KAYUGA SOLUTION

City of Livermore

Public Works Department

Citywide Asset Management Plan

2021

Acknowledgements

The City of Livermore asset management plan was completed with the combined efforts of many members of the community and the engineering, operations, and maintenance staff. Contributions were made through project management, transfer of knowledge, development and review of asset management methodology, processes, data, condition assessment, analytical results, and the asset management plan.

The asset management plan was prepared, reviewed, and finalized under the guidance of the City's project team and the 2016-2019 Community Asset Management Program (CAMP) Committee, including the following:

City of Livermore Project Team

- Anthony Smith – Asset Management Program Project Manager
- Debbie Bell – Asset Management Program Manager
- Darren Greenwood – Public Works Director
- Cheri Sheets – City Engineer
- Jeff Shafer – Maintenance and Golf Operations Manager
- Kathy Hughes – Public Works Administration Assistant

2016-2019 Community Asset Management Program (CAMP) Committee

- Susan Frost – Chair
- Bob Dashner – Vice Chair
- Regina Bonanno
- Jan Evans
- Paul Foster
- Erik Gets
- Gordon Jones
- Jennifer Estridge
- Jennifer Yeamans

1 Introduction

The City of Livermore (City) is currently strengthening its asset management program to make more efficient use of its financial and physical resource investments. As part of this effort, the City embarked on developing and implementing a comprehensive asset management program to gain better understanding of the current and future asset needs, asset risk profile, appropriate levels of service, cost to provide services, and financial requirements to sustain the delivery of services. The City's comprehensive asset management program will provide an integrated, citywide vision for all city assets. Building on the City's existing asset management work, the asset management program will provide the data foundation to effectively manage the needs of the City's infrastructure assets.

In the past, the City has focused its asset management efforts around enterprise funded assets (i.e., water, wastewater) and some portions of the non-enterprise funded assets (i.e., pavement for roads and trails). The intent of this effort is to build on this initial asset management work to develop a comprehensive citywide asset management program. With an asset management program for enterprise funded assets in progress, the City decided to focus on the following non-enterprise, general-funded infrastructure:

- Buildings
- Sidewalks
- Curb Ramps
- Curb & Gutter
- Storm Water
- Parks and Plazas
- Street Lights
- Traffic Control Systems
- Landscape Areas
- Walls and Fences
- Pavement
- Trails
- Street and Pedestrian Bridges
- Golf Course

An asset management system was created for each of these infrastructure categories. This asset management plan documents the findings and future needs of the non-enterprise, General Fund infrastructure assets.

1.1 Asset Management Definition

The City defined asset management as:

"Delivering an established level of service while managing individual assets to minimize the life cycle cost with an acceptable level of risk."

With the City's established asset management definition, the City wanted to develop a defendable mechanism to manage its assets while balancing level of service, cost of service, risk, and resident expectations as illustrated in the following figure.

Figure 1 Asset Management Program Factors

The City's asset management definition formed the fundamental basis of the City's asset management program.

1.2 Asset Management Plan

An asset management plan is a long-range planning document that provides a framework for understanding the assets an organization owns and manages, services it provides, risks it assumes, and financial investments required to sustain the services. An asset management plan can help an organization move from reactive to proactive management of its physical and financial resources. This transition requires answers to the following questions:

- What is an asset? What is not an asset?
- Which assets need to be managed?
- What are the current states of the assets?
- What maintenance and capital work is required? When and how much?
- How long until the assets need to be renewed?
- Which assets are critical?
- What levels of service can and should be provided?
- What is the long-range investment needed to sustain the delivery of services?

The answers to these questions help in the development of an asset management plan. An asset management plan is a living document. It is meant to grow and change with the organization and system for which it is written. In the spirit of continuous improvement, recommendations for future improvement activities were also developed and presented.

The key processes of the asset management plan development are as follows:

1. Asset inventory – What does the City own and manage?
2. Condition assessment – What are the needs of the assets?
3. Risk assessment – Which assets are critical? Which are not?
4. Work management – What work needs to be done? Where, when, and for how much?
5. Life cycle cost assessment – What are the long-term financial needs?
6. Resource analyses – How much funding is needed to sustain the delivery of our assets?
7. Level of service – What level of service can and should the City provide?

The asset management plan documents the outcomes of each process.

1.3 Asset Management Program

An asset management program encompasses the framework, goals, data, methodologies, processes, practices, and information systems utilized to support asset management decisions. The following sections highlight the key components that drive and shape the asset management program.

1.3.1 Goals

Some of the major challenges the City faces include the following:

- Old assets are in need of maintenance, rehabilitation, or replacement
- High level of service standards

- Limited budget and limited workforce

The goal of the City's asset management program is to shift from reactive to proactive planning and management of infrastructure assets. Specifically, the purpose of the City's asset management plan is the following:

- Understand the magnitude and timing of infrastructure reinvestment needs
- Understand the risk associated with assets
- Develop a data-backed justification to plan and prioritize infrastructure needs
- Transition from reactive to proactive infrastructure management
- Understand the cost to provide service
- Develop a consistent and transparent decision-making process
- Develop a sound foundation for continuous improvement
- Communicate and be able to tell the infrastructure story

The City aims to gain better understanding of the current and future asset needs, asset risk profile, appropriate levels of service, cost to provide services, and financial requirements to sustain the delivery of services. The City will communicate this improved understanding of the infrastructure status and needs to the public and the decision makers in a consistent and defendable manner.

1.3.2 Methodology

The following diagram illustrates the methodology the City implemented to develop the asset management program. These processes were applied step-by-step to each asset management system to achieve the goals of the asset

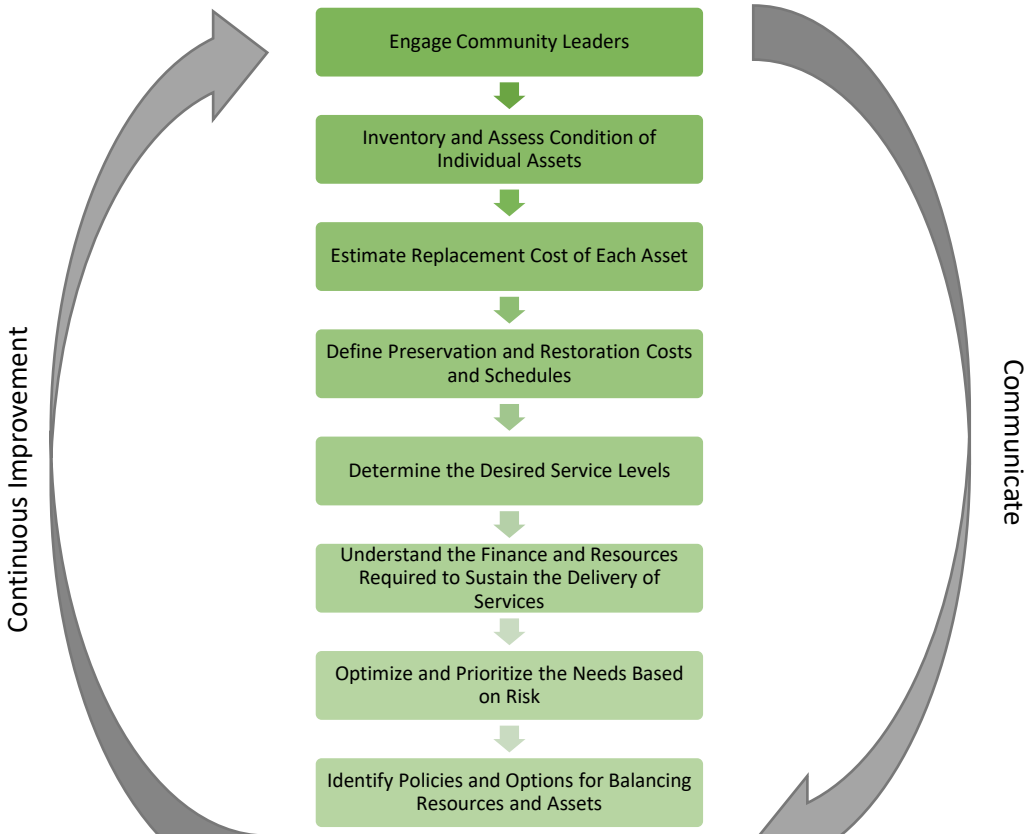

Figure 2 Asset Management Program Methodology

management program and to develop the asset management plan.

In order to promote education, communication, and transparency, the City established the Community Asset Management Program (CAMP) Committee. The members of CAMP are City Council-appointed residents who played an important role in the development of the City's asset management program. Representing the public, CAMP reviewed the overall approach, methodology, and output of the asset management program and provided input and feedback from the citizen's perspective. As the proponents of the asset management program, CAMP also helped provide public outreach support.

In order to establish the data foundation for the asset management analyses, a comprehensive inventory of assets took place for each asset management system (e.g., roadway, parks, buildings). Where accessible, assets were visited, their attributes (e.g., location, size, type, material) were recorded, and their conditions were assessed. Based on the condition, actions required to restore the asset (e.g., repair, paint, replace) were identified, and the cost and timing were estimated. Through assessment of risk (probability and consequence of failures), activities were prioritized and communicated regarding urgency, level of service, and the financial and resource requirements.

1.3.3 Components

The following section lists the key components and methodology used to build the asset management program.

Asset Register

The asset register establishes the data foundation of the asset management program by consolidating and documenting all assets owned and managed. The development of the asset register required establishing the following key elements:

- *Asset Definition* – Helps to define what is an asset versus what is not an asset. With the asset definition established, the City is able to focus on assets rather than components. An asset is generally defined at the level at which the work is performed, while a component is generally a smaller part of an asset. For example, a street light is an asset, while the light bulb is a component of the street light.
- *Asset Hierarchy* – Organizes the thousands of assets in the asset register. With the asset hierarchy, the City is able to easily find and support asset management decisions at any level within the asset hierarchy.
- *Asset Classes* – Groups the assets to allow the City to characterize the life-cycle behavior of the assets in the register. An asset class is developed by grouping assets with similar characteristics, such as type, function, useful life, material, and size. Asset classes are used to help model the life-cycle costs of the assets.

Replacement Cost

Each asset in the register was assigned a replacement cost. This replacement cost estimates the budget required to replace the asset in kind. The individual replacement costs for the assets are then summed to create a total estimated replacement cost for the management system.

The estimated replacement cost was then increased to estimate the fully burdened project cost for an in-kind replacement. An additional 30% was added to include additional project costs. These costs may include the following:

- Engineering/Design/Project Management
- Demolition and removal
- Permit
- Contractor overhead/profit
- Contingency
- Traffic control
- General conditions

Risk

Risk is used for effective prioritization of limited resources (e.g., budget, staff availability). The two main components of risk are Probability of Failure (PoF) and Consequence of Failure (CoF). PoF indicates the projected time until the asset fails to function at the established levels of service. CoF provides an indication of the impact of a failure in consideration of the triple bottom line factors of sustainability: economic, social, and environmental. Where applicable, assets were assigned a risk score. Under limited resources, the City should address the assets with the highest risk scores before addressing the lower-risk assets. Risk allows the City to transparently prioritize.

The following formula is used to calculate the risk score:

Figure 3 Risk Score Formula

With each asset's risk score calculated, the City was able to plot the assets in the risk matrix shown in the following figure. The risk-based strategy should be to manage the high-risk zone before moving down to medium and low risk zones. The City has decided to move towards a risk-based decision-making strategy. All decisions and investments will be made to ensure maximum risk reduction.

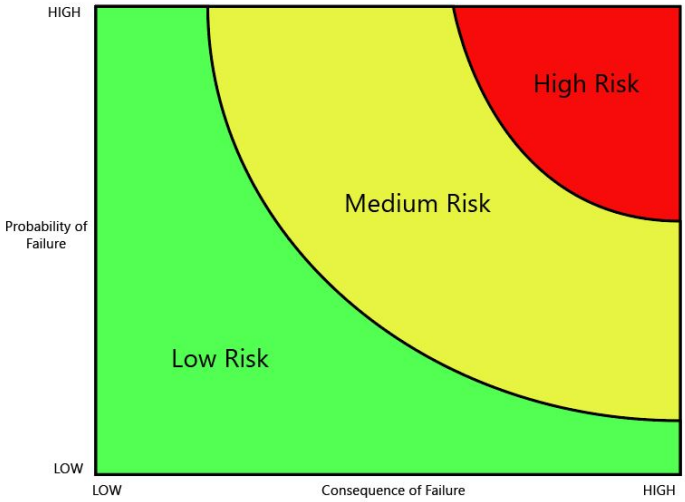

Figure 1-4 Risk Matrix

Life-Cycle Cost

In order to predict the future replacement and rehabilitation need of all assets, a life-cycle cost analysis is performed. The life-cycle cost analysis is a calculation of costs required to support the set of activities (e.g., rehabilitation, replacement) that are needed to sustain the delivery of an asset's services during the life of the asset or for the planning horizon (e.g., 20, 30, or 50 years). Life-cycle cost analysis is performed for each asset in the asset register. For every year of the planning horizon, the life-cycle analysis will calculate which asset needs a refurbishment activity and how much it will cost to perform the needed activity. When all the anticipated activity costs are summed for each year, the overall needed budget for the year can be established. The life-cycle cost analysis drives the estimation of the future financial needs to sustain the delivery of the assets.

In order to calculate the life cycle cost, every asset is given a management strategy. The management strategy is used to estimate how an asset will decay, how long it will last, how often it may need to be rehabilitated and the cost associated with the rehabilitation or replacement of the asset. From life cycle cost analysis, the cost associated with maintaining the asset at an acceptable level of service can be predicted. The following figure illustrates the relationship between asset condition, management activities, and life cycle cost. As shown in the figure, the asset condition, shown in red, will gradually decrease after the initial installation. Maintenance or rehabilitation activities increase the life span of the asset as shown in the figure; these activities have an associated cost. Eventually, the asset will need to be replaced at the end of its useful life, after which the cycle will repeat.

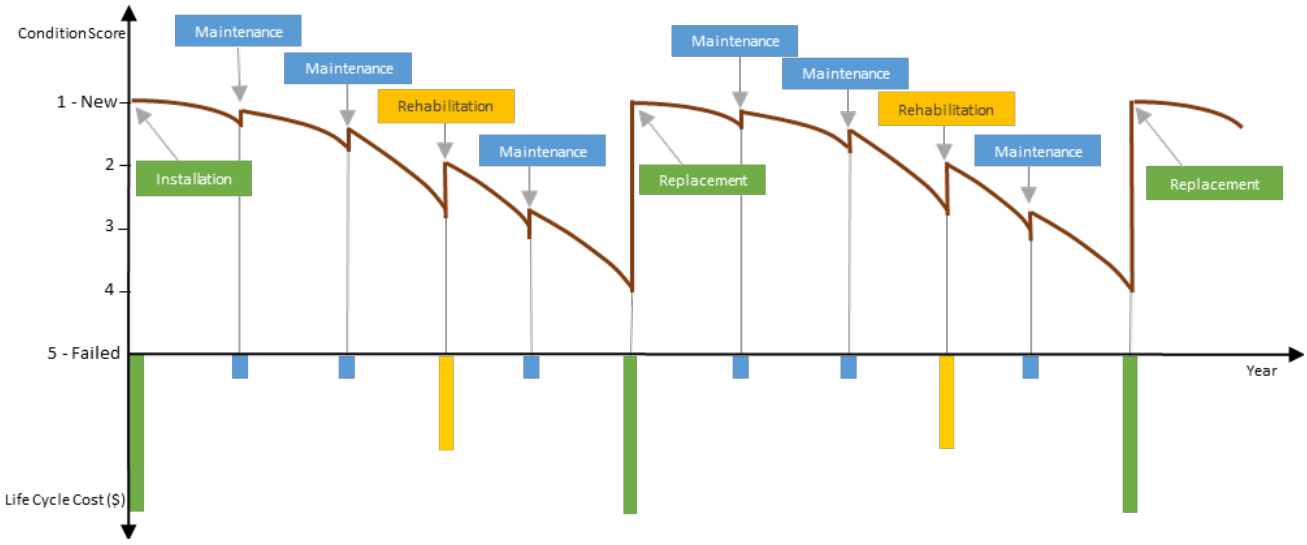

Figure 1-5 Life Cycle Cost Logic Illustration

The life-cycle cost assessment allows the City to proactively manage assets. Using this information, the City will be able to plan for replacement of high-risk assets to prevent failure. The City will also have an understanding of the work and investment required for future years. These estimations will be used to prepare the budget and resources required to sustain the delivery of services. When budget and resource limitations exist, the City will be able to prioritize the needs by risk to ensure the budget is first spent on high-risk assets. In essence, the City will be able to ensure that funds are spent to maximize risk reduction.

IRIS (Infrastructure Reinvestment Intelligence System)

Life cycle cost calculation can be very tedious and time consuming. It is especially difficult when the calculations need to be performed for thousands of assets, year-by-year, asset-by-asset. For this reason, the City utilizes Kayuga Solution's asset management planning tool, IRIS (Infrastructure Reinvestment Intelligence System), which incorporates the developed asset register and performs the life cycle cost and risk assessment work.

IRIS is an asset management dashboard that utilizes the City's asset data and performs asset management calculations and analyses presented in the City's asset management plan. It is a tool the City uses to project the future maintenance, rehabilitation, and replacement needs, understand its high-risk assets, understand the cost of ownership, calculate the appropriate budget required to mitigate the high-risk assets, and identify assets estimated to require rehabilitation or replacement year-by-year, asset-by-asset. IRIS will not replace the City's existing asset management systems (i.e., CMMS, GIS). In fact, IRIS is designed to supplement these systems by performing asset management calculations that CMMS and GIS cannot perform (i.e., future long-range capital funding need forecasts, risk analyses, funding scenarios, cost of ownership).

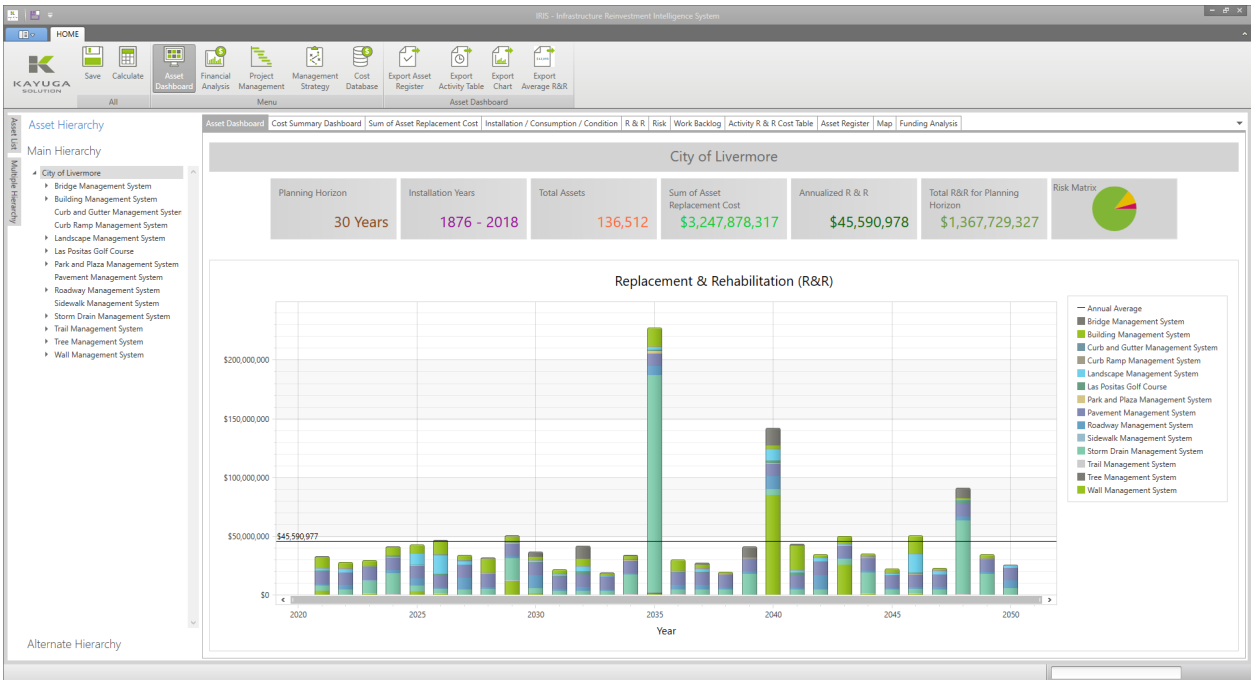

Figure 1-6 IRIS (Infrastructure Reinvestment Intelligence System)

Long Range Replacement and Rehabilitation Profile

Based on the life cycle cost analysis, the long-range replacement profile for estimated future replacement and rehabilitation financial needs is generated. A 30-year horizon life-cycle cost analysis was performed to evaluate the replacement and rehabilitation needs of the assets. Every year, those assets requiring investment are identified and summed to generate the replacement profile.

Catch Up and Keep Up

Over the years, deferred replacement and rehabilitation has resulted in a growing backlog of work, which can be described as “Catch Up.” Catch Up refers to all immediate and past-due replacement and rehabilitation needs. In alignment with the City’s risk-based policy, the Catch Up is associated with the high risk “red zone” (high probability of failure and consequence of failure) in the risk matrix. Any asset in the red zone is high risk, which is generally due to deferred or immediate needs (i.e., replacement, rehabilitation).

Once the City catches up, the “Keep Up” describes what the year-to-year replacement and rehabilitation budget is needed to sustain the level of service for all assets.

The Catch Up is presented as all incurred costs for the first year of the planning horizon, while the Keep Up is presented as an average of all replacement and rehabilitation costs in the 30-year horizon.

Management System Scoring

Each management system was also given a grade. This grade was based on two components: physical health and financial health.

The physical health of each management system is based on the condition of the infrastructure. To measure the

overall condition of the system, the replacement cost of the poor condition assets was compared to the sum of the asset replacement costs. In addition, the replacement cost of the high-risk assets was compared to the sum of the asset replacement costs. The following table illustrates the analyses for the physical health of each system.

Table 1-1 Physical Health Scoring Formula for each Management System

Subcategory	Formula for Score
Overall Condition	$\frac{Sum\ of\ Condition\ 4\ \&\ 5\ Replacement\ Cost}{Sum\ of\ All\ Replacement\ Cost}$
High Risk Assets (Red Zone)	$\frac{Sum\ of\ Red\ Zone\ Asset\ Replacement\ Cost}{Sum\ of\ All\ Replacement\ Cost}$

The financial health of each management system is based on the amount of funding currently available for each system. The current budget was compared to both the catch up and the keep up to determine the overall ability of the City to fund the current and future replacement and rehabilitation needs of the system.

Table 1-2 Financial Health Scoring Formula

Subcategory	Formula for Score
Catch Up	$\frac{Current\ Replacement\ Funding}{Sum\ of\ Red\ Zone\ Asset\ Replacement\ Cost}$
Keep Up	$\frac{Current\ Annual\ Replacement\ Funding}{Projected\ Annual\ Replacement\ Needs}$

Once the score was determined, a grade was assigned for each subcategory based on the rating table below. Once the individual grades were determined, an overall grade was assigned to the management system.

Table 1-3 Management System Scoring

Category	Subcategory	A	B	C	D	F
Physical Health	Condition	≤5%	≤10%	≤20%	≤30%	>30%
	Red Zone	≤5%	≤10%	≤15%	≤20%	>20%
Financial Health	Catch Up	≥95%	≥90%	≥80%	≥70%	<70%
	Keep Up	≥85%	≥75%	≥65%	≥55%	<55%

Level of Service

The key concept of asset management is to balance level of service, cost to provide the service, and risk. Level of service sets the commitments the City intends to provide. During the asset management plan development process, the City came up with two potential levels of service: the preferred and the minimum. The preferred level of service is to fully fund the replacement and rehabilitation activities at the ideal level for the upkeep of the assets. The minimum level of service will typically fund rehabilitation and replacement work at the maximum level of risk the City is willing to accept by focusing on high-risk assets.

Confidence Level

Each asset management system is rated on the confidence level of the data and methodology developed throughout the project. The purpose of this is to examine the work that was done in order to identify future improvement opportunities.

For each asset management system, the confidence level is rated based on the following factors:

1. Asset Inventory – examines the completeness of the asset data
2. Data Quality – examines the quality and completeness of the asset attribute data used to develop the asset management plan
3. Condition Assessment – examines the quality and completeness of the condition assessment data
4. Asset Valuation – examines the accuracy of the methodology used to calculate asset value
5. Life-cycle Cost Logic – examines the accuracy and completeness of the methodology used to calculate the life-cycle cost and the results
6. Risk – examines the accuracy of the risk assessment methodology and results
7. Staff Review – examines the staff involvement in the development and review of the asset management plan
8. Community Asset Management Program (CAMP) Committee – represents the review by the CAMP committee

The following table presents the confidence level factors and their respective weights used to calculate the confidence level.

Table 1-4 Confidence Level Logic

Confidence Level Factor	Weight
Asset Inventory	20%
Data Quality	15%
Condition Assessment	20%
Asset Valuation	10%
Life-cycle Cost Logic	10%
Risk	10%
Staff Review	5%
CAMP Committee Review	10%

The confidence level factor weights are based on the City's specific goals for the project. Completing the asset inventory and condition assessment were of particular interest to the City in this phase of the development of the asset management program. As such, these areas had a high weight in the overall confidence level rating. Another of the City's main goals was to encourage buy-in on the part of its stakeholders, so the CAMP committee review was given a significant weight.