# City *of* Lawrence
## UTILITIES

# MEMORANDUM

**TO:**       Dave Corliss, City Manager
Cynthia Boecker, Assistant City Manager
Diane Stoddard, Assistant City Manager
Casey Toomay, Budget Manager
**FROM:**  Dave Wagner, Utilities Director
Mike Lawless, Assistant Director of Utilities
Philip Ciesielski, Assistant Director of Utilities
**RE:**      Utilities Department Efficiency Measures
**DATE:**  May 15, 2012

The Utilities Department has made significant accomplishments to increase efficiency and reliability during the past three years. Through these efficiencies, the department has used the savings to repair and replace critical, aging infrastructure, as well as absorb some of the increasing fixed costs of personnel, fuel, energy, chemicals, and raw water contracts to maintain a relatively flat operations and maintenance budget request for 2013.

Some of the areas where efficiencies have been achieved include:
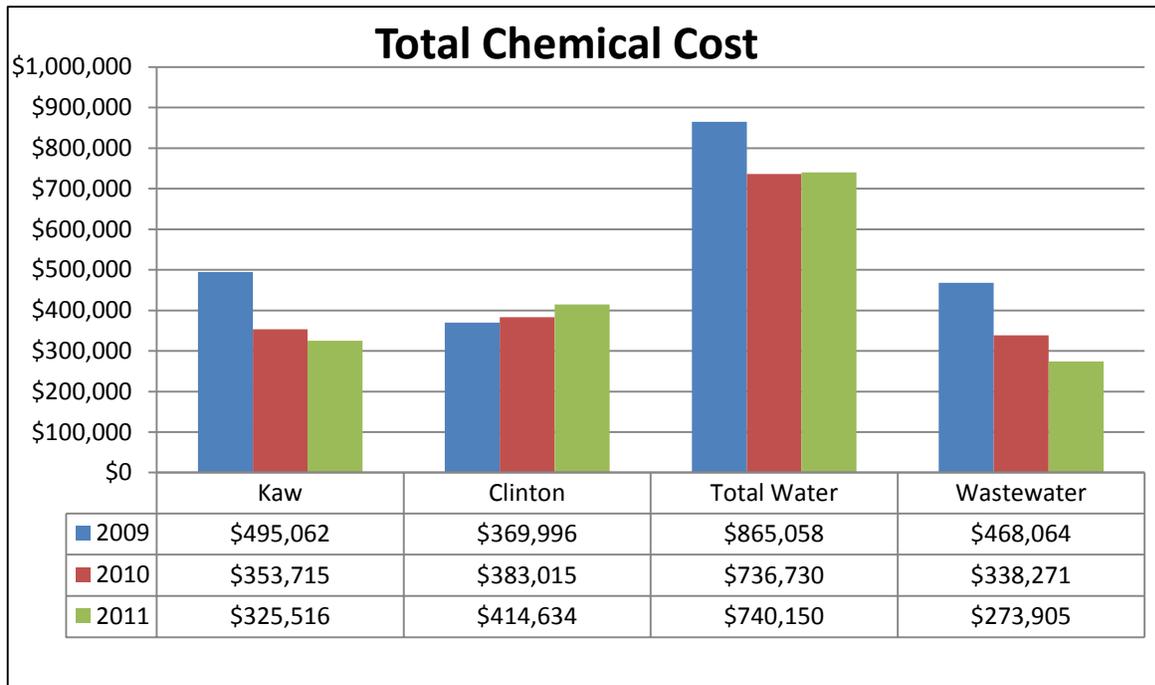
## 1. Chemical usage

**Total Gallons of Water Treated vs. Chemical Costs**
Chemical costs fluctuate due to a number of factors. Some of those factors include volume of water treated, cost of the chemical, and chemical dosing needs based on raw water quality. Increased plant automation and instrumentation help to optimize chemical dosing. The gas chromatography/mass spectrometer (GCMS), acquired in 2009, in the laboratory provides quicker analytical results to help plant operators make process changes more effectively.
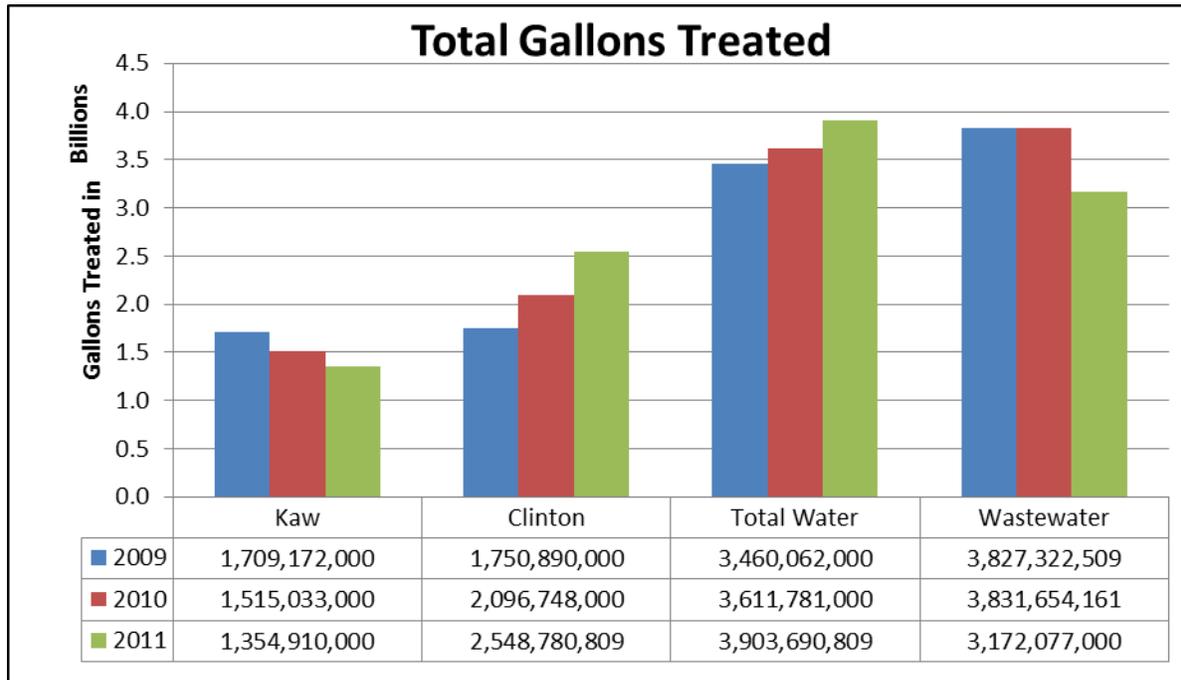
Graph 1 below illustrates the overall decrease in chemical cost from 2009-2011 for water despite the significant increase in water production illustrated in Graph 2. Wastewater chemical cost has decreased due to optimizing chemical usage, as well as the dry weather conditions experienced in 2011.

Graph 1.

## Total Chemical Cost

|  | Kaw | Clinton | Total Water | Wastewater |
|---|---|---|---|---|
| ■ 2009 | $495,062 | $369,996 | $865,058 | $468,064 |
| ■ 2010 | $353,715 | $383,015 | $736,730 | $338,271 |
| ■ 2011 | $325,516 | $414,634 | $740,150 | $273,905 |

Graph 2.

## Total Gallons Treated

Gallons Treated in Billions

|  | Kaw | Clinton | Total Water | Wastewater |
|---|---|---|---|---|
| ■ 2009 | 1,709,172,000 | 1,750,890,000 | 3,460,062,000 | 3,827,322,509 |
| ■ 2010 | 1,515,033,000 | 2,096,748,000 | 3,611,781,000 | 3,831,654,161 |
| ■ 2011 | 1,354,910,000 | 2,548,780,809 | 3,903,690,809 | 3,172,077,000 |

**Total Chemical Cost per Unit of Water Treated**
The overall decrease in chemical cost per million gallons of water and wastewater treated is a result of optimizing the chemical dosing through the use of plant automation and laboratory testing, use of the GCMS analyzer results for faster chemical adjustment, the volume of water treated, and chemical, fuel, and raw material costs.

Graph 3 below illustrates the overall cost of chemical decrease per million gallons treated over both water and wastewater treatment.

Graph 3.
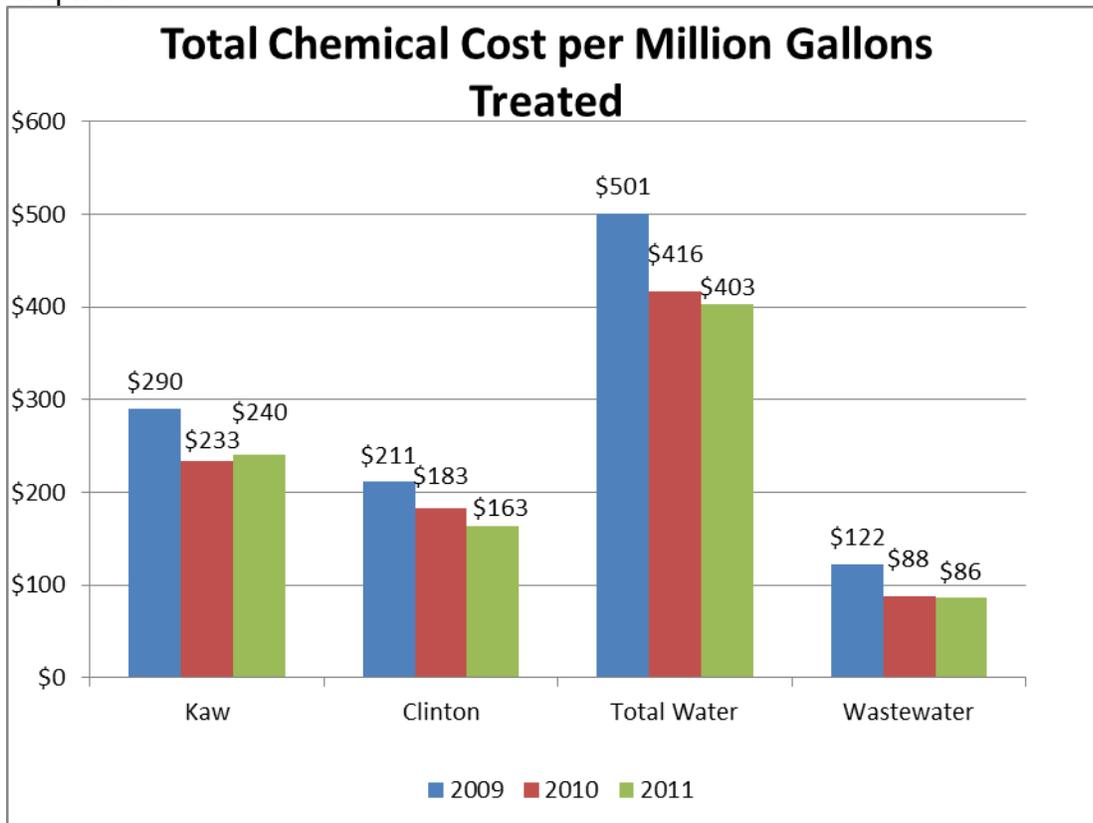


## 2. Electrical Usage

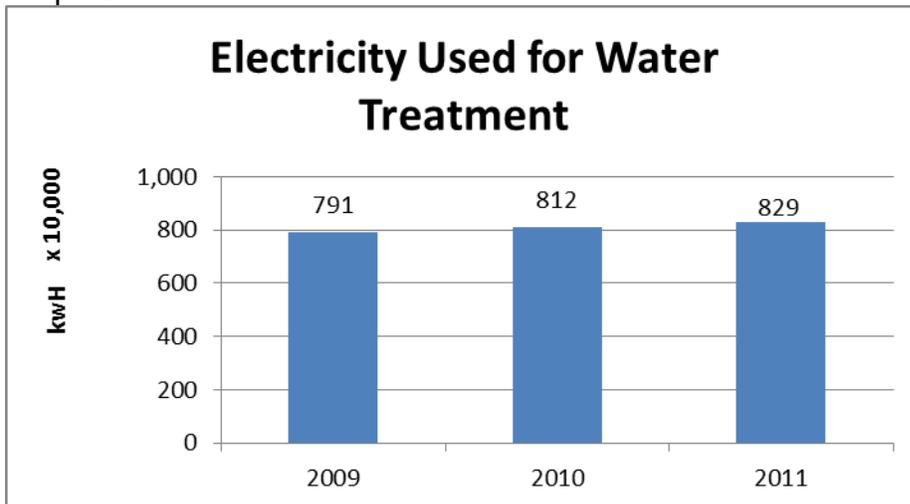**Electrical Use for Water Treatment**
Electrical use increases with the increase of water treated above a minimum baseline level. The increase in gallons of water treated per kwH used also increases due to efficiencies of scale.

Graphs 4-6 below illustrate the slight increase of electrical usage between 2009 and 2011. However, the per unit cost of electricity increased by 19% in that same timeframe. The volume of water treated also increased by 7% between 2010 and 2011. The efficiency savings is illustrated in Graph 6 with the increased number of gallons of water treated per kwH.
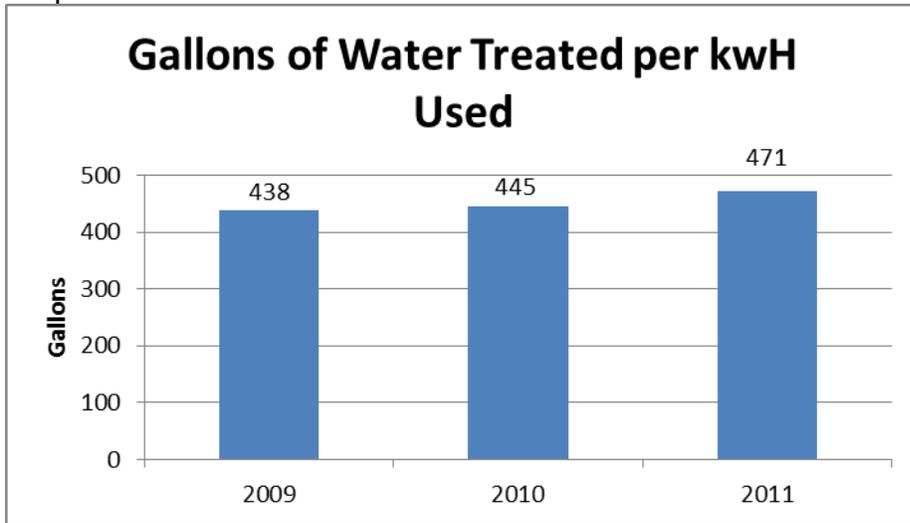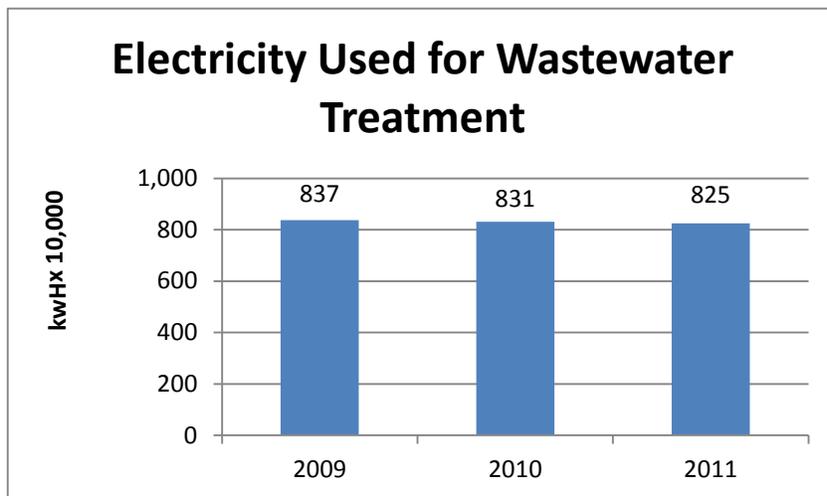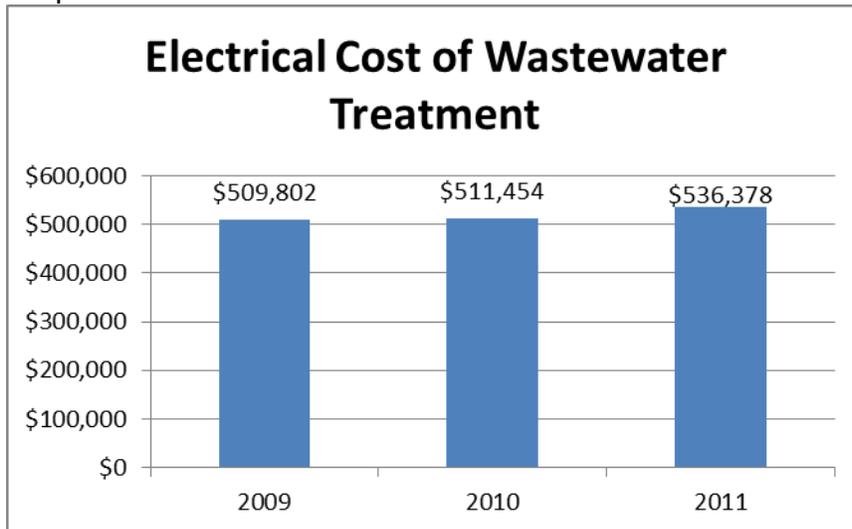
Graph 4.

**Electrical Cost of Water Treatment**

| Year | Cost |
|------|------|
| 2009 | $570,066 |
| 2010 | $639,294 |
| 2011 | $711,114 |

Graph 5.

**Electricity Used for Water Treatment**

(kwH x 10,000)

| Year | Value |
|------|-------|
| 2009 | 791 |
| 2010 | 812 |
| 2011 | 829 |

Graph 6.

**Gallons of Water Treated per kwH Used**

(Gallons)

| Year | Gallons |
|------|---------|
| 2009 | 438 |
| 2010 | 445 |
| 2011 | 471 |
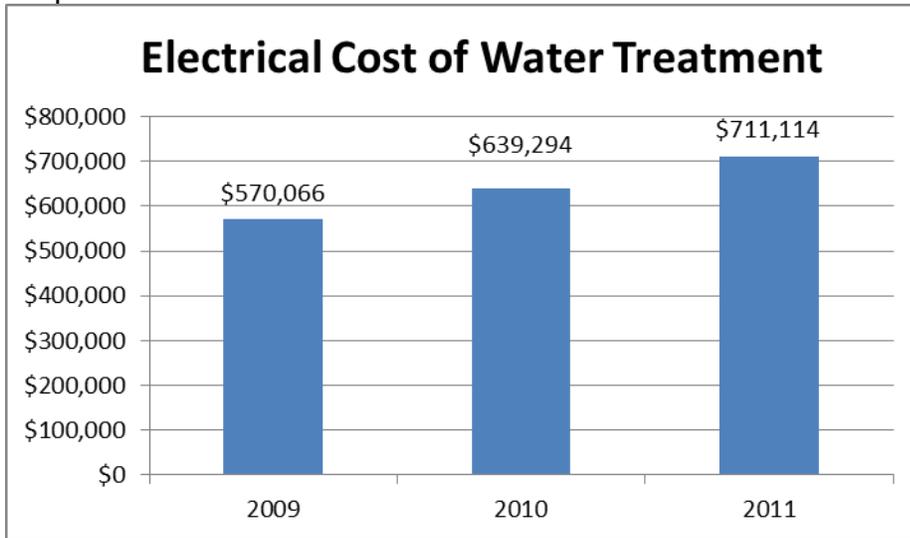
**Electrical use for Wastewater Treatment**

Electrical use increases with the increase of wastewater treated above a minimum baseline level. Other factors include increase to the general electricity costs and the various fees charged by the supplier.

Graph 7 and 8 illustrate a decrease in electricity used for wastewater treatment, but a slight increase in the total cost paid for electricity between 2009 and 2011. Graph 9 indicates a 17% decrease in the gallons of wastewater treated per kwH, which would be expected due to the 16% decrease in wastewater treated and the spreading of the minimum baseline cost over a smaller volume of wastewater.
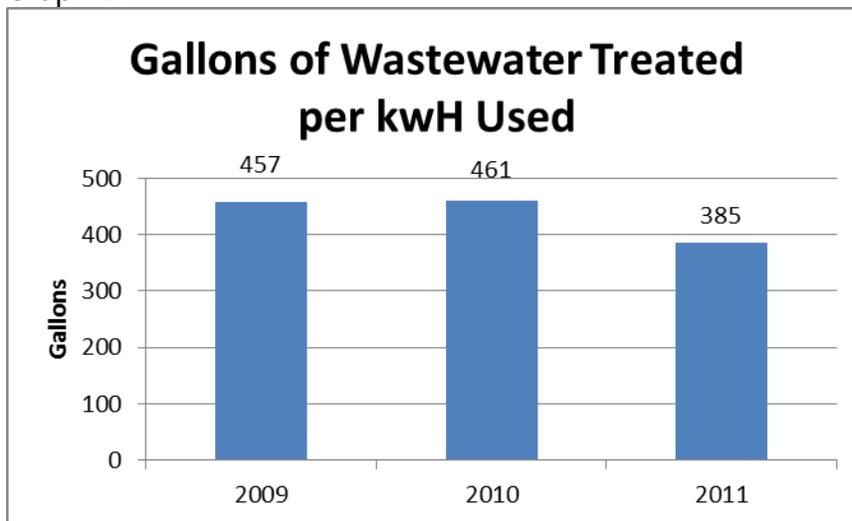
Graph 7.

**Electricity Used for Wastewater Treatment**

(kwH x 10,000)

| Year | kwH x 10,000 |
|------|--------------|
| 2009 | 837 |
| 2010 | 831 |
| 2011 | 825 |

Graph 8.



Graph 9.



## 3. Service calls and repairs

**City Sewer Main Blockages**
The number of city sewer blockages has decreased due to preventive maintenance programs, including 4-year section cleaning, chemical root control, TV inspection of the sewer lines, and monthly/3-month/6-month cleaning of specific areas. The decrease in service calls, specifically those which include a city main blockage, not only decreases the likelihood of a compliance issue due to a sanitary sewer overflow, but also decreases the staff time necessary to attend to these service calls, which can then be re-directed to other projects. Graph 10 corresponds with the red bars in Graph 11 below.
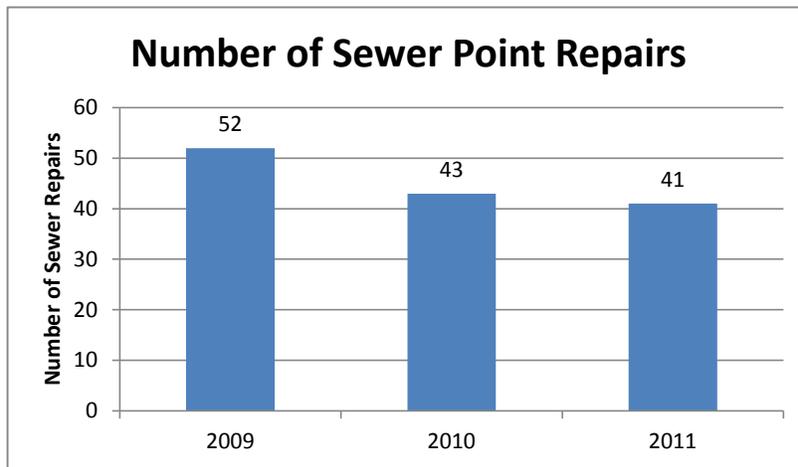
Graph 10
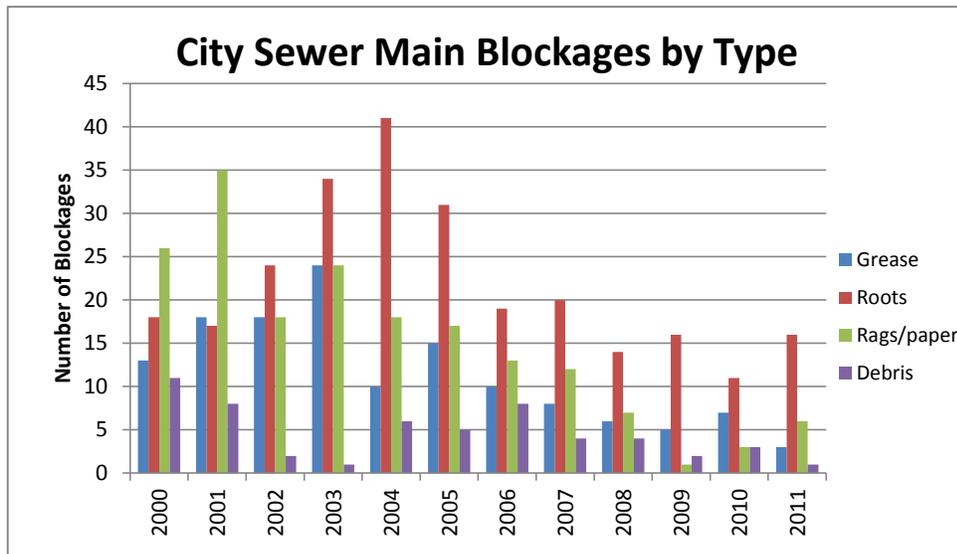


Graph 11
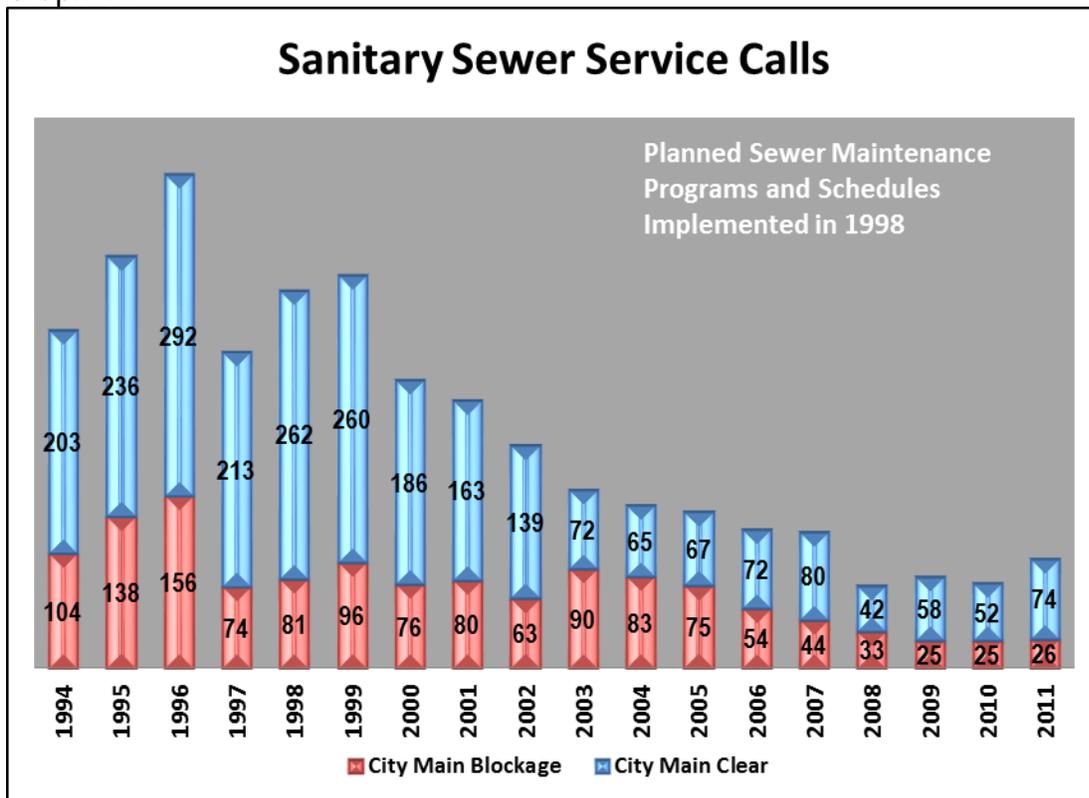
**Sanitary Sewer Repairs**

Sanitary sewer repairs have decreased between 2009 and 2011. In the coming years, the use of technology such as the TV van and its integration with system models and GIS will target rehabilitation dollars for better asset management and more reliable results in less staff time.

Graph 12 and 13 illustrate a 20% decrease in the number of repairs and a 23% decrease in the total cost of those sewer repairs over that timeframe. This decrease was due to a backlog of sewer repairs prior to 2009 that were completed in 2009, as well as fewer leaks identified due to mechanical issues with the TV van, which prevented use, and the use of CIPP to repair problematic sewer lines.
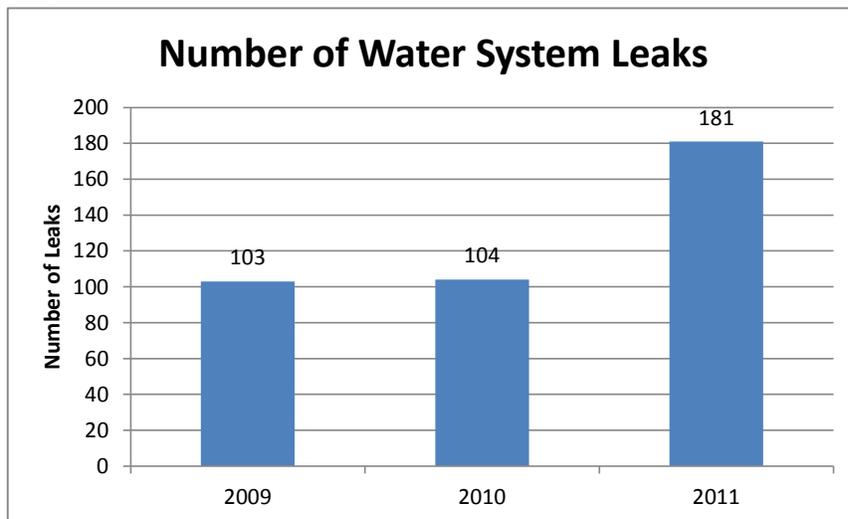
Graph 12



Graph 13
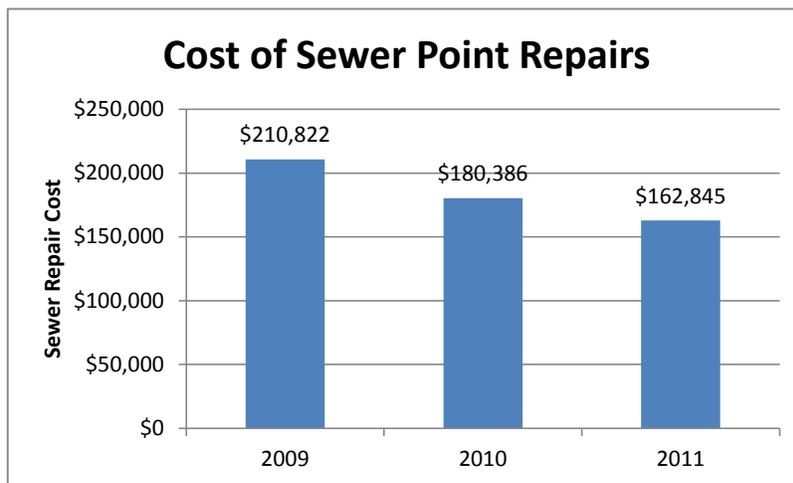
## 4.  Other efficiency measures
- City staff is using the water and wastewater models to evaluate the new developments that would previously have required a consultant. Projects that have benefited from this include the new recreation center, downtown hotels, and the farmland property development.
- An increase in filter run time at the Clinton Water Treatment Plant may result in a savings of 177 million gallons of finished water or $30,000 per year.

Through the efficiencies described above, the department has used the savings to repair and replace critical, aging infrastructure, as well as meet the fluctuating costs of necessary consumables. However, other work such as the backlog or replacement and maintenance of deteriorating critical infrastructure exists.

An example of these maintenance and repair needs is evident in the condition of the water distribution system as illustrated in Graphs 14 and 15. Graph 14 shows a 74% increase in water main leaks from 2010 to 2011, which resulted in a similar increase in the cost of those repairs, as shown in Graph 15.  The increase in water system leaks may be due to the dry weather conditions experienced in 2011. Similar increases were generally seen in neighboring water utilities in the region.

Graph 14

Graph 15
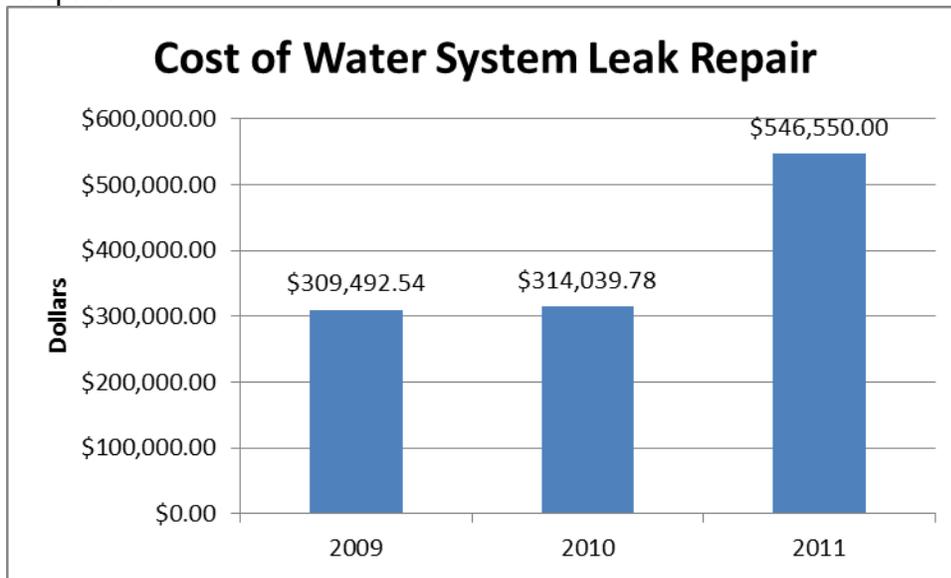


Ongoing development of a "pipe condition index" uses GIS and work order data to identify aging and/or compromised infrastructure and prioritize the repair and rehabilitation. This process has identified $19 million in capital improvements to waterline replacement necessary to maintain system reliability. Graph 16 indicates the increasing trend of infrastructure deterioration will continue to be an issue without proactive replacement and maintenance resources in place.

Graph 16.
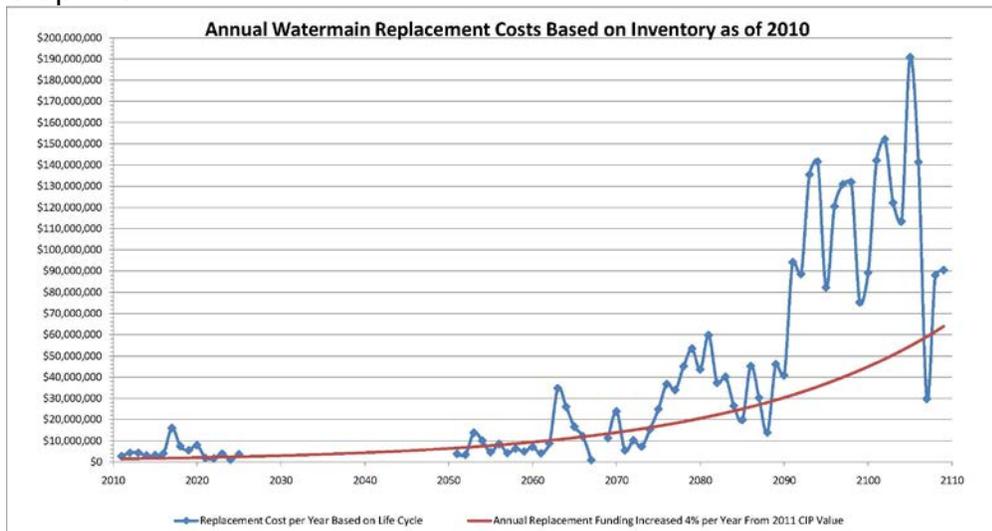


The Utilities department continues to look for programs and practices to increase the efficiency and reliability of the department's services. However, in the area of repair and replacement of deteriorating infrastructure, the needs far exceed the ability of department make up those resources and still maintain the quality of water and wastewater services expected.