

WATER SERVICES ZERO-BASED REVIEW



**Water Services ZBR Recommendations
Implementation Plan and Update**

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EXECUTIVE SUMMARY

On March 17, 2015, Scottish Water International (SWI) presented its findings from the Water Services Zero-Based Review to Council. The findings included 33 recommendations to help the Water Services business unit realize financial benefit or a higher level of connection with the customers of the water utility. Following a high-level analysis of all business activities across Water Services, SWI focused on business “themes” that could provide financial benefit across multiple lines of service in Water Services. Using the wastewater utility as the subject for the analysis, the themes identified were those with benefits that could be “scaled” across other utility operations within Water Services. This report details the research and planning to advance SWI’s recommendations and identifies the first wave of projects and initiatives of an iterative approach to Water Services’ continuous improvement journey.

The advancement of continuous improvement initiatives has been part of the Water Utility’s work plan for a number of years. The Water Utility includes Water Services and Water Resources. At the time of the review, Water Services had a number of continuous improvement initiatives underway, but the Zero-Based Review highlighted areas that would benefit from a new or refreshed focus. As well, the review provided insight into the benefit of a stronger commitment to identifying, tracking and reporting the financial benefit of continuous improvement initiatives, something that Water Services has not focused on in the past.

SWI’s in-depth analysis grouped its 33 recommendations into five themes:

1. **Performance Measurement:** to strengthen the reporting of business performance so everyone can see their contribution to service delivery and improvement.
2. **Trenchless Technology:** to be a leader in utilizing technology for the repair and maintenance of the wastewater and water networks.
3. **Resource Optimization:** to deliver an efficient and effective service by being more proactive, through the optimization of resources.
4. **Customer Experience:** to deliver the best customer experience by providing an informed and consistent customer journey.
5. **Risk-Based Maintenance:** to maintain our assets effectively, at the most optimum frequency, delivering financial efficiency and best-in-class asset management.

SWI estimated that the recommendations, once fully implemented, could generate between \$2.4 and \$5.0 million in annual financial benefits (approximately 1.6% to 3.4% of the \$149M 2013 operating budget for Water Services) through operational efficiencies or changes in service delivery effectiveness. Water Services accepted all of the recommendations as worthy of further assessment, and made a commitment to Council to report back by April 2016 with an assessment and implementation plan for these recommendations.

Following the March 2015 report to Council, Water Services assembled action teams to further assess the feasibility and opportunity of all 33 recommendations. The teams identified annual

financial benefits of \$6.1 million per year that can be achieved once the implementation plan is fully enacted. By acting immediately on some recommendations, Water Services realized financial benefits of \$1.2 million in 2015. These financial benefits are expected to increase as programs and initiatives are extended to the operating and maintenance activity across all lines of service in the Water Utility. The implementation research assessed the recommendations for their suitability to be scaled across the Water Utility, but does extend to providing financial efficiency estimates for utility services not directly involved in the in-depth analysis.

Through the work the research teams completed on the SWI recommendations, Water Services arrived at the following opportunity assessments:

Performance Measurement:

The Water Utility considers performance measurement to be a critical component in driving business improvement and customer value. The Water Utility continues to be committed to following the corporate approach to performance measurement and strengthening its overall performance measurement system. The implementation of Results Based Accountability (RBA) at The City of Calgary has provided a simple, plain language approach that has helped drive business improvements and promote customer-centric decisions. To further advance the Results Based Accountability (RBA) framework, the Water Utility will concentrate on defining customer levels of service, identified as a focus of the Water Resources Zero-Based Review, underway in 2016. Scottish Water International did not identify direct financial gains from the performance measurement opportunities, however, the Water Utility recognizes that there is significant opportunity to advance measurement practices and introduce technology solutions to improve performance throughout the business.

Trenchless Technology:

Water Services is preparing to expand the use of different types of trenchless technology within its operation. Building this capability will help maximize the use of existing financial resources and increase the number of customers assisted, while reducing the number of homes on long-term maintenance, and reduce overall repair costs on wastewater connections. The first initiative in this program will be the creation of a program that addresses growing pressures in the wastewater network, reduces conventional repair costs, and is able assist up to two thirds as many customers with the same budget amount. Using trenchless technology that has already proven successful in Canada, the wastewater connection lining program is expected to result in net cumulative financial benefits of \$2.4 million by 2020 in its pilot-scale, and the potential to grow as the program is fully developed. As the program expands, the need for the root-augering program and repeat maintenance visits will diminish over time. Research and dialogue with customers and other municipalities will continue until recommendations can be made on the viability of cost-sharing the lining program with homeowners.

Resource Optimization:

SWI's recommendations on resource optimization will not be advanced independently, because they are closely interconnected with those provided in the customer experience group of recommendations, sharing a focus on advancing the customer experience. Initiatives in the resource optimization theme have been prioritized in consideration of cost and forecasted benefit. Water Services began advancing small-scale projects with less complexity and high return potential in 2015 and continue into 2016. Working quickly on several recommendations realized financial benefits of \$0.6 million per year in 2015, and identified an additional \$1.3 million per year in efficiencies when the opportunities are fully implemented. The potential of scaling the resource optimization recommendations across all lines of service will be reviewed as part of the implementation plan.

Customer Experience:

While the SWI recommendations largely focus on improvements in the areas of information and processes to improve the customer experience, Water Services recognizes that success also requires a culture shift to ensure the customer is at the center of business decisions. Work happening across The Corporation on culture, initiatives out of Corporate Customer Service and Communications, along with efforts to enhance the Customer Strategy team within the Water Utility will all be key contributors to advancing customer focus. The establishment of IT infrastructure for centralized information access, re-structuring business processes, and clearly defining the levels of service offered by the Water Utility is a long-term journey that will require investment and time. Once fully implemented, Water Services identified potential efficiency improvements between \$0.45 million and \$0.89 million per year.

Risk Based Maintenance:

The Zero-Based Review recognized Water Services' advanced asset and maintenance management practices. The principles of risk-based maintenance promoted by SWI are being applied as a strategy to advance the maturity of the Water Utility's asset management practices, allowing the Water Utility to achieve a higher level of proficiency. Efficiency gains resulting from these strategies will be used to offset increases in maintenance costs anticipated from the continuing pressure of aging infrastructure, increasing plant complexity, system growth and inflation. Implementing risk-based maintenance recommendations in the water treatment facilities resulted in productivity gains of \$0.6 million in 2015 with additional increases to be made as these management practices are scaled to other facilities.

Water Services Estimated Financial Efficiencies

Recommendation Theme		Estimated Range of Efficiency		Investment Requirements
		Early Stage Estimate	Full Implementation Estimate	
Performance Measurement	Scottish Water estimate range	\$0 /year	\$0 /year	\$30,000
	Water Services efficiency improvements	\$0 /year	\$0 /year	\$30,000
Trenchless Technology	Scottish Water estimate range	\$900,000 /year	\$1.8M /year	\$500,000
	Water Services efficiency improvements	\$800,000 /year	\$2.4M /year*	\$2.0M /year
Resource Optimization	Scottish Water estimate range	\$575,000 /year	\$1.4M /year	\$200,000
	Water Services efficiency improvements	\$595,000 /year	\$1.9M /year	none
Customer Experience	Scottish Water estimate range	\$282,000 /year	\$801,000 /year	unknown
	Water Services efficiency improvements	\$345,000/year	\$890,000 /year	\$825,000
Risk Based Maintenance	Scottish Water estimate range	\$506,000 /year	\$800,000 /year	\$85,000
	Water Services efficiency improvements	\$600,000 /year	\$860,000 /year	\$100,000
Total Efficiency Improvements	Scottish Water estimate total	\$2.4M /year	\$5.0M /year	
	Total Water Services efficiency improvements	\$2.3M /year	\$6.1M /year	

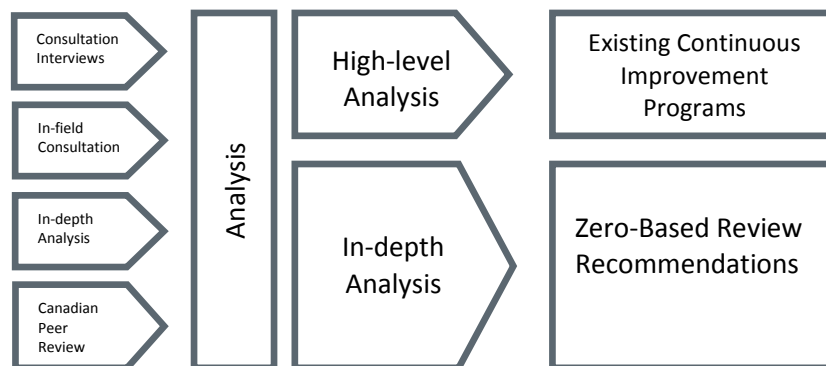
*Cumulative net financial benefits reached by 2020. On-going investment required to support program delivery.

ZERO-BASED REVIEW BACKGROUND

Water Services began its journey in The City of Calgary’s Zero-Based Review (ZBR) program in January 2014. Through this corporate-wide program, City Administration is undertaking a systematic review of all city services to identify efficiency and effectiveness opportunities to maximize a business unit’s ability to deliver customer value. The outcome of the review process is an overall assessment of a business unit’s services, with a series of focused recommendations for delivering services more efficiently or effectively. This could include changes to a service level or it’s delivery to reduce costs or changes to a service’s delivery that would achieve greater results with the resources currently available.

The Water Services ZBR was managed by Corporate Initiatives (a division of the Chief Financial Officer’s Department), with active participation from Water Services. In April 2014, Scottish Water International (SWI) was selected as the consultant for the Water Services review through a competitive request for proposal process. SWI assessed all services delivered by Water Services in a high-level analysis, then used that information to focus on a specific line of service: the operation and maintenance of the wastewater system. The in-depth analysis identified 33 recommendations grouped into five theme areas: performance measurement, trenchless technology, resource optimization, customer experience and risk-based maintenance. SWI estimated that the recommendations, once fully implemented, could potentially realize between \$2.4 and \$5.0 million in annual financial benefits and pursue opportunities to define service levels, deliver consistent customer experiences and strengthen Water Services’ capacity to maximize value for its customers.

The Water Services Zero-Based Review Investigation Approach



After Council’s approval of the recommendation report in March 2015, Water Services assembled internal action teams comprised of employees from business groups directly involved in the implementation of the recommendations. The research teams focused in a specific recommendation theme, assessing each recommendation with the following criteria:

1. **Efficiency Gains:** estimating and tracking the realized financial benefits of pursuing a recommendation.
2. **Effectiveness Benefits:** understanding how a recommendation will improve a line of service to improve customer experience or deliver more customer value.
3. **Timing and Sequencing:** determining the appropriate time to implement a recommendation and understanding the dependence on other initiatives.

4. **Implementation Requirements:** assessing the resource requirements and demand on capital and operating budgets.
5. **Scalability:** evaluating where recommendations are applicable across the Water Utility to the water and drainage lines of service, thereby maximizing gains made from implementing the report.
6. **Performance Measurement:** tracking the changes a recommendation has on the business.

Water Services approached the research and investigation of the Zero-Based Review recommendations as an opportunity to advance our existing continuous improvement culture and practices by using the review as a catalyst for change. The Implementation Plan's continuous improvement approach allows projects to build upon each other, with some projects and initiatives launched in 2015, setting the foundation for other initiatives in the future. The integrated nature in which Water Resources and Water Services operate the Water Utility means that the projects within the Implementation Plan will provide benefits across.

Through investigations, research and pilot projects, the research teams identified annual financial benefits of \$2.7 million per year that can be achieved in the near term. By acting immediately on some recommendations, Water Services realized financial benefits of \$1.2 million per year in 2015. These financial benefits are expected to grow as recommendations are scaled across the Water Utility, as projects and practices are extended beyond the wastewater line of service to the water and drainage lines of service.

RECOMMENDATION ANALYSIS

1. PERFORMANCE MEASUREMENT

CURRENT STATE

The Water Utility recognizes the importance of performance measures in assessing how successfully it is performing to ensure customers are getting the best value for the services being provided. Performance measures have been tracked in various capacities throughout the business for many years. These performance measures are used to drive improvement by creating visibility, accountability and focus on critical areas of the business. At the Water Treatment Plant, for example, performance measures are used regularly to drive improvements in energy management, process maintenance and plant reliability.

There was recognition in 2010 that the Water Utility would benefit from a more formal governance structure for performance measures. A performance measure committee was developed which consisted of leads from various divisions in both Water Services and Water Resources. This committee has focused on advancing performance measures over the last five years and providing standardization, common language and best practice sharing.

In addition, the Water Utility have aligned their performance measures with the City's corporate standard for performance measurement, Results-Based Accountability (RBA). RBA is a simple, practical and disciplined approach for planning, evaluating and continuously improving services and programs. It uses targeted data to assess impact on improving the quality of life in communities and performance of City programs and services. The method aims to develop a clearly defined set of performance measures that aligns with one of the three Results Based Accountability categories:

- How much do we do?
- How well do we do?
- Is anyone better off?

Although the Water Utility are currently using performance measures in various capacities throughout the business, there is recognition that there is significant opportunity to advance the practices and maturity of performance measures to drive improvement and ultimately, increase value for customers.

THEME RECOMMENDATIONS

The six recommendations Scottish Water International made about performance measures aim to “strengthen the reporting of business performance measures so everyone can see their contribution to service delivery and improvement.” The recommendations suggest improvements to the key performance measures used by Water Services’ management team, as well as to the business processes used to collect and analyze the data. They also

recommended making this data visible and meaningful to all employees. Although no direct financial benefits were identified through these recommendations, SWI highlighted performance measurement as essential to understanding and driving business performance in the Water Utility.

DETAILED RECOMMENDATIONS

1. **Dashboard Reporting:** Rename the dashboard, introduce more customer-focused measures, introduce measures related to the Zero-Based Review process and other continuous improvement initiatives, make it clear what improvement looks like, move to report on a monthly basis, and include performance measures as a standing item on meeting agendas.
2. **Maximize Benchmarking:** Review measures supplied for Ontario Municipal Benchmarking Initiative (OMBI) and National Water and Wastewater Benchmarking Initiative (NWWBI).
3. **Visibility of Data and Performance Opportunities:** Link all performance measures to the bigger picture, make performance data visible, and focus reports on the intended audience.
4. **Develop an Overall Performance Measure:** Develop a set of customer focused measures that can be grouped together to form a single performance score.
5. **Set Internal Targets:** Owners of individual performance measures should be set increasing annual targets over the four year period to 2018. These can be tied into personal objectives. This will enable the business to clearly track and measure performance on an on-going basis.
6. **Technology and Performance Measure Improvement:** Create a data agenda, use a reporting tool, and build a single repository for reports.

SWI Proposed Effectiveness Benefits	
Data quality improvements	Increasing the visibility of performance information and the increased utilization of data
Improved decision making	Making decisions in the context of a 'bigger picture' to deliver better outcomes for customers
Leverage technology	Data extraction and reporting is more efficient , enables analysis, increases availability for decision making
Customer experience	Focus on customer-oriented measures reinforces the customer ethos and drives decisions based on the needs of the customer

SWI Estimated Efficiency Improvements		
Estimated Range of Efficiency	Low	High
	<i>No financial efficiencies expected</i>	

WATER SERVICES INVESTIGATION

1. Dashboard Reporting

I. CURRENT FINDINGS

The dashboard reporting opportunity identified through the Service Review is considered a foundational component to the other recommendations. As a result, this area has been selected as the priority area and notable progress has been made throughout 2015. Some of the highlights include:

- The Water Utility developed standardized performance measurement language by renaming the dashboard reports to Performance Measure Reports (PMR);
- A utility-wide level Performance Measure report was developed and organized using Results-Based Accountability framework for quarterly review by the Water Management Team (Managers and Directors from Water Resources and Water Services);
- Progress was made on identifying performance measures for Divisional Performance Measure Reports;
- Customer focused measures were reviewed and added to the Performance Measure Report using the lens of 'is anybody better off'.

II. REALIZED BENEFITS

Regular performance measure reporting has provided an opportunity to provide consistent language and understanding of performance across the Water Utility.

In addition, the increased utilization of performance measure data has had a positive effect on the quality of the data.

The use of performance measures is believed to have some positive impacts on employee engagement and has been useful in defining priority areas.

III. FUTURE OPPORTUNITIES

To further advance performance measures and improve performance, reporting of performance measures is a key focus area for 2016 and beyond. This is a critical foundational piece in moving the other Service Review recommendations forward. This includes development of clear customer focused measures where appropriate to measure 'is anyone better off?'. The advancement of these measures is strongly tied to the Water Resources Zero-Based Review (ZBR). It is anticipated that customer measures will be defined for the Wastewater line of service as part of this review. Learnings from this process can be scaled to the Water and drainage lines of service. Timing will be aligned with the ZBR schedule.

The Performance Measurement Committee will also be focused on standardizing measures where possible and sharing best practices and learnings across different areas of the business as a priority area for 2016 and 2017.

It is anticipated that there will be opportunities in the future to start measuring improvements in data quality and the usefulness of performance measures in decision making.

Example:

- Regular reviews of response and repair times led to improvements in data quality and the identification of required process improvements, resulting in a reduction of average response time for water emergencies by 18 minutes.

2. Maximize Benchmarking

I. CURRENT FINDINGS

The Water Utility currently participates in two benchmarking initiatives:

- Ontario Municipal Benchmarking Initiative (OMBI): includes areas from most business units within The City of Calgary. The benchmarking is focused on water and wastewater systems and includes approximately 100 measures.
- National Water and Wastewater Benchmarking Initiative (NWWBI): Calgary’s water utility provides over 1900 measures for this benchmarking initiative. The benchmarking includes Water, Wastewater and Drainage water systems. The review of benchmarking is focused on NWWBI as the effort for data collection is much greater.

II. REALIZED BENEFITS

The benefits of participating in benchmarking to date have been realized primarily through networking opportunities created at the annual NWWBI Workshop and various taskforce groups. The ability to easily connect with other municipalities delivering similar services has provided opportunities to explore best practices and solutions to common problems. NWWBI also provides opportunities to easily survey other municipalities on various topics which provide valuable insight into industry information.

Examples:

- A survey was conducted by Wastewater Treatment (in 2015) for de-icing at the airport. This survey was used as a quick industry scan on how de-icing residuals are being managed by other Municipalities.
- In order to develop a strategy for public/private responsibilities for repairs

to the linear system, a survey (in 2015) was developed to obtain information on responsibilities from other municipalities.

III. FUTURE OPPORTUNITIES

A review of the two benchmarking initiatives is complete. This review identified opportunities to increase the value of participating in benchmarking initiatives through increasing awareness and accessibility of surveys, networking tools and other benchmarking resources. In addition, the review identified opportunities to further evaluate and optimize the effort and resources put into data collection.

3. Visibility of Data and Performance Opportunities

I. CURRENT FINDINGS

The recommendations for the Zero-Based Review highlighted opportunities to increase the visibility of data and performance measures and focus on developing a ‘golden thread’ to link performance to high level objectives. There has been progress made in this recommendation area within various areas of the business and pilots that are currently underway have the potential to be scaled across other areas of the business.

II. REALIZED BENEFITS

Benefits of this increased visibility have been most notable in divisions that have a more mature performance measurement system in place (Water Treatment and Construction Services). Providing visibility of performance measures has increased awareness of performance and operational risks. It has also provided the opportunity for front line staff to link into the bigger picture and see how their day to day work contributes to performance improvements creating line of sight and increased staff engagement.

III. FUTURE OPPORTUNITIES

This recommendation also has a strong linkage to the Zero-Based Review underway in Water Resources. Ultimately, high level objectives would be set through defining customer level of services, which is currently a focus area of the Water Resources review. The advancement of level of service within the Water Utility will provide the ‘golden thread’ linking performance to high level customer objectives. As mentioned previously, the timing of level of service will be aligned with the Water Resources Zero-Based Review timelines.

IV. PERFORMANCE MEASURES

None at this time

4. Develop an Overall Performance Measure

I. CURRENT FINDINGS & RESPONSE

The Water Utility is committed to aligning with The City of Calgary Performance Management System and will consider introducing one single measure for the Water Utility if that is introduced as part of the corporate approach.

5. Set Internal Targets

I. CURRENT FINDINGS

Within the Water Utility there are internal targets set for Council Measures and a handful of other areas (such as financial and regulatory measures). Target setting provides the opportunity to clearly track and monitor performance and direction of activities.

II. REALIZED BENEFITS

Target setting has provided clarity on direction and performance aspirations for the Water Utility.

III. FUTURE OPPORTUNITIES

While there has been work on performance measurement prior to Scottish Water's recommendations, there is still opportunity to drive continuous improvement through target setting and focusing on "turning the curve". As a result, the near term focus area will be as follows:

- The Performance Measurement Committee will evaluate opportunities to set targets where appropriate (Q2-Q4, 2016);
- There could be negative cultural and performance consequences if target setting is not coupled with reliable and meaningful performance information. Prior to target setting, more work needs to be done to ensure quality of performance information.
- Further progression of target setting will be aligned with the City of Calgary Results-Based Accountability approach and the progression of customer levels of service. It is anticipated that customer levels of service will set the highest level of performance measure targets, which will then allow for alignment of performance objectives and measures throughout the organization. The timing of these measures will be determined by the Water Resources ZBR.

6. Technology and Performance Measure Improvement

I. CURRENT FINDINGS

Currently performance measures are tracked using manual processes. The goal is to introduce technology to automate the data collection process where possible.

II. FUTURE OPPORTUNITIES

The following priorities have been set in order to advance technology for performance measure reporting:

- In the near term, the focus will be on developing a single repository for performance measures that will move the data management and reporting of performance measure from various spreadsheets to a web application. The new application will allow for analytics, drilldowns and appropriate record summaries for performance measures. This is considered a foundational piece that will allow the business to move certain measures from a manual data collection process to automation over time (expected to be in place by Q2 2016, estimated cost is \$20-\$40 thousand). The single repository will be part of the overall UEP data hub, a foundational component of the UEP Data Foundation Strategy to enable staff to have timely access to consolidated business and customer data;
 - Annually, the PMR committee will review opportunities to advance performance measures that are currently not available due to data availability or low integrity;
 - A process will be introduced to allow for ongoing prioritization of automation and dashboard opportunities. The PMR committee will play a critical role in determining the sequence and priority of performance measure automation (Q4 2016 and beyond, continuous evaluation);

Additionally, ongoing reviews will be incorporated into annual reporting to identify gaps in performance measurement data and develop plans to introduce ideal measures where gaps in data exist.

THEME SUMMARY

Performance Measurement in the Water Utility is a critical component in driving business improvement. The Water Utility continues to be committed to following the corporate approach to performance measurement and building maturity of its overall performance measurement system. It is recognized that the implementation of Results-Based Accountability at the City of Calgary has provided a simple, plain language approach that has helped drive improvements and ‘turn the curve’ thinking. In order to further build out the ‘who is better off’ as part of the RBA framework, the Water Utility will focus on advancing customer levels of service as part of the Water Resources Zero-Based Review. As the Water Utility advances its maturity in performance measurement, there is significant opportunity

to share best practices and introduce technology solutions to improve performance throughout the business.

Water Utility Anticipated Effectiveness Benefits	
Data quality improvements	Regular performance measurement reporting will increase data quality
Improved decision making	The creation of a 'line-of-sight' for employees to enable better decision making Integrating Results Based Accountability to drive a plain language, customer-oriented approach
Leverage technology	A centralized data hub that connects external and internal information sources to increase analysis and inform customer-based decisions
Customer experience	Advancing customer levels of service, in alignment with the Water Resources Zero-Based Review

Efficiency Improvements Summary		
SWI Estimated Range of Efficiency	Low	High
	\$0.0M /year	\$0.0M /year
Water Services Efficiency Improvements	Realized 2015	Future 2016
	\$0.0M /year	\$0.0M /year

2. TRENCHLESS TECHNOLOGY

CURRENT STATE

Water Services employs trenchless technologies to maintain and repair the water and wastewater networks that deliver service to Calgarians. Water Services crews currently employ various trenchless technologies in their everyday work, using high-resolution video and robotics that perform small spot repairs to pipe-bursting longer lengths under roadways. Since 1991, the Water Utility has renewed and extended the life of wastewater mains using internally applied liners, and the program's success has seen its expansion to an annual program that renewed 195 kilometers of wastewater mains. Although not every repair can be performed without excavating, the benefits of trenchless repairs compared to conventional excavation approaches are numerous: less environmental damage from open cuts, less disturbance of road traffic, transit and train routes, less landscape rehabilitation, and significant cost savings.

Trenchless technology has been suitable for large diameter pipes, such as wastewater mains that convey sewage to treatment plants. Maintaining the small diameter wastewater pipes that connect homes and businesses (referred to as a wastewater connection or wastewater service) to wastewater sewer mains has historically been done using conventional excavations. But these repairs can be expensive and disruptive to businesses and the community including vehicle traffic. With the availability of technology options and repair-reliability for small-diameter pipes within the wastewater network, Water Services is taking steps to expand its use of trenchless technology.

Water Services owns approximately 350,000 wastewater connections joining property owners to the wastewater collection system. Each year, Water Services responds to over 8,000 wastewater backup service requests (SR's) through the 311 system. Analysis indicates that over 85 per cent of these calls are the result of a problem with the connection pipe joining properties to the wastewater main. Investigation into past failures identified certain material types of connections to be at higher risk of failure than others. 46 per cent of the wastewater connections in the asset pool are of vintages identified as high risk and have been accounting for 86 per cent of the failures. Analysis of past failures indicates that the current inventory of connections includes high risk materials that are failing at an increasing rate as they age. This upward trend is reducing Water Services' emergency response times, and making current maintenance levels unsustainable. Growing demands to repair or replace degraded connection pipes using traditional methods is exceeding current operating budgets.

THEME DESCRIPTION

During the deep-dive analysis of the ZBR, the evidence demonstrated that an enhancement to the current approach to replacement/rehabilitation of wastewater services could be the further use of trenchless technology. This method has the potential for efficiency and effectiveness benefits for Water Services, for example cost reduction in delivering these wastewater service improvements to customers, along with providing minimal disruption to traffic, business, and other activities and, therefore, providing effectiveness benefits to customers. The analysis undertaken demonstrated different decision processes provide input to the decision regarding whether or not to carry out a wastewater service replacement. Once that decision has been made, there should be alternatives to replacing the service such as pipe bursting or lining.

SWI Estimated Efficiency Improvements		
Estimated Range of Efficiency	Low	High
		\$900,000 /year

DETAILED RECOMMENDATIONS

1. **Adoption of Trenchless Technology:** Reduce rehabilitation, repair costs and repeat visits by adopting trenchless technology where suitable. Options are the delivery of cured in place liners, slip liners or pipe bursting either through creation of an in-house trenchless crew to or through procurement of an external service provider to carry out the same. Estimated efficiency range of between \$0.9M and \$1.8M per year based on assumption of 100 to 200 wastewater services lined per year at average cost of \$15K per service.
2. **Adoption of Trenchless Technology – Reduction of Root Auger Program:** By using trenchless technology the wastewater main will have been lined meaning the regular clearing of roots under the Root Auger program and number of emergency field operations call outs to clear roots are reduced. Financial savings with an 8 – 15 per cent decrease in auger program home visits is estimated between \$21K and \$40K per year.
3. **Innovation - Continuously Review Innovation Possibilities:** By continuously reviewing the market and exploring adding innovative methods to current processes, Wastewater Services delivery and efficiency can potentially be improved.
4. **Innovation - Cost Sharing with Customers:** Explore possibilities for cost sharing of trenchless technology with customers for private wastewater services. Estimated savings of \$75K to \$150K per year based on assumption of 50 linings undertaken per year.

WATER SERVICES INVESTIGATION

1. Adoption of Trenchless Technology

I. CURRENT FINDINGS

Water Services undertakes approximately 80 spot-repairs and over 200 full replacements of wastewater connections each year. The re-paving and replacement of concrete curb and gutter can represent 23 per cent of the costs of the repair, a significant proportion of total repairs costs. For minor repairs, trenchless tools can be an effective method to reduce costs and provide options to repair wastewater and storm drainage infrastructure. The Water Utility's experience with trenchless tools has proven to be an effective method of renewing at significant cost savings over open excavations. Water Services has been investigating and testing technologies that allow crews to identify and remediate wastewater services without having to resort to accessing the pipe by excavation. In addition, steps have been taken to adjust the capital program to create a large-scale wastewater connection lining program to align with and complement the established wastewater main lining program

In 2015, Water Services' focused its research on wastewater service rehabilitation technologies. From this research, a new program employing Cured-in-Place Pipe (CIPP) technology has been recommended to compliment the ongoing Wastewater Connection Lining Program with a target to begin installations in 2016. Research also identified several trenchless technologies that provide both condition assessment capability as well as the ability to perform small-scale spot-repairs, installing stainless steel inserts in failing mains and pipe-patches in connections. Two of these multi-function tools have already been put into service in 2013, with plans to replace the aging fleet of current single-use cameras in 2016.

II. REALIZED BENEFITS

The expansion of trenchless applications will have a positive impact on customer experience in the long term. More visible social impacts will include less disruption to commuter traffic and affected residences/businesses. Expanding the Water Utility's ability to undertake repairs in busy or hard-to-reach locations trenchless avoids the cost of digging as well as the social disruption of traffic congestion (interrupting traffic on a major road or transit route). Proactive rehabilitation on a larger scale through the proposed wastewater service lining program will also help reduce the number of emergencies that crews are called out to repair or replace on a daily basis.

A triple bottom line analysis was completed that considered the social, environmental, and economic costs of wastewater connection failures. The model took into consideration the social costs for the customer (the backup itself, days without service, and claims cost) and the reactive maintenance cost (trouble visit

and follow-up diagnostic activities), and compared it to the rehabilitation and replacement costs. This analysis seems to indicate that when open-cut replacement was the only option (average \$30,000 per property), maintenance was usually the most cost-effective option. However, when rehabilitation costs can be reduced to the estimates similar for lining (average \$10,000 per property).

Example:

- Water Services’ crews worked in concert with an external contractor to replace a major water distribution main under 16th Avenue NW. The trenchless approach used for the work, saved \$600,000 over conventional methods, and avoided excavating and interrupting vehicle traffic.

III. FUTURE OPPORTUNITIES

The Water Utility has approved the re-assignment of \$2.0 million annually in 2016 within the existing budget to initiate a pilot Wastewater Connection Lining program. The program is expected to begin on a pilot-scale in 2016, initially targeting approximately 200 connections. The lining program will achieve a lower cost-per-repair, allowing crews to resolve minor repairs for up to two thirds more customers for the equivalent budget amount. The pilot program is expected to realize net cumulative financial benefits of \$2.4 million by 2020, a payback period of 3 years. By 2025 cumulative net financial are expected to reach \$7.3 million

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	2016 estimated	Full Implementation
	\$800,000 /year	\$ 2.4M /year

The scalability of trenchless repair or renewal technologies to other lines of service is very promising. Additional assessments in 2016 will focus on identifying financial efficiencies in water and drainage systems repair by expanding trenchless applications.

IV. PERFORMANCE MEASURES

- Number of wastewater services rehabilitated per year
- Average cost per lined service vs. Average cost per repaired san service

2. Reduction of Augering Program

I. CURRENT FINDINGS

The Root Augering Program was identified as an opportunity for applying a permanent trenchless repair approach to reduce or eliminate in-home root augering visits. Asset management analysis has found that one of the primary causes of wastewater service failure in Calgary is invasive root penetration. Homes built in the late 1950's to the late 1970's with a clay-tile wastewater pipe are typically at risk of root penetration. Water Services estimates approximately 77,000 wastewater connections are made from this material. As Calgary's wastewater assets age, it is anticipated the number of homes experiencing failures will continue to rise, rendering the root augering program unsustainable. The Wastewater Connection Lining Program will target areas with a high frequency of root penetration issues to reduce failures.

II. REALIZED BENEFITS

An effective connection lining program will eventually reduce the amount of wastewater connections requiring on-going maintenance with augering. However, the benefits of this program are not expected to occur quickly. With approximately 77,000 potential lining candidates throughout Calgary, it will take years to achieve a reduction in augering visits. Therefore, Water Services must continue to operate the root augering program as a maintain solution in the near-term.

III. FUTURE OPPORTUNITIES

Communicating with customers, making appointments and entering customers homes to clear their wastewater services of invasive tree roots cost an average of \$250 per visit. The Wastewater Connection Lining Program is intended to address this opportunity, creating financial savings by reducing or eliminating a program that costs \$125,000 per year to operate.

IV. PERFORMANCE MEASURES

- Annual total of in-home root-auger visits.
- TBL cost benefit of on-going maintenance vs. cost of cure-in-place liner

3. Continuously Review Innovation Possibilities

I. CURRENT FINDINGS

Water Services created a multidisciplinary team of subject matter experts from across the business to share research, experience, and industry contacts to build a shared knowledge base of trenchless technology, vendors and applications. This team has engaged several municipalities across Canada to learn from their experience in trenchless approaches to linear systems repair, in addition to participating in on-site vendor demonstrations, educational webcasts, product demonstrations, and conference opportunities. The Water Utility actively participates and supports the Calgary Chapter of the North American Society for Trenchless Technology, sponsoring annual conferences, hosting technical seminars, and supporting employees as members.

II. REALIZED BENEFITS

Through research, conference attendance, municipal contact networking, and in-field inspections, Water Services has gained insight into the various no-dig product offerings, licensing requirements, quality-control requirements, and reporting offered in Canada and North America. The results of that research are summarized below:

- Since 2010, product innovation has created an environment of product and vendor expansion.
- To date, no major suppliers of Cure-In-Place liners that install without additional access to customer wastewater connections do not exist in the Calgary market, and few Canadian vendors offer services in Western Canada.
- Pipe preparation, installation, quality control and quality assurance procedures, and customer impacts vary from product to product.
- Product availability is limited somewhat if the desired specification does not include cleanouts (which is Calgary's preferred method.)
- Wastewater connection lining should be coordinated, where possible, with wastewater main lining program.

III. FUTURE OPPORTUNITIES

From the lessons learned in previous trenchless technology projects, the committee is making improvements in its approach to understand the market forces that will add to the success of future programs. The Water Utility will continue to increase its involvement in the industry, seeking to attract vendors and advance technology in Alberta. Water Services has identified opportunities to intentionally engage with industry and play an active role in attracting trenchless technology specialists, to increase the application of this innovative and less invasive approach. The Water Utility employs trenchless technology in its projects, mainly on capital projects. The

City of Calgary can play a role in attracting trenchless technology specialists to Western Canada by investing trenchless technology programs.

4. Cost Sharing with Customers

I. CURRENT FINDINGS

Scottish Water International identified opportunities for potential cost-recovery from customers for service calls or repairs extending onto a customer's property. This represents a departure from current service levels, and will be closely examined as part of the work identified in the development of levels of service described in the Customer Experience section of this report.

Water Services leveraged its membership in the National Water and Wastewater Initiative (NWWBI) to access information on water utilities across Canada. The research was focused to understand the level of service provided to customers across the country including what maintenance activities were undertaken, who provides those activities, and what cost sharing arrangements exist.

The research identified a broad spectrum of practices for proactive (risk based) maintenance activities for wastewater connections. The span of services offered included public education programs, video inspection, or the provision of maintenance program (as offered by Water Services). However, municipalities vary on the practice of charging the customers any response services. Some municipalities are not involved in anyway with wastewater connections, others defer customers to plumbers, while other utilities had fixed fees or cost reimbursement arrangements (hourly and overtime rates). These charges ranged from \$260-\$700 (including options to have outstanding charges placed on a property tax payment).

II. REALIZED BENEFITS

Research and ongoing dialogue with other Canadian municipalities' shows that cost sharing with customers is a common practice for municipalities and reflects the ownership responsibilities established in provincial legislation and bylaws. The research identifies an environment in which Water Services may be able to realize costs savings for services currently offered internally. This could include cost-sharing relationships with customers for wastewater connection lining on private property.

III. FUTURE OPPORTUNITIES

The Water Utility will continue to investigate cost sharing with customers as part of a comprehensive program (including education, policy, pricing and infrastructure investment) to align with wastewater service levels. The development of this approach will be informed and shaped by the work described in the Customer Experience section of this report. The policy will balance customer

expectations, resourcing limitations, and legal considerations as it relates to private side liability.

IV. PERFORMANCE MEASURES

The value of the service review to both customers and the Water Utility can be highlighted by identifying and trending key performance metrics throughout the customer journey:

- The number of wastewater backup calls (and repeat calls) should decrease due to changes in service level offerings, cost sharing agreements, and the implementation of the lining program.
- The Water Utility’s response time for emergency calls should stabilize as call volumes decrease and process efficiencies such as direct dispatch are implemented.
- Follow up activities for video assessment and augering should decrease due to changes in service level offerings, decreased calls (and repeat calls), and the implementation of the lining program.
- Cost savings and productivity gains should be achieved by implementing cost sharing opportunities and the implementation of the lining program.

THEME SUMMARY

Water Services is preparing to expand the use and types of trenchless technology it uses. Building this capability will help maximize the capital budget and the number of customers assisted, take steps to reduce the number of homes on long-term maintenance, and reduce overall repair costs on wastewater connections. The first initiative on this journey is the creation of a Wastewater Connection Lining Program. A pilot-scale program will be launched in 2016 using re-allocated funds within the existing capital budget. Financial benefits expected to reach \$2.4 million by 2020 and reach \$7.4 million by 2025. As this program expands, the long-term maintenance of problematic connections in the root-augering program will diminish over time. Research and dialogue with customers and other municipalities will continue until recommendations can be made on the viability of cost-sharing the connection lining program with homeowners.

Efficiency Improvements Summary		
	Low	High
SWI Estimated Range of Efficiency	\$900,00 /year	\$1.8M /year
Water Services Efficiency Improvements	Estimated 2016	Estimated 2018
	\$800,000	\$2.4M

3. RESOURCE OPTIMIZATION

CURRENT STATE

Water Services responds annually to over 8,000 wastewater-related service requests (SR's) through the 311 system. Over the past number of years, response times for this emergency response have slowed due to a growing call volume, an expanding linear system, more complex issues, and aging infrastructure. Remedy options are limited; long-term maintenance, such as root augering, is used but is temporary and involves getting access to a customer's property. When maintenance is no longer effective, the partial or full replacements of a customer's wastewater connection pipe is performed. But repair and replacement costs have been increasing annually, including landscape rehabilitation, asphalt and concrete repair replacement. These increases are putting pressure on repair budgets to and the number of customers that can be assisted efficiently.

THEME RECOMMENDATIONS

The Resource Optimization theme is a diverse collection of recommendations that push Water Services to assess how to address growing maintenance and customer service demands as efficiently as possible, with existing resources. Scottish Water submitted recommendations that proposed changes to repair crew composition, coordination and communication between field and planning groups.

SWI Estimated Efficiency Improvements		
Estimated Range of Efficiency	Low	High
		\$575,000 /year

DETAILED RECOMMENDATIONS

- Optimizing Construction Crews:** Optimizing proactive Construction Services crews per type of wastewater replacement
- Increase Spot Repairs:** Increase spot repairs by improving problem diagnosis processes and adopt a 'don't dig asphalt' mantra to reduce impact of street work on citizens.
- Decision Support Matrix:** agree on a decision support matrix such as the Responsible, Accountable, Consulted and Informed (RACI) matrix to help determine scope of work between divisions to maximise effectiveness.
- Service Level Agreement with Roads:** Review the Service Level Agreement with The City of Calgary Roads Department. Should agreed upon service levels not be achieved, then Water Services and Roads may explore the use of an alternative asphalt rehabilitation subcontractor.
- Support Challenges to Roads:** Explore options to support challenges to Roads' decisions on dig sizes and re-compacts to reduce their cost to Wastewater Services.
- Excavated Material Reuse:** Explore regulations and options to reuse suitable excavated material on-site to reduce repair costs.

7. **Appointment Route Planning:** Centralize appointment route planning for dedicated crews to further increase number of planned appointments for Field Services crews.
8. **New Video Equipment and Process:** Explore new video equipment, interface and process for Field Services crews to capture field notes and update systems automatically for viewing by the wider Water Services.

WATER SERVICES INVESTIGATION

1. Optimizing Construction Crews

I. CURRENT FINDINGS

A typical Repair Crew consists of a Foremen, Pipemen, Backhoe Operator, Dump-Truck driver and Labourer. When required, crews utilize a contractor-operated trucks or excavators. A recommendation was made by Scottish Water International to adopt a flexible approach to manpower requirements and adjust crew size according to the specifics of the repair underway. In conjunction with changes made to the re-use of excavated soils on jobsites, Water Services has reduced the demand for contractor-operated trucks to support Repair Crews.

II. REALIZED BENEFITS

A pilot project in 2015 to reduce the number of contractor-operated dump trucks used by Repair Crews, realized financial efficiencies of approximately \$175,000.

III. FUTURE OPPORTUNITIES

Water Services is continuing to evaluate the crew sizes for other types of work and identify opportunities for further reductions. In 2016, Water will be looking at combining equipment operator positions and as a result will be able to re-assign 4 FTE's for an approximate cost savings of \$392,000.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	2015 Realized	Full Implementation
	\$175,000/year	\$ 567,000 /year

IV. PERFORMANCE MEASURES

- Average Labour and Equipment costs per repair
- Monthly contractor equipment expenditures

2. Increase Spot Repairs

I. CURRENT FINDINGS

Scottish Water International recommended increasing the number of spot-repairs undertaken on wastewater connection pipes, to reduce overall repair costs. Further investigation into this recommendation revealed this was not a cost-effective approach, nor an effective asset management strategy. Instead, Water Services adopted a new approach that would expand the use of trenchless solutions and avoid excavations where ever possible. Water Services introduced two different no-dig technologies for undertaking small-scale spot repairs in residential and commercial wastewater pipes. Both approaches have resulted in significant financial efficiencies and fewer excavations. The two types of technology we are using are:

1. Locking steel cylinders installed remotely with a lateral launch camera,
2. Cure-in-place liners inserted into the wastewater pipe that chemically bond to the pipe wall.

Both of these trenchless approaches to wastewater connection repair are easy to operate and cost-effective, and reduce the need for disruptive excavation repairs or specialized-contractor work. Water Services will continue to develop and expand cost effective solutions for wastewater connection defects, depending on their severity.

II. REALIZED BENEFITS

Water Services began piloting the robotic insertion of locking steel cylinders for wastewater pipe repairs. Using this type of trenchless tool where appropriate has allowed Water Services crews to perform several small-scale spot repairs and avoid conventional repair techniques. Additional savings totaling at least \$220,000 was realized through the use of both technologies in 2015.

Example:

- The use of robotically inserted cylinders to spot-repair a collapsed wastewater pipe avoided over \$250,000 in costs by avoiding the interruption of a Calgary Transit LRT platform.

These savings will be realized primarily through the avoidance of excavation repairs, and the reduction or elimination of repeat visits to customer’s homes or businesses.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	2015 Realized	Full Implementation
	\$220,000	\$ 440,000 /year

III. FUTURE OPPORTUNITIES

Both technologies were able to demonstrate business cases that supported expanded testing or introduction into service. The implementation costs of this technology is being aligned with asset life cycle replacements. The new self-propelled units will replace aging inspection-camera vehicles as required, and an estimated cost of \$200,000 per unit including transport vehicle. Purchasing the cure-in-place spot repair machinery requires an expenditure of \$6,000 per unit for the equipment. The use of this equipment can be scaled directly to drainage collection system repairs. However, tools involved in wastewater or drainage repairs cannot be used for repairs to the potable water system, so further market research and field testing is required to determine application to potable water mains.

3. Decision Support Matrix

I. CURRENT FINDINGS

This recommendation has been completed. An internal task force has developed a decision-making tool for field staff that includes common definitions and schedule commitments for emergency and urgent wastewater service replacements. This process has already had a direct impact on the 2015 repair budget, resulting in a more effective balance between repair and replacement decisions.

In association with this work, the flow of information to and from customers throughout the repair process was reviewed to identify opportunities to improve the customer journey. This recommendation is interconnected with the introduction of proactive notifications discussed in the Customer Experience section of this report. Water Services is supporting projects to review the wastewater trouble response process to identify opportunities to improve the customer experience, reduce repeat private side visits, and apply cost-effective repair options.

II. REALIZED BENEFITS

The introduction of a standardized decision making tool has significantly reduced the number of excavation repairs or replacements, reducing overspending on the capital budget for wastewater service replacements in 2015. However, the wastewater services that are not replaced will require ongoing maintenance. While this may not be shown as specific cost savings, there is opportunity to more effectively balance maintain and asset replacement decisions

III. FUTURE OPPORTUNITIES

Water Services is currently developing a comprehensive wastewater lining program that will improve the ability for Water Services to manage these assets, increase their life cycle and improve service.

Although the decision matrix developed is specific to the wastewater line of service, the internal task force will use the lessons learned to develop other decision support tools for supporting employees in the field and help guide consistent decision making.

IV. PERFORMANCE MEASURES

- Percent of wastewater connection repair budget spent
- Percent of wastewater connection repairs completed on schedule

4. Service Level Agreement with Roads; and

5. Support Challenges to Roads

I. CURRENT FINDINGS

The Zero-Based Review identified a gap in the service levels provided by Calgary Roads to support Water Services repair and field operations. To strengthen the coordination of traffic management, permitting and worksite hand-off practices, Water Services has engaged Roads in an operational-level dialogue.

The discussions have focused on strengthening relationships and working at understanding the business drivers and challenges of the respective business units. Next phases will include workflow mapping, process documentation and hand-off practices between the two business units to identify opportunities that improve the customer experience. Each business unit is currently measuring their part in the process but not necessarily looking at the process from end to end. By working together, a common set of measurement can be developed and targets set.

II. REALIZED BENEFITS

By ensuring the hand-offs between the operational units of Roads and Water Services is efficient and coordinated, impacted roadways will be re-opened quickly and reduce the likelihood of repair or geotechnical complications to the road-bed, both of which will have a direct positive impact to customers.

III. FUTURE OPPORTUNITIES

Field-testing and engineering analysis identified the opportunity for controlling excavation size, implementing consistent and standardized construction practices to ensure geo-technical stability of the road-bed, and efficient coordination of worksite hand-off between Water Services and Roads to realizing financial benefits. Financial benefits of scaling the revised construction practices across the Water Utility will compound the financial efficiencies gained.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	Full Implementation
		\$300,000 /year

IV. PERFORMANCE MEASURES

- Time to complete paving after backfill is complete
- Percentage of excavation re-compactions caused by paving delays
- Excavation permit costs as a per cent of total job costs

6. Excavated Material Reuse

I. CURRENT FINDINGS

The Zero-Based Review examined the practice for managing excavated material from construction work and the practice at a significant proportion of sites where dug-material is hauled away. While this practice virtually eliminates any environmental risk associated with contamination or sediment control, there is a significant cost associated with this practice.

II. REALIZED BENEFITS

New standard operating procedures and evaluation criteria for stockpiling material on worksites have been developed and rolled-out to crews, resulting in operational savings. An estimated efficiency of \$200,000 per year has been saved by reduced trucking costs.

III. FUTURE OPPORTUNITIES

The current practice of hauling wet material to a Recycle Centre to be dried is unique compared to other Canadian water utilities. The Water Utility will be completing a study in 2016 to evaluate that practice and identify potential alternative backfill materials.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Realized 2015	Full Implementation
	\$200,000	\$ 300,000 /year

IV. PERFORMANCE MEASURES

- Average number of tonnes of backfill clay per standard excavation
- Total trucking costs per repair

7. Appointment Route Planning

I. CURRENT FINDINGS

The goal of this recommendation is to maximize productivity through route planning efficiency to reduce travel times. This recommendation is closely linked to recommendations in the Customer Experience section of this report which identify the need for a centralized appointment system. Pilot-level testing of software for centralized appointment calendaring was unsuccessful in 2015 (the software proving to be incompatible with existing City IT environment). Water Services will continue to pursue this recommendation; including involvement in potential upgrades to The City’s 311 system and the assessment of its capability to operate a centralized appointment scheduling calendar.

Water Services proceeded with other investigations in 2015 that will provide additional information and capability to implement this recommendation. This included an assessment of appointment scheduling practices and potential impacts to current levels of service.

II. REALIZED BENEFITS

Any improvement to route planning will reduce travel times and create better efficiency. An improved appointment system will improve customer service and provide easier access to City services.

III. FUTURE OPPORTUNITIES

It is not difficult to see that improvements to route planning can be applied to other areas in Water Services. Costs to implement have not been determined at this time.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	Full Implementation
	\$30,000 /year	\$ 75,000 /year

IV. PERFORMANCE MEASURES

- Kilometers traveled per appointment
- Average cost per appointment type

8. New Video Equipment

I. CURRENT FINDINGS

When Scottish Water International conducted their review of this line of service, Water Services employed multiple technologies and formats that made transferring, storing and reviewing data disjointed and time consuming. The recommendation also aligns with customer-focused outcomes and the benefit of crews having remote access to asset details notes and address history. In 2015, the video collection and review process has undergone significant initial improvements that will move Water Services closer to the end result of the recommendation. Efforts have been made to make all the video data transferable via wireless network (including field notes) and transferred to 'cloud' storage that can be easily accessed by office-based staff for analysis.

II. REALIZED BENEFITS

Improved use of video technology and consistency of data obtained in the field is allowing employees to make better decisions, contributing to an improved customer experience. The ease-of access to data via the cloud has also increased the efficiency of the review process.

III. FUTURE OPPORTUNITIES

Additional upgrades and software standardization will be made in 2016. In addition to that, Water Services will proceed with purchasing new service video equipment with a unifying standard software package in 2016, further improving functionality of data transfer and storage. An opportunity exists to further develop field (mobile) technology to fully achieve this objective. A project will need to be developed around this area. Scalability of this business process is limited to the wastewater line of service; however research into the opportunities for the wireless transfer of data collected in the field is continuing.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	Full Implementation
		\$30,000 /year

THEME SUMMARY

Initiatives in this theme have been prioritized in consideration of cost and forecasted benefit and the initiatives underway have already realized savings. Many of these recommendations focus on service delivery, and therefore are interconnected with initiatives being undertaken in the customer experience group of recommendations. Water Services is advancing small scale projects with high return and less complexity in 2016, while projects with a higher degree of complexity will be investigated further. Advancing on several recommendations in 2015 realized efficiencies of \$595,000 and identified an additional \$320K per year in efficiencies when additional projects are implemented in 2016. Scaling the Resource Optimization recommendations across all lines of service is currently underway.

Efficiency Improvements Summary		
SWI Estimated Range of Efficiency	Low	High
	\$575,000 /year	\$1.4M /year
Water Services Efficiency Improvements	Realized 2015	Full Implementation
	\$595,000	\$1.9M /year

4. CUSTOMER EXPERIENCE

CURRENT STATE

The Water Utility scores well in customer satisfaction as rated in the Customer Satisfaction Survey, however it is recognized there is a need for greater emphasis on customer outcomes to drive business decisions and continuous improvement. Strengthening the customer focus across the Water Utility will be enabled through better information to make decisions, improved processes, leveraging the interdependencies within The Corporation and a strong culture of delivering customer value. The recommendations of the Zero-Based Review largely focus on improvements in the areas of information and processes to improve the customer experience.

THEME RECOMMENDATIONS

The eight recommendations within this theme intend to position Water Services, within the Water Utility framework “to deliver the best customer experience by providing an informed and consistent customer journey.” The recommendations are highly interconnected and aim to improve the accessibility of customer data and address history, enhance “first-call” resolution for customers and reduce repeat customer calls, and clarify the service levels provided to all customers.

SWI Estimated Efficiency Improvements		
Range of Efficiency	Low	High
	\$280,000 /year	\$800,000 /year

DETAILED RECOMMENDATIONS

1. **Customer Data - 360° Customer View:** All current customer information and site history available to view within all divisions contributing to wastewater services.
2. **Customer Data - Access to Customer Data:** Customer data that is held outside of Water Services.
3. **Customer Data - Centralised Appointment System:** All customer appointments for planned work are received, organised and issued by a central team and appended to customer information.
4. **The Customer Journey - Reducing Enquiries and Promoting Self-Service:** Working with front line call handlers to improve decisions trees and with improved customer data the number of calls passed to operations for response will be reduced. Creating a self-service portal for customers will also reduce call volumes. If CSR’s that required home visits could be reduced by 5 to 15 per cent a productivity improvement with a range of \$200,000 to \$600,000 per year could be achieved.
5. **The Customer Journey - Zero Impact for Repeat Private Visits:** By either flagging Customer/Site data so crews do not attend private visits or charge for private visits so their time is paid for, there is no impact on Water Services for repeat visits by trouble crews to private side issues. If 311 service requests that involved removing blockages from private property where reduced by 5 to 15 per cent could create an equivalent efficiency of \$50,000 to \$150,000 per year.

6. **The Customer Journey - Proactive Customer Notifications:** Contacting the customer before and after attending site and giving out customer information cards when on-site will improve the Customer Journey and Experience.
7. **Partnership Working - Zero Impact for Connection Reuse in Water Services:** Service reuse work which is outside of the scope of Water Services is charged to the customer. Agree standards to assist with this process.
8. **Partnership Working - Service Level Agreements:** Negotiate Service Level Agreements for customers to assist with the Customer Experience.

WATER SERVICES INVESTIGATION

1. **Customer Data - Customer View; and**
2. **Access to Customer Data**

I. CURRENT FINDINGS

The Zero-Based Review acknowledged the benefits to advancing customer-focused decision making with access to customer data, previous requests and address history, describing a **360°** view, or awareness, of customer history. This provides a full picture of the customer's situation to ensure informed, holistic and timely service to that customer. Water Services recognizes that the more employees know about a customer situation, the better equipped they are to provide a solution to that issue in a timely manner and potentially be more proactive to identify opportunities or issues the customer may not be aware of. Existing customer data is fragmented, hosted in numerous systems, including external databases with ENMAX, is not easily accessible by customer-facing staff, and information is manually handled in many cases, impacting data quality.

II. REALIZED BENEFITS

Managed at the departmental level within Utilities and Environmental Protection (UEP), the Data Foundation Program will support a 'one stop shop' centralized repository for customer information. This project will enhance the business data needed to support decision making, and enable the Water Utility to leverage eGovernment trends such as self-service, improve operational effectiveness and efficiency, and capture data at the source, reducing paper and improving data quality. A key project within the Data Foundation Program is the creation of the UEP Data Hub, a digital repository to house customer data in one location, including data currently housed in ENMAX systems.

While the Data Foundation Program is a multi-year initiative, other activities are underway to make smaller scale, incremental improvements to increase employee access to customer information:

- Direct access to Service Request information from 311, including pictures and video, is enabling quicker responses to water and wastewater

emergency calls using better information to triage and prioritize emergencies.

- Improved flex-questions used by 311 operators is helping to improve the quality of information collected from citizens during water and wastewater emergencies to better inform the necessary action required.

III. FUTURE OPPORTUNITIES

The Data Foundation Program is a UEP Information Technology initiative that is fundamental to accomplishing the Customer Experience recommendations one through five described in this report. High-level estimates indicate that a foundational capital investment of approximately \$825,000 will be required for IT infrastructure, access to customer information databases, and engagement on levels of service will be required.

IV. PERFORMANCE MEASURES

- To be determined on a project by project basis.

3. Centralized Appointment System

I. CURRENT FINDINGS

The Zero-Based Review report highlighted the need to consolidate the wide variety of service appointments Water Services manages to assist customers. This includes scheduling video inspections on wastewater connections, root-augering maintenance visits, meter replacement scheduling, water quality concerns and water consumption checks. These appointments have various independent processes to schedule appointments. An effective centralized appointment system requires the sharing of information with 311, multiple divisions across the Water Utility and potentially with the ENMAX Call Centre. Customer survey data indicates that customers want better scheduling, tighter timeframes for home visits and better issue-resolution on “first-visits” to customers. A more sophisticated, inclusive appointment system requires technology enhancements subsequent to the improvements achieved via the UEP Data Foundation Program and alignment with Corporate level initiatives to improve self serve options for citizens.

II. BENEFITS AND FUTURE OPPORTUNITIES

Broader application for customer appointments for all planned work will be addressed following broader technology improvements listed above, including opportunities to coordinate with ENMAX Call Centre. There are also opportunities to improve efficiencies within existing processes to improve route planning for appointments, as identified in the Resource Optimization section of this report.

III. PERFORMANCE MEASURES

- Post-visit Customer Satisfaction survey responses

4. Reducing Inquiries and Promoting Self-Service

I. CURRENT FINDINGS

All customer inquiries to the 311 Call Centre are handled through flex questions and if necessary information is not available to the 311 Call Centre agent, the inquiry is redirected to the subject matter expert within Water Services. The Zero-Based Review recognized that with improved information resources for the 311 Call Centre and expanded functionality within Calgary.ca, fewer customer inquiries will be passed on to crews in Water Services for a response.

II. REALIZED BENEFITS

Work is underway with the 311 Call Centre to dispatch Service Requests generated by the 311 mobile application directly to the appropriate business units, thereby eliminating the step of routing through the call centre. Of Water Services 46 Service Requests, 14 are online, and five of those are also on the mobile application. Placing SRs online was also accompanied with providing more information online for customers in order to further reduce inquiries. The recent changes to implement a three-stage classification for 311 service requests (assigned, in progress or closed) should also reduce inquiries through more transparency on status of service requests.

Water Services has conducted time-motion studies to analyze the time required in each stage of the process from when a citizen makes contact with The City to when emergency work is completed. By eliminating unnecessary steps that delay response, combined with better information, Water Services was able to reduce average response time for water emergencies by 12 per cent.

Following the success of the Water Trouble Process improvements, Water Services has launched Phase 1 of the Wastewater Trouble Response Process Review to enhance flex-questions for 311 Call Centre agents to provide more context for customer information, provide better information for customer responsibilities and ultimately improve efficiencies in emergency trouble response.

III. FUTURE OPPORTUNITIES

Enhanced analysis and trending of all types of 311 service requests will help identify opportunities to proactively share information to reduce inquiries (e.g. enhanced web information, proactive notifications, etc.). Self-service opportunities will be addressed via the UEP technology initiative and will have a strong linkage to Corporate direction on citizen self serve options.

Work continues on improving the Wastewater Trouble Process to better triage emergencies, improve determination of whether the problem is on the private or public side, and improve information to citizens on actions they need to take in

order to reduce private side visits. There are opportunities for efficiencies in route planning as well to reduce time, cost, and environmental impact associated with vehicle travel across the city.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	High
		\$100,000 /year

IV. PERFORMANCE MEASURES

Current 311 Service Target Adherence Reports track various metrics including total SR count, escalations response time, etc. There is an opportunity for improvements to performance measures with enhanced analysis and trending of Water 311 inquiries.

- Water trouble service level target: 80 per cent responded to within one hour
- Wastewater trouble service level target: 80 per cent responded to within two hours

5. Zero Impact for Repeat Private-Side Visits

V. CURRENT FINDINGS

The Zero-Based Review recommended that Water Services assess the customer service outcomes of no longer providing assistance with wastewater issues on the private-side, or to charge customers for this work to have a net zero impact on operating budgets.

On average, 70 per cent of wastewater trouble responses are related to problems on the privately owned portion of the wastewater connection. While the majority of the responses are one time, there are instances of repeat visits to the same address (six per cent of responses are three or more repeat visits to the same address). The lack of defined service standards for responding to wastewater problems on the private-side leads to inconsistency in service delivery.

A National Water and Wastewater Benchmarking Initiative (NWWBI) benchmarking survey was used to gather Canadian municipal experience in this area. Service levels for private side work varied among the Canadian Utilities that responded. Service levels varied from the provision of video and augering services at no charge to the customer; instructions to customers to call a plumber or external contractor provided by the Water Utility; or various fixed fees or cost reimbursement arrangements for other utilities to conduct work range from \$260-\$700 per visit.

VI. REALIZED BENEFITS

Clarity around levels of service pertaining to private side work will ensure a consistent service level for customers, a consistent understanding amongst crews of their responsibilities and will inform the necessary resource requirements.

VII. FUTURE OPPORTUNITIES

This recommendation is about determining a level of service for our customers. Therefore, a detailed triple bottom line analysis is required to adequately determine business impacts, customer impacts, potential costs and recoveries in administering a fee for service, legal considerations, etc. This analysis will also address the recommendation in Trenchless Technology around potential cost sharing with customers for private wastewater services. This will also have linkages to the wastewater levels of service work to be conducted under the Water Resources Zero-Based Review. While Scottish Water associated the greater savings to reducing inquiries and offering self-serve options to customers with the notion that will result in less site visits. The work on confirming private side service levels and potential for full cost recovery or elimination of the service will take place under implementation of this recommendation and therefore Water Services has associated the greatest cost savings to this recommendation.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	High
		\$200,000 /year

VIII. PERFORMANCE MEASURES

- Total sewer backup visits per year
- Sewer backup repeat visits per year

6. Customer Journey – Proactive Customer Notifications

I. CURRENT FINDINGS

Customer notifications are limited and manually delivered in most cases. Water Services conducts surveys of customers who have experienced a water outage due to water construction activity, with the most prevalent trends indicating a desire for more effective communication to customers and a desire for more proactive notifications (i.e. via telephone, electronic) and on-going real-time information. While there are some incremental improvements underway including proactive notifications for wastewater service repair or replacements and notifications for when water service is returned (processes to be in place by Q2 2016), these still rely on manual delivery of messages (e.g. door hangers). In order to meet customer expectations, the longer term goal is to enhance the use of technology to provide

notifications and is dependent on enhanced customer information that will be achieved through the UEP Data Foundation Program.

II. REALIZED BENEFITS

It is anticipated this will enhance the customer experience as customers can be informed of and plan for service interruptions or changes, proactive notification will also help reduce inquiries (linked to recommendation #4) and more informed customers are more likely to take necessary actions to enable service to improve efficiency (e.g. moving vehicles reduces delays by providing necessary site access).

III. FUTURE OPPORTUNITIES

Opportunities for enhanced notifications for planned and emergency work that meets customer expectations through the use of technology is dependent on enhanced customer information that will be explored through the work of UEP Data Foundation Program. Opportunity to post status updates during construction activities, requires further analysis of customer need and interest.

IV. PERFORMANCE MEASURES

- Post-work Customer Satisfaction Survey response results

7. Zero Impact for Service Reuse

I. CURRENT FINDINGS

Residential Water Service Re-Use Guidelines are in development to address water and wastewater connection reuse applications. Water Services field crews were spending time on-site to assess and approve service reuse for infill development. The guidelines will provide conditions and criteria for re-use of existing services along with direction to applicants on their roles and responsibilities to demonstrate that the service is appropriate for reuse. Water Services will conduct a desktop review, eliminating the cost associated with on-site visits by field crews.

II. REALIZED BENEFITS

Homeowners and developers will have a consistent and clear guideline for water and wastewater pipe reuse options. Application review time will be minimized with a new review process. Water Services field staff will not spend time on-site assessing and approving service reuse for infill redevelopment.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	High
		\$45,000 /year

III. FUTURE OPPORTUNITIES

Re-use guidelines will be in place for both wastewater and water services, and scaled for application to both water and wastewater lines of service.

IV. PERFORMANCE MEASURES

- Number of service reuse applications and associated cost savings.

8. Customer Service Level Agreements

I. CURRENT FINDINGS

Formal Service Level agreements between a service provider and its customers require significant customer engagement to form a mutual agreement for provision of services. A first step towards formal service level agreements is to manage customer expectations with some relatively simple service improvements and by creating, documenting and communicating service standards.

II. FUTURE OPPORTUNITIES

In the near term, focus will be on documenting the service improvements made throughout the service review implementation process and seeking opportunities where appropriate to create, document and communicate service standards following those improvements (e.g. service reuse).

The Water Resources Service Review taking place in 2016 includes a focus area on Levels of Service for Wastewater. It is expected that this will be a scalable approach to all three services (Wastewater, Water and Drainage) and will entail a strong customer engagement element.

III. PERFORMANCE MEASURES

- Performance measures to be developed in concert with specific service standards.

THEME SUMMARY

While incremental improvements are underway such as increasing access to 311 customer information in the field; improving response times through process changes; and enhancing notification to customers for service disruptions, there are some significant foundational improvements required to set up the Water Utility for success in enhancing the customer experience for the long-term. Technology, access to information and determination of levels of service will require a capital investment in IT infrastructure in the coming years that will have far-reaching benefits to our customers in how they interact with us and for employees by enabling them with the tools and resources to be most effective in their work.

While the recommendations of the Service Review largely focus on improvements in the areas of information and processes to strengthen the customer experience, it is recognized that success also requires a culture shift to ensure the customer is the focus of our decisions. Work happening across The Corporation on culture, initiatives lead by Customer Service and Communications, along with efforts to enhance the Customer Strategy team within the Water Utility will all be key contributors to advancing that customer focus.

SWI Estimated Efficiency Improvements		
SWI Estimated Range of Efficiency	Low	High
	\$282,000 /year	\$801,000 /year
Water Services Efficiency Improvements	Full Implementation	
	\$345,000 /year	\$890,000 /year

5. RISK BASED MAINTENANCE

CURRENT STATE

Even though Water Services' Zero-Based Review focused on the wastewater line of service for its in-depth analysis, the wastewater treatment division was intensely focused on recovering from the damage caused by the 2013 flood while maintaining regulatory requirements. Therefore, in consideration recommendations made in the review would be scalable across the Water Utility, the water treatment plants became the focus of asset management practices.

Risk Based Maintenance (RBM) includes a number of maintenance strategies that are intended to focus maintenance effort on the assets that are most critical to providing service. The goal of RBM is to undertake the 'right level' of maintenance on the 'right assets' at the 'right time' to balance the level of service and operational risk. The implementation of many of the "risk based" methods described in the recommendations in this section are currently underway to varying degrees in several areas across Water Services.

Preventative maintenance activities have traditionally been based on a combination of staff experience and equipment manufacturer's recommendations. The frequency of these activities is typically based on a fixed-calendar cycle (i.e. monthly, annual, bi-annual) and is based on past experience or equipment performance.

Water Services has transitioned to the risk based approach for both corrective and preventative maintenance work, in which work is prioritised based on the potential risk to service level and safety. This is done to ensure that the repairs that comprise the highest risk to service or safety are completed with the highest priority. Similar work is underway to prioritize all preventative work based on asset criticality and to match the amount of planned work to the available resources.

The overall effectiveness of the maintenance program is measured through regular review of plant reliability and maintenance costs. These measures are also used to track and to quantify the impact of improvement efforts.

Maintenance performed on the various valves in the water distribution system typically involves periodic inspection and adjustment/repair of the valves. The frequency of these activities is typically driven on a fixed calendar cycle (i.e. monthly, annual, bi-annual) and is based on past experience and best practices within the water industry.

THEME RECOMMENDATIONS

The seven recommendations in this section aim to position Water Services “to maintain assets effectively, at the most optimum frequency, delivering both financial efficiencies and ‘best in class’ asset management.” A risk based approach involved targeting maintenance resources to assets where there is the greatest risk to customers and consider social, environmental and economic risks.

SWI Estimated Efficiency Improvements		
Range of Efficiency	Low	High
		\$506,000 /year

DETAILED RECOMMENDATIONS

1. **Reduce Dead-End Water Mains Flushing:** Whilst it does not appear cost effective to close out or “Loop” existing dead end mains, it is important to work with Calgary’s development community (UDI), in order to develop a best practice approach and that every opportunity is taken to close the loop on new mains, thus not adding to the current burden.
2. **Reduce Valve Survey:** Devise decision matrix to determine asset criticality in order to optimize valve survey program (need to negotiate with Fire Underwriter’s survey dependency) Develop a risk scoring matrix in order to produce an optimized plan of categorised zones. Determining categories include, but are not limited to; Residential, Business, Special Needs, Hospitals, Restricted Access areas. Use optimized plan to deliver revised program
3. **Air Valve Management:** Devise a decision matrix to determine asset criticality in order to optimize the program. Devise mechanism to measure plan attainment.
4. **Pressure Reduction Valve Management:** Devise decision matrix to enable optimization of program with an outcome of implementation of partial or complete remote system monitoring capability.
5. **Risk Based Maintenance:** Risk Based Maintenance is a comprehensive and site-specific plan of cost/risk optimized maintenance tasks, frequencies, and techniques. Techniques include, spares holding, task schedules and labour saving devices. The plan should aim to improve serviceability of assets and make the most economical use of maintenance resources.
6. **Asset Lifecycle Plans:** Implement Asset lifecycle plans to provide maintenance planners with information to make decisions related to major maintenance activities such as refurbishment and replacement. The age of the asset, the remaining life and future planning changes are used to better plan or prevent major work.
7. **Condition Based Maintenance:** Implement condition monitoring processes in order to use of the condition and/or performance of the equipment as a “trigger” for routine maintenance activities.

WATER SERVICES INVESTIGATION

1. Closing Dead-End Watermains

I. CURRENT FINDINGS

Scottish Water International's analysis acknowledged the amount of resources and time Water Services' invests in monitoring and managing over 4000 dead-end water mains throughout the water distribution network. Canadian subject matter experts recognized during a peer-review of the in-depth analysis, that this was an opportunity for Water Services to re-evaluate specifications for water distribution networks.

Water Services has been able to prioritize these water mains, identifying fewer than 200 sites require periodic flushing to maintain water quality. Construction costs to remedy these problematic sites would be significant (an estimated average of \$150,000 per dead-end main), in addition to the legal complications of acquiring rights-of-ways through private property. Water Services' investigation concluded that in the majority of cases, looping existing dead-end mains is not a financially viable option.

Scottish Water International recognized the significant financial investment this strategy would require, but promoted actions that would realize operational efficiencies and urged The Water Utility to promote best practices for water system design with its partners

To advance this recommendation and its long-term benefits, the Water Utility will pursue the initiation of a dialogue with the development community to find design alternatives to reduce or eliminate the installation of new dead-end water mains in the distribution system in the future.

II. FUTURE OPPORTUNITIES

The benefits of minimizing the number of dead-end water mains will reduce the potential for the development of water quality risks in addition to providing system redundancy that contributes to reliability and customer service. The minimization of dead-end mains and provision for system redundancy is considered a best management practice for the design of water distribution systems.

Additional opportunities to loop dead-end mains will come when the assets are at the end of their life cycle and are being scheduled for replacement. That would be the most opportune time to move forward with any plans for looping existing dead-ends

III. PERFORMANCE MEASURES

Performance measures for this area include monitoring the number of water quality complaints related to dead-ends, the number of dead-end mains that require

frequent flushing and tracking the total length of dead-ends mains verses total of water system length.

2. Reduction of the Valve Survey Program

I. CURRENT FINDINGS

Scottish Water International's recommendation encourages Water Services to re-assess the frequency at which all valves with the water distribution get inspected. The City currently inspects small valves (<400mm) on a 5 year rotating schedule so that each valve is visited once every 5 years. Large valves (400mm and greater) are inspected annually. Through a peer review undertaken during the ZBR analysis it was apparent that Calgary was operating comfortably within North American guidelines. Furthermore, it was established that other Canadian utilities are considering transitioning to a higher frequency of inspection of critical valves. The business practice assessment prompted by the ZBR does have value and identified several improvement opportunities that will help to optimize program efficiency. However, it was determined that this program will not result in a reduction in the frequency of critical-valve inspections and as result it won't produce any significant cost savings.

II. REALIZED BENEFITS

Water Services' internal assessment of this recommendation found that current valve inspection practices conform to North American best practices, and succeed at minimizing operational risk. Therefore, adjustments to the valve survey program will not likely result in significant cost savings. The internal assessment did, however identify opportunities to re-assess and update standard operating procedures that will optimize the field-level operability and reliability assessment of valves.

III. FUTURE OPPORTUNITIES

The first work will revisit valve priority in the distribution system. Currently the priority valves have been identified as the large valves. Valve inspection frequency of these will be evaluated and reviewed for effectiveness based on the level of criticality of the valves.

IV. PERFORMANCE MEASURES

- Percentage of customers who experience a water outage

3. Air Valve Management

I. CURRENT FINDINGS

The intent of this recommendation is to reduce the number of field-visits taken to inspect or operate air valves on the water distribution system. In Water Services overall valve inspection program are inspected on an annual basis.

Air valves function to remove air pockets that build up in the water distribution network. The SWI recommendation suggested the removal of selected low-risk air valves. Water Services internal assessment of this suggested change indicated that a more thorough risk assessment is required to determine the impact to the distribution network and service reliability.

II. FUTURE OPPORTUNITIES

Water Services will initiate a review of the air valve inspection program in 2016 with the intent of optimizing the functionality of the program. The first phases will assess the number of air valves that are adequately protected from freezing temperatures to be candidates for a revised risk assessment. Internal assessments of this recommendation indicate that financial savings realized from adjustments to the air valve management will be minimal.

III. PERFORMANCE MEASURES

Performance measures in this area include percentage of valves that have been reviewed and the annual cost of the air valve survey program.

4. Pressure Reduction Valve Management

I. CURRENT FINDINGS

SWI recommended the reduction of the number of field-visits to inspect pressure reducing valves (PRVs), with the intent of realizing operational efficiencies. During this business cycle, Water Services has equipped a selected number of PRV's with wireless monitoring systems. These systems have provided some information and experience to support an expanded rollout of remote monitoring across the distribution system in the distribution system. A detailed cost-benefit analysis is still required before advancement on this recommendation can proceed.

II. FUTURE OPPORTUNITIES

Water Services is undertaking a cost-benefit analysis of the proposal to expand remote monitoring on the distribution network. Expanding the remote monitoring network could result in reducing the number of field-visits required to inspect the system, but installation and maintenance costs of monitoring systems could be prohibitive. To monitor half of the 200 PRVs Water Services has estimated a \$900,000 one-time capital investment would be required to wirelessly monitor PRVs in the water network. Cost estimates indicate that approximately \$30,000 per year of operational efficiencies could be realized from fewer routine visits. A detailed cost-benefit analysis is still pending to weigh the implementation costs with the payback period and potential benefits to system reliability and customer service levels.

III. PERFORMANCE MEASURES

Performance measures in this area include the percentage of valves monitored and the annual cost of the PRV maintenance program.

5. Risk Based Maintenance (Water Treatment Plants)

I. CURRENT FINDINGS

SWI has recommended the implementation of a maintenance strategy that “Prioritizes maintenance resources toward assets that carry the most risk if they were to fail.” In reviewing this recommendation, Water Services has determined that advancement in this area will require the development and completion of an asset criticality matrix to guide maintenance decisions assets based on the potential impact of asset failure to service, environment, safety and repair cost.

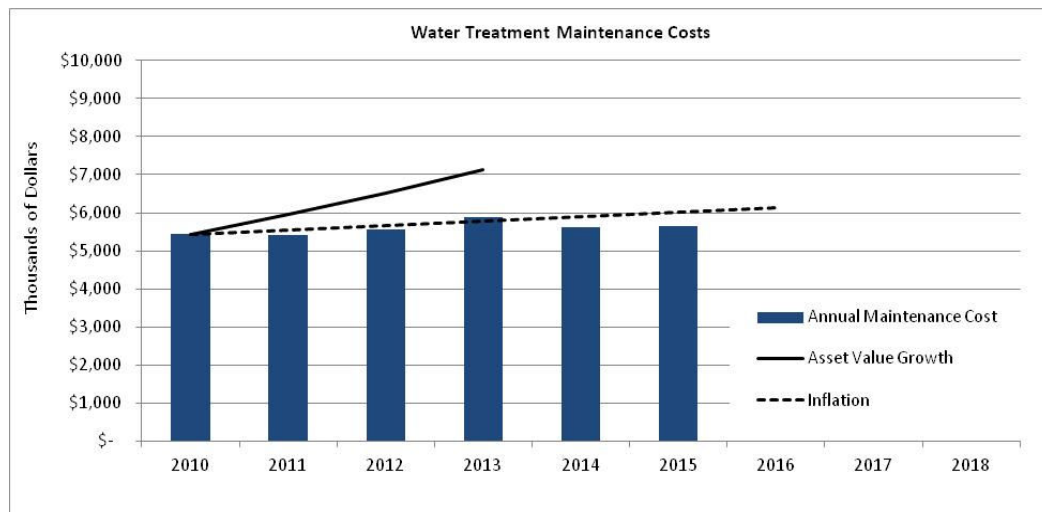
Over the past 3 years significant progress has been made in this area to better understand and manage plant equipment reliability, criticality, work priority, maintenance cost and asset condition. Improvements in this area described in the sections that follow. A comprehensive maintenance performance measurement review has been implemented to help better manage maintenance costs, plant reliability, service risk, and maintenance program effectiveness.

II. REALIZED BENEFITS

Over the past 5 years Water Treatment maintenance costs have increased at a rate much lower than the combined effects of inflation and asset growth (both in terms of asset numbers and complexity). This has been a result of better utilization of existing resources to address key plant areas. These results have been achieved while also improving plant equipment reliability and better managing the overall risk to service.

The figure below compares the cost of water treatment maintenance compared to the impact of inflation and growth in asset base. From 2010 to 2013 the value of assets maintained by the Water Treatment Division has increased at a rate of 9.5 per cent per year. The cost of maintaining the Water Treatment plants and related infrastructure has been held to a rate slightly less than the rate of inflation (approximately 2 per cent per year). This has allowed the division to maintain a growing asset base with a relatively constant level of resources and has been achieved through continuous advancements in the application of risk and asset management practices.

Water Treatment Maintenance Costs



Another example of the use of risk based maintenance involves the improved the improved prioritization of repair work. This has resulted in the avoidance of over \$500,000 per year of previously unplanned maintenance tasks.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Realized 2015	Full Implementation
		\$500,000 /year

In addition to the improved prioritization of work, the improved scheduling of maintenance shutdown activities and the use of advanced inspection methods have reduced the cost of certain activities by more up to 50 per cent (e.g. The use of divers for “Wet inspection” of process tanks versus traditional unit shutdown, draining and scaffold setup).

Example:

- By balancing the importance of equipment with system redundancy, it was determined that it would be significantly more cost effective to respond to

performance problems as required, then to adhere to pre-scheduled work.

III. FUTURE OPPORTUNITIES

Activities over the next 3 years will involve the completion of asset criticality definition work at the water treatment plants. This information will be utilized to improve the prioritization of preventative maintenance work to further minimize risk to service. Water distribution and pump stations and water storage reservoirs will be reviewed and completed by the end of 2018.

Implementation of these improvements will be accomplished using existing resources and budgets. Enhancements to the IT systems in the areas of improved analytics and mobile work management will be required to maximize the benefits from this focus area.

Although this recommendation was specific to Water Treatment, direct scalability opportunities exist to implement improvements made across the Water Utility. Water Treatment and Wastewater Treatment workplans are closely aligned to ensure the scalability of all improvement related to Risk Based Maintenance. Criticality workshops have begun within Wastewater Treatment and are scheduled in roughly the same timeframe. There is also a potential opportunity to scale RBM approach to drainage and wastewater lift station maintenance however a schedule for this has not been developed.

IV. PERFORMANCE MEASURES

A comprehensive performance measure review process has been implemented to manage maintenance cost, plant reliability, service risk, and preventative maintenance program effectiveness.

For this recommendation progress will be measured based on the percentage of assets that have been reviewed and assigned a criticality score. To date the focus has been on the assets considered to be the most critical to service. The remainder of the asset base will be reviewed by 2018.

6. Asset Lifecycle Plans

I. CURRENT FINDINGS

SWI has recommended the creation of “Optimized lifecycle plans that will define the inspection, monitoring, maintenance, refurbishment and replacement strategies for selected asset types and groupings.”

Water Services has reviewed this recommendation and has determined that advancement in this area will involve the development of asset specific planning document that will be used to inform planners with information to make decisions

related to major maintenance activities such as refurbishment and replacement. The age of the asset, the remaining life and future planning changes will be used to better plan or prevent major work. Lifecycle plans will be created for major equipment classes that have historically consumed the largest portion of maintenance resources (large pumps, engines, major electrical equipment, major treatment process units).

To date, a number of improvements have been made in the area of asset lifecycle planning. Between 2010 and 2013 a complete inventory of plant assets and equipment has been completed. A coordinated approach across the Water Utility is underway to develop and implement “Asset Lifecycle Plans” for major treatment plant equipment and infrastructure.

Example:

- By strategically coordinating the expansion needs of the treatment system with equipment lifecycles, the maintenance of a major raw-water lift pump was identified and deferred, saving approximately \$60,000.

II. FUTURE OPPORTUNITIES

Effective lifecycle planning will reduce or defer spending on end-of-life assets. It is estimated that one major rebuild or repair per year (Approximately \$50,000-\$100,000 per year) can be eliminated or deferred through improved planning. Capital maintenance budgeting for lifecycle asset replacements will also be improved reducing the financial and service risks at the treatment plants.

Work in this area will commence in Q4 2016 and will be complete by the end of 2018. Although this recommendation was specific to Water Treatment, Water Services is confident that scalability opportunities exist to implement asset lifecycle planning for Wastewater Treatment infrastructure and drainage and wastewater lift stations. Specific timelines in these areas have not been developed.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	Full Implementation
	\$50,000 /year	\$100,000 /year

III. PERFORMANCE MEASURES

Potential performance measure in this area include: Per cent of major assets with lifecycle plans and major repairs/replacement spending.

7. Condition Based Maintenance

I. CURRENT FINDINGS

SWI has recommended the implementation of condition monitoring which they have defined as “The process of monitoring the performance of a machine against a measurable parameter. Monitoring can either be a physical check or a monitoring device used to determine the optimal frequency at which to maintain an asset.”

Water Services has reviewed this recommendation and has determined that advancement in this area will involve enhancing the implementation of automated asset condition and performance monitoring equipment and processes. Examples of this include: vibration and temperature monitoring on large motors and engines, strain monitoring on critical structures and efficiency monitoring on major pump units.

In 2014, condition monitoring was integrated into the management of the Shaganappi Pump Station, a major water distribution hub. In addition, energy and hydraulic performance monitoring of the large raw water and high-lift pumps (500hp and greater) has been implemented at the Glenmore and Bearspaw treatment plants. Stand-alone vibration monitoring equipment is in place and used routinely to monitor pump stations and investigate pump issues.

II. REALIZED BENEFITS

Monitoring of the Shaganappi Pump Stations has significantly reduced risk of catastrophic failure and loss of service to a large number of customers. Improved pump performance monitoring has identified several operational cost improvements through improved utilization of variable speed pumps reduction of valve throttling and the use of optimal pump combinations to meet customer demand.

Example:

- Routine maintenance of key water treatment equipment was switched from a fixed-schedule to a frequency based on actual operation hours. This reduced the maintenance cost of the equipment by 25 per cent.

III. FUTURE OPPORTUNITIES

2016-2017 work plans include the investigation and implement of improved vibration and temperature monitoring on all large pumps and engines.

Additional resources will be required to monitor condition data and plan repair work. Capital funding for improved monitoring (estimated \$300,000 to \$400,000 one-time investment) will be managed through the existing capital maintenance budget. It is estimated that Preventive Maintenance activities on large pumps and engines can be reduced by \$100,000 to \$200,000 per year through the use of condition based maintenance.

Although this recommendation was specific to Water Treatment, Water Services believes that scalability opportunities exist to expand condition monitoring within Wastewater Treatment during the 2014 – 2018 business cycle.

Water Services Estimated Efficiency Improvement		
Estimated Efficiency	Low	Full Implementation
	\$100,000 /year	\$200,000 /year

IV. PERFORMANCE MEASURES

A comprehensive performance measure review process has been implemented to manage maintenance cost, plant reliability, service risk, and preventative maintenance program effectiveness.

THEME SUMMARY

Water Services is committed to continually improving the effectiveness of maintenance activities across the full infrastructure portfolio. The principles of risk based maintenance are being applied as a strategy to move the Water Utility’s Asset management practices to the next level of maturity. Efficiency gains resulting from these strategies have been used to offset potential maintenance costs increases that are a result of increasing asset age, increasing plant complexity, system growth and inflation.

Efficiency Improvements Summary		
SWI Estimated Range of Efficiency	Low	High
	\$506,000 /year	\$799,000 /year
Water Services Efficiency Improvements	Realized 2015	Full Implementation
	\$500,000 /year	\$860,000 /year

6. OTHER CONTINUOUS IMPROVEMENT PROGRAMS

CURRENT STATE

During the high-level analysis phase of the Zero-Based Review, Scottish Water International recognized a number of efficiency and effectiveness opportunities currently underway within the Water Utility. Because of the established programs related to these initiatives, SWI did not bring forward specific recommendations as part of the ZBR process. Nonetheless, work has continued on these initiatives and they are included within this implementation plan for your information. Because the work outlined in this section isn't specifically related to SWI recommendations, the financial efficiencies stated are in addition to those recognized within the Zero-Based Review

WATER SERVICES INVESTIGATION

1. Succession Management

I. APPROACH AND PHILOSOPHY

The Water Utility is aligned with the Corporation's systematic approach to succession management which is designed to ensure continuity in key positions and to retain and develop intellectual and knowledge capital for the future. The main emphasis is to encourage individual advancement and ensure continuity in key positions, including management, technical and professional specialist roles.

II. CURRENT PRACTICES

Water Services' succession management approach is to identify upcoming vacancies and opportunities in leadership positions and match them to ready potential candidates. Targeted meetings with Directors and the GM identify a pool of candidates for senior management positions, and meetings at WMT identify candidates for management and other leader positions. At these sessions, strategies are discussed to provide developmental opportunities for the identified successors. Each potential candidate is reviewed for strengths and areas of growth, as well as skills and competency gaps. The readiness and interest of the candidates is assessed and considered in making decisions.

A structured competency management system identifies and articulates the knowledge, skills, abilities and behaviors that are required for each position. This tool can be used through the full employee experience from recruitment and on-boarding, through learning and development, performance management, and individual career planning.

Employees can pursue training and development for potential upcoming roles by focusing on pre-identified competencies, which are closely aligned with corporate leadership expectations and reflect the values of The City of Calgary. Available training and development activities include corporate leadership programs (including the Supervisory Leadership Development Program and Master's

Certificate in Municipal Leadership), participation in a formal mentoring program, and a structured development planning program (Driving Your Development). To build capacity in critical positions, specific recruitment, knowledge transfer, and development strategies are implemented to diversify the candidate pool and strengthen capacity within that pool.

III. FUTURE OPPORTUNITIES

To support the succession management program within the Water Utility, and address workforce risks, several projects are being researched or have been initiated in 2016:

- A formalized on-the-job training program is being piloted in a division that has experienced a very high rate of retirement and turnover. This program will help to establish a consistent baseline of on-the-job knowledge in the division, and will help to transfer specific knowledge from experienced to less-experienced employees.
- The competency framework will be leveraged and expanded to field-based positions to track and assess current skill level. Based on those assessments, Learning & Employee Development (L&ED) can develop coordinated and comprehensive training programs to close learning gaps and prepare employees for success in their next positions.
- Tacit knowledge transfer strategies have been successfully piloted in at-risk, highly technical positions in Water Resources. The opportunity to formalize these processes for succession management purposes is currently being researched.
- A tool to bring consistency and objectivity to the assessment of potential succession candidates, and target development opportunities has been developed. This tool will be used to support managers to build leadership capacity and develop a stronger candidate pool for succession.

IV. PERFORMANCE MEASURES

Current performance measures being tracked include the number of internal position moves (promotions, demotions, transfers) at the L4 (Manager) and L5 (Leader) level.

2. Regulatory Standards and Dialogue

I. CURRENT FINDINGS

With changing and increasingly stringent regulatory requirements, greater focus is required to ensure environmental risks are understood and business process strategies are in place to manage the level of risk. A greater degree of consideration of environmental matters at a strategic level, and within the context of long term

planning is also necessary. To effectively manage these growing regulatory and compliance expectations, The Water Utility has built a strategy that invests in four critical areas that support and advance managing its environmental and regulatory risk:

- i. Positive External Relationships – strive to build and maintain transparent relationships with regulators on the premise that timely and open communications sets the foundation for positive working relationships.
- ii. Informed Internal Networks - educate internal divisions to inform them of regulatory changes, interpret regulations and provide guidance, and help advance their projects through regulatory approvals.
- iii. Risk Management - embed both regulatory and environmental risk analysis and assessment more deeply into the organization. Proactively identify current and emerging regulatory risks to operations, and assess how to effectively respond to those risks and engage with regulators.
- iv. Research/Projects - Invest in research, both internally and through partnerships, to acquire advanced knowledge and baseline data to understand the implications of potential legislative changes to operations.

II. REALIZED BENEFITS

The Water Utility investment in strategic regulatory affairs and compliance management and strengthening the relationship with provincial and federal regulators has had a positive outcome. The strengthening level of trust between the Water Utility and regulators, has promoted a willingness to collaborate when challenges are encountered, and seek mutually beneficial solutions. The positive relationship has increased the ability to negotiate positive outcomes with regulators, when regulations require further interpretation. Infrastructure planning and capital construction projects benefit from the strong working relationship, as operational and financial impacts of regulatory changes are identified, and the regulatory review of projects are advanced in a timely manner. All of these aspects, including the ongoing management of provincially mandated Drinking Water Safety Plans and ISO 14001 contribute to delivering customer value.

III. FUTURE OPPORTUNITIES

The Water Utility will continue to increase investment in building a strong dialogue with the provincial regulator. A regulatory governance and policy negotiations program is being developed to better meet the interdependencies within the Water Utility and ensure priorities are monitored and advanced. The Water Utility is also investing in strengthening collaborative relationships with neighboring municipalities that face similar issues, and collectively advance issues with The Province.

IV. PERFORMANCE MEASURES

The City of Calgary’s Environmental Management System (ISO 14001) promotes continuous improvement, with an emphasis on tracking environmental performance. It is anticipated that The City’s EnviroSystem will become an increasingly important tool to inform and support the integration of environmental improvement and stewardship in our business planning process.

3. Fleet Optimization

I. CURRENT FINDINGS

The Water Services Fleet Strategy project was initiated in collaboration with Fleet Services and Finance & Supply to optimize fleet management across the Utilities and Environmental Protection department with the goal of realizing cost savings without affecting current levels of customer service. UEP’s business units worked closely with Fleet Services to identify key project drivers that include: financial streamlining, equipment lifecycle optimization, and a strengthened governance model.

II. REALIZED BENEFITS

In 2015, the Fleet Optimization project realized savings of \$700,000 per year through the optimization of hired equipment, improvements to vehicle utilization, as well as reduced lease and maintenance costs from streamlined processes, right-time acquisitions, and reducing the numbers of extended life vehicles.

The Fleet Optimization project team pursued four strategies that successfully realized financial benefits:

1. Utilization: By imposing formal targets on vehicle replacements and reductions and implementing cross-divisional vehicle sharing, increasing fleet utilization is major contributor to realizing financial benefits.
2. Financial streamlining: Water fleet budget decentralization to provide managers better understanding of their budget and spending.
3. Life cycle optimization: Gap analysis and process improvement for planning and vehicle acquisitions to reduce delays in commissioning and lower maintenance costs.
4. Improved governance: Formalizing processes for master fleet inventory, maintenance schedules and cost codes.

III. FUTURE OPPORTUNITIES

A fleet optimization project has set targets to reduce fleet budget variances to approximately 8.0 per cent by end of 2016. An additional goal of the project is to validate the Water Utility fleet budget once efficiencies are fully realized. Water Services has an appropriately sized budget to support the number of vehicles required to meet customer service expectations. As all the outcomes from current initiatives are realized, the Water Utility will be able to use the outcomes to provide informed budget forecasting and allocation for 2019-22 budget cycle.

Estimated Efficiency Productivity Improvements		
Range of Efficiency	Realized 2015	Full Implementation
	\$700,000 /year	\$900,000 /year

IV. PERFORMANCE MEASURES

The Water Utility has developed a comprehensive dashboard with focus on the following key performance areas:

1. Acquisitions
2. Monthly financial expenditure
3. Vehicle utilization
4. Unit availability
5. Maintenance compliance

4. Biosolids Management

I. RECENT DEVELOPMENTS

In 2010 the Waste Organic Materials and Biosolids Master Plan project was initiated in collaboration with Waste & Recycling Services (W&RS). The plan included recommendations that would increase capacity, of Water Services’ Calgro program. The Calgro biosolids-to-land program, operating successfully since 1983, applying biosolids produced at Calgary’s wastewater treatment plants to agricultural lands aligned with the Biosolids Master Plan to diversify its re-use options and strengthen the resilience of program against operating risk.

II. CURRENT PRACTICES

Synergies with the biosolids program became apparent as W&RS embarked on the development of the green cart strategy, and the associated organics composting facility: a facility that enjoyed a large summer peak of green waste would be underutilized over the winter season. It was recognized that the wastewater treatment plants could provide biosolids to the composting facility throughout the winter thereby maintaining a steady feedstock rate and maximizing the efficiency of the facility year-round. Additional benefits include the ability to maximize the use of Calgro employees and hauling equipment to serve the composting facility through the winter months

In 2012 Water Services’ diversified Calgro’s application option with two significant projects. The first involves the improvement of marginal agricultural land by the application of dewatered biosolids. The second employed the creation of a purpose-built 1000 acre willow plantation, the largest in North America. The biomass produced can potentially be used as amendment for biosolids composting in the City’s new facility, and over time the below ground root system decay will improve soil quality significantly in the area of the plantation.

In 2015, The Calgro program optimized it's fleet with the introduction of new field application equipment, and additional transportation combinations to expand hauling capabilities, and increase application efficiency in the field.

III. FUTURE OPPORTUNITIES

The interim beneficial reuse projects have been a significant success, and represent options that the City could employ in the future as biosolids volumes grow with population. The projects also have the potential to influence regulatory change to allow these types of reuse options to be approved uses. The projects currently operate under temporary authorizations from Alberta Environment and Parks.

IV. PERFORMANCE MEASURES

Current performance measures include percentage of biosolids produced/biosolids beneficially re-used, total cost/dry tonne of biosolids beneficially re-used, fleet cost/dry tonne of biosolids beneficially re-used, and acres of land applied with biosolids.

5. Energy Management

V. CURRENT FINDINGS

The Water Utility's energy (electricity and natural gas) consumption has steadily increased in past years to meet the demands of Calgary's growth and increasingly stringent regulatory requirements. The Water Utility is a significant energy consumer in the corporation, with energy costs representing 15 per cent of base operating and maintenance costs. The year-over-year energy cost increase peaked in 2014, requiring treatment plants to reserve up to one third of operational budgets to cover energy costs. The Water Utility recognizes that it is essential to invest in the resources required to advance strategies and practices to improve energy efficiency, and created the Water Energy Management Strategy (WEM).

The WEM Strategy is the starting point for the development of a new standard of excellence for energy management across the Water Utility. It outlines strategies to address the issue of increasing energy costs and the resultant impacts on operating budgets. This strategy will help form a detailed work plan for implementation during Action Plan 2015-2018 and identify targets for the next 25 years.

VI. REALIZED BENEFITS

The Water Energy Management Strategy has advanced business practices in energy auditing, data monitoring, billing analysis, operating profile trending, and research into best practices, new technologies and potential funding opportunities. Cost savings realized through billing adjustments and operational changes realized operational efficiencies totaling approximately \$407,000 per year and identified a one-time capital avoidance savings of approximately \$240,000.

Estimated Efficiency Productivity Improvements		
Range of Efficiency	Realized 2015	Estimated 2016
		\$647,000

VII. FUTURE OPPORTUNITIES

The Water Utility continues to seek opportunities and improvements in a number of areas including reporting, demand forecasting, operational cost savings and capital avoidance savings. Internal energy management teams continue to assist with optimization opportunities with the operations and Infrastructure Delivery teams, including training and consulting in energy efficient operations of the treatment plants and pump stations. The operational savings in 2016 are estimated to reach \$406,000. The implementation of the Water Energy Management Strategy has been scaled to achieve efficiency savings in all three business lines of service: water, wastewater and drainage. More work will be done in the next two years in setting the foundation for a sustainable and effective energy management program in Water that is engrained in Water’s operational culture and practices.

VIII. PERFORMANCE MEASURES

- Water Treatment System Energy Performance (kWh/ML)
- Wastewater Energy Performance Indicator in Kilowatt-hour per Equivalent Population