information regarding the nature of the savings from this package. Figure 32 and Figure 33, for Hillsboro and Beaverton respectively, show that the majority of the savings are from the single family customer category, with the remaining savings attributed to the multifamily and non-residential customer categories. Figure 34 and Figure 35, for Hillsboro and Beaverton respectively, show the majority of the savings are associated with measures with year-round savings, compared to measures focused only on peak season savings.

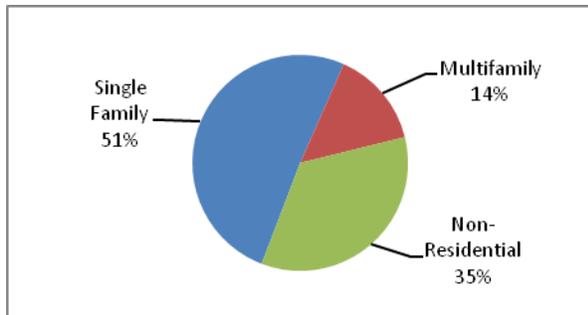


Figure 32 - Savings by Customer Category (Hillsboro Package #3a)

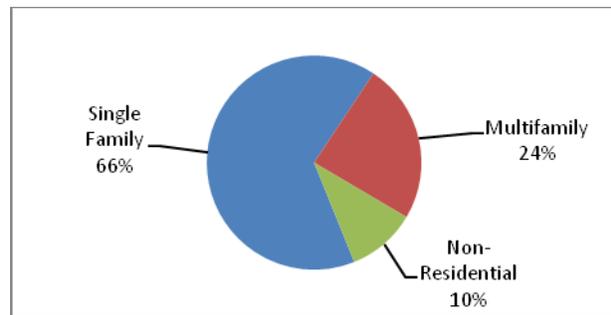


Figure 33 - Savings by Customer Category (Beaverton Package #3a)

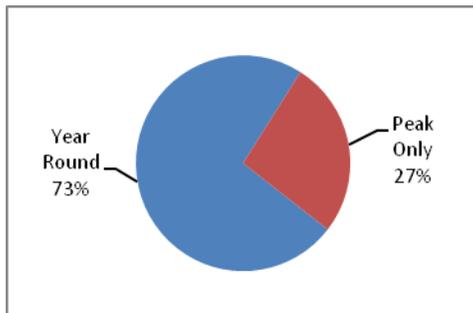


Figure 34 - Savings by Seasonality

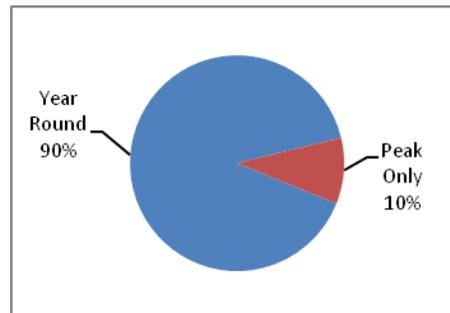


Figure 35 - Savings by Seasonality

(Hillsboro Package #3a)

(Beaverton Package #3a)

Figure 36 and Figure 37, for Hillsboro and Beaverton respectively, show the gallons per day savings for each year, on an average annual basis. The pattern in the figure is similar to the pattern discussed under Package #1a.

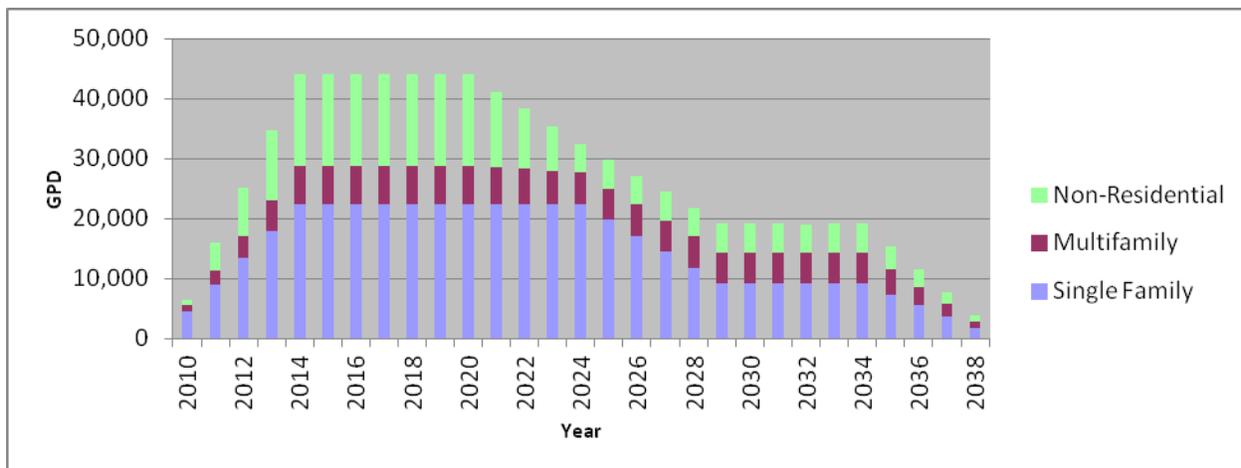


Figure 36 - Total Savings Each Year (Hillsboro Package #3a)

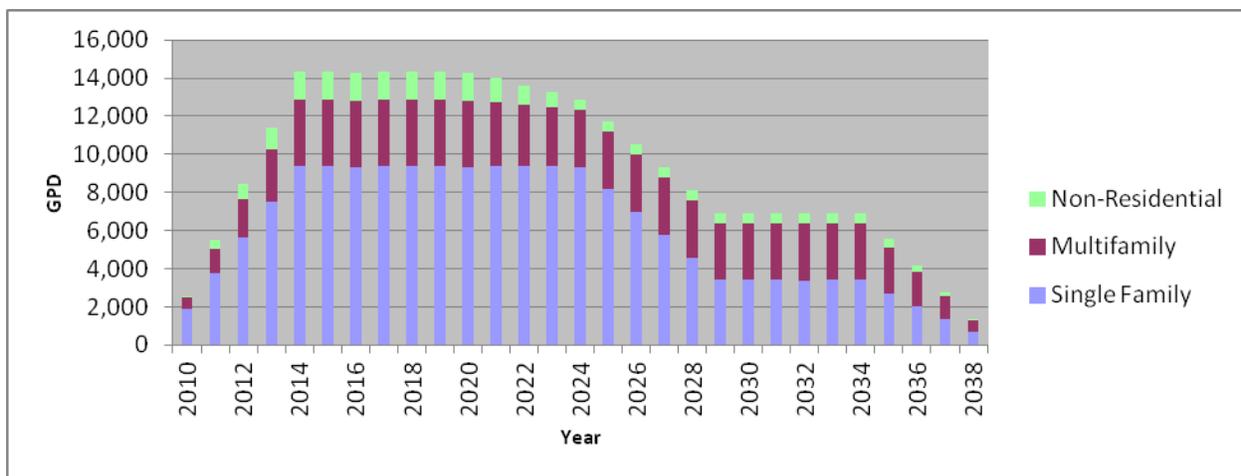


Figure 37 - Total Savings Each Year (Beaverton Package #3a)

Figure 38 and Figure 39, for Hillsboro and Beaverton respectively, show the costs for each year during the planning period for each customer category. As explained earlier, the costs are primarily direct costs. The figure shows how the costs only occur during the implementation period. Note that the slightly lower cost in the first year is due to the one-year delay in implementing the irrigation controller program, as described in Section 2.3 related to the implementation schedule.

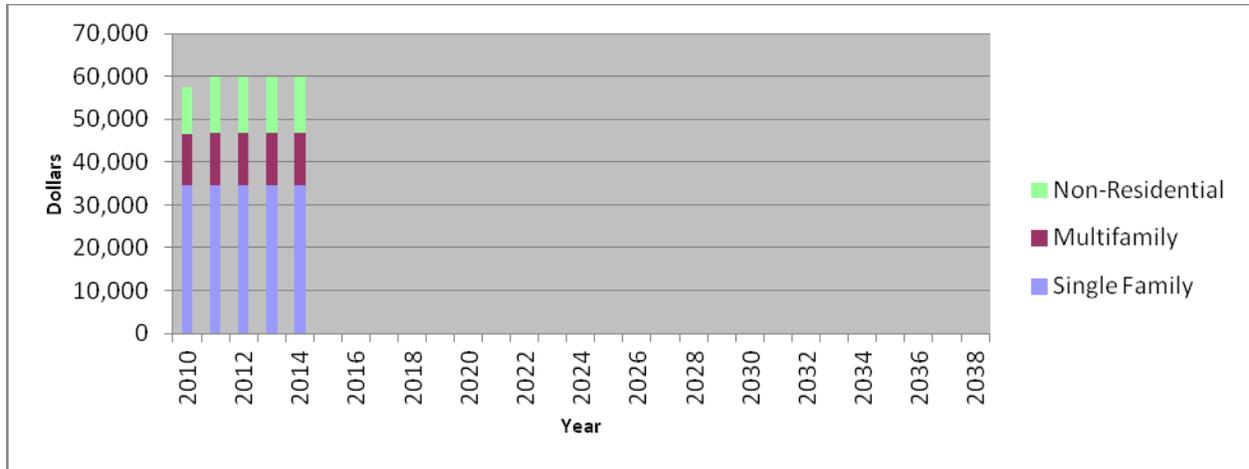


Figure 38 – Costs Each Year (Hillsboro Package #3a)

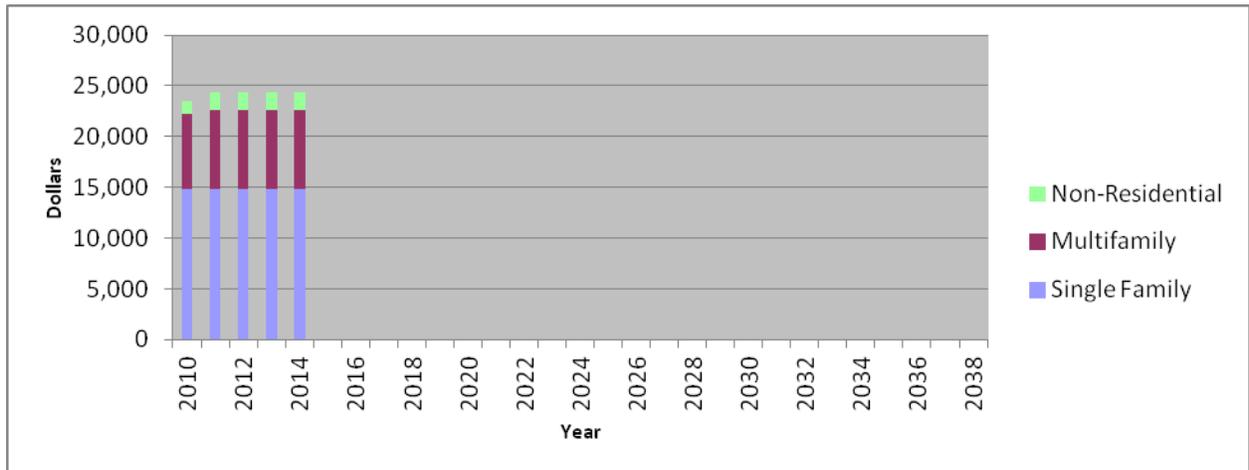


Figure 39 – Costs Each Year (Beaverton Package #3a)

3.7. Package #3b: Double Current Conservation Budget - Giveaways/Audits

As described previously, this package was designed to modify Package #1b to reflect an enhanced level of conservation by doubling the Cities' current conservation budgets. For both Hillsboro and Beaverton, since Package #1b (the conservation potential assessment package) costs less than double their current budgets, Package #1b also serves the purpose of Package #3b. Therefore, this section does not repeat that information.

3.8. Conclusions

A summary of the results from the conservation packages is provided in Table 20 and 21, for Hillsboro and Beaverton respectively. A scatter plot of the average annual savings and the total cost over the planning period for each package is provided in Figure 40 and Figure 41, for Hillsboro and Beaverton respectively. This information helps provide guidance to Hillsboro and Beaverton staff in determining which packages to implement.

Table 20 - Summary of Conservation Package Results (Hillsboro)

Package	Average Annual Savings		Peak Season Savings (gpd)	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
	(gpd)	% of 2007-2009 Average Demand ¹			
#1a: Conservation Potential Assessment - Rebates	145,000	1.1%	167,000	\$821,000	\$0.74
#1b: Conservation Potential Assessment - Giveaways/Audits	85,000	0.6%	85,000	\$56,000	\$0.09
#2a: Current Conservation Budget - Rebates	22,000	0.2%	26,000	\$149,000	\$0.83
#2b: Current Conservation Budget - Giveaways/Audits	Same as Package #1b.				
#3a: Double Current Conservation Budget - Rebates	44,000	0.3%	53,000	\$297,000	\$0.83
#3b: Double Current Conservation Budget - Giveaways/Audits	Same as Package #1b.				

1. Based on consumption data provided for this project. Note this does not include non-revenue water.

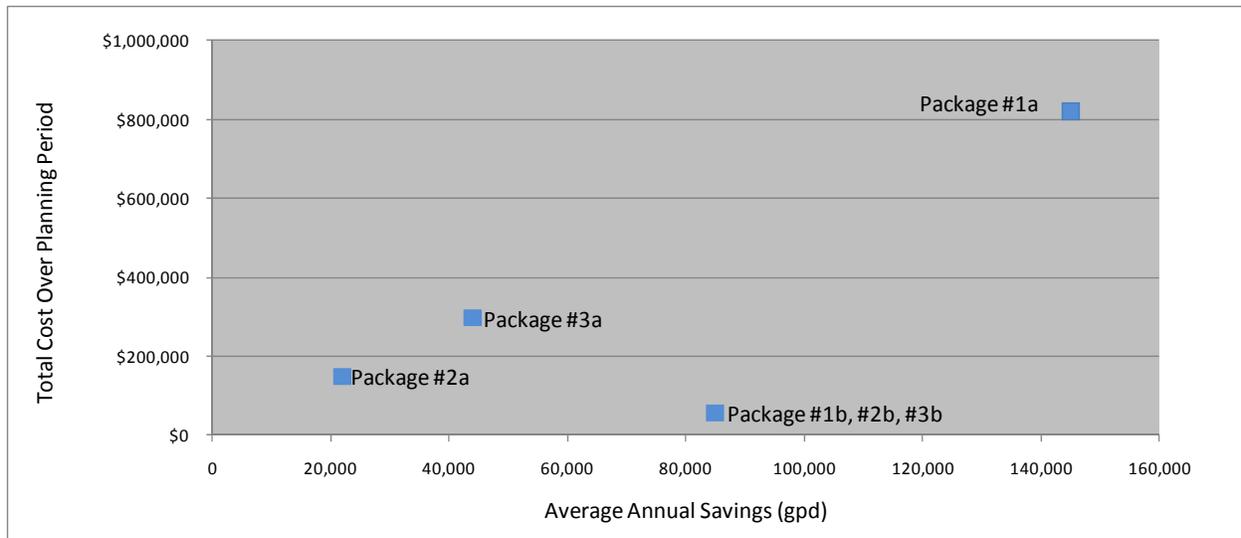


Figure 40 - Comparison of Savings and Costs (Hillsboro)

Table 21 - Summary of Conservation Package Results (Beaverton)

Package	Average Annual Savings		Peak Season Savings (gpd)	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
	(gpd)	% of 2007-2009 Average Demand ¹			
#1a: Conservation Potential Assessment - Rebates	119,000	1.7%	125,000	\$718,000	\$0.80
#1b: Conservation Potential Assessment - Giveaways/Audits	74,000	1.1%	74,000	\$52,000	\$0.09
#2a: Current Conservation Budget - Rebates	7,100	0.1%	7,400	\$60,000	\$0.97
#2b: Current Conservation Budget - Giveaways/Audits	60,000	0.9%	60,000	\$40,000	\$0.09
#3a: Double Current Conservation Budget - Rebates	14,300	0.2%	14,800	\$121,000	\$0.97
#3b: Double Current Conservation Budget - Giveaways/Audits	Same as Package #1b.				

1. Based on consumption data provided for this project. Note this does not include non-revenue water.

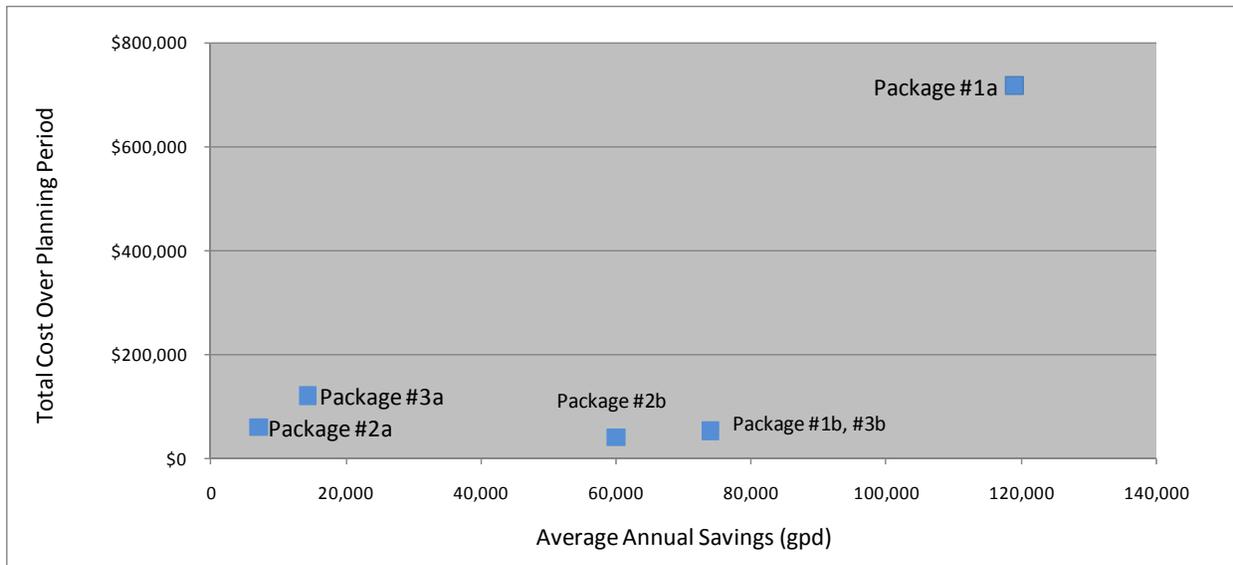


Figure 41 - Comparison of Savings and Costs (Beaverton)

Hillsboro and Beaverton anticipate implementing both a rebate program and a giveaway/audit program.

For both Hillsboro and Beaverton, the choice for the rebate package primarily hinges on how much budget each City is able to allocate to rebates and incentives, due to capital program requirements. The amount of savings is not a significant driver in the decision as to which rebate package to implement since none of the packages save enough water to likely impact the Cities' decisions regarding future water sources. Compared to the 2007-2009 average consumption, the rebate packages save 0.2% to 1.1% for Hillsboro and 0.2% to 1.7% for Beaverton. Based on cost-effectiveness, all three rebate packages for each City would be reasonable to implement since they all have reasonable cost-effectiveness numbers. The cost per ccf of saved water ranges from \$0.74 to \$0.83 for Hillsboro and \$0.80 to \$0.97 for Beaverton. However, taking absolute costs into consideration, Packages #2a and #3a may be more feasible since their costs are much lower than Package #1a. For Hillsboro, Packages #2a and #3a are \$149,000 and \$297,000 respectively, while Package #1a is \$821,000. For Beaverton, Packages #2a and #3a are \$60,000 and \$121,000 respectively, while Package #1a is \$718,000.

For Hillsboro, the choice for the giveaways/audits package is clear. The conservation potential assessment package (Package #1b) is within both the City's current conservation budget and double the City's current conservation budget. Additionally, the cost-effectiveness of that package at \$0.09 per ccf of saved water is very strong. Therefore, implementing Package #1b seems appropriate.

For Beaverton, the choice for the giveaways/audits package primarily hinges on how much budget the City is able to allocate to rebates and incentives. Similar to the rebate packages, the amount of savings is not a significant driver in the decision as to which package to implement. Compared to the 2007-2009 average consumption, the giveaways/audits packages save 0.9% to 1.1%. The conservation potential assessment package (Package #1b) is within double the City's current conservation budget, therefore there is effectively a choice between Packages

#1b and #2b. Based on cost-effectiveness, both packages would be reasonable to implement since they both have the same, strong cost-effectiveness number of \$0.09 per ccf of saved water. However, taking absolute costs into consideration, Package #2b may be more feasible since it costs \$40,000 while Package #1b costs \$52,000.

Table 9 - Analysis Results for All Measures (Hillsboro)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	2,694	2,694	2,694	41,488	41,488	258,119	\$134,700	\$0.52
Clotheswashers - Efficient Res. Capacity (In Unit)	MF	Year Round	Hardware	MF Households	844	844	844	12,998	12,998	80,866	\$42,200	\$0.52
Clotheswashers - Efficient Res. Capacity (Common Area)	MF	Year Round	Hardware	MF Households	844	844	169	12,998	12,998	80,866	\$8,440	\$0.10
Clotheswashers - Efficient Comm. Capacity	NR	Year Round	Hardware	NR Accounts	3	3	36	4,032	4,032	25,085	\$9,000	\$0.36
Faucets - 0.5 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	1,888	1,416	4,720	14,443	14,443	133,909	\$4,720	\$0.04
Faucets - 0.5 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	1,085	814	1,628	5,372	5,372	49,794	\$1,630	\$0.03
Faucets - 1.0 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	4,721	3,541	11,803	27,271	27,271	252,818	\$11,800	\$0.05
Faucets - 1.0 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	2,712	2,034	4,068	10,170	10,170	94,290	\$4,070	\$0.04
Showerhead 2.0 gpm	SF	Year Round	Hardware	SF Households	4,721	3,541	9,442	21,605	21,605	150,220	\$28,330	\$0.19
Showerhead 2.0 gpm	MF	Year Round	Hardware	MF Households	2,712	2,034	4,068	12,410	12,410	86,295	\$12,200	\$0.14
Showerhead 2.0 gpm	NR	Year Round	Hardware	NR Accounts	21	16	210	3,520	3,520	24,094	\$630	\$0.03
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	1,888	1,888	4,342	22,847	22,847	264,784	\$325,680	\$1.23
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	1,085	1,085	1,953	13,130	13,130	152,167	\$146,480	\$0.96
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	168	168	1,868	11,827	11,827	137,068	\$140,100	\$1.02
Urinals - 0.5 gpf Models	NR	Year Round	Hardware	NR Accounts	335	335	1,862	7,437	7,437	68,951	\$186,240	\$2.70
Irrigation Controllers - ET Model	SF	Peak Only	Hardware	SF Households	963	963	963	11,393	17,089	52,812	\$192,600	\$3.65
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	21	21	21	3,032	6,064	14,055	\$4,200	\$0.30
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	95	95	95	26,454	45,350	122,633	\$19,000	\$0.15
Outdoor Audit	SF	Peak Only	Behavior	SF Households	980	245	1,960	2,898	4,348	13,436	\$490,000	\$36.47
Outdoor Audit	MF	Peak Only	Behavior	MF Accounts	21	5	42	722	1,444	3,514	\$10,500	\$2.99
Outdoor Audit	NR	Peak Only	Behavior	NR Accounts	96	24	192	6,683	11,457	30,981	\$192,000	\$6.20
Toilets - Leak Detection	SF	Year Round	Behavior	SF Households	864	432	182,400	9,029	9,029	35,160	\$23,783	\$0.68
Toilets - Leak Detection	MF	Year Round	Behavior	MF Households	502	251	18,083	5,246	5,246	20,429	\$9,114	\$0.45
Faucets - 1.5 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	4,721	3,541	11,803	18,413	18,413	170,704	\$11,800	\$0.07
Faucets - 1.5 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	2,712	2,034	4,068	7,322	7,322	67,889	\$4,070	\$0.06
Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	4,721	3,541	9,442	38,951	38,951	270,828	\$28,330	\$0.10
Showerhead 1.5 gpm	MF	Year Round	Hardware	MF Households	2,712	2,034	4,068	22,374	22,374	155,579	\$12,200	\$0.08
Showerhead 1.5 gpm	NR	Year Round	Hardware	NR Accounts	21	16	210	6,400	6,400	43,807	\$630	\$0.01
Spray Valves - 1.25 gpm Pre-Rinse Spray Valve	NR	Year Round	Hardware	NR Accounts	59	59	177	6,974	6,974	32,328	\$23,020	\$0.71
Indoor Audit - Faucets - 1.0 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	189	189	473	1,456	1,456	13,495	\$3,070	\$0.23
Indoor Audit - Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	189	189	378	2,079	2,079	14,456	\$3,020	\$0.21
Indoor Audit - Toilets - Leak Detection	SF	Year Round	Behavior	SF Households	190	19	437	397	397	1,841	\$3,060	\$1.66

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 10 - Analysis Results for All Measures (Beaverton)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	2,650	2,650	2,650	37,369	37,369	232,492	\$132,500	\$0.57
Clotheswashers - Efficient Res. Capacity (In Unit)	MF	Year Round	Hardware	MF Households	1,042	1,042	1,042	14,694	14,694	91,418	\$52,100	\$0.57
Clotheswashers - Efficient Res. Capacity (Common Area)	MF	Year Round	Hardware	MF Households	1,042	1,042	208	14,694	14,694	91,418	\$10,420	\$0.11
Clotheswashers - Efficient Comm. Capacity	NR	Year Round	Hardware	NR Accounts	4	4	48	5,376	5,376	33,447	\$12,000	\$0.36
Faucets - 0.5 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	1,545	1,159	3,863	10,780	10,780	99,927	\$3,860	\$0.04
Faucets - 0.5 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	1,355	1,016	2,033	6,096	6,096	56,532	\$2,030	\$0.04
Faucets - 1.0 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	3,862	2,897	9,655	20,279	20,279	187,982	\$9,660	\$0.05
Faucets - 1.0 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	3,387	2,540	5,081	11,433	11,433	106,015	\$5,080	\$0.05
Showerhead 2.0 gpm	SF	Year Round	Hardware	SF Households	3,862	2,897	7,724	15,937	15,937	110,803	\$23,170	\$0.21
Showerhead 2.0 gpm	MF	Year Round	Hardware	MF Households	3,387	2,540	5,081	13,973	13,973	97,175	\$15,240	\$0.16
Showerhead 2.0 gpm	NR	Year Round	Hardware	NR Accounts	22	17	220	3,740	3,740	25,241	\$660	\$0.03
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	1,545	1,545	3,554	16,995	16,995	196,959	\$266,510	\$1.35
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	1,355	1,355	2,439	14,905	14,905	172,738	\$182,930	\$1.06
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	175	175	433	2,748	2,748	31,844	\$32,510	\$1.02
Urinals - 0.5 gpf Models	NR	Year Round	Hardware	NR Accounts	350	350	433	1,750	1,750	16,225	\$43,350	\$2.67
Irrigation Controllers - ET Model	SF	Peak Only	Hardware	SF Households	767	767	767	5,905	10,122	27,372	\$153,400	\$5.60
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	104	104	104	6,244	8,326	28,946	\$20,800	\$0.72
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	99	99	99	11,663	15,550	54,064	\$19,800	\$0.37
Outdoor Audit	SF	Peak Only	Behavior	SF Households	776	194	1,552	1,493	2,560	6,923	\$388,000	\$56.04
Outdoor Audit	MF	Peak Only	Behavior	MF Accounts	105	26	210	1,561	2,081	7,306	\$52,500	\$7.19
Outdoor Audit	NR	Peak Only	Behavior	NR Accounts	99	25	198	2,945	3,927	13,516	\$198,000	\$14.65
Toilets - Leak Detection	SF	Year Round	Behavior	SF Households	734	367	149,237	7,010	7,010	27,298	\$19,486	\$0.71
Toilets - Leak Detection	MF	Year Round	Behavior	MF Households	644	322	23,182	6,151	6,151	23,950	\$11,400	\$0.48
Faucets - 1.5 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	3,862	2,897	9,655	13,906	13,906	128,902	\$9,660	\$0.07
Faucets - 1.5 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	3,387	2,540	5,081	8,385	8,385	77,753	\$5,080	\$0.07
Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	3,862	2,897	7,724	28,970	28,970	201,409	\$23,170	\$0.12
Showerhead 1.5 gpm	MF	Year Round	Hardware	MF Households	3,387	2,540	5,081	25,400	25,400	176,637	\$15,240	\$0.09
Showerhead 1.5 gpm	NR	Year Round	Hardware	NR Accounts	22	17	220	6,800	6,800	45,893	\$660	\$0.01
Spray Valves - 1.25 gpm Pre-Rinse Spray Valve	NR	Year Round	Hardware	NR Accounts	62	62	186	7,328	7,328	33,972	\$24,180	\$0.71
Indoor Audit - Faucets - 1.0 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	154	154	385	1,078	1,078	9,995	\$2,500	\$0.25
Indoor Audit - Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	154	154	308	1,540	1,540	10,708	\$2,460	\$0.23
Indoor Audit - Toilets - Leak Detection	SF	Year Round	Behavior	SF Households	154	15	354	287	287	1,364	\$2,480	\$1.82

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 11 - Analysis Results for Package #1a: Conservation Potential Assessment - Rebates (Hillsboro)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	2,694	2,694	2,694	41,488	41,488	258,119	\$134,700	\$0.52
Clotheswashers - Efficient Res. Capacity (In Unit)	MF	Year Round	Hardware	MF Households	844	844	844	12,998	12,998	80,866	\$42,200	\$0.52
Clotheswashers - Efficient Res. Capacity (Common Area)	MF	Year Round	Hardware	MF Households	844	844	169	12,998	12,998	80,866	\$8,440	\$0.10
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	1,888	1,888	4,342	22,847	22,847	264,784	\$325,680	\$1.23
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	1,085	1,085	1,953	13,130	13,130	152,167	\$146,480	\$0.96
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	168	168	1,868	11,827	11,827	137,068	\$140,100	\$1.02
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	21	21	21	3,032	6,064	14,055	\$4,200	\$0.30
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	95	95	95	26,454	45,350	122,633	\$19,000	\$0.15
Total					N/A	N/A	N/A	144,773	166,701	1,110,557	\$820,800	\$0.74

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 12 - Analysis Results for Package #1a: Conservation Potential Assessment - Rebates (Beaverton)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	2,650	2,650	2,650	37,369	37,369	232,492	\$132,500	\$0.57
Clotheswashers - Efficient Res. Capacity (In Unit)	MF	Year Round	Hardware	MF Households	1,042	1,042	1,042	14,694	14,694	91,418	\$52,100	\$0.57
Clotheswashers - Efficient Res. Capacity (Common Area)	MF	Year Round	Hardware	MF Households	1,042	1,042	208	14,694	14,694	91,418	\$10,420	\$0.11
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	1,545	1,545	3,554	16,995	16,995	196,959	\$266,510	\$1.35
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	1,355	1,355	2,439	14,905	14,905	172,738	\$182,930	\$1.06
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	175	175	433	2,748	2,748	31,844	\$32,510	\$1.02
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	104	104	104	6,244	8,326	28,946	\$20,800	\$0.72
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	99	99	99	11,663	15,550	54,064	\$19,800	\$0.37
Total					N/A	N/A	N/A	119,310	125,279	899,879	\$717,570	\$0.80

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 13 - Analysis Results for Package #1b: Conservation Potential Assessment - Giveaways/Audits (Hillsboro)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Faucets - 0.5 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	1,888	1,416	4,720	14,443	14,443	133,909	\$4,720	\$0.04
Faucets - 0.5 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	1,085	814	1,628	5,372	5,372	49,794	\$1,630	\$0.03
Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	4,721	3,541	9,442	38,951	38,951	270,828	\$28,330	\$0.10
Showerhead 1.5 gpm	MF	Year Round	Hardware	MF Households	2,712	2,034	4,068	22,374	22,374	155,579	\$12,200	\$0.08
Indoor Audit - Faucets - 1.0 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	189	189	473	1,456	1,456	13,495	\$3,070	\$0.23
Indoor Audit - Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	189	189	378	2,079	2,079	14,456	\$3,020	\$0.21
Indoor Audit - Toilets - Leak Detection	SF	Year Round	Behavior	SF Households	190	19	437	397	397	1,841	\$3,060	\$1.66
Total					N/A	N/A	N/A	85,072	85,072	639,902	\$56,030	\$0.09

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 14 - Analysis Results for Package #1b: Conservation Potential Assessment - Giveaways/Audits (Beaverton)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Faucets - 0.5 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	1,545	1,159	3,863	10,780	10,780	99,927	\$3,860	\$0.04
Faucets - 0.5 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	1,355	1,016	2,033	6,096	6,096	56,532	\$2,030	\$0.04
Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	3,862	2,897	7,724	28,970	28,970	201,409	\$23,170	\$0.12
Showerhead 1.5 gpm	MF	Year Round	Hardware	MF Households	3,387	2,540	5,081	25,400	25,400	176,637	\$15,240	\$0.09
Indoor Audit - Faucets - 1.0 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	154	154	385	1,078	1,078	9,995	\$2,500	\$0.25
Indoor Audit - Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	154	154	308	1,540	1,540	10,708	\$2,460	\$0.23
Indoor Audit - Toilets - Leak Detection	SF	Year Round	Behavior	SF Households	154	15	354	287	287	1,364	\$2,480	\$1.82
Total					N/A	N/A	N/A	74,151	74,151	556,572	\$51,740	\$0.09

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 15 - Analysis Results for Package #2a: Current Conservation Budget - Rebates (Hillsboro)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	431	431	431	6,637	6,637	41,295	\$21,550	\$0.52
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	378	378	869	4,574	4,574	53,013	\$65,210	\$1.23
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	217	217	391	2,626	2,626	30,433	\$29,300	\$0.96
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	34	34	378	2,394	2,394	27,740	\$28,350	\$1.02
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	4	4	4	578	1,155	2,677	\$800	\$0.30
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	19	19	19	5,291	9,070	24,527	\$3,800	\$0.15
Total					N/A	N/A	N/A	22,100	26,456	179,685	\$149,010	\$0.83

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 16 - Analysis Results for Package #2a: Current Conservation Budget - Rebates (Beaverton)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	212	212	212	2,989	2,989	18,599	\$10,600	\$0.57
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	154	154	354	1,694	1,694	19,632	\$26,570	\$1.35
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	135	135	243	1,485	1,485	17,210	\$18,230	\$1.06
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	17	17	42	267	267	3,093	\$3,160	\$1.02
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	4	4	4	240	320	1,113	\$800	\$0.72
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	4	4	4	471	628	2,184	\$800	\$0.37
Total					N/A	N/A	N/A	7,147	7,384	61,833	\$60,160	\$0.97

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 17 - Analysis Results for Package #2b: Current Conservation Budget - Giveaways/Audits (Beaverton)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Faucets - 0.5 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	1,236	927	3,090	8,622	8,622	79,941	\$3,090	\$0.04
Faucets - 0.5 gpm Bathroom Aerators	MF	Year Round	Hardware	MF Households	1,084	813	1,626	4,878	4,878	45,226	\$1,630	\$0.04
Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	3,167	2,375	6,334	23,750	23,750	165,164	\$19,000	\$0.12
Showerhead 1.5 gpm	MF	Year Round	Hardware	MF Households	2,778	2,084	4,167	20,840	20,840	144,877	\$12,500	\$0.09
Indoor Audit - Faucets - 1.0 gpm Bathroom Aerators	SF	Year Round	Hardware	SF Households	77	77	193	539	539	4,997	\$1,250	\$0.25
Indoor Audit - Showerhead 1.5 gpm	SF	Year Round	Hardware	SF Households	77	77	154	770	770	5,354	\$1,230	\$0.23
Indoor Audit - Toilets - Leak Detection	SF	Year Round	Behavior	SF Households	76	8	175	153	153	673	\$1,220	\$1.81
Total					N/A	N/A	N/A	59,552	59,552	446,233	\$39,920	\$0.09

Table 18 - Analysis Results for Package #3a: Double Current Conservation Budget - Rebates (Hillsboro)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	862	862	862	13,275	13,275	82,590	\$43,100	\$0.52
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	755	755	1,737	9,137	9,137	105,885	\$130,240	\$1.23
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	434	434	781	5,252	5,252	60,867	\$58,590	\$0.96
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	67	67	745	4,717	4,717	54,664	\$55,870	\$1.02
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	8	8	8	1,155	2,310	5,354	\$1,600	\$0.30
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	38	38	38	10,582	18,140	49,053	\$7,600	\$0.15
Total					N/A	N/A	N/A	44,117	52,830	358,414	\$297,000	\$0.83

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.

Table 19 - Analysis Results for Package #3a: Double Current Conservation Budget - Rebates (Beaverton)

Conservation Measure	Sector	Seasonality	Hardware vs Behavior	Customer Definition	PARTICIPATION			SAVINGS			COSTS	
					All Customers			Savings For All Customers At Full Implementation (gpd)		Savings For All Customers Over Measure Life	Total Cost Over Planning Period	Cost per CCF Saved Over Measure Life
					Participating Customers	Savings Generating Customers	Devices / Rebates / Audits	Annual Average	Peak Season	CCF 1		
Clotheswashers - Efficient Res. Capacity (In Unit)	SF	Year Round	Hardware	SF Households	424	424	424	5,979	5,979	37,199	\$21,200	\$0.57
Toilets - 1.28 gpf High Efficiency Toilets (HET)	SF	Year Round	Hardware	SF Households	309	309	711	3,399	3,399	39,392	\$53,300	\$1.35
Toilets - 1.28 gpf High Efficiency Toilets (HET)	MF	Year Round	Hardware	MF Households	271	271	488	2,981	2,981	34,548	\$36,590	\$1.06
Toilets - 1.28 gpf High Efficiency Toilets (HET)	NR	Year Round	Hardware	NR Accounts	35	35	87	550	550	6,369	\$6,500	\$1.02
Irrigation Controllers - ET Model	MF	Peak Only	Hardware	MF Accounts	8	8	8	480	640	2,227	\$1,600	\$0.72
Irrigation Controllers - ET Model	NR	Peak Only	Hardware	NR Accounts	8	8	8	942	1,257	4,369	\$1,600	\$0.37
Total					N/A	N/A	N/A	14,331	14,806	124,102	\$120,790	\$0.97

SF – Single Family, MF – Multifamily, NR – Non-Residential

1. Savings from free riders have been omitted from this column, since this number is used in the cost-effectiveness calculation.