

# **City of Elk Grove Urban Forest Canopy Assessment**



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Special thanks to the City Manager, John Danielson, his dedicated staff, and the leadership of the City of Elk Grove's City Council, most notably Greenprint champions Mayor Rick Soares and Vice Mayor Sophia Scherman. Their support for this project has provided information on the value of Elk Grove's urban forest and the many benefits it provides the community.

NOTE: This draft report relied on data obtained from other organizations and has not been subjected to the peer-review process.

### *Mission*

To build the best urban forest for the Sacramento region.



## Executive Summary

The City of Elk Grove's City Council signed on to the Greenprint in May of 2005. In doing so, the City joined in partnership with the Sacramento Tree Foundation to determine the existing street tree canopy, a 40-year canopy goal, and a plan through which to reach this goal. Volunteers from throughout the region were recruited and trained to collect street tree data from a random three percent sample of the City's streets.

Canopy cover can be described as the percent or amount of ground covered by trees, as seen from above in an airplane or on aerial photography. Overall, the street trees in Elk Grove (both public and private) are distributed over the following land uses: 76.7% are in single family residential; 15.5% are in parks, medians, or vacant land; 3.3% are in multi-family residential; 2.4% are in small commercial; and 2.1% are in industrial and large commercial.

This assessment found that Elk Grove has 22.88 percent canopy cover over the City's streets and sidewalks. Since Elk Grove has recently experienced a lot of development, the City's urban forest is fairly young; and most street trees are located in residential areas. The urban forest species population is diverse, with only one species comprising more than 10% of the population, and it appears to be in very good condition. According to the data collected, over 76% of the street trees are in good condition, with no apparent problems.

This young healthy canopy cover, and the shade it provides Elk Grove's streets and sidewalks, also has a great deal of value in the services it provides to the urban environment:

Table 1. Summary of Benefit Values for Elk Grove Canopy Assessment, 2006.

<b>Benefit Category</b>	<b>Annual Dollar Value</b>
Energy savings	\$848,656
Air quality improvement	\$549,552
Stormwater runoff reduction	\$311,073
Property value increase	\$11,506,090
<b>Total benefit value</b>	<b>\$13,215,361</b>

Of course there are costs of managing the urban forest. We estimate the overall cost of managing Elk Grove's urban forest, including private and public, is approximately \$883,069 annually, including purchasing and planting trees, maintenance, tree removals, pruning, administrative costs, repairs to infrastructure, and personal injury claims (Appendix A). Balancing the benefits and costs, the net benefits are approximately \$12,332,292 a year, with a benefit-cost ratio of \$14.97 to \$1.

There is no other resource that provides almost 15 times the return on investment, while enhancing the urban environment, reducing temperatures, and improving community ties and quality of life!

This value should be considered when investing in the management of the urban forest for the future. Recommendations based on the data collected for this study include: implement best practices in tree planning, planting, and maintenance; facilitate tree ordinance and policy updates to support urban forest initiatives; and educate and engage the community on the value of the urban forest through sponsoring or developing various educational and outreach programs.

## History

The City of Elk Grove was incorporated in July of 2000. Previously this largely urbanized area was in the unincorporated area of Sacramento County. In the last five to seven years, the City has experienced exponential growth rates with developments establishing every year in residential, commercial, and retail land uses. With consistently increasing growth rates, the City is working on several initiatives to ensure the quality of life remains high for its residents and that the City sustains itself for the long term.

The Sacramento Tree Foundation is working with the City of Elk Grove and elected officials in the greater Sacramento area on the Greenprint. The Greenprint is a regional initiative to increase the urban tree canopy by at least five million trees over the next 40 years and to optimize the benefits of our urban forest. The Greenprint is a call to awareness, action, and a plan of work for each of the 28 local governments in our six-county region to adopt tree canopy goals, policies and ordinances, best management practices, and community involvement strategies. The City of Elk Grove was the first local government to sign on to the Greenprint, and the first to allocate funds to begin working on the program.

Part of the Sacramento Tree Foundation's role in leading the Greenprint is assisting cities and counties in surveying their urban street trees. Surveying a sample of the urban forest can provide a wealth of information to government leaders, community groups, and citizens to help better manage the urban forest. Among the elements of knowledge gained through this survey are an average percent of tree canopy cover, the value of the urban forest in energy savings, air quality, and other benefits; as well as overall health, structure, and maintenance needs of the urban forest.

The City of Elk Grove's City Council signed on to the Greenprint in May of 2005. In doing so, the City formed a partnership with the Sacramento Tree Foundation in a two-year start-up program to implement Greenprint. The City Council appropriated staff time, resources, and contract services to: 1) determine the City's existing shade cover, 2) review what programs and policies the City has already implemented, 3) determine the City's 40-year canopy goal, and 4) develop a path and/or plan through which to reach this goal.

The City of Elk Grove Urban Forest Canopy Assessment was conducted to address the first of the four main goals identified by the City Council, with an additional task of conducting a cost-benefit analysis of the urban forest. The cost-benefit analysis was conducted based on the dollar value of the various benefits trees provide Elk Grove (e.g. air quality, water quality, energy savings, increased business, real estate values, etc.), balanced by the cost of planning, planting, and maintaining the urban forest.

The assessment was developed and led by the Sacramento Tree Foundation under contract with the City of Elk Grove and under the direction of City Planner John Smoley and consulting Landscape Architect Marty Hughes. The Sacramento Tree Foundation recruited and trained 21 volunteers to conduct the sample street tree survey. The data collected was imported into STRATUM (Street Tree Resource Analysis Tool for Urban Forest Managers), a new software program developed by the U.S. Department of Agriculture Forest Service and Davey Resource Group. STRATUM compiles and summarizes the sample street tree data for overall structure, canopy cover, and quantifiable benefits information.

This report will present the data, analyze and interpret the results, and provide recommendations for future management of the urban forest and canopy goals in the City of Elk Grove.

## Methodology

This analysis combined aerial photography, Geographic Information Systems (GIS) data, a sample street tree inventory, and benefit modeling to produce four types of information: 1. resource structure (canopy extent, species composition, diversity, age distribution, health, etc.) 2. resource function (magnitude of environmental and property value benefits) 3. resource value (dollar value of benefits realized) and 4. Future management needs (sustainability, planting, research and monitoring).

This section describes the methods and inputs used to derive this information.

### Volunteer Recruitment and Training

Volunteers were recruited from throughout the region by the Sacramento Tree Foundation and the City of Elk Grove for several months preceding the assessment. A call for volunteers was distributed through public meetings, announcements, e-newsletters, postings, and press releases. In addition, direct phone calls were conducted to organizations with closely aligned missions and letters were sent to the 25 neighborhood associations in the City. To our pleasure, we successfully recruited approximately 25 dedicated volunteers for the assessment.



A volunteer training program was developed by the Sacramento Tree Foundation with the support of the City of Elk Grove and the volunteers themselves. Volunteer Marsh Wildman assisted in developing and producing tree identification pocket guides and Bryan Klung developed and produced street segment maps for the field portion of the training.

Volunteers attended two evening classroom training sessions where they received an introduction to the project and the City's purpose in conducting the assessment. They also learned tree identification, health and maintenance inspection techniques, and use of personal data assistants (PDAs) for data collection. A field training session was held on a Saturday to practice and refine skills learned in the evening classes and to gain consistency across volunteer groups.



### Street Segment Sample Selection

Using ArcView GIS, based on the size (42 square miles) and population (approximately 120,000) of Elk Grove, a three percent sample of street segments was selected for the assessment. For the purposes of this assessment, a street segment is defined as a portion of a street from one intersection to the next, including both sides of the street. Volunteer Bryan Klung took this information and created a set of ten maps covering all sample segments, and assigned sections of the City to each volunteer group.

## Data collection

On April 29<sup>th</sup>, May 6<sup>th</sup>, and May 13<sup>th</sup>, 2006, volunteers gathered and formed teams of 2-3 people and collected data from different areas within the City over a 6-hour period each day. Each team was supplied with the necessary equipment, including a PDA to record data, a map of their team's street segments, a Biltmore stick for measuring the diameter of the trees, a quick reference tree identification guide, and Ziploc bags and markers to collect samples of trees they could not identify. Each team collected street tree data along the selected street segments from the random three percent sample of the City's streets. Along each segment, trees were surveyed on both sides of the street and, if present, along the median. For each tree the following data was collected:

Tree ID #  
Street Segment #  
Tree Species  
Diameter at breast height (DBH) (by class 0-3", 3-6", 6-9", etc.)  
Condition of wood (i.e. roots, trunk, limbs, and branches)  
Condition of foliage (i.e. leaves, fronds, flowers)  
Maintenance task (e.g. stake, train, prune, crown clean, etc.)  
Maintenance priority (most important maintenance task)  
Land use (e.g. single family residential, commercial, and industrial, etc.)  
Location (e.g. planting strip, median, front yard, etc.)  
Sidewalk upheaval (in fractions on an inch)  
Conflicts with utilities (branches touching overhead lines)  
Other – additional information



At the end of each field day, the equipment was collected and the data was uploaded from the PDAs to a computer. Following three full days of data collection and a few last field checks, the data was compiled in an Access database and checked for accuracy and consistency. The Access database was then imported into STRATUM. STRATUM automatically generates error notifications or bugs in the data and those were corrected.

In addition to the tree survey data, a number of other inputs to STRATUM were required for the cost-benefit analysis to be conducted. Additional data collected included the following, specific data inputs are provided in Appendix A:

City Definitions: total municipal budget, population, total land area (square miles), average street width (feet), average sidewalk width (feet), total linear miles of street (miles)

Cost Definitions: planting, pruning, tree and stump removal/disposal, pest/disease control, establishment and irrigation, infrastructure repair (e.g. sidewalks), litter/storm clean-up, litigation settlements (i.e. trip and fall), administration, inspection/service requests, other (i.e. consulting Landscape Architect)

Benefit Value Definitions: electricity, natural gas, carbon dioxide, particulate matter (10 microns), nitrogen oxide, sulfur oxide, volatile organic compounds, stormwater inception, and median home price

The cost definitions were especially challenging to identify, as the City does limited tree management and maintenance. The majority of this work is conducted by the Elk Grove Community Services District (CSD). This information was not available for the analysis.

Alternatively, several reputable resources were used to compile cost definitions to best represent the costs of tree maintenance and management in Elk Grove. Should better data become available, STRATUM is very user-friendly to update and modify, and the City can quickly re-run the cost-benefit analysis.

### **Benefits of the Urban Forest**

Trees are a natural wonder. Among the many benefits trees provide to urban environments, they produce oxygen and store carbon dioxide, contributing to a natural balance of atmospheric gases.



Trees are one of the planet's natural resources for moderating the influence of climate. Their leafy branches shade and cool, and absorb harmful ultraviolet rays. Trees in heavily populated areas play an important role, because they significantly reduce the demand for energy. Trees are particularly valuable in warm, sunny populous areas like Elk Grove, because they reduce what is known as the urban heat island effect, or increased temperatures in areas of concentrated impervious surfaces.

In Elk Grove, where summer temperatures regularly reach 100 degrees and higher, the street trees alone (including front yard trees within 12.5 feet of the right-of-way), are saving \$848,656 in annual energy costs. This equates to approximately \$7.88 per tree or \$6.48 per capita. Elk Grove's urban forest is fairly young, so if managed well, this number will increase with time as the trees mature and provide more shade benefit. If all available planting spaces were filled with energy-saving trees, this number would also increase significantly.

In addition to reducing temperatures and energy demand, trees improve our air quality by directly absorbing ozone and by capturing and filtering air pollutants like carbon dioxide, particulate matter, nitrogen oxide, and sulfur oxide. The benefits of street trees to Elk Grove's air quality equate to \$549,552 in annual savings, or \$5.11 per tree or \$4.20 per capita. Improvements to energy savings and air quality not only benefit Elk Grove and its citizens, but also provide benefits for the entire Sacramento region. Our region shares energy resources and we certainly share the air!



Table 2. Benefits and Values for Elk Grove’s Street Tree Canopy, 2006.

<b>Benefit Category</b>	<b>Total Annual Dollar Value</b>	<b>Value Per Tree</b>	<b>Value Per Capita</b>
Energy savings	\$848,656	\$7.88	\$6.48
Air quality improvement	\$549,552	\$5.11	\$4.20
Stormwater runoff reduction	\$311,073	\$2.89	\$2.38
Property value increase	\$11,506,090	\$106.88	\$87.92
<b>Total annual dollar value</b>	<b>\$13,215,361</b>		

Trees also help reduce stormwater runoff by capturing and slowing down the flow of heavy rains into storm drains. This also reduces the amount of pollutants that reach our waterways. Tree roots absorb water and keep soil intact, stopping dirt from eroding, clogging pipes and drains, and eventually ending up in our waterways. The street trees in Elk Grove provide \$311,073 in annual savings to stormwater runoff and improvements to water quality, equivalent to \$2.89 per tree or \$2.38 per capita.

The most financially lucrative benefit of trees in Elk Grove is aesthetics and their effects on property values. Partially, this is due to the fact that most street trees in Elk Grove are actually on private property, within 12.5 feet of the right-of-way. Most credit, however, goes to the real estate market in California, so the value added by trees to homes is high. With median home sales at \$456,000 in Elk Grove, the value added by front yard street trees equates to \$11,506,090 annually, or \$106.88 per tree and \$87.92 per capita.

Of course there are costs of managing the urban forest including purchasing and planting trees, maintenance, tree removals, pruning, administrative costs, repairs to infrastructure, and personal injury claims. Through research and analysis, we estimate the overall cost of managing Elk Grove’s urban forest, including private and public, is approximately \$883,069 annually, or \$8.20 per tree and \$6.83 per capita.

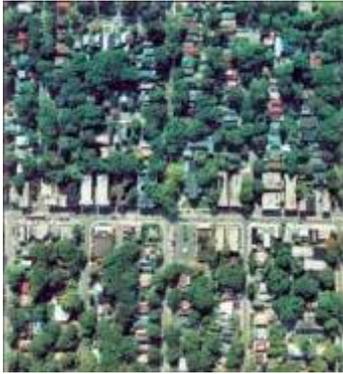


Balancing the total benefits (\$13,215,361/year) with the total costs (\$883,069/year), the net benefits are approximately \$12,332,292 a year, with a benefit-cost ratio of \$14.97 to \$1 (Appendix A). There is no other resource that provides almost 15 times the return on investment, while enhancing the urban environment, reducing temperatures, and improving community ties and quality of life!

Different types of trees provide different levels of benefits, and therefore financial values. For example, a London plane (*Platanus x acerifolia*), which is a large canopy tree, provides approximately \$202.20 of benefits in Elk Grove annually; however a crape myrtle (*Lagerstroemia indica*), which is a small tree that provides minimal shading, provides only \$18.12 in benefits annually. Both are providing benefits and have a positive net value; however, some trees provide more value. This is important when deciding what trees to plant in yards or neighborhoods, but also when planning for the percentage and mixture of trees throughout the City.

## Street Tree Canopy Cover

Canopy cover can be described as the percent or amount of ground covered by trees. As seen from above in an airplane or on aerial photography, canopy is the two-dimensional area covered by trees. Therefore, street tree canopy cover is the percent or area of streets and sidewalks blanketed by trees.



This assessment surveyed only street trees; therefore, the percent of canopy cover represents that over streets and sidewalks. Out of a total of 26,880 acres, the City of Elk Grove has approximately 3,153 acres of streets and sidewalks and 721 acres of street tree canopy cover. The sample survey estimated there are a total of 111,924 street trees in the City of Elk Grove. This equates to 22.88 percent canopy cover over the City's streets and sidewalks. This is a fair amount, especially in a City with a lot of new development and a young urban forest.

## Conditions and Challenges

### *Age/Size*

Given the City recently incorporated and has experienced an increase in development over the past 5 to 7 years, Elk Grove's urban forest is very young in age. Approximately 85% of the City's street trees are less than 12" DBH, 13% are 12-30" DBH, and 2% are 30-42+" DBH. Certain species of trees are in the older age brackets (or larger DBH) including valley oak (*Quercus lobata*), hackberry (*Celtis spp.*), eucalyptus (*Eucalyptus spp.*), interior live oak (*Quercus wislizenii*), camphor (*Cinnamomum camphora*), coast redwood (*Sequoia sempervirens*), and palm (*Washingtonia spp.*).

### *Species Diversity*

The species diversity of Elk Grove's street tree population is high, with only one tree species accounting for more than 10% of the street tree population. Species diversity is important to the long-term health of the urban forest. Too many of one species can be harmful to the overall population, especially if that particular species is susceptible to a pest or disease that attacks a large portion of the tree population at one time. London planes and California sycamores (*Platanus acerifolia*) together account for almost 11% of the street tree population. Crape myrtles account for approximately 9% of the street tree population. Both species are broad leaf deciduous trees, which provide the most energy-saving benefit in Elk Grove's climate; however, London planes and California sycamores are large shade trees providing up to 10 times more shade, and other benefits related to leaf surface area, than the crape myrtle. A third species, coast redwood, accounts for almost 7% of the street tree population. Other species accounting for 0.9-2.7% of the street tree population each include: valley oak (or California white oak), Sweetgum



(*Liquidamber styraciflua*), hackberry, oak (*Quercus spp.*), pear (*Pyrus spp.*), red maple (*Acer rubrum*), Chinese pistache (*Pistacia chinensis*), European white birch (*Betula pendula*), black tupelo (*Nyssa sylvatica*), Japanese zelkova (*Zelcova serrata*), plum (*Prunus spp.*), eucalyptus, and interior live oak. The remaining species representing fractions of a percent of the population include: camphor trees, palms, and medium and small conifers.

*Health/Condition and Maintenance Needs*

Elk Grove’s street tree population appears to be in very good condition. According to the data collected, over 76% of the street trees are in good condition, with no apparent problems. Sixteen percent of the population is in fair condition showing minor problems, 6% is in poor condition having major problems, and less than 2% are dead or dying and exhibiting extreme problems. This is a good sign, as most of the trees are young and healthy. The first three years of a tree’s life are the most important for close care and maintenance. Staking, mulching, watering, and pruning are critical at this time for the long term success and health of the tree.

The volunteers collected data on the maintenance needs and identified the priority maintenance task for the tree. For example, if one tree was pest ridden, and also needed a crown reduction the priority task would be to treat the tree from the pest so that it may survive and not pass the pest along to neighboring trees.

Table 3. Summary of Elk Grove Canopy Assessment Results, 2006.

<b>Data Collection Category</b>	<b>Results</b>
Number of Street Trees	111,924
Amount of healthy street trees	76%
Amount of street/sidewalk covered by trees	22.88%
London plane tree annual value	\$202.20
Crape myrtle annual value	\$18.12

In the maintenance needs assessment, over 48% of all trees, both public and private, were in no need of maintenance. Over 30% were young trees in need of staking or stake removal and some training, or early pruning cuts. About 12% needed a crown cleaning, which is the removal of dead or diseased limbs and branches from mature trees. Four percent were in need of a crown raise or reduction, where the crown is pruned to either raise limbs higher from the ground, or reduce the overall height of the tree from the top. The remaining 4% were mature trees in need of pest or disease treatment, or tree removal.

In the City of Elk Grove, the CSD maintains most of the public street trees in landscape strips and medians, as well as parks. Because the City is not currently responsible for maintaining the public street trees, this information is useful as general knowledge of the state of the urban forest and the level of care it requires.

The remaining street trees are on private property, but within the utility easement (12.5 feet from the back of the sidewalk). Many of the street trees are on private property in Elk Grove, so this places the maintenance responsibility on private property owners, mostly individual homeowners. Many homeowners, especially in new developments, receive their trees from the developer when the home is built. In this situation, the developer chooses the planting location and tree species, and is responsible for planting the tree. Often the developer is not knowledgeable in urban forestry, nor are the consultants or contractors they hire. It is common for developers to hire

urban designers or landscape architects who have a general knowledge of the value of green infrastructure and aesthetic design, but often they are not aware of proper species selection, spacing requirements, and planting techniques. In addition, homeowners who receive the tree(s) may not be knowledgeable about the species or the space and maintenance the tree needs to grow healthy and mature.

### *Land Use*

Overall, the street trees in Elk Grove (both public and private) are distributed over the following land uses: 76.7% are in single family residential; 15.5% are in parks, medians, or vacant land; 3.3% are in multi-family residential; 2.4% are in small commercial; and 2.1% are in industrial and large commercial. This is closely related to the acreage of land use type in the City.

Private street trees in Elk Grove are those street trees that are on private property but within the utility easement; these constitute 91.7% of all street trees in Elk Grove. The remaining 8.3% of public street trees are distributed as follows: over 50% in single-family residential areas; 0.8% in multi-family residential areas; 37% in parks, medians, or other public areas; 4.8% in small commercial land uses; and 2.7 % are in industrial or large commercial areas.

## **Recommendations**

The following recommendations are provided for future management decisions regarding urban forest related issues. Recommendations are based on the existing information, the data collected for this study, and the results generated by the Urban Forest Canopy Assessment.

1. Implement best practices in tree planning, planting, and maintenance:
  - Design more separated sidewalks with landscape strips to replace, or add to, front yard street trees on private property.
  - When front yard trees are used, design for narrower streets to optimize the street tree canopy.
  - Implement proper spacing and planting requirements to ensure long term health and shade of street trees.
  - Implement young and mature tree maintenance programs that identify specific objectives, outline a maintenance cycle for different stages of tree care over time, and provide a budget to support the proper level of care required to maintain a healthy urban forest.
  - Conduct regular assessments of the urban forest to determine extent, health, condition, and progress toward shade cover objectives.
2. Facilitate tree ordinance and policy updates to support urban forest initiatives including:
  - Protection of trees in addition to native oaks
  - Tree replacement and mitigation policies
  - Shade cover goals and objectives by land use type
  - Shade requirements for new development

- A preferred tree list with more large shade tree species
  - Proper spacing and planting requirements
  - “Right tree, right place” policy, considering species, available space, & conditions
  - Optimum species diversity mix
3. Educate and engage the community in urban forest programs through sponsoring or developing:
- Educational workshops and materials for private homeowners on young and mature tree care including planting, mulching, watering, pruning, staking, and landscaping under or around trees
  - Community-wide, volunteer, and school district tree plantings
  - Media outreach
  - Neighborhood programs
  - School education programs
  - Participation in the Tree City USA program
  - Participation in the Greenprint regional initiative

**Appendix A.**

**Elk Grove Tree Canopy Assessment Data Inputs 8.30.06**

A. Defining the City:

<b>Statistic</b>	<b>Value</b>	<b>Source</b>
City Name	Elk Grove	
Total Municipal Budget (\$)	\$262,000,000	City of Elk Grove, Adopted Budget: Fiscal Year 2005-2006 ( <a href="http://www.elkgrovecity.org/finance/financial-planning-division/annual-budget-fy-05-06.htm">http://www.elkgrovecity.org/finance/financial-planning-division/annual-budget-fy-05-06.htm</a> ).
Population	130,874	California Department of Finance Demographic Research Unit <a href="http://www.dof.ca.gov/HTML/DEMOGRAP/e-1press.pdf">http://www.dof.ca.gov/HTML/DEMOGRAP/e-1press.pdf</a>
Total Land Area (sq mi)	42	City of Elk Grove GIS Server
Average Street Width (ft):	47	Derived from data provided by Mike Lindvall Public Works Dept., City of Elk Grove, 687-3057, <a href="mailto:mlindvall@elkgrovecity.org">mlindvall@elkgrovecity.org</a>
Average Sidewalk Width (ft):	5	Derived from data provided by Mike Lindvall Public Works Dept., City of Elk Grove, 687-3057, <a href="mailto:mlindvall@elkgrovecity.org">mlindvall@elkgrovecity.org</a>
Total Linear Miles of Street (mi):	461	Mike Lindvall, Public Works Dept., City of Elk Grove, 687-3057, <a href="mailto:mlindvall@elkgrovecity.org">mlindvall@elkgrovecity.org</a>

B. Defining Costs (average annual):

<b>Statistic</b>	<b>Value</b>	<b>Source</b>
Planting	\$125,000	Derived from estimate of 5,000 trees planted since 2004 (Personal communication with Roy Herren, Parks and Recreation Manager, CSD. 2006); for an average of 2,500 trees planted annually x \$50/tree regional average planting cost (San Joaquin Tree Guidelines. USDA Forest Service, 1999).
Pruning	\$440,200	Derived from Tree Maintenance Needs section of CSD Tree Inventory Report & Management Plan, 2004.
Tree and Stump Removal/Disposal	\$10,800	Derived from Tree Maintenance Needs section of CSD Tree Inventory Report & Management Plan, 2004.
Pest/Disease control	\$6,750	\$0.15/tree (San Joaquin Tree Guidelines. USDA Forest Service, 1999) x 45,000 public trees (extrapolated by STRATUM from 3% sample inventory)
Establishment and Irrigation	\$182,354	Derived from Tree Maintenance Needs section of CSD Tree Inventory Report & Management Plan, 2004.
Infrastructure Repair	\$24,818	A Practical Approach to Assessing Structure, Function, and Value of Street Tree Populations in Small Communities. Journal of Arboriculture,

		March 2003.
Litter/storm clean-up	\$57,150	\$1.27/tree regional average (San Joaquin Tree Guidelines. USDA Forest Service, 1999) x 45,000 trees (extrapolated by STRATUM from 3% sample inventory)
Litigation settlements (i.e. trip and fall)	\$22,447	A Practical Approach to Assessing Structure, Function, and Value of Street Tree Populations in Small Communities. Journal of Arboriculture, March 2003.
Administration	\$8,550	\$0.19/tree (San Joaquin Tree Guidelines. USDA Forest Service, 1999) x 45,000 public trees (extrapolated by STRATUM from 3% sample inventory)
Inspection/service requests	--	n/a
Other	\$1,500	Landscape Architect (Marty Hughes) consulting services for street trees, City of Elk Grove.

**Total Avg. Annual Costs                    \$879,569**

C. Defining Value of Benefits (regional averages represented)

<b>Statistic</b>	<b>Value</b>	<b>Source</b>
Electricity	\$0.1461/kWh	SMUD (average of residential Tier 2 rates for all seasons)
Natural Gas	\$1.25278/Thermal	STRATUM Default value
CO2	\$0.0075/lb	STRATUM Default value
PM10	\$16.84/lb	SMAQMD Emission Reduction Credits 2005
NO2	\$15.96/lb	SMAQMD Emission Reduction Credits 2005
SO2	\$2.50/lb	SMAQMD Emission Reduction Credits 2005
VOC	\$13.95/lb	SMAQMD Emission Reduction Credits 2005
Stormwater Inception	\$0.0078/gallon	STRATUM Default value
Median Home Price as of May 2006	\$456,000	California Association of Realtors ( <a href="http://www.car.org/index.php?id=MzYzOTk">http://www.car.org/index.php?id=MzYzOTk</a> )