

## ***BEST PRACTICE 12: High-Efficiency Fixture and Appliance Replacement for Residential and Non-Residential Sectors***

- Programmatic, regulatory, and customer support best practice (utility perspective)
- Customer side best practice - implemented by water customers with support from water utilities
- Customer participation – action by customers required for successful implementation

### **Overview**

The goal of this best practice is to increase the installation rate of water efficient fixtures and appliances and to remove inefficient and wasteful devices from the service area in favor of efficient products. Various means are used to spur customers into replacing products. In some programs, customers are simply given hardware that is more water efficient. Faucet and showerhead replacement programs often adopt this tactic. Rebates and vouchers are also important tools for coaxing customers to replace devices with more water efficient models. For the commercial sector more generalized incentives may be appropriate as fixtures and equipment vary from site to site.

A “retrofit on reconnect” ordinance may be the most effective and least-cost implementation method for accelerating installation of efficient fixtures and appliances. There are a variety of ways this type of ordinance can be written and implemented, but the general concept is that when a property is sold or changes hands, the new owners or occupants must sign up for water service – i.e. reconnect to the system. As a condition of providing water service to the property, the water provider can require that designated fixtures and appliances be upgraded to meet current plumbing code and efficiency standards.

Programs relying on rebates or vouchers must carefully assess the economic trade offs in order to maximize benefits. Incentives are best targeted to customers with high demand who would be unlikely to take action in absence of an incentive. Incentive programs must also guard against customers who would purchase new fixtures or appliances regardless of the financial incentives (i.e. free riders).

Water utilities should maintain lists of equipment eligible for incentive programs. These lists might include hundreds of makes and models. One way to streamline this process is to rely on the EPA’s WaterSense labeled products. These products are intended to use at least 20% less water than conventional devices.

### ***Why a Best Practice?***

Indoor water use in Colorado presents a significant ongoing opportunity for water savings. High efficiency fixtures and appliances result in long-term demand reductions. Replacement and incentive programs speed the adoption of high efficiency devices.

### ***State Planning Requirements***

Colorado statute requires that all covered entities (water providers that deliver more than 2,000 acre-feet per year) file a water conservation plan with the Colorado Water Conservation Board

(CWCB). Entities that do not have an approved plan on file are not eligible to receive grant funding from the State. Under this statute, utilities must consider incentives to implement water conservation techniques, including rebates to customers [CRS 37-60-126 (4)(a)(1 and X)].

### **Applicability**

This best practice is a reasonable option for water utilities with available storage and/or groundwater resources. Utilities that rely on direct flow water rights and have limited storage would be better advised to focus on consumptive use reductions.

The age of homes and commercial facilities in a service area should be taken into consideration. Older buildings tend to have older fixtures and older fixtures tend to be less water efficient. Utilities with significant numbers of older homes (before 1994) might find properly targeted incentive programs particularly useful in curbing demand.

### **Implementation**

Fixture or appliance replacement and incentive programs should have the following components (Vickers 2001):

- Targeting customers with high-water using fixtures.
- Program economic and financial planning including setting reasonable rebate rates.
- Marketing and outreach campaigns reaching target audience.
- Installation guidance or assistance.
- Purchasing information such as toilets that qualify for replacement rebates.
- Rebate application forms.
- A convenient, efficient inspection procedure.
- Payment processing.
- Program monitoring and reporting.
- Relationships with retailers and plumbers.

While many of these components are self explanatory, several deserve further expansion.

### **Targeting**

As with most best practices, targeting incentives to the right customers is essential for success. Retrofits have the greatest impact when exchanging inefficient fixtures and appliances with modern water efficient devices.

As plumbing codes evolve, new fixtures are mandated to be more efficient than older devices. For targeting, it is often assumed that older buildings will have older inefficient fixtures and appliances. The age of a building can be determined from tax assessor records or possibly from the account start date in a utility billing system. This provides water utilities a parameter for targeting program participants. Homes or facilities built after 1994 will likely have toilets, faucets, and showerheads that comply with the 1992 EPA Act, which stipulates 1.6 gallons-per-flush toilets, and sets flow limits on faucets and showerheads.

Incentive program costs also highlight the need for targeting. Targeting helps a utility maximize water savings and benefits.

The City of Greeley used their customer billing database and their geographical information system (GIS) to target regions of the city that might benefit from participation in a toilet retrofit program. Using the historic billing data, the average annual indoor use was calculated for each property and daily per capita use was estimated using average household size data from the US Census. Then the GIS was used to map regions of average, above average, and below average water use as shown in Figure 4-18. Areas with above average indoor use are shown in red. These areas represent the best opportunities for indoor conservation including toilet retrofits. This is the type of targeting effort that can significantly improve results from a water conservation program focused on indoor use reductions.

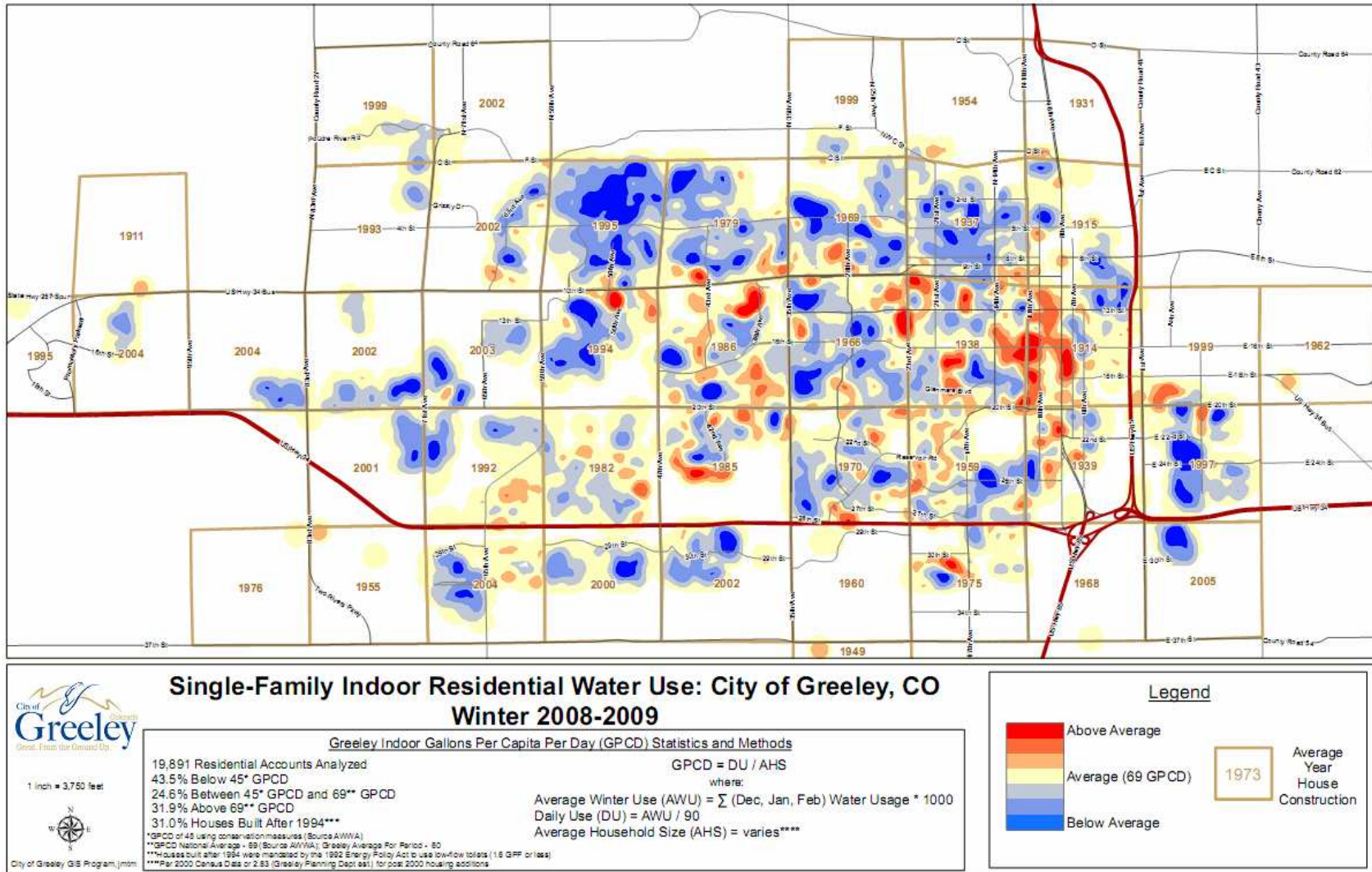


Figure 4-18: Greeley “toilet map” which identifies varying levels of indoor water use across the service area.

### ***Economic and Financial Planning***

Evaluating costs and benefits is a key component to creating cost-effective incentive programs. The value of an incentive must be high enough to motivate the customer to replace a fixture or appliance, but given a finite program budget, the incentive value should be minimized to allow greater participation and to ensure cost-effective savings.

Some customers are willing to replace devices without an incentive but they apply for a utility incentive anyway. These customers tap funds that would otherwise go to customers who require a financial incentive to improve water efficiency.

Determining the proper incentive level is an important consideration in program design. As a basic rule of thumb, incentive values should be based on the value of the anticipated water savings to be achieved by the retrofit. Utilities can use the avoided cost of new water supply to help set incentive values. Because of the natural replacement of fixture and appliances, incentive programs only offer accelerated water savings that will likely be achieved without incentive at some future date. This reduces the cost-effectiveness of incentive programs.

Desired replacement rate may also be a factor in setting values for incentives. For a more aggressive replacement program, rebates may be set rather high to drive customers to replace devices before the end of their useful life.

The California Urban Water Conservation Council has extensive resources on a wide array of water conservation measures, including incentive programs. In addition, their *BMP Costs & Savings Study*, which is out of print but can be found online in electronic form, has several extended discussions of cost-benefit analysis for incentive programs. One place to start is [www.cuwcc.org/resource-center/technical-resources/bmp-tools.aspx](http://www.cuwcc.org/resource-center/technical-resources/bmp-tools.aspx).

### ***Retrofit on Reconnect Ordinance***

For utilities, a “retrofit on reconnect” ordinance may be the most effective and least-cost implementation method for accelerating installation of efficient fixtures and appliances. However, customers will bear the brunt of costs. There are a variety of ways this type of ordinance can be written and implemented, but the general concept is that when a property is sold or changes hands, the new owners or occupants must sign up for water service – i.e. reconnect to the system. As a condition of providing water service to the property, the water provider can require that designated fixtures and appliances be upgraded to meet current plumbing code and efficiency standards.

The new account holder would then be given a fixed amount of time (several weeks to a month) to complete the necessary fixture and appliance upgrades. Once completed an inspection should occur to verify that all requirements have been met. Those who fail to comply with the ordinance in a timely manner could be fined and/or penalized. The water provider may also choose to offer financial incentives to assist customers in making the required upgrades, thus “softening” the financial impact of the regulations.

The State of California recently passed a retrofit on reconnect ordinance that was described by the Alliance for Water Efficiency as follows:

*If you buy a home, condo, or commercial property in California in the coming years water efficient toilets and urinals will be part of the deal – like it or not. Under new legislation passed in October 2009 and signed into law by Governor Arnold Schwarzenegger toilets and urinals across the state must be meet efficiency standards as a condition of receiving a certificate of occupancy.*

*According to California’s legislative bill-tracking website, “The bill would require, on and after January 1, 2017, that a seller or transferor of single-family residential real property, multi-family residential real property, or commercial real property disclose to a purchaser or transferee, in writing, specified requirements for replacing plumbing fixtures, and whether the real property includes noncompliant plumbing.”*

*“The bill would permit an owner or the owner's agent to enter rental property for the purpose of installing, repairing, testing, and maintaining water-conserving plumbing fixtures, as specified,” according to posted information, “and would require, on and after January 1, 2019, that the water-conserving plumbing fixtures prescribed by the bill operate at the manufacturer's rated water consumption at the time that a tenant takes possession, as specified.”*

*This bill represents a tremendous leap forward in plumbing retrofit policy in the United States. If other states adopt similar legislation, adoption of efficient plumbing fixtures could occur even more rapidly than anticipated.*

*(Alliance for Water Efficiency from: [www.allianceforwaterefficiency.org/water-efficiency-watch-oct-nov-2009.aspx](http://www.allianceforwaterefficiency.org/water-efficiency-watch-oct-nov-2009.aspx))*

A copy of the California retrofit on resale ordinance is provided in Appendix B.

### ***Recommended Domestic Fixture Replacement Specifications***

The following fixture and appliance minimum specifications are recommended for utility incentive programs. Requiring WaterSense labeled equipment wherever possible eases specification requirements and helps ensure water savings and performance.

- **Toilets -- Residential** - Replacing a 3.5 gpf toilet with a WaterSense labeled toilet can save 40,000 gal/household annually (EPA 2010).
  - **Recommended replacement:** WaterSense labeled high efficiency toilets rated at 1.28 gpf.
  
- **Toilets -- Commercial** - WaterSense labeled tank-type toilets and flushometer toilets are available for specification.
  - **Recommended replacement for Flushometer-style toilets:** WaterSense labeled fixtures rated at 1.28 gpf or less. Bowls must be matched to valves.

- **Recommended replacement for tank toilets:** WaterSense labeled high efficiency toilets rated at 1.28 gpf.
- **Recommended replacement for pressure assist toilets:** WaterSense labeled 1.0 gpf pressure assist toilets.
- **Urinals – Commercial** – WaterSense labeled urinals are available for specification. Replacing a 1.5 gpf urinal with a WaterSense urinal can save an estimate 4,600 gallons annually (EPA 2010).
  - **Recommended replacement:** WaterSense labeled urinals that use 0.5 gpf or less.
- **Clothes washers – Residential and Light Commercial** - High efficiency clothes washers can cut water use in half (or better) and reduce energy use by 30%.
  - **Recommended replacement:** EnergySTAR rated, Consortium for Energy Efficiency Tier 3 washers with Water Factor < 4.0.
- **Faucet aerators – Residential or Commercial** - WaterSense labeled aerators can reduce flow by 30% or more. Aerators are inexpensive and often achieve economical savings.
  - **Recommended replacement – kitchen:** 2.2 gpm aerators.
  - **Recommended replacement – bathroom:** 0.5 gpm aerators are mandated by federal code in commercial settings and are also appropriate for residential applications. WaterSense labeled fixtures recommended.
- **Showerheads – Residential or Commercial** - WaterSense labeled showerheads rated at 2.0 gpm. There are also showerheads with even lower flow rates.
  - **Recommended Replacement:** 2.0 gpm WaterSense labeled showerheads or better.

## Water Savings and Other Benefits

### ***Range of Likely Water Savings: Varies***

The water savings achieved through domestic fixture replacement are achieved by accelerating the installation date over what would have “naturally” occurred at some later date. When incorporating domestic fixture replacement into demand forecasts it is important not to double count natural conservation savings.

Full retrofit of toilets, clothes washers, showerheads, and faucets in single-family residences has been shown to reduce indoor demand by approximately 30% to between 35 and 40 gpcd (Aquacraft 2001, 2003, 2004). Additional indoor savings may be possible in the future, but at this time this level of demand appears to be a reasonable and achievable minimum.

The savings that can be achieved in the non-residential sector through the replacement of domestic fixtures (as described above) and through specialized equipment (described in more detail in Best Practice 14) are substantial, but less definitively quantified because of the variability inherent in non-residential demand. The *WaterSmart Guidebook – A Water Use Efficiency Plan Review Guide for New Businesses* guide offers reasonable estimates of water savings that can be achieved in a wide variety of non-residential settings. This guidebook is



available for free and can be downloaded as a PDF from the Alliance for Water Efficiency: [www.allianceforwaterefficiency.org/WaterSmart\\_Guidebook\\_for\\_Businesses.aspx](http://www.allianceforwaterefficiency.org/WaterSmart_Guidebook_for_Businesses.aspx)

The Alliance for Water Conservation Tracking Tool, available for free to members of AWE, can also be used to estimate water savings from domestic fixture replacement (AWE 2009).

### ***How to Determine Savings***

Savings can be estimated by tracking incentive-based fixture replacements and using published estimates of per fixture water savings. Savings should be assumed for the useful life of the fixture, but if forecasts include savings from natural replacement, care must be taken to avoid double counting. Savings can also be measured through a pre- and post- comparison of water use using utility billing data.

Penetration rate is an important parameter in assessing replacement programs. It is best thought of as the fraction of customers in a population that have a given device. Tracking penetration rate helps utilities determine how many low-efficiency devices remain in their service population.

### ***Savings Assumptions and Caveats***

The water savings achieved through domestic fixture replacement are achieved (in many cases) by accelerating the installation date over what would have “naturally” occurred at some later date. When incorporating domestic fixture replacement into demand forecasts it is important not to double count natural conservation savings.

The level of water savings that can be achieved through fixture and appliance replacement depends on the efficiency and utilization of the old fixtures as well as the new fixtures. Replacing a 5 gpf toilet with a 1.28 HET offers more savings than replacing a 1.6 gpf toilet with an HET.

Another caveat on water savings from fixture replacement is making sure the replacement actually happens. Simply providing a customer with an aerator or a food service pre-rinse spray valve does not guarantee installation or water savings. If these savings are to be relied upon, it is important to verify installation through an inspection or through a direct installation process. Large installation programs may choose to verify installation on only a sample of customers.

### ***Other Benefits***

In the case of devices that use hot water, energy savings are an additional benefit of water conservation. Showerheads, clothes washers, pre-rinse spray valves, faucets, and dishwashers all use hot water. Energy savings often make the return on investment for the conservation measure more attractive. Customers billed for wastewater based on consumption of water will also see a reduction in their wastewater bill.

## **Costs**

### ***Utility Costs***

The face value of the incentive offered is only one part of costs related to a device replacement program. Programs can have overhead costs that range up to \$100,000 for a large utility



program. Processing costs add \$7 to \$35 per rebate or voucher. Requiring an inspection (a sound idea) also increases costs. The high overhead costs necessitate large volumes of device replacement over several years. Overhead and startup costs come from marketing materials, setting up tracking systems and banking procedures (Alliance for Water Efficiency 2010).

### ***Customer Costs***

While incentives offset some customer costs, replacing fixtures and appliances can be expensive and often limits participation from lower income customers. For residential toilets installed costs range from \$200 - \$500. Commercial toilets and urinals typically cost an additional \$100 - \$200 per fixture. Clothes washers typically range from \$450 - \$1000 installed. Showerheads range from \$15 - \$100 per fixture installed. Faucet aerators can be purchased in bulk for \$1 - \$3 each and installation can often be accomplished in conjunction with other measures. Costs for non-residential fixtures and equipment such as pre-rinse spray valves, cooling tower upgrades, air-cooled ice machines, and commercial clothes washers and dishwashers are variable and must be evaluated individually.

When considering the merits of a rebate or voucher program, utilities may wish to consider the potential cost for the customer of “floating” the entire purchase price up front. This happens with rebate programs but not voucher programs. With rebates, customers have to pay full price for the device replacement, but they see a financial return from the rebate (often in the form of a credit applicable to future water bills). Paying full price may be particularly burdensome for low-income customers. On the other hand, with voucher programs utilities pay the retailer an amount for every voucher collected from customers as part of sales. This forces retailers to float some of the costs of the replacement devices (Alliance for Water Efficiency 2010).

## **Resources and Examples**

### ***Resources***

The American Water Works Association has conservation case studies, including rebate programs. These can be found at:

[www.awwa.org/waterwiser/education/casestudies.cfm?showLogin=N](http://www.awwa.org/waterwiser/education/casestudies.cfm?showLogin=N).

AWWA also has links to rebate programs from different water utilities around the country. These may provide useful examples. And they can be found at:

[www.awwa.org/WaterWiser/links/index.cfm?LinkCategoryID=34&navItemNumber=3369&showLogin=N](http://www.awwa.org/WaterWiser/links/index.cfm?LinkCategoryID=34&navItemNumber=3369&showLogin=N).

Energy savings can come from water savings if the water used is heated. As a result, some energy efficiency programs overlap with water conservation programs. The Data base of State Incentives for Renewables and Energy Efficiency provides comprehensive lists of energy rebates, some of which may also apply to water conserving devices. DSIRE’s Colorado-specific page can be found at:

[www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=CO](http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=CO).

Keeping lists of water efficiency fixtures and appliances up to date can be daunting. However, the EPA’s WaterSense program lists different fixtures that qualify for the WaterSense label.

Products bearing the WaterSense label have passed third-party testing that shows water use that is 20% less than conventional fixtures. Info at: [www.epa.gov/WaterSense/products/index.html](http://www.epa.gov/WaterSense/products/index.html).

The *Handbook of Water Use and Conservation* (2001 Amy Vickers) provides a great deal of information on water conservation measures including fixture replacement and retrofit.

The California Urban Water Conservation Council has extensive resources on a wide array of water conservation measures, including rebate programs. In addition, their *BMP Costs & Savings Study*, which is out of print but can be found online in electronic form, has several extended discussions of cost benefit analyses of rebate programs. One place to start is [www.cuwcc.org/resource-center/technical-resources/bmp-tools.aspx](http://www.cuwcc.org/resource-center/technical-resources/bmp-tools.aspx).

## **Examples**

### ***Denver Water***

Denver Water offers rebates on a number of water-saving fixtures and appliances. These rebates are available to Denver Water customers as well as customers of Denver Water's distributors. Rebate programs are tailored to customer type. The residential rebate program offers rebates for various household fixtures, provided that the fixtures are on Denver Water's lists of qualifying models and that the receipt and application are submitted within 90 days of the purchase. Likewise the commercial rebate program rebates only eligible fixtures purchased within the calendar year.

Residential rebates, as of 2010, include:

- Clothes washers (\$150 rebate)
- High-efficiency toilets (\$125 rebate)
  - Only listed toilets that use 1.28 gallons per flush or less are eligible; low-flow toilets (1.6 gallons per flush) do not qualify for rebate.
- Wireless rain sensors (\$50 rebate) and rain sensors (\$25 rebate)
- Rotary nozzles (\$5 rebate, minimum purchase is four)
- Weather-based smart controllers (25% of purchase price)

Commercial rebates for domestic fixtures, 2010, include:

- Commercial High-Efficiency Toilet Rebate (\$125)
- Flushometer Bowl and Valve Combination Rebate
  - \$125 for 1.28 gallon per flush HET
  - \$60 - \$75 rebates for 1.6 gallon per flush valve and bowl combinations.
- High-Efficiency Urinal Rebate (\$50). Must flush using 0.5 gallons or less.
- Urinal Half-Gallon per Flush Retrofit Rebate (\$25)

More information can be found from Denver Water's website at:


[www.denverwater.org/Conservation/Rebates/](http://www.denverwater.org/Conservation/Rebates/).

### ***City of Westminster***

The City of Westminster Water Department has a rebate program for toilets. Rebates are \$25 for 1.6 gallon per flush toilets and \$100 for 1.3 gallon per flush toilets. To identify qualifying toilets, Westminster directs potential applicants to the EPA's WaterSense website for lists of qualifying toilets. Residential as well as non-residential water customers can apply for the rebate, but they must be the property owner, not renters. The rebate is issued as a credit on the water bill, but customers who have common water account, such as those living in condos, will be issued a check. Customers can qualify for up to two rebates per dwelling unit. The old toilets are to be disposed of in the customer's trash. A screen capture of the rebate application form is shown in Figure 4-19. Information on the program may be found in the environment section of Westminster's website at: [www.ci.westminster.co.us/345.htm](http://www.ci.westminster.co.us/345.htm)


### ***State of California Retrofit on Resale Ordinance***

Full text of the ordinance is provided in Appendix B.



**WESTMINSTER**

Reservation / Application Number:



Support local businesses -  
support local services

**\$25 1.6 GALLON/FLUSH TOILET    \$100 HET TOILET**

**Rebate Reservation Application**

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Number of toilet rebates requested: \_\_\_\_\_

Water Account #. (where toilet is installed):	Application Date:
Name of Applicant:	Social Security # (required for checks)
Address of Applicant:	Unit Number:
Name of HOA or complex:	
City:	State:
Home Phone:	Work Phone:
Address where toilet is installed, if different:	

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**Toilet Information**

Where purchased:	Toilet cost:
Make:	Date purchased:
Model:	
How old is the toilet you are replacing (in years):	
How many toilets are in your home or unit:	How many of your toilets are newer than 1994:

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**Building Information**

Building age in years: \_\_\_\_\_

Type of use (check one):  1 or 2 family home     Multi-family unit     Commercial unit

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**REBATE CONDITIONS:**

- Eligible toilets must be purchased after Nov 1, 2009. The City of Westminster does not guarantee performance or workmanship. Toilets replaced must be older than 1994. Rebates will not be issued for replacing newer toilets or for new toilet installations. Use the age of your building as a guideline for the age of the toilet. **HET toilets must be approved WaterSense toilets on website listed on the other side of this application, or call (303) 658-2188.**
- Rebates will be issued to the customer as a **CREDIT** to the water service account as noted above within 60 days from the approval date. Rebates will be **up to \$25 for 1.6 gallon toilets, \$100 for HE toilets,** or the cost of the new toilet, whichever is less. Tax, labor or delivery charges are not included. Customers are limited to a maximum of 2 toilet rebates per unit. Rebates to customers with common water accounts such as condominiums, and townhomes may be issued as a rebate check. Social Security numbers **must** be provided to receive any rebate check.
- To receive a rebate reservation, mail this application to the address below. Your application will be returned with a reservation number. Next, purchase and install your toilet. Rebates may be applied for without a reservation but are only available as funds permit. After the installation is complete, mail this form, along with your **original dated** receipt, and a copy of your most recent Westminster water bill to: City of Westminster, Rebate Program, 4800 West 92<sup>nd</sup> Avenue, Westminster, Colorado, 80031. If you would like your receipt returned, please include a self-addressed, stamped envelope. You must own the living unit where the new toilet is located. The property must receive a water bill from the City of Westminster. Customers with common water accounts such as condominiums, and townhomes should contact the property manager for a copy of the most recent Westminster water bill. The applicant agrees to an on-site inspection performed on business days, from 8:00 am until 5:00 pm. **Rebates are limited and available on a first come, first served basis. Program expires December 31, 2010 or when funds are exhausted. Old units must be disposed of or recycled. They may not be reused.**

I, the undersigned, have read the above and agree to all rebate conditions. I certify that the toilet listed above has been properly installed at the address and that I own the unit where the new toilet(s) is installed.

Date

Signature of Applicant

**Figure 4-19: Image of Westminster’s rebate application form.**