CITY OF LIVERMORE
LANDSCAPE MAINTENANCE DISTRICT MASTER MANAGEMENT PLAN

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PROJECT

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LANDSCAPE MAINTENANCE DISTRICT MASTER MANAGEMENT PLAN

A Project

by

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Department of Recreation, Parks and Tourism Administration
Abstract

of

CITY OF LIVERMORE
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By
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The purpose of this project was to develop the framework for a Landscape Maintenance District Master Management Plan (MMP). Key elements of the Master Plan would be developed and applied to a pilot study within the Dunsmuir Landscape Maintenance District (LMD). The sections of the overall Master Plan being developed as part of this project are an asset inventory model, a master maintenance schedule framework and a reserve funding analysis framework. Data for this project was gathered from multiple sources including internal databases, blueprints, engineering reports, council agendas, actual physical inventory data collection, reference books and web sources. This project resulted in the creation of a framework for the Master Management Plan which will assist in the management of the LMD program. The key elements of the MMP were applied to the Dunsmuir LMD zone, where a 10-year reserve budget was developed from the data collected in the asset inventory project. From this pilot project a cost estimate was derived for completing the entire reserve fund study for the remaining 90 LMD zones.

_________________________________________. Committee Chair
Katherine J. Pinch, Ph.D.
DEDICATION

For

Katherine Pinch:
My advisor at California State University, Sacramento;

Staff of the City of Livermore
Who contributed to making this study possible;

And especially,
For my wife, Krista, and sons Ryan and Austin, who inspire me
to do my best every day.

Thank you.
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Chapter 1

INTRODUCTION

This Landscape Maintenance District Master Management Plan project was commenced at a time of immense change for the City of Livermore’s Landscape Maintenance Section. Specifically, the Landscape Maintenance District Program did not implement long term planning and financial forecasting. To help facilitate these planning and forecasting processes, it was determined that a master management plan should be developed that would help establish a framework for operational decision making. It was felt that staff and management needed a road map to help them along the path to progressive change. This Master Management Plan (MMP) Framework will serve as a foundation from which future policies and procedures can be based. Often, master plans become too large and too theoretical in their approach. So, for this project, a specific program in the Landscape Maintenance Section (LMS) was selected as a starting point in developing the master plan framework. This was the Landscape Maintenance District (LMD) program. This Master Management Plan Framework will include specific operational areas within the LMD program.

First, the outline of the Landscape Maintenance District Master Management Plan for the LMD program is established. Following the establishment of the MMP outline, specific operational segments will be developed with functional frameworks. These frameworks will be developed according to their operational order. The framework segments that have been included in this project include an asset inventory gathering
framework, a master maintenance schedule framework, and a reserve fund policy framework. These frameworks will then be applied to a single pilot zone, the Dunsmuir District, that will serve as the prototype for the remaining zones. By completing the asset inventory, and applying this data to the reserve fund framework for the pilot zone, a reserve fund cost model can be applied to the entire program. This cost to perform the reserve fund study for the pilot program will serve as the basis for the LMD program reserve study cost projections.

**Background of the Problem**

The LMD program was started over 20 years ago when the City had much slower growth and a smaller population. The City of Livermore today is a city of nearly 80,000 people living in a 25 square mile area, where development has expanded throughout the borders and interior of the City. This recent explosion in development has turned much of the native grasslands and legacy vineyards into planned neighborhoods. With these planned neighborhoods comes more community park and landscaped areas. These areas must be maintained after they have been installed by the developers. The City forms Landscape Maintenance Districts as part of the conditions of the development. The selected landscape features are perpetually funded for maintenance by the property owners that reside within the borders of the district. From the humble beginning 20 years ago, when three districts were formed, the City now has 90 Landscape Maintenance Districts spread throughout the old and the new areas of the City. This equates to an average of 4.5 LMDs being formed each year for the last twenty years. This may not
seem like much, but, when one considers that each District has its own unique living
structure that requires maintenance, then it becomes clear that more resources must be
added each year to keep them up. As the Districts age, more maintenance is required to
keep them maintained within established standards. The LMD program is facing aging
infrastructure in an economy that is driving agencies into cost-cutting measures. This
project is an attempt to develop a framework from which resource maximization efforts
can be developed.

Many of the LMD’s have parks and landscaping that is maintained by the Park
and Recreation District that exists in Livermore. The City of Livermore has a symbiotic
relationship with the Livermore Area Park and Recreation District (Park District). This
special district has stewardship over all the athletic-oriented parks in the City. This
means that they do all the programming and maintenance of these facilities, even though
the City owns the property. The City has stewardship of all the boulevards and median
strip landscaping located throughout the City. City staff also manages much of the
grounds associated with City-owned properties such as the library, water treatment plant,
and the airport.

Because the Park District has parks, trails and roadside landscaping in or near the
City’s LMD’s, at times this creates an inconsistency in the look of the neighborhood’s
landscape because of the differing maintenance standards between the two agencies.
Many of the home owners do not know what properties are managed by the City versus
the Park District. One of the future goals of this project is to develop a comprehensive
map system, using GPS mapping and Geographical Information Systems (GIS) technology, which would highlight the areas that the City maintains. In order to complete this map, a comprehensive asset inventory must be completed for all of the LMD’s. This will help office staff in identifying who has responsibility when a complaint phone call comes in from the public.

The LMD program is what this project is focused on specifically because when one combines property owner tax assessments with the aesthetic ambiance of their neighborhood, intense public scrutiny is inevitable. This intense scrutiny demands a high level of accountability and justification within each LMD. The LMD program is funded solely from the special landscape assessments that each property owner pays annually. This assessment is formed before any landscaping even exists, so it is solely an estimate of what the annual maintenance will cost. In some cases, the assessment is set too low for proper upkeep. This presents a problem because either services are reduced or assessments increased. The latter solution is much more difficult because no one wants to see their taxes increased. In many cases, not only does this annual assessment not cover the total cost of annual maintenance, but it does not create a funding source for future infrastructure replacement. Each LMD is unique in its design, but they all contain infrastructure which requires future replacement. These costs are considered a capital cost which is usually a separate budget. If there is not funding allocated for the future capital replacement of assets in the zone, the annual maintenance budget usually funds that work at a deficit.
The City went from contracting out the landscape maintenance for the LMD program, to taking the program completely in house. Then, as fiscal burdens of an all-City staff model increased, a shift toward a blended approach was adopted. A long-term plan to achieve sustainability in both the LMD residential areas and in the City landscaped areas is desirable. This project will establish the basis from which further analysis and decision making can be made.

Statement of Problem

The main difficulty with the Landscape Maintenance District Program is that it has been passed around to various departments, and no clear long term plan was ever established for its successful management. Newly assigned staff will benefit from the establishment of a MMP because there are 20 years of history and institutional knowledge and culture, which is difficult for someone new to the program or the public to interpret. The MMP will serve as a quick reference guide and resource that can guide management decisions.

There are a few operational problems facing the LMD program at this time. Besides the fact there are new people managing the program, there is a need to have a comprehensive inventory of all the assets in the 90 LMD zones. This data is needed for resource allocation, facilitated by knowing what assets need replacement and when various tasks are performed. So, a model or framework is needed to commence the inventory project. A master schedule is needed to assist in directing staff activities, and to justify resource allocations with the residents of the LMD zones. Also, the most immediate problem the Landscape Maintenance Section has in managing the LMD
program is that there is no official policy that establishes a justifiable reserve fund for future capital renovation costs within the separate LMD’s. As zones age, the infrastructure, such as the irrigation system, begins to fail at an accelerated rate to where a full replacement is needed. In order to pay for this type of large capital replacement, there needs to be an established reserve fund. This fund needs to be built up over time, since the costs are very high. Thus, a policy must be developed which establishes the parameters of this funding mechanism. Much of this project is crafted to establish this end product of LMD reserve fund policy.

**Purpose of the Project**

The purpose of this project is to develop a working outline for the Master Management Plan for the Landscape Maintenance District Program. From the MMP outline, key operational areas will be further broken down to their core frameworks and finally applied to a pilot LMD zone, so that cost projections can be applied to the entire program. The project segments are as follows:

1. **Creation of the Livermore Landscape Maintenance District Master Management Plan (MMP) framework**, that includes various operational and management areas within the LMD program. An overall framework for this master plan will be presented. The key segments of this MMP are further explored in this project to accomplish the objective of establishing a reserve fund policy and budget analysis. A framework for the asset inventory, master maintenance scheduling and the reserve study will also be developed as part of this project.
2. Develop a reserve funding level policy that can be adopted by the City Council, and applied to the LMD program. Having an adopted policy that can justify reserve funding balances for each LMD will create a uniform and predictable funding source for future infrastructure renovations.

3. Conduct a pilot project in one of the LMD zones, the Dunsmuir District, which can be used as a model for further reserve fund study implementation and program-wide budget analysis.

4. Forecast the costs to complete the reserve fund study for the entire LMD program.

5. Provide recommendations for elements to include in the MMP, including staffing levels and organizational structures.

The Landscape Maintenance Section has a rich heritage of high standards and efficiency. However, with the increasing demands on the scarce resources, a proactive strategy must be developed that addresses some of these challenges. By establishing the various program frameworks, the inventory process, scheduling and reserve fund establishment projects will get off the ground.

**Landscape Maintenance Master Management Plan Process Flow Chart**

A Landscape Maintenance Master Management Plan framework for the City of Livermore was developed specifically for Livermore’s LMD program maintenance operation. This maintenance master management plan is a working framework that can be added to and updated as issues of importance are analyzed. The key segments of this
framework are shown as a flow chart in Figure 1. These segments, and others that can be added over time, combine to form the overall MMP.

The first arrow represents the outline of the master plan framework and the components that are included within it. The remaining arrows are programs and activities that are explored in the master plan. The master plan framework is a working document that evolves with the needs of the work unit.

The second arrow within the flow chart represents the creation of the asset inventory framework. An agency must identify all the assets that it has stewardship over. Having a comprehensive inventory collection system is paramount to completing this arduous project.

The third arrow represents the maintenance activities that must be accomplished to maintain that particular property. Maintenance activities are an identified action required to maintain an asset.

The fourth arrow represents the service levels that each property has. Service levels are defined by the frequency with which maintenance activities occur.

The fifth arrow represents developing a master maintenance schedule framework that can be applied to each individual LMD. By combining the individual LMD zone master maintenance schedules, the development of a comprehensive schedule can be realized.

The sixth arrow represents creating a reserve fund study framework. This framework will serve as the LMD program’s reserve fund policy, and will help to create a 10 year reserve fund budget for the program.
The seventh arrow shown in the flow chart is the implementation of the main segments of the MMP into the pilot LMD zone. The pilot zone chosen was the Dunsmuir LMD, where the asset inventory, master schedule and reserve fund framework was tested.

The center of the flow chart depicts the fiscal analysis that will be conducted from the data generated by the pilot study. The fiscal analysis will generate a cost estimate for the completion of the reserve study for the entire LMD program.

Figure 1. Landscape Maintenance District Master Management Plan Diagram (Created by Justin Drinkwater, Landscape Maintenance Supervisor for the City of Livermore).
The focus of this project was on Steps 1, 2, 5, 6, & 7 in the Flow Chart. Steps 3 and 4, Maintenance Activities and Service Levels, are explored in the Review of Literature section, and are included in the body of results, but are not central to this project.

**Limitations**

This study was limited in scope to the specific work that could be accomplished by the Livermore Landscape Maintenance Section as outlined above, and because of the following resource limitations:

- Extensive, labor-intensive field site surveys and drawing research
- Prioritized budgets and limited funding for forward-looking projects
- Difficult economic times and California budget problems

The framework for the Landscape Maintenance District Master Management Plan (MMP) has been developed as part of this project, but being able to fully implement the plan is a challenge due to the scenarios mentioned above. As funding permits, the project will be able to expand.

**Definitions of Landscaping Maintenance Terms**

The following terms are used in the daily operations of the Landscape Maintenance Section and throughout this research project:

**Annual frequency** is the number of times per year that a maintenance activity is performed for a physical asset. The frequency reflects the operating standards of an agency for a particular landscape area. The frequency of maintenance is dependent on the type of park and the resources available.
Annual hours are equal to the maintenance time per occurrence to maintain the physical assets, multiplied by the annual frequency of maintenance.

Asset refers to the physical property specifically found on a property that requires some level of maintenance.

Backlog of Needs refers to the facility which is identified in the needs assessment as requiring repair, but which is not funded for repair.

Baseline Funding is the level of funding that is set at a break even level for the annual maintenance expenses. This level of funding leaves the zone with no reserves to cover unexpected expenses.

Benchmarking means the regularly and widely used measure for work or customer response that meets the expectations of the customers. Benchmarking is a process to learn how to become the best. It seeks to achieve superior results and seeks to improve internal systems by learning from external resources. Benchmarking can be utilized in two ways:

1. Implementing best practices
2. Comparing levels of services from similar communities

Capital cost/improvement refers to new construction projects or renovation projects that renew aged infrastructure.

Component is a physical asset that is included in a reserve study as an item that needs to have reserve funding allocated to it from future replacement or renovation.
**Condition Categories** refers to the placement of facilities in different categories (excellent, good, poor, and failed) expressed in percentages. This provides useful information that is more readily understood by elected officials and the public.

**Deferred Action** strategy is when the facility condition has deteriorated to the point that preventative maintenance is no longer cost effective, but the facility does not require major rehabilitation.

**Deferred Funding Needs** refer to the amount of money that would be needed to fund the backlog of projects an agency has. This is the sum of the estimated costs of those projects carried forward from previous years.

**Full Maintenance** is the level of maintenance required to achieve a safe, clean and aesthetically pleasing landscape with the funding available. This level of service is applied to most City funded landscapes and LMD zones with appropriate funding.

**Full Funding** reserve fund is fully funded for future replacement according to the reserve fund study report.

**Infrastructure** refers to a permanent structure or system that requires maintenance.

**Landscape Maintenance District (LMD);** These districts are special tax assessment districts that pay for landscape and park features. Each zone has its own budget that determines the level of service. Each zone has a unique design and there are varying site amenities. Some zones have extension trails, playgrounds and entrance features. One aspect the LMD budget does not address is the long term reserve fund requirements.
Limited Maintenance is a service level that is applied to City funded landscape on a per site basis. There is a need to ration resources so certain areas that require less maintenance will be allocated lower frequencies. LMD zones which have a negative fund balance can be placed in this category and a schedule of reductions per the adopted council policy will be applied. The list below shows the aspects that are considered regarding the City of Livermore’s reduced maintenance policy:

- Stop replacing dead material
- Reduce irrigation
- Stop removing trash
- Reduce mowing to once every two weeks
- Reduce trimming and pruning of trees and shrubs
- Stop pulling weeds
- Stop applying pre-emergent
- Stop applying fertilization
- Reduce mowing to once every four weeks

Maintenance, Rehabilitation and Reconstruction (MR & R) is the comprehensive approach to asset management that requires the development and use of maintenance, rehabilitation and reconstruction strategies in order to effectively maintain the infrastructures.

Maintenance Operation is a term to describe the type of maintenance that will be performed. A maintenance operation is further broken down into specific tasks.
Maintenance Standards are qualitative outcomes that are established by industry standards or established by agency specifications.

Maintenance Task is the identified maintenance that an agency determines necessary to maintain physical assets in the landscape or park. Maintenance tasks are an integral part of a maintenance management plan as they directly determine the life of the asset.

Master Landscape Maintenance Plan is a plan that shows the maintenance tasks for a given site asset. Managers use the plan to schedule maintenance frequencies and resource allocations. The plan provides a framework for maintenance operations in regards to maintenance tasks that need to get done and to what standard they will be completed.

A list of common maintenance tasks and standards are included in Appendix 1.

Physical assets are any fixed items that are found within a park or landscaped area that require maintenance. Table 1 outlines assets and the kinds of tasks needed to be performed there.

Preventative Maintenance is intended for facilities that are already in relatively good condition. Much of the maintenance that is done in landscaped and park areas is of a preventative nature as you are maintaining the health of the plant material so that further more costly maintenance is avoided.

Quantitative maintenance standards are how long it takes to accomplish a maintenance task. These average times for various maintenance tasks can be found by analysis agency work schedule data or from industry publications.
Qualitative maintenance standards are the desired results from a specific maintenance task.

Reactive Maintenance Cycle refers to performing maintenance on an as needed basis. This type of maintenance scheduling is where staff fight one fire to the next.

Reconstruction/Replacement is utilized when rehabilitation is not cost effective due to age or asset condition.

Rehabilitation is when extensive corrective actions are needed to repair a facility that has deteriorated past a condition that cannot be corrected through preventative or routine maintenance. Treatments are applied to return the facility to a condition similar to its original condition.

Remaining Service Life is the amount of time before a facility reaches an unacceptable condition.

Reserve Study is a detailed report that assists property owners and land managers to manage common interest facilities. These studies plan for the long term maintenance and replacement expenses of certain components that make up the common use areas. In the City of Livermore these common areas are called Landscape Maintenance Districts. See example LMD budget in Appendix 2. Note there is no reserve funding line item:

Routine Maintenance is a strategy where facility deteriorations are identified and repaired in order to maintain a high performance level. Routine maintenance is heavily performed in landscaped and park areas as staff inspects the facilities and deficiencies are identified and scheduled for maintenance.
**Service level** is based on the frequency of maintenance that occurs. Though maintenance activities are common in all landscaped areas, some have high levels of service depending on the funding level or plant material.

**Stopgap Maintenance** is used to describe repair activities that are applied to keep a section in serviceable condition until the needed funding becomes available.

**Threshold Funding** is a method that has been loosely applied in the LMD program in setting a particular percentage of reserve throughout all the zones. The recommended minimum threshold is ten percent of the annual budget. This method can produce excess or even deficient levels of reserve because it does not take in site specific anomalies.

**Under Funded** is a level of funding which is applied to the LMD zones that do not bring in enough revenue to cover the annual maintenance cost. These zones continue to run the operating budget in the negative unless revenues are increased or service levels are reduced.

**Unit of measure** is the measured quantity of an identified asset or component. An asset can be measured as a single unit or as another spatial measure such as per square feet. Assets like water meters and trees would be counted individually while areas such as turf would be measured per thousand square feet. Unit of measure explanations:

- **SF** – Square Feet is surface area measurement that encompasses a one foot by one foot area.
- **SY** – Square Yard is a three foot by three foot surface area measurement.
- **LF** – Linear Feet is a measurement in feet that goes in consecutive feet like a measuring tape.
Chapter 2

REVIEW OF THE LITERATURE

This project focuses on developing a master plan for the Landscape Maintenance District Program for the City of Livermore. Included in the master plan are sections on assets inventory, maintenance scheduling and reserve budget funding studies. Because there is not a lot of literature on these subjects which are solely from the landscape maintenance sector, related sectors were chosen. The parks and recreations field has published works on asset management, after which much of this project was patterned. A lot of the scheduling and reserve fund study literature was from the manufacturing and public works sectors.

Literature was reviewed under the following headings: Maintenance Management Master Planning, Infrastructure Asset Management, Landscape Maintenance Operations and Scheduling, Maintenance Service Levels, and Reserve Funding Planning.

**Maintenance Management Master Planning**

New development has multiple funding avenues, but consistent funding for maintenance is rare. Thus, the largest challenge in maintaining landscapes is the persistence of inadequate funding. Municipalities are facing this problem more than ever before (Sternloff & Warren, 1993). During the building boom years this problem was compounded with the runaway pace of new development. Now agencies are faced with the task of maintaining this new infrastructure with decreasing resources. In many instances, agencies are holding positions open or even laying off seasonal and full-time
employees. This strains the resources of the maintenance department to the point that reductions in services are the only response feasible.

Landscape and park maintenance is usually funded by an agency’s general fund or by special tax assessment. During tough economic times, the general fund is hit the hardest because every department is straining to cover their expenses with falling revenue. The special tax assessed areas, commonly know as Landscape Maintenance District or Lighting and Landscape Districts, have in many instances been under budgeted from the inception of the district. It requires a majority vote in all districts to increase the funding, and that is not an easy thing to obtain, especially in today’s economy. The Annual Engineer’s Report for 2009/2010 states that Proposition 218 extends the initiative process to all local taxes, assessments and fees which reaffirms the Proposition 13 standing that the increase must be approved by a majority vote (City of Livermore, 2009). In these tough economic times obtaining a majority vote for a special assessment increase is very difficult; thus maintenance budgets continue to suffer.

City councils and various boards often expect maintenance departments to operate like a business (Pacific Northwest Maintenance Management School, 1998). This may be more realistic for the LMD, because their funding is specific to particular zones. However, as mentioned previously, many of these zones over time do not have the resources to provide the needed renovations. Landscape and park maintenance that is funded by the General Fund is targeted for cuts as other departments and programs compete for the dwindling resources. As budgets in many agencies are being reduced,
and staff sizes are shrinking, some agencies are looking to fund general fund positions by allocating them to special funded programs like the LMD program. Wyatt (2009) reports a proposed General Fund budget saving initiative in Manteca California that shifts landscape maintenance to City staff versus the current contractor model. Richie (2004) reported back before the housing bubble that park agencies were going to see budget reductions. This is now occurring in California. The state is also considering taking some city property tax revenues and most cities are looking at some level of staff reductions. Park and landscape maintenance staff are usually the first hit in these cuts. The City of Lathrop recently laid off three parks workers in their first round of budget reductions (Burkin, 2009).

The California Department of Parks and Recreation suggested in a report that agencies quantify all budget requests with solid outcome analysis or that funding may be taken away (Seamen, 2004). A Master Management Plan will assist agencies in forecasting future budget demands by quantifying the capital replacement cost for a determined time period. The Master Management Plan will promote the development of a more effective budget proposal (Conover, 1977). The Master Management Plan, or Maintenance Plan, as it is often referred to, is a document that shows various maintenance tasks required in a park or landscape according to set standards. It is the primary instrument for developing the management plan of various protected areas (Putney & Harmon, 2003). The National Parks Board states, “the purpose of a management plan is to document all relevant information which exists about a reserve, to state the objectives, determine the different types of land use within the reserve and to set
out the future management of the area” (Grobler, 1984). Many times agencies fall into a reactive mode of maintenance. However, it is suggested by McDonald (1990) that a way to overcome this is by utilizing a formal planning tool, such as a master maintenance plan, which will aid in the overall planning and scheduling of maintenance resources.

The master maintenance management plan should present maintenance objectives and detail the desired standards (Sternloff & Warren, 1993). A framework for a park maintenance specific management plan was developed by the Pacific Northwest Maintenance Management School which is a seminar put on by a group of park maintenance professionals that formed a committee endorsed by the National Parks and Recreation Association. A fine implementation of this model was conducted by Chris Surawski in the City of West Sacramento. Surawski (2006) implemented this model in West Sacramento and included an asset inventory, maintenance activity selection, maintenance productivity standards, and service levels. The California Parks and Recreation Society published the framework of this maintenance management plan in 2006.

**Infrastructure Asset Management**

Asset management is an accounting practice that tracks the depreciation of building and equipment for tax purposes. It also is a term that is used by property and facility managers who need to budget for maintenance purposes. It is a process of quantifying the infrastructure so sound management decisions can be made regarding maintenance activities and other resource allocations. The settings for the use of asset
management, specifically asset inventorying, are immensely diverse, from the federal
government to the private property manager, and every thing in-between. An agency or
organization has to have a detailed picture of the assets they possess so they can make
prudent management decisions with ever-scarce resources.

Any management plan for maintenance must be based off the assets managed
within the particular agency’s stewardship. The National Park Service has developed an
asset management program that identifies the assets, values those assets according to
condition, and then ranks them for funding priority. The highest priority is placed on risk
levels and user visit valuation (National Park Service, 2003). The asset inventory
information can be utilized for establishing maintenance task time and frequency
standards such as the maintenance management plan modeled by Surawski (2006) or it
can be used to develop long term reserve budget as done by the National Park Service.

Having a complete picture of all the individual assets an agency has within their
maintenance management realm is vital for operational effectiveness and long term
sustainability.

**Landscape Maintenance Operations and Scheduling**

Much of the maintenance that is performed in parks and landscaped areas is of a
preventative and routine nature. Turf areas are mowed once a week to maintain the look
and health of the grass. It is preventative in that, if it is not mowed every week, it will get
too long and damage will occur when it is finally mowed. It is routine in the sense that it
is done every week, usually on the same day. The separation between preventative and
routine is that there may not be any sign of wear or need for
maintenance on a preventative cycle (Nyman & Levitt, 2001). When performing preventative maintenance, doing it on a scheduled basis whether there is noticeable deterioration or not is paramount. With routine maintenance the process is inspecting and identifying deteriorated conditions and then scheduling the maintenance. A good example of preventative maintenance in landscape and park management is the use of pre-emergent herbicides. Using this type of herbicide will dramatically reduce the amount of routine weeding that needs to be done in a treated area. The deterioration of the landscape area is minimized because the herbicide eliminates the germination of most of the invasive weeds in the landscaped area; thus one has prevented massive amounts of routine weed pulling. One task that is very routine is litter cleanup. This is a maintenance task that cannot be prevented, because people litter no matter what measures are implemented. This task becomes a scheduled maintenance event with certain areas receiving a higher frequency level due to increased use and clientele.

Landscape maintenance has its own specific maintenance tasks unique to the field. The various tasks are grouped according to their commonality. These common tasks then have crews assigned to them that perform specific tasks, thus gaining efficiency. A mow crew performs only mowing, because they become highly efficient by not having to start and stop repeatedly. Agencies develop certain landscape and park maintenance standards and it’s up to the manager to meet those standards. This is not always easy as McDonald (1990) highlights the many skills a maintenance professional must possess. He describes the maintenance manager as one with knowledge in business,
construction, architecture, forestry and horticulture. Developing a maintenance plan will insure that the assets in the landscape are managed in the most efficient way possible.

Landscape and park maintenance has two specific maintenance modes: the routine and the non-routine. Another way to explain it is the proactive maintenance cycle versus the reactive maintenance cycle. The majority of landscape maintenance is performed routinely. Routine maintenance occurs on a daily, weekly, monthly, and annual basis. Routine maintenance can include litter pickup, lawn mowing, and fertilizing. Non-routine maintenance is unexpected and occurs from an asset failure which can be accidental or causal. Pantera, et al. (2002) suggest that a third form of maintenance should be employed which is the preventative maintenance function. This type of maintenance attempts to avoid the unscheduled or reactive type of maintenance by scheduling the maintenance function before failure.

Most maintenance operations do not plan to fail; they simply fail to plan, and therefore do indeed fail (Nyman & Levitt 2001). Nyman and Levitt (2001) introduce a key theory in regards to maintenance scheduling and employee recognition. They suggest that maintenance organizations minimize competition, improve communications, and promote understanding and commitment.

Many times in a maintenance operation the field staff create competition between other work groups. This competitive feeling can be minimized by establishing systems that reward satisfactory work performance. Agencies should improve communications with field staff by allowing ample opportunities for questions and clarifications of work schedules. It is also important to promote understanding by repeating instructions and
promoting feedback. The sense of commitment can be increased by allowing field staff the chance to submit feedback and insight into various stages of the work process.

The major reason most park and landscape maintenance operations fail to plan is that they are putting out today’s fires instead of planning for tomorrow’s scheduled maintenance. By scheduling maintenance operations in the future, the agency is able to more effectively plan for maximum resource efficiency. The goal is to protect the weekly schedule so that efficiencies are not lost. A brief morning “tool box” stand-up meeting with staff can help minimize reactive maintenance distractions. This arrangement is supported by Nyman & Levitt:

A well thought out schedule provides a framework for achievement of weekly targets, but problems do occur and changes need to be made on a daily basis. All parties must be involved in discussions related to course corrections. The morning meeting is such a forum and is often effective, especially when the maintenance function is still operating in a reactive environment. (2001, p. 87)

This meeting should be brief and sometimes a standing meeting that focuses on maintaining service schedules with the least amount of disruption.

While reviewing the literature, a key distinction between efficiency and effectiveness was conveyed. Sterling (2007) makes the distinction between the two stating that effectiveness is getting the job done and reaching objectives, while efficiency is doing the job at the lowest cost.
Often in the public sector effectiveness is more paramount in importance. Most citizens expect the traffic signals to work and the water to flow safely and, thus, they value the reliability of the service. The elected officials and the citizens are satisfied with a service that costs more as long as they are getting the desired outcome which equates to effectiveness.

**Maintenance Service Levels**

There are many factors that determine the level of service that a park or landscape receives. The American Public Works Association (APWA 2007) defines a service level as the agency’s ability to produce a service within a set time, cost or resource.

The frequency that maintenance occurs depends on the landscape’s unique design and the maintenance challenges that are inherent in the design. The end results are determined by the agency’s standards and the needs of visitors. Conover (1977) identifies maintenance demands associated by specific areas, such as high use areas, scenic areas, and natural areas. Each landscape property or park has its own personality which requires varying service levels.

Because each landscape and park has varying uses depending on its design and location, an agency must have different levels of services as a way to direct resources appropriately. It is important to look further into the underlying factors that determine a site’s service level. The APWA has determined five basic categories of a service level as follows:

1. A level of service that is directed by your governing board.
2. A level of service directed by surveying the citizens.
3. A level of service adopted for your community when compared with similar communities (Benchmarking).

4. The level of service your community can afford or prioritizes.

5. The level of service, that you, as the public works manager, determine or recommend that your agency can accomplish within the resources given to you.

Most of the time these five elements are fused together by the manager in establishing the required service level for a given property. However, there are times when one of the factors is the determining factor because it is given a heavier weighting. Many times all it takes is an outspoken individual or committee that will dictate the agency’s service level. As it is said, “The squeaky wheel gets the grease”.

When looking at service levels specifically for landscaped and park areas, the Pacific Northwest Maintenance Management School (1998) has developed various service level criteria. The program tailors the service level based on the asset’s use and the maintenance required for that asset. Certain assets have a higher frequency in which maintenance occurs. Not all landscapes and parks require the same level of maintenance. The higher the service level is, then the expected quality of the landscape is raised as well. Some areas can receive less maintenance frequency and still have a high quality look; it highly depends on the assets in that particular area and their intended use.

**Asset Rehabilitation Through Reserve Funding Planning**

Maintenance operations personnel must know what they have to maintain and that is why an asset inventory is vital. Maintenance must be efficiently scheduled and
performed. Beyond doing the routine maintenance, planning for future renovations and replacement in regards to infrastructure that has a useful life must be considered. As Nyman & Levitt (2001) highlight, it is important for an organization to eliminate deferred maintenance:

Once an organization fails to keep up with deterioration it cannot maintain a proactive program if one is in place and certainly cannot climb out of an existing reactive state without an influx of adequate resources. Without such an influx it is impossible for the facility to be proactive because inspections both detract from the resources available for backlog relief and identify more corrective work to be added to the backlog. The resource-demand imbalance continually worsens. (p. 137)

This goes back to the operations and scheduling section, as it shows that when one is constantly reacting, the ability to be proactive is lost. That is why the reserve study undertaking is vital to the success of the organization because it helps reduce the occurrences of large unexpected budget demands.

The first two strategies for maintenance, rehabilitation and reconstruction (MR & R), were discussed in the landscape operations section as they were related to scheduled maintenance which does not factor into reserve assets funding. The last three strategies however, are related to reserve assets funding and how deteriorated assets are rehabilitated or reconstructed. Roohanirad (2000) suggests that most of the time rehabilitation and reconstruction operations become deferred actions because there is not
sufficient funding for proper maintenance. This is a wide spread problem in maintenance which requires a proper funding mechanism.

This is where a reserve study serves as a tool in justifying the required assets rehabilitation reserve fund. Mccaffery (2005) explains a reserve study as a detailed report that assists common interest property owners and managers in planning for long-term common area repair and replacement expenses. Many neighborhoods have homeowner associations and cities have lighting and landscape districts which have common areas that require maintenance through community finance means. These common areas can include streets, sidewalks, trails, park facilities and even recreational facilities. Most modern neighborhoods have entrance landscaping and parkways that are funded via the residences in that development.

A reserve study includes two parts: first the physical analysis, followed by the financial analysis. The physical analysis contains information about the condition and repair cost of the components within that assessment area. The physical analysis includes the components’ estimated useful and remaining life. The financial analysis evaluates the reserve fund balance and income. The analysis will look at the percent funded by comparing the actual reserve with the projected fully-funded balance. From this, the estimated annual contributions can be established so that the district will have budget funds for the future replacements and renovations.

One of the ways to calculate the desired balance is by utilizing the formula by Mccaffery (2005), which is the fully funded reserve balance (FFRB) equals the current
cost of replacement multiplied by the number of years the component has been in service, divided by the useful life of the component:

$$\text{FFRB} = \frac{\text{Cost\$ of Replacement} \times \text{Years of Service}}{\text{Useful Life of Component, years}}$$

**Summary**

The literature serves to formulate a solid foundation for developing maintenance management plans. Each agency has their own challenges, strengths and weaknesses. For Livermore, the Landscape Maintenance District program has presented a number of challenges for staff working in it. As this project evolved, and literature was reviewed on the subjects of master management planning, asset management and service level establishment, it was realized that this project would be ongoing, a continuous work of process improvement. From this literature review, a focus was put on the development of the frameworks needed to get the project going and to a place where it could be worked as time allowed. As explained earlier, this project focuses on developing the MMP core frameworks and conducting a pilot study in one of the largest LMD zones, so that a cost projection for a completed reserve fund study can be established. The objective of determining the total cost of the reserve fund study would be accomplished by completing the pilot reserve study in the Dunsmuir zone. By completing this trial zone, the framework could be tested for validity, and a reserve fund budget could be established for the Dunsmuir zone and cost projections could be applied to other zones.
Chapter 3

METHODS

The methodology for this project was first to outline the various elements covered in the MMP. Then the main elements of this plan would have their respective frameworks conveyed. These frameworks would then be applied to a pilot zone so that further budgetary and cost analysis functions could be completed. The frameworks for the asset inventory, master maintenance schedule and the reserve fund policy have been crafted and are shown in the first part of the results section. The theoretical design of these frameworks is first explained. Then the data collection process for the trial LMD will be examined. The final aspect of this project is the quantitative analysis of the trial LMD.

Design & Approach

MMP Outline

The Landscape Maintenance District Master Management Plan can include any program topic which is deemed to be of operational value. The most important elements of the plan have been included in this project such as the inventory framework, master schedule and reserve fund study framework. However, the outline given will show other topics such as LMD program mission, goals and objectives. This is a section that will be addressed at a latter date in the implementation of the plan, but it is shown in the outline as a topic of interest.
Inventory Framework

An asset inventory is simply a compilation of all the physical assets that require maintenance on a regular basis necessary to sustain the life-cycle expectancy of each asset. A complicated quantitative analysis of all of the City of Livermore assets must be accomplished for proper management and analysis of resources. For this project the framework to compile this data will be presented and a pilot inventory conducted to validate the framework’s usability.

Master Schedule Framework

The theory around the Landscape Master Maintenance Schedule (LMMS) is that there should be a way to effectively schedule the annual maintenance cycle for each of the LMD zones. Because the LMD zones are funded by special assessment, it is sound management to have an annual maintenance schedule that gives home owners an idea when they can expect service. The annual schedule is based on seasonal maintenance demands, and is broken down according to the specific work team that performs the needed tasks. The irrigation crews have different maintenance schedules to adhere to than the mow crews, who during the active growing season, are on a weekly schedule.

An example master schedule format will be presented for this project in the results section. The City of Livermore’s Landscape section will have to formalize their approach and review the historical data for each LMD zone to establish an accurate work schedule. Much of the concern with this type of undertaking is that, because there are so many unplanned events that take place in a living landscape environment, a fixed maintenance schedule is impacted and thus, is seemingly rendered useless. This results
in the realization that a new crew structure may be beneficial to the operation. This could be a structure that has a quick response or special project work crews to handle the emergency needs and so-called fires, and leave the other work crews to maintain the continuity of the annual schedule.

**Reserve Fund Study/Policy**

A reserve funding policy for the LMD program will be presented in the results section. This reserve funding policy will utilize data gathered from the asset inventory process. Certain components which will be inventoried have a large replacement cost, which needs to be budgeted for with money set aside for future expenditures. By having this policy adopted by the various stakeholders within the LMD program, a staff report can be prepared which will seek the City Council’s approval for this policy. Once this policy has been officially adopted, a reserve funding plan can be developed for each of the 90 LMD zones. A pilot reserve study was completed for one of the largest LMDs, and the results have been included in the results section of this project.

**Pilot Zone Study**

The trial zone for developing a LMMS will be the Dunsmuir LMD. The Dunsmuir zone will also be utilized in testing the reserve fund study framework and a reserve study cost will be developed for completing the entire study.

By completing the trial reserve fund analysis for the Dunsmuir LMD, a total cost to complete the reserve study for all 90 LMD zones can be determined. Also, a specific analysis for the Dunsmuir LMD can be completed which will determine whether the zone
has sufficient reserve funding and what levels of assessment will have to be levied to obtain a full reserve funding level.

**Data Collection and Recording**

Once the frameworks were established for the project, there was a need to test the applicability of the design. This was done by focusing the data collection efforts on one particular zone. The Dunsmuir LMD zone was selected for its large size, over 800,000 square feet of landscaping. By using this zone as a trial, the practitioners will be able to identify applicable adjustments to the framework, as illustrated by the full circle continuous process improvement flow chart in Figure 1, in the Introduction.

Data from the City’s maintenance management program was used to analyze the annual maintenance frequencies to assist in developing the annual maintenance schedule for the Dunsmuir zone. Much of the data collection will be utilized in developing the reserve fund budget as this project is vital in sustaining long term funding for this particular zone and others.

Data collection and recording for this project focuses on the vital component areas that are identified in the reserve fund policy. These include most infrastructures, such as irrigations systems and site structures that have a useful life and require eventual replacement or renovation. Data was collected using site visitations, standardized forms, and landscape plan analysis. Each component will be analyzed for its remaining useful life and expected replacement cost. When all the components are added together a total reserve fund number can be established.


Quantitative Analysis

The testing of the framework, and whether there is need to add or remove a portion of it, will be completed as a result of the Dunsmuir trial, but that is more of a qualitative measure. First, the primary quantitative analysis, which will come from the completed Dunsmuir trial, is to take the inventoried component data and obtain a total reserve fund budget for a ten year period. Then, compare that total budget to the existing Dunsmuir operating budget. From that, a fully funded budget figure can be established which would include the needed ten year reserve figure.

The second quantitative analysis that will be conducted is to take the cost of the completed Dunsmuir trial study, and apply that to the remaining 90 LMD zones using a per square foot reserve study factor. The total cost to do the Dunsmuir reserve study will be outlaid by taking the total man hours required to complete the site inventory and compile the data. Then, that number can be divided by the total number of landscape square feet for an average per square foot cost. This cost can be multiplied by the remaining LMD square footage for a total cost to the program.

This method will be a general rough order of magnitude (ROM) estimate, since each zone has its own unique features which may require more intensive data collection. But the estimated cost should suffice for general budgeting purposes. Cost can be controlled on an as needed basis, since each zone will fund its own study. Some zones have more flexibility in their funding, but the end product needs to be as accurate as possible so that the final budgets are fully justifiable.
Chapter 4

RESULTS

This project is a major step forward in the development of the Master Management Plan (MMP) for the City of Livermore’s Landscape Maintenance District (LMD) program. The desired future outcome for this project has five major components:

1. An Asset Inventory Worksheet to be used for data collection across the LMD program.

2. A framework for the development of a Landscape Master Maintenance Schedule (LMMS) for the LMD program.

3. A Reserve Fund Study to be used to establish a Reserve Fund Policy for the LMD program.

4. A Pilot Reserve Study in one of the Landscape Maintenance Districts (The Dunsmuir LMD). Included in the Pilot Study are three main components of the MMP:
   a. An Asset Inventory for the Dunsmuir LMD.
   b. A Landscape Master Maintenance Schedule (LMMS) for the Dunsmuir LMD.
   c. A Budget Analysis for a 10 year Reserve Fund in the Dunsmuir LMD.

5. A cost estimate for the cost to complete the reserve study for the entire Livermore LMD program.

These segments will be the basis of the Landscape Maintenance District Master Management Plan (MMP) for the LMD program. In order to create this document, a comprehensive existing asset data gathering process was undertaken, which developed
the framework for a master schedule, and presented data for the reserve fund analysis process.

Data collected for this study will be presented in this chapter. Much of the data relates to the assets inventory for Dunsmuir LMD. This was the district that was chosen to be the initial trial zone for the newly created master management plan framework. This section will show the assets or components that were surveyed for this LMD zone. The Landscape Master Maintenance Schedule (LMMS) will be completed when the remaining zones are inventoried. However one of the largest LMD’s, the Dunsmuir neighborhood, has a pilot master maintenance schedule completed. As a product of this assets inventory project, a 10 year capital expense reserve budget was created for the Dunsmuir zone.

First, the framework that was developed for the asset inventory portion will be presented, followed by the framework for the LMMS. Since funding and budgets control most LMD activities, the largest and most detailed framework, the reserve funding policy framework, will be presented, covering all aspects, components, and typical budget calculations to show the important features of the funding requirements. Finally, the results of the Dunsmuir zone inventory and reserve fund study will be presented. The total cost to complete the Dunsmuir reserve fund study will be presented, and a total projected cost to complete the reserve study for the entire LMD program will be calculated.
Asset Inventory

This section covers the asset inventory portion of the project. The framework has been developed for this project, but the results for the actual LMD districts will come at a later date. This work requires a lot of field analysis and site survey resources, which, during these economic times, becomes a severe financial strain on the operating budget. An example worksheet that is used to tabulate the various assets is shown in Table 1.

Table 1. Asset Inventory Worksheet

<table>
<thead>
<tr>
<th>Asset</th>
<th>Unit of Measure</th>
<th>Inventory Quantity</th>
<th>Asset Condition</th>
<th>Maintenance Activity</th>
<th>Time Per Occ.</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>Annual Freq</th>
<th>Annual Hours</th>
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</thead>
<tbody>
<tr>
<td>Movable Turf</td>
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<td>Fescue Grass</td>
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<td>Shrub Plantings</td>
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<td>Irrigation-Maintenance</td>
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<td>Controller scheduling</td>
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<td>Contractor Maintenance</td>
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</tbody>
</table>

Master Maintenance Schedule

First, the basis for the MMS is the Landscape Section-identified properties that it manages. Then, the areas are broken up into areas of similarity, because those areas will need the same type and frequency of maintenance. An example of a maintenance area work list is shown in Table 2. Finally, those areas are put on a monthly schedule according to the seasonal task that needs to be done for that month. An example of a monthly landscape task chart is shown in Figure 2.
Table 2. Landscape Section Area of Responsibility

<table>
<thead>
<tr>
<th>Legend No</th>
<th>Landscaping Maintenance Districts</th>
<th>Zone Names</th>
<th>Sq. Footage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Autumn Valley Tracts 5990 &amp; 6128: 1989-1</td>
<td>Autumn Valley</td>
<td>33000</td>
</tr>
<tr>
<td>2</td>
<td>Stratford Park: 1989-2</td>
<td>Stratford Park</td>
<td>308207</td>
</tr>
<tr>
<td>3</td>
<td>Tract 6758, 6764, 6223, 6423 6110 &amp; 5970; 1989-4</td>
<td>Amber Ridge</td>
<td>221000</td>
</tr>
<tr>
<td>7</td>
<td>Portola Glen, Tract 6177, 6347 &amp; 5645; LL-2</td>
<td>Portola Glen</td>
<td>125000</td>
</tr>
<tr>
<td>9</td>
<td>Parcel Map: 1993-2</td>
<td>Walmart Trail</td>
<td>34500</td>
</tr>
<tr>
<td>11</td>
<td>Windmill Springs</td>
<td>Windmill Springs</td>
<td>16250</td>
</tr>
<tr>
<td>12</td>
<td>California Nugget, Tract 6741; 1994-6</td>
<td>California Nugget</td>
<td>15797</td>
</tr>
<tr>
<td>14</td>
<td>Orchard Greenville Business Park; 1995-1</td>
<td>Orchard Greenville Business Park</td>
<td>148200</td>
</tr>
<tr>
<td>23</td>
<td>Tract 6801; 1996-7</td>
<td>Devon Place</td>
<td>12,420</td>
</tr>
<tr>
<td>24</td>
<td>Maralisa, Tract 6433 &amp; 6863; 1996-8</td>
<td>Maralisa</td>
<td>47493</td>
</tr>
<tr>
<td>26</td>
<td>Tract 6847; 1997-3</td>
<td>California Mt 2</td>
<td>1145</td>
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<tr>
<td>27</td>
<td>Tract 6783, 1997-4</td>
<td>National Drive</td>
<td>12200</td>
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<td>29</td>
<td>Ridgecrest Estates, Tract 6807; LL-803</td>
<td>Ridgecrest Estates</td>
<td>1893</td>
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<tr>
<td>31</td>
<td>Parcel Map 7090; LL-810</td>
<td>Contractor's Place</td>
<td>16915</td>
</tr>
<tr>
<td>39</td>
<td>Dunsmuir, Tract 6989, 7116, 7280, 7331, 7333, 7375, 7404, 7443 &amp; 7444; LL-823</td>
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<td>718,184</td>
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<tr>
<td>44</td>
<td>Tract 7189; LL-836</td>
<td>Legacy Collection</td>
<td>98075</td>
</tr>
<tr>
<td>47</td>
<td>Birchwood Park, Tract 7203; LL-840</td>
<td>Birchwood Park</td>
<td>57675</td>
</tr>
<tr>
<td>48</td>
<td>Vineyard Gate, Tract 7164; LL-841</td>
<td>Vineyard Gate</td>
<td>44183</td>
</tr>
<tr>
<td>52</td>
<td>Rose Gate, Tract 7330; LL-846</td>
<td>Rose Gate</td>
<td>2381</td>
</tr>
</tbody>
</table>

Note: The Legend No 39 Dunsmuir site was the location of the project pilot study.
Figure 2. Landscape Maintenance Task Monthly Interval Chart

The different crews are scheduled per the task frequency chart shown in Figure 2. The main key to making this LMMS work is to create an emergent needs crew that responds primarily to special requests and emergencies. If there is not a dedicated crew to handle these unscheduled requests, then the scheduled crews are pulled, and the organization falls into a reactive maintenance mode that is less efficient than the scheduled operation.
Reserve Fund Policy Outline

RESERVE STUDY FRAMEWORK

City of Livermore

Landscape Maintenance District Reserve Fund Policy
Introduction

The reserve fund study was implemented as a means to establish a policy that justifies appropriate reserve funding for each Landscape Maintenance District in the City of Livermore.

Reserve funding is needed in each zone; thus an established policy that is adopted by the City Council is necessary to allow management the ability to adjust assessments. Having justifiable reasons for increasing assessments is in line with good governance practices of accountability and transparency.

What is a Reserve Fund Study?

A reserve fund is needed in order to prepare for capital repairs and replacement costs for the major components of the landscape common areas. For a component to be included, it must be part of the common area maintained by the city, have a limited useful life and a predictable life limit.

The replacement cost must also be significant. The information on remaining useful life of components is based on projections and is not an exact science. Many of the landscape components are influenced by natural occurrences such as freeze or excessive heat. Therefore, some component failures may occur earlier than anticipated.

Reserve studies create a maintenance plan which keeps a development in good condition and protects neighboring property values. Having adequate reserves built up in the district’s fund will eliminate the need to seek special assessment increases. The study contains information about the current condition, and repair or replacement cost for the
major common area components the city is obligated to maintain. It should be reviewed on a yearly basis and adjusted accordingly. Due to changing economic conditions, physical factors and ownership expectations, the costs and timing associated with projections will most likely need review and adjustments.

**What is a Major Component?**

A component can be considered major in a reserve study if it falls into all of these three criteria:

1. The component or asset is included within the LMD’s engineer’s report, stating that the City has responsibility for the maintenance, repair and restoration of that particular item.

2. The component or asset has a limited life.

3. The component or asset has a reasonably defined life.

If the component does not meet all three of these qualifications it does not qualify. Site components such as concrete sidewalks and block walls normally are not included as they are considered to have an unlimited life. These components can, however, be included in reserve funding if circumstances indicate a future replacement burden.

Components that are replaced on an as needed basis such as light bulbs and sprinkler heads are not included in the reserve study as they are funded by the annual maintenance budget. They do not constitute a large capital expense, and they occur infrequently.
Categorizing useful life and useful life remaining for a given component can be a subjective task, so five categories were developed to assist in developing remaining life estimates for the various components in the LMD zones. The categories are as follows:

1. **Cyclic Regular** – These components have a high degree of predictability concerning both useful and remaining life. These include items such as wood painting and asphalt seal coating.

2. **Cyclic Irregular** – These components have a normal life span, but climate, level of preventative maintenance and owner care affect the actual life. These components are things in the landscape like trees, irrigation controllers and valves.

3. **Predictable, but Irregular Non-Catastrophic Failure** – These components are expected to wear out with some predictability, but do not need to be replaced until failure. These include examples such as pumps and valves.

4. **Catastrophic Failure** – These components are items where waiting until failure is not appropriate. Funding for the replacement of these components should be budgeted for replacement before failure. Safety related components are examples.

5. **Outdated Design/Aesthetics** – This category refers to items where, due to aesthetic reasons, the component is scheduled for replacement or renovation.

These categories are not rigid, and, in fact, some components may fit into several categories.
In order to establish an accurate reserve fund for future replacement a complete list of qualifying components must be produced. Components that share the same type and age can be quantified together on the chart. A sample blank chart showing the components, how many of them are present on the site, the useful life of that particular component and an estimated remaining useful life of the component is shown in Table 3.

Table 3. Landscape Component Detail List

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Useful life</th>
<th>Remaining useful life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backflow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master Valve</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controllers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote Control Valves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shrubs / Groundcover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lawn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meadow Grass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A compilation of some of the key components and their expected useful life have been compiled in Table 4.

Table 4. Component Useful Life Projections

<table>
<thead>
<tr>
<th>Component</th>
<th>Useful life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation pump</td>
<td>30 yrs</td>
</tr>
<tr>
<td>Backflow</td>
<td>20 yrs</td>
</tr>
<tr>
<td>Master Valve</td>
<td>15 yrs</td>
</tr>
<tr>
<td>Controllers</td>
<td>15 yrs</td>
</tr>
<tr>
<td>Remote Control Valves</td>
<td>10 yrs</td>
</tr>
<tr>
<td>Trees</td>
<td>Varies on Species</td>
</tr>
<tr>
<td>Shrubs / Groundcover</td>
<td>Varies on Species</td>
</tr>
<tr>
<td>Lawn</td>
<td>10 yrs</td>
</tr>
<tr>
<td>Meadow Grass</td>
<td>10 yrs</td>
</tr>
<tr>
<td>Lighting</td>
<td>20-25 yrs</td>
</tr>
<tr>
<td>Benches</td>
<td>20 yrs</td>
</tr>
<tr>
<td>Playground Equipment</td>
<td>20 yrs</td>
</tr>
</tbody>
</table>
Useful life is based on experience with the component, as well as manufacturer’s recommendations, and adjusted for normal wear and tear, regular maintenance and exposure to the elements. The remaining useful life for a component is based on the current observed condition of that component, and may not be based on the actual age of the component. Components that are in high traffic areas and receive excessive use may have a shorter remaining useful life span than the same component that may be in a low-use area.

**Component Repair/Replacement Costs**

Estimated replacement costs for the components are based on actual repair/replacements for a similar or the same component in today’s market. Over time these costs will change and should be re-evaluated on a yearly basis in order to have a realistic projection of expenses. These costs can come from the following sources:

1. Local Historical Cost
2. City of Livermore Estimate
3. Consultant Estimate
4. Contractor Bid
6. Previous Study

A list of components and their estimated replacement cost are shown in Table 5.
Table 5. Component Replacement Cost

<table>
<thead>
<tr>
<th>Component</th>
<th>Replacement Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation pump</td>
<td>$30,000</td>
</tr>
<tr>
<td>Backflow</td>
<td>$1,000-$2,000</td>
</tr>
<tr>
<td>Master Valve</td>
<td>$450</td>
</tr>
<tr>
<td>Controllers</td>
<td>$1,500-$3,000</td>
</tr>
<tr>
<td>Remote Control</td>
<td>$100-$350</td>
</tr>
<tr>
<td>Valves</td>
<td></td>
</tr>
<tr>
<td>Irrigation Heads</td>
<td>$18-$60</td>
</tr>
<tr>
<td>Lawn</td>
<td>$1.10 per square ft.</td>
</tr>
<tr>
<td>Meadow Grass</td>
<td>$.50 per square ft.</td>
</tr>
<tr>
<td>Lighting</td>
<td>$2,000-$4,000 for new</td>
</tr>
<tr>
<td></td>
<td>fixtures</td>
</tr>
<tr>
<td>Benches</td>
<td>$1,000-$2,000 for new</td>
</tr>
<tr>
<td></td>
<td>benches</td>
</tr>
<tr>
<td>Playground Equipment</td>
<td>$20,000-$50,000 For</td>
</tr>
</tbody>
</table>

Note: Tree and shrub replacement costs are shown in the shrub replacement section.
Component Review

Irrigation

Irrigation systems comprise much of the infrastructure within the LMD, and these require constant maintenance and eventual replacement. Most of the components have a 15-20 year life span. By then, if they haven’t been replaced by routine maintenance, replacement or renovation is justified.

Typical Irrigation Control System
Major system components are:

a. Pumps
b. Backflow Preventer
c. Master Valve & Flow Sensor
d. Controllers
e. Remote Control Valves
f. Irrigation Heads

A simple chart is utilized to catalog the addresses and sizes of irrigation components such as controllers and backflows. Examples of these charts are shown in Tables 6 and 7.

Table 6. Irrigation Controller Detail List

<table>
<thead>
<tr>
<th>Controller Address</th>
<th>Active Stations</th>
<th>.75”</th>
<th>1”</th>
<th>1.25”</th>
<th>1.5”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7. Irrigation Backflow Detail List

<table>
<thead>
<tr>
<th>Size of Backflow Device</th>
<th>1”</th>
<th>1.5”</th>
<th>2”</th>
<th>2.5”</th>
<th>3”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backflow Device Address</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Trees

Trees are included as a capital expense if there are numerous hazards, tree failures or known health issues that will require the removal and replacement of a large number of trees over a certain time period. In all other cases tree pruning and maintenance should be considered a yearly maintenance cost.

In order to develop the reserve funding level estimate for tree pruning, an accurate count of the type and size of a particular tree species is required. Each tree species has unique pruning requirements. Some trees require very infrequent care, while others need
an annual level of service. Tree size, recommended health care treatments and tree count is gathered in the example blank table shown in Table 8: This is also a place to note any pruning or health care recommendations.

Table 8. Tree Species Count List

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Size</th>
<th>Care</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poplar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sycamore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live Oak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flowering Peach/Cherry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Pepper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Oak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hackberry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afghan Pine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canary Island Pine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eucalyptus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Each tree species has an individual maintenance cost per tree that will be incurred for a one time pruning cycle. Whether the tree species is pruned annually, or every few years, this annual cost can be used to budget for reserve funding. The cost is shown as an annual cost per year to prune a specific species of tree at a mature size. This cost can be multiplied depending on the frequency of the pruning cycle. Table 9 shows the pruning frequency and cost of some of the most common trees found within Livermore’s LMD’s.
## Table 9. Annual Tree Pruning Cost per Species

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Pruning Frequency</th>
<th>Annual Cost Per Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poplar</td>
<td>Annual</td>
<td>$55</td>
</tr>
<tr>
<td>Sycamore</td>
<td>3 years</td>
<td>$35</td>
</tr>
<tr>
<td>Live Oak</td>
<td>3 years</td>
<td>$41</td>
</tr>
<tr>
<td>Flowering Peach/Cherry/Pear</td>
<td>2-3 years</td>
<td>$15</td>
</tr>
<tr>
<td>California Pepper</td>
<td>Annual</td>
<td>$42</td>
</tr>
<tr>
<td>Linden</td>
<td>3 years</td>
<td>$38</td>
</tr>
<tr>
<td>Red Oak</td>
<td>2 years</td>
<td>$26</td>
</tr>
<tr>
<td>Hackberry</td>
<td>2 years</td>
<td>$18</td>
</tr>
<tr>
<td>Afghan Pine</td>
<td>As needed</td>
<td>$35</td>
</tr>
<tr>
<td>Canary Island Pine</td>
<td>As needed</td>
<td>$35</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>Annual</td>
<td>$180</td>
</tr>
<tr>
<td>Camphor</td>
<td>3 years</td>
<td>$35</td>
</tr>
<tr>
<td>Modesto Ash</td>
<td>2-3 years</td>
<td>$55</td>
</tr>
<tr>
<td>Southern Magnolia</td>
<td>3 years</td>
<td>$35</td>
</tr>
<tr>
<td>Pistache</td>
<td>3 years</td>
<td>$30</td>
</tr>
<tr>
<td>Sweetgum/Liquidamber</td>
<td>3 years</td>
<td>$35</td>
</tr>
<tr>
<td>Zelkova</td>
<td>3 years</td>
<td>$35</td>
</tr>
</tbody>
</table>
Shrubs and Groundcover

Shrubs and groundcover are not necessarily considered a capital expense unless large areas are at maturity and need to be considered for renovation or replacement. Short lived shrubs that should either be removed or replaced should receive some reserve funding allocations.

Most landscape shrubs have an average life expectancy from 10-20 years. Beyond that, the plant material begins to be very dated and the design has usually lost its appeal. Table 10 shows the most common shrubs that are found in Livermore’s LMD’s, as well as their average life expectancy.
Table 10. Landscape Shrub Life Expectancy

<table>
<thead>
<tr>
<th>Shrub Species</th>
<th>Life Expectancy (In Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosemary</td>
<td>7-10</td>
</tr>
<tr>
<td>Cotoneaster</td>
<td>8-10</td>
</tr>
<tr>
<td>Coprosma</td>
<td>10</td>
</tr>
<tr>
<td>Hypericum</td>
<td>2-3</td>
</tr>
<tr>
<td>Snow-in-Summer</td>
<td>2-3</td>
</tr>
<tr>
<td>Little Sur Manzanita</td>
<td>10</td>
</tr>
<tr>
<td>Dwarf Coyote bush</td>
<td>5-7</td>
</tr>
<tr>
<td>Rockrose</td>
<td>3-5</td>
</tr>
<tr>
<td>Coleonema (Breath of Heaven)</td>
<td>5-7</td>
</tr>
<tr>
<td>Cotoneaster ‘Red Clusterberry’</td>
<td>10-15</td>
</tr>
<tr>
<td>Toyon</td>
<td>15-20</td>
</tr>
<tr>
<td>New Zealand Tea Tree</td>
<td>10-15</td>
</tr>
<tr>
<td>Pacific Wax Myrtle</td>
<td>15-20</td>
</tr>
<tr>
<td>Raphiolepis</td>
<td>10-15</td>
</tr>
<tr>
<td>Xylosma</td>
<td>20</td>
</tr>
<tr>
<td>Roses</td>
<td>10-12</td>
</tr>
</tbody>
</table>
Table 11 shows the average cost of replacement plant material. These prices are for installed plant material.

Table 11. Landscape Tree & Shrub Replacement Costs

<table>
<thead>
<tr>
<th>Size &amp; Cost Planted</th>
<th>Landscape</th>
<th>1 Gal</th>
<th>5 Gal</th>
<th>15 Gal</th>
<th>24” Box</th>
<th>36” Boxd</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landscape Plant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perennial Shrub</td>
<td>$11</td>
<td>$35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rose</td>
<td>2.5 Gal $25</td>
<td>$45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shade Tree</td>
<td></td>
<td></td>
<td>$110</td>
<td>$320</td>
<td>$600</td>
<td></td>
</tr>
</tbody>
</table>
Lawn

With normal maintenance, including aeration and fertilization, turf should be replaced every 8 – 10 years depending on foot traffic and use. Replacement cost for turf is approximately $1.10 per square foot.
Meadow Grass / Red Fescue:

Although it is known as a ‘no mow’, fescue should be mowed down at least every other year to prevent the build up of the thatch layer that prevents water and fertilizer from penetrating to the root zone. These large clumps become hazardous to maintenance personnel walking through the area, and also become a refuge for rodent pests. Estimated renovation cost per square foot is $0.50
Lighting & Other Site Furnishings

Light fixtures are normally reserve fund items that require periodic replacement rather than extensive repairs or maintenance. The appearance of rusted, broken or otherwise decrepit fixtures will dictate the replacement and thus reserve funding needs to be allocated for such.

Other site furnishings such as benches and trash receptacles are items that constantly attract vandalism, so reserve funding is necessary for replacement.
Masonry Wall

The masonry wall repair funding needs to be adequate to replace one or two segments, since these walls at some point in their life will have a car crash into them if they are located along a traffic way. Graffiti removal and painting are another large cost in keeping these structures well maintained. Costs can range from a few hundred dollars to paint over graffiti, up to tens of thousands of dollars for section replacement.
Entrance Sign Repairs

Entrance signs are a high profile feature found in most LMD districts. They can be stand alone structures or lettering found on the sound wall near the entrance street. These structures are targets for vandalism which can create costly repairs. Reserve funding should be allocated for renovations. Cleaning and painting are common renovation tasks that can be in the $1,000 - $2,500 range.
Playground Equipment

The LMD zones that do have playground equipment need to have a reserve fund that can support the cost of component repairs and eventual replacement. The useful life should be over 20 years, but during that time large components may need replacement, with an average cost of $2,500 - $3,500 for a slide or platform component.
Calculating the Reserve Fund

Once you have all the components inventoried and their remaining useful life established, you can allocate cost estimates for that component. By adding all these sums together, you then have your reserve fund.

One of the ways to calculate the desired balance is by utilizing the following formula:

\[
\text{Desired Balance} = \left( \frac{\text{Current Cost}}{\text{Useful Life}} \right) \times (\text{Current Life})
\]

Example

\[\$20,000 = \left( \frac{\$100,000}{10 \text{ years}} \right) \times (2 \text{ years})\]

Reserve Funding Levels

The LMD program for the City of Livermore is moving toward a full funding level model where each LMD will be analyzed following the established policy to determine the required reserve. There are four basic funding levels that currently exist in the LMD program.

1. Full Funding - Reserve fund is fully funded for future replacement according to the reserve fund study report.

2. Baseline Funding - This level of funding is set at a break even level for the annual maintenance expenses. This level of funding leaves the zone with no reserves to cover unexpected expenses.

3. Under Funded - This level of funding is applied to the LMD zones that do not bring in enough revenue to cover the annual maintenance cost. These zones continue to
run the operating budget in the negative unless revenues are increased or service levels are reduced.

4. Threshold Funding - This method has been used loosely in the LMD program in setting a particular percentage of reserve throughout all the zones. The recommended minimum threshold is ten percent of the annual budget. This method can produce excess or even deficient levels of reserve, because it does not account for site specific anomalies.

Using the fully funded reserve method requires that all the components be computed together for a total replacement fund balance.

**Summary**

In summary, it is important that the format of the reserve study and some of the highlighted material is covered. The following sections and topics should be included:

**Executive Summary** - provides the general information about the LMD and summarizes the findings of the study. Percent funded and recommend reserve contributions are included in the summary.

**Component Summary** - List of all the components and their details in tabular form.

**Funding Plans** - Lists theoretical fully funded balance for the next 10, 20 and 30 years. Also lists theoretical annual contribution, projected year-end balance, and percent funded for the current, recommended, and threshold funding plans.

**Annual Expenses** - Lists projected annual expenses for each component over the next 10, 20 and 30 year intervals.
Component Details - Provides detailed information on each component.

Contingency - An Allowance for miscellaneous components or unpredictable expenses. Usually 5% of total cost unless otherwise justified.

Current Budgeted Reserve Assessment - Amount Currently being deposited into reserve account.

Depreciation This Year - Amount that should be saved for component during current year. Provided for each component and summed for all components.

Full Funded Balance - The total depreciation over the life of the component. In other words, the amount that should have been saved during the life of the component. Provided for each component and summed for all components.

Normal Useful Life - Typical useable life for a component.

Percent Funded - The percentage of the fully funded balance that the LMD has in reserve fund.

Projected Balance - Projected balance at fiscal year end with current funding plan. Calculated using current reserve balance, remaining contributions to reserves before year end, and planned expenses before year end.

Recommended Reserve Contribution - Recommended amount that the LMD should allocate into reserves.

Remaining Life - Expected remaining useable life of component.

Replacement Year - Year that component is projected to be replaced or repaired.

Useful Life - Time in years component is expected to last.
Finally, Table 12 is a worksheet that can be used in the field to collect information on the various components that are included in a reserve fund study.

Table 12. Asset Inventory Worksheet

<table>
<thead>
<tr>
<th>Component Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property address/location:</td>
</tr>
<tr>
<td>Date:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Irrigation: List Irrigation Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
</tr>
<tr>
<td>Type / Manufacturer:</td>
</tr>
<tr>
<td>Approx Age/Installation date:</td>
</tr>
<tr>
<td>Estimated Remaining Useful:</td>
</tr>
<tr>
<td>Notes/Comments:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hardscape: List Sidewalk, Benches, or other Hardscape structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
</tr>
<tr>
<td>Quantity/Type / Manufacturer:</td>
</tr>
<tr>
<td>Approx Age/Installation date:</td>
</tr>
<tr>
<td>Estimated Remaining Useful:</td>
</tr>
<tr>
<td>Notes/Comments:</td>
</tr>
<tr>
<td>Est. Replacement $</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landscape: List Trees or Shrub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botanical / Common name</td>
</tr>
<tr>
<td>Quantity:</td>
</tr>
<tr>
<td>Approx Age/Installation date:</td>
</tr>
<tr>
<td>Estimated Remaining Useful:</td>
</tr>
<tr>
<td>Notes/Comments:</td>
</tr>
<tr>
<td>Est. Replacement $</td>
</tr>
</tbody>
</table>
Dunsmuir Zone Pilot Reserve Study Results

Asset Inventory

The MMP framework was applied to the Dunsmuir LMD zone as a trial. The various components within the zone have been inventoried, and a ten year reserve fund budget was created from the collected data.

Table 13 shows the asset inventory for the Dunsmuir LMD zone. All of the major components in the landscape which require future replacement funding have been included.

Table 13. Master List of Reserve Study Components for the Dunsmuir LMD

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Useful life</th>
<th>Remaining useful life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation pump</td>
<td>6</td>
<td>30 yrs</td>
<td>20 yrs</td>
</tr>
<tr>
<td>Backflow</td>
<td>15</td>
<td>20 yrs</td>
<td>5 – 15 yrs</td>
</tr>
<tr>
<td>Master Valve</td>
<td>16</td>
<td>15 yrs</td>
<td>5 – 15 yrs</td>
</tr>
<tr>
<td>Controllers</td>
<td>16</td>
<td>15 yrs</td>
<td>3 – 15 yrs</td>
</tr>
<tr>
<td>Remote Control</td>
<td>444</td>
<td>10 yrs</td>
<td>1 – 10 yrs</td>
</tr>
<tr>
<td>Valves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td>1069</td>
<td>Varies</td>
<td></td>
</tr>
<tr>
<td>Shrubs / Groundcover</td>
<td>429,000 sq. ft</td>
<td>Varies</td>
<td></td>
</tr>
<tr>
<td>Lawn</td>
<td>11,400 sq. ft</td>
<td>10 yrs</td>
<td>4 yrs</td>
</tr>
</tbody>
</table>
Component Review

Irrigation

Pumps: Six Watertronics pumps are located throughout the site. The oldest two are located at East Ave., Charlotte Way entrance. They are approximately 9 to 10 years old. The rest of the pumps are relatively new and range in age from two to five years. The expected normal life span of a pump is approximately 20 - 30 years. Estimated cost for replacement of a pump would be $30,000.00.

Backflow: There are fifteen backflow prevention devices on the site. There are five 2" Febco 825Y and two 2" Wilkins. The remaining are 1" Febco 825Y. All are in good condition, with insulated covering for frost protection. The expected normal life span of a backflow device is 20 years. Estimated cost for replacement with similar would be 2" = $2,000.00, and 1" = $1,200.00.

Master Valve & Flow Sensor: Each Controller has a Master Valve and Flow sensor. All were in very good condition with boxes clearly marked. The expected normal life span of a Master Valve and flow sensor is approximately 10 - 15 years. Estimated replacement cost would run approximately $450.00.

Controllers: All controllers are Rainmaster Evolution DX2. The majority of them are in very good condition. The estimated useful life for this controller is 10-15 years. Average cost for replacement of same controller would be $3,100.00. Table 14 lists all the controller locations and how many stations are part of the irrigation system.
Table 14. List of Irrigation Controllers for Dunsmuir LMD

<table>
<thead>
<tr>
<th>Controller Address</th>
<th>Active Stations</th>
<th>.75”</th>
<th>1”</th>
<th>1.25”</th>
<th>1.5”</th>
</tr>
</thead>
<tbody>
<tr>
<td>227.00</td>
<td>36</td>
<td>3</td>
<td>7</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>228.00</td>
<td>38</td>
<td>5</td>
<td>24</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>230.00</td>
<td>30</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>230.01</td>
<td>27</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>229.00</td>
<td>48</td>
<td>3</td>
<td>13</td>
<td>13</td>
<td>19</td>
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<tr>
<td>144.00</td>
<td>8</td>
<td>8</td>
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</tr>
<tr>
<td>140.00</td>
<td>40</td>
<td>6</td>
<td>25</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>150.00</td>
<td>42</td>
<td>1</td>
<td>5</td>
<td>29</td>
<td>9</td>
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<td>145.00</td>
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<td>20</td>
<td>9</td>
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<tr>
<td>146.00</td>
<td>18</td>
<td>5</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>121.00</td>
<td>24</td>
<td>8</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td>444</td>
<td>23</td>
<td>105</td>
<td>202</td>
<td>114</td>
</tr>
</tbody>
</table>

Remote Control Valves: Valves are Rainbird EFB ranging in size from ¾” to 1½”. All appear to be in good, to brand new, condition, and are enclosed in valve boxes below ground. The expected normal life span for this type of valve is 10 – 15 years.

Estimated cost for valve replacement would range from $325.00 – $450.00.
Irrigation heads: Head replacement is an ongoing yearly maintenance cost. Irrigation heads on the site are either Hunter I-20’s rotors or Rainbird 1800 popup sprinklers. Because of the varied locations of the heads, normal useful lifespan can range from 3 to 7 years. Heads in turf areas are more likely to have a shorter life expectancy compared to those in shrub/groundcover areas. Estimated cost for replacements for Rainbird 1800 series = $30.00 – 40.00; Rainbird 1400 bubbler = $18.00; and Hunter I-20 = $60.00.

Trees:

Trees are included as a capital expense only if there are numerous hazards, tree failures or known health issues that will require the removal and replacement of a large number of trees over a certain time period. In all other cases, tree pruning and maintenance should be considered a yearly maintenance cost. The majority of the trees on the site are young to newly-planted, with the exception of the Poplars at the East Avenue entrance, which are mature. The trees are all in good health with no noticeable disease or pest problems at the time of inspection, and have, therefore, not been considered a capital expense. Tree count is broken down as follows, with any pruning or health care recommendations included.

Poplars: 24 total; overall good health with some large surface roots. Recommendation would be to prune out deadwood every 2-3 years. Estimated pruning cost per tree = $55.00.
Sycamore: 208 total; all appeared to be in good health with no apparent pest or disease problems. Recommend pruning on 3 year cycle to remove dead wood and clear lights and signs. Estimated pruning cost per tree $35.00.

Live Oak: 194 total; with one dead oak located just south of Carnegie loop on Charlotte Way. Replacement cost for 24” box is approximately $400.00. The rest of the trees all appear in good health with no disease or pest problems. Recommend pruning only on an as needed basis to remove dead, damaged or broken limbs. Estimated pruning cost per tree = $41.00.

Flowering Peach / Cherry: 59 total; these are planted in the street medians and appear to be generally in good health with no pest or disease problems at time of inspection. Recommendation for a fall fertilization and yearly pruning to encourage bloom. Estimated pruning cost per tree = $28.00, Fertilization cost per tree = $8.00.

California Pepper: 136 total; these trees range from very young to almost mature. All appear to be thriving with no disease or pest problems. Recommend yearly light pruning to remove dead/damaged wood and clearance for walkways as needed. Estimated pruning cost per tree = $42.00.

Linden: 93 total; all appeared to be in good health with no apparent pest or disease problems. Recommend pruning on 3 year cycle to remove dead wood and clear lights and signs. Estimated pruning cost per tree = $38.00.

Red Oak: 196 total; all appear to be in good health with no apparent pest or disease problems. Recommend pruning on a 2 year cycle to remove dead/damaged wood and sidewalk clearance. Estimated pruning cost per tree = $26.00.
Hackberry: 127 total; all appear to be in good health with no apparent pest or disease problems, although they are prone to Wooly Aphid and White Fly infestation in spring and summer. Recommend pruning on a 2 year cycle to remove dead/damaged wood and sidewalk clearance. Estimated pruning cost per tree = $38.00. Recommend Merit soil drench for insect control at $18.00 per tree.

Afghan Pine: 9 total; all appear to be in good health with no apparent pest or disease problems. Prune only as needed to remove dead or damaged wood.

Canary Island Pine: 18 total; all appear to be in good health with no apparent pest or disease problems. Prune only as needed to remove dead or damaged wood.

Eucalyptus: 5 total; one located south of Maybeck Lane appears to be failing. Recommend removing and replacing with a more suitable tree such as Linden or Hackberry. The rest are on the perimeter of property and appear to be in good condition. Recommend 2 year pruning cycle to remove dead/damaged wood and reduce canopy sail to prevent limb breakage during windy periods. Estimated pruning cost per tree = $180.00. Estimated replacement cost with Hackberry for 24” box is approximately $400.00.

The Dunsmuir LMD has a total of 1069 trees as shown in Table 15. These trees are pruned according to their recommended pruning cycles from between three to five years.
Table 15. Total Tree Inventory Chart for Dunsmuir LMD

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poplar</td>
<td>24</td>
</tr>
<tr>
<td>Sycamore</td>
<td>208</td>
</tr>
<tr>
<td>Live Oak</td>
<td>194</td>
</tr>
<tr>
<td>Flowering Peach/Cherry</td>
<td>59</td>
</tr>
<tr>
<td>California Pepper</td>
<td>136</td>
</tr>
<tr>
<td>Linden</td>
<td>93</td>
</tr>
<tr>
<td>Red Oak</td>
<td>196</td>
</tr>
<tr>
<td>Hackberry</td>
<td>127</td>
</tr>
<tr>
<td>Afghan Pine</td>
<td>9</td>
</tr>
<tr>
<td>Canary Island Pine</td>
<td>18</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>1069</td>
</tr>
</tbody>
</table>

The species breakdown for the Dunsmuir LMD are shown in Figure 3. The zone has a large percentage of Sycamore trees, with 19 percent of the population. The Sycamore tree is a tree that requires pruning every three years.
Shrubs and Groundcover:

Shrubs and groundcover are not necessarily considered a Capital expense, unless large areas are at maturity and need to be considered for renovation or replacement. There is approximately 429,000 square feet of groundcover and shrub beds throughout the site.

Shrubs

Most of the shrubs on the site are in fairly good condition, with a few species that have reached maturity and are starting to decline. These are relatively short lived shrubs that should either be removed or replaced, or removed and let surrounding shrubs fill in.
Shrub condition varies from species to species. Several of the shrubs are relatively short lived, temperamental shrubs, but the majority of the shrubs are in good condition or thriving.

**Rockrose**: This is a short lived flowering shrub. Estimated life span is 3-5 years. Estimated Replacement cost for 5-gallon is $35.00. There are relatively few of these in the shrub beds mainly at the entrances to tracts.

**Coleonema (Breath of Heaven)**: Short lived flowering shrub, does not do well if sheared or hedged. Estimated life span from 5-7 years if left alone, shorter if sheared. There are a few of these throughout the site. Replacement cost for 5-gallon is $35.00.

**Cotoneaster ‘Red Clusterberry’**: Usually a long lived shrub with normal maintenance practices and proper irrigation. In most areas this shrub is thriving. The estimated normal life span is 10+ years.

**Toyon**: Toyon throughout the site is thriving. To prolong its life it should not be sheared and only pruned naturally to maintain size and form. Expected life span is from 15-20 years.

**New Zealand Tea Tree**: Should be a long lived flowering shrub, but life is shortened by hard pruning and over irrigation. With normal maintenance practices expected life span is 12-15 years.

**Pacific Wax Myrtle**: Myrtle throughout the site is thriving. Pruning should be done only to reduce height and spread and not sheared. Expected life span is from 15-20 years. Will occasionally be infested with aphids but usually not a major problem. It appears that a few have been removed or died and should be replaced. Estimated replacement cost for 5-gallon is $35.00
Raphiolepis: Many of the older shrubs observed appeared to be struggling or failing, perhaps due to competition from surrounding plants and age. With normal maintenance practice the expected life span is 10 years. Estimated replacement cost for 5-gallon is $35.00

Xylosma: All the Xylosma on the site are thriving. This is a bullet-proof background shrub that can be sheared, hedged or pruned into a tree form. It is long lived: 20+ years with little or no pest problems.

Roses: Several varieties of roses are planted around the site. With proper maintenance practices and irrigation the expected life span in a commercial setting for a rose is 10-12 years. Roses are also susceptible to many pest and disease problems which can shorten their life span. Estimated replacement cost for 5-gallon is $42.00

Groundcovers

The groundcover over all appears to be in good condition, with the exception of a few species that are struggling or have failed altogether. These areas should be replanted with species that appear to be thriving on the site. Groundcover presently consists of:

Rosemary: This groundcover appears to be thriving throughout the community. With normal maintenance practice expected life span for Rosemary is from 7-10 years.

Cotoneaster: Usually a long lived groundcover with normal maintenance practices and proper irrigation. In most areas this groundcover is thriving, although there are areas where one or more plants have died out or been removed and not replaced. The estimated normal life span for Cotoneaster groundcover is from 8-12 years.
Coprosma: Usually a long lived groundcover with normal maintenance practices and proper irrigation. In most areas this groundcover is thriving. The estimated normal life span for Coprosma groundcover is about 10 years.

Hypericum: Most Hypericum on the site is doing well. There are a few islands where it appears to have died out and should be replanted. Estimated planting cost per one-gallon is $11.00.

Snow-in-Summer: One island of this groundcover was found at the entrance to Maybeck lane. This groundcover is very short lived and does not take well to any foot traffic. This island should be replanted with a different groundcover that is doing well in the site. Estimated planting cost per one-gallon is $11.00.

Little Sur Manzanita: Usually a long lived groundcover with normal maintenance practices and proper irrigation. In most areas this groundcover is thriving. The estimated normal life span for Manzanita groundcover is about 10 years. Estimated planting cost per one-gallon is $11.00.

Dwarf Coyote bush: In most areas this groundcover has been left to grow with no maintenance. This groundcover should be cut back on a yearly basis to encourage green succulent growth and prevent the center from becoming woody and barren. If properly maintained estimated life span should be from 5-7 years. Estimated planting cost per one-gallon is $11.00.

Lawn:

There is approximately 11,400 square feet of mowed turf throughout the site. Very few weeds were observed and overall fertility was good. With normal maintenance, including aeration and fertilization, turf should be replaced every 8-10 years, depending
on foot traffic and use. Most of the turf areas appeared to receive very little foot traffic and were in good condition. Replacement cost for turf is approximately $1.10 per square foot.

**Meadow Grass / Red Fescue:**

There is approximately 500,000 square feet of Meadow Grass site wide. An estimated 20 percent (about 100,000 sq. ft.) is in very bad condition and in need of complete renovation. These areas are spread throughout the site and have either completely failed, or are bare patches between grass, which is OK. Although it is known as a ‘no mow’, fescue should be mowed down at least every other year to prevent the build up of the thatch layer that prevents water and fertilizer from penetrating to the root zone. These large clumps become hazardous to maintenance personnel walking through the area, and also become a refuge for rodent pests. Estimated renovation cost per square foot is $0.50.

**Dunsmuir LMD 10-Year Reserve Budget**

Once all the necessary components for the reserve study have been inventoried, a ten year reserve budget can be developed. The inventoried components are given a value based on historical data and contractor costs. The components are also given an expected useful life estimate so that appropriate funding can be allocated for when the component is due for replacement. Table 16 shows the proposed ten year capital reserve budget for the Dunsmuir LMD zone.
Table 16. Dunsmuir LMD Reserve Budget

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
<th>Total Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Replacement</td>
<td>$30,000</td>
<td>$30,000</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>$30,000</td>
</tr>
<tr>
<td>Backflow Replacement</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>$4,000</td>
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<tr>
<td>Master Valve</td>
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<td>$450</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Remote Control Valves</td>
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<td>$3,500</td>
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<tr>
<td>Tree Pruning</td>
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<tr>
<td>Shrub Replacement</td>
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<td>$35,000</td>
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<tr>
<td>Lawn Renovation</td>
<td>$12,540</td>
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<td></td>
<td></td>
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<td>$12,540</td>
</tr>
<tr>
<td>Fescue Renovation</td>
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<td>$10,000</td>
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<td>$10,000</td>
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<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$90,000</td>
</tr>
<tr>
<td>Total Per Year</td>
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<td>$18,500</td>
<td>$26,950</td>
<td>$16,500</td>
<td>$41,040</td>
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<td>$26,500</td>
<td>$18,500</td>
<td>$26,950</td>
<td>$46,500</td>
<td>$192,940</td>
</tr>
</tbody>
</table>

Landscape Master Maintenance Schedule for Dunsmuir LMD

A LMMS was created for the Dunsmuir LMD as part of the Master Management Plan framework trial test. From utilizing the completed component inventory, and also utilizing staff work task data, an annual maintenance schedule was developed. Table 17 shows the annual work task data for the City of Livermore employees that performed maintenance activities in the Dunsmuir LMD for the 2007-2008 fiscal year.
Table 17. Dunsmuir Annual Work Task Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
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<tr>
<td>Dunsmuir</td>
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<td>44.00</td>
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<td>28.50</td>
<td>40.00</td>
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<td>25.00</td>
<td>30.00</td>
<td>60.00</td>
<td>27.00</td>
<td>55.00</td>
<td>668.50</td>
</tr>
</tbody>
</table>

This table shows that staff worked a total of 668.50 hours for the year. Now this data can be broken down on a monthly task chart that will show what tasks need to be performed at Dunsmuir for that particular month, and the appropriate level of staff that will be assigned to that duty. The previous year’s monthly task hour reports are referenced for a general idea on how much staff to assign to the maintenance task. Figure 4 shows the tasks and frequencies in a yearly calendar format, for a 6 month period.
The Master Maintenance Schedule can be utilized by supervisors and managers for allocating staff resources. The master schedule is also an important public document that can be distributed to the public for reference as to when maintenance will occur within the LMD. Now that the asset inventory has been completed for the Dunsmuir zone, and all the components have been compiled in a reserve budget, further analysis is warranted for this particular trial to test the validity of the MMP framework, and to formulate a budget figure for the completion of the reserve fund study for all the remaining LMD zones. This is the standard Plan, Do, Check, Act (PDCA) cycle for continuous process improvement used by most of today’s industries.
Dunsmuir Trial Study Budget Analysis

Upon the completion of the Dunsmuir trial reserve study, a budget number for a ten-year reserve budget was determined. This number was developed from the tabulation of all the reserve study components that were collected by the field surveys. This compilation of physical assets was specifically selected for inclusion in the study because they matched the criteria of a reserve funded component. These particular components in the LMD have a useful life, and serve as a needed or desired infrastructure asset within the LMD zone.

As shown in Table 16, the total reserve fund budget required for the ten year period is $192,940, just for Dunsmuir.

Dunsmuir is a zone of 843,364 square feet of landscaping. This equates to over 20 acres of landscaping consisting of mowable turf areas, native fescue grass areas and shrub plantings. The zone has 530 properties that are assessed an annual LMD tax which funds the yearly landscape maintenance budget. This annual budget for maintenance is currently $426,678. The current revenue in the Dunsmuir zone is $311,110 for the 2009 budget year. The Current assessment for each of the 530 properties within the zone is $587 a year for 2009. The Dunsmuir zone for the 2009 budget year is projected to have a $115,568 budget shortfall. Currently the Dunsmuir zone has a reserve of $300,000 which is what the zone is using to make up the annual budget shortfall. However, this reserve is not sustainable with the current assessment level and with component replacements looming in the near future. At the current assessment of $587 per parcel the zone will reach a negative budget reserve by 2012. If the assessment is not increased, the annual
maintenance budget will exceed its revenue by over $100,000 per year, which puts the zone in an unsustainable budget situation.

The assessment can be raised to a maximum of $769 per parcel annual without a majority vote. This would be annual revenue of $407,570 which is still under the current expense budget for the zone which is $426,678. In order for the zone to match its current revenue, minus expenses, the annual assessment would need to increase to $805 per year. This would be a $36 dollar a year increase beyond the $769 maximum “no vote” amount just to have a break even annual maintenance budget. This does not even factor in the needed reserve funding for the ten year component replacement.

The ten year reserve fund is estimated to be $200,000 (based on $192,940 pilot). This equals a $20,000 a year increase to the annual budget, which would be saved for the component replacement. This $20,000 a year would increase the annual budget to about $446,000. This would raise the assessment to $842.00 per parcel per year. This is an increase of $255 from the current assessment. This is a conservative estimate with no increase in maintenance costs and no inflationary cost increases.

The cost to accomplish the trial reserve study for the Dunsmuir zone is calculated by taking the total number of staff hours and multiplying that number by the established staff rate of $75 dollars an hour. A total of 62 personnel hours were applied to gathering the inventory data and compiling it into a report form. Staff time in the field consisted of 28 hours performing site observations, a total of 45% of the total time. The remaining 34 hours, or 54% of the total time, was utilized in compiling the data into a usable report form. The $75 dollars an hour cost is multiplied by the total number of staff hours
utilized on the Dunsmuir trial for a total cost of $4,650. This cost can be further analyzed by obtaining a cost per square foot to perform a reserve study.

To obtain a cost per square foot to perform the required reserve study, the total cost of $4,650 is divided by the total amount of landscape square footage within the Dunsmuir LMD. The zone has a total of 843,364 square feet of landscape. The cost per square foot of landscaping to perform similar reserve studies across the LMD program is therefore $0.005 per square foot of landscaping.

**Estimated Cost for Complete LMD Program Reserve Study**

The cost to complete the reserve study for all the remaining zones within the LMD program is calculated by taking the total square feet of landscaping within the entire program and multiplying it by the cost per square foot of $0.005. The LMD program in the City of Livermore has a total of 5,109,815 square feet of landscaping. Subtracting the 843,364 square feet of landscaping for the Dunsmuir LMD out of the equation will provide for an estimated total cost to finish the entire reserve study for all the remaining districts. After subtracting the Dunsmuir zone square footage the program has a remaining 4,266,451 square footage which is multiplied by $0.005 for a program total of $21,332.25. This equates to 7 tenths of one percent of the total LMD program budget which is $2,915,165 annually. However, each zone has its own unique landscaping, some having more assets which would be included in a reserve study, thus those zones may have a higher cost per square foot to do the study. Also many zones are currently operating at an annual budget shortfall, or breakeven every year, and thus the
unexpected cost of the reserve study may push those zones into the red. This is a policy decision that must be discussed further with the various stakeholders.

Assuming that the Dunsmuir zone gave an average representation of the time required to complete a detailed reserve study, the staff hours required to complete the study for the remaining zones would be 350 hours of staff time. This was derived by taking the 62 hours required for the Dunsmuir zone and applying that average hour rate toward the remaining square footage. There is also some time included in the 350 hours to finalize a report which would be presented to the City council upon completion of the entire reserve study project. This brings the total cost of the reserve study for the LMD to $26,250, of which $4,918 is absorbed by the administrative overhead that is applied to all the LMD zones.

A rough order of magnitude calculation for the total LMD landscaping budget including these reserve estimates would be:

\[
\frac{446K}{843K \text{ sq ft}} = \$0.53/\text{sq ft}; \text{ times } 5.1 \text{ M sq ft in Livermore LMD} = \$2.7M/\text{yr}
\]

The results of the Dunsmuir Inventory and Data Analysis Projections are shown in Figure 5, an annotated version of the original process flow chart used to describe the methodology of this project.
Develop Reserve Fund Study Framework

Implement Frameworks On Dunsmuir Pilot

Outline Master Plan Framework For LMD Program

Dunsmuir Reserve Fund:
- 10-Year Fund Req'd $200K
- Current Plan $0
- Need Conservatively $20K/yr
- All LMD Reserve: $121K/yr

LMD Program Fiscal & Operational Analysis

All Livermore LMD = 5.1M sq ft

Cost to Complete Inventory on Remaining 4.26M sq ft = $21.3K
Estimated 350 m-hours including admin
Total Cost: $26,250

Annual Maint Budget with Reserve Fund:
$2,702,246/yr

Define Maintenance Activities

Establish Service Levels

Create Asset Inventory Framework

Define Maintenance Activities

Create Asset Inventory Framework

Figure 5. LMD Master Management Plan Process Results Flow Chart
Chapter 5

DISCUSSION

The first purpose of this project was to develop a framework to apply to the development of a Master Management Plan for the Landscape Maintenance Section at the City of Livermore. Once the framework was established for the MMP, the principles were applied to one specific Landscape Maintenance District. The Dunsmuir district was used as a pilot project to see how workable the framework was. A comprehensive asset inventory, maintenance schedule and reserve fund study was produced for the Dunsmuir zone.

After completing the Dunsmuir LMD trial, the framework for the asset inventory proved to work as designed. Once the data is captured in the established database, it is very usable for various resources allocation decisions. The most apparent conclusion from this study is that to complete the inventory for all the LMD zones the Landscape Section would need an additional 350 staff hours. During the current staffing crunch that many agencies are experiencing, this is a difficult resource to come by. It may be easier to build this cost into a contract for service contract that can be allocated to each zone according to its size.

A Master Landscape Maintenance Schedule was completed for the Dunsmuir zone, which is one of the largest zones in the entire LMD program. From the results of the trial, it was found that this was useful information to have, since it would serve as a day-to-day reference for operations staff and administrative staff in responding to customer inquires. However, this schedule takes a large amount of time to develop and
fine tune to make it useful. There are so many variables in the landscape that what is shown on the schedule may not be what the landscape needs for that particular month or season. When staff are pulled off the schedule to respond to special service requests, there is such a cascading effect on the annual schedule that it becomes mostly a reference document.

The reserve fund study framework was tested during the Dunsmuir LMD trial. From this trial a few conclusions were drawn. One of the most apparent conclusions for the Landscape Sections management teams is that it is impossible for the section to complete the study for the entire LMD program with the current staffing level. To complete this project, the section would need a full-time employee working solely on this project for a minimum of 9 weeks. This may be accomplished by hiring an intern to work specifically on the project, but during these tight budget times, many agencies, including Livermore, have mandatory hiring freezes. The City of Livermore has recently cut back or eliminated much of the part-time employee budgets. From this analysis, and considering current budget constraints, the most feasible way to complete the study is to hire a consultant to work with staff in gathering the needed asset inventory data. Also, consultants have expertise in formulating detailed budget reports. Another benefit of using a consultant is that it could provide a third party perspective to the project. This also can protect the agency from a liability standpoint, since a large portion of the liability is transferred through the professional consultant agreement.
Another conclusion, that has been developed from this LMD MMP process, is the realization that the agency’s resources may be better utilized with a reorganization of responsibilities. Over the next five years, the Landscape Maintenance Section should evolve into more of a coordination and specialization work force. The meaning of this is that with the increased cost and inefficiencies that come with employing public agency maintenance staff, the City is better served by accomplishing landscape maintenance in other ways. The orientation of the staff will need to evolve into more of a coordination and management role, with contractors performing the routine scheduled landscape maintenance services. The contractors will handle all the mowing, trimming, blowing, litter and debris removal, while City staff concentrate their efforts on irrigation management and overall asset management functions. The City would also have a crew that works on special projects and unscheduled emergencies. With this organization structure, the Landscape Section will spend less time organizing and scheduling large work crews, and focus on the overall quality and aesthetics of the landscape.

During tight economic times like we are facing today, the elected officials and the citizens are looking for the most efficient and economical solutions to the services we provide. Just as people in their home lives are looking for ways to reduce their costs, whether it is driving less or purchasing lower-cost brands at the store, public agencies may have to consider giving up some effectiveness to stay within budget for the public good. By moving towards a more contract maintenance service we may lose some effectiveness because the City does not have the number of staff to assign to a particular request, but, in the end, the routine landscape maintenance tasks can successfully be
transferred wholly to a contract model. The LMD program has been the City of Livermore’s roller coaster ride in operations management and policy. The City went from contracting out the landscape maintenance for the LMD program to taking the program completely in house, and then, as fiscal burdens of an all-City staff model mounted, a shift toward a blended approach was adopted. To illustrate this new operational model, Figure 6 shows a visual description of this new organization.

Initially, this project set out to create a Master Maintenance Plan for the Landscape Maintenance Section in the City of Livermore. It evolved into a framework for the development of such a plan and a pilot project to assess the frameworks viability. An asset inventory tool and a master maintenance schedule framework was developed. These were used to gather data in the pilot project. A reserve fund policy was created which was implemented in the pilot area. As subject literature was reviewed and the framework for the master plan was developing, there was a realization that master plans can be overwhelming and almost too broad to really help the manager with real day-to-day decisions. Master plans are by no means a catch-all for the organization’s daily challenges. The time and resources required in developing a strategic or master plan is significant. Future planning is important for the organization to stay on course, and the master plan can help define that course. But, when it comes to the daily decision making each manger is faced with, it is proven that the events that affect an organization are too random and dynamic to be readily accounted for in the master plan. With that, the master plan framework will be used as a starting point and a guideline in future decision making. The principles learned in developing the master plan framework are some of the most
valuable aspects to its creation, since one has to think about many of the current and future aspects related to the operation.

Through all the inventorying, scheduling and reserve funding planning, it is clear that, for the manger in the pilot’s seat of the LMD program, there is always going to be dynamic decision making that goes on. The master plan framework will act as the guide for which it was created, and the fires of the day will be quenched by those brave enough to face the challenge known in Livermore as the “LMD program”.
Figure 6. LMD Operational Organization Chart
### APPENDIX A

<table>
<thead>
<tr>
<th>Maintenance Task &amp; Description</th>
<th>Full Maintenance Standard</th>
</tr>
</thead>
</table>
| **Hardscape Features:** Concrete & pavement sidewalks, decomposed granite trailways.  
  - Blow debris  
  - Rake debris  
  - Pressure wash stains  
  - Edge  
  - Vacuum  
  - Resurface as needed  
  - Graffiti removal  
  - Weed control  
  - Litter pickup | 1. Perimeter has a maintained straight edge.  
  2. Area is litter free.  
  3. Weed free  
  4. Soil free  
  5. No standing water  
  6. Level surface  
  7. Graffiti free  
  8. Landscape edging is flush with grade |
| **Irrigation System:** This includes central controllers, Master valves, Flow sensors, sprinkler heads, and quick couplers.  
  - Test for coverage  
  - Program for maximum efficiency  
  - Inspect plant material for health  
  - Replace outdated and inefficient parts  
  - Repair leaks  
  - Winter protection | 1. Turf is irrigated around mow schedule.  
  2. Utilize most efficient ET rates.  
  3. Controllers are replaced with ET based smart controllers.  
  4. Irrigation supplies are stocked.  
  5. Yearly irrigation training.  
  6. Zones are renovated for appropriate plant health |
<table>
<thead>
<tr>
<th>Task &amp; Description</th>
<th>Full Maintenance Standard</th>
</tr>
</thead>
</table>
| **Turf**<br>Areas with mowable grass.  
  - Ridging mower  
  - Hand mower  
  - Spray tree wells  
  - Fertilize  
  - Broadleaf weed control  
  - Aerate  
  - Overseed | 1. Turf is green.  
2. Height is less than 3”.  
3. Turf is thick and resilient.  
4. Turf is free of broadleaf weeds.  
5. Eliminate rodents and their tailings. |
| **Tree and Shrub**<br>Includes trees and shrubs found in landscaped areas  
  - Prune trees  
  - Prune shrubs  
  - Dead head flowers  
  - Remove dead trees  
  - Remove dead shrubs  
  - Remove flowers  
  - Plant trees  
  - Plant shrubs  
  - Plant flowers  
  - Maintain tree wells | 1. Mature deciduous tree canopies maintained at a height of 8-10 feet.  
2. Evergreen tree canopies when possible can reach grade height.  
3. Trees planted 10 feet in from any edge when possible.  
4. Dead trees promptly removed.  
5. Maximize tree health.  
6. Root barriers used for trees planted next to concrete.  
7. Walkways are free of plant material.  
8. Shrubs maintained in a natural habit. |
<table>
<thead>
<tr>
<th>Maintenance Task &amp; Description</th>
<th>Full Maintenance Standard</th>
</tr>
</thead>
</table>
| **Site Infrastructure:**  
Site furnishings such as lighting, electrical outlets, bollards, benches, fences and gates.  
- Repair damaged fencing  
- Test and repair electrical outlets  
- Maintain light fixtures  
- Bollards inspected  
- Benches inspected | 1. Light fixtures are repaired and functioning at the desired time.  
2. Bollards are functioning and have locks.  
3. Benches are painted or replaced  
4. Fencing is painted or replaced  
5. Electrical outlets are functioning. |
| **General Maintenance:**  
These tasks apply to all City areas including parks, roadways, sidewalks and vacant lots.  
- Litter pick up  
- Graffiti removal  
- Trash can service  
- Painting structures  
- Playground inspections | 1. Garbage cans are clean and routinely emptied.  
2. Areas are litter free.  
3. Picnic tables are clean.  
4. All sight furniture is clean and graffiti free.  
5. Painted structures have fresh paint. |
APPENDIX B

CITY OF LIVERMORE
MAINTENANCE DISTRICT NO. 841
Vineyard Gates I

FY 07/08 ESTIMATE OF COSTS

<table>
<thead>
<tr>
<th>Direct Costs</th>
<th>Annual Quantity</th>
<th>Unit Cost</th>
<th>Annual Cost Estimate</th>
<th>Category Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel Costs</td>
<td></td>
<td></td>
<td>$31,880.00</td>
<td></td>
</tr>
<tr>
<td>Irrigation Water</td>
<td>149,839 SF</td>
<td>$0.1 per SF</td>
<td>$14,983.90</td>
<td></td>
</tr>
<tr>
<td>Maintenance Materials</td>
<td></td>
<td></td>
<td>$1,200.00</td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
<td></td>
<td>$150.00</td>
<td></td>
</tr>
<tr>
<td>Equipment Maintenance &amp; Operation</td>
<td></td>
<td></td>
<td>$1,793.62</td>
<td></td>
</tr>
<tr>
<td>Equipment Purchase Repayment</td>
<td>149,839 SF</td>
<td>$0.0094 per SF</td>
<td>$1,408.49</td>
<td></td>
</tr>
</tbody>
</table>

Subtotal: $51,416.01

Indirect Costs

<table>
<thead>
<tr>
<th>Indirect Costs</th>
<th>10% of Direct Costs</th>
<th>$5,141.60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alameda County Charge</td>
<td>1.7% of Assessment Revenue</td>
<td>$784.55</td>
</tr>
</tbody>
</table>

Subtotal: $5,926.15

Total cost of maintenance: $57,342.16

If Enduring Cap is NOT approved:

Proposed 07/08 Assessment is $658.62 per unit.

Total Revenue (07/08 Assessment x No. of Units) | ($658.62 x 69) | $45,444.78

Net Change | $-11,897.38

Estimated fund balance as of June 30, 2007 | $-8,100.78
REFERENCES


