Street Tree Inventory
Report and Recommendations

City of Shenandoah, TX

Shenandoah
TEXAS

September 2007

TEXAS FOREST SERVICE
The Texas A&M University System

Contents

Credits

The Texas Community Tree Inventory (TXCTI) system and report was developed by the Texas Forest Service. It is adapted from the Street Tree Management Tool for Urban Forest Managers (STRATUM) computer model developed by researchers at the Center for Urban Forest Research, a research unit of the USDA Forest Service's Pacific Southwest Research Station. Any statistical equations used to compute Standard Error values and percentages were specifically drawn from the STRATUM model, as published in the user's manual. For more information about STRATUM or the other i-Tree tools, go to www.itreetools.org.

Recommendations provided are the judgment of the Texas Forest Service forester listed below, based on the data collected in cooperation with community staff or volunteers. Questions or comments should be directed to:

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Executive Summary

In February 2007, Texas Forest Service foresters and city of Shenandoah personnel conducted a street tree inventory on 58 street segments, covering the entire 11.8 miles (100%) of roadway maintained by the city.

Results include:

* Shenandoah has 999 public trees that occupy 73% of the available planting sites.
* The tree population is dominated by loblolly pine (23%), crapemyrtle (20%), water oak (9%), live oak (8%), and sweetgum (7%).
* Most trees are small, with more than 50% of trees in the 0-3" diameter class and only four trees larger than 24" diameter.
* Two-thirds of street trees are in good condition and 59% require only routine care.
* Safety clearance of limbs over streets, sidewalks, and near traffic signals is not a problem, with just 11 trees with limbs that affect traveler safety.
* Street trees in Shenandoah are valued at nearly $1 million.

Recommendations include:

* Begin a program of pruning to train and shape young trees.
* Favor shade trees other than pines in street tree planting projects.
* Locate and remove the estimated 40 trees that pose risk to persons or property.
* Develop an annual work plan for tree maintenance and planting.
* Conduct an annual Arbor Day celebration and involve local groups.
* Craft a public tree care ordinance.

City Description

Shenandoah, Texas, is located approximately 30 miles north of downtown Houston, along the Interstate 45 corridor, adjacent to The Woodlands master-planned community.

Shenandoah is a convenient commuting distance to major employers in The Woodlands, Conroe, and Houston, and has experienced tremendous growth and development of retail shopping centers, medical office space, and residential subdivisions in recent years. Outdoor recreational activities are in high demand among citizens and concerns about community appearance consistently rank near the top of issues raised by residents.

Newer subdivisions are designed with curb-and-gutter systems with sidewalks, but older subdivisions in Shenandoah were typically established in the 1970s with narrow streets and drainage (or "borrow") ditches along each side to funnel storm water runoff. These ditches required periodic maintenance, so very few public street trees have been planted. Fortunately these older neighborhoods have retained significant tree cover on private property, although these trees could be impacted as old streets are upgraded to the curb-and-gutter system.

One area of special significance is the Tamina community, an unincorporated, historically African-American area immediately east of the city limits, but within Shenandoah's extra-territorial jurisdiction (ETJ). City leaders are in the planning stages of extending utilities and other infrastructure to those residents.

Current Tree Management

The Director of the Public Works department is responsible for tree management in the city's parks, rights-of-way, and public buildings. Additionally, the city contracts with a qualified urban forestry consultant to administer the city's tree preservation and landscape ordinances, which can be found at www.shenandoahtx.com. Department staff covers most emergency tree removal or maintenance, but if the job requires specialized equipment or expertise city staff will contact the urban forester for assistance.

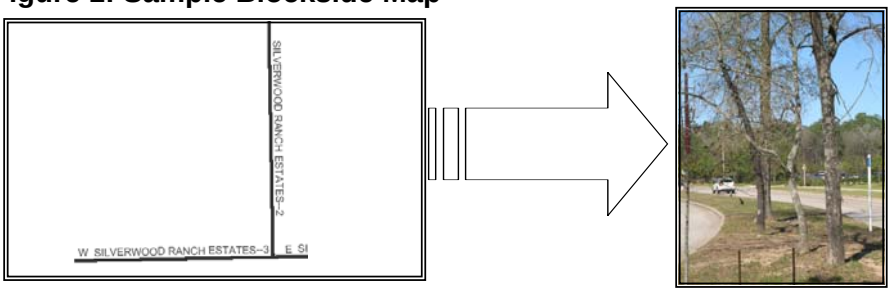
At this time there is no ordinance that defines responsibility or provides standards of care for public trees, nor does the city have a formal program for the planting and maintenance of street trees. However, street trees are routinely planted by individual homeowners, homeowner associations (HOAs), businesses, developers, and occasionally by city crews.

Training for general tree care and maintenance for public works employees and the public has been provided by the Urban District Forester at the Conroe office of the Texas Forest Service, who also provides advice through one-on-one site visits. Shenandoah also celebrates the value of trees and a green environment at their annual Arbor Day celebration, where hundreds of native Texas trees are given away to the public and businesses, along with tree care and maintenance guidelines.

Inventory Methods

The Texas Community Tree Inventory (TXCTI) system is designed to provide city staff and community leaders with basic information about the street tree resource. Typically, Texas Forest Service (TFS) foresters identify and survey a 5-15% sample of street segments, or "blocksides" (see Figure 1 below), and collect data on the individual trees they find there. Due to the relatively small number of street miles in Shenandoah, 100% of blocksides within the city limits were surveyed in order to make short- and long-term recommendations for managing this important community asset.

Figure 1: Sample Blockside Map



Median view

Field data collection is limited to relatively few measurements in order to speed up the process (see Appendix A for data collection form and definitions). Trees located within the public right-of-way (ROW) on both sides of a blockside segment, or within a center median, were evaluated for species, trunk diameter, general condition, maintenance needs, and safety clearance. Private trees outside the ROW are evaluated solely for safety clearance. Street segments are also surveyed for available planting spaces, both within the ROW or median and within 30' of the roadway on private property. All estimates provided in this report represent public ROW and median trees combined, unless specifically identified otherwise. Table 1 details the basic results of this survey.

Table 1: Street Tree Survey Results

Number of blocksides:	58
Sample size:	100%
Total ROW miles:	11.8
Median miles:	2.4
Number of public trees:	999

Two blocksides in Shenandoah were omitted from this survey: a section of Wellman Road (from the I-45 frontage road to Hurley Lane) and Hurley Lane. The Wellman Road segment is in the process of being widened, meaning the existing trees will be removed, and Hurley Lane is being decommissioned as a city street. Newly planted trees between I-45 and the frontage roads (both north and south) were not included either, since maintenance of these trees will cease in a few years when the trees form a closed canopy.

The report findings are divided into three sections: Street Tree Structure, Street Tree Care, and Street Tree Values. The TFS forester has provided professional insight into the data results, followed by a set of recommendations based on an understanding of the city's current program and the state of the street tree resource.

Street Tree Structure

The pattern of trees found in a community can be referred to as its structure. This includes the different tree species and their sizes, as well as the overall number of trees and how they fill the available space along city streets – what urban foresters call stocking. These key measures will guide the recommendations at the end of the report.

Stocking

In any city there are a certain number of miles of streets to maintain. A model residential street has trees planted along both sides of the right-of-way (ROW), often between the curb and sidewalk. Larger collector streets and boulevards may also have medians that are wide enough to support street trees. If all planting spaces are filled with trees of the largest size possible for the available growing space (termed "full stocking"), a typical U.S. city will have about 105 ROW trees per mile. This benchmark is equivalent to one tree every 50 feet, but takes into account visibility triangles at corners and lost planting spaces due to intersections, driveways, and other public infrastructure. Median spaces provide additional planting opportunities above that number, as do spaces on adjacent private property that can shade public sidewalks and ROWs. The estimates here did not take into account underground utility conflicts that would lower the potential number of planting sites.

Table 2 shows the current estimate of street trees in the community, as well as planting site criteria and opportunities, as found in the sample inventory.

Table 2: Street Tree Stocking

Number of ROW Trees:		347
Number of Median Trees:	+	652
Total Number of Street Trees:		999
Total Street Miles:		13.05
Stocking (trees/mile):		76.57
% Stocking:		73%
Median/ROW Planting Spaces:		566
Private Yard Planting Spaces:	+	292
Total Planting Opportunities:		858

Planting Site Criteria

Tree Size: Medium or large tree to be planted under powerlines.

Location: Within public ROW and/or within 30' of ROW edge in private front yard. Tree lawn minimum 4' width.

Distances: Overhead - 15'
Hydrant, utility pole, streetlight - 10'
Street intersection - 25'
Driveway - 5'
Other trees - 20-50'

Key findings:

Shenandoah has a total of 347 ROW trees and 652 median trees, for an overall street tree stocking level of 73%, which is considered very good. The low number of ROW trees is primarily due to street construction favored in the older neighborhoods that includes open ditches. Medians, however, are well stocked, with an above-average 271 trees/mile. These strips contain remnants of the native forest in certain sections, adding to the character of the community.

There are still a few opportunities for increasing street tree cover on public property. To reach full stocking, the city would need to fill the estimated 566 planting spaces along medians and ROWs. But since the ditches along many streets require periodic maintenance, the majority of tree planting opportunities remain on the center medians of the major thoroughfares.

Private homeowners and businesses can also contribute, but overall we found Shenandoah neighborhoods to have excellent tree cover. Our survey discovered only 292 planting spaces in the front yards of homes or businesses, within 30 feet of the curb. Since owners provide tree maintenance, Shenandoah can realize the added benefits of trees over streets and sidewalks without an increase in management costs.

Species

As a rule, urban foresters recommend having no more than 10% of the street tree population made up of any single species, and no more than 20% made up of any one tree genus (i.e. the oaks or elms). This can prevent the catastrophic loss of trees due to an outbreak of insects or disease, like the story of Dutch Elm disease in the Eastern U.S. or current outbreaks of Emerald Ash Borer in the Upper Midwest. Species diversity is one sign of a healthy tree resource.

Figures 2 and 3 show the most common species and genera, respectively, found in the sample inventory. The top ten species or genera are shown (could be more if categories tie for tenth place), plus a category combining the remaining species or genera. A complete list of species encountered during the inventory is listed in Appendix B.

Figure 2: "Top Ten" Species

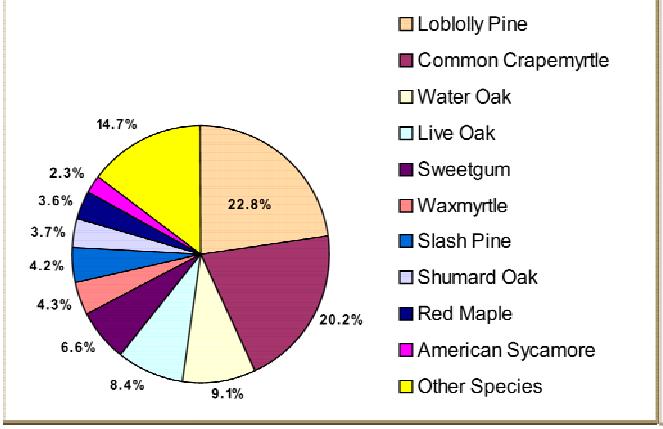
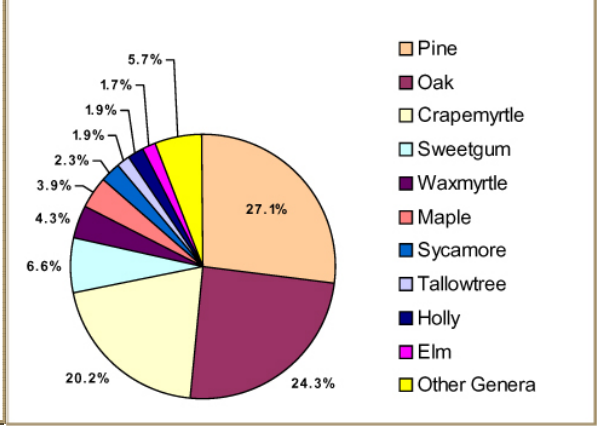


Figure 3: "Top Ten" Genera



Key findings:

The population of street trees in Shenandoah is dominated by just a few species: loblolly pine (23%), crapemyrtle (20%), water oak (9%), live oak (8%), and sweetgum (7%) combine for two-thirds of ROW and median trees. At the genus level, pines (27%) and oaks (24%) account for over half of all trees, reflecting the dominant species of the native forest. Crapemyrtle and waxmyrtle (at 4%) represent two small-statured species that have been planted extensively for ornamental purposes.

In fact, because pines, oaks, and crapemyrtles are so prevalent today, it may be impossible to achieve a model street tree distribution in Shenandoah. More importantly, the greatest risks are posed to pine trees, which are vulnerable to outbreaks of bark beetles (Southern Pine Beetle, Ips beetles, etc.) and strong wind events. It would be prudent to have a rapid-response plan in place to inspect and remove dying pine trees from public streets to quickly minimize the risk of falling debris and the risk of insects spreading to adjacent pine trees.

For the ornamental trees, the risk of having so many crapemyrtles is not from insects or disease (since most modern horticultural varieties are resistant to powdery mildew), but from high maintenance costs. Crapemyrtles can be costly to maintain, especially if annual pruning is performed; yet they rarely reach sizes that deliver significant environmental benefits. Planting a variety of ornamental trees can also lengthen the period of showy blooms in the community.

The diversity of recent plantings, though, is a positive trend. Appendix B shows a number of species we encountered that are native or well adapted to the area, and only small numbers of less-desirable species such as Chinese tallowtree, mimosa, and silver maple.

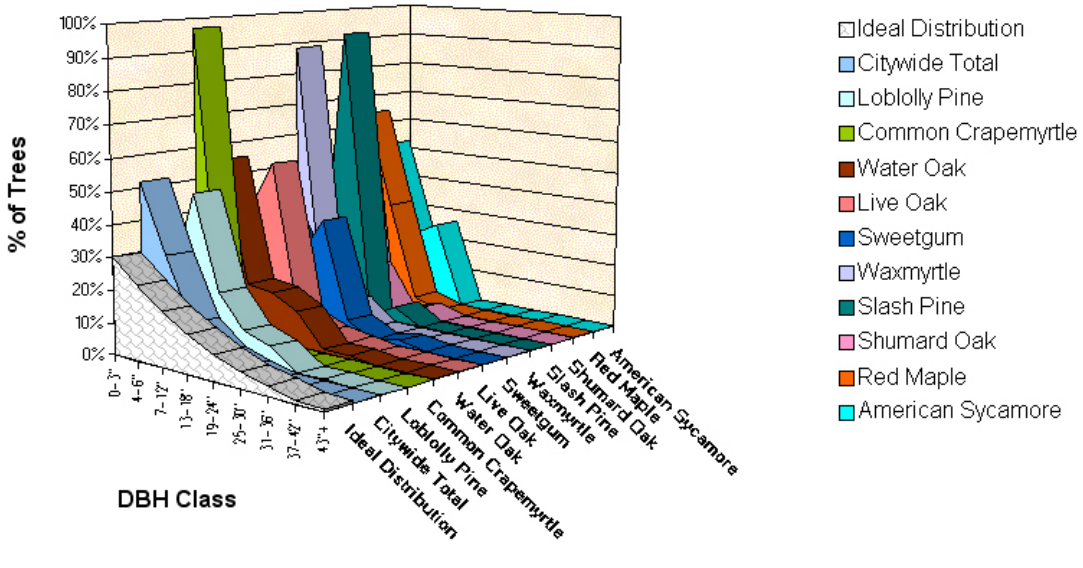
Size

Tree diameter is measured at a point on the trunk located 4.5 feet off the ground, also called diameter at breast height (DBH). This sample inventory assigned each tree to one of nine size classes, as detailed in Appendix B (palms are assigned to a class by feet of clear trunk height). The ten most prevalent species are displayed as a graph in Figure 4 (below).

The distribution of street trees by size mirrors its age structure, since older trees are usually larger than young trees. Species composition can also influence the size class distribution, since small-statured species will never grow into the larger classes. Taking into account mortality rates that are higher for trees when they are young, a balanced size distribution for a species will have more trees in the smaller size classes and fewer in the large size classes. For example, the City of Davis, CA set an overall goal of having 40% young trees (<6" DBH), 30% maturing (6-12" DBH), 20% mature (13-24" DBH), and 10% old trees (>24" DBH).

This survey considers medium (25-50' tall) and large (>50' tall) species mature when they reach 13-24" DBH. A reasonable target distribution would then be: 30% young trees (0-3" DBH), 40% maturing (4-12" DBH), 20% mature (13-24" DBH), and 10% old (>24" DBH).

Figure 4: DBH Distribution of Top Ten Species, in Order of Abundance



Key findings:

The size distribution of street trees in Shenandoah reflects the effort in recent years to landscape major thoroughfares and streets, with over 50% of all trees in the 0-3" DBH class and only four trees larger than 24" DBH (Figure 4). Basically, you have a very young population of street trees. The distribution also reflects some of the species choices for streetscapes, since small-statured species like crapemyrtle, waxmyrtle, and yaupon rarely grow into a larger class.

Some of the distributions for individual species offer additional insight (see Appendix B for detail). In particular, loblolly pine, water oak, and sweetgum represent tree species likely present when roads were built into the native landscape. They survived the construction and are now some of the larger trees found in our survey. But damage to trunk or roots during construction can start the decay process that leads to structural failure many years later. Trees in the larger size classes should be inspected periodically for structural soundness as part of the overall management program.

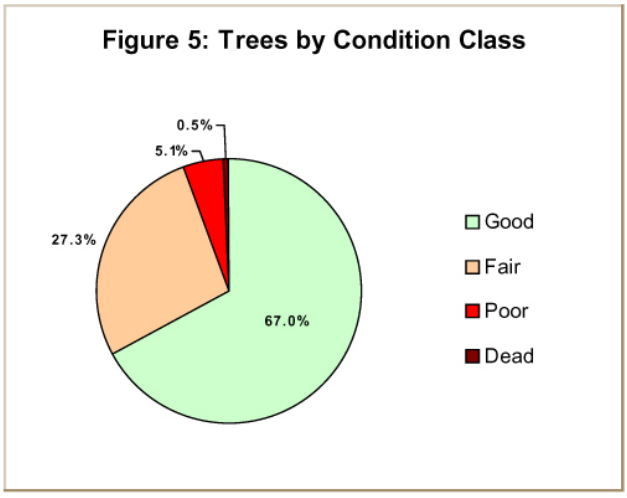
Street Tree Care

The care and maintenance practices – or lack thereof – that cities perform on their street trees will determine the condition of the resource as well as its future needs. This sample inventory evaluated trees for their overall condition, maintenance needs, and safety clearance.

Condition

Sampled trees were briefly observed and assigned to one of four condition classes: good, fair, poor, or dead (see Appendix A for condition class descriptions). This evaluation was designed to capture an overall assessment of the tree, including its health and structural soundness, but did not rate each portion of the tree such as leaves, twigs, branches, trunk, and roots.

Figure 5 shows the distribution of street trees by condition class, as found in the sample inventory.



Key findings:

The majority of street trees in Shenandoah are well cared for, with two-thirds (67%) in good condition. If proper maintenance continues, these trees can remain in good health and produce increasing economic and environmental benefits to the community for years to come.

But 27% of street trees are only in fair condition. These are trees that can usually be restored to full health with appropriate treatment, but much depends on the reason for the classification. Trees in this category may be larger specimens that survived the original road construction and have the scars to prove it. Injuries to the trunk, branches, or root systems would be reasons to rate a tree as fair instead of good. Or, these trees could be new plantings that have not become established or trees that may have suffered mowing injury.

A relatively small number of trees rated poor (5%) in the survey. Some of these trees could be saved if timely maintenance is conducted. Without maintenance, they will likely continue to decline and will need to be removed at some point. Removal costs are almost always higher than maintenance costs.

Only five dead trees were discovered in the survey and these trees should be located and removed.

Maintenance

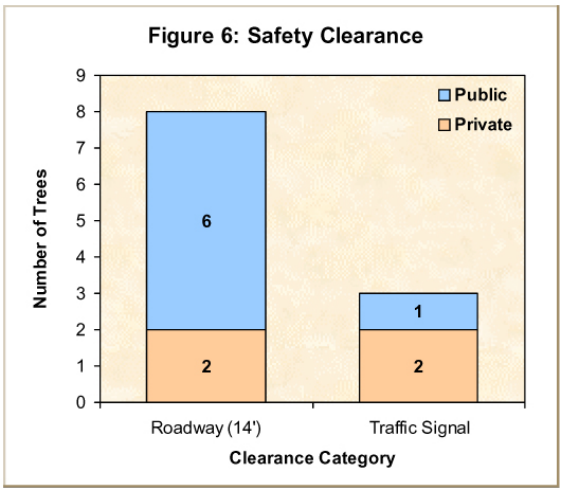
Tree maintenance is the primary responsibility of the street tree manager. A prudent maintenance program will remove or repair trees that pose risk to the public, as well as improve tree health and reduce future maintenance costs. This sample inventory evaluated ROW and median trees and assigned each to a maintenance category, as shown in Table 3 (below).

Table 3: Maintenance Needs

Treatment	Description	Estimate	Percent
Prune-Immediate	Dangerous broken branches and/or large deadwood. Presents safety risk to persons or property. Pruning should be accomplished as soon as resources are available.	0	0.0%
Prune-High Priority	Broken branches or deadwood, but no apparent immediate safety risk to persons or property. Prune as soon as resources are available.	8	0.8%
Prune-Routine	Routine, ongoing pruning should be scheduled on a cycle of five to seven years to remove dead, dying, or diseased branches.	589	59.2%
Prune-Training	Recent plantings require pruning of root and trunk suckers; dead, crossing, diseased, or weak branches; and to develop a strong central leader and scaffold limbs.	359	36.1%
Remove-Immediate	Trees should be removed ASAP because their condition and proximity to active-use areas pose an apparent risk to persons or property.	3	0.3%
Remove	Low priority removals should be scheduled when resources are available and after high-priority removals. Trees are generally located away from facilities and areas of use.	37	3.7%

Clearance

One important aspect of a tree maintenance program is to create safe clearance for the public and emergency vehicles over streets and sidewalks, and for visibility of traffic signs and signals. In these situations, even though a tree may be located on the adjacent private property, it is the city's responsibility to insure that the required pruning is performed – either by the owner or the city. Figure 6 shows the number of trees that require pruning to meet the appropriate distance standard.



Key findings:

Because Shenandoah has a lot of small trees – either because of the species chosen or because they were recently planted – training pruning is needed on more than 350 trees (36%). This type of pruning shapes and directs the growth of young trees, helps reduce future maintenance costs, and allows each tree to reach its potential. Training is the single best maintenance investment a city can make.

Most trees (59%) require only routine inspection and pruning. A relatively small number of trees (37) require removal as time allows and only eight trees were observed to have branches or deadwood that would require attention. Three trees were reported to city officials during the inventory process and may have already been removed.

Safety clearance is not a major problem in Shenandoah. Our survey found very few trees (3) that obstruct street signs or signals, and only eight trees with limbs that encroach into the safety zones above streets (14') and sidewalks (8').

Street Tree Values

Developing a management program for street trees undoubtedly carries the burden of cost. But public trees also deliver valuable returns to a community, and in recent years many of these values have been quantified. These include the value of air and water pollution reductions, storm water and energy savings, carbon sequestration, and even deferred medical costs. The aesthetic benefits of street trees are often harder to quantify – but just as important if you ask most citizens. Current research aims to quantify the health benefits to pedestrians from direct solar shading, the economic benefits from increased shopping activity in business districts, and reduced street repair costs. In fact, public trees are the only part of a city's infrastructure that can increase in value over time because healthy trees grow each year and increase the benefits they provide. Investing in a tree maintenance program can actually deliver a positive return to a city, when the full benefits of trees are considered.

Tree Replacement Value

The accepted method for quantifying the landscape value of trees was developed by the Council of Tree and Landscape Appraisers, published as the *Guide for Plant Appraisal–9th Edition (2000)*. This method combines tree ratings in four categories (species, condition, size, and location) to calculate the cost of replacing a given tree in the event it is damaged or destroyed. The location rating is an average of three factors: site, contribution, and placement. This sample inventory used a conservative location rating of 70%, recorded DBH class values and condition ratings, and published species ratings and regional replacement costs (*2003 Texas Supplement and Species Approximation*) to arrive at the estimated street tree value shown in Table 4. A complete list of replacement values, by species, is shown in Appendix C.

Table 4: Tree Replacement Values

Number of Trees:	999	
Total Value:	$979,543	
Average Tree Value:	$981	ea.

Key findings:

Street trees in Shenandoah have a landscape value totaling almost $1 million, for an average of $981 each. Considering the number of small trees that will continue to grow over time, city leaders can expect increasing value from street trees for many years.

Appendix C illustrates the value of large trees. Even a tree with a low species rating like eastern cottonwood has a high tree value of $8,187 each because the average DBH is 21 inches. Conversely, crapemyrtles represent 20% of the population, but because the average size is so small (1.9" DBH), they represent only 2% of total value (just $98/tree). Unfortunately, this species simply won't grow much beyond this average DBH, meaning its value contribution won't increase much either. In fact at $98/tree, the current average value is less than the cost of replacement.

The real star in terms of value, though, is loblolly pine, which makes up 23% of all trees but accounts for over half (51%) of the total tree value. The average DBH is slightly less than 9" and this species can easily grow to over 20" DBH, with the largest ones exceeding 30" DBH. In fact, it was the only species in our sample with a tree over 30" DBH. For the foreseeable future this species will likely remain extremely valuable to the community, easily justifying the management expenses required to keep them maintained and pest-free.

Recommendations

The purpose of this report is to provide city leaders with a snapshot of the current structure, maintenance needs, and replacement value of the street tree population. Below are the short- and long-term recommendations from the Texas Forest Service that the city can use to craft a plan for managing street trees into the future.

Short-Term (1-3 years)

Planting: develop a strategy to plant new trees annually

With a very good stocking rate of 73% on street ROWs and medians, there are relatively few opportunuties to add trees on public property. One way to achieve full stocking would be to first evaluate each median in the city and develop planting plans to fill these spaces. Just budgeting for 50 new trees per year would systematically fill the remaining 500 planting spaces in the city. The current spacing of median trees is quite close, so spreading out shade tree species to a minimum of 30 feet apart will help to maximize the shading potential on each site.

If new trees are planted in any setting – median, ROW, or front yards – diversifying the species planted is an important goal. Some species to consider adding or increasing are baldcypress, blackgum, eastern hophornbeam, southern magnolia, flowering dogwood, white oak, cherrybark oak, hawthorn, and fringetree. At this time, it would be better to add loblolly pines only in settings where there are none nearby.

Maintenance: lower the risk to the public from trees

In beginning to manage the risk from street trees, the first priority should be to locate and remove the 40 trees that pose risk to persons or property. This is a relatively small number, so it may be most effective to educate other city departments (public works, fire, police) how to identify and report a risky tree. From our survey, safety clearance over streets, sidewalks, and near traffic signals is not a problem in Shenandoah.

City staff should concentrate on a program of pruning for young trees (6" DBH or less). Approximately 359 trees require this maintenance investment, which will correct poor branching and greatly reduce future maintenance costs. Training pruning requires few specialized tools and is easily taught to staff members. Other basic maintenance practices such as watering, mulching, and fertilizing can also improve young tree health and survival.

Some of this activity may be included in contracts for median maintenance, but our observations show that the work is not entirely effective. One way to improve performance under a maintenance contract is to write in specific conditions when training pruning will be performed and strict standards that can be monitored. Another way is for contractors to attend periodic training classes to review effective pruning techniques for young trees.

Finally, we recommend the development of an inspection and pruning cycle for street trees, visiting each neighborhood on a 5-7 year cycle. This systematic approach will keep your trees healthy and allow city staff to observe any trees on private property that have clearance problems. Consider using a contract workforce for this maintenance program.

All tree work should conform to the latest ANSI A-300 (Standard Practices for Tree, Shrub and Woody Plant Maintenance), ANSI Z-133 (Safety Standards), and the latest Tree Pruning Guidelines from the International Society of Arboriculture (ISA) or Tree Care Industry Association (TCIA), and should be directed by ISA Certified Arborists.

Short-Term Recommendations, cont'd

Policy: review ordinances, standards, and training

Craft a public tree care ordinance that clarifies the role of city departments in caring for street trees. A public tree care ordinance is one of the four required standards for becoming a Tree City USA. The ordinance can also set standards for locating new plantings and can define the role for individuals, groups, and businesses in planting trees in the public ROW.

Develop a system for tree maintenance and planting and keep track of your progress. Such annual accomplishment reports can also be used to qualify for Tree City USA. A complete management plan covering the next three to five years would help guide work into the future and help set budget levels to accomplish your goals.

Conduct a basic tree care workshop to train city personnel from all applicable departments on proper tree maintenance practices and inspection procedures. Texas Forest Service regional foresters can help schedule training classes, workshops, and other educational opportunities.

Community Support: get the public involved

In writing the public tree care ordinance, consider creating a citizen tree board. Many public tree ordinances establish such boards to build support for a tree management program and help set priorities for tree planting and care throughout the city.

Continue to conduct an annual Arbor Day celebration, and involve citizen groups to help plan the event. This is often one of the defined tasks for a citizen tree board, but Arbor Day can involve other community organizations such as the local Garden Club or even a new group such as Keep Shenandoah Beautiful. These organizations can be great partners that support and advocate for tree issues in the community, and can help you retain Tree City USA status. This award program of the National Arbor Day Foundation and the State Foresters recognizes communities that invest in and manage public trees. Your Texas Forest Service forester can support a recognition ceremony at city council meetings or on Arbor Day.

Look to the private sector for additional support. Through your non-profit partners, many local businesses are often willing to donate towards activities that have such a strong public benefit as planting and caring for trees.

Long-Term Recommendations

Develop a Street Tree Master Plan to guide annual work plans and provide long-range budget forecasting. This can be an important tool in communicating with city leaders on the need for an ongoing maintenance budget. This plan will identify street tree priorities, goals and objectives and can help integrate street trees as part of the public infrastructure. To fund the plan, create a "green infrastructure" provision for capital improvement projects to create a dedicated income stream for planting new trees on all city construction projects.

Use this inventory to conduct a more thorough analysis of the city's trees, through models like the U.S. Forest Service's STRATUM or UFORE, or American Forests' CityGreen. These tools can calculate the ecosystem benefit of trees from processes such as pollution mitigation, storm water runoff prevention, energy savings and other values that trees provide to a community.

Appendix A–Part 1: Sample Blockside Data Sheet

Blockside #: _____ **ROW Width (ft.):** _____ **Date:** _____ **Crew:** _____

Street: _____ **From:** _____ **To:** _____

Tree #	Median/ Private Tree?	Species/ Code	DBH Class									Condition Class/Rating				Maintenance						Clearance Issues			
																Prune				Remove					
			0-3	4-6	7-12	13-18	19-24	25-30	31-36	37-42	43+	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	N/A
1	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
2	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
3	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
4	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
5	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
6	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
7	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
8	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
9	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
10	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
11	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
12	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
13	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
14	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
15	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
16	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
17	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
18	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
19	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
20	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
21	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
22	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
23	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
24	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
25	M PVT		1	2	3	4	5	6	7	8	9	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA

Special Notes

Address/Intersection

Number of Planting Sites per Block:

In Public Median or ROW: _____

Private Yards (<30' from ROW): _____

Blockside Sheet **1** of _____

Appendix A–Part 2: Data Sheet Definitions

Tree Inventory Information: TXSCTI

Blockside Number: Blockside = street name from street name to street name. 5% random sample has been mapped with ROW width and Blockside numbers assigned before the survey begins.

Tree #: Tree number is just to help you keep track of where you are since this is a sample inventory. Start at a block end. The survey is taken by walking or driving up one side of the block and down the other. All trees are counted in ROW and medians (if applicable) for residences, businesses, parks and other maintained areas. Only survey trees over 6 inches in fencerows or wild areas. If you have more than 25 trees, use a sheet with blank tree number column and fill in 26, 27, 28… and fill in "Blockside Sheet ____ of ___" at bottom of survey sheet.

Median Tree: Circle 'M' if tree is in a center median strip. Mark map to indicate the total length of the median on the blockside.
Private Tree: Circle 'PVT' if tree is on private property **and** has 'Clearance Issues' - don't record Species, DBH Class, Condition Rating or Maintenance for this tree.

Species Code: From list. Write name in if not on list.

DBH Class: Measure or estimate DBH and assign to one of the following classes: 1 (0-3), 2 (4-6), 3 (7-12), 4 (13-18), 5 (19-24), 6 (25-30), 7 (31-36), 8 (37-42), 9 (43+). If forked, take diameter at narrowest point below fork. If multi-stemmed (i.e. crape myrtles), average the diameters of stems over 1" at DBH. For palm species, assign to class based on feet of clear trunk height (from ground to base of live crown).

Condition Class: Condition addresses the current state of the tree's health, structural soundness, shape, and growth rate. Rate the overall health and condition of a tree by analyzing root characteristics, trunk and branch structure, canopy, twigs, buds, foliage, and any presence of disease and pest pathogens. Classify and record the condition of each tree in one of the following categories adapted from the rating system established by the International Society of Arboriculture:
Good: Trees in this class are judged to be desirable and with regular maintenance can retain this classification. They have few signs of physical damage, decay, disease or insect damage, or deadwood in the crown, limbs or trunk, although they may be interfering with utility lines or are planted in an overcrowded location.
Fair: Trees in this category have visible signs of stress, including one or more of the following: thinning canopy or small leaves; premature fall coloration; limited insect or disease infestation; structural faults or poor form; mechanical stem damage, including evidence of past 'topping'; deadwood >2" in the crown, limbs or trunk.
Poor: Trees in this group are in a general state of decline, exhibiting major disease or insect damage, physical defects, over 50% of the crown has deadwood or other serious defects, or bark may be beginning to peel. Priority pruning is likely required (i.e., large dead wood is present that could cause significant harm or damage).
Dead: Trees in this category are either already dead or in such very poor condition that removal is warranted. These trees have over 90% dead branches and have completely succumbed to insects, pathogens, or nutritional deficiencies. Little or no live foliage is visible during the growing season.

Maintenance:
PI*: Prune Immediate Priority. Requires immediate pruning – record under special notes at bottom of page. Trees in the immediate pruning category present possible safety risks to persons or property. Trees in this category are characterized by broken branches and large deadwood. Pruning should be accomplished as soon as resources are available.
PH: Prune High Priority. Trees requiring high priority pruning should be attended to as quickly as scheduling will allow. These trees, like the immediate priority pruning category, have broken branches and areas of deadwood. The dead areas, however, do not present an apparent immediate safety risk to persons or property.
PR: Prune Routine Priority. All other trees except young and recent plantings fall into the routine pruning category. They require removal of dead, dying, diseased, or obviously weak and heavy branches and deadwood. Routine, ongoing pruning should be scheduled and programmed to ensure all tree pruning is accomplished on a minimum cycle of five to seven years. It is important to remember that low priority problems can become high priority if they are not maintained for an extended period of time.
PT: Prune Train. The final maintenance category is training pruning. Trees in this category are generally young, recent plantings. Minimum maintenance includes trimming root and trunk suckers, deadwood, crossing, diseased, or weak branches, and staking improvement or removal. Trees in this category need to be scheduled for maintenance and not neglected. Generally, young trees should be pruned to reflect their species' natural growth pattern or to a single leader or a strong central leader to promote the development of strong scaffold limbs.
RI*: Removal Immediate Priority. Record under special notes at bottom of page. Trees categorized as high priority removals should be removed as soon as possible based on their lower condition class and proximity to active use areas or structures.
R: Removal-low priority. Low priority removals should be scheduled and accomplished when resources are available after high priority removals have been accomplished. These trees are generally located away from population areas and facilities.

Clearance Issues: Note if it is a private tree by circling PVT.
***TS: Traffic Signal.** Record under special notes at bottom of page. Circle if tree is blocking traffic control device such as a sign or light.
R: Road Clearance. Limb(s) is less than 14' over the curb or roadway.
S: Sidewalk Clearance. Limb(s) is less than 8' over a sidewalk (or other hardscapes for parks and public facilities besides streets).
N/A: No Clearance Issues.

Planting Sites: Medium or large trees to be planted if room. Under power lines, only small trees to be planted. Minimum 4-foot tree lawn needed to plant a tree. Record the number of planting spaces in Public ROW or Median. Also record number of planting spaces in Private Front Yards within 30' of ROW edge.
Distances From:
Utilities – overhead (15'); Hydrants, utility poles, and light posts (10'); Intersections (measured from corner) (25'); Driveways (5'); Other trees: 20-50'

TFS January 2007 PDS

Appendix B: List of Species Sampled and the Distribution of Each by DBH

Common Name (Scientific Name)	Distribution by DBH Class									Tree Count	Percent of Total	Running %
	0-3	4-6	7-12	13-18	19-24	25-30	31-36	37-42	43+			
Loblolly Pine (Pinus taeda)	18%	48%	19%	9%	6%		0%			228	22.8%	22.8%
Common Crapemyrtle (Lagerstroemia	97%	2%	1%							202	20.2%	43.0%
Water Oak (Quercus nigra)	55%	16%	15%	11%	1%	1%				91	9.1%	52.2%
Live Oak (Quercus virginiana)	37%	54%	6%	2%	1%					84	8.4%	60.6%
Sweetgum (Liquidambar styraciflua)	38%	21%	35%	5%		2%				66	6.6%	67.2%
Waxmyrtle (Myrica cerifera)	88%	5%	7%							43	4.3%	71.5%
Slash Pine (Pinus elliottii)	2%	93%		5%						42	4.2%	75.7%
Shumard Oak (Quercus shumardii)	84%	14%		3%						37	3.7%	79.4%
Red Maple (Acer rubrum)	64%	33%	3%							36	3.6%	83.0%
American Sycamore (Platanus occidentalis)	52%	22%	26%							23	2.3%	85.3%
Chinese Tallowtree (Sapium sebiferum)	37%	32%	26%		5%					19	1.9%	87.2%
Yaupon (Ilex vomitoria)	89%	11%								18	1.8%	89.0%
Southern Magnolia (Magnolia grandiflora)	50%	42%	8%							12	1.2%	90.2%
Callery Pear (Pyrus calleryana)	8%	92%								12	1.2%	91.4%
Southern Red Oak (Quercus falcata)	36%	27%	9%	27%						11	1.1%	92.2%
Winged Elm (Ulmus alata)	36%	27%	27%	9%						11	1.1%	93.6%
Nuttall Oak (Quercus nuttallii)	90%	10%								10	1.0%	94.6%
Baldcypress (Taxodium distichum)	70%	30%								10	1.0%	95.6%
Cedar Elm (Ulmus crassifolia)	33%	67%								6	0.6%	96.2%
Oriental Arborvitae (Thuja orientalis)	75%	25%								4	0.4%	96.6%
Silver Maple (Acer saccharinum)		100%								3	0.3%	96.9%
River Birch (Betula nigra)		100%								3	0.3%	97.2%
Eastern Redcedar (Juniperus virginiana)		67%	33%							3	0.3%	97.5%
Bur Oak (Quercus macrocarpa)	100%									3	0.3%	97.8%
Mexican Fanpalm (Washingtonia robusta)	67%	33%								3	0.3%	98.1%
Mimosa (Albizia julibrissin)		50%	50%							2	0.2%	98.3%
Eastern Redbud (Cercis canadensis)		100%								2	0.2%	98.5%
Black Tupelo (Nyssa sylvatica)	50%		50%							2	0.2%	98.7%
Laurel Oak (Quercus laurifolia)	50%					50%				2	0.2%	98.9%
Willow Oak (Quercus phellos)	50%		50%							2	0.2%	99.1%
Post Oak (Quercus stellata)			50%	50%						2	0.2%	99.3%
American Hornbeam (Carpinus caroliniana)	100%									1	0.1%	99.4%
Green Ash (Fraxinus pennsylvanica)				100%						1	0.1%	99.5%
American Holly (Ilex opaca)		100%								1	0.1%	99.6%
Shortleaf Pine (Pinus echinata)			100%							1	0.1%	99.7%
Eastern Cottonwood (Populus deltoides)					100%					1	0.1%	99.8%
Mexican Plum (Prunus mexicana)	100%									1	0.1%	99.9%
Sawtooth Oak (Quercus acutissima)		100%								1	0.1%	100.0%
									Total Number of Public Trees Sampled:	**999**		
									Total Number of Species Sampled:	**38**		

Appendix C: Tree Replacement Values, by Species

*Values are calculated for each tree in the sample using its recorded condition class rating, an average DBH for its assigned class, an average location rating of 70%, and the Houston/Beaumont 'Basic Price' ($84 per square-inch) for a 3-inch caliper specimen, installed and guaranteed for one year. Values for palm species are calculated using an average height in 'brown trunk feet' (BTF) and a Basic Price for that species. Species ratings for species marked with # were determined by the regional forester.

	Tree Species	Species Rating #	Average DBH/BTF	Number of Trees	Average Tree Value	Total Value	Percent
	Loblolly Pine	80%	8.9”	228	$2,197.53	$501,037	51.2%
	Water Oak	68%	7.4”	91	$1,136.35	$103,408	10.6%
	Live Oak	100%	5.4”	84	$997.66	$83,803	8.6%
	Sweetgum	67%	7.5”	66	$1,114.81	$73,577	7.5%
	Slash Pine	70%	5.8”	42	$863.44	$36,264	3.7%
	Laurel Oak	80%	19.1”	2	$10,798.14	$21,596	2.2%
	Common Crapemyrtle	80%	1.9”	202	$97.99	$19,793	2.0%
	Chinese Tallowtree	66%	7.3”	19	$1,020.27	$19,385	2.0%
	Southern Red Oak	76%	8.7”	11	$1,408.86	$15,497	1.6%
	Winged Elm	74%	7.1”	11	$1,300.48	$14,305	1.5%
	American Sycamore	60%	5.3”	23	$564.42	$12,982	1.3%
	Eastern Cottonwood	67%	21.0”	1	$8,187.13	$8,187	0.8%
#	Waxmyrtle	70%	3.0”	43	$174.45	$7,501	0.8%
	Red Maple	45%	3.5”	36	$194.11	$6,988	0.7%
	Post Oak	80%	12.4”	2	$3,391.56	$6,783	0.7%
	Green Ash	80%	15.0”	1	$6,650.12	$6,650	0.7%
	Callery Pear	60%	4.8”	12	$498.53	$5,982	0.6%
	Shumard Oak	80%	3.4”	37	$154.22	$5,706	0.6%
	Southern Magnolia	53%	4.3”	12	$356.33	$4,276	0.4%
	Eastern Redcedar	87%	6.6”	3	$1,186.59	$3,560	0.4%
	Cedar Elm	78%	4.2”	6	$501.90	$3,011	0.3%
	Baldcypress	80%	3.0”	10	$268.22	$2,682	0.3%
#	Yaupon	80%	2.2”	18	$130.95	$2,357	0.2%
	Willow Oak	76%	6.5”	2	$884.47	$1,769	0.2%
	Black Tupelo	75%	6.5”	2	$857.24	$1,714	0.2%
	Nuttall Oak	92%	2.1”	10	$153.81	$1,538	0.2%
	River Birch	55%	5.0”	3	$508.00	$1,524	0.2%
	Mimosa	38%	7.3”	2	$744.08	$1,488	0.2%
	Silver Maple	45%	5.0”	3	$415.63	$1,247	0.1%
	Shortleaf Pine	78%	9.0”	1	$1,167.10	$1,167	0.1%
#	Oriental Arborvitae	80%	2.8”	4	$234.60	$938	0.1%
#	American Holly	80%	5.0”	1	$738.90	$739	0.1%
	Sawtooth Oak	80%	5.0”	1	$738.90	$739	0.1%
	Eastern Redbud	45%	5.0”	2	$363.68	$727	0.1%
#	Mexican Fanpalm	50%	3.1'	3	$149.33	$446	0.0%
	Bur Oak	86%	1.5“	3	$59.57	$179	0.0%
	American Hornbeam	64%	1.5”	1	$53.20	$53	0.0%
	Mexican Plum	60%	1.5”	1	$49.88	$50	0.0%
				Total: 999	**Average: $981 ea**	**$979,653**	