



City of Edina

Year 1 Measurement &  
Verification Report

September 2013

FOR THE  
LIFE OF  
YOUR  
BUILDING



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# 1. Executive Summary

## BACKGROUND

On April 20, 2011 City of Edina signed a Detailed Engineering Study Agreement with McKinstry for the purpose of developing a performance contract. A performance contract totaling \$701,098 was signed on October 4, 2011. This report summarizes the annual savings for Year 1 for the implemented systems at City of Edina. The project has natural gas (Therm), electric (kWh), and water (gallons) savings due to the implemented Facility Improvement Measures (FIMs).

## ENERGY AND COST SAVINGS

The project is achieving utility savings through the implementation of the following FIMs:

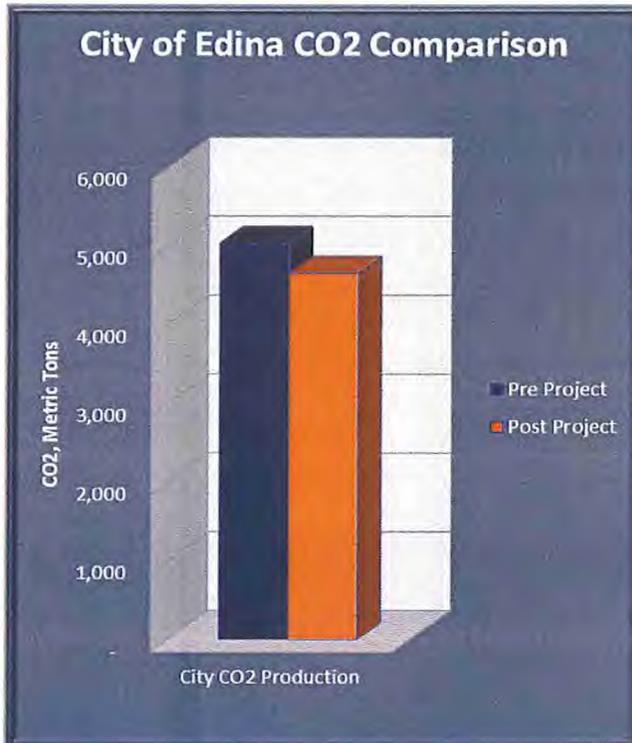
| FIM Name           | Project Locations   | Guaranteed Performance Savings | Performance Savings Realized |
|--------------------|---|--------------------------------|------------------------------|
| Interior Lighting  | City Hall, Braemar Arena, Art Center, Fire Station 1, Fire Station 2, Braemar Clubhouse, Braemar Maintenance, Executive Clubhouse, Edina Liquor Vernon, Edina Liquor 50 <sup>th</sup> | \$35,332                       | \$33,748                     |
| Building Envelope  | City Hall, Braemar Arena, Art Center, Fire Station 2, Braemar Clubhouse, Braemar Maintenance, Executive Clubhouse, Public Works, Edina Liquor Vernon, Edina Liquor 50 <sup>th</sup>   | \$11,078                       | \$14,312                     |
| Solar PV           | City Hall   | \$1,306                        | \$831                        |
| Water Conservation | Art Center, Fire Station 1, Fire Station 2, Braemar Clubhouse, Public Works   | \$2,361                        | \$3,245                      |
| <b>Total</b>       |   | <b>\$50,077</b>                | <b>\$52,136</b>              |

The guaranteed annual performance savings of \$50,077 was exceeded through the installation of the FIMs. The following table illustrates the performance savings realized to the guaranteed performance savings:

|                                |          |
|--------------------------------|----------|
| Guaranteed Performance Savings | \$50,077 |
| Performance Savings Realized   | \$52,136 |
| Difference (Excess Savings)    | \$2,059  |

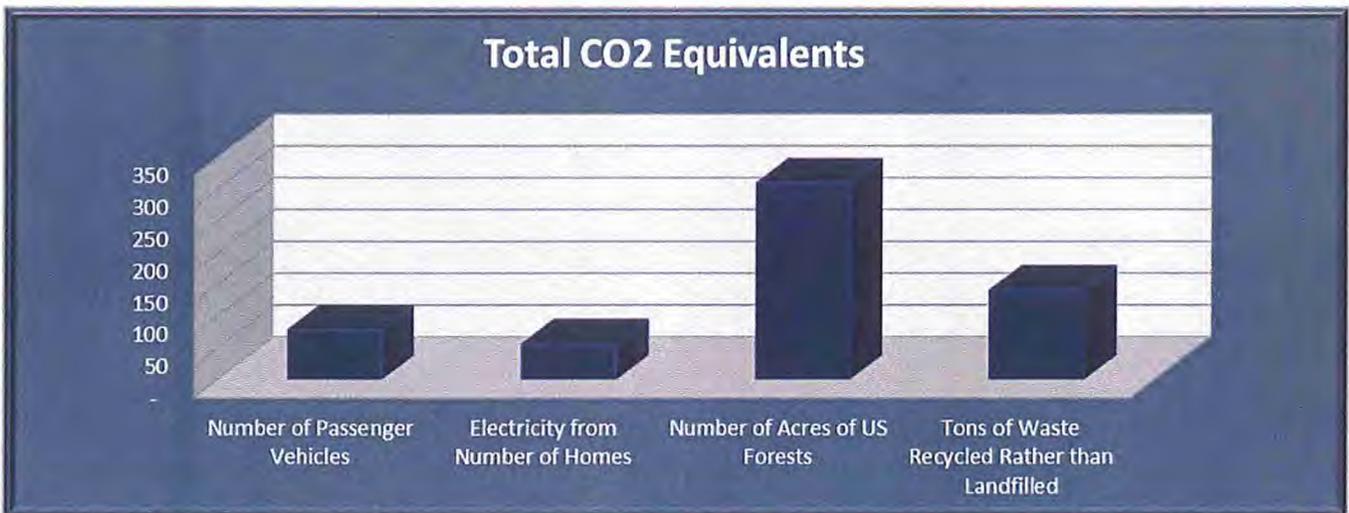
## 2. Environmental Impact

The first year performance savings of \$52,132 equates to the reduction of natural gas, electric, and water consumption. The FIMs have a total savings of 17,047 therms, 422,827 kWh and 364,042 gallons of water. The savings combine to a 7.4% reduction in total energy usage for the affected buildings.



By implementing the facility improvement measures, the City is not only saving money, but also helping to protect the environment.

- The City of Edina lowered its electric CO2 production by 292 Metric Tons.
- The City of Edina lowered its natural gas CO2 production by 85 Metric Tons.
- The City of Edina is saving the equivalent of 0.55 Olympic-sized swimming pools' worth of water.



*Environmental Impact information is intended for informational use only.*

Please see Appendix A for Supplemental Information.

# 3. Facility Improvement Measures

## Interior Lighting Upgrades

### FIM DESCRIPTION

McKinstry retrofitted the lighting in the following buildings: City Hall, Braemar Arena, Art Center, Fire Station 1, Fire Station 2, Braemar Clubhouse, Braemar Maintenance, Executive Clubhouse, Edina Liquor Vernon, and Edina Liquor 50<sup>th</sup>. The implementation of this FIM improved the quality of light and reduced the electric utility consumption throughout the buildings. The annual electric utility consumption from lighting has been reduced by 46% which equates to \$33,744 in annual utility savings.

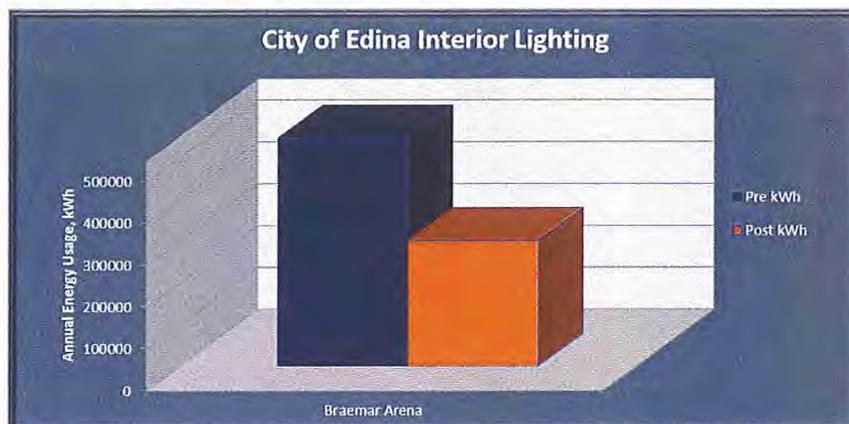
### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- Retrofitting existing T12 fixtures with T8 lamps and ballasts.
- Retrofitting existing 32W T8 fixtures with reduced wattage T8 lamps.
- Upgrading high bay fixtures with high output fluorescent fixtures.
- Retrofitting existing CFLs with LED lamps.
- Retrofitting incandescent lamps with CFLs.
- Replacing existing exit signs with LED exit signs.
- Delamping over lit areas.
- Installing occupancy sensors where applicable.

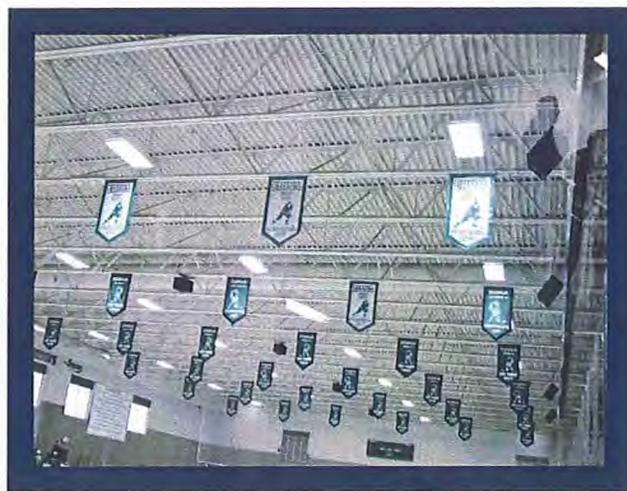
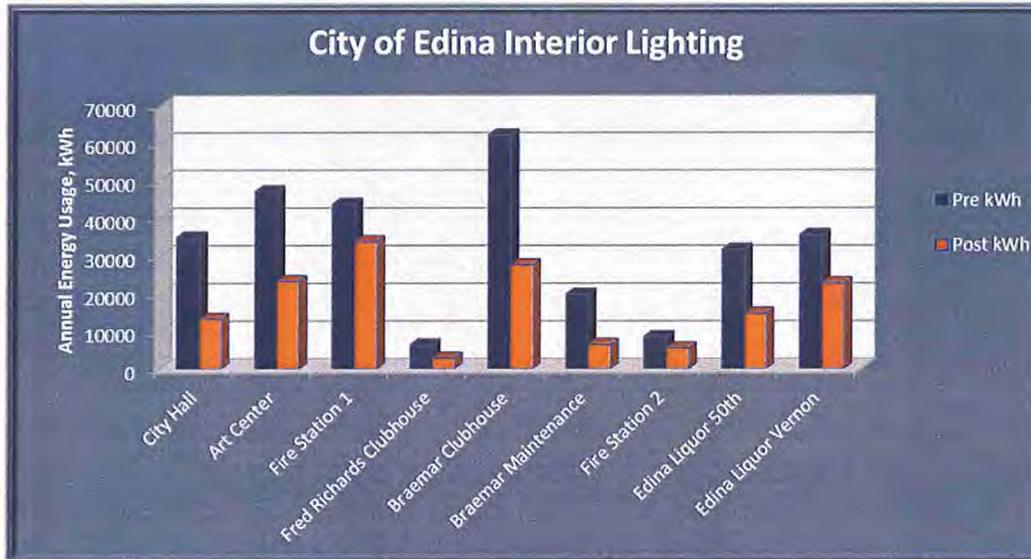
| Predicted Energy Savings  | Actual Energy Savings | Predicted \$\$ | Actual \$\$     |
|---------------------------|-----------------------|----------------|-----------------|
| -310 Therms               | -303 Therms           | -\$213         | -\$208          |
| 392,732 kWh               | 384,188 kWh           | \$35,547       | \$33,957        |
| <b>Unrealized Savings</b> |                       |                | <b>-\$1,584</b> |

The following figures depict the pre and post annual energy usage of interior fixtures.



# 3. Facility Improvement Measures

## Interior Lighting Upgrades - Continued



Pre (top) and post (bottom) lighting fixtures at the Ice Arena

Please see Appendix B for Additional Supporting Information.

# 3. Facility Improvement Measures

## Building Envelope

### FIM DESCRIPTION

McKinstry improved the building envelope in the following buildings: City Hall, Braemar Arena, Art Center, Fire Station 2, Braemar Clubhouse, Braemar Maintenance, Executive Clubhouse, Public Works, Edina Liquor Vernon, and Edina Liquor 50<sup>th</sup>. Filling in cracks and crevices of each building increases the performance of the building by reducing exterior air infiltration into the conditioned spaces of the building.

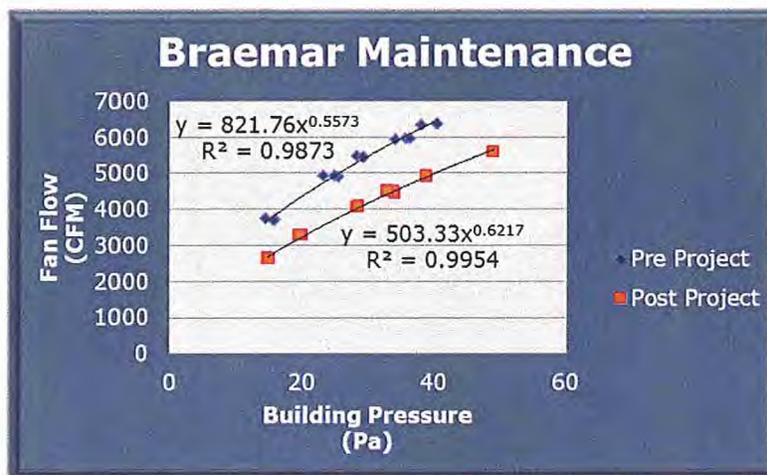
### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- Sealing all exterior wall and roof penetrations to prevent air infiltration.
- Sealing exterior door sweeps and replacing weather stripping around doors.
- Caulking around window frames to ensure no air flow through cracks.
- Replacing deteriorated weather stripping around operable windows.
- Sealing roof/wall intersections to keep warm air from escaping during the winter.

| Predicted Energy Savings | Actual Energy Savings | Predicted \$\$ | Actual \$\$    |
|--------------------------|-----------------------|----------------|----------------|
| 11,259 Therms            | 16,035 Therms         | \$8,625        | \$12,481       |
| 18,301 kWh               | 20,161 kWh            | \$1,640        | \$1,831        |
| 154 CCF                  | 0 CCF                 | \$813          | \$0            |
| <b>Excess Savings</b>    |                       |                | <b>\$3,234</b> |

The following figure depicts the actual data from a building pressurization test at the Braemar Maintenance Building.



Please see Appendix C for Additional Supporting Information.

# 3. Facility Improvement Measures

## Solar Photovoltaic Installation

### FIM DESCRIPTION

McKinstry installed a 25 kW roof-mounted photovoltaic system on the City Hall Building. This renewable power generation system offsets electricity consumed in the City Hall building and provides the City with clean, renewable power.

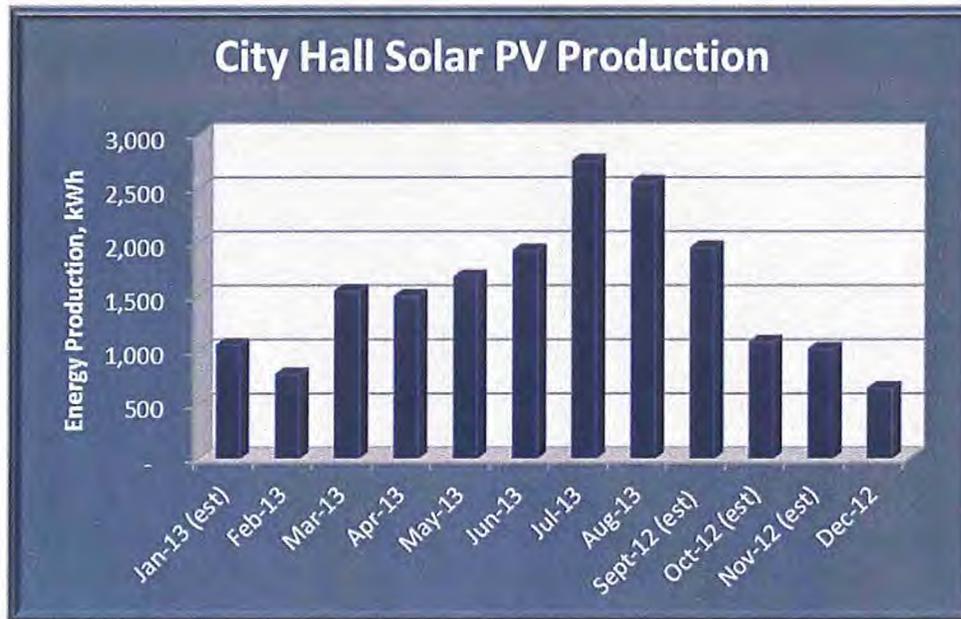
### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- Installing a 25 kW solar photovoltaic array system on the roof of the City Hall building.

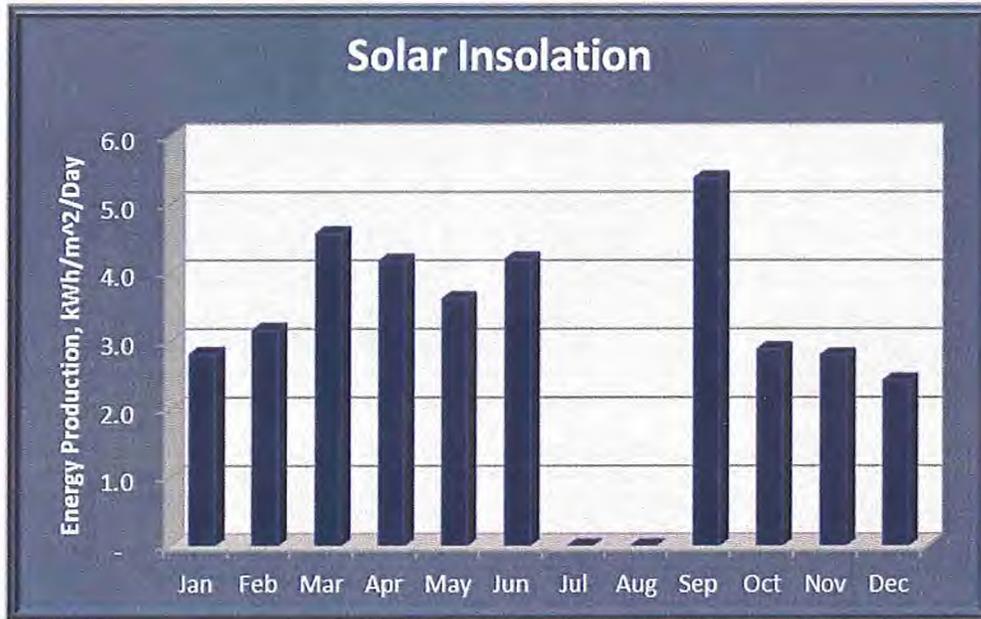
| Predicted Utility Savings | Actual Utility Savings | Predicted \$\$ | Actual \$\$   |
|---------------------------|------------------------|----------------|---------------|
| 29,025 kWh                | 18,478 kWh             | \$1,306        | \$831         |
| <b>Unrealized Savings</b> |                        |                | <b>-\$475</b> |

The following graphs depict the solar panel production and the solar insolation available for harvesting. At the completion of this report, insolation data for July and August were not available. The City has the capability of trending solar insolation with the weather station installed within the McKinstry project. More information detailing how the panels should perform can be collected if the City wishes for future M&V.



# 3. Facility Improvement Measures

## Solar Photovoltaic Installation - Continued



*Installed solar panels on the City Hall roof shown with mirror reflectors*

Please see Appendix D for Additional Supporting Information.

# 3. Facility Improvement Measures

## Water Conservation

### FIM DESCRIPTION

McKinstry upgraded the plumbing fixtures in buildings throughout the City. These new, more efficient fixtures use less water by incorporating screens and aerators to slow the water flow down while maintaining adequate flow for general purposes. By implementing these new more efficient fixtures, the City of Edina is saving water as well as natural gas used to heat the water.

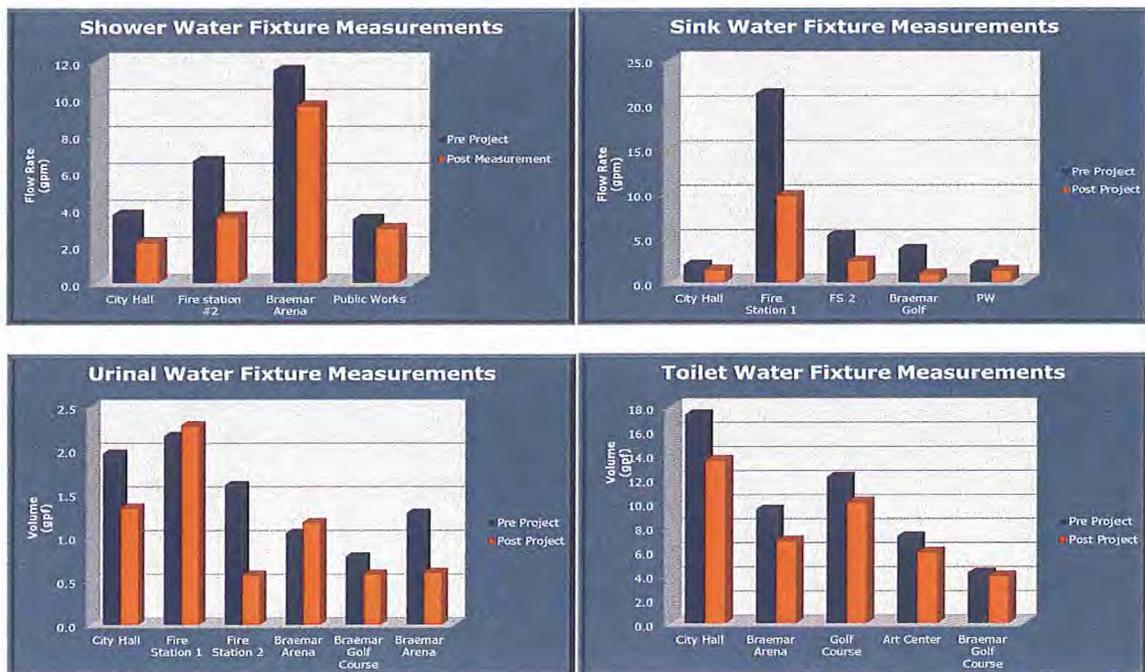
### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- Conducting a diaphragm calibration or X-Body replacement of flushometers for urinals and toilets.
- Installing Vandal-Resistant flow control faucet heads throughout City facilities.
- Installing low flow wall and handheld shower units throughout City facilities.

| Predicted Utility Savings | Actual Utility Savings | Predicted \$\$ | Actual \$\$  |
|---------------------------|------------------------|----------------|--------------|
| 726 Therms                | 1,322 Therms           | \$629          | \$1,130      |
| 180 CCF                   | 487 CCF                | \$1,731        | \$2,114      |
| <b>Excess Savings</b>     |                        |                | <b>\$884</b> |

The following graphs depict the actual pre and post-flow measurements on specific fixture types.



Please see Appendix E for Additional Supporting Information.

# 4. Conclusions & Recommendations

McKinstry recommends utilizing all systems as commissioned to maintain savings obligations. Further savings can be achieved by ensuring the light fixtures in unoccupied spaces are kept off, water usage is kept to minimal necessary levels, and space temperatures and schedules are adjusted for the typical occupancy patterns throughout the year.

The following chart depicts the utility rates used to determine dollar savings from the calculated energy savings. The rates are taken directly from the Performance Contract signed between McKinstry and the City of Edina.

| Location                   | \$/kWh | \$/Therm | \$/CCF |
|----------------------------|--------|----------|--------|
| City Hall                  | \$0.07 | \$0.77   | \$4.34 |
| Braemar Arena              | \$0.09 | \$0.63   | \$4.34 |
| Art Center                 | \$0.10 | \$0.82   | \$4.34 |
| Fire Station 1             | \$0.07 | \$0.79   | \$4.34 |
| Fire Station 2             | \$0.09 | \$0.89   | \$4.34 |
| Braemar Golf Course        | \$0.09 | \$0.91   | \$4.34 |
| Fred Richards Executive GC | \$0.11 | \$0.92   | \$4.34 |
| Public Works               | \$0.10 | \$0.85   | \$4.34 |
| Edina Liquor 1 - 50th St.  | \$0.08 | \$1.03   | \$4.34 |
| Edina Liquor 2 - Vernon    | \$0.08 | \$0.94   | \$4.34 |

# 5. Appendices

## Appendix A

### ENVIRONMENTAL IMPACT

The following chart shows the pre and post project energy consumption and CO2 production from the website below.

| City CO2 Production |              |                 |       |
|---------------------|--------------|-----------------|-------|
|                     | CO2 from kWh | CO2 from Therms | Total |
| Pre Project         | 3,876        | 1,154           | 5,030 |
| Post Project        | 3,584        | 1,069           | 4,653 |

| City Energy Consumption |           |         |            |
|-------------------------|-----------|---------|------------|
|                         | kWh       | Therms  | kBTU       |
| Pre Project             | 5,617,730 | 230,792 | 42,247,692 |
| Post Project            | 5,194,903 | 213,745 | 39,100,273 |

<http://www.epa.gov/cleanenergy/energy-resources/calculator.html>

The following table shows the total Number of Each Equivalent based on savings from the energy source:

| Total  | Therm  | kWh   |   |
|--------|--------|-------|---|
| 79     | 61     | 18    | Number of Passenger Vehicles                  |
| 42,310 | 32,758 | 9,552 | Gallons of Gasoline                           |
| 878    | 680    | 198   | Barrels of Oil                                |
| 5      | 4      | 1     | Tanker Trucks                                 |
| 57     | 44     | 13    | Electricity from Number of Homes              |
| 19     | 15     | 4     | Energy from Homes                             |
| 9,677  | 7,492  | 2,185 | Trees Grown for 10 Years                      |
| 310    | 240    | 70    | Number of Acres of Pine or Fir Forest         |
| 3      | 2      | 1     | Acres of Trees Saved                          |
| 15,725 | 12,175 | 3,550 | Propane Cylinders                             |
| 2      | 1      | 0     | Railcars' Worth of Coal                       |
| 141    | 109    | 32    | Tons of Waste Recycled Rather than Landfilled |
| 377    | 292    | 85    | Metric Tons                                   |

# 5. Appendices

## Appendix B

### INTERIOR LIGHTING UPGRADES

The following table depicts the savings associated with interior lighting installed throughout the City.

| Location                | Pre Project kWh | Post Project kWh | kWh Saved      | \$\$ Savings  |
|-------------------------|-----------------|------------------|----------------|---------------|
| City Hall               | 34,885          | 13,243           | 21,642         | \$1,515       |
| Braemar Arena           | 545,749         | 300,994          | 244,755        | \$22,028      |
| Art Center              | 47,054          | 23,243           | 23,811         | \$2,381       |
| Fire Station 1          | 43,718          | 33,829           | 9,889          | \$692         |
| Fire Station 2          | 8,581           | 5,576            | 3,005          | \$270         |
| Braemar Clubhouse       | 62,069          | 27,629           | 34,440         | \$3,100       |
| Braemar Maintenance     | 19,855          | 6,524            | 13,331         | \$1,200       |
| Fred Richards Clubhouse | 6,401           | 2,885            | 3,516          | \$387         |
| Edina Liquor Vernon     | 35,540          | 22,738           | 12,802         | \$1,024       |
| Edina Liquor 50th       | 31,741          | 14,744           | 16,997         | \$1,360       |
| <b>Total</b>            | <b>835,593</b>  | <b>451,405</b>   | <b>384,188</b> | <b>33,957</b> |

The following table depicts the actual pre and post measurement data at several of the retrofitted buildings.

| Building          | Fixture Type         | Pre Fixture Wattage | Post Fixture Wattage | Percent Reduction |
|-------------------|----------------------|---------------------|----------------------|-------------------|
| Art Center        | 1L 75W INT           | 75                  | 16                   | 78.4%             |
|                   | 4L 32W W1X4          | 110                 | 96                   | 12.7%             |
|                   | 2L 34W W1X4          | 78                  | 43                   | 44.6%             |
| Fire Station 1    | 1L 60W INC           | 60                  | 20                   | 66.7%             |
|                   | 2L 32W 4' T8         | 58                  | 52                   | 10.3%             |
|                   | 3L BL 32W 4' T8      | 85                  | 73                   | 14.1%             |
|                   | 4L 32W 4' T8         | 110                 | 85                   | 23.1%             |
| Fred Richards     | 3L 32W INDUSTRIAL    | 85                  | 55                   | 34.9%             |
|                   | 3L LT2X4 32W         | 85                  | 78                   | 8.2%              |
|                   | 3L 60W INCAN         | 180                 | 39                   | 78.3%             |
|                   | 2L SM2X2 U 34W       | 78                  | 31                   | 60.0%             |
|                   | 2L PT1X4 34W TW      | 78                  | 20                   | 74.4%             |
| Braemar Clubhouse | 2L SM2X2U 34W        | 78                  | 32                   | 59.0%             |
|                   | 4L SM2X4 34W         | 156                 | 54                   | 65.4%             |
|                   | 2L SS8 60W           | 129                 | 57                   | 55.6%             |
|                   | 2L SS8 40W           | 88                  | 27                   | 69.9%             |
|                   | 4L W1X4 34W          | 156                 | 56                   | 64.1%             |
| Maintenance Shop  | 4L W1X4 34W          | 156                 | 56                   | 64.1%             |
|                   | 2L INDUSTRIAL 60W    | 129                 | 59                   | 54.3%             |
|                   | 2L 8' INDUSTRIAL 95W | 209                 | 134                  | 35.8%             |
|                   | 2L W1X4 34W          | 78                  | 60                   | 23.1%             |
| Arena             | 1L MHHB 1000W        | 1,080               | 456                  | 57.8%             |
|                   | 3L LT2X4 32W         | 86                  | 66                   | 23.8%             |
|                   | 2L W1X4 32W          | 58                  | 44                   | 23.6%             |
|                   | 4L W1X4 32W          | 110                 | 91                   | 17.3%             |

# 5. Appendices

## Appendix C

### BUILDING ENVELOPE

The following table depicts the savings associated with Building Envelope Improvements at the city.

| Location                 | Guaranteed    |                 |               |                 | Actual        |                 |               |                  |
|--------------------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|------------------|
|                          | kWh           | \$\$            | Therms        | \$\$            | kWh           | \$\$            | Therms        | \$\$             |
| City Hall                | 1,513         | \$ 106          | 2,447         | \$ 1,884        | 1,835         | \$ 128          | 2,968         | \$ 2,285         |
| Braemar Arena            | 13,575        | \$ 1,224        | 3,064         | \$ 1,930        | 16,465        | \$ 1,482        | 3,716         | \$ 2,341         |
| Art Center               | 441           | \$ 44           | 713           | \$ 584          | 535           | \$ 53           | 865           | \$ 709           |
| Fire Station 2           | -             | \$ -            | 407           | \$ 362          | -             | \$ -            | 494           | \$ 439           |
| Braemar Golf Clubhouse   | 221           | \$ 21           | 359           | \$ 327          | 268           | \$ 24           | 435           | \$ 396           |
| Braemar Golf Maintenance | 1,659         | \$ 157          | -             | \$ -            | -             | \$ -            | 2,012         | \$ 1,831         |
| Fred Richards            | 71            | \$ 8            | 86            | \$ 79           | 86            | \$ 9            | 104           | \$ 96            |
| Public Works             | 447           | \$ 45           | 3,612         | \$ 3,070        | 542           | \$ 54           | 4,381         | \$ 3,724         |
| Edina Liquor Vernon      | 311           | \$ 31           | 503           | \$ 342          | 377           | \$ 30           | 610           | \$ 573           |
| Edina Liquor 50th        | 43            | \$ 4            | 68            | \$ 47           | 52            | \$ 49           | 82            | \$ 85            |
| <b>Total</b>             | <b>18,281</b> | <b>\$ 1,640</b> | <b>11,259</b> | <b>\$ 8,625</b> | <b>20,161</b> | <b>\$ 1,831</b> | <b>15,668</b> | <b>\$ 12,481</b> |

The following calculation depicts the pre and post Effective Leakage Area that was sealed by implementing building envelope improvements at the Braemar Maintenance Building.

Obtaining Effective Leakage Area (ELA)

$\rho = 1.2 \text{ kg/m}^3$

$ELA = Q_f / ((2P_f/\rho)^{0.5})$

$Q_f = \text{Blower Door Test Forced Air Flow Rate}$

Constant Leakage

0 10.76

0.08 0.908 ft<sup>2</sup>

**Pre ELA**

**0.36**

**Post ELA**

**0.279**

| Reference Pressure | Power Law | Pressure (Pa) | Flow Rate (CFM) | Flow in m <sup>3</sup> /s | Constant Leakage |       | Pressure (Pa) | Flow Rate (CFM) | Flow in m <sup>3</sup> /s | ELA  |
|--------------------|-----------|---------------|-----------------|---------------------------|------------------|-------|---------------|-----------------|---------------------------|------|
|                    |           |               |                 |                           | 0                | 10.76 |               |                 |                           |      |
| 10                 | 0.557     | 40.4          | 6376            | 3.0                       | 0.367            | 0.338 | 49.1          | 5579            | 2.6                       | 0.29 |
|                    |           | 38.1          | 6342            | 3.0                       | 0.376            | 0.348 | 49            | 5584            | 2.6                       | 0.29 |
|                    |           | 40.6          | 6373            | 3.0                       | 0.366            | 0.337 | 49.1          | 5594            | 2.6                       | 0.29 |
|                    |           | 34.2          | 5941            | 2.8                       | 0.371            | 0.346 | 38.9          | 4899            | 2.3                       | 0.29 |
|                    |           | 35.7          | 5954            | 2.8                       | 0.364            | 0.339 | 39            | 4904            | 2.3                       | 0.29 |
|                    |           | 36.3          | 5958            | 2.8                       | 0.361            | 0.336 | 38.8          | 4913            | 2.3                       | 0.29 |
|                    |           | 29.3          | 5435            | 2.6                       | 0.367            | 0.345 | 34.2          | 4435            | 2.1                       | 0.28 |
|                    |           | 28.2          | 5466            | 2.6                       | 0.376            | 0.355 | 34            | 4507            | 2.1                       | 0.28 |
|                    |           | 29.2          | 5443            | 2.6                       | 0.368            | 0.346 | 33.1          | 4522            | 2.1                       | 0.29 |
|                    |           | 25.4          | 4898            | 2.3                       | 0.355            | 0.337 | 33            | 4493            | 2.1                       | 0.29 |
|                    |           | 24.8          | 4924            | 2.3                       | 0.361            | 0.343 | 28.6          | 4082            | 1.9                       | 0.28 |
|                    |           | 23.2          | 4914            | 2.3                       | 0.373            | 0.355 | 28.2          | 4070            | 1.9                       | 0.28 |
|                    |           | 15.8          | 3720            | 1.8                       | 0.342            | 0.333 | 28.6          | 4064            | 1.9                       | 0.28 |
|                    |           | 15.7          | 3695            | 1.7                       | 0.341            | 0.332 | 20.1          | 3301            | 1.6                       | 0.27 |
|                    |           | 14.5          | 3747            | 1.8                       | 0.36             | 0.352 | 19.8          | 3291            | 1.6                       | 0.27 |
|                    |           |               |                 |                           |                  |       | 19.5          | 3286            | 1.6                       | 0.27 |
|                    |           |               |                 |                           |                  |       | 14.7          | 2646            | 1.2                       | 0.25 |
|                    |           |               |                 |                           |                  |       | 14.7          | 2617            | 1.2                       | 0.25 |
|                    |           |               |                 |                           |                  |       | 15.1          | 2629            | 1.2                       | 0.25 |

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## Appendix D

### SOLAR PHOTOVOLTAIC INSTALLATION

The following table depicts the savings associated with the solar photovoltaic system installation at the Edina City Hall.

|           | Guaranteed     |                |         | Actual         |                |         |
|-----------|----------------|----------------|---------|----------------|----------------|---------|
|           | Insolation kWh | Production kWh | % Yield | Insolation kWh | Production kWh | % Yield |
| January   | 13,487         | 2,488          | 18.4%   | 9,900          | 1,050          | 10.6%   |
| February  | 14,996         | 2,672          | 17.8%   | 10,083         | 778            | 7.7%    |
| March     | 17,558         | 3,030          | 17.3%   | 16,158         | 1,548          | 9.6%    |
| April     | 16,889         | 2,743          | 16.2%   | 14,263         | 1,501          | 10.5%   |
| May       | 20,496         | 3,199          | 15.6%   | 12,778         | 1,682          | 13.2%   |
| June      | 20,452         | 3,111          | 15.2%   | 14,354         | 1,921          | 13.4%   |
| July      | 21,027         | 3,196          | 15.2%   | N/A            | 2,754          | N/A     |
| August    | 20,071         | 3,060          | 15.2%   | N/A            | 2,556          | N/A     |
| September | 17,848         | 2,806          | 15.7%   | 18,408         | 1,951          | 10.6%   |
| October   | 15,116         | 2,466          | 16.3%   | 10,174         | 1,079          | 10.6%   |
| November  | 10,037         | 1,686          | 16.8%   | 9,535          | 1,011          | 10.6%   |
| December  | 9,983          | 1,791          | 17.9%   | 8,553          | 647            | 7.6%    |

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## Appendix E

### WATER CONSERVATION

The following tables depict the actual measured flows through the identified fixtures, the estimated flows through the same fixtures, and the percent of savings based on estimated and actual information.

|                     | Building            | Use Category | Make / Model | Flush Style       | Pre-Retrofit Fixture Rating | Post-Retrofit Fixture Rating | Pre-Retrofit Avg. Volume | Post-Retrofit Avg. Volume | Actual Pre-Retrofit Volume (gpf) | Actual Post-Retrofit Volume (gpf) | Savings (gpf) |
|---------------------|---------------------|--------------|--------------|-------------------|-----------------------------|------------------------------|--------------------------|---------------------------|----------------------------------|-----------------------------------|---------------|
| Toilet Flow         | City Hall           | Hi Use       | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 1.8                      | 1.6                       | 2.4                              | 1.5                               | 0.9           |
|                     | City Hall           | Hi Use       | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 1.7                      | 1.6                       | 2.0                              | 1.6                               | 0.4           |
|                     | City Hall           | Low Use      | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 1.8                      | 1.6                       | 1.9                              | 1.6                               | 0.4           |
|                     | City Hall           | Hi Use       | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 2.1                      | 1.6                       | 2.4                              | 1.7                               | 0.7           |
|                     | City Hall           | Hi Use       | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 1.7                      | 1.6                       | 2.5                              | 2.0                               | 0.5           |
|                     | City Hall           | General Use  | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 2.0                      | 1.6                       | 2.2                              | 1.8                               | 0.4           |
|                     | City Hall           | General Use  | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 1.6                      | 1.6                       | 1.8                              | 1.7                               | 0.1           |
|                     | City Hall           | Hi Use       | Crane        | Reverse Trap      | 1.6 gpf                     | 1.6 gpf                      | 1.6                      | 1.6                       | 2.1                              | 1.7                               | 0.4           |
|                     | Braemar Arena       | Hi Use       | Kohler       | Siphon Jet        | 1.6 gpf                     | 1.6 gpf                      | 2.3                      | 1.6                       | 3.4                              | 2.5                               | 0.9           |
|                     | Braemar Arena       | Hi Use       | Am Std       | Reverse Trap      | 3.5 gpf or More             | 3.5 gpf or More              | 2.7                      | 2.4                       | 2.4                              | 1.9                               | 0.5           |
|                     | Braemar Arena       | Hi Use       | Am Std       | Reverse Trap      | 3.5 gpf or More             | 3.5 gpf or More              | 2.5                      | 2.4                       | 3.6                              | 2.4                               | 1.1           |
|                     | Braemar Golf Course | Hi Use       | Am Std       | Siphon Jet        | 3.5 gpf or More             | 3.5 gpf or More              | 3.0                      | 2.6                       | 3.4                              | 3.1                               | 0.3           |
|                     | Braemar Golf Course | Hi Use       | Am Std       | Siphon Jet        | 3.5 gpf or More             | 3.5 gpf or More              | 3.0                      | N/A                       | 4.5                              | 3.0                               | 1.6           |
|                     | Edina Art Center    | Hi Use       | Am Std       | Siphon Jet        | 1.6 gpf Tank Toilet         | 1.6 gpf Tank Toilet          | 2.0                      | 1.6                       | 2.0                              | 1.9                               | 0.1           |
|                     | Edina Art Center    | General Use  | Am Std       | Siphon Jet        | 1.6 gpf Tank Toilet         | 1.6 gpf Tank Toilet          | 4.3                      | 3.0                       | 5.2                              | 4.0                               | 1.2           |
| Braemar Golf Course | Staff Use           | Am Std       | Siphon Jet   | 3.5 gpf or More   | 3.5 gpf or More             | 2.5                          | 2.6                      | 4.2                       | 3.9                              | 0.3                               |               |
| Urinal Flow         | City Hall           | Hi Use       | Crane        | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 0.6                      | 0.6                       | 1.1                              | 0.6                               | 0.5           |
|                     | City Hall           | Hi Use       | Crane        | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 0.6                      | 0.6                       | 0.8                              | 0.7                               | 0.1           |
|                     | Fire Station 1      | Hi Use       | N/A          | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 0.7                      | 0.6                       | 1.0                              | 0.6                               | 0.4           |
|                     | Fire Station 1      | General Use  | N/A          | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 0.9                      | 0.6                       | 1.2                              | 1.7                               | -0.5          |
|                     | Fire Station 2      | Hi Use       | Am Std       | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 1.5                      | 0.6                       | 1.6                              | 0.6                               | 1.0           |
|                     | Braemar Arena       | General Use  | Kohler       | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 1.1                      | 0.6                       | 0.5                              | 0.6                               | -0.2          |
|                     | Braemar Arena       | General Use  | Kohler       | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 0.8                      | 0.6                       | 0.6                              | 0.5                               | 0.0           |
|                     | Braemar Golf Course | Hi Use       | Kohler       | Siphon Jet Urinal | 1.0 gpf Urinal              | 1.0 gpf Urinal               | 1.0                      | 0.6                       | 0.8                              | 0.6                               | 0.2           |

# 5. Appendices

## Appendix E -Continued

### WATER CONSERVATION

|                     | Building        | Use Category     | Application           | Pre-Retrofit Avg. Flow | Post-Retrofit Avg. Flow | Date of Pre-Retrofit Measurement | Actual Pre-Retrofit Flow (gpm) | Date of Post-Retrofit Measurement | Actual Post-Retrofit Flow (gpm) | Savings (gpm) |
|---------------------|-----------------|------------------|-----------------------|------------------------|-------------------------|----------------------------------|--------------------------------|-----------------------------------|---------------------------------|---------------|
| Sink Flow           | City Hall       | Hi Use           | Lav Sink              | 2.2                    | 0.5                     | 10/26/11                         | 2.1                            | 10/26/11                          | 0.5                             | 1.6           |
|                     | City Hall       | Hi Use           | Lav Sink              | 1.9                    | 0.5                     | 10/26/11                         | 1.9                            | 10/26/11                          | 0.5                             | 1.4           |
|                     | City Hall       | Low Use          | General Use Sink      | 2.3                    | 1.5                     | 10/26/11                         | 2.1                            | 10/26/11                          | 1.4                             | 0.7           |
|                     | City Hall       | Low Use          | Lav Sink              | 2.0                    | 0.5                     | 10/26/11                         | 2.1                            | 10/26/11                          | 0.5                             | 1.6           |
|                     | City Hall       | Hi Use           | Lav Sink              | 2.1                    | 0.5                     | 10/26/11                         | 2.1                            | 10/26/11                          | 0.5                             | 1.6           |
|                     | City Hall       | Hi Use           | Lav Sink              | 2.3                    | 0.5                     | 10/26/11                         | 2.0                            | 10/26/11                          | 0.5                             | 1.5           |
|                     | City Hall       | General Use      | General Use Sink      | 2.1                    | 1.0                     | 10/26/11                         | 2.1                            | 10/26/11                          | 0.5                             | 1.6           |
|                     | City Hall       | General Use      | General Use Sink      | 2.3                    | 1.5                     | 10/26/11                         | 2.0                            | 10/26/11                          | 1.4                             | 0.6           |
|                     | Fire Station 1  | Hi Use           | Multipurpose Lav Sink | 1.7                    | 1.0                     | 10/27/11                         | 2.0                            | 10/27/11                          | 0.8                             | 1.1           |
|                     | Fire Station 1  | Hi Use           | Multipurpose Lav Sink | 1.7                    | 1.0                     | 10/27/11                         | 2.0                            | 10/27/11                          | 0.8                             | 1.2           |
|                     | Fire Station 1  | Hi Use           | Multipurpose Lav Sink | 1.7                    | 1.0                     | 10/27/11                         | 1.9                            | 10/27/11                          | 0.8                             | 1.1           |
|                     | Fire Station 1  | Hi Use           | Multipurpose Lav Sink | 1.7                    | 1.0                     | 10/27/11                         | 2.0                            | 10/27/11                          | 0.9                             | 1.1           |
|                     | Fire Station 1  | General Use      | General Use Sink      | 1.9                    | 1.5                     | 10/27/11                         | 2.1                            | 10/27/11                          | 1.6                             | 0.5           |
|                     | Fire Station 1  | General Use      | General Use Sink      | 2.0                    | 1.5                     | 10/27/11                         | 1.8                            | 10/27/11                          | 1.4                             | 0.4           |
|                     | Fire Station 1  | General Use      | General Use Sink      | 2.2                    | 1.5                     | 10/27/11                         | 1.8                            | 10/27/11                          | 1.5                             | 0.3           |
|                     | Fire Station 1  | General Use      | Lav Sink              | 1.7                    | 0.5                     | 10/27/11                         | 1.9                            | 10/27/11                          | 0.5                             | 1.4           |
|                     | Fire Station 1  | General Use      | Lav Sink              | 1.7                    | 0.5                     | 10/27/11                         | 1.9                            | 10/27/11                          | 0.5                             | 1.4           |
|                     | Fire Station 1  | General Use      | Lav Sink              | 1.8                    | 0.5                     | 10/27/11                         | 1.9                            | 10/27/11                          | 0.5                             | 1.5           |
|                     | Fire Station 1  | General Use      | Lav Sink              | 1.8                    | 0.5                     | 10/27/11                         | 1.9                            | 10/27/11                          | 0.5                             | 1.4           |
|                     | Fire Station 2  | Hi Use           | Multipurpose Lav Sink | 2.3                    | 1.0                     | 10/27/11                         | 2.7                            | 10/27/11                          | 0.9                             | 1.8           |
| Fire Station 2      | General Use     | General Use Sink | 2.4                   | 1.5                    | 10/27/11                | 2.6                              | 10/27/11                       | 1.5                               | 1.1                             |               |
| Braemar Golf Course | Staff Use       | Lav Sink         | 1.9                   | 0.5                    | 10/31/11                | 1.9                              | 10/31/11                       | 0.5                               | 1.5                             |               |
| Braemar Golf Course | Staff Use       | Lav Sink         | 2.3                   | 0.5                    | 10/31/11                | 1.8                              | 10/31/11                       | 0.5                               | 1.3                             |               |
| Public Works        | General Use     | General Use Sink | 3.0                   | 1.5                    | 10/31/11                | 2.0                              | 10/31/11                       | 1.3                               | 0.6                             |               |
| Shower Flow         | city Hall       | Low Use          | Wall Showers          | 1.88                   | 1.80                    | 10/26/11                         | 1.6                            | 10/26/11                          | 1.4                             | 0.2           |
|                     | city Hall       | Hi Use           | Wall Showers          | 1.88                   | 1.80                    | 10/26/11                         | 2.1                            | 10/26/11                          | 0.7                             | 1.4           |
|                     | Fire station #2 | Hi Use           | Handheld Showers      | 2.75                   | 1.80                    | 10/27/11                         | 2.9                            | 10/27/11                          | 1.7                             | 1.2           |
|                     | Fire station #2 | Hi Use           | Handheld Showers      | 3.00                   | 1.80                    | 10/27/11                         | 3.7                            | 10/27/11                          | 1.9                             | 1.8           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 1.75                   | 1.80                    | 10/27/11                         | 1.4                            | 10/27/11                          | 1.0                             | 0.4           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 1.75                   | 1.80                    | 10/27/11                         | 1.4                            | 10/27/11                          | 1.1                             | 0.3           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 1.75                   | 1.80                    | 10/27/11                         | 1.5                            | 10/27/11                          | 1.3                             | 0.2           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 1.75                   | 1.80                    | 10/27/11                         | 1.5                            | 10/27/11                          | 1.3                             | 0.3           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 2.00                   | 1.80                    | 10/27/11                         | 1.3                            | 10/27/11                          | 1.1                             | 0.3           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 2.00                   | 1.80                    | 10/27/11                         | 1.5                            | 10/27/11                          | 1.2                             | 0.3           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 2.00                   | 1.80                    | 10/27/11                         | 1.4                            | 10/27/11                          | 1.2                             | 0.2           |
|                     | Braemar Arena   | General Use      | Wall Showers          | 1.50                   | 1.80                    | 10/27/11                         | 1.5                            | 10/27/11                          | 1.5                             | 0.0           |
|                     | Public Works    | General Use      | Handheld Showers      | 2.13                   | 1.80                    | 10/31/11                         | 1.7                            | 10/31/11                          | 1.6                             | 0.2           |
|                     | Public Works    | General Use      | Handheld Showers      | 2.00                   | 1.80                    | 10/31/11                         | 1.7                            | 10/31/11                          | 1.4                             | 0.3           |