

# **Asset Management Strategic Plan, City of Hamilton**

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## **Abstract:**

With the Infrastructure deficit in Canada and other countries climbing along with the changing economy, there is a real need for municipalities and utility's to take a hard look at the way they view the management of their infrastructure assets. The "asset management" eras is upon us and many municipalities across Canada and internationally are recognizing this need to change the way we do business and deliver services. How we implement this change is the question which has perplexed a number of municipalities, which is not surprising given the magnitude.

Through developing advanced asset management practices, cities and utilities are beginning to understand infrastructure on a global or enterprise basis, including all the influencing factors surrounding the full life cycle management. These practices are providing insight into the influences that go beyond just engineering, but into financial management, risk management, information management and service levels, which will have profound effects on the decisions we make in the management of all infrastructure.

The City of Hamilton has taken a progressive role towards developing better management practices around its infrastructure in order to address the growing infrastructure pressures. The plan includes nine major components:

1. State of the Infrastructure (Phase I & II)
  - a) Trends
  - b) Revenue Forecasts
  - c) Communication Tool
2. Management Frameworks
  - a) Risk Model
  - b) Information Management
  - c) Decision Rationalization
  - d) Condition Rating Rationalization
  - e) Assessment Technique Rationalization
  - f) Intervention Rationalization
3. Sustainability Plan
  - a) Total Cost of Ownership (TOC)
  - b) Life cycle cost
4. Service Delivery Model
  - a) Service Levels
  - b) Willingness to Pay
  - c) Affordability
1. Asset Management Plan
  - a) Detailed Documented Plan
6. Asset Management Audit
  - a) Performance measures
  - b) Accountability
7. Corporate Asset Management
  - a) PSAB
  - b) Sustainable Development
  - c) Infrastructure reinvestment
8. Asset Management Rationalization
  - a) ROW Asset Management Business Optimization Policy (RAMBO)
  - b) Trade Off decision model
9. Related Challenges and Opportunities
  - a) Impact of Advanced Technologies; i.e.Trenchless Technology (Buried Infrastructure)
  - b) City's role in Innovation/Technology development

This paper will discuss the Strategic Asset Management Plan the City of Hamilton has developed, including its components and the initiatives taken to date, related to the implementation of the Plan.

## Introduction

The City of Hamilton's Asset Management team was initiated in 2001 after the amalgamation of seven former municipalities. The team was built in the vision of chartering and empowering a multi-disciplined group of individuals who could drive innovation in the management of infrastructure. The team consists of technical, financial and Information Management (IT) professionals brought together from across the various infrastructure groups within the Public Works department. The Asset Management groups primary responsibilities include, the coordination of the City's Capital Investment budget, development of Asset Management policies, development and oversight over new technologies, development and implementation of infrastructure programs and champion asset management initiatives corporate wide.

Since 2001 the asset management group has built a number of programs and infrastructure documents. Some of the more significant initiatives include: 2005 State of the Infrastructure, 2006 State of the Infrastructure, Redhill Valley Expressway Sustainability Plan, Watermain Management Framework and Critical Watermain Management Framework. Through the experiences gained over the past several years, staff has been able to begin to frame the philosophies around which an Enterprise Asset Management Plan (EAMP) need to be formed.

In 2007 the City's Asset Management group undertook a planning exercise to outline a strategic plan. The plan is intended to provide a structure (figure 1) and basic road map (figure 2) for the next 5 – 10 years. The city has progress through a portion of this plan and continues to pursue the remainder. Given the enormous learning curve in our City, with respect to the management of our services via our infrastructure, it has been critical that this plan be as dynamic as possible to allow for continuous adjustments to improve the future outcomes. Of the work areas identified in the strategic plan, some have had work initiated while others have had projects established or completed and as such this paper provides more specific information on the structure and outcomes of the later. The other established areas in the strategic plan have basic description of the intended objective.

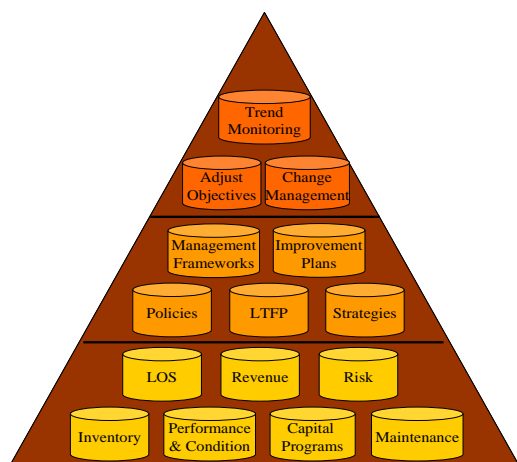


Figure 1 – Asset Management Strategic Structure

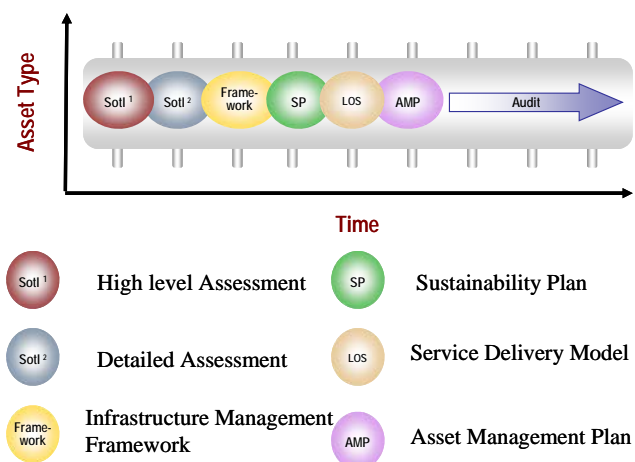


Figure 2 – Asset Management Road Map

The first of these projects was actually initiated in 2004 prior to the development of the Strategic Plan.

The work area's identified in the plan include the following:

- 1) State of the Infrastructure (SotI)(Phase I & II)
- 2) Management Frameworks
- 3) Sustainability Plan
- 4) Service Level Delivery Model
- 5) Asset Management Plan
- 6) Asset Management Audit
- 7) Corporate Asset Management
- 8) Asset Management Rationalization
- 9) Related Challenges & Opportunities

### **State of the Infrastructure Reports (SotI) (completed & future work plan)**

The focus of this project was to prepare a Report Card evaluating the current state of various public works assets within the City, and to predict their status in 2020 should the current management approach be maintained. The following assets were included in the study, with Water, Wastewater and Roads being reviewed in greater detail:

- 1) Water: pipes, pumping stations, storage facilities and treatment facilities (centralized and communal systems).
- 2) Wastewater: pipes, pumping stations, storage facilities and treatment facilities.
- 3) Roads: streets, sidewalks, bridges and culverts, signs, signals, markings, street lights.
- 4) Storm: pipes, pumping stations, storage facilities and/or treatment facilities (ponds).
- 5) Solid Waste: landfill, transfer stations, waste diversion and any other processing facilities.
- 6) Facilities & Open Spaces: arenas, pools, recreation centers, and other buildings currently in the City's database (estimated 300) as well as parks, trails and fields.
- 7) Transit: rolling inventory, facilities.
- 8) Fleet: balance of fleet inventory that is not included in specific programs.

The 2005 SotI Report Card was developed with the objective to provide an easy-to-understand reference that could be updated regularly to track the City's path toward sustainability. As a strategic document, the SotI Report identifies trends and issues that will impact the community in dealing with infrastructure and services on a sustainable basis, and provides recommendations aimed at continuing the deployment of asset management practices within the City of Hamilton organization. It will serve as a catalyst for communication amongst stakeholders and form a starting point for development of more detailed tactical and operational plans aimed at identifying expenditures needed to provide service in a cost-effective, sustainable manner.

The direction of this project was influenced by the City's own policies of sustainability as defined in Vision 2020, and the work of the National Guide for Sustainable Municipal Infrastructure. In November 2003, the National Guide to Sustainable Municipal Infrastructure published a Best Practice for Municipal Infrastructure Asset Management. It stated that the framework for an asset management plan can be described in terms of seven questions:

- 1) What do you have and where is it? (Inventory)
- 2) What is it worth? (Costs/replacement Rates)
- 3) What is its condition and expected remaining service life? (Condition and Capability Analysis)
- 4) What is the level of service expectation, and what needs to be done?  
(Capital & Operating Plans)
- 5) When do you need to do it? (Capital and Operating Plans)
- 6) How much will it cost and what is the acceptable level of risk(s)?  
(Short/Long-term Financial Plan)
- 7) How do you ensure long-term affordability? (Short- and Long-term Financial Plan)

The SotI Report employs this framework, which the City has already adopted in its assessment of sustainable water and wastewater financing needs, to systematically evaluate each asset category. Best Practices from the US, the United Kingdom, and Australia/New Zealand have also been incorporated in to the work.

This SotI Report Card was developed through numerous meetings with staff from the Capital Planning and Implementation Division (CPID) as well with the relevant asset managers of the Public Works Department in order to better define the Rating System to be used and the systematic approach to the project. Their expert comment, input, and concerns were greatly appreciated and are included throughout this SotI Report Card.

In addition to the numerous asset specific recommendations, there are eight recurring recommendations that were identified as a result of this SotI Report:

Review the other assets (transit, open spaces and facilities, fleet, waste management and storm) in greater detail (similar to water, wastewater and roads) in order to assess all City assets using a clear and standard methodology;

Determine an appropriate % of replacement cost to be used for optimum funding of operation and maintenance activities for specific assets. This will assist in future SotI Reports;

Review operating and maintenance practices on a business-case basis, using the Best Practices published by InfraGuide as well as other technical documents, and review associated funding levels in order to ensure that systems are maintained at the least life-cycle cost;

Review the use of rehabilitation technologies (i.e. cost vs. impact on remaining useful life for specific assets) and maintenance programs on a business-case and return-on-investment (ROI) basis. This

could have a significant positive impact on overall costs to the community. This SotI Report Card, limited in scope, was generally based only on replacement costs, except for the sanitary wastewater system;

Review the traditional practice of using capital (debt) financing in the context of sustainable levels of funding. When sustainable levels of funding and expenditures are achieved, use of capital funding (and associated interest/debt payments) results in the community paying on average 10-20% more every year than it receives in actual value (i.e. the difference between the gross and the net expenditures) as a result of a permanent debt level. There may be a need to differentiate between original construction of infrastructure and its subsequent replacement. This is obviously a complex issue that merits more discussion and analysis;

Develop an implementation plan for each asset, to move towards sustainable levels of funding (i.e. in accordance with Question No. 7);

Ensure, when additional funding is identified, that a portion of this funding is for additional staff to successfully develop and implement the required asset management plans;

Engage the community in discussing the true cost of assets and services. Match service levels with public expectations and willingness/ability to pay.

In summary, the City's water and wastewater assets are on track for sustainable funding as required under the new provincial legislation (Bill 175), but increased revenues are required for the storm system. Transit also appears to generally have adequate funding levels, although future growth may prove to be challenging and current funding is very much dependent on senior levels of government. Waste Management will receive an influx of capital from the Hamilton Future Fund for new facilities over the next few years, however there does not appear to be any funding committed for the operation and maintenance, as well as ultimate replacement of these facilities as well as for a new landfill site. The balance of the Public Works assets that were reviewed are generally under-funded at the operating and capital levels, and the prognosis is that these assets will continue to deteriorate rapidly in the future, negatively impacting service levels as well as future operating and capital costs, and in some cases the natural environment.

### **Management Frame Works (completed & current work plan)**

Two asset specific frameworks have been developed, first is the Watermain Management Framework (WMMF) (figure 3) and the second for the Redhill Valley Expressway. Each was created independently, but with the same objectives.

The goal of the Management Framework Implementation is to provide the City with the tools needed to optimize the collection, management, and use of information in making and prioritizing maintenance and

rehabilitation decisions for its infrastructure assets. This process involves the development of standard analytical processes for use by infrastructure managers in the Capital Planning and Implementation Division and the greater Public Works Department.

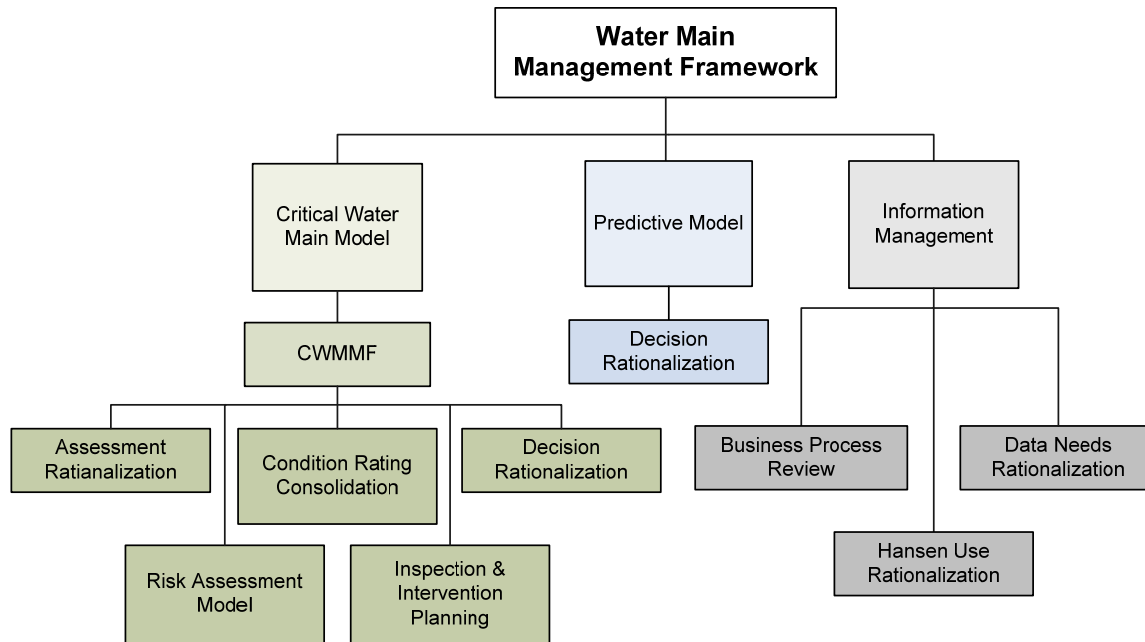


Figure 3 – Water Management Framework

**Water Main Information Management (WMMF)(current work plan)**, presents the findings of the Water Main Information Management Review, and is aimed at enhancing the procedures and systems used in collecting, storing, using, and maintaining water system data. Key outcomes include recommended enhancements to the way in which water system data is collected and stored within current systems, and information requirements for proposed water main predictive and criticality models.

**Predictive Model for Water Main Assessment (complete)**, developed for the modeling and use of structural performance data in the planning and prioritization of water system rehabilitation and renewal programs. The document describes the statistical model for modeling the deterioration of cast iron and ductile iron water mains. The configuration of the model was based on available data and on some simplifications to produce preliminary results. While the preliminary results are adequate for demonstrating the adequacy of the model, and can assist in the decision making process, further work is required for full scale implementation. This work includes a review of segmentation with the current GIS model, further calibration, further refinements to the EconomicLoss.xls to improve usability with City’s Planning Process, and further define Minimum Acceptable Level of Service (MALOS).

**Decision Rationalization (complete)**, development of a Geographic Information System (GIS) based Criticality Model that can be used in day-to-day decision making that is focused on infrastructure asset management. The intent of this Criticality Model is to answer questions such as “Which water mains will have the greatest impact to the City, should a break occur?” in order to focus resources and effort on these assets before they fail. Using risk management principals, model outputs will be combined with water main performance information to prioritize and schedule system assessment, maintenance, and rehabilitation works.

**Critical Watermain Management Framework (CWMMF)(complete)**, Evaluating the condition state of infrastructure is one of the most integral pieces of information to the asset manager. Assessing the condition state has tremendous implications on liability, operations, maintenance, capital renewal, and valuation. Within the context of buried infrastructure in particular, ascertaining a reliable measure for condition state can be a daunting task compared to surface infrastructure. Water infrastructure poses specific challenges compared to, say, sewer infrastructure where techniques like CCTV are now being consistently used to assess condition. With condition state information for water infrastructure at such a premium, a rational, consistent, framework is sought to enable the asset manger to make defensible decisions based on sound condition rating for critical water main assets.

The concept of ‘criticality’ or ‘risk’ is a vital first step in determining the management approach for many infrastructure assets. Low risk water mains, where failure can be addressed through the course of normal operations should be treated differently than high-risk ‘critical’ water mains, whose failure strains operations and/or results in considerable economic, environmental and social ramifications. Some of the key differences in management approach for critical versus non-critical water mains include:

**Repair policy:** With non-critical water mains, breaks can be tolerated and hence a run-to-failure approach can be accepted. With critical water mains, a proactive maintenance and rehabilitation policy should be sought.

**Tolerance to uncertainty:** Whereas with non-critical water mains uncertainty in condition state can be tolerated, no such tolerance can be allowed for critical water mains. This has ramifications on the amount and accuracy of information being collected. For non-critical water mains, breakage data along with basic pipe attributes (e.g. material, diameter, age, depth, etc...) are usually sufficient to drive a performance model. On the other hand, for critical water mains more detailed information pertaining to deterioration factors (e.g. detailed soil properties, potable water quality, presence of stray current, etc...) as well as observed distress indicators (e.g. cracking, pitting, joint displacement, etc...) need to be collected and properly managed, including the level of detail at which this information should be collected and stored.

In non-critical water mains a coarse network segmentation can be tolerated (e.g. at a street block level), whereas with critical water mains information should be tracked at a more individual pipe-segment level (e.g. using laying schedules).

This Critical Watermain Management Framework (CWMMF) presents a comprehensive management approach for critical water mains in the City of Hamilton. The management framework consists of several tool sets that are used to drive the decision-making process. The overall management approach as shown in figure 3 highlights four main analysis areas: 1) Assessment Technique Rationalization Tool, 2) Condition Rating Consolidation Tool, 3) Risk Model Development, 4) Decision Analysis.

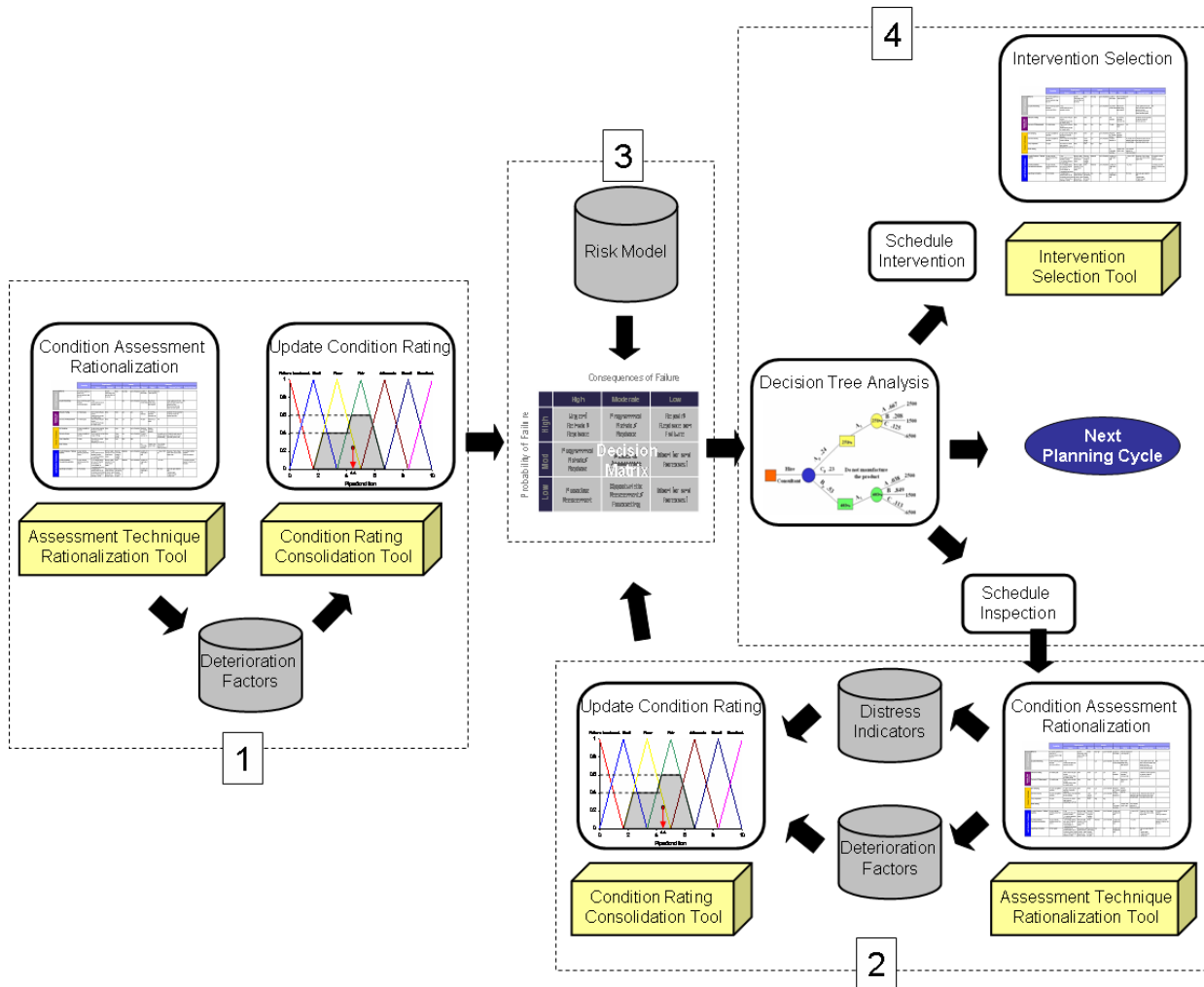


Figure 4 – Critical Watermain Management Approach

### Sustainability Plan (future work plan)

This plan will build on the SotI reports, which provided the basis for a Long Term Financial Plan (LTFF). The sustainability plan will provide the framework for a Long Term Financial Plan (LTFF). This plan will identify the investment levels needed to match the recommended service levels and consequently the levels of maintenance, rehabilitation and renewal.

**Service Delivery Model (future work plan)**

Develop a customer focused vision (figure 6) and plan through a clear understanding of community values and a clear link with council’s strategic objectives.

Under the service delivery model there are two focus areas, a primary and secondary. The primary focus would be on customer service level agreements (CSLA)/Customer Service Levels (CSL) and the secondary would be on the technical service levels (TSL) needed to achieve the CSL and meet the CSLA.

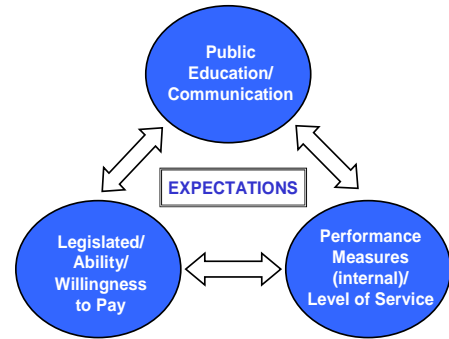


Figure 5 – Service Levels

This would be accomplished through the engagement of the community to review service levels for each service delivery (figure 5). The Customer Service Level Agreements (CSLA) and Customer Service Key Performance Indicators (CSKPI’s) would ultimately establish the basis for accountability audits. They would also set the basis to establish technical service levels (TSL’s) and technical performance indicators (TPI’s) to ensure the tangible assets which provide the services are managed in accordance with meeting the CSLA and CSKPI’s.

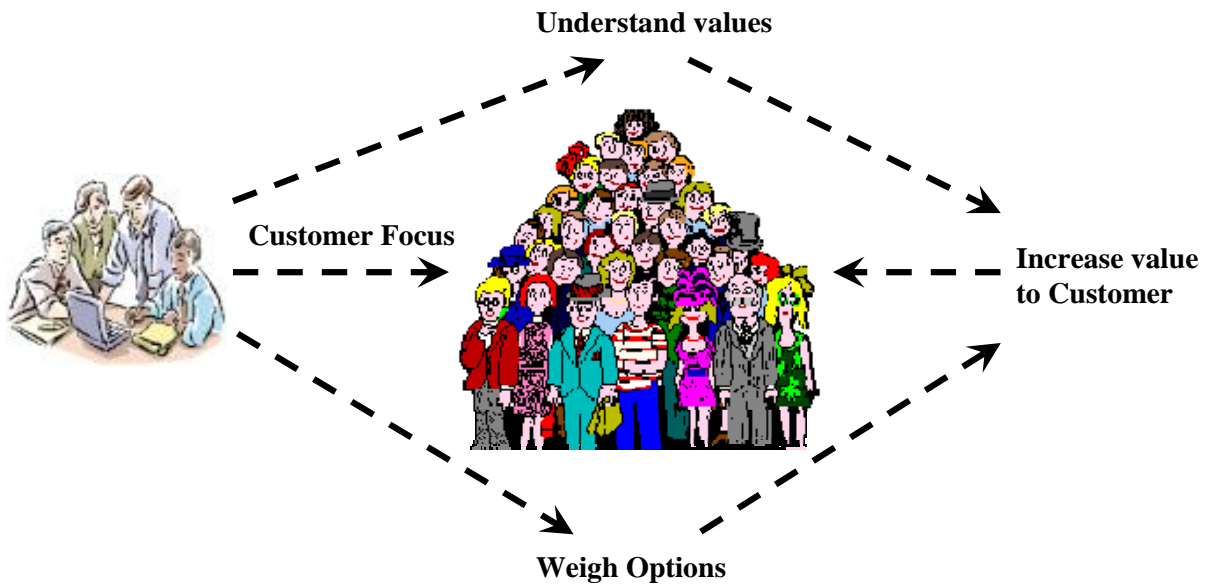


Figure 6 – Customer Focused Vision

### **Asset Management Plan (future work plan)**

This is the development of an enterprise asset management plan which provides the basis for the documentation of:

- Links to Corporate Strategic Plans
- Accountability Reports
- Optimized decision making
- Service level standards
- Change Management
- Community Trends
- Predict Failure Modes
- Knowledge of Asset Performance
- Knowledge of Current Asset Condition
- Knowledge of Levels of Service
- Budget Rationalization
- Predict Future Customer Demand

The plan would allow for the going audit and review of community values and objectives to ensure the continued effective management of services.

### **Asset Management Audit (future work plan)**

On completion of the Asset Management Plan, including the documentation of defined service levels along with there associated CSKPI's and TKPI's for each of the asset groups, the City will have the necessary information to establish a transparent accountable report. This report will be used to provide an ongoing performance review of the asset manager's ability to maintain the viability of the City's assets and thus the provision of the services associated with them.

This phase of the process will have an ongoing requirement to publish the performance review based on established CSKPI's and TKPI's at a minimum of once a year or more frequently if the data is readily available.

### **Corporate Asset Management**

#### ***PSAB (current work plan)***

Review current inventory and other asset systems within Public Works to determine the feasibility of using and/or enhancing current systems to meet PSAB requirements in the simplest manner possible. PSAB will be expanded to include provisions to integrate with all aspects of the Asset Management Strategic Plan.

### ***Sustainable Development (current & future work plan)***

Review current design criteria and contract award process, including analysis of options, with respect to sustainability, Life-cycle Cost (LCC) and Total Cost of Ownership (TCO). There is a need to ensure that the replacement of assets considers both the LCC and TCO, to ensure we are obtaining the best return on investment (ROI). This will require a change in the products approval process, design standards and QA/QC policies to include these considerations.

### ***Infrastructure Reinvestment (future work plan)***

Develop infrastructure investment and reinvestment policies required for sustainable infrastructure, in order to provide the desired level of service in the most cost effective way. This component of the plan will require the integration of Corporate Finance and Asset Management and would likely require a three-pronged approach:

1. Stop the Slide: growth was included as an additional cost in the SotI Reports, since it is traditional practice to use new revenues from growth (levy {assessment} or rates {water and sewer}) to deal with existing problems and/or avoid a tax/rate increase in a given year. If some or all of that additional revenue was in fact directed from Day One, in the assets life, towards reserve funding for future operation, maintenance, rehab and replacement of these new assets, this cost of growth could be removed from the analysis. The AM deficit would immediately decrease significantly since these new assets would be properly funded from the time that they are received by the City, and would not have to be considered as a future liability. However, as long as such a policy is not securely implemented, these new assets are received "free of charge" and are a future liability.
2. Close the Gap: Analyze options to closing the remaining funding gap. Implementation of PSAB could correct this if a policy of funding depreciation was voluntarily implemented by the City, since it is not expected that this requirement will be legislated by the Province. A gradual implementation (10 years?) of the "Close the Gap" policy could be developed combined with a review of under utilized assets to reduce asset inventories and a review of service levels to reflect the community's needs.
3. Debt Financing: Analyze options with respect to when to issue debt, debenture periods, sensitivity to interest rates, projected future debt levels, quantifying long-term benefits of debt- avoidance vs., more rapid tax/rate increases, etc.

### **Asset Management Rationalization (current working plan)**

#### ***ROW Integrated Management Policy***

Development of a policy which defines the overall process of managing the City's assets contained within the right-of-way. This document will outline the criteria used for making the decisions with respect to asset replacement/rehabilitation. It will also identify when work completed on the subsurface impacts on the surface, including how the surface should be restored. Given that various levels exist from only

trench restoration being required, to a mill & overlay, to a full reconstruction. The document (Policy Paper) will be a guide for identify which of the three thresholds will be selected and why. It will include the identification of loss of road life due to the surface disruptions made from traditional (open cut) underground works.

### ***Trade-Off Decision Tree***

This will for the basis of the global decision tree within the RAMBO system and will define the criteria utilized in the decision making process for managing the assets contained within the right-of-way.

### ***Right of Way Asset Management Business Optimization (RAMBO)***

This component of the Strategic Asset Management Plan is to develop and implement a Right of Way Asset Management Business Optimization tool. This tool will implement the ROW Integrated Management Policy and the Trade of Decision Tree into the daily decision making process.

### **Related Challenges and Opportunities (current work plan)**

There are many indirect challenges and Opportunities with respect to the management of infrastructure. These challenges and opportunities can sometimes have significant benefits to the global objective of cost effective service delivery via infrastructure management. One instance of this would be the investment in technological innovation. An example of the benefits or even the need to invest in technological innovation is in the buried infrastructure asset field.

Buried water, wastewater and storm water infrastructure makes up a significant percentage of the total infrastructure deficit for many cities and poses a significant challenge to intervene. Just as we have been putting resources towards identifying the financial deficit in order to promote the increase in revenues to afford the required interventions, we should also be planning and forecasting how we should intervene. It is not good enough to rely solely on past practice of replacing buried infrastructure via cut and cover, practical and realistic intervention programs need to be developed. Given the magnitude of buried assets (pipes) which require intervention the potential socioeconomic impact is as significant as the deficit itself. The majority of these pipes are located in dense urban settings, buried beneath roadways and in some cases; the very old pipes exist under buildings and other surface infrastructure. The strict use of cut and cover techniques to intervene on the magnitude of buried infrastructure requiring intervention would have a profound effect on society and other surrounding infrastructure such as transportation. As a result the singular use of the open cut technique would restrict our ability to intervene on the amount of buried pipe required in the average year. This restriction

would result in the unrealistic average life expectancies of 150 to 200 years or more on buried infrastructure and continued reduction in service levels and increases in risk.

Trenchless Technologies, both rehabilitation and new installation are a significant key to address the required amount of intervention in the average year through its ability to dramatically reducing the socioeconomic impacts. It has been recognized for many years now that trenchless technologies provide significant benefits to reduce the social impact of intervening on buried infrastructure, however it is only now being understood the reality of that impact on managing the size of the infrastructure deficit.

As important as it is to increase the financial investment into water, wastewater and storm water infrastructure and it is definitely an important first step, we need to start to take the next steps. The increased financial investment will not fix the infrastructure it will only pay for it, we need to begin to invest in technology and developing programs to physically address the infrastructure though all and every means possible. Trenchless Technologies has a key role to play in our ability to reduce the infrastructure deficit, provide the established service levels and manage corporate risk.

There are likely hundreds more challenges and opportunities surrounding the issues of infrastructure management, we just need to work in an unconfined innovative environment in order to see them.

### **References:**

City of Hamilton, State of the Infrastructure report (2005 & 2006)\*

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City of Hamilton, Critical Watermain Management Framework

\*[www.myhamilton.ca/myhamilton/CityandGovernment/CityDepartments/PublicWorks/CapitalPlanning/Asset+Management/](http://www.myhamilton.ca/myhamilton/CityandGovernment/CityDepartments/PublicWorks/CapitalPlanning/Asset+Management/)

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