

City of Calgary Pre-Rinse Spray Valve Pilot Study



Final Report

December 2005

**By
Veritec Consulting Inc.
Mississauga, Ontario**

Table of Contents

Executive Summary

1.0	Overview	2
2.0	Efficient Pre-Rinse Spray Valves	3
3.0	Methodology	3
4.0	Water & Energy Savings	5
5.0	Potential Rebate Level	7
6.0	Projected Savings – City-Wide Program	8
7.0	Potential Program Barriers.....	8
8.0	Conclusion	8

Acknowledgement

Some photographs used in this report were obtained from the California Urban Water Conservation Council's Rinse & Save Final Report Summary.

City Contact / Project Manager

Margaret Beeston
Water Efficiency Program Specialist
City of Calgary Waterworks & Wastewater
Phone: (403) 268-5726
Fax: (403) 268-5709
Email: Margaret.Beeston@calgary.ca

Report Author

Bill Gauley, P.Eng., Principal
Veritec Consulting Inc.
1495 Bonhill Rd., #12
Mississauga, ON L5T 1M2

Phone: (905) 696-9391, ext. 102
Fax: (905) 696-9395
Email: bill@veritec.ca

Executive Summary

The City of Calgary is considered one of the leading municipalities in Canada regarding water efficiency. The City implements indoor, outdoor, and industrial/commercial/institutional (ICI) water efficiency programs. The City website is a good source for both general and program-specific water efficiency information.

One relatively new water-efficiency measure to receive attention in North America is the pre-rinse spray valve (also called a spray nozzle or spray head). These valves are used by restaurant and cafeteria kitchen staff to remove loose or 'sticky' food from plates and other dishes prior to loading them in the dishwasher. The efficient valves utilize a 'knife-edge' spray rather than a 'shower-type' spray to better focus the available energy and remove food particles more efficiently.

Programs in California (*Rinse & Save*) and the Region of Waterloo in Ontario have identified that replacing existing valves with new efficient units save not only significant volumes of water but energy (either gas or electricity related to water heating) as well. In fact, the savings are so significant that the valves in both programs are supplied and installed by the Agency/Municipality at no cost to restaurants or cafeterias.

Because of the significant potential for water and energy savings, Calgary initiated a pilot project to replace inefficient pre-rinse spray valves in ten area facilities. Data collected at each site included:

- flow rate of existing fixture,
- flow rate of replacement fixture,
- supply pressures, and
- duration of use.

The City's pilot project was extremely successful and identified significant savings – an average of about 358 litres per valve per day. The average water and energy savings in the participating facilities is approximately \$1,400 if gas is used for water heating and \$1,800 if electricity is used, over the five-year life expectancy of the valve.

With average water savings of 358 litres per valve per day, and an installed cost of approximately \$150 each (when purchased in bulk), the City could easily justify providing the valves at no cost to qualifying restaurants, institutional kitchens, and commercial food preparation operations.

Summary of the City of Calgary Pilot Project Results

- **Approximate Installed Cost of Valve: \$150**
- **Average Water Savings: 358 litres per day per valve**
- **Customer Savings: between \$1,400 - \$1,800 per valve over 5 years (water & energy)**
- **Projected daily water savings, City-wide program: between 107 – 215 m³/day**
- **Projected annual water savings, City-wide program: between 39,200 – 78,400 m³/day**

1.0 OVERVIEW

There have been significant advancements in many areas of water efficiency in recent years; many of these are related to residential fixtures and appliances (e.g., 6-litre toilets, horizontal-axis clothes washers). One measure beginning to receive significant attention in the food service sector (restaurants, cafeterias, etc.) is the installation of efficient pre-rinse spray valves (also called spray nozzles or spray heads).



Figure 1: Efficient nozzle



Figure 2: Nozzle and hose

Typically, large restaurants and food service operations utilize commercial dishwashers. Prior to loading the dishwasher, plates and dishes are manually sprayed (pre-rinsed) to remove loose or ‘sticky’ food. The time it takes to successfully pre-rinse the dishes is a function of how well the spray valve works – better valves clean dishes in less time, using less water and less energy.

The *Rinse & Save* program in California¹ states that the dishwashing operation in a typical restaurant can consume over two-thirds of the facility water use. What’s more, it concluded that in some cases, nearly half of the water demand in the entire dishwashing process is used by the pre-rinse spray valve. Traditional spray nozzles can use 10 to 20 litres of water per minute (Lpm) while the new models use 6 Lpm or less². Efficient nozzles are inexpensive, easy to install, and do not require any additional effort on the part of the user to obtain water and energy savings. The valves in California’s *Rinse & Save* program and the Region of Waterloo’s *Pre-Rinse Spray Valve Replacement Program* are delivered and installed at no charge to the customer.



Figure 3: Using spray valve

The City of Calgary’s pilot project included ten area establishments (identified below). These sites were chosen somewhat randomly and are not intended to represent all of the possible types or sizes of facilities using pre-rinse spray valves in the city. The sites were contacted and offered free pre-rinse spray valves and installation in return for participation in the monitoring program.

Site No.	Site Name	Site No.	Site Name
1	The Hose & Hound Pub	6	The Kilkenny Pub
2	The Siding Café	7	Wildwood (upstairs restaurant)
3	The Westin Calgary	8	Wildwood (downstairs restaurant)
4	City Hall Café	9	Safeway
5	The Bent Elbow Pub	10	Ranchmans

¹ California Urban Water Conservation Council, *Rinse & Save*, 2003

² Under typical system pressures.

2.0 EFFICIENT PRE-RINSE SPRAY VALVES

The Calgary project involved replacing existing pre-rinse spray valves with either a Fisher model 2949 “Ultra Spray” or Niagara Conservation model N2180 “Power Rinser” (five valves of each type were installed as part of the project). There is no significant or obvious difference between these valves.

Participating sites did not receive any special training regarding use of the efficient spray valve as it is considered somewhat intuitive.

3.0 METHODOLOGY

Project savings was determined by monitoring the water demands of both the existing inefficient and new efficient valves.

Demand data was collected using a data-logged KOBOLD PSR paddle-type flow switch and a pressure logger. This type of monitoring equipment was used because there is typically no throttling associated with the operation of a pre-rinse spray valve (they are either ‘on’ or ‘off’). The collected data was used to establish flow rate vs. pressure curves for each of the site installations (flow rate x duration = volume).

Veritec also completed a series of laboratory tests to establish flow vs. pressure curves for replacement and existing valves. Figure 7 and Figure 8 on the following page illustrate pressure vs. flow rate data for both models of efficient valves. The curves represent the results of laboratory-testing (controlled environment) and the coloured squares indicate the results of spot field measurements (uncontrolled environment). There is a strong correlation between the two sets of data.

Similar curves were derived for the spray valves removed from the field (Figure 9), though, unlike the efficient valves, each of the field-nozzles is somewhat unique (different makes, models, ages, etc.) and has an individual curve. Note that each field valve has its own flow rate vs. pressure curve and that these curves show much greater flow rates for any given pressure than the efficient valves.



Figure 4:
Typical Spray Valve



Figure 5:
Efficient Spray Valve



Figure 6: Paddle-type Reed Switch

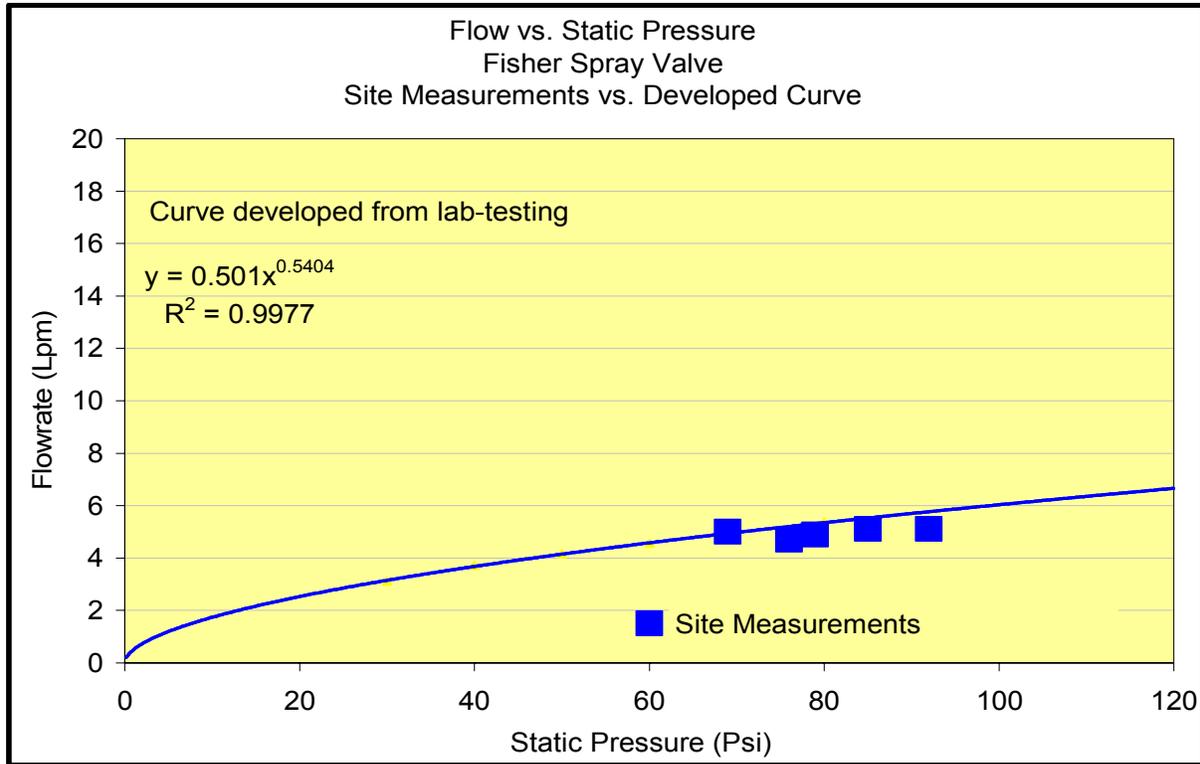


Figure 7

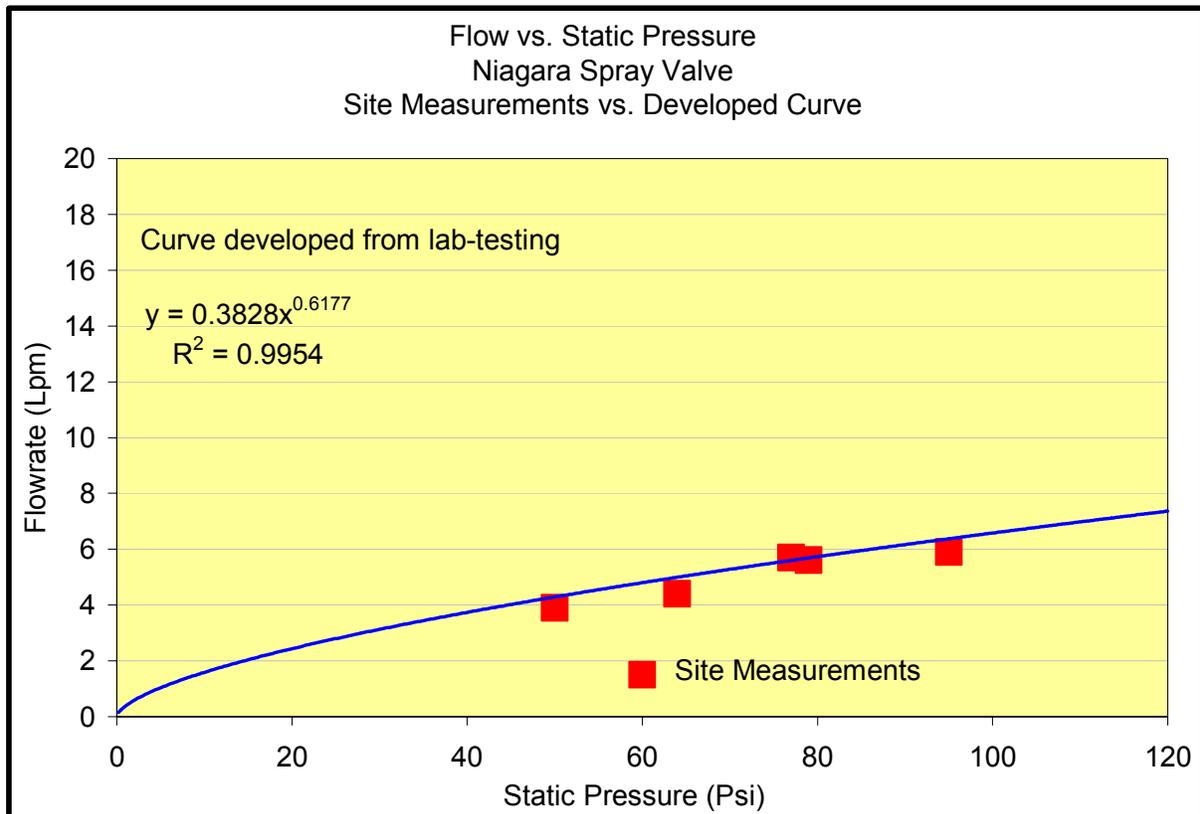


Figure 8

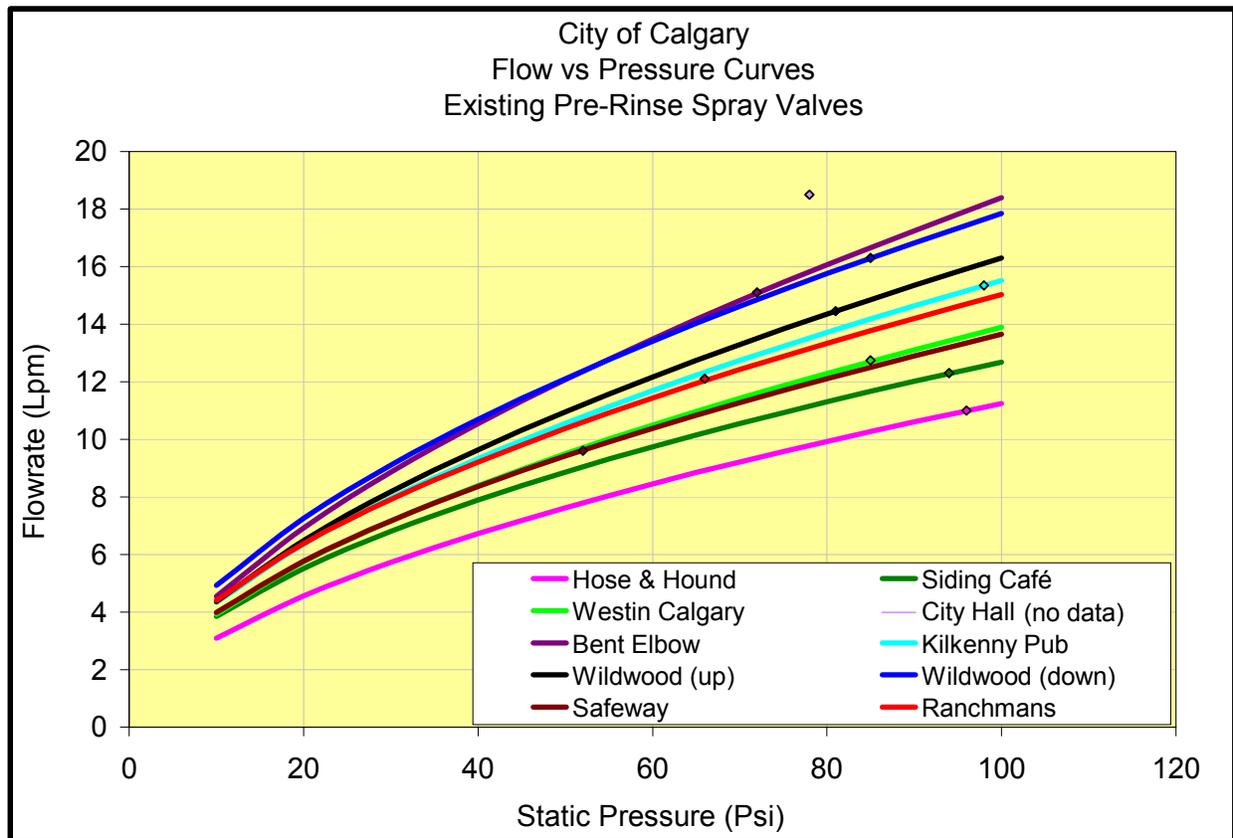


Figure 9

4.0 WATER & ENERGY SAVINGS

Table 1 identifies the average flow rates, system pressures, duration of use, and savings associated with the installation of the new and efficient spray valves. The average water pressure during both pre and post monitoring was at 81 PSI. The average flow rate of the original inefficient valves was 13.7 litres per minute, whereas the average flow rate of the efficient valves was only 5.6 Lpm³.

The program saved an average of 358 litres per day per valve⁴ or 56 percent of their existing pre-rinse spray valve demand. Savings in individual sites ranged from a low of minus 35 litres per day to a high of 764 litre per day, and from a low of minus 162 percent to a high of 79 percent.

Although there was almost no change in the average duration of use in the ten sites between pre and post monitoring (47 minutes per site per day PRE and 50 minutes per site per day POST) there were some differences noted in individual sites. The Siding Café, for instance, used their inefficient valve only 1.6 minutes per day, whereas they used the new efficient valve 8.2 minutes per day. On the other

³ Higher water pressures in Calgary vs. the Region of Waterloo (81 vs. 66 PSI respectively) resulted in greater flow rates for both inefficient and efficient valves. Waterloo’s average values were 10.4 Lpm (inefficient) and 4.6 Lpm (efficient).

⁴ Only one valve was replaced at each site

hand, the Safeway and Ranchmans sites each used the efficient valve for approximately half of the duration that they used the inefficient units.

Although duration of valve use was an important criteria to consider when calculating savings, the two primary criteria for determining program success are:

- are customers satisfied with the performance of the efficient valve,
- do the efficient valves save significant volumes of water and energy.

Although the Siding Café originally complained about some splashing and over-spray (likely caused by high water pressures), they have opted to continue using the efficient spray valve. Only one site, the City hall cafeteria, was not happy with the new valve and asked that their original valve be reinstalled. They felt that it took too long to rinse dishes with the lower flow rate of the efficient valve (the flow rate of their existing valve was very high at 18.5 litre per minute).

Based on project results, it appears that customers are generally satisfied with the performance of the efficient spray valve. As can be seen in Table 1, the new valves save a considerable percentage of water demands - 56 percent.

Water savings data was collected as part of this project. Gas and electricity savings estimates in the following summary are based on values provided in California's *Rinse & Save* report summary.

Water Savings:	358 litres per valve per day
	131 m³ per valve per year
	653 m³ per valve over the 5-year life of product
	\$653 in savings (based on avg. cost of \$1.00/m³ over 5 yrs.)
Energy Savings⁵	
Gas Savings:	2,613 m³ of gas saved over the 5-year life of product⁶
	\$758 in savings at \$0.29 per m³
	OR
Electric Savings:	16,240 kWh per valve over the 5-year life of product
	\$1,137 in savings at \$0.07 per kWh⁷

Depending on whether gas or electricity is used to heat water, the projected average customer savings over the 5-year life of the valve is estimated between approximately \$1,400 and \$1,800.

Estimated water and energy savings: between \$1,400 and \$1,800 per valve over five years.

⁵ Values are approximate and assume 50% hot, 50% cold water.

⁶ Based on requiring 8 m³ of natural gas to heat 1.0 m³ of water by 50C.

⁷ Cost of heating with electricity has been conservatively estimated as 150 percent cost of heating with gas.

Table 1 – Pre vs. Post Demands & Water Savings

SITE		Average Flowrate	Ave Pressure	Duration	Daily Use	Savings %
		(Lpm)	(Psi)	(minutes/day)	(L/day)	
1	Hose & Hound PRE	11.4	98	53	605	
	Hose & Hound POST	5.9	95	58	344	
	Savings	48%		-10%	261	43%
2	The Siding Café PRE	13.7	106	1.6	22	
	The Siding Café POST	7.0	115	8.2	57	
	Savings	49%		-413%	-35	-162%
3	Westin Calgary PRE	12.1	79	98	1188	
	Westin Calgary POST	5.3	80	80	425	
	Savings	56%		18%	764	64%
4	City Hall Café PRE	18.5	78	28	522	
	City Hall Café POST	5.6	78	-	-	
	Savings	70%		-	-	-
5	The Bent Elbow PRE	14.8	70	17	252	
	The Bent Elbow POST	5.0	70	19	96	
	Savings	66%		-13%	156	62%
6	Killkeny Pub PRE	14.0	95	95	1328	
	Killkeny Pub POST	6.3	95	103	648	
	Savings	55%		-8%	680	51%
7	Wildwood (Up) PRE	14.4	81	61	881	
	Wildwood (Up) POST	5.4	81	70	374	
	Savings	63%		-14%	507	58%
8	Wildwood (Dn) PRE	16	83	74	1182	
	Wildwood (Dn) POST	5.7	81	92	528	
	Savings	64%		-25%	655	55%
9	Safeway PRE	9.8	54	17	171	
	Safeway POST	4.4	53	9	38	
	Savings	55%		51%	133	78%
10	Ranchmans PRE	12.1	67	24	284	
	Ranchmans POST	5.0	66	12	59	
	Savings	58%		50%	225	79%
Avg.	Average PRE	13.7	81	47	644	
	Average POST	5.6	81	50	285	
	Savings	59%		-7%	358	56%

5.0 POTENTIAL REBATE LEVEL

It is anticipated that the average customer will save at least \$1,400 per valve over the life of the valve when water, wastewater, and energy savings are included.

The City currently rebates water-efficient toilets at a rate of approximately \$0.625 per L/d savings⁸.

If the same rebate level was applied to the pre-rinse spray valve program, Calgary could offer up to \$224 per valve (i.e., 358 L/day/valve x \$0.625 per L/d savings).

Data from other programs indicate that Calgary could implement a City-wide pre-rinse spray valve replacement program for less than \$150 per valve including installation. As such, the program would be very cost-effective to the City.

⁸ City offers a \$50 rebate per toilet to achieve savings of approximately 80 litres per day per fixture.

6.0 PROJECTED SAVINGS – CITY-WIDE PROGRAM

Total estimated savings potential from implementing a City-wide program⁹:

- # of restaurants in City: between 1,200 and 2,400
- facilities with suitable valves: 50% (between 600 and 1,200 sites)
- facilities willing to participate: 50% (between 300 and 600 sites)
- Savings per site: 358 L/day
- Estimated Daily Savings: between 107 - 215 m³
- **Estimated Annual Savings: between 39,200 – 78,400 m³**

7.0 POTENTIAL PROGRAM BARRIERS

The Region of Waterloo's Region-wide pre-rinse spray valve replacement program identified three significantly potential barriers to program success:

- Difficult to get fast-food-type restaurants to participate as “decision maker” not typically on site,
- Many restaurants with high percentage of coffee mugs vs. dinner plates (e.g., Tim Horton's) experienced high levels of splashing and requested original valves be reinstalled,
- Some site ‘managers’ were suspicious about free offer (i.e., too good to be true) and did not participate. City may wish to promote or publicize program prior to full program rollout.

8.0 CONCLUSION

Calgary's pre-rinse spray valve replacement pilot program saved approximately 358 litres per valve per day. Total average savings over the 5-year life of the valve is estimated between \$1,400 and \$1,800 when water, wastewater, and energy costs are included.

The installed cost of each valve, based on a City-wide program, is estimated to be \$150 or less. Based on expected savings, Calgary could offer the efficient spray valves at no charge to eligible customers.

Should you have any questions regarding the findings in this report please contact the author at:

Bill Gauley, P.Eng., Principal
Veritec Consulting Inc.
1495 Bonhill Rd., #12
Mississauga, ON L5T 1M2

Phone: (905) 696-9391, ext. 102
Fax: (905) 696-9395
Email: bill@veritec.ca

⁹ Based on the results of a similar project completed by the Region of Waterloo