City of Northglenn
High Efficiency Toilet Giveaway Program
100% Completion Report
June 10, 2009

Grant Recipient: City of Northglenn
11701 Community Center Drive
Northglenn, CO 80233-8061

Contact: Sonja Sjoholm-deHaas, Water Resources Technician
303-450-8782
ssjoholmdehaas@northglenn.org

The City of Northglenn (City) hosted a large scale high efficiency toilet (HET) give-away program on July 26, 2008 in an aggressive effort to continue to conserve water. The City gave away 500 dual flush Caroma HETs to eligible residences that currently use 3.5 gallon per flush (gpf) toilets. It is commonly assumed that toilets account for the majority of indoor water use. With the replacement of 500 high volume toilets with HETs, the City anticipates saving 20-25 acre feet of water annually. This project is estimated to cost less than $80,000. In comparison, the cost to purchase 20 acre feet of water is estimated at $220,000. This 100% Completion Report document is in fulfillment of the Colorado Water Conservation Board's Water Efficiency Grant requirements. A summary of the project status, success of meeting identified goals and objectives, preliminary findings and obstacles, and project modifications are discussed.

**Project Status**

Program advertising began in April. An article was placed in both the *Northglenn Connection* newsletter and in the utility bill. The *Connection* is mailed to every Northglenn household and business, approximately 15,000 copies. The utility bill insert reached 10, 400 households. The local newspaper the Sentinel also picked up the article.

Applications were taken the entire month of May. Citizens could sign up via the City web site, by calling in or completing a paper form. Applications were limited to one per account number, i.e., one per residence. All applications were entered into a web based database. Toilet recipients were chosen from a lottery in a random drawing. Recipient selection took place June 5$^{th}$; notification of winners began on June 6$^{th}$. Email addresses were provided by 327 of the 529 applicants. This allowed City staff to send email notification to these winners, saving considerable expense in staff time and postage. Winners that did not provide an email account were notified via mail.

State Legislation HB 1343 and HJR 1023, effective August 1, 2006, require documentation that proves legal status. As a result, the City required recipients to complete, in person, an affidavit for verification of eligibility for state and local benefits. The original 500 winners had from June 16th through July 11th to complete their

affidavit. Upon completion of the affidavit, lottery winners were given a coupon with their name, address and account number on it. An arrival time was also printed on the coupon. Customers were requested to arrive within the designated time period printed on their coupon. Long wait lines were avoided by spreading out the arrival times. Coupons were printed on security paper and could not be photocopied. These actions improved check-in efficiency and reduced distribution times. Sixteen of the original winners did not complete affidavits by the July 11th deadline. Applicants on the waitlist were contacted and were given until July 23rd to complete the required paperwork. All waitlisted applicants received a toilet.

A committee composed of staff from multiple divisions was formed in May to establish a timeline and identify program tasks and assignments.

Per the grant application, 25 residences were selected to measure pre installation and post HET installation water usage. Care was taken to select only owner occupied residences. A survey was finalized and distributed with an instructional packet. Toilets were delivered July 11th and were stored at the City Maintenance and Operations Facility and were distributed on July 26, 2008.

**Table 1. Project Schedule**

| | | |
|---|---|---|
| Step #1<br>Finalize toilet order and delivery plans from toilet manufacturer | • Negotiate price and delivery plans with toilet manufacturer | February 2008 |
| Step #2<br>Secure staffing and give away location | • Plan Toilet Give Away process<br>• Organize labor<br>• Secure location for Give Away | March 2008 |
| Step #3<br>Marketing | • Start advertising program in Connections Newsletter, Channel 8 TV station, website, mailers to residents, on the water bill, and through press releases to Sentinel, Post, and News. | April-June 2008 |
| Step #4<br>50% Grant Completion Notice to CWCB | • File 50% completion notice to CWCG | July 2008 |
| Step #5<br>Toilet Give Away | • Setup for Give Away | July 2008 |

| | | |
|---|---|---|
| | • Traffic Control<br>• Verify address and citizenship<br>• Load Toilets<br>• Hand out surveys | |
| Step #6<br>Collect and Dispose of old toilets | • Maintenance and Operations conducted old toilet pickups<br>• 4.88 tons of old toilets were recycled | Aug-Oct 2008 |
| Step #7<br>Toilets to be installed and surveys completed | • Surveys entered into database<br>• Results compiled | Sep-Nov 2008 |
| Step #8<br>95% Completion Report | • File 95% Completion notice to CWCB | Dec 2008 |
| Step #9<br>Document Winter Water Savings<br>File 100% Completion Report | • Compile list of toilet installations<br>• Compute winter usage and water savings from Utility billing<br>• File 100% Completion notice to CWCB | Nov 2008<br><br>April 2009<br><br><br>June 2009 |

**Goals and Objectives**
The City has met their goals and objectives for the HET give-away program. Documentation of water savings will be reported in this 100% completion report. The customer satisfaction survey summary report was included as part of the 95% completion report.

**Preliminary Obstacles and Solutions**
The Caroma toilet selected for the grant (Sydney 305 ULF) required a 12 inch rough-in for the bowl. Most of the older homes in Northglenn have a 10 inch rough-in. Installing this toilet would have required considerable modification to the existing plumbing at an additional cost to the recipient. A substitute bowl (Reflections 270) that could be fitted to either a 10 or 12 inch rough-in by using an offset adaptor was selected to replace the original bowl. This modification increased the program cost by $7,000 (500 x $140). The substitution did not change the dual flush system. Therefore, no change in estimated water savings was expected.

Another problem encountered was the use of a flow meter to measure the 25 selected Northglenn residences' toilet usage. The use of a flow meter to track water savings in 25

selected residences could pose a potential liability issue for the city. Older plumbing increases the chances of a City employee to cause damage due to the need that the flow meter has to be connected to a delivery line. In lieu of the flow meter, the City Attorney suggested a less invasive approach. Instead, the gallons per flush (gpf) from the toilet tank dimensions and flush counts were used to obtain the amount of water used by the 25 residences as outlined below.

**Methods**

Calculations of water savings from the 25 selected residences were accomplished by a formula for toilet water use. All 25 of the replaced toilets were measured and the gallons per flush were determined by measuring the height, width, and depth of water of the tank and then converting that volume to gallons per flush. The 25 participants were instructed to track flush counts for pre-install (old toilets) and the solid and liquid flush counts for the post-install (HET) for one week each. An observation form was supplied to them. Collected data was entered into a spreadsheet to calculate an average water savings.

The water use (winter water use) from the 07-08 water year was compared to the 08-09 water year, to track water savings for the metered households that had installed the HET toilets. This method of tracking water savings was taken from the 2003 Toilet Replacement Program used by the Jordan Valley Water Conservancy District in Utah. Thus, customer water use records from the Utility Billing Dept. prior to and after the new HET installation was used to track water use and changes in it. The inherent problem in doing this is that we are tracking total water use, which could include outdoor water use, and not just toilet water usage. Therefore, it is difficult to ascertain the savings from the installation of the HETs.

**Results**

The results of water saved by the new toilets were not as high as projected in the grant application. Using data from the25 selected residences, Northglenn calculated an annual savings of 11 AF for all 500 replaced toilets as opposed to the original estimate of 20-25 AF. After careful study of the discrepancy, it was determined that 2 separate methods were used; one method for the grant application using a national average from Amy Vickers' Handbook of Water Use and Conservation and the method described above for calculating savings for Northglenn. Using two different sets of averages (4.25 gpf and 5.1 flushes/day per Amy Vickers), and the average use of Northglenn toilet recipients (3.91 gpf and 7.25 flushes/day) caused the total water use of older toilets to be different. In estimating the savings from the HETs for the grant application, a 0.95 gpf was used in the calculations. The survey results for Northglenn found the average to be closer to 1.6 gpf, thus cutting the savings in half. This explains the discrepancy between the original estimate of 20-25 AF savings and the actual result of 11 AF. The City has chosen to use the more accurate survey results of toilet usage for the demonstration of actual water savings. Regrettably the results do not substantiate the Amy Vickers numbers.

Tracking winter water use of 349 residences suggested only a 2.7 AF savings from the water years 07-08 to 08-09. Comparing the 2 years showed an average reduction of 13% of water use in the residences tracked (17% for Nov., 19% for Dec., 10% for Jan., and

7% for Feb.). The total difference between the 2 years is 872,000 gallons, or approximately 2.7 AF. The relationship between total water use and toilet use is unknown, thus this exercise is not as meaningful as toilet usage tracking.

To date, the City of Northglenn was able to determine that 412 toilets were installed. Another email and phone contact attempt was attempted for the 139 recipients who had not previously responded to the November contact attempt. Of those 139, only 63 responded that they had since installed the toilets. Seventy six recipients did not return repeated phone call attempts or emails. Respondents gave various excuses, the most common being procrastination. Northglenn gave those toilets away in good faith that they would be installed, policing the installation has proven to be problematic.

The 12 toilets that were returned to the city will be given away to 12 Northglenn residents who have requested them. The main reason the toilets were returned was due to problems with the size of the Caroma HETs. Either they were too tall or too long for the bathroom space of the recipients. Prior to the giveaway, all recipients were given the dimensions of the toilets, so they did have prior knowledge of the size requirements.

**Summary**

The City has completed all identified program tasks to date including modified procedures to maximize efficiencies, and obstacles encountered. A total of 233 replaced toilets were collected and 4.88 tons were recycled by Brannan Sand & Gravel. Survey response was overwhelmingly positive, with 80% of the total 215 responses stating that they liked the new HET more than their old toilet. The collected survey responses were sent with the 95% completion report.

Data has been collected for winter water usage in 349 households where it was determined that the HET toilets were installed. Using the calculations from the 25 Northglenn residences provided a more accurate measure of toilet water usage site specific to the city. The City of Northglenn determined that 11 AF/year of water will be saved with the installation of the HETS. The potential exists to realize 22 AF savings in two years, rather than in one year.

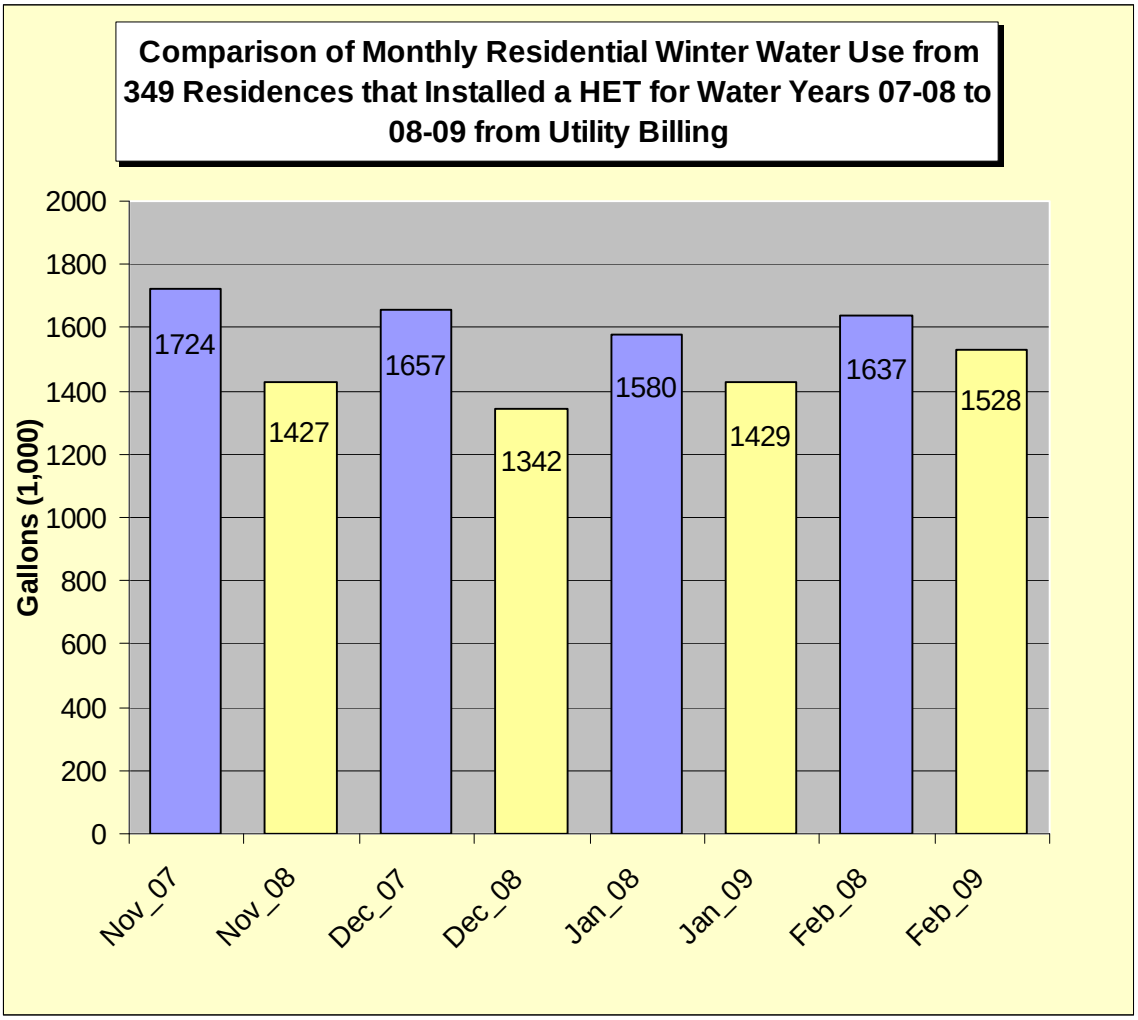
**Lessons to be Learned**

Water use and savings need to be calculated from toilet volumes and use (e.g. flushes) and not from national averages. The use of a flow meter to measure flows from participating recipients and the liability issues of having City personnel install them in recipients' homes has to be considered. The collection of volume and use data is a viable alternative that is not invasive and does not have the liability issues.

As for verifying the installation of the toilets in the recipients' homes, municipalities considering a toilet giveaway should have a system in place for verification. Even though the City of Northglenn had the recipients sign an affidavit, this was only to prove citizenship for inclusion in the program. The Jordan Valley Water Conservation District in Utah retained a licensed professional plumbing contractor to install the toilets for their

toilet giveaway, thus ensuring that the toilets were, indeed, installed. This is probably the most reliable way to ensure installation. Northglenn could not afford that expense.
The bottom line is that Northglenn does and will save water by the implementation of this HET giveaway, and every drop counts.

**Graph of Winter Water Use Comparing Pre-install use to Post-install use**




Y-axis= (dependent variable) and corresponds to the total gallons (1,000) of metered household use.
X-axis= (independent variable) and corresponds to the month tracked. The blue bars are pre-install usage, and the yellow bars are the post-install usage.

**Observation form to track flush counts in the selected 25 residences**:

**PRE LOW FLOW TOILET INSTALLATION WATER USAGE -**

**ADDRESS:** _____

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | TOTAL |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**At the end of the week please report the total number of flushes by calling: 303.450.8905**

**THANKS FOR YOUR COOPERATION**

**POST LOW FLOW TOILET INSTALLATION WATER USAGE -**

**ADDRESS:** _____

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| SOLID | | | | | | | | | SOLID |
| LIQUID | | | | | | | | | LIQUID |

**At the end of the week please report the total number of flushes by calling: 303.450.8905**

**THANKS FOR YOUR COOPERATION**

**COMMENTS:** _____

_____

_____

**Spreadsheet and calculations for the selected 25 residences are attached in Excel.**

# WATER SAVINGS CALCULATIONS

| | PRE-INSTALLATION | | | | | | | | POST-INSTALLATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Height (in) | Depth (in) | Width (in) | Cubic Inches | Gallons/Flush | Flushes/ Wk | Gallons/ Wk | Pre Install Gallons/year | Solid Flushes | Liquid Flushes | Solid Gallons/ Wk | Liquid Gallons/ Wk | Gallons/ Wk | Gallons Saved | % Difference | Percent Saved | Post Install Gallons /year |
| 1 | 10 | 6 | 18.5 | 1110.00 | 4.81 | 36 | 173.0 | 8995.3 | 10 | 27 | 16.0 | 21.6 | 37.6 | 135.4 | 21.74% | 78.26% | 1955 |
| 2 | 8.5 | 6.5 | 18 | 994.50 | 4.31 | 46 | 198.0 | 10298.0 | 8 | 43 | 12.8 | 34.4 | 47.2 | 150.8 | 23.83% | 76.17% | 2454 |
| 3 | 8 | 6.5 | 18 | 936.00 | 4.05 | 79 | 320.1 | 16645.4 | 11 | 68 | 17.6 | 54.4 | 72.0 | 248.1 | 22.49% | 77.51% | 3744 |
| 4 | 9.5 | 6.5 | 18.5 | 1142.38 | 4.95 | 29 | 143.4 | 7457.6 | 10 | 25 | 16.0 | 20.0 | 36.0 | 107.4 | 25.10% | 74.90% | 1872 |
| 5 | 7.75 | 5.5 | 18 | 767.25 | 3.32 | 72 | 239.1 | 12435.4 | 8 | 65 | 12.8 | 52.0 | 64.8 | 174.3 | 27.10% | 72.90% | 3370 |
| 6 | 7.25 | 6.5 | 19 | 895.38 | 3.88 | 61 | 236.4 | 12294.9 | 12 | 48 | 19.2 | 38.4 | 57.6 | 178.8 | 24.36% | 75.64% | 2995 |
| 7 | 7.5 | 6.5 | 18 | 877.50 | 3.80 | 79 | 300.1 | 15605.0 | 19 | 54 | 30.4 | 43.2 | 73.6 | 226.5 | 24.53% | 75.47% | 3827 |
| 8 | 8.5 | 6 | 18 | 918.00 | 3.97 | 23 | 91.4 | 4752.9 | 9 | 28 | 14.4 | 22.4 | 36.8 | 54.6 | 40.26% | 59.74% | 1914 |
| 9 | 7 | 6 | 16.5 | 693.00 | 3.00 | 25 | 75.0 | 3900.0 | 7 | 23 | 11.2 | 18.4 | 29.6 | 45.4 | 39.47% | 60.53% | 1539 |
| 10 | 7.75 | 6.25 | 18.25 | 883.98 | 3.83 | 50 | 191.3 | 9949.6 | 9 | 46 | 14.4 | 36.8 | 51.2 | 140.1 | 26.76% | 73.24% | 2662 |
| 11 | 11 | 6.25 | 18.5 | 1271.88 | 5.51 | 43 | 236.8 | 12311.3 | 9 | 33 | 14.4 | 26.4 | 40.8 | 196.0 | 17.23% | 82.77% | 2122 |
| 12 | 9 | 6.5 | 17 | 994.50 | 4.31 | 53 | 228.2 | 11865.1 | 14 | 43 | 22.4 | 34.4 | 56.8 | 171.4 | 24.89% | 75.11% | 2954 |
| 13 | 6.5 | 8 | 18.75 | 975.00 | 4.22 | 56 | 236.4 | 12290.9 | 11 | 33 | 17.6 | 26.4 | 44.0 | 192.4 | 18.62% | 81.38% | 2288 |
| 14 | 6 | 6 | 18.5 | 666.00 | 2.88 | 121 | 348.9 | 18140.6 | 22 | 76 | 35.2 | 60.8 | 96.0 | 252.9 | 27.52% | 72.48% | 4992 |
| 15 | 7.5 | 6.25 | 18.25 | 855.47 | 3.70 | 47 | 174.1 | 9050.9 | 9 | 48 | 14.4 | 38.4 | 52.8 | 121.3 | 30.34% | 69.66% | 2746 |
| 16 | 7.5 | 5.5 | 18 | 742.50 | 3.21 | 43 | 138.2 | 7187.1 | 12 | 44 | 19.2 | 35.2 | 54.4 | 83.8 | 39.36% | 60.64% | 2829 |
| 17 | 9 | 6.5 | 18 | 1053.00 | 4.56 | 19 | 86.6 | 4503.7 | 7 | 12 | 11.2 | 9.6 | 20.8 | 65.8 | 24.02% | 75.98% | 1082 |
| 18 | 6.25 | 8.5 | 19 | 1009.38 | 4.37 | 22 | 96.1 | 4998.8 | 13 | 27 | 20.8 | 21.6 | 42.4 | 53.7 | 44.11% | 55.89% | 2205 |
| 19 | 8.5 | 5.5 | 17.5 | 818.13 | 3.54 | 56 | 198.3 | 10313.3 | 18 | 41 | 28.8 | 32.8 | 61.6 | 136.7 | 31.06% | 68.94% | 3203 |
| 20 | 8 | 6.25 | 18.5 | 925.00 | 4.00 | 88 | 352.4 | 18323.8 | 11 | 75 | 17.6 | 60.0 | 77.6 | 274.8 | 22.02% | 77.98% | 4035 |
| 21 | 7.5 | 5 | 17 | 637.50 | 2.76 | 28 | 77.3 | 4018.2 | 4 | 23 | 6.4 | 18.4 | 24.8 | 52.5 | 32.09% | 67.91% | 1290 |
| 22 | 7.5 | 6 | 18 | 810.00 | 3.51 | 76 | 266.5 | 13857.6 | 12 | 64 | 19.2 | 51.2 | 70.4 | 196.1 | 26.42% | 73.58% | 3661 |
| 23 | 7.5 | 6 | 18 | 810.00 | 3.51 | 70 | 245.5 | 12763.6 | 8 | 65 | 12.8 | 52.0 | 64.8 | 180.7 | 26.40% | 73.60% | 3370 |
| 24 | 10 | 6 | 18.75 | 1125.00 | 4.87 | 18 | 87.7 | 4558.4 | 9 | 13 | 14.4 | 10.4 | 24.8 | 62.9 | 28.29% | 71.71% | 1290 |
| 25 | 6 | 6 | 18.5 | 666.00 | 2.88 | 29 | 83.6 | 4347.7 | 7 | 28 | 11.2 | 22.4 | 33.6 | 50.0 | 40.19% | 59.81% | 1747 |
| **AVG** | | | | | **3.91** | **50.76** | **192.97** | **10035** | **10.76** | **42.08** | **17.216** | **33.664** | **50.88** | **142.1** | **28.33%** | **71.67%** | **2646** |

| | |
|---|---|
| **Avg water savings/year** | **7,388.86** |
| **Total savings for HET toilets** | **3,605,761.57** |
| **Savings in AF/yr** | **11.07** |
| **Savings in AF for 20 years** | **221.31** |
| **Cost to buy 11 AF/yr** | **$121,722.44** |

**Avg gpf for old is 3.91 and 7.25 Flush/day**
**Used 4.25 and 5.1 Flush/day from Amy Vickers Nat'l avg for grant app**