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**PRELIMINARY STRATEGIC
ASSET MANAGEMENT PLAN**

March, 2016

City of Burlington, Vermont

Abstract

This document provides a 30,000 foot level view of the steps and priorities needed for the City of Burlington to develop and implement a successful City-wide Enterprise Asset Management System and integrate it into the daily operations.

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1. INTRODUCTION

The City of Burlington manages more than \$500 Million in property, infrastructure, facilities, vehicles and equipment assets. These assets exist to directly and indirectly support the services the City of Burlington delivers to the community. A significant proportion of Burlington’s operational and capital budgets are directed to managing these assets, which include:

- Transportation and Multi-modal Infrastructure (roads, sidewalks, signs, lights, bike path and etc.)
- Stormwater and wastewater collection systems
- Water distribution system
- Active and passive open space
- Facilities (schools, water & wastewater facilities, community facilities, etc.)

Burlington has embraced the importance of asset management by developing and funding the development of a *Preliminary Strategic Asset Management Plan (SAMP)*. The *Preliminary SAMP* is the basis of the asset management framework from which specific asset management plans will be subsequently developed. The following steps will guide the implementation of these plans:

- development of an overarching *Asset Management Policy (AMP)*
- the commitment to asset renewal funding
- the regular condition auditing of asset
- the integration of asset management systems
- regular performance measurement
- supporting significant changes to management practices,

Asset management is a process with no end point, as it is a process that is continually refined. The diagram below in Figure 1 illustrates the asset management continuum with a focus on system-wide assets. Understanding the basic steps of a successful asset management program will help the City of Burlington in developing a process, and not a project.

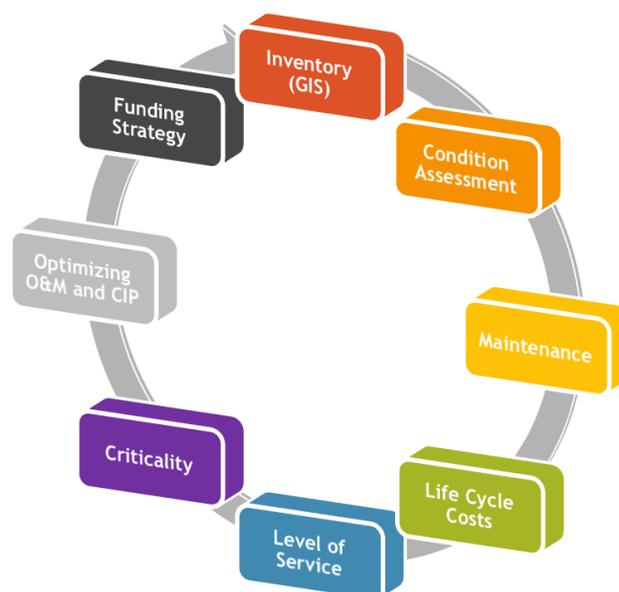


Figure 1

Asset management is critical to the overall performance of Burlington in delivering services to the community, and it will provide the key link between a number of processes, strategies and systems. The diagram below in Figure 2 reflects the intrinsic relationships between asset management and these processes, strategies and systems.

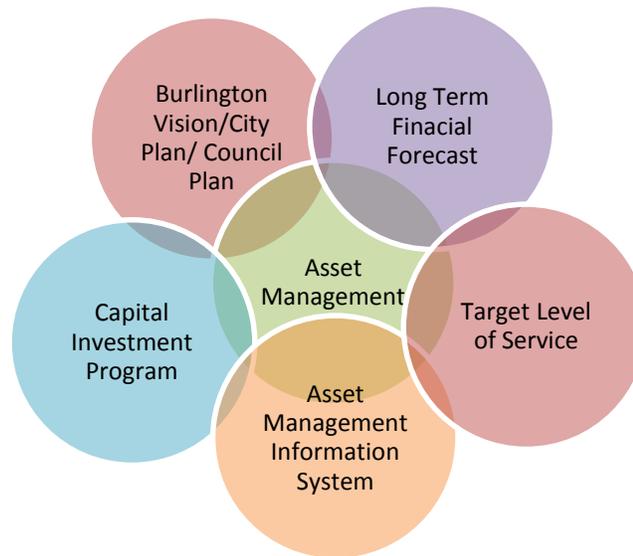


Figure 2

The strong foundations already in place in Burlington, with respect to the commitment to asset management, have been included in the *Preliminary SAMP*. In addition, it also includes the future considerations designed to ensure Burlington has a well-planned and achievable approach to City development, through responsible asset planning and delivery.

In Phase IA (Task 2) of the City of Burlington’s Asset Management Planning and Implementation, Hoyle, Tanner completed a series of interviews with the different departments of the City of Burlington. The purpose of these interviews was:

- to gain insight into the existing condition of the City Departments’ operation and management practices and policies
- evaluate and analyze the strengths and deficiencies of existing programs
- provide an assessment of shortfalls (gap analysis)
- provide the City of Burlington with the framework of a plan to move forward

The *Preliminary SAMP* document summarizes the findings of the interviews and provides initial recommendations for the City to advance a city-wide asset management system. The document identifies recommendations for gap closures and identifies preliminary Levels of Service (LOS) and performance metrics. This *Preliminary SAMP* will also provide a business case as an initial roadmap for the continued planning for the implementation of an asset management system.

Our findings and recommendations are organized in three basic levels:

1. We present the observations and recommendations for things that need to be done at the city-wide management level. These recommendations support the program development and ensure consistency in all City departments.
2. We present the departmental level of recommendations. In the beginning phases of the asset management program, the Department of Public Works (DPW) will be the largest system user. However, it is anticipated that Burlington Electric, the Airport, and other City departments will use the system as well. Each department will have policies and goals internal to their department.
3. We focus on the Water Resources group within the DPW, as this group will most likely implement an asset management program first.

2. INVENTORY AND DOCUMENTATION OF EXISTING CONDITIONS

In early December of 2015, Hoyle, Tanner built on the knowledge base established at the Primer Workshop by meeting with 19 different functional groups within the City of Burlington. The groups were organized based on their overall departmental responsibilities (i.e. Water Resources – Water Treatment Plant, DPW – Parking Garages) and were primarily represented by management staff and field foremen. Our primary objective was to “ask the right people the right questions” to gain insight into the existing operational systems and programs within the various departments of the City.

The process began with an information gathering survey. Interviews were then conducted with each of the 19 groups, with interviews ranging from 1 to 2 hours each. Using the information gathered from the survey and a free flowing conversation during the face-to-face interviews, Hoyle, Tanner gathered the information needed to assess Burlington’s current status along the asset management continuum. We also worked to identify any broad data gaps that would need to be considered during the Phase II portion of the project for each group.

The survey and interviews focused on four main areas:

- existing functional workflows
- functional group needs
- preliminary existing LOS
- performance measures or metrics

The key take-away points of these interviews is discussed herein under “Current Asset Management Practices.” The interviews were structured to ensure everyone was heard. The interviews provided an opportunity for staff to share ideas and build consensus and support for the project approach. Because asset management is a long-term commitment, it is essential to capture institutional knowledge from all staff, so that it is preserved and can be used to inform future decisions regarding infrastructure investment. During future phases of implementation, this institutional data gathering will be an ongoing core function.

Whenever an organization embarks on major changes in its operations, it is important to develop realistic expectations. During the interviews with each group, we discussed the process, the work required for successful implementation, and what it would take to meet their goals. Each group also shared concerns about being able to meet the requirements for the successful implementation and the continued operation and maintenance of an asset management program with limited funds, staff time, and training.

The intent of the interviews was not to find weaknesses or omissions in each group, but rather to understand the strengths and challenges of each group. During the interview process, we found that many of the groups already possess a high level of skills. Through the use of the interviews, Hoyle, Tanner was able to determine what tools each department has available for effective management systems, each department's strengths, and opportunities for improvement for each department.

A. BURLINGTON CITY-WIDE CURRENT ASSET MANAGEMENT PRACTICES

1. Strengths – City-Wide

From interviews conducted with personnel from the various City departments, we determined the current strengths of the City's asset management efforts to date. These strengths include the following:

Organizational

- Burlington is well-positioned to implement asset management. There is strong executive level support.

Tools

- The City has a documented process for developing Capital Improvement Plan programs supported by Facility Dude software and this process is used for facilities throughout the City.
- Staff throughout the City are increasingly making use of the data available to them, from historical records, Geographical Information System (GIS), and the Pavement Condition Index (PCI) program to make decisions.
- The City has started using See/Click/Fix program to determine the level of satisfaction of the public with City programs and operations.
- The development of the Assessor's information in a GIS format will allow the future development of LOS policies to be linked graphically to privately owned assets.
- Pavement inventory and condition information (Pavement Management System Micropaver) is considered high quality and robust. Modeling of conditions under various scenarios can be performed and this capability is constantly evolving. There exists a good foundation for this asset class. This program is being used to drive all the roadway assets making for better management of the water, drainage and sewer assets.
- The Pipe Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP) are beginning to be used by Water Resources for sewer and stormwater collection system condition evaluation, thus providing a standard for condition assessment framework/model for AM inventory data collection for other assets besides pipe.
- Hoyle, Tanner, on behalf of the City, has completed condition assessments on all of the City's parking structures. These condition assessments were used to develop a capital improvement projects and can provide future maintenance standards for the asset management program.
- The GIS-based asset management software program used by the City Arborist, Treeworks, is mature and effective, and can be leveraged as a key asset management tool.
- The recent stormwater & sewer inventory GIS project by Water Resources resulted in a robust GIS database, which can serve as a model for other horizontal asset inventory initiatives in the City.
- The City currently has an inventory system used to track and link parts to work orders and projects. These existing workflows will work well with an asset management program to help track life cycle costs.

- Many of the departments had some level of computerized maintenance management system (CMMS) for maintaining the vertical assets, such as Facility Dude for municipal buildings, Manager Plus for Water Facilities, KeepTrack for Wastewater Facilities, and RTA for DPW Inventory.

Policies

- The utilization of Facility Dude has facilitated the development of workflows for some departments. Workflows provide ownership of data gathering, tracking infrastructure maintenance and allowing for data driven decisions.
- Vehicle Maintenance has developed a workflow that provides the use of an inventory asset management program (RTA) which captures life cycle costs and allows information for data-based decisions for capital and maintenance investments.
- There are a few basic LOS policies in place, however most departments lack formal LOS policies.

Culture

- There is general agreement that development of a city-wide *Asset Management Policy (AMP)* will assist in providing focus for the implementation of a Computerized Maintenance Management System (CMMS) and the overall asset management effort.
- Broad employee support is present and staff is eager to begin formal adoption of asset management practices. There exists a strong professional desire and pride within the City Staff to take the best possible care of assets. Most employees understand the importance of asset management and therefore implementing a new workflow that would improve the data, system performance, and decision making would be welcomed.
- The City has a history of being able to implement information technology projects successfully, such as the implementation of the accounting software program, FlexiBill, which is used for water, wastewater and stormwater billing, and the implementation of a GIS database.

2. Asset Management Opportunities for Improvement – City-Wide

Review of the City's current practices identified several opportunities to strengthen Burlington's asset management capabilities and processes as the City moves forward with implementing an *Asset Management Policy (AMP)*.

Organizational

- Development of a strategic direction (scope, policies, definitions, direction, and goals, etc.) is needed to further the City's *AMP*. The *AMP* needs a focal point and structure. Due to the magnitude of demand on time and importance, the City should dedicate staff to the effort (not a collateral duty) and give this staff clear strategic direction. The City's personnel appear ready to move forward with an *AMP* in a structured manner, but the City will need to give attention and resources to that structure in order to be successful.
- The City will need to determine a consistent strategy for maintaining existing infrastructure to be applied city-wide.

Tools

- The City needs better analytical tools to manage their assets. These tools can range from Enterprise Asset Management software to the use of LIDAR for surface evaluation of pavement.

- Frameworks, such as See/Click/Fix or social media tools such as Twitter and Facebook, that are currently used for asset cost improvements are not clearly linked to the performance of that asset. The connection between these frameworks and asset management will need to be developed.
- Staff opinion seems to favor using the GIS as the future primary warehouse for asset data, therefore a structural expansion of the city-wide GIS is needed. Water Resources has robust GIS database because it has been prioritized and staffed. The City will need to allocate the necessary staff and budget to implement a city-wide GIS database for asset management.
- Some current inventory systems are linked to simplified work orders (not robust), but not assets. The existing inventory systems will need to be further developed to link to assets.
- Continue to develop Assessor's information in a GIS format to allow the future development of Levels of Service (LOS) policies to be linked graphically to an asset.
- The priority for implementation into an AMP are the City's horizontal assets. Many of the departments had some level of computerized maintenance management system (CMMS) for maintaining the vertical assets, such as Facility Dude for municipal buildings, Manager Plus for Water Facilities, KeepTrack for Wastewater Facilities, and RTA for DPW Inventory, however development of CMMS for maintaining the horizontal assets is needed. The priority horizontal asset are: sanitary and stormwater collection systems, water distribution lines, culverts, guardrails, signals, overhead signs, ground-mounted signs, ITS devices, sidewalks, roadway, etc.

Policies

- Development of an asset management training and communications plan within the City to bridge the gap in asset management knowledge is needed. This can plan also be used to inform outside stakeholders (the public) on the process and goals of asset management.
- There was agreement that the Key Performance Indicators (KPI) LOS is the primary vehicle to communicate overall strategy within the organization and that the KPI is important to asset management efforts. The City will need to strengthen the link between the KPI and tactical decisions (i.e. program funding levels and project selection).
- While there is general consensus that establishing customer-based LOS policies are a step in the right direction, existing LOS policies do not appear to be tracked or linked to assets. The City's asset management program will need to link LOS policies to assets.
- The development of Target LOS for different asset classes need to be completed for all City departments where none currently exist. See attached sample of a Target LOS in Appendix A.
- There is no system or process in place to manage assets to the lowest life-cycle cost. The City needs to incorporate life-cycle costs into their workflows.

Culture

- Improvements to the decision making process can be made to improve transparency. This should be expanded to include other currently available indicators. An example of this could be the decision process for the purchase of a new snow plow truck; is the investment to improve levels of service such as decreasing response times, help prevent school delays, or it is the improvement to just replace equipment and maintain current levels of service?
- A majority of staff believe that engineering judgment is the primary method of project selection for the City. Sound engineering judgement is critical, however, that judgement informed by utilizing the data/observations/condition assessments collected in the field, will improve asset improvement decisions.
- Many staff believe that in the current situation, the City has not determined what the "right" (data driven) allocation is between assets and the "right" balance between preservation and

reconstruction. Improvements to utilize institutional knowledge of staff, historical and collected data, customer calls and in-field observations should be made.

B. DEPARTMENT OF PUBLIC WORKS - CURRENT ASSET MANAGEMENT PRACTICES

1. Strengths – Department of Public Works

From interviews conducted with personnel from the various departments within the DPW, we determined the current strengths of the DPW's asset management efforts to date. These strengths include the following:

Organizational

- The DPW is well-positioned to implement asset management. There is strong department wide support.
- The priority of asset classes for implementation into an AMP are the City's horizontal assets. Many of the departments had some sort of computerized maintenance management system (CMMS) for maintaining the vertical assets. The priority horizontal assets are: sanitary and stormwater collection systems, water distribution lines, roadway, culverts, guardrails, signals, overhead signs, ground-mounted signs, ITS devices, sidewalks, etc.

Tools

- DPW Staff are increasingly making use of the data available to them to make decisions. Examples of this include the use of data from historical records, GIS database, Pavement Condition Index (PCI) program, Pavement Management System (PMS) program, PACP, and MACP to name a few.
- DPW is using See/Click/Fix program to reach out to the public to determine their level of satisfaction with City programs and operation.
- The DPW Department uses social media, such as Facebook, Twitter, Front Porch Forum, Instagram, and City website, for communication with public.
- Facility Dude program, populated by data collected during the EMG Corporation building report preparation (including condition ratings), is starting to track lifecycle costs.
- The GIS database is being used for an inventory of sidewalks throughout the City including information such as sidewalk condition, handicap accessibility, safety, and replacement history.
- The use of Pavement Management System Micropaver for pavement inventory and condition information is a good foundation for this asset class. This program is being used to drive all roadway asset decisions, making for better management of the water, drainage and sewer assets.
- Vehicle Maintenance uses RTA for an inventory asset management program.
- Planning and Zoning use AMANDA software for maintaining a database for zoning, building permitting, plumbing and electrical permits. AMANDA is linked to map and lot numbers, and GIS feature connects to street and address.
- The Treeworks software program used by the City Arborist for managing tree assets is mature, and can be leveraged now as a key asset management tool.

Policies

- The Parking Garages group has already developed a strong capital program using condition assessment reports of existing parking structures.

- Vehicle Maintenance has developed a workflow that provides the use of an inventory asset management program (RTA) which captures life cycle costs and allows information for data-based decisions for capital and maintenance investments.
- There are some informal Standards of Practice (SOP) in place in some divisions, such as SOPs for meter collection and traffic signs in the Parking Meters and Traffic Signs division, however most divisions lack formal SOP policies.
- There are a few basic LOS policies in place, such as the Right-of-Way Maintenance's LOS for Snow and Ice Control Plan for Roads and Sidewalks, however most departments within DPW lack formal LOS policies.

Culture

- Broad DPW employee support is present and staff are eager to begin formal adoption of asset management practices.
- There exists a strong professional desire and pride in the DPW Staff to take the best possible care of assets. Most employees understand the importance of asset management and therefore implementing a new workflow that would improve the data, system performance, and decision making would be welcomed.

2. Asset Management Opportunities for Improvement – Department of Public Works

Our review of current practices identified several opportunities to strengthen DPW asset management capabilities and processes. Opportunities for improvement include the following:

Organizational

- DPW needs to implement routine data collection into a normal workflow to provide asset condition assessments.

Tools

- Currently only some of the DPW assets are documented in the City's GIS database, and to differing levels of what data is included. There needs to be further development of the geographic information to include all of DPW assets. The City needs to develop standards for GIS data, data collection, and how the data will be maintained.
- DPW feels one of its greatest needs is to have GIS information and work order system available to them in the field to be able to review historical information on a specific asset while out in field. Currently the tools available for use in field are limited. The City should move towards providing the necessary tools, such as tablets or laptops with access to GIS data and work order system, to use in field. This data collection needs to be part of an asset management program.
- Asset management will provide the ability to link service calls and work orders to non-city assets, and in doing so, will provide the ability to link permits, the City's asset, and cost to these non-city assets. To do this, the City will need the ability to link to the Assessor's data (tax map, owner's information, and/or E911 map layer) and keep the information current.

Policies

- DPW will need to expand upon existing LOS policies and/or develop new LOS policies for each asset class. See attached sample of a Target Level of Service in Appendix A.
- The following factors for the DPW engineering department are considered important for an asset management program and should be further developed by the City in the final *SAMP*: establishing

data governance standards, data-driven project selection, considering risk in managing assets, requiring as-built submittals be in the appropriate digital format including data for CMMS and developing policy and procedures for analytical trade-off analysis.

- Budgets for asset improvement need to be clearly linked to performance or measurement after improvements are completed. For example, after a new parking garage is constructed, measure the revenue coming in from the new asset to measure performance. DPW needs to establish performance guidelines for each capital improvement and measure that performance.
- Ways to evaluate current workflows and improve their efficiencies and information will need to be developed. This is important information to capture as long-term employees retire from the workforce.

Culture

- The current See/Click/Fix has provided an unrealistic expectation to the public and the staff creating the opposite effect in regards to the LOS provided by DPW. While there is general consensus that establishing customer-based LOS policies is a step in the right direction, it does not appear to be considered a key factor at this point in time, as DPW personnel are not prioritizing customer response. DPW needs to provide education to the public, develop a realistic LOS for See/Click/Fix, and develop an improved workflow to get information back to the customer.
- The investment that DPW has made in the pavement program through the use of PMS has resulted in the transparency of investment decisions for that asset class as decisions are more data driven based on condition assessment. The same logic and procedure should be used for other asset classes to achieve transparency in decision making.

C. WATER RESOURCES - CURRENT ASSET MANAGEMENT PRACTICES

1. Strengths – Water Resources

From interviews conducted with personnel from the various departments within Water Resources, we determined the current strengths of the Water Resource's asset management efforts to date. These strengths include the following:

Organizational

- Water Resources is currently in the best position to implement an asset management program. There is strong leadership level support and understanding.

Tools

- The Wastewater Treatment Department already utilizes a work sheet that incorporates the risk of failure providing a departmental understanding of asset management.
- Water Resources staff are increasingly making use of the data available to them to make decisions, such as rain intensity data, historical records, GIS, catch basin condition assessments, and sewer and stormwater collection system filming to name a few.
- A coordinated and complete linear referencing system (GIS database) already exists. The GIS is becoming increasingly robust and mature.
- The Pipeline Assessment & Certification Program (PACP) is beginning to be used for sewer and stormwater drain video logging, and as such Water Resources has developed a concept for standardized condition assessment for inventory data collection. This concept could be used for other assets besides sewer pipe.

- Water Resources uses many different technical analysis tools in evaluating assets, such as PCSWMM hydraulic software for stormwater, wastewater, and watershed modeling. Water Resources also has a hydraulic model for the water system.

Policies

- The recent GIS stormwater inventory project can serve as a model for other large scale asset inventory initiatives.
- Water Resources is currently developing a complete inventory and condition assessment for vertical assets and developing a methodology for condition assessment of horizontal assets as part of a project called *20-year Capital Investment Plan and Gravity Pipe Assessment and Rehabilitation*. The recently released Water Resources RFQ for gravity pipe assessment will provide a thorough condition assessment baseline for the City's horizontal wastewater and stormwater assets. This information will provide a large amount of data which should be set up to be analyzed in the asset management software.
- Water Resources also participated in the EMG Corporation Report providing inventory and condition evaluation of their facilities.
- An example of a good policy change was the rewriting of the Ordinance Chapter 31 on the replacement of the water meters. The old ordinance resulted in poor maintenance and cost to customers, however, removing the requirement for the owner paying for the replacement meter only to get a higher water bill was a positive policy change.

Culture

- Water Resources has broad employee support and the staff are eager to begin formal adoption of asset management practices. Several employees have participated in asset management training programs.
- The Water Resources staff exhibit a strong professional desire and pride in taking the best possible care of assets for which they are responsible. Most employees understand the importance of asset management, and therefore building upon existing workflows to implement improved workflows that would improve data collection and maintenance, system performance, and decision making would be welcomed.

2. Asset Management Opportunities for Improvement – Water Resources

Our review of current practices identified several opportunities to strengthen Water Resources asset management capabilities and processes. Opportunities for improvement include the following:

Organizational

- Water Resources has maintenance records and work history on the City's vertical assets, but there is still a great need to develop condition assessments, maintenance records and work history on the City's horizontal assets.
- Water Resources needs more efficient ways to capture day to day operations linked to assets.
- Communication and data sharing between departments throughout the City needs to be priority with proper protocols.

Tools

- Water Resources needs better analytical tools to manage their assets. There are many types of tools that provide predictive maintenance, as well as tools that help analyze the data collected.

Examples of such tools range from infrared analysis of the electrical connections to tracking life cycle cost through the asset management program.

Policies

- Budgets for asset investments are not clearly linked to performance, or measureable metrics.
- There is no system or process in place to manage assets to the lowest life-cycle cost.
- Target Levels of Service for critical Water Resource assets needs to be developed. A target level of service is the minimum expectation of a specific asset, where if the asset falls below that target, it is no longer considered beneficial (i.e. level of service for SCADA system, or level of service hydrant flushing).
- System Levels of Service needs to be developed for Water Resources. A system level of service is broad in nature (i.e. only 20 breaks per year for every mile of water line).

Culture

- Capital project level decision making should be more data driven.
- Improvements can be made to make asset investment decisions more transparent. Also, LOS should be defined and measurable.

3. PRELIMINARY LEVELS OF SERVICE (LOS)

Burlington will need to develop Levels of Service (LOS) for each asset class. Assets exist to deliver services and goods that are valued by customers; for each customer there is a minimum level of service below which a given service is not perceived as adding value. There are “System” Levels of Service and “Target” Levels of Service. A system level of service is a broader, more general level of service that is measurable, such as a goal of only having a certain number of water main breaks in a year. Target LOS will provide guidelines for the organization to use when establishing the annual maintenance work program, emergencies and service responses, project selection, and budget development.

Examples of both a System LOS and a Target LOS are presented in Appendix A.

4. PRELIMINARY GAP ANALYSIS

Table 1 – Preliminary Gap Analysis for City of Burlington’s *Preliminary Strategic Asset Management Plan*, presented in Appendix B, is a summary of Hoyle, Tanner’s gap analysis and program development. The table lists the gap identified in each area and provides a set of goals to guide the development and implementation of an asset management program. The first column of the table lists the criteria and objective for each area. The second column of the table is a city-wide look at Burlington’s existing asset management gaps and goals to move forward. The third column is a gap analysis for the DPW. The fourth column addresses the Water Resources Division’s asset management gaps and goals to move forward.

5. GOALS AND RECOMMENDATIONS

A. Goals for Asset Management Program Implementation

The following goals have been identified in this *Preliminary SAMP* as general goals that will direct the development of the final *SAMP*.

City-Wide Goals

- Develop an asset management process that supports Burlington’s strategic direction to maintain, preserve, and improve asset condition, optimize mobility, enhance safety and security, and strengthen the economy.
- Create a culture through training and communication where asset management is viewed as the way of doing business.
- Create an asset management process that can be used to justify budget requests based on resultant level of service.
- Develop a centralized asset management framework from which personnel can extract high quality complete asset data sets and information.
- Develop an asset management process that yields the ability to perform a robust funding/level of service trade-off analysis between asset classes.
- Advance other asset classes to the point where they can be incorporated into the funding/level of service trade-off process.
- Incorporate risk (consequence of failure) into the asset management process.
- Maintain, preserve, and improve infrastructure assets with targeted performance results and quantifiable cost effectiveness measures.
- Deliver to Burlington customers the best value for the dollar spent.
- Enhance Burlington transparency and accountability.
- Provide support for structural expansion of GIS database by committing staff and budget.

Goals for Department of Public Works

- Provide the analysis and data to allow elected officials to make more informed decisions.
- Provide better access to data within and across other departments.
- Provide the ability to track life cycle costs, including loss of revenue and societal cost.
- Have GIS data available in the field linked to historic information.
- Move paper-form work orders and tracking to electronic and remote.
- Provide the ability to work with a common database.
- Provide the ability to generate reports based on condition assessment and criticality.
- Provide the ability to streamline tasks and reduce duplication.
- Provide the ability to track service calls in a transparent fashion with communication back to customers in a reasonable and identified time period.
- Develop a better inventory system for all of DPW allowing for a better organization and tracking.

Goals from the interviews for Water Resources (further refined goals will follow in Phase 1B, Task 1)

- Gather, keep current, and available asset data.
- Have a robust asset management system where data is up to date and entered once.
- Provide adequate training to make asset management a cultural part of everyone’s job.
- Adequate funding for the program.
- Develop better workflow from Service Calls, Work Orders, and Closeout.
- Reorganize staff/groups to improve efficiencies and share skill levels.
- Provide training and new technology to staff to perform their job.
- Provide transparency, promptness, real-time 24-hr/d updates, and use of social media for public communication.
- Develop a better understanding of consequence of failure associated with different assets.
- Have the right tools for staff to perform job and have access to data/information to make changes.

B. Recommendations

The *Preliminary SAMP* recommends the following sixteen (16) broad actions be taken by the City of Burlington to further the implementation an asset management program:

1. That condition surveys be undertaken for all asset categories, including safety and risk assessments, identification of remaining useful life and determination of appropriate treatments.
2. That implementation plans are developed to prioritize and minimize high risks identified in condition surveys done in the 20 year evaluation.
3. That service levels are established for each asset category for unscheduled and routine maintenance and renewal programs, including optimum funding levels required to match desired service levels and minimize risk exposure.
4. That an assessment of optimum maintenance and renewal treatments, intervention levels and construction/design standards is undertaken to maximize service life and reduce life-cycle peaks.
5. That valuation of City's identified assets is completed.
6. That a financial strategy is developed to address the financial gap in asset management and the identified backlog determined from condition audits.
7. That future demand plans are developed for the provision of services and assets, including disposal and rationalization of existing assets.
8. That long-term planning and implementation programs are developed for each asset category for consideration in future capital works programs.
9. That the long-term funding implications for future asset upgrade and expansion works are assessed, including ongoing maintenance and end of life renewal needs.
10. That City Service Call Management System is advanced to enable identification and assessment of service calls per asset category.
11. That risks associated with each asset category are identified and assessed, including determination of costs to remedy.
12. That processes and procedures are developed for continual risk and safety assessments, including relevant documentation.
13. Development of an integrated asset management knowledge database.
14. That financial assessments are incorporated for all new capital upgrade and expansion projects.
15. That individual Asset Management Plans for each asset category are developed.

16. That community education about the nature and seriousness of infrastructure deterioration is increased.

Asset Management Steering Group

In addition to the sixteen broad actions outlined above, a primary recommendation of this *Preliminary SAMP* is that the City of Burlington create an Asset Management Steering Group. Asset Management Policy commitment is an organizational issue. Infrastructure asset management needs to be integral with the overall City planning process, aligned with strategic business planning of the City, and needs commitment from across the organization to be successful. In order to fulfil these goals, the City of Burlington should develop an Asset Management Steering Group. The development of the outline of the objectives, roles and membership of this group needs to be developed to provide guidance.

The International Infrastructure Management Manual (IIMM) is recognized worldwide as best practice guidelines for asset management planning. The IIMM acknowledges the importance of having an asset management team with representatives from a cross section of departments to ensure that asset management is an integrated part of the corporate process rather than an isolated activity, as well as to broaden best practice.

According to the IIMM, the establishment of a corporate Asset Management Steering Group as part of this framework will achieve the following benefits for City:

- Demonstration of executive and senior management support for sustainable service delivery and asset management.
- Facilitation of political buy-in and shared responsibility for asset management outputs.
- Improved coordination of strategic planning, information technology, financial and asset management activities.
- Promotion of uniform asset management practices and programs across the organization.
- Improved information sharing.
- Pooling of city expertise.
- Championing of asset management practices and processes.
- Wider accountability for achieving and reviewing corporate sustainable service delivery and asset management goals and objectives.

Objectives of Steering Group

- To drive and implement sustainable asset and service management across City.
- To increase awareness of the importance of integrated service planning and asset management across the organization.
- To audit and report progress on a regular basis to City.
- To comply with the City's developed Asset Management Assessment Framework.
- To work in unison with the Service Planning Steering Group to create and implement integration opportunities for asset management and service planning.

Roles of the Steering Group

- To monitor and assess progress and determine responsibility for implementation projects arising from the Strategic Asset Management Plan, Asset Management Plans and the Asset Management Systems Review (Improvement Recommendations)
- To assist in the self-assessment of City's asset management improvement program as part of the City's developed Asset Management Assessment Framework.
- To assist in the preparation of progress reports for the City.
- To complement the work undertaken by the Service Planning Service Group with a view to realize integration opportunities for sustainable asset management and service planning.

C. Business Case

Recent initiatives undertaken by the DPW Water Resources Department, such as Integrated Permit Planning, 20 Year Sewer Evaluation, Gravity Pipe Assessment Project as well as this Asset Management Project, demonstrate an understanding and recognition that the City's infrastructure management approach needs to change. While Burlington has been on a progressive journey with its facilities asset inventory and renewal practices, in past few years, there has been a movement towards a much broader look at City assets, in a holistic way. The reality of management of infrastructure in today's regulatory environment is very complex. Burlington's infrastructure is inextricably linked to the waterbodies that make up 33% of Burlington's land area and drive Burlington's economy. The vibrancy of Lake Champlain is essential to Burlington's existence. As we have also learned in the past couple of decades, water quality degradation is not easily remedied through a singular upgrade. Stormwater systems combine runoff from roadways and individual yards all of which gather contaminants from human use. Any changes made throughout the City's complex infrastructure will have a causal effect on another aspect of the infrastructure. It is critical that the City is in a position to view its infrastructure in an integrated way, breaking down the "silos" of typical infrastructure management through independent divisions, and combining its limited resources from varying funding mechanisms.

Another main issue with infrastructure maintenance is the well-known fact that resources to fund maintenance are extremely limited. Competing community interests in public education and public safety compete regularly with infrastructure needs during budget development. It is essential that the limited dollars available for infrastructure spending be used in the most cost effective way possible. Critical infrastructure should be evaluated utilizing a risk-based approach to ensure that money is spent on the highest value infrastructure first. Leveraging enterprise funding from water, sewer, and stormwater with transportation funding to provide upgrades that enhance water quality as well as benefit the travelling public is the best use of limited resources. There are too many inter-relationships, causal affects and customer influences on every physical asset that the City needs to maintain to keep track of them all in a conventional methodology. A robust Enterprise Asset Management System will bring all of the assets into one database so that risk based analysis can be readily conducted. Real-time updates will keep data accurate and reliable for future generations.

The primary goal of a robust Asset Management Program is to move management from a reactive mode to a proactive mode. Conventional public works is generally in the business of responding to emergencies. Each day dealing with whatever catastrophic issue (i.e. water main break or sewer backup) arises. There is no more expensive way to manage infrastructure than to be constantly spot repairing the system due to failure. Aside from the actual cost of the emergency response, there is the disruption to business, the traveling public and the image of the community. To add emphasis to the critical importance and benefit that asset management brings to community management, it is now a requirement to have an asset management system for almost every

federal funding program that exists. EPA, FHWA and FAA have all worked asset management requirements into their funding programs. The reason is clear, federal money is also limited so there needs to be an effort to use it in the most cost-effective manner possible.

A final *Strategic Asset Management Plan (SAMP)* will guide Burlington in:

- Supporting the implementation of Burlington's Asset Management Policy (AMP).
- Supporting the integration of service planning and asset management.
- Aligning with external guidelines.

The final *SAMP* will be structured in a manner to highlight four key areas of improvement:

- Service Planning Integration
- Sustainable Asset Funding
- Asset Management Plans
- Asset Management Information System

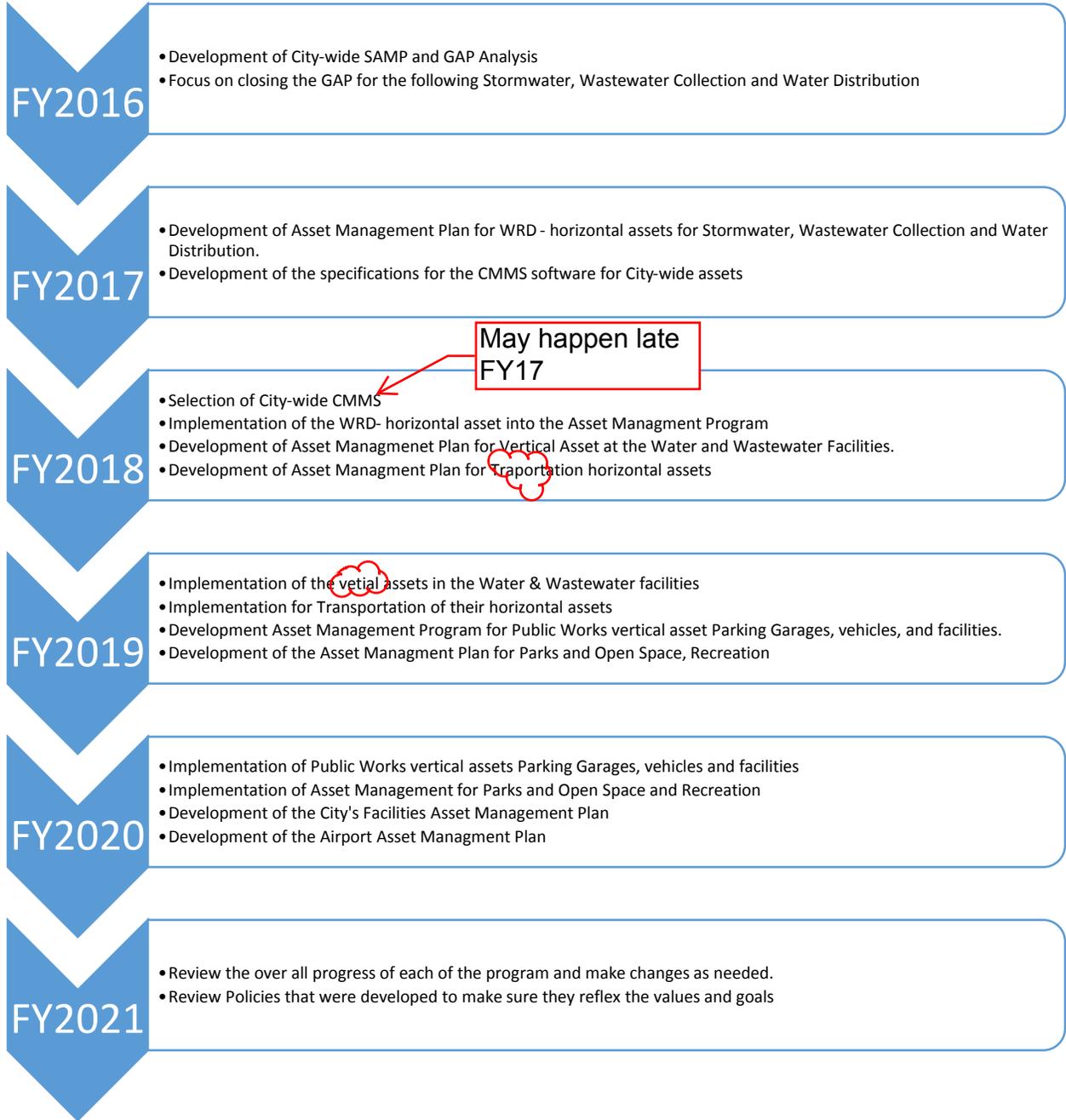
In essence, these recommendations will assist Burlington in:

- Reaching a sustainable level of renewal funding
- Having regard to the affordable, long-term asset requirements of Burlington to deliver desirable service outcomes
- Advancing asset decision tools and information system, to facilitate service planning integration, data management, and efficient work practices

Role and Purpose of City Council to Asset Management:

The City of Burlington manages over \$500 million of infrastructure, facilities, and equipment assets. These assets exist to directly or indirectly support the services the City of Burlington delivers to the community. Therefore, in order to support the provision of services, the City has invested in an extensive asset portfolio over a long period of time. Assets typically have a long lifecycle, with significant costs required at each stage of the lifecycle, to ensure continued delivery of the desired level of service.

D. Timeline for Implementation

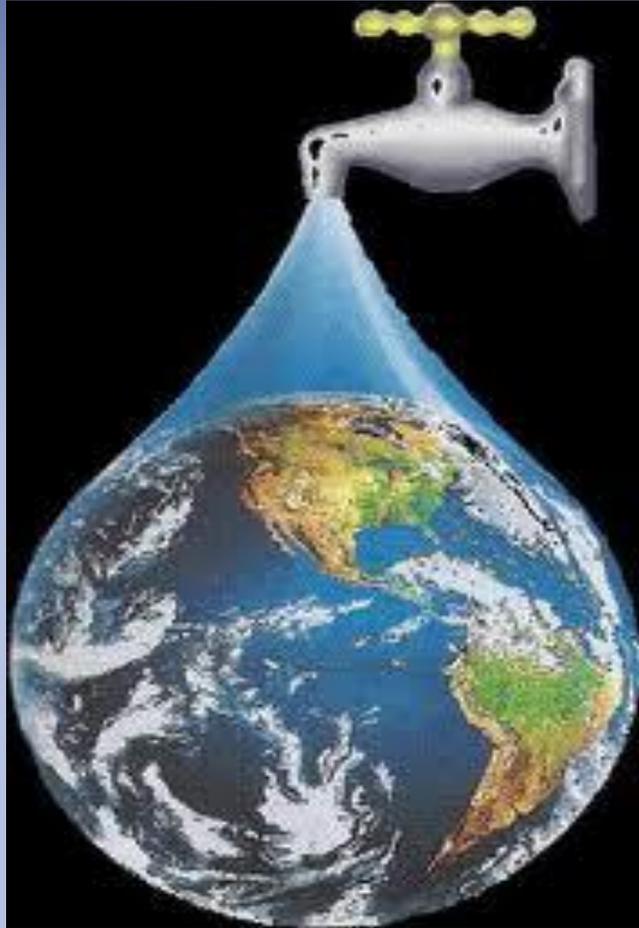


APPENDIX A

SAMPLES OF LEVELS OF SERVICE (LOS)

Sample Water System Levels of Service

<i>Cat.</i>	<i>Level of Service</i>	<i>Performance Measure</i>	<i>Target</i>	
Health and Safety	1. WATER QUALITY Compliance with Safe Drinking Water Act (SDWA) primary and secondary standards	Number of violations per year	0 violations/year	
	2. WATER QUALITY Compliance with Ground Water Rule (GWR)	Number of violations per year	0 violations/year	
	3. FIRE PROTECTION There will be fire flow available for 100% customers	Meet Insurance Service Office's (ISO) requirements:		
		• Flow test		All test ≥ 750 gpm
		• Hydrant inspection frequency		Twice/year
	• Hydrant flushing frequency		Once /year	
	4. WATER AVAILABILITY No adverse event, unless related to electrical failure or severe weather condition, will cause the customer to be without water	Time without water	< 8 hrs	
5. WATER PRESSURE A minimum pressure will be maintained in the distribution system	Monthly average of daily minimum values	35 psi		
6. WATER SYSTEM PERFORMANCE	Main break frequency per year	≤ 15 /100 miles		
	Full leak detection survey	Every 5 years		
Customer Service	7. RESPONSE TIME Respond to customer complaints/requests in a timely manner	Response time due to:		
		• Emergency (breaks)	1 – 2 hours	
		• Leaks	1 – 2 hours	
	8. COMPLAINTS Customer complaints will be tracked and monitored on a regular basis	• Meter Repair	1 – 5 days	
		Number of complaints due to unplanned or unanticipated		
		• Water outage	≤ 2/month	
		• Colored water	< 3/month	
• Water w/ bad taste, odor	< 5/month			
• Pressure	< 5/month			
9. EDUCATION AND OUTREACH	Water conservation information included with water bill and in website	Yearly		
10. COMMUNICATION Notification of planned shutdown will be provided.	Number of days	≥ 7 days		
11. COSTUMER READINGS Ensure meters communicate information	Number of non-communicating meters per month	< 75 meters/month		
Source Water Protection	12. OUTREACH Outreach to property owners within the protection area	Outreach frequency	Once/year	
	13. SHORELINE INSPECTION	Boat inspection of reservoir shoreline	Once/year	
Financial	14. FINANCIAL CAPABILITY Rates are reviewed on an annual basis and revised as needed to ensure full cost recovery	Revise, review rates	Yearly	



Target Service Levels for Water Assets

City of Anywhere Public Works Department

"To enhance the quality of life, now and into the future, for people living, working and raising families in City of Anywhere through the economic, efficient, and environmentally responsible stewardship of superior water utilities."

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BACKGROUND

The maintenance of Anywhere Public Works Department related assets is the responsibility of the Operations & Maintenance, Engineering & Construction Management of the Water System. These Water Department manage and maintain a complex network of The Public Works infrastructure which serves approximately 2,000 town residents and 450 customers.

The major assets that represent the foundation of the water system include:

- | | | | |
|-----------------|-------------|-----------------------|---------------------------|
| 1. Intakes | 4. Mains | 7. Gate Valves | 10. Treatment facilities |
| 2. Wells | 5. Services | 8. High Lift Stations | 11. Backflow devices |
| 3. Transmission | 6. Hydrant | 9. Storage Tanks | 12. Right-of-Way Corridor |

In addition to performing routine and scheduled maintenance on these assets, the department also performs minor improvements, occasional reconstructions and round-the-clock coverage for handling emergencies and other critical service responses.

PURPOSE

The levels of service standard provides a description of the criteria which will be used to establish the level of funding to provide high quality water, fire protection and provide service 24 hours a day, make effective use of available funds, and preserve the public and private investments in the water system. In addition, the department also strives to preserve and protect the natural environment as it relates to the water infrastructure. The purpose of this document is to augment the Water Maintenance Priority Matrix by establishing target service levels for certain water assets managed and maintained by Anywhere Public Works. The assets listed here are considered to be the Department's "major" assets which form the backbone of the water system.

In order to maximize the effectiveness of resources, the following "Target Service Levels" provide guidelines for the Department to use when establishing the annual water maintenance work program, responding to emergencies and service requests, selecting projects, and developing budgets. The target service levels established in this document will supplement the priority matrix to improve the process for selecting maintenance activities that occur on the treatment and distribution system.

Equally fundamentally, the methodology allows identification of those aspects of services customers' value (or do not wish to see as part of the service). In this report we are trying to set a level of service based on input from calls in the past. Going forward we will evaluate the service call based on the asset that is affected or causing the complaint. The goal of this document is not to set levels above the requirement or needs of the customers and cause unnecessary cost to the operations. Critical findings included:

- Respondents generally could cope with short interruptions, and the components of interruptions that were deemed to be important were:
 - Duration of the interruption;
 - If they are notified of the interruptions;
 - Time of day the interruptions happened; and
 - The number of interruptions per year (both planned and unplanned, although there was a greater tolerance for planned interruptions than unplanned.)
- Compensation was generally not expected for planned or unplanned interruptions, with customers more interested in having the problem fixed, than any form of rebate (which

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they felt they would pay for anyway through increased water bills), but in many countries the customer is given a rebate based on the interruption. It is important to understand that there is a cost to the customer to be without water or quality issues.

DEFINITIONS

Asset Types

1. **Intakes:** A water inlet structure is a structure located within a river, lake, reservoir or other water source designed to receive water from its surroundings for use within a water treatment plant or other facility. The intakes consists of opening, strainer or grating through which water enters and conduit conveying the water usually by gravity to a treatment facility.
2. **Wells:** A water supply well meets the definition of a "public water supply" when the well and distribution system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.
3. **Transmission:** Water transmission mains convey raw water to the treatment plant from various surface and underground sources. This includes rivers, lakes and surface reservoirs as well as underground aquifers. After it is treated, transmission mains carry water to storage reservoirs or to smaller-diameter distribution mains that carry water to commercial and residential users.
4. **Mains:** A principal pipe in a system of pipes for conveying water, especially one installed underground.
5. **Service laterals:** Domestic Water Service Lateral shall be the pipe from the public water main to the primary service shut off valve, except when the meter is inside, and then it is to the curb stop.
6. **Hydrants:** A fire hydrant is a source of water provided in most urban, suburban and rural areas with municipal water service to enable firefighters to tap into the municipal water supply to assist in extinguishing a fire.
7. **Gate Valves:** The function of a gate valve is to ensure a straight line flow of a liquid where minimal restriction is desired. When the valve is wide open, the gate gets fully drawn up into the valve, which leaves an opening that is the same size as the pipe installed in the valve. This thus allows the liquid to flow since there is little pressure or restriction in the valve.
8. **Highlift stations:** A highlift Pump Station is a pump station designed to pump treated water into the water reticulation system at pressure either directly or via a Water Tower.
9. **Storage Tanks:** a large steel or concrete tank designed for holding water,
10. **Treatment Facilities:** A Water Treatment Plant is a facility designed to produce potable water for a Water Reticulation Network.
11. **Backflow devices:** A backflow prevention assembly is used to protect potable water supplies from contamination or pollution due to backflow.

12. **Right-of-Way Corridor:** A public area used to place transportation and utility assets for the benefit and ease of moving vehicles, personnel, and commodities.

Functional Classifications of Water Systems

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities
2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense.
3. **Commercial:** Malls, retail areas, grocery stores
4. **Urban:** High and medium density residential area
5. **Suburban:** Low density of residential housing.

RISK FACTORS

Certain inherent risks are involved when it comes to public water infrastructure. The goal of Anywhere Public Works is to minimize the water services complaints, as well as the users of the system, is exposed to some level of risk when the public infrastructure is used. The goal of the managing agency is to reduce the exposure of risk both to the end users as well as to the agency. Factors to consider when managing risk include:

Factor	Issues	Stakeholder
Economics	Travel Delay Maintenance	End User Agency
Legal	Liability due to damage or injury claims Law Suits/ Litigation	Agency End User/ Agency
Community	Poor Mobility/Connectivity Quality of Life Nuisances	End User End User End User
Health/Safety	Injury /loss of life Property damage Vehicle damage	End User End User End User
Environment	Destruction/Degradation of habitat Pollution Regulatory Violations	End User End User Agency
Reputation	Loss of Trust Loss of Partners/Allies	Agency Agency

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The management of these risks includes the following strategies:

Avoid: Do not own the asset or perform the activity that presents the risk

Transfer: Shift the risk to a third party either through insurance or through a performance contract.

Mitigate: Implement design or operating measures that reduce the likelihood or severity of occurrence.

Accept: Self Insure or otherwise assume the likely consequences of occurrence.

When dealing with risk, it is important to take into consideration the consequences of failure. For each asset class, “failure” can occur in a number of ways with varying degrees of severity. Understanding that failures of assets will occur, the challenge for the agency is to keep those failures to a minimum in order to reduce the likelihood of a catastrophic failure that can injure a person, damage personal property, or harm the environment.

Risk Assessment Matrix

Likelihood of event Occurring

		Unlikely/Rarely (1)	Could Happen (2)	Likely (3)	Certain (4)
Impact to Community if Event Occurs	Extreme (4)	4	8	12	16
	High (3)	3	6	9	12
	Medium (2)	2	4	6	8
	Low (1)	1	2	3	4

FAILURE MODES

There are two failure modes for any given water asset.

- A **Functional failure** is when the asset continues to operate but stops performing the way it was designed or intended. This failure can be short-lived with the asset being restored to full capacity with the use of limited resources. For example, a water pipe may have iron and manganese sediment in the pipe reducing the C value causing a reduction in quantity and quality of the water. During a fire event the fire department may not have adequate water flow to fight the fire. This type of failure could be corrected with increase operation and maintenance cost to increase quantity and quality back to the system.
- A **Catastrophic failure** is when an asset is destroyed creating a “life-safety” gap in the water system. An example of this would be a water line failure that is not looped going under a major road prevents the water supply. The typical solution to a catastrophic failure is constructing a new asset altogether or performing a major rehabilitation on the existing feature.

Failure Examples

A. Functional/ B. Catastrophic

Wells

- A. The well production has dropped and is not producing and needs screens cleaned.
- B. The well has been contaminated and no longer usable or screen collapses.

Transmission

- A. The transmission line has leaks and iron buildup
- B. The transmission line failed under the railroad.

Mains

- A. Water main leak or break
- B. Water main failure in an area that is not looped, loss to fire protection

Services Lines

- A. Service line leak or freeze
- B. Service line break in a vacant home

Hydrants

- A. Hydrant stem broke and does not work, bag over hydrant
- B. Hydrant broken and no one knows, fire and it does not work

Gate Valves

- A. Gate valve does not close completely, causing greater work to repair
- B. Gate valve does not work at all and there is a break in the line

Storage Tank

- A. Vandalism, bacteria contamination,
- B. Structural failure

Treatment Facility

- A. Corrosion of valves, piping, and controls
- B. Lighting strike and lose all electronics, plant cannot operate

Backflow Devices

- A. Leaking and failed test
- B. Back feed contaminate into the water system

Right-of-Way Corridor

- A. Cannot access Right of Way because of trees
- B. Someone build over the infrastructure, or not access during emergency

MAINTENANCE PRIORITIES

There are four different types of priorities associated with transportation infrastructure maintenance:

- 1) **Emergencies:** Work related to abating or managing an immediate threat to public safety, private property, or environmental resources
- 2) **Mandated:** Work related to regulatory or legislative requirements that require the agency to perform certain activities
- 3) **Essential:** Work that maximizes the efficiency of the water system but is not required, by law, to be performed
- 4) **Non-Essential:** Work that is typically for aesthetic or non-functional enhancements as it relates to painting of hydrants, ground maintenance around the well site.

CRITICAL SERVICE RESPONSE TIMES

In addition to water category routine service levels, certain water system infrastructure conditions warrant critical responses regardless of the water infrastructure category or service level. Such activities are included in certain water infrastructure service areas and represented as Critical Service Response Times. If the safety or integrity of any water infrastructure element or structure has been compromised in a manner that presents an immediate hazard to the public, the public will be notified and necessary actions and repairs will be implemented immediately.

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INTAKES

Critical Service Response

WELLS

Critical Service Response
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

Routine Service Levels

Service Level A: The wells will be available 100% for 100% production of 100% regulatory compliance.

Service Level B: The wells will be available 90% for 90% production of 100% regulatory compliance. Well back to 100% within 30 days

Service Level C: The wells will be available 50% for 70% production of 100% regulatory compliance. Well back up within 60 days

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)

2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)

3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)

4. **Urban:** High and medium density residential area (Service Level C)

5. **Suburban:** Low density of residential housing. (Service Level C)

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TRANSMISSION

Critical Service Response

MAINS

Critical Service Response
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

EPA's secondary standards related to aesthetics shall be met by the system.

Rates will be reviewed on an annual basis and raised as needed to ensure full cost recovery.

All customer complaints will be investigated within 2 business days of reporting the complaint.

Service Level A: Water loss will be less than 1% and pressure greater than 60 psi and meeting 100% regulatory and 100% design flow capabilities. Customers are notified 48 hours prior to any work or repairs done on the main that impacts the customer. Repairs done between 8:00 am and 3:30 pm and cleaned up in 8 hours

Service Level B: Water loss will be less than 10% and pressure greater than 40 psi and meeting 100% regulatory and 90% design flow capabilities. Customers are notified 24 hours prior to any work or repairs done on the main that impacts the customer. Repairs done between 8:00 am and 5:00 pm full service within 8 hours cleaned up the next day.

Service Level C: Water loss will be greater than 10% and pressure greater than 40 psi and meeting 100% regulatory and 70% design flow capabilities. Customers are notified at the time of the work or repairs done on the main that impacts the customer. Repairs when ready and will be completed in 24 hours with cleanup within a week.

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)
2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)
3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)
4. **Urban:** High and medium density residential area (Service Level C)
5. **Suburban:** Low density of residential housing. (Service Level C)

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SERVICES LINES

Critical Service Response
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

Service Level A: Water loss will be less than 1% and pressure greater than 60 psi and meeting 100% regulatory and delivery taste free, low turbid, color free water. The customer is notified 48 hours prior to any work being done on the service line.

Service Level B: Water loss will be less than 10% and pressure greater than 60 psi and meeting 100% regulatory and delivery taste free, low turbid, color free water. The customer is notified 24 hours prior to any work being done on the service line.

Service Level C: Water loss will be less than 10% and pressure greater than 40 psi and meeting 100% regulatory. The customer is notified at the time work being done on the service line.

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)
2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)
3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)
4. **Urban:** High and medium density residential area (Service Level C)
5. **Suburban:** Low density of residential housing. (Service Level C)

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HYDRANTS

Critical Service Response
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

Service Level A: There will be fire flow available for 100% and all hydrants working of the customers within the system. Spare parts in stock 100% of the time.

Service Level B: There will be fire flow available for 100% and an active hydrant within 500 ft of the customers within the system. Repairs made to the hydrant within 24 hours of notification of damage.

Service Level C: There will be fire flow available for 95% and an active hydrant within 500 ft of the customers within the system.

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)

2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)

3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)

4. **Urban:** High and medium density residential area (Service Level C)

5. **Suburban:** Low density of residential housing. (Service Level C)

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GATE VALVES

Critical Service Response
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

Service Level A: All gate valves available for 100% working of the customers within the system.

Service Level B: All gate valves available for 100% working within 500 ft of the customers within the system.

Service Level C: All gate valves available for 95% working within 500 ft of the customers within the system.

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)

2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)

3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)

4. **Urban:** High and medium density residential area (Service Level C)

5. **Suburban:** Low density of residential housing. (Service Level C)

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HIGHLIFT STATIONS

Critical Service Response
(NEED A DESCRIPTION)

Routine Service Levels:

STORAGE TANKS

Critical Service Response
(NEED A DESCRIPTION)

Routine Service Levels
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

Service Level A: Water level is at 95% full 100% of the time and meeting 100% regulatory and delivery taste free, low turbid, color free water.

Service Level B: Water level is at 90% full 100% of the time and meeting 100% regulatory and delivery taste free, low turbid, color free water.

Service Level C: Water level is at 90% full 90% of the time and meeting 100% regulatory and delivery taste free, low turbid, color free water.

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)

2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)

3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)

4. **Urban:** High and medium density residential area (Service Level C)

5. **Suburban:** Low density of residential housing. (Service Level C)

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TREATMENT FACILITIES

Critical Service Response
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

Routine Service Levels:

Service Level A: The treatment is available 100% of the time with backup available 100% of the time. and meeting 100% regulatory and delivery taste free, low turbid, color free water.

Service Level B: The treatment is available 100% of the time with backup available 50% of the time. and meeting 100% regulatory and delivery taste free, low turbid, color free water.

Service Level C: The treatment is available 95% of the time with backup available 0% of the time and meeting 100% regulatory and delivery taste free, low turbid, color free water.

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)

2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)

3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)

4. **Urban:** High and medium density residential area (Service Level C)

5. **Suburban:** Low density of residential housing. (Service Level C)

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BACKFLOW DEVICES

Routine Service Levels
(NEED A DESCRIPTION)

One that meets your organization level currently (1 poor and 5 excellent)

Communication	1	2	3	4	5
Clearly define LOS	1	2	3	4	5
Regulatory current & future	1	2	3	4	5
Measurable LOS	1	2	3	4	5
Customer demands & future needs	1	2	3	4	5

Service Level A: Backflow works 100% of the time and meeting 100% regulatory requirements and is tested every 6 months.

Service Level B: Backflow works fails and is repaired within one day and meeting 100% regulatory requirements and is tested every six months.

Service Level C: Backflow works fails and is repaired within 30 day and does not meet regulatory requirements.

1. **Health and Safety:** This would be area that include schools, hospital, medical facilities, shelters, police & fire facilities (Service Level A)

2. **Industrial:** Facilities that employ large number of people and shut down result in costly expense. (Service Level B)

3. **Commercial:** Malls, retail areas, grocery stores (Service Level B)

4. **Urban:** High and medium density residential area (Service Level C)

5. **Suburban:** Low density of residential housing. (Service Level C)

APPENDIX B

TABLE 1 - PRELIMINARY GAP ANALYSIS

TABLE 1 – PRELIMINARY GAP ANALYSIS for CITY OF BURLINGTON’S STRATEGIC ASSET MANAGEMENT PLAN

Business Practice Characteristics	City-Wide	Department of Public Works	Water Resources Division
<p>Define Goals and Objectives: Goals and objectives are comprehensive, integrated with other City’s policies, and supported by quantitative and measurable performance criteria.</p>	<p>The Council needs to adopt an asset management policy for the City outlining the Statement of Policy, Purpose, Applicability and Principles.</p>	<p>The Department of Public Works (DPW) needs an asset management policy that will reflect the city-wide asset management policy focusing on life cycle cost at target levels of service.</p>	<p>Water Resources needs to take their mission, goals and objectives and make sure they align with the City goals & objectives.</p>
<p>Assets Purchasing Based on Life Cycle Costing: Principles are outlined in the purchasing policy to drive decisions based on life cycle economic analysis of the asset performance and cost, and encourage strategies with long-term benefits.</p>	<p>The City’s purchasing policies encourage life cycle cost analysis, but do not have a policy standard that is based on measurable and quantitative criteria. The City needs to develop a policy to purchase based on life cycle analysis and performance for decision making, including the initial, maintenance, societal, and environmental costs.</p>	<p>DPW utilizes many different methods for purchasing of assets. Because of DPW’s knowledgeable staff and their experience, they are able to leverage this knowledge. There seems to be a move towards a better purchasing process to provide better evaluation of their Capital Investment. There needs to be better coordination between departments to develop the best purchasing policy for the whole organization.</p>	<p>Water Resources needs to identify the life cycle cost attributes to provide measurable and quantitative data in the purchasing of assets. Water Resources needs to develop specifications and an evaluation process based on life cycle analysis and performance. This will support the city-wide purchasing and evaluation policies. An example of this would be water meter replacement policy where lost revenue increases the life cycle cost.</p>
<p>Policy Formulation Allows Latitude in Arriving at Performance Driven Decisions on Resource Allocation: Provide information on which driving factors for assets dictate the investment of associated assets.</p>	<p>The City needs to identify the driving factors (growth, usage, infrastructure needs, services, etc...) that provide balance in their decisions and investments. Utilizing these factors, standards should be developed to ensure consistent prioritization of projects during capital investment decisions.</p>	<p>The paving asset program PMSM is driving the investments by other departments, i.e. water, wastewater, and stormwater. There needs to be a policy developed which will guide this process. This policy will provide information to allow evaluation of other possible assets that could drive the decision for the allocations of resources. The policy needs to take into consideration risk, goals, and societal costs over the long term investment.</p>	<p>Water Resources currently allows the Pavement Condition Index of the street assets to drive prioritization of investments in the water distribution, sewer, and stormwater collection systems. A policy needs to be developed to evaluate assets using risk to drive the capital investment of associated assets during integration with the Street Paving program, as well as assets on streets outside the paving program.</p>
<p>Engagement with Policy Makers: The staff actively engages with political leaders and other policy makers to define expectations of the infrastructure.</p>	<p>The policy makers need to engage staff to ensure policies reflect current operating procedures. The policies need to be reviewed and updated to ensure they are meeting the City’s goals and criteria.</p>	<p>The Department of Public Works needs to provide information to policy makers in a format that will provide engagement. This information will provide a better expectation of the infrastructure and the services provided.</p>	<p>Water Resources may be the leading group in the development of policies that provide the information to the decision makers. Water Resources needs to be actively engaged with policy makers and provide the information necessary to support policies.</p>
<p>Prioritizing Capital Investment Projects Based on Risk: Capital project should start by managing high risk assets through investment process.</p>	<p>The City needs to ensure that the information collected provides the data to evaluate risk. The City will need to periodically review the data and modify as needed. This should be an open evaluation process to the public to ensure buy-in.</p>	<p>For Department of Public Works to manage their assets based on risk, there needs to be an evaluation of risk for each asset class. DPW needs to develop workflows and define risk standards in order to start collecting the data needed to support risk decisions.</p>	<p>Water Resources needs to look at these investments using asset management principles. The staff currently analyzes risk (though often informally) when making capital investment decisions. This process needs to be formalized/developed and standardized across different assets.</p>
<p>Capital Investments are Based on Added Level of Service and is Measurable: Each capital investment will have a measurable level of service and be able to be evaluated based on expectations.</p>	<p>The City currently develops capital improvements based on engineering staff recommendations to either maintain or improve services. The City needs to develop measureable levels of service for each capital improvement project so that the asset’s performance can be measured enhance the data available for engineering review.</p>	<p>The Department of Public Works capital investment program needs to document what each investment is going to provide with what increased level of service that will be measurable after the investment has been made to ensure that the asset meets or exceeds expectations of the investment.</p>	<p>Water Resources needs to develop their capital investment program to include measurable levels of service that are developed as part of the AM program. Water Resources capital investments need to meet the required level of service expected by the customers and regulatory agencies.</p>

Asset Management Policy

TABLE 1 – PRELIMINARY GAP ANALYSIS for CITY OF BURLINGTON’S STRATEGIC ASSET MANAGEMENT PLAN

	Business Practice Characteristics	City-Wide	Department of Public Works	Water Resources Division
Asset Information System	<p>Inventory: Maintains an inventory of assets that is a complete and accurate.</p>	<p>The City needs to develop standards for the collection and maintenance of their asset inventory. This will require oversight of the GIS system to provide standards between departments. This may require additional resources be allocated by the City to fund additional staff to expand and maintain a robust GIS database.</p>	<p>The Department of Public Works needs to work on the development of their horizontal assets. Development of the different asset types and what data attributes that are needed to be collected for each of the different assets, as well as the risk of each asset so that assets can be ultimately ranked by risk.</p>	<p>Water Resources needs to work with the City to develop standards for the collection and maintenance of their inventory. The development of basic inventory has been conducted, and attribute data input is currently underway.</p>
	<p>Workflows: Development of standard operating procedures (SOPs) throughout the organization to create continuity and capture information.</p>	<p>The City needs to develop workflows/SOPs to ensure the maintenance of data (GIS, inventory, data links, and expansion of information), and provide confidence in the information and level of accuracy throughout the AM program. The City needs to provide adequate support in funding and time allocation to provide training of City staff to execute workflow/SOPs.</p>	<p>Department of Public Works needs to maintain and develop workflows/SOPs as part of everyday operations so the development of minor changes will allow the AM program to grow and expand its information and data. The data collected needs to support the goals and policies of the organization. DPW staff will need to be trained in the execution of workflow/SOPs for the AM program to be successful.</p>	<p>Water Resources needs to maintain and develop workflows/SOPs as part of everyday operations so the development of minor changes will allow the AM program to grow and expand its information and data. Training in both the development and execution of workflow/SOPs is necessary so that they can be easily be employed by Water Resources staff.</p>
	<p>Condition: Asset condition data is updated on a periodic schedule sufficient to provide information to develop deterioration curves to provide timely and accurate information on the status and performance of an asset to allow for meaningful data-driven decision making.</p>	<p>The City needs to develop asset condition assessment standards and scheduling cycles to update data to provide a better understanding and more accurate information for data-driven decision making. The development of these standards will need to be both a top-down and bottom-up process to ensure the right information is captured.</p>	<p>The Department of Public Works currently utilizes condition assessment for their pavement evaluation. They have also utilized condition assessment for the City’s trees that are in the public right-of-ways. Both of these condition assessments are standardized and are able to be utilized by any of the staff doing these condition assessments. DPW needs to work on the development of condition assessment standards for different assets throughout the department. DPW will also need to understand how an asset fails (structural, capacity, energy, regulatory, financial, and performance) in the development of these conditions standards.</p>	<p>Water Resources is currently moving towards using standards for condition assessment of some of their asset types, including PACP for sewer and stormwater pipes. Utilizing this training of condition evaluation standards will help in the development of additional assessment standardization assets. Water Resources should start by developing condition assessments for horizontal assets with a useful life of 25 years or greater, such as the sanitary sewer collection system. Assets with a useful life less than 25 years, such as mechanical equipment, should be limited to inspection standards allowing prioritization of assets requiring condition assessment.</p>
	<p>Consequence of Failure: Consequence of failure provides a risk standard for each of the assets based on financial, environmental and social impacts of failure.</p>	<p>The City needs to develop policies based on the risk of failure of an asset, including the City’s risk tolerance for that failure. The City should review the data that determines the risk decision to ensure that it reflects the City’s established risk tolerance.</p>	<p>The Department of Public Works needs to start looking at their assets with regard to the consequences of them failing. The development of the consequence of failure of an asset, along with the condition assessment of an asset, will allow DPW to focus their strategic planning efforts in funding based on assets determined to be a high risk.</p>	<p>Water Resources will need to start incorporating the asset’s consequences of failure into the evaluation process and condition assessment. By understanding and evaluating how an asset will fail and the associated consequences of that failure, Water Resources will be able to prioritize assets by risk tolerance and create a risk tolerance ranked list of priorities. By focusing on the high risk assets, Water Resources can employ effective strategies to reduce the City’s risk.</p>

TABLE 1 – PRELIMINARY GAP ANALYSIS for CITY OF BURLINGTON’S STRATEGIC ASSET MANAGEMENT PLAN

	Business Practice Characteristics	City-Wide	Department of Public Works	Water Resources Division
Maintenance Program	<p>Tracking Life Cycle Cost: Life Cycle Cost has an impact on many of the decisions in the management of assets. The workflow throughout the life of an asset will capture all the costs from initial purchase, operation and maintenance, down time and societal cost of inoperation, environmental cost, and disposal.</p>	<p>The City needs to develop a level of management to review and make adjustments to capture the information necessary to better evaluate the life cycle costs of individual assets, asset types and asset classes.</p>	<p>The Department of Public Works needs to develop a workflow for assets to capture the full life cycle costs of the initial purchase, installation, operations and maintenance, and cost of disposal of an asset so that they can capture and track life cycle costs. The operation and maintenance cost need to reflect the minimal level of service of the asset.</p>	<p>Water Resources will need the tools to capture the information needed to evaluate life cycle cost. This will allow the capture of the initial purchase, installation, operation and maintenance, societal, and disposal cost in the program to support better decision making.</p>
	<p>Tracking Actual Cost of Delivering Services Based on Asset Level of Service: The measurement of the Level of Service provided and the associated cost to the LOS will provide the understanding of the actual cost when the level of service or budget becomes modified.</p>	<p>The City needs to understand what the cost is for the delivery of service based on asset Level of Service. This will provide information to make adjustments to the delivery of services based on the demands of the public, regulatory requirements and/or future needs.</p>	<p>For Department of Public Works to better understand where their resources are being used, there needs to be the development of a link between work performed and the asset that the work is being performed on. A starting point could be to capture the DPW service calls and associate them to the assets that the customer is calling about.</p>	<p>Water Resources needs to develop Level of Service standards for assets by using design standards, customers’ feedback, regulatory requirements and future needs. Water Resources will need to put economic value to incidents such as CSO events and accidents, as well as other non-monetary influences like public confidence that correlate to an asset in order to evaluate the true cost of the asset. By improving an asset’s performance there is cost avoidance, preventing non-monetary events.</p>
Level of Service	<p>Develop Levels of Service Required for Different Asset Classes (System-Wide): Assets exist to deliver services and goods that are valued by customers; for each customer there is a minimum level of service below which a given service is not perceived as adding value. Additionally, higher levels of service than what customers are willing to pay for may not be cost-effective for the City to continue to provide.</p>	<p>The City needs to develop system Levels of Service LOS for assets to ensure a sufficient level of performance to align with public expectations, as well as City policies. Currently, the City uses key performance indicators (KPI) which can be extended to help develop system levels of service.</p>	<p>The Department of Public Works needs to develop measurable levels of service for both their outside customers and internal customers. The LOS will provide key performance indicators for the staff to understand what is expected at the minimum level of service. When minimum levels are exceeded by the staff, there will be clear recognition for their performance. When staff fall below the minimum level of service, there will be a clear understanding of their performance.</p>	<p>Water Resources needs to develop a level of services for water supply, wastewater treatment, and stormwater collection systems. The minimum level of service required by regulatory, performance and response requirements, as well as customer expectations, health and safety, and financial requirements should define the level of service to be provided, performance measured, and target level.</p>
	<p>Development of Target Levels of Service for Assets Based on Different Types, Locations, and Customers: “Target Service Levels” provide guidelines for the organization to use when establishing the annual maintenance work program, emergencies and service responses, project selection, and budget development.</p>	<p>Each department needs to develop a Target Level of Service. These target levels of service will be reviewed and supported by staff. For increased effectiveness, these target levels can become policies ensuring budget support.</p>	<p>The Department of Public Works has the largest number of assets that are maintained for the public. These assets are also the most visible. The development of Target Levels of Service for an asset will provide a clearer understanding to the public of what their expectations for performance should be. These targets levels of service for assets will also provide an expected budget to maintain the asset to these standards.</p>	<p>Water Resources needs to develop Target Levels of Service for the major assets (CSO, catch basins, intakes, pump stations, gate valves, disinfection, water mains, etc.) within the system. These target levels of service will vary by location, usage, age, customer and environment. The levels of service standard provides a description of the criteria which will be used to establish the level of funding that will need to be provide to maintain the asset.</p>
	<p>Customer Perceptions: Customer perception information is collected and updated through surveys, focus groups, complaint tracking, etc. to gauge the perception of asset condition and performance. This methodology allows for the identification of the service aspects customers value.</p>	<p>Customer perceptions are collected through many different sources, but are not currently linked to assets. This customer service needs to be evaluated in regards to workflow, duplication of work, and communication.</p>	<p>By having the Department of Public Works develop Levels of Service, and educate the public by providing these service levels, they will be managing the public’s expectations. DPW also needs to develop workflows that complete the loop on any service request from the public to provide a professional perspective.</p>	<p>Customer perception of Water Resources is that this division has a better workflows providing better perception by customers. Water Resources needs to link services calls to asset and Levels of Service.</p>

TABLE 1 – PRELIMINARY GAP ANALYSIS for CITY OF BURLINGTON’S STRATEGIC ASSET MANAGEMENT PLAN

	Business Practice Characteristics	City-Wide	Department of Public Works	Water Resources Division
Training	<p>Investment in the Staff is an Investment in the Assets: The international standards for asset management include the need for training and investing in staff.</p>	<p>The City will increase asset life and levels of service by providing opportunities for personnel to learn and grow. This will provide the atmosphere for creativity as well as an understanding and correlation between asset classes.</p>	<p>The Department of Public Works needs to create opportunities for personnel to share among the group. DPW should develop SOPs to capture information and develop workflows and tasks to improve quality and quantity of work being completed. This will also allow evaluation, improvements of procedures, and provide education to new employees.</p>	<p>Water Resources needs to create opportunities for personnel to share among the group. Water Resources should develop SOPs to capture information and develop workflows and tasks to improve quality and quantity of work being completed. This will also allow evaluation, improvements of procedures, and provide education to new employees.</p>