

APRIL 30, 2023

City of Millwood, Washington Urban Forestry Management Plan



URBAN FORESTRY MANAGEMENT PLAN (UFMP)

City of Millwood
9103 E Frederick Avenue
Millwood, Washington 99206



Millwood, 1929; Northwest across Dalton Street

APRIL 30, 2023

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EXECUTIVE SUMMARY

The urban forest is a mixture of people, plants, politics, and planning that results in our daily integration with our city environment. Urban or community forestry is the integration of people, trees, environment, and the continual change of how they interact with one another. Urban forest management plans (UFMPs) are developed by many communities to provide a common vision for urban forest health and sustainability, establish goals, and coordinate actions toward achieving them. An urban forest includes street and park trees, remnant forested areas, and those planted in medians, parking lots, tree pits, and other urban spaces. An urban forest management plan recognizes the impacts of tough urban conditions on the natural landscapes and public trees and balances those impacts with the needs of humans who share this ecosystem. Urban forest management can help Millwood provide environmental, social, and economic benefits that enhance the quality of life, minimize the effects of urbanization, foster civic pride, and contribute to community character; long-term benefits that residents, businesses, and visitors seek.

Trees make places work, look, and feel better. As well as playing a role in climate proofing our neighborhoods and supporting human health and environmental well-being, trees can also help to create conditions for economic success. This management plan takes a progressive, applied approach to urban trees, providing decision makers with the principles and references they need to fully realize this potential.

Millwood has completed an inventory assessment of trees in parks, along trails, and trees in the right of way along city streets. It will facilitate the ongoing commitment to maintain, enhance, and preserve Millwood's tree canopy and guide Millwood staff, landowners, contractors, utility companies, developers, planners, and residents in making decisions about their trees.

Millwood's inventory and management plan was initiated to manage, maintain, enhance, and preserve the community tree canopy. Project funds were provided from a grant obtained from the USDA Forest Service Urban and Community Forestry Program administered by Washington Department of Natural Resources Urban and Community Forestry Program (WDNRUCF). Technical and staff support was provided by the City of Millwood staff.

Two primary methods of community outreach were used:

- Interviews with City Staff; Millwood Beautification & Tree Board
- Public meetings

Public Process

A crucial element of developing the UFMP was soliciting information from city staff, city boards, and residents of Millwood. Stakeholder input was used to assist CFC in identifying opportunities, issues, elements, actions, and goals for the UFMP. Methods of gathering public input included holding stakeholders' public meetings and conducting interviews and soliciting comments from city staff. Every attempt was made to engage community members in the process of developing the UFMP.

Public meetings were held at Millwood City Hall on August 11, 2022, February 7, 2023, and March 21, 2023. Meeting notices were advertised throughout city communication

channels. A copy of the draft plan was posted to the City's website for review. All comments were forwarded to CFC for inclusion in the plan.

Purpose of the UFMP

The starting point for success understands where you are and where you want to go (Figure 1). The UFMP principles will help Millwood staff integrate the goals and objectives of the City of Millwood Urban Forestry Program while managing the specific needs of the community trees and values of residents.

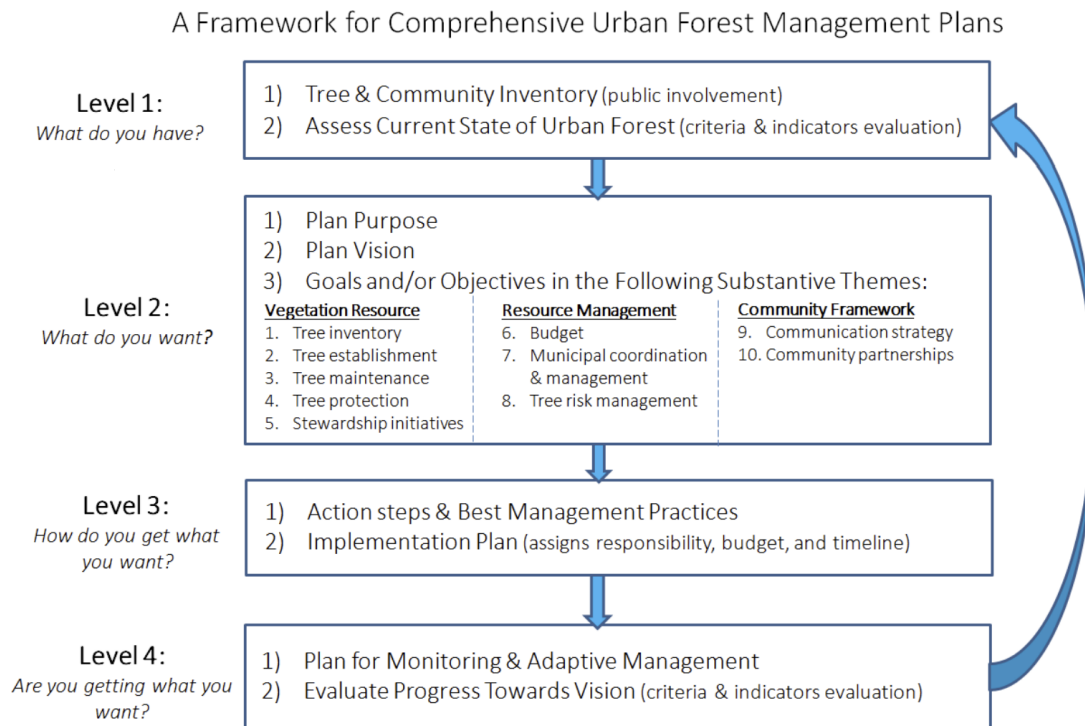


Figure 1 – A framework for comprehensive UFMPs (Gibbons, 2014)

Managing, maintaining, and preserving urban trees can only be achieved effectively by developing and implementing a strategic urban forest management plan. An effective and sustainable urban forest management program must address three major components: Social systems, governance systems, and the ecological systems. Positive and negative social impacts of implementation efforts influence the political standing of urban forestry programs, suggesting that the political and social skill of city staff, their superiors, and community advocates are key factors in the success of implementation. The governance component provides guidance to responsible entities on how, when, and where management activities will occur. The ecological components addresses the dynamic nature of the system, which is the reason this process is different than simply managing other infrastructure such as transportation systems, sewer systems, or electrical grids. An urban forest management plan standardizes policies and practices for tree-related activities. This plan lays out components that encompass a long-term vision with short-term goals for managing Millwood's trees.

An Urban Forest Management Plan (UFMP) is a guide for ensuring that public trees and forests are appropriately cared for according to arboriculture standards and community goals. Millwood's UFMP is a strategy to expand its urban forestry program to meet a range of policy, education, and management goals. The plan is a tool to explore community concerns and management conflicts, while offering a series of prioritized implementation actions based on inventory data, current urban forestry and arboriculture practices, and community outreach. The plan evaluates species composition, maintenance requirements, tree population trends, and the condition of the urban forest.

The capacity of the urban forest to provide benefits depends on how the resources are developed and managed. The UFMP will lead to improvements in urban tree management and stewardship in a coordinated, cooperative approach with city departments, program partners, and residents. The plan was prepared from a comprehensive analysis of tree inventory data, staff input, and community participation.

As a strategic and forward-looking document, this plan should be incorporated into the existing policies and requirements of the Millwood Comprehensive Plan, City Tree Ordinance, Millwood Shoreline Master Plan, Capital Facilities Plan, Parks and Recreation Plan, other city master plans, and agreements with other government agencies, Homeowner associations, and local education institutions.

Millwood Tree Inventory Summary

Community Forestry Consultants, Inc. (CFC) collected tree inventory data in the fall and winter of 2022. Attributes in the database consisted of GPS location, species, condition rating, tree dimensions, and maintenance needs. CFC used the data to develop report summaries, project staff and maintenance needs, and evaluate tree population characteristics. Findings in this report are limited by tree inventory data attributes collected as of the date of this report.

Data results

- Tree Sites: 910.
- Trees requiring maintenance: 650
- Trees requiring removal: 67.

Major Issues

- Structural defects (co-dominant stems; dead branches)
- Tree sidewalk conflicts
- Limited species diversity

Goals of the UFMP

The management plan supports the mission of improving Millwood's tree population through proper management of a community asset. The UFMP follows the vision to retain a high quality of life by improving Millwood's urban forest management and thereby increasing the numerous, proven benefits derived from trees.

Relying on the UFMP for guidance, the city will partner with or engage in the following:

- Encourage tree planting and stewardship by utilizing community members, organizations, and volunteers.

- Preserve and protect existing trees.
- Promote public safety, tree health, and structure; implement cost-effective and proper arboriculture maintenance of the community forest.
- Increase public education and awareness of the value of the community forest.
- Maximize the social, economic, and environmental benefits of the community forest for current residents and future generations.

The UFMP guidelines promote consideration of public trees as major and important urban infrastructure and outlines best practices to incorporate trees into the city fabric. It provides for the development of a progressive long-range urban forestry program that will result in a healthier and sustainable forest in Millwood. The UFMP is a tool to use in guiding the tree program and garnering support, cooperation, and funding for the tree program.

Lastly, it is understood that woody shrubs and ground cover plant communities are part of, and integral to, the overall health of the urban forest, but the primary scope of this plan is to focus on trees – the largest, longest-lived, and most significant member of the landscape community. The implementation of the UFMP will ultimately contribute to the quality of life in Millwood through enhancements to the tree population.

Millwood Urban Forestry Management Plan goals:

- Millwood City Council adopts and implements an Urban Forestry Management Plan.
- Provide adequate tree program and maintenance funding to sustain Millwood's tree canopy based on council, staff, Beautification & Tree Board, stakeholder, and resident input.
- Maximize and expand the urban tree canopy. Create a tree planting plan; promote proper planting of new trees and diversification of species; incorporate tree planting into community planning.
- Coordinate and integrate local urban forestry goals into city and regional planning processes.
- Maintain and update the inventory of Millwood trees to improve management and maintenance of the tree population.
- Review existing tree ordinance to incorporate the recommendations and goals of the city's tree management plan, adopt the ordinance into the city code, and implement ordinance enforcement practices.
- Provide education and public awareness of the importance of the trees to the community; educate city staff, contractors, and the community on proper tree care; related city ordinances and encourage greater participation in tree stewardship activities.

The recommendations made in this plan are intended to be considered and implemented over a period of five years. A systematic maintenance program, tree planting program, adequate funding, staffing, regulations, and resources today will allow Millwood's urban forest to thrive, expand, and be sustainable.

The success of this plan is based on people's expectations of the benefits they may receive from the Millwood's community forest and their willingness to invest in its sustainable management.

Urban Forestry Program Actions

The primary actions and objectives of the plan are listed below and described in detail in the body of the management plan.

- Application of arboriculture industry standards for Millwood tree care
- Engagement of International Society of Arboriculture (ISA) certified arborists to perform tree maintenance.
- Maintain tree inventory data.
- Proactive tree maintenance of Millwood trees
- Eliminate trunk damage caused by lawnmowers and weed eaters.
- Annual analysis and mitigation of risk trees
- Implement a cyclic pruning program for young and mature trees.
- Mitigate tree sidewalk conflicts and avoid creating infrastructure conflicts.
- Proper tree planting
- Proper tree maintenance
- Canopy preservation

The recommendations and actions will expand and conserve Millwood's tree resource and sustain the tree canopy for future generations. Although this commitment will come with costs, the long-term benefits are significantly greater and will result in a sustainable asset for the citizens of Millwood today and tomorrow.

INTRODUCTION

In 2022 the City of Millwood Urban Forestry program received a grant from WDNRUCF for a tree inventory and to develop and generate an urban forestry management plan for street and park trees. The City of Millwood contracted with Community Forestry Consultants, Inc. (CFC) to collect and analyze inventory data, and engage the city staff, community, and elected officials in the development an urban forestry management plan. The City of Millwood is responsible for the maintenance of trees in parks and designated public areas, and the administration of Millwood's urban forestry program. Care and maintenance of public trees located on the right-of-way adjacent to private property are the responsibility of the owners. An aerial view of some inventory sites is shown in Figure 2.

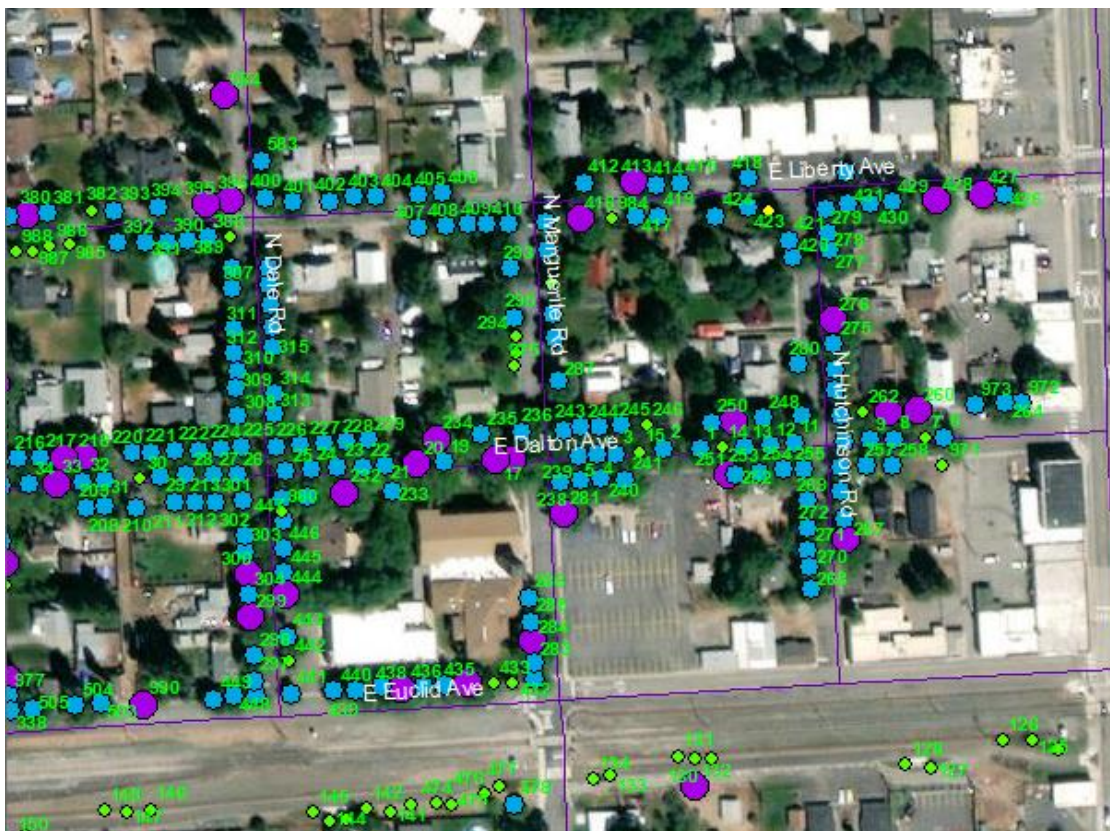


Figure 2 – Aerial photo of a portion of Millwood trees inventoried.

Vision Statement

The vision statement describes how Millwood should look and function now and in the future. It implies an action goal that facilitates objectives of proper arboriculture practices, preservation, restoration, and stewardship of trees in Millwood. The Millwood vision statement includes sentiments about the environmental, social, economic, and ecological importance of trees and natural resources to Millwood in terms of management, benefits, community values, and sustainability. The UFMP vision statement aligns with Millwood's community and organizational values.

City of Millwood Urban Forestry Vision Statement

The City of Millwood shall recognize urban forestry as an equal part of the community infrastructure, will create, enhance, maintain, support, and sustain a vibrant, healthy, structurally, and ecologically sound community forest resource for the benefit and enjoyment of Millwood residents and visitors.

Millwood Canopy Cover Goals

Canopy cover is the percentage of an area on the ground that, when considered in plan/map view, is covered by the crowns of trees. In a dense forest the canopy cover would be expected to approach 100%. On the other hand, open prairies are dominated by grasses and widely spaced trees creating canopy cover as low as 5%. In between is a variety of treed urban environments.

In considering an urban forest canopy target, several factors should be noted. First, there are no widely agreed upon, figures for canopy cover targets in urban areas. A commonly cited figure is 40%, the recommendation by the American Forests Organization, based on their “professional opinion that this tree cover is a reasonable target”.

Second, the issue of empirically deriving a percentage that is appropriate to the local environment seems to be given attention. Any study of canopy cover figures must consider local climate and soil factors and consider the differences in land development within a community.

Third, there is no attention given to the fact that the urban environment is far from homogeneous and that varying local conditions within a city, particularly related to type and design of development, will offer different constraints and opportunities. For example, it is unreasonable to expect that the same canopy coverage can be achieved in a densely built industrial area as in a residential neighborhood dominated by single-family homes. Thus, the notion that a single canopy cover figure can be – or should be – applied city-wide, would appear to be difficult to defend.

Each urban land use environment is associated with a different set of opportunities and constraints to tree growth and target value selection must recognize these.

- Right-of-way target value is best measured by stocking level, not canopy cover. Stocking level is a proportion of existing street trees to the total number of potential street trees (number of trees plus the number of available planting spaces).
- Park canopy varies between natural areas and active recreation areas and between various uses of a park; Canopy cover figures should be developed by city staff on a site-by-site basis.
- Residential areas should seek to achieve 50% canopy.
- Commercial/Industrial areas should seek to achieve 15% canopy.

The City of Millwood should establish land use canopy cover goals. Suggested land use areas and canopy cover goals are:

Canopy Coverage Goals

- Single family; multi-family residential – 50%
- Developed parks – 35%
- Undeveloped/Natural parks – 80%
- Commercial – 15%
- Streets, rights-of-way (ROW) – 80% stocking level

The bordering topography and its remnant vegetation create a prominent visual background of verdant natural landscape that contrasts with the landscape of the recent developed properties. This essentially has limited canopy coverage currently due to the small size of the trees or limited planting space. In new sites planting density should be sufficient to achieve canopy goals. In established residential areas trees are a significant feature. They should be replaced when possible, following a removal and remaining trees maintained to sustain existing canopy cover. The challenge for Millwood is clear: given the length of time that trees need to grow, efforts to increase canopy must continue today and maintenance and preservation of existing trees and forests need to start now to improve the canopy coverage.

City Plan and Policy Coordination

There are many existing plans and policies in the City of Millwood that affect and are affected by the tree population. The Millwood UFMP will act as a stand-alone management tool for the agency but should also function within the context of the City of Millwood Urban Forestry Program plans and policies and other city plans and policies that impact trees. Trees can provide solutions and fulfillment of goals in other city plans and should be integrated where appropriate. City plans should be cross-referenced and link together. Use the UFMP actively to seek linkages when working on other issues and then use trees to support and solve those broader public policy goals. Other city plans include but are not limited to:

- Millwood Comprehensive Plan 2019
- Millwood Parks and Recreation Plan
- Millwood Shoreline Master Plan
- Millwood Capital Facilities Plan
- Millwood Historical Preservation Plan
- City Tree Ordinance

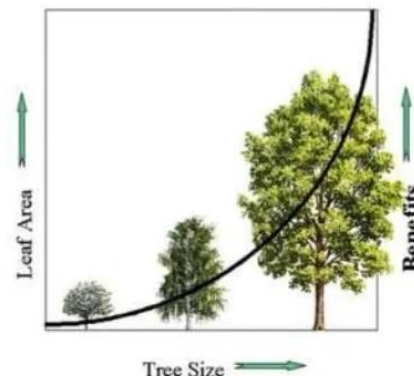
All city plans and component parts shall incorporate the UFMP into their development and implementation.

Tree Benefits

Few elements of the grey infrastructure of urban places can be said to boost property values, support retail activity, enhance tourism experiences, improve agency health, protect water quality, abate wind speeds, reduce air particulate, reduce storm water runoff, counter climate change, and ensure roadway safety all at once.

COMMUNITY FORESTRY CONSULTANTS, INC.
APRIL 30, 2023

Larger Trees, Greater Benefits



URBAN FORESTRY MANAGEMENT PLAN
CITY OF MILLWOOD, WASHINGTON

Communities looking for these benefits may be surprised to find a solution right in their own backyards, along their streets, and in their parks. The green infrastructure of trees, along with parks and open space, provide a wealth of benefits to Millwood (Figure 3).

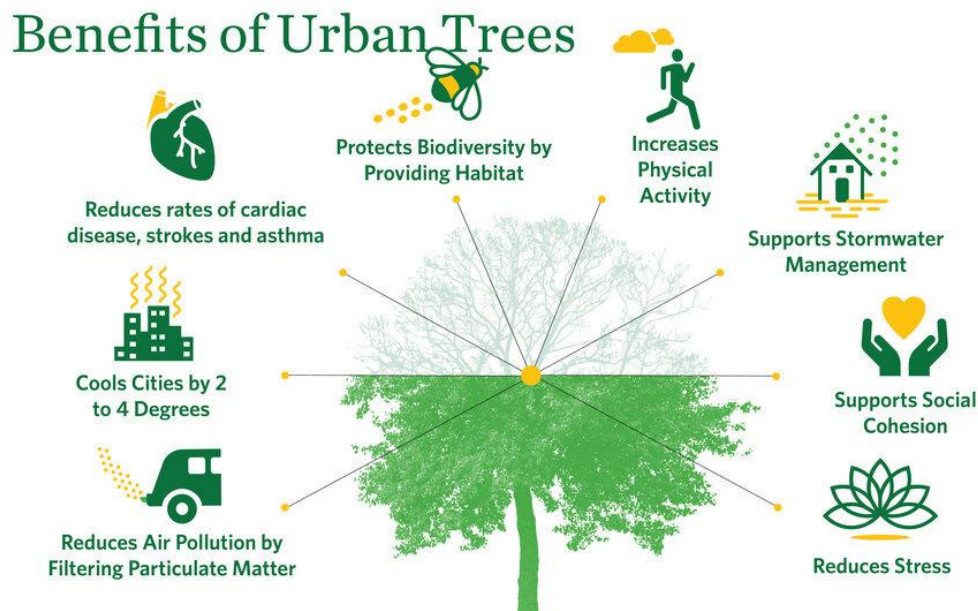


Figure 3 – Trees provide many benefits for Millwood if maintained properly.

Many scientific studies in recent years have addressed the role of trees in urban environments. Trees and urban forests provide environmental, ecological, economic, and social benefits. Urban trees and natural forestlands play a huge role in the quality of life in Millwood. A summary of key values and benefits, and some supporting sources, is provided below.

Street Tree Effect and Driver Safety. Pedestrian safety is an important facet of livability. There is often a need to recognize and improve livability along many urban walking environments, especially for non-vehicular users and commercial activity. While continuing to support and advocate for street trees in the pedestrian realm, planners can use street trees to help meet livability goals by leveraging place-making, walkability, destination accessibility, traffic safety, and provisioning ecosystem services. Again, these goals are critical to meet and recognize populations who are utilizing the sidewalk networks most and are exposed to the greatest amount of risk.

Research indicates that trees contribute to a sense of safety. The significant reduction in driver speeds in the suburban condition indicates that street trees may provide positive operational values. Trees have a positive impact on the transportation network in the city and neighborhoods (Dumbaugh 2005; Wolf 2006; Naderi et.al. 2008). For the suburban landscape, the presence of trees significantly dropped the cruising speed of drivers by an average of 4.87 kilometers per hour (3.02 miles per hour). Faster drivers and slower drivers both drove slower with the presence of trees (Figure 4).

Street trees positively impact pedestrian safety. People walking on streets with new tree plantings both prefer and feel safer on streets with high tree cover. This suggests a compelling rationale for not only planting new street trees, but also investing in their stewardship and survival.

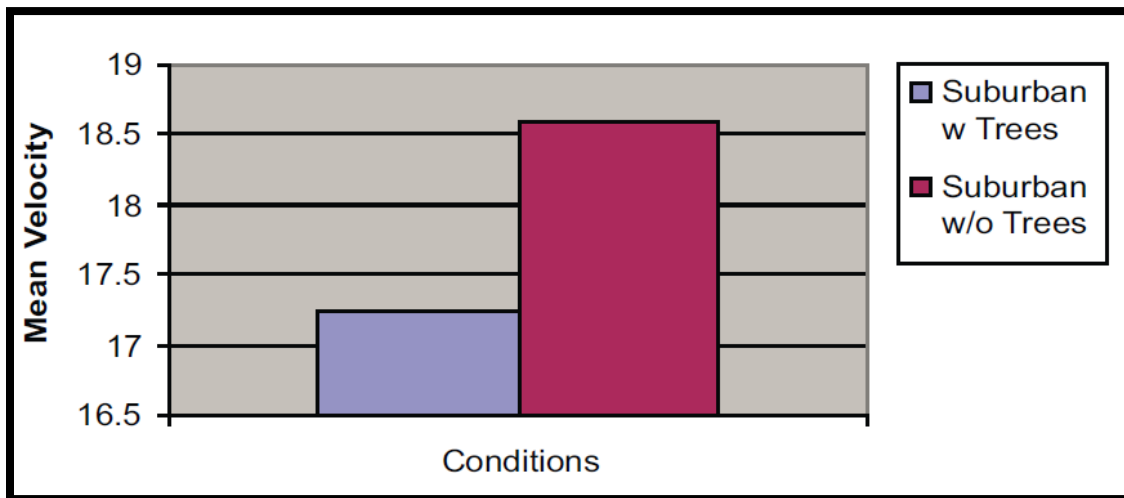
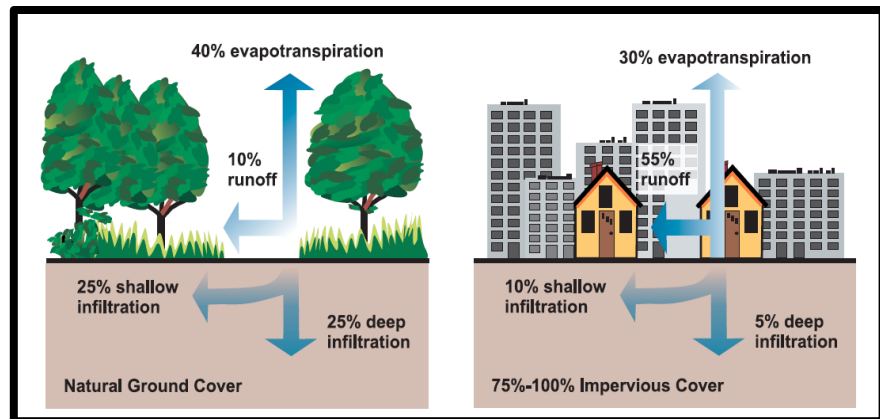


Figure 4 – Trees significantly drop cruising speed (feet/second) of faster and slower drivers.

Vegetation and Violence. A scientific study by the University of Illinois at Urbana-Champaign has demonstrated that contact with nature help reduce the incidence of aggression and violence in city neighborhoods. According to the study, levels of aggression were significantly lower among people who had some kind of nature outside of their apartments versus those who didn't. The impact of the physical environment on human aggression has been well established — crowding, high temperatures, and noise have all been linked to violent behavior. Some scientists believe that it is because people living under these conditions suffer from something called chronic mental fatigue, which can make them inattentive, irritable, and impulsive – all of which have been linked to aggressive behavior. It has been shown that exposure to green spaces, trees, and other vegetation can mitigate the harmful effects of chronic mental fatigue, reducing aggressive behavior in the process.

Water Quality, Storm Water Retention. Water quality continues to be an important issue to Millwood and ways to avoid nutrient loading and other forms of water

contamination to the city water and irrigation systems become critical. Water quality has the potential to be degraded by development due to erosion, storm water discharge, and on-site sewage treatment systems.

Urban trees are an effective tool available every day to improve water quality, conserve water resources, and reduce storm water runoff. Urban forests absorb rainfall, control surface water runoff, filter ground water and assist in ground water recharge. According to one study, 37,500 tons of sediment per square mile per year comes off developing and developed landscapes, and urban trees could reduce this amount by 95% (Coder 1996).

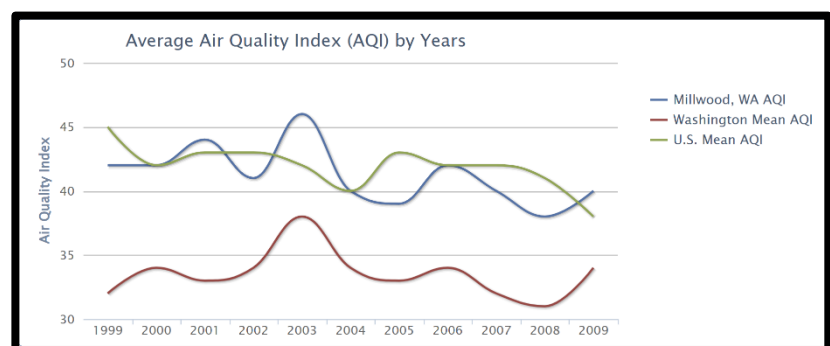
Trees can contribute to the overall goals of the Millwood stormwater management and aid in solving water quality, retention, and discharge issues in the consolidated irrigation district. Trees are a current asset that can address stormwater and water quality issues important to the community and do it in an economically feasible manner.

Urban tree canopy reduces storm water runoff by intercepting and storing rainfall and increasing infiltration into the soil through improved soil structure. The US Environmental Protection Agency issued a report, *Using Smart Growth Techniques as Storm Water Best Management Practices*, which identified urban tree canopy as an innovative and sustainable means to dramatically reduce stormwater runoff and the costs associated with stormwater management. Trees contribute to water quality and quantity improvement through stormwater control, attenuation of peak flows, maintenance of base flow, erosion control and rainfall interception (Bernatzky 1983; Xiao et al 1998; Floyd 2002; American Forests 2007). Trees should be integrated into Millwood's stormwater management program.

A tree canopy and continuous vegetation, which is adapted to the local environment, has a positive effect on slope stability (Reubens et al. 2007). Tree root systems enhance the shearing strength of the soil, enabling it to resist landslides and erosion (O'Loughlin 1974). Through interception, evapotranspiration and enhancing soil permeability, trees also improve the hydrological characteristics of the soil (Ziemer 1981). Trees on slopes can prevent, protect, and minimize the damage in the event of landslides or avalanches.

Air Quality Improvements. Eastern Washington often experiences poor air quality. Air quality is impacted by residential wood heating in the fall and winter, wildfires, and prescribed burning in the summer and fall, and general open burning throughout the year. Particulate matter poses a dangerous threat to human health and the environment. Regional haze can impair visibility in all directions over a large area. Air toxins such as carbon monoxide and sulfur dioxide contribute to respiratory problems. Smoke outs can be severe in Spokane County.

Trees absorb gaseous pollutants such as ozone, nitrogen oxides and sulfur dioxide; and they filter



particulate matter such as dust, ash, pollen, and smoke. Reductions in these pollutants results in improved public health and reduces the severity of ozone-induced asthmatic responses and other respiratory illnesses. Urban trees absorb carbon dioxide, a major greenhouse gas, at an approximate rate of 230-lbs per year per tree. According to the U.S. Department of Agriculture, "one acre of forest absorbs six tons of carbon dioxide and puts out four tons of oxygen. This is enough to meet the annual needs of 18 people."

Trees improve air quality by producing oxygen, absorbing pollutants, and sequestering carbon (Rowntree and Nowak 1991; Nowak 1992; McPherson et al 1999; American Forests 2007). A regional ecosystem analysis specific to Millwood using tree inventory data can estimate the monetary value of pollution removal services provided by the urban forest.

The Economics of Aesthetics. Millwood is noted for its vibrant downtown with a mix of small businesses and housing that give residents the feeling of a small town. Millwood has attracted large-scale commercial development along its most heavily trafficked roads, thus growing its tax base. It is important to the community and fiscal revenues to remain competitive and attractive to businesses and customers, and residents alike. Recent population and development increases in Millwood and neighboring communities continue to increase competition for businesses and customers.

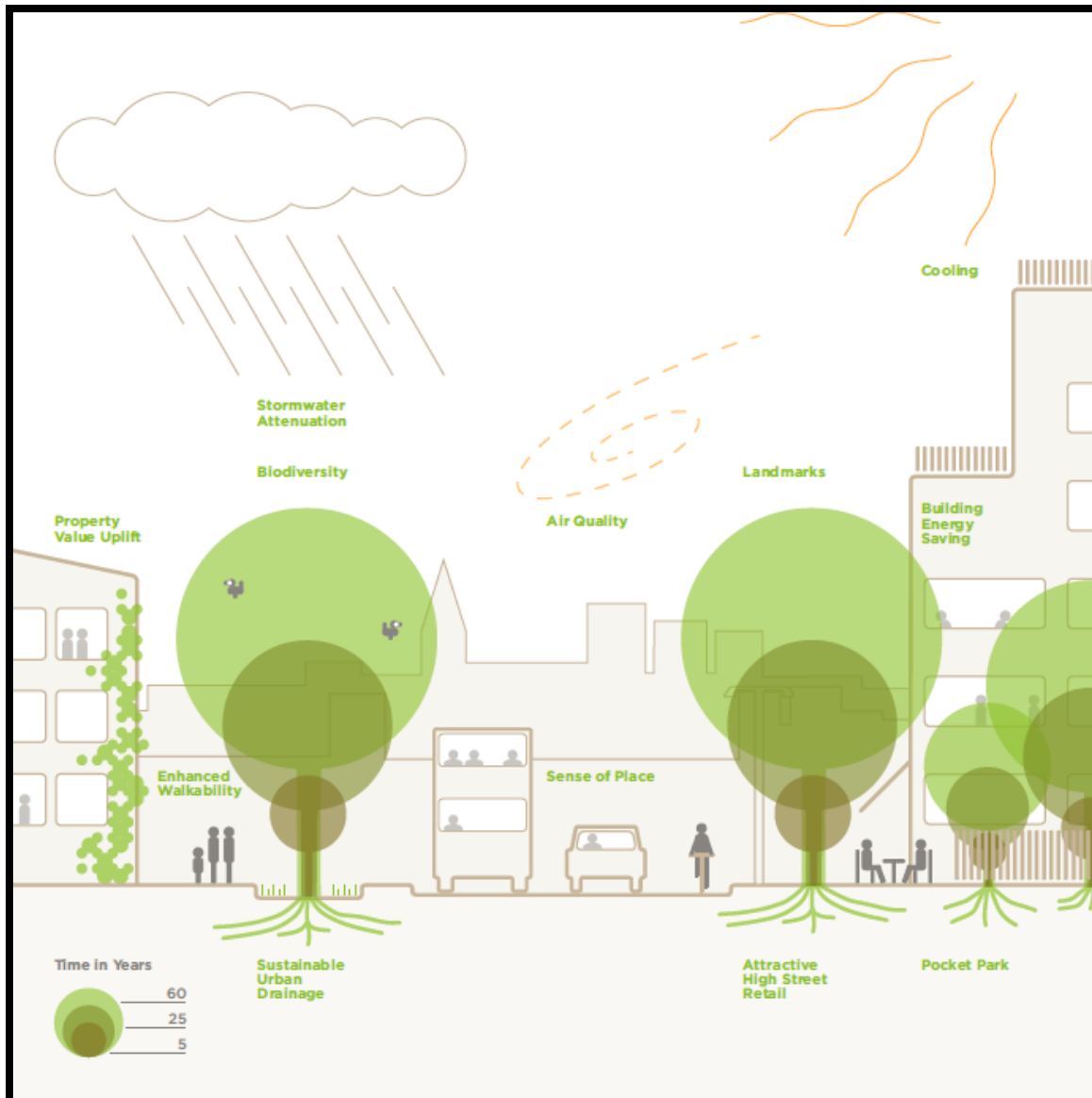
Improving aesthetics has tangible economic benefits. Networks of parks, natural areas, and trails give a community a reputation for being a good place to live, work and visit. Increased recreational and community activity attracts new businesses, fosters expressions of creativity, and stimulates tourism. Businesses locate or re-locate based on a community's quality of life, including an abundance of open space, nearby recreation, and pedestrian friendly neighborhoods. Nationwide, easy access to parks and open space has become a new measure of community wealth – an important way to attract businesses and residents by guaranteeing both quality of life and economic health.

Aside from the potential price effect on residential property sales, trees in retail settings increase shoppers' willingness to pay for goods and services by 12%. Shoppers also indicate that they are willing to drive farther and stay longer if a retail district is well-landscaped with trees. Also, respondents consistently reported greater willingness to pay values for goods and services in the landscaped mall at an overall rate of 8.8%. Urban forests create an appealing consumer environment in business districts (Wolf 2003, 2005). Trees provide a critical solution that allows Millwood to maintain its role as a regional housing provider, generate higher tax revenues, and keep property taxes at a lower rate.

- travel time, travel distance
- duration of visits
- frequency of visits
- willingness to pay for parking

increased market range & potential

Increases in land values or sale prices because of quality landscaping and the presence or retention of trees offers a secondary benefit to the local jurisdiction. The adjustments relate to additional revenue from sources such as real estate transfer taxes and property tax assessments (Behe et. al. 2005; Wolf, 2007).



Health & Well-Being.

Trees provide a benefit to the health care industry and improve the mental and physical states of the community residents and visitors. Trees foster safer, more sociable neighborhood environments and have been shown to reduce levels of crime, including domestic violence. Views of nature reduce the stress response of both body and mind



Trees and Green Space improve physical and mental health:

- Stress
- Recovery
- Attention disorders
- Asthma
- Obesity
- Exercise
- Birth outcomes

when stressors of urban conditions are present. Hospital patients with window views of trees recover significantly faster and with fewer complications than comparable patients without access to such views.

Public spaces with trees receive more users, increasing the frequency of casual social interactions and strengthening the sense of community. Trees along transportation corridors narrow a driver's field of vision, reducing traffic speeds and increasing pedestrian safety by providing a natural, physical barrier. Studies have found that urban highways lined with trees decrease driver stress, resulting in fewer incidents of road rage.

Parks, green space, and trees are important assets for Millwood residents and visitors. Use of these resources by the community promotes the health and well-being of the individuals as well as the sense of community.

While real costs must be realized by Millwood and its residents because of the urban forest (e.g., storm damage, removals, planting, care, leaf removal, infrastructure impacts, etc), the protection and expansion of the Millwood urban forest will yield increased environmental, economic, and social benefits. This plan specifies several actions the City of Millwood can take to maximize these benefits and engender community involvement and activism.

Millwood Beautification & Tree Board (MBTB)

The MBTB is established by Millwood Municipal Code (MMC) Chapter 2.52.020. Board duties are described in MMC Chapter 2.52.030. The MBTB is an advisory committee with the purpose of providing advice to the mayor, council, and city staff as to the preservation, protection, and management of the community forest of the city. Their function is to celebrate trees and promote a community commitment to sustaining Millwood's urban forest. The MBTB forms the middle link, a communication link in a chain of moral authority among the community, city staff, and city council. The MBTB does not function as an operations board and should stay out of operational functions of the program. The tree committee has the authority to develop a strategic vision for public

street and park trees. Tree committees should not be involved in the daily operations of the urban forestry program. Individual committee members do not have authority to make decisions on behalf of the MBTB. The committee provides leadership by first serving, and then seeking to put community interests ahead of any personal interests committee members may have.

A tree committee fulfills one of the criteria to become recognized as a Tree City USA by the Arbor Day Foundation. A tree committee can be a particularly useful resource for Millwood urban forestry staff working to develop and implement a strategic vision since it provides additional opinions from individuals who are interested in, and typically knowledgeable about the subject at hand, and STC also helps foster and maintain relationships with groups and individuals that may be able to assist with implementation.

The primary role of the MBTB for Millwood's UFMP would be periodic (e.g., once a year) review of the strategic plans, to track the status of the various recommendations, and evaluate the progress towards management goals.

The MBTB is engaged in many activities promoting the planting and preservation of community trees such as Arbor Day celebrations, Millwood Daze, Back to School Community Days, and other community education programs and presentations.

The MBTB can continue to support and involve Millwood residents in the tree program through duties described in MMC Chapter 2.53.030 and:

- Reviewing a community urban forestry management plan
- Foster community support for the urban forestry program
- Public outreach meetings and presentations
- Program advocacy to city council, business leaders, civic groups, and other stakeholders
- Soliciting funds, including grants and donations
- Reviewing a street tree ordinance
- Assisting with Arbor Day celebrations, other events, and education programs

For a community the size of Millwood the MBTB should have five members consisting of two members who have experience and expertise in arboriculture or urban forestry and three members from the community that reflect the will of the community in an official capacity on issues pertaining to the strategic management of the urban forest. One member acts as chair of the tree committee. The MBTB should report to and be overseen by the staff member responsible for directing and managing the implementation of the UFMP and city trees. City staff acts as an ex-officio member of the committee.

URBAN FOREST MANAGEMENT PLANNING

The urban forest is a human ecosystem in which there are formal regimented plantings of trees along streets, trees in parks, trees in residential yards, and remnant native forest. The pressures created by urban sprawl are leading to a reduction in forested land in North America. Poorly controlled land-use planning contributes to the haphazard urbanization of many small communities. Urban forests are largely ignored as an asset and the potential benefits they can offer to communities are often not acknowledged in the planning process. Relatively few communities across the United States have any form of urban forest management.

In natural forests trees in all stages of growth and decay are important to functioning of the ecosystem, and even when left alone a forest will convey many benefits to humans. The same cannot be said of city and park trees. The term “city trees” includes trees subjected to tough urban conditions including street and park trees and those planted along boulevards, in medians, in parking lots, in tree pits, and other urban open spaces. Their health and vitality are compromised primarily through limited soil volume, compacted soils, restricted root space, drought, and conflicts with other infrastructure.

Other urban activities such as mowing, weedeater damage, leaf removal, vehicle and pedestrian traffic, vandalism, and pollutants submit community trees to additional stresses. Intense citizen use necessitates pruning and prompt removal of high-risk trees to maintain high safety standards. A sustainable urban forest requires careful management to maximize the benefits of green infrastructure while addressing the direct and indirect human influences on the trees.

Trees play an important role in the livability of Millwood. The urban forest has been recognized as a visual amenity and for its environmental benefits for several decades but has only recently begun to be considered as a vital component of a community’s infrastructure and given the specific label of “green infrastructure” or “natural capital” (e.g., Benedict and McMahon 2002; Wilkie and Roach 2004; Ewing and Kostyack 2005). As a result, in Millwood, as in many cities, allocated resources for management of urban trees has been relatively limited. Staff has largely been occupied with responding to emergency situations and minimal maintenance rather than having the opportunity to pursue more proactive management practices.



As with any type of infrastructure, the urban forest requires regular maintenance and monitoring to ensure that it continues to function properly and provide benefits to its maximum capacity. Infrastructure such as buildings, offices, and equipment that are neglected for many years can only be repaired at a great cost to taxpayers. For the urban forest, this neglect typically comes in the form of failure to plant young trees to

replace maturing populations, to adequately diversify tree species to protect against species-specific diseases, to prune trees early on to limit the risks posed by trees as they mature and failing to maintain mature trees properly.

Fortunately for Millwood there are many opportunities to improve the urban forest through well-planned proactive management over time. This is one key area in which green infrastructure differs from built infrastructure. Trees in cities, like other infrastructure, require maintenance to remain functional and viable but their value to the community generally increases over time as they mature, while becoming less of a liability.

The recommended goals are for Millwood to follow. It is up to Millwood to provide the short and long-term support required for implementation. The goal is to provide specific guidance on managing, maintaining, and preserving trees within the urban and suburban infrastructure.



Employing the best management practices of the arboriculture and urban forestry industries, Community Forestry Consultants, Inc. offers the following management and maintenance recommendations to improve the health, quality, size, and diversity of the working forest of Millwood.

PROGRAM MANAGEMENT OBJECTIVES

The overall goal of strategic planning and management of the urban forest is to ensure a healthy, aesthetic, safe, and diversified tree canopy that can provide a sustained supply of environmental, economic, and social benefit to Millwood. Research shows the average city tree lives only 32 years (Moll and Ebenreck, 1989) and the closer to the city's center, the shorter the life of the average tree. To help address issues like these, a long-range plan is essential for management of a resource that is by its very nature a long-term matter.

Strategic plans define long-term and short-term goals for the city's urban forestry program. Management plans define how individual goals are achieved through action plans and timelines. Each goal must have an achievable and discernible outcome. The objective of this report is to provide a framework for a Strategic Management Plan for a ten-year period.

Ordinance Review

Enacting laws and policies that make public prohibitions and direct action in a certain way is not a popular method of influencing behavior. However, sometimes an issue is so important and complex that legislation and official policies are appropriate tools for local governments to use to protect its citizens and property. Managing urban forests is an important complex task.

In recognition of the many benefits conferred by trees, hundreds of local governments are adopting street and park tree ordinances. Street and park tree ordinances apply mostly to publicly owned trees, as well as nuisance trees on private property.

Tree ordinances reflect the values of a community, and the worth of a community's trees. A tree ordinance encourages tree maintenance to secure the beautification, air purification, noise and dust abatement, storm water management, water quality, property value enhancements, public health and safety benefits trees provide.

The key benefits to revising the tree ordinance are:

- Helps establish the tree management program.
- Provides reference to permanent procedures and legal authority.
- Legalizes a tree program through authorization of a tree committee.
- Establishes a permit review, approval, and appeal process for tree removal, planting, and pruning.
- Establishes the nature and degree of public responsibilities to community's trees according to specific standards and specifications.
- Establishes an official tree policy for the community.
- Specifies and ordines arboriculture standards for tree planting, pruning, and other tree work.
- Identifies standards and regulations for arboriculture practices.
- Ensures that the people who perform work on the trees are professionally qualified.

Street and park tree ordinances must resolve two key issues. First, the tree ordinance should identify municipal (and private property owner, if desired) responsibilities for tree ownership and planting, pruning, removing, and maintaining trees. Second, the tree ordinance should establish a tree committee and provide the committee with authority to develop a strategic vision for public street and park trees. **Tree committees should not be involved in the daily operations of the urban forestry program.**

It is apparent some common elements are missing in Millwood's tree ordinance. The city's tree ordinance requires revisions to existing components to align with goals and objectives of the UFMP it must also address issues missing in most city and urban forest ordinances. To ensure that public trees will be properly cared for, street tree ordinances usually contain most, or all the sections listed below. The comments and examples are intended to help in revising the city tree ordinance. Municipalities should understand and plan for their own needs and abilities and not rely only on model ordinances from other places. Common elements for ordinance evaluation and explanations for inclusion in tree ordinances are described in Table 1 on page 26. Table two on page 27 shows the common elements in selected ordinances from other cities in the Northwest United States and those elements missing in Millwood's tree ordinance.

The following are examples of proposed revisions and additions to the Millwood Urban Forestry ordinance (MMC Chapter 2.52):

1. The purpose section should be revised to reflect vision statement and goals of the UFMP.

2. The definitions section should include industry definitions for terms such as species, topping, pruning or street tree and public terms such as right-of-way or planting strip. The definition section needs to include urban forestry and arboriculture industry terms not familiar to the public.
3. There is no language regarding ownership of the trees.
4. There is no definition or language addressing boundary or border trees.
5. Disposal of urban forest products is not addressed in the ordinance.
6. The ordinance should be expanded to include other pest infestations or disease infections that are considered incurable and epidemic such as spruce bark beetle, emerald ash borer, or pine bark beetle.
7. Severe maintenance treatments such as banning topping of public trees deserve individual recognition in the ordinance.
8. There are sections that refer to permit requirements for tree maintenance activities but no sections referencing plan review or permit revocation. These sections could be consolidated into one section that clarifies the permit process, plan reviews, and revocation for all activities affecting public trees.
9. The incorporation of a Risk Management Policy in the tree ordinance is strongly recommended as part of the city's tree risk management program. A risk management policy ensures continuity in the risk management program despite changes in the political and administrative components of the city.
- 10. As a rule, the fundamental program guidelines such as tree committee establishment and other more static items should be included in the ordinance. Industry standards and specifications that are subject to change as the arboriculture industry evolves should be placed in separate documents such as "Millwood Arboriculture Standards and Specifications Manual" which can be cited in the ordinance.**

Table 1 - COMMON ELEMENTS FOR ORDINANCE EVALUATION

Element	Explanation
Purpose	The goals and objectives of the ordinance. These are crucial to implementation, enforcement, and defense of the ordinance if challenged.
Authority	The source of the local government's authority to regulate – usually its own police powers and relevant state statutes (enabling legislation).
Definitions	Terms and phrases with special meaning within the body of the ordinance. Clear, concise definitions are important to ordinance comprehension.
Designation of Administrative Responsibility	The specification of a position, department, or committee responsible for enforcing the ordinance and carrying out specified duties. Ideally, limits of authority and responsibilities are clearly defined.
Plan and/or Permit Review Process	Explanation of how a new/proposed development or other action will be reviewed. Should detail information to be submitted with permit or platting requests, such as site survey of trees and proposed building locations.
Incentives	The methods that can be used to achieve conservation & compliance with ordinance (e.g. preserved trees credited to required project landscaping).
Preservation	What is to be preserved and how it is to be accomplished. There are many approaches to this, such as retaining ≥30% of existing tree canopy.
Construction Protection Measures	Specific measures required to protect trees during construction activities. Usually involves providing a protective zone for trunk and root structures.
Maintenance After Development	Specification of required maintenance of trees and vegetation after project has been completed, often including replacement for damage-killed trees.
Appeals	Provides for possible flexibility with a process for appealing decisions, which serves as a check on authority, but can potentially undermine management.
Enforcement	Provision for enforcement, and penalties for ordinance violations. May include fines, imprisonment, withholding of permits, work stoppage, etc.

Table 2 -COMMON ELEMENTS PRESENT IN SELECTED NORTHWEST CITY TREE ORDINANCES

City	Purpose	Authority	Definitions	Designation of administrative responsibility	Permit and Plan Review Process	Incentives	Preservation and Heritage Trees	Construction Protection Measures	Maintenance after Development	Appeals	Enforcement
Bellevue	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Bellingham	✓	✓	✓	✓	✓					✓	✓
Boise	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Bothell	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Clarkston	✓	✓									
Coeur d'Alene	✓	✓	✓	✓	✓		✓	✓		✓	✓
Colville		✓	✓	✓					✓		
Covington	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ellensburg		✓	✓	✓	✓					✓	✓
Enumclaw	✓	✓	✓	✓	✓					✓	✓
Grandview		✓	✓	✓	✓					✓	✓
Helena	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Millwood		✓		✓							
Lacey	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Missoula	✓	✓	✓	✓	✓		✓	✓		✓	✓
Olympia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Omak	✓	✓	✓	✓				✓			✓
Port Townsend	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pullman	✓		✓	✓	✓	✓	✓	✓	✓		✓
Redmond	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Spokane	✓	✓	✓	✓	✓	✓			✓	✓	✓
Vancouver	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Walla Walla	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Woodinville	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Tree ordinances are a necessary tool in preserving tree resources. Tree ordinances provide the city an opportunity to set policy and back it with the force of law when necessary. It provides clear guidance for planting, pruning, removing and other maintenance on street, park, arboretum, and other public trees. The ordinance should be flexible enough to fit the needs and circumstances of the city. The inventory data can provide the quantitative evidence for ordinance policy development.

Arboriculture and tree care maintenance and operations are very specialized fields of work. Many years of education and training are required to perform competently in the field and without harm to the trees. **Tree care performed to Millwood's public trees should be accomplished by International Society of Arboriculture (ISA) certified arborists or ISA certified tree workers. The language of the ordinance should reflect this standard of tree care.**

There are many existing tree ordinances and tree ordinance-writing resources. A comprehensive list is provided in Appendix A.

Tree Inventory

Many communities have public street and park trees, a shade tree commission, and plant trees, but how many know what the resource looks like, the condition it is in, the benefits it is providing, and how effective their program has been? Whether you are managing a retail store or natural resources, an inventory is critical. Without an inventory of the resource, you don't know what you have, its condition, and what kind of work is needed to maintain or manage it for the future.

As with any form of asset management, the foundation for ensuring maximum benefits from trees is a clear understanding of the characteristics of your tree population. An inventory also helps you better document the many benefits that trees are providing the community. Tree inventories are the foundation of an effective tree management program. It allows tree managers to identify current and potential problems and plan for budgets, removals, pruning, planting, and other maintenance requirements. An inventory is a record of objective and quantifiable information about the condition and value of Millwood's tree resources that can be used to document estimates for funding, personnel, and equipment (Figure 5). Using and regularly updating the tree inventory moves the urban forestry program into proactive management.

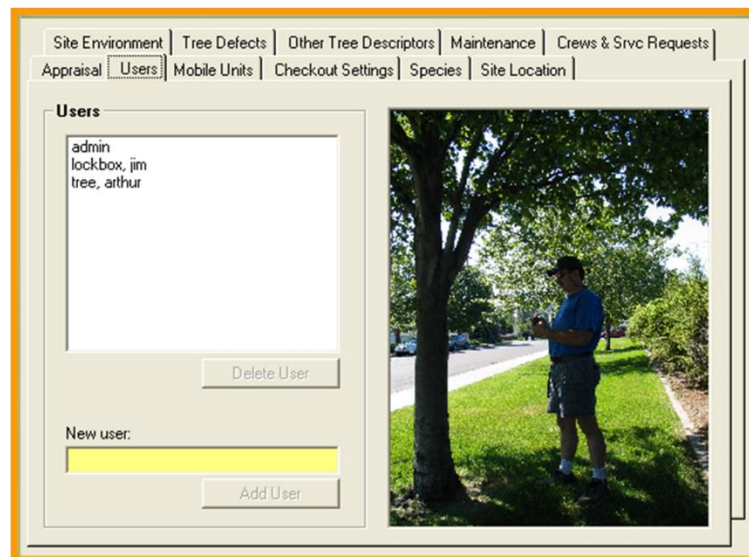


Figure 5 - Inventory data collection

A park and street tree inventory provides information for planning, design and development impacts to trees, and management information for tree maintenance and plantings. It helps justify starting and managing a tree program and funding an existing program. An inventory of Millwood's trees and planting spaces is a prerequisite for making sound decisions. Without an inventory management, decisions may be based on guesses rather than an accurate assessment. An inventory provides the location of risk trees, the number of trees within the public right-of-way, the value of street and park trees, and the number of available planting sites. It helps identify insect or disease problems, maintenance needs, and budget priorities.

With this information, Millwood staff can better plan and prioritize tree removals, maintenance work, and plantings and coordinate the City of Millwood's urban forestry program with all city departments. They can also determine the value of Millwood trees, which can help emphasize the importance of maintaining a valuable asset.

An inventory can be used to monitor tree conditions to answer management questions quickly and accurately, such as where and how many trees should be planted in a year. Over the years, changes can be seen in the number, age, condition, and species of trees. A well-maintained inventory can be used in cases of liability to demonstrate that there was no negligence in the inspection or care of these trees. An inventory will also improve the chances of receiving grants and other assistance by providing documentation of the extent and worth of street and park trees.

The following objective will enhance management of the urban forestry program.

- Contract for professional audit periodically of existing tree inventory data to insure accurate, consistent data collection and correct existing gaps in the tree inventory data such as tree maintenance requirements.
- Maintain the assessment of the tree population to obtain accurate, functional data necessary to manage the urban forestry program.
- Maintain and update the tree inventory regularly as part of the urban forestry management program maintenance activities.

It is important that inventory data be accessible to tree managers, consistent, and accurate. All efforts should be made to ensure that the local tree inventory survey results can be used in the City of Millwood ArcGIS Geographic Information System (GIS).

Maintaining the tree inventory and using a tree management program to prioritize maintenance establishes a systematic tree maintenance program which reduces costs. This is primarily because systematic maintenance in general leads to healthier trees that require less expensive maintenance over the long run than unhealthy, high-risk trees. A computerized tree inventory aids in reducing the subjectivity of tree management decisions and stimulates proactive responses.

Embed tree inventory data updates into routine management procedures. Data needs to be kept up to date. Once a baseline has been created, updating can be conducted on a rolling basis, integrating as much as possible of the survey work within maintenance and other routine works conducted. Some areas experiencing strong pressures or fast changes might need to be surveyed annually while others may only need to be looked at

once every three years. Areas can be zoned based on level of use and development changes and surveyed accordingly.

Framework for the 5-year Strategic Management Plan (2023 – 2028)

The plan is intended primarily to provide guidance for Millwood staff and the MBTB using the tree information database and a management cycle approach to monitor short to long term trends.

Traditional forestry is the management of trees or stands of trees for timber production and other values including wildlife, water quality, and ecological health. Urban forestry is the management of trees and other forest resources in urban ecosystems for the environmental, economic, social, health, and aesthetic benefits trees provide society.

Agency tree plans provide policy and standards for implementing and managing community tree programs. A community tree plan is to guide the management and maintenance of a community tree program, including tree removal, pruning, planting, funding, and volunteer opportunities. Tree plans should be consistent with other agency planning strategies and usually include a vision statement, goals, objectives, and strategies.

In any given city nationwide, buildings and roads receive careful planning and scheduled maintenance. It is widely recognized that neglect can result in deterioration leading to numerous potential expenses and risks. Why should trees receive any less planning, attention, and care? Tree management plans help cities proactively manage their tree resources to avoid risk, reduce liability, cut maintenance costs, and increase the value of trees. A comprehensive plan helps promote the health and sustainability of the community's trees, while providing a framework to make difficult decisions about tree removal, preservation, pruning, and planting. A proactive approach to tree issues reduces costs for maintenance, removal, and liability associated with tree failures.

Community Forestry Consultants, Inc. developed this comprehensive UFMP after analyzing available tree inventory data; making field observations; and by applying national arboriculture standards and best management practices. This is a customized plan based on local conditions, resources, and priorities. The UFMP plan will help the members of the Millwood staff, MBTB, city council, and citizens understand the current condition of the community forest and shape its future.

While limited city funds for urban forestry programs often constrain proactive tree care, management planning efforts can increase the effectiveness and reach of scarce resources and have significant impact on the landscape.

The UFMP can show Millwood staff, MBTB members, city council, and citizens how science informs tree management as well as promoting community values. It will help raise citizen awareness of the benefits of a healthy, diverse, and well-managed urban forest. A strong management plan will serve as a tool to use for garnering public support, cooperation, funds, and to help the community sustain its trees for future generations.

A higher level *20 Year Plan* which sets out the vision, goals and objectives that are to be achieved may be developed. The *20 Year Plan* (2022 - 2042) may be used to oversee

the implementation of urban forest management. Nested within a 20-year plan are 5-year *management* plans, the first being this UFMP. Each successive 5-year management plan should incorporate strategies, recommendations, and incomplete components from previous plans building upon the successes or failures of the previous management plan. Finally, each year there will be an *annual operating plan* (AOP) in which the details of the day-to-day activities are outlined (Figure 6).



Figure 6: Temporal structure of the Strategic Urban Forest Management Plan
(source: A. Kenney).

The recommendations made in this plan are intended to be considered and implemented over a period of five years. A systematic tree planting and maintenance program, adequate funding, staffing, regulations, and resources today will allow Millwood's urban forest to thrive, expand, and be sustainable.

The success of this plan is based on people's expectations of the benefits they may receive from the Millwood's community forest and their willingness to invest in its sustainable management.

The objectives of the Millwood UFMP plan include:

- Maintain the comprehensive tree inventory data.
- Review, update, and evaluation of operating plans.
- Annual analysis and mitigation of risk trees.
- Proper tree selection and purchase.
- Proper tree planting.

- Proper tree maintenance.
- Adequate funding and staffing.
- Staff training.
- Contractor quality control and monitoring.

Effective Administration

Like the gray infrastructure of streets and utilities, trees are an essential part of a community's green infrastructure and should be administered effectively. The responsibility for administering a community tree program must be clearly defined and carried out on a regular basis. These responsibilities often are divided among city departments, appointed board members, city officials, a tree committee, and agency employees.

The size and complexity of an agency will determine how to organize the tree program. Millwood's tree population and maintenance requirements require that a staff person's time is funded and allotted to manage the tree program and to coordinate work with the city tree program, city departments, and the public. To ensure good program administration, responsibilities need to be directly assigned and procedures defined clearly.

Community tree plans provide overall guidance to the long-term administration of public trees and must then be translated into effective actions. Annual work plans for tree removal, tree maintenance, tree planting, periodic inspections, task scheduling, funding security, and public education and involvement should be used to schedule the work required to meet the plan's objectives and goals. By using an annual work plan and a budget based on this plan to prioritize and schedule tasks for the upcoming years, a tree program can become more efficient and avoid crisis management.

Business Corridors and Downtown Trees

City streets are not just thoroughfares for motor vehicles. They often double as public spaces where people walk, shop, meet, and generally participate in many social and recreational activities that make urban living enjoyable. Urban foresters, designers, and planners encourage streetscape tree planting to enhance the livability of urban streets. Large, high-quality trees play important roles in community improvement. Trees are as much a part of the city infrastructure as roads, buildings, and streetlights. Extensive research has documented the environmental, social, and economic benefits of large trees for communities, municipalities, and regions.

Trees in small city business districts influence retail and shopping behavior in positive ways. The results of several studies suggest that trees are good for business. Shoppers prefer trees and consider trees an important amenity. They spend more, shop longer, and are willing to pay more for goods in business districts with mature, healthy trees.

Yet, city trees are too often placed into "tree coffins", cutouts in the sidewalk with an insufficient soil volume, oxygen level, and water availability for roots, where trees grow poorly, live fast, and die young (Figure 7). The sidewalk cutouts are enclosed with iron grates to create a contiguous surface for pedestrian travel. The iron grates usually girdle the trunk as the tree grows, damaging the tree they were intended to protect, and often lead to trip-and-fall hazards for people resulting in severe injuries.

Some common procedures exacerbate tree problems. For decades, it has been common to plant street trees in “tree pits.” But if these excavations are too small, the root system cannot support the tree for more than a few years, according to James Urban, an authority on trees in built-up areas. The lack of room for roots stunts the tree’s growth, and soon the tree begins to die, says James Urban, FASLA and principal of Urban Trees and Soils in Annapolis, Maryland.



Figure 7 – Trees and other infrastructure compete in business corridors and downtown areas for space.

The trees may lift adjacent sidewalks which lead to risk issues for the city. Confined to ever-smaller cutouts and planting strips, it is no wonder that roots carve out their space at the expense of sidewalks, curbs, and driveways. The typical public works response is tree removal or aggressive root pruning which often leads to a slow, agonizing tree failure or mortality. If the trees are removed the city is left with vacant tree pits. When this happens, trees lose, and cities lose.

While some trees are associated with sidewalk damage, research in many cities has shown that trees are minor contributors to sidewalk failures. The soil type and suitability for sidewalk construction and root growth all have a bearing on tree-sidewalk conflicts.

Those trees that do survive tend to experience stunted growth, pest and disease problems, exposure to road pollution, vandalism, and mutilation described as pruning for clearance issues. When trees are stressed, they often decline and die, creating a public eyesore during the process. It is not surprising that some city officials and the public have a poor opinion of trees in downtown business districts and along city streets. The trees never reach their potential to provide the benefits for city dwellers.

Where space is at a premium, one of the biggest challenges for arborists, urban foresters, city planners, landscape architects, soil specialists, engineers, and public works staff is to provide sufficient soil space for root growth and tree health. The trend is to downsize the urban forest and plant smaller trees.

The Millwood downtown business corridor is under constant competition for space. Many infrastructure items must share the same space and co-exist (Figure 8). The key site condition factor to consider in resolving tree-sidewalk conflicts is to integrate trees into the infrastructure design up front. The fundamental solution to most city tree problems is simple: provide each tree access to more and better soil.

The downtown business district is the heart of Millwood. As might be expected in the downtown, several organizations, property owners and tenants are stakeholders in the management of trees. Many areas of the downtown are planted with trees, several are recent installations, and most are planted in tree pits. Development and redevelopment

of property in the downtown can mean additional planting opportunities or it can mean facing the loss of established trees to development of buildings, parking lots and street redesign.

When development does occur where trees currently grow, great care must be taken to protect those trees that are healthy and structurally sound whether on public or private property.

An American Forests article published in the early 80's stated that an oak or maple tree is capable of living up to 400 years in the forest, up to 80 years on a college campus, up to 30 years in a heavily used park, up to 20 years along a city street and about 4 years in a downtown planting pit. Thirty years after the article was published, the same design mistakes are still being made in cities across the United States. There are several challenges when planting trees in any downtown area:



Figure 8 – Trees located in tree pits surrounded by excessive concrete.

- **Limited Planting Space.** This is one of the greatest challenges to maintaining a healthy urban forest in the downtown district (Figure 7, 8). These are typically concrete walls on all sides; four feet square and leave little space for root expansion necessary for vigorous tree growth.
- **Availability of Irrigation.** Water is vital to ensure trees thrive. Lack of water is a primary stress to the tree and often leads to poor growth, premature defoliation, and death. Installation of automated irrigation should be required on new development. New tree wells or water filtration systems that capture run off for trees before sending it down the drains should be incorporated in the design and construction.
- **Difficult Growing Conditions.** In any location tree growth is limited by the conditions present in its surroundings. In Millwood's downtown area, limited growing space, poor soil, seasonal heat and exposure to sun and wind impose stress on trees. Incorporating new designs that identify more growing space for trees and selecting trees more tolerant of harsh growing conditions will help.
- **Owners and Tenants.** Some business and property owners perceive trees to be an obstacle to business operations because trees create litter, block visibility of signs and displays and are difficult to maintain. The latest research indicates that trees in downtown corridors increase business, increase shopping time spent and increase the amount spent per visit (Wolf 2005). Trees and business owners in downtown corridors can co-exist and provide benefits to each other.

- Poor Maintenance. Many people do not understand how trees grow or how to best care for them. Trees in downtown areas often go without any regular care. Some trees are topped to clear signs, and they become a liability to the adjoining property and the city. Education is crucial to help owners, tenants and contractors understand proper pruning, and tree care can create assets rather than liabilities.
- Tree Grates and Guards. As trees grow and mature, their trunks can come into conflict with the grates covering the planting hole. Roots from the trees often grow into the soil under the sidewalk, cracking and heaving the concrete (Figure 9). Grates can girdle trunks in a short time without maintenance. If left in place, the grates can damage the trees they were meant to protect. The grates are also trip hazards. Their use should be limited and temporary.



Figure 9 – As trees grow grates girdle trunks and create trip hazards.

Often, the downtown and other business districts are selected as high priority areas to increase beauty and attractiveness. Traditionally, downtown trees were installed according to traffic engineering design standards that did not consider the biology and culture requirements of trees. The business district of Millwood is characteristic of this design concept. Unfortunately, little can be done to improve the current planting spaces without a major change to the infrastructure.

Tree plantings in the downtown business district and Millwood add greatly to the economics and aesthetic appeal of the city. Tree selection for business and shopping areas must take into consideration the need for shoppers to view storefronts, as well as the need to provide enough shade for shoppers. **The branching habit must be high enough to allow pedestrians to walk comfortably beneath the trees.** Some options are tall, narrow growing (fastigate) species. These trees can provide beauty, a look of uniformity, and a formal appearance to the shopping district.

Public streets and sidewalks constitute a large percentage of the Millwood's impervious surface, generating runoff and pollutants. Reducing the amount of impervious surface, implementing low-impact development (LID) stormwater techniques, and increasing vegetation planting within Millwood's right-of-way can assist in creating greener business districts and neighborhoods. Techniques to accomplish this include reducing the amount of pavement, utilizing pervious pavers, installing rain gardens, and incorporating traffic circles and medians which can be planted with vegetation. These techniques can also

help to achieve traffic calming goals and a better balance between vehicles, pedestrians, and bicycles, and are also part of a “complete streets” approach.

“Complete streets” is a term used to describe streets designed to enable safe, attractive, and comfortable access for all users. Transportation engineers define “green streets” as streets where green infrastructure practices such as reducing road widths are integrated in the design. Within green streets, LID techniques and vegetation planting will be prioritized.

Objectives of urban forestry program for the downtown business district and other commercial corridors:

- Preserve existing trees in parks and open spaces on public lands in the downtown core.
- Improve appearance of downtown public spaces/sidewalks – by adding trees and landscaping. Improve appearance and sense of welcome in key placemaking nodes of interest in downtown. Support efforts to clean up and landscape publicly owned portions of the downtown area. This includes lawns, landscaped areas, and street trees.
-

Tree-based Strategies to Reduce Infrastructure Damage

Methods to reduce infrastructure damage have been varied and numerous, with both preventive and remedial strategies employed. Three groups of strategies have been used based upon their action approach: tree-based strategies; infrastructure-based; or root zone-based. Often a combination of action types is used on the same tree to mitigate infrastructure conflicts.

Species selection is an important consideration in any planting situation and particularly important in downtown business districts. Matching a suitable species with the planting space is the first step in the process. Other considerations include drought tolerance, litter, maintenance requirements, and mature size. The trend is to plant small stature trees, but studies have shown that ultimate tree stature is not a good indicator of potential for hardscape damage. It is more important to consider the mature size of the trunk flare and buttress roots of the tree when selecting species for limited spaces.

Root system characteristics or root architecture is another tree-based strategy to consider when selecting plant material. There is little scientific research available about the root architecture differences between species or the differences within a species and the influence rootstocks may have on root architecture. Yet, there is some empirical experience that can be applied. Ash trees generally have a wide, lateral root system while oak trees tend to have an oblique root system. Ash trees may not be suited for downtown corridors because of their root architecture and emerald ash borer issues. However, other factors influence plant choice such as soil type, drought tolerance, and litter. Ash would be a suitable candidate for a downtown tree if these factors were the primary criteria. The point is that many factors influence species choice for downtown sites.



Figure 10 – When designing the tree opening, ask yourself what the minimum size of paving would be instead of the minimum size of the tree opening. Additional space available will help reduce conflicts between roots and paving and improve the soil growing conditions.

Infrastructure-based Strategies to Reduce Infrastructure Damage

Infrastructure damage is often caused by trees that outgrow their planting space. The objective of design strategies is to maximize the distance between trees and infrastructure to minimize the potential for conflict (Figure 10). Infrastructure-based strategies focus on prevention of problems. For new trees, providing adequate space by using larger planting spaces, tree islands, or narrower streets are key preventive strategies. The goal is to eliminate some hard surface when possible.

For established trees, creating additional space using curving sidewalks and pop-outs, or eliminating sidewalks altogether are remedial strategies to consider. Bridges and ramps over existing root systems is an alternative but compliance with the Americans with Disabilities Act (ADA) must be considered.

Planting spaces of appropriate size for the desired species is critically important. The larger the planting space, the lower the potential for damage from trunk expansion, buttress root development, or surface root development. Various researchers have suggested planting strips be 10 feet wide and cutouts be 6.5 feet by 6.5 feet.

Although tree height provides some guidance in matching trees and planting space size, measuring the trunk diameter at ground level gives a direct assessment of the minimal planting space needed for a species. This measurement includes both the trunk flare and root buttress growth. To accommodate species with surface-rooting characteristics, additional space beyond that needed for trunk diameter at ground level will be required.

Curving sidewalks away from the tree increases the distance between the tree and the sidewalk and the damage potential decreases. Sidewalk meandering—realigning the

sidewalk's direction of travel—enables the community to provide more growing space for trees in an aesthetically appealing way (Figure 11). The amount of growing space created can be substantial and, therefore, sidewalk meandering is usually the most feasible way to retain large, mature trees. Also, increased distance from sidewalk edge to lateral roots or trunk flare allows for root pruning, when necessary, to occur further from the trunk, which reduces direct contact between the sidewalk and tree roots or trunk. Sidewalk meandering often requires permission from the abutting property owner to dedicate more of their property to the public right-of-way.



Figure 11 – Re-routing sidewalks around a large tree is a successful option.

There are several remedies for solving tree sidewalk conflicts. These are discussed in detail in Appendix C.

Recycling Wood Waste and Chip Disposal

Tree removal is typically the most expensive tree maintenance operation on a per tree basis. Other costs associated with tree removal include stump removal and wood waste disposal.

Currently, most of the wood generated from park tree removals brings little economic return to tree management budgets. The growing concern about the environment and overburdened landfills, coupled with an opportunity to augment the forestry budget, should prompt Millwood to the possibility of utilizing waste wood for city and community programs.

There are many opportunities today to recycle tree residue. The following options are available for agency use.

- Mulch (new tree installation, trails, landscape beds)
- Biomass fuel production
- Small scale sawmill operators (building materials)
- Secondary product production (park benches, furniture, wood sculptures)
- Woodworker associations (knotted and twisted wood pieces)
- Composting
- Firewood

Which option(s) to apply and implement will depend on city laws, agency policies and resources. An internal review and revisions of existing laws and policies governing agency wood waste utilization can improve the agency's ability to sell this material (USDA, NA-TP-02-94).

INVENTORY and TREE MAINTENANCE SUMMARY

Appraised Value

Trees in urban areas are valued differently than from the timber value of their forestry counterparts or trees in undeveloped areas of the community. Appraised value of urban trees is based on the species of tree, the trunk diameter, the condition of the tree, and the location of the tree (Guide for Landscape Appraisal, 9th Edition). Millwood trees represent a considerable economic, social, recreational, and environmental asset to the community (Table 3).

The graph shows the number of trees in a range of dollar values. Most trees inventoried in the sample are mature trees. The median appraised value for trees in this data set is \$6,100.00. Higher condition ratings come with improved maintenance which increases appraisal values.

Partial Inventory Appraised Value: **\$5,900,000.00**

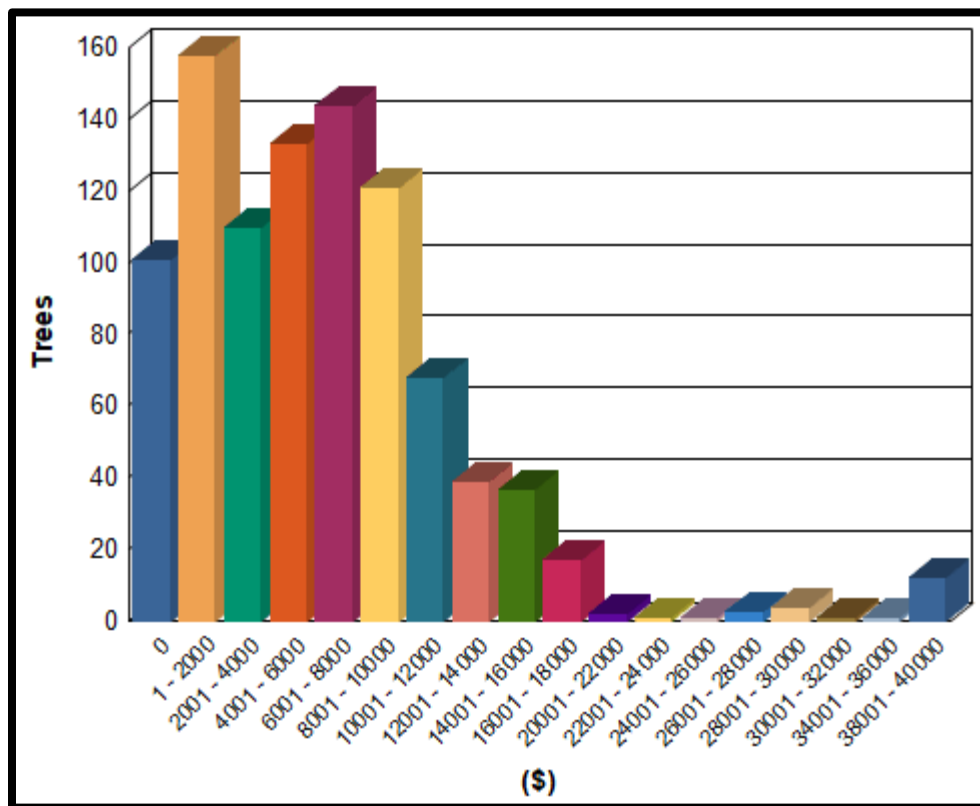


Table 3 – The appraised value of inventoried trees was determined from the Council of Tree & Landscape Appraisers Guide for Plant Appraisal, 9th Edition.

The appraised value of Millwood's 900 street and park trees have an appraisal value of several million dollars. Trees are the only asset owned by the City of Millwood that increases in value as they age, but only if they receive proper maintenance.

Ecosystem Services Benefits

As discussed in earlier sections of the UFMP trees provide many benefits beyond ornamental and aesthetic traits. Many of these values can be measured through use of regional computer modeling systems (I-Tree) developed by the USDA Forest Service to assist cities in assessing the value of these environmental benefits. Enumerations of the benefits Millwood's public trees provide can be calculated using I-Tree.

- Energy savings reflect cost savings in electricity and natural gas for cooling due to shading of buildings (energy units, economic value in \$ based on energy costs).
- Sequestration storage (Nowak et al. 2008) of carbon from atmospheric carbon dioxide (CO₂), a greenhouse gas (mass units, economic value in \$ based on CO₂ emission control costs) is determined from allometric equations based on tree species, diameter, and crown light exposure.
- Removal of air pollutants (Nowak et al. 2008) [nitrogen dioxide (NO₂), ozone (O₃), sulfur dioxide (SO₂), and particulate matter < 10 microns in diameter (PM₁₀)] (mass units, economic value in \$ based on pollution control costs), including avoided emissions due to energy savings from pollution removal by trees is based on the median externality values for the United States for each pollutant.
- Stormwater runoff reduction (water volume, economic value of stormwater management infrastructure savings in \$) consider the seasonal variation in leaf area for evergreen vs. deciduous trees and calculate precipitation interception on an hourly basis from weather records.
- Aesthetics as determined by annual increase in private real estate values are based on tree presence, size, and growth.

Tree Maintenance and Care

Millwood staff makes decisions on tree maintenance, mitigation options and then schedules the work. With populations of trees and limited funds, such as in Millwood, scheduling becomes more important and requires prioritization. Pruning plans are essential, not only to ensure healthy, aesthetically pleasing trees but also to increase public safety, decrease liability, and demonstrate due diligence.

A variety of requirements can inform pruning plans, some more desirable than others. Common factors that determine pruning priorities are residential or business requests, and emergency pruning. This kind of “reactive management” is most common in jurisdictions where no planning exists. Scheduling pruning based on these factors may increase liability for damages because many high and extreme risk trees remain unidentified until a failure occurs.

Healthy trees confer numerous benefits, yet poorly maintained trees can pose a considerable risk to the surrounding community. Broken branches and even entire trees can fall, especially during inclement weather. In paved areas, roots can cause cracks and buckles in pavement which may be tripping hazards. Leaves can clog gutters and fruits can rot and smell.

While the benefits of trees far outweigh the costs, careful maintenance is needed to manage risks that are often predictable, detectable, and preventable. Excluding immediate, acute problems (tree and branch failure, storm damage, pest outbreaks, and extreme vandalism) tree maintenance should be performed on mature trees following a two-to-five-year pruning cycle based on a management plan. The pruning cycle for Millwood’s mature trees is based on the severity of pruning that may be required due to deferred tree maintenance.

Tree health can be greatly increased by regular pruning, especially when the tree is young. Immature trees that are not pruned can develop many structural problems such as weak branch structure, crossing branches, and co-dominant leaders (ISA 2005) (Figure 12, 13, 14). If corrected early, the tree can develop a strong support structure with a healthy canopy. This in turn will reduce the necessity of more expensive and often intrusive corrective pruning during the normal life of the tree. If tree condition is improved

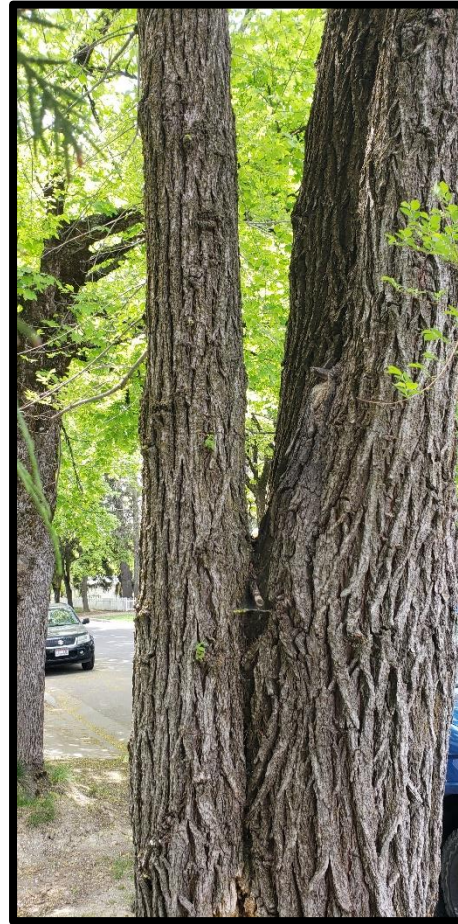


Figure 12 - Co-dominant stems are easily fixed on a young tree but often fail if not mitigated early in the life of a tree.

at a young age and maintained during the tree's life, there will be less need for a reactive approach to pruning.

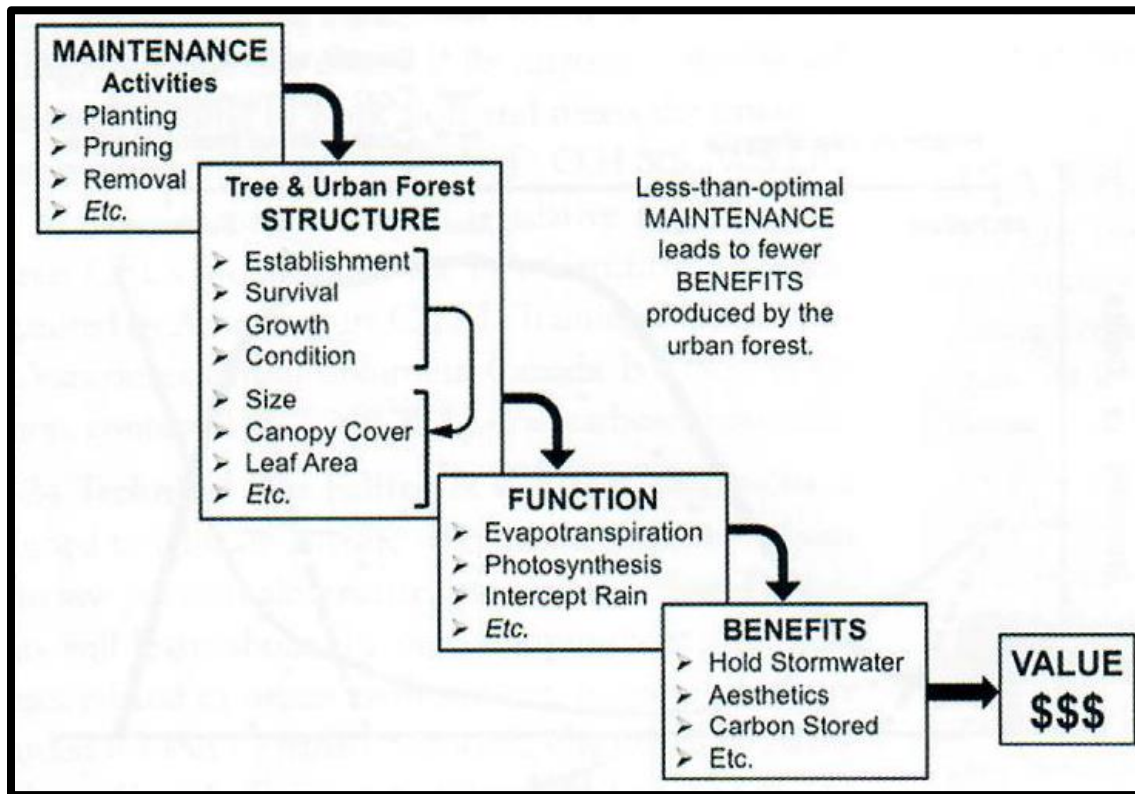


Figure 13 – Maintenance directly impacts tree structure, which in turn impacts the functions and benefits provided by the urban forest (Hauer, et. al, Arborist News, 2015)

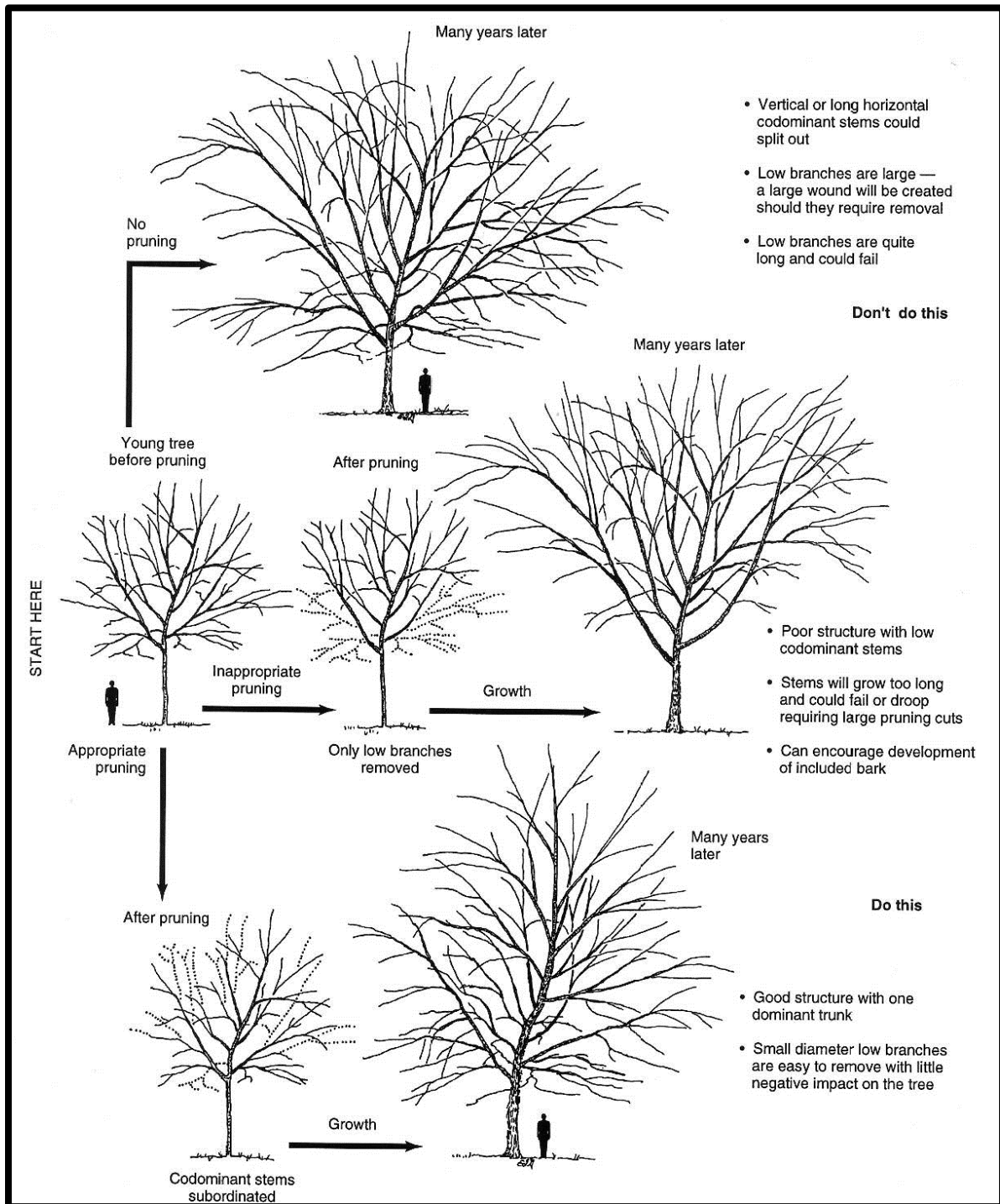


Figure 14 – Preventive arboriculture is the heart of a sustainable urban forestry program (Image courtesy of Ed Gilman)

Most communities try to implement a two-to-five-year pruning cycle. The ability to implement a cyclic pruning program is limited by the staff and financial resources in Millwood. Most cities and towns cannot afford to contract services for all trees. There are

options available to deal with budget constraints. For example, contract pruning of large trees with significant structural defects near high use areas may be an initial management recommendation while small tree pruning is performed by Millwood staff or trained volunteers. The objective is to start and maintain a cyclic pruning program within the fiscal and personnel resource constraints of Millwood.

Industry standards such as ANSI 300, 133.1, or 60.1 define the standards and terms of arboriculture. Specifications and best management practices determine how the agency applies the standards to manage its trees. The standards and specifications are applied universally to all public trees regardless of who is doing the work – Millwood staff or contractor. The standards and specifications guarantee that, if invoked, a healthy, structural sound urban forest will be perpetuated. The standards and specifications also demonstrate that Millwood is implementing currently accepted practices by the urban forestry and arboriculture professions. The arboriculture specifications should, at a minimum, include specifications for removal, pruning, planting, species, tree preservation, risk rating system, and inventory methodology.

Objective for tree care maintenance that should apply to all Millwood staff and contractors.

- Pruning treatments should follow the best management practices established by the ISA, ANSI Z133.1 and ANSI A300 standards and employ ISA certified arborists to perform tree maintenance. In addition to ANSI standards, the city should develop pruning specifications that serve to define treatments for different species, ages of trees, pruning techniques, and other pruning issues.
- Promote longevity in trees and reduce risk by instituting a structural pruning program in Millwood.

Proper pruning adds value to the landscape and is one of the few active management techniques that helps a landscape appreciate while minimizing liability concerns. Proper pruning, with an understanding of tree biology, can maintain good tree health and structure while enhancing the aesthetic and economic value the community forest creates for Millwood.

Mature Tree Care

The benefits and values of trees are maximized when trees reach maturity. To maintain this high level of benefits for a longer period, Millwood should commit to providing regularly scheduled maintenance to its mature trees and prepare for other, non-routine arboriculture treatments as needed. A comprehensive mature tree care program primarily centers on routine or preventive pruning, and the ability to fertilize, irrigate, control insects and diseases, and cable and brace trees when necessary.

If regular pruning is planned in a systematic manner, crews and equipment can work much more efficiently than if pruning is done only by request or in case of emergency. The cost difference can be dramatic. The ISA has compared efficiencies of both methods and has found planned pruning to be at least twice as productive. When crews examine the urban forest regularly for possible risks and tree health problems, there is a reduction in citizen calls for emergency pruning (Luley et al. 2002). Additionally, the crews often find problems that would not have been reported by residents. Regular

pruning cycles can also focus on certain species that may require more attention. This is common practice when a pest needs to be controlled, for example. Regular, cyclic pruning maintains a greater safety level in the urban forest and can decrease liability for the agency (McGauley et al 2000).

Most of the trees (over 90%) inventoried in Millwood require maintenance (Table 4). Pruning represents most of the maintenance tasks. Regular pruning will improve the condition rating of the trees, reduce the potential for storm damage to trees, reduce the risk associated with community trees, and demonstrate proactive management of Millwood's tree resources (Table 5).

Planned Tree Maintenance

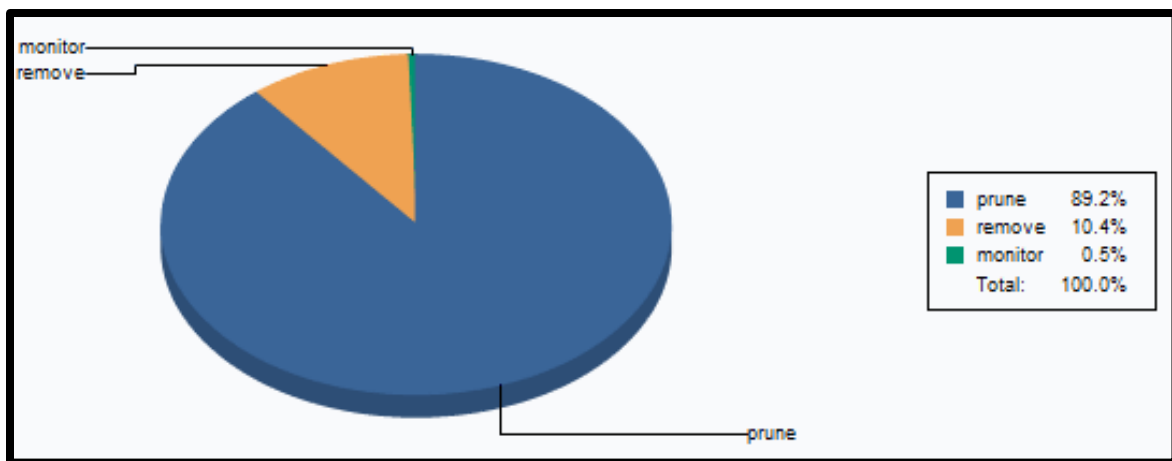


Table 4 – Planned Maintenance from Tree Inventory Data Collection

Tree Condition Distribution

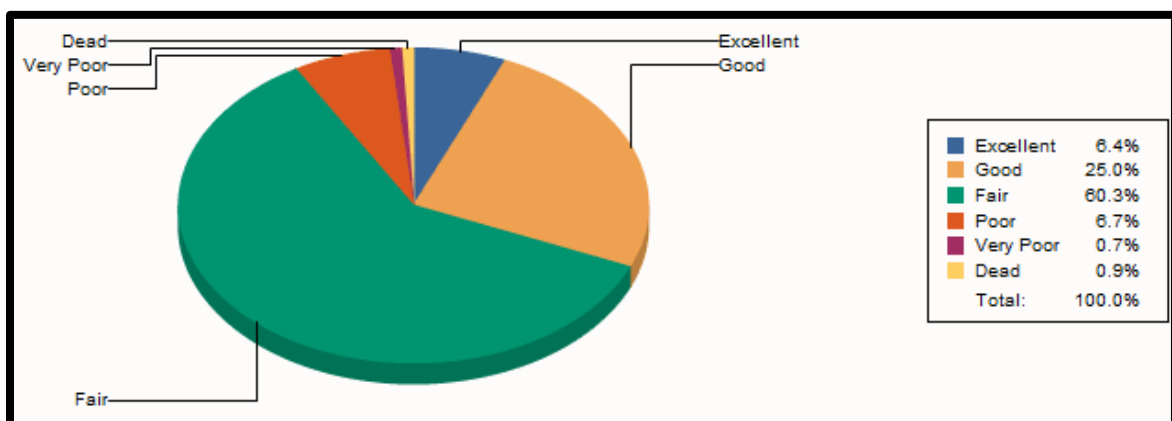


Table 5 – Condition ratings of inventoried trees.

Young Tree Pruning Program

There are many newly planted or young trees in Millwood. More new trees will be added as trees are removed, development changes, and the city diversifies the existing tree population. It is critical to understand the proper maintenance techniques required to ensure the longest and safest service life of these trees. The major components of a young tree care program are pruning, mulching, and watering.

Pruning young trees to obtain good structure requires an understanding of the growth-habits of the various species being planted and of tree biology, anatomy, and physiology. Training pruning is used to develop a strong structural architecture of branches so that future growth will lead to a dominant central leader, strong branch attachment and proper branch spacing along the trunk.

Many young trees may have branch structure that can lead to potential problems as they grow, such as codominant stems, many limbs attaching at the same point on the trunk or crossing/interfering limbs (Figure 15). When trees are small, these problems can be remedied easily and inexpensively. If structural problems are not corrected while trees are young, they can become safety risks as they grow larger and create potential liability.



Figure 15 – Young tree with codominant stems.

All newly planted trees should receive their first training pruning the third year following planting. Training pruning should not be done when a tree is planted, because it is already under stress from transplanting and needs as much of its leaf canopy as possible to manufacture food and increase root growth for proper establishment in its new site. Only dead or broken branches should be removed at the time of planting, and in the next two years.

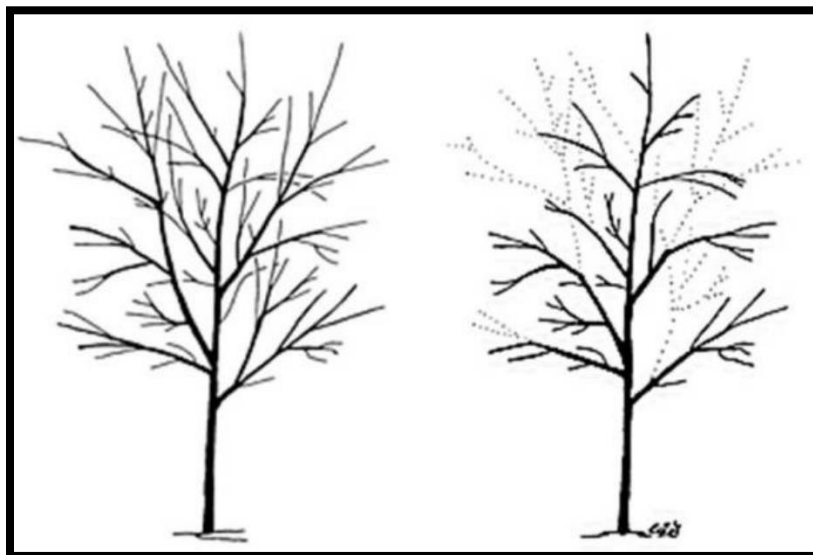


Figure 16 – Tree structure in young trees.

The training pruning program would also be accomplished on a cyclical basis, but the work would be scheduled during a three-year cycle rather than the two-to-five-year cycle for the routine pruning of larger established trees. As mentioned above, newly planted trees should receive their first training pruning three years after planting. This work can be accomplished throughout the year (Figure 16).

An optimum time to perform this pruning is late winter–early spring prior to bud break. The leaves are gone allowing clear visibility of the branches and trees will react positively to pruning at this time of year. Also, it is usually a time of the year when city staff workloads are less demanding. Training pruning can be accomplished from the ground with a minimum amount of equipment. Millwood should develop an organized, documented approach to cyclical tree maintenance that can be easily managed by staff.

Objectives that promote stewardship, longevity, structural integrity, and health of the community forest.

- Educate mower and weed eater operators about equipment operation around tree trunks.
- Maintain the GIS-based inventory to manage the composition, character, and distribution of the urban forest.
- Establish a long-term tree care and management program for public trees to enhance urban forest and ecosystem health and function that includes structural pruning of young trees, cyclical pruning and crown cleaning of older trees, line-of-sight and height clearance pruning of street trees, removal and replanting efforts, risk identification for street and park trees.
- Coordinate city departments to identify and address serious and persistent tree-related infrastructure conflicts, to include street, sidewalk and utility impacts along with maintenance and installation impacts within utility easements.
- Maintain industry-appropriate storm and risk tree response protocols.
- Maintain, promote, and apply industry-appropriate pruning and planting standards through staff training and hiring of ISA certified arborists.
- Monitor tree population for insect pests and diseases, particularly invasive.
- Review operating plans on an annual basis.
- Review and update the Urban Forestry Management Plan on a 5-year cycle, or as needed, to adjust to changing circumstances.

Tree Maintenance Pruning Cycle

Pruning is one of the best treatments an arborist can do for a tree, but also one of the worst treatments that can be done to a tree (Alex Shigo, 1991). Pruning that is well executed for the tree provides a variety of benefits, including reduced likelihood of whole tree branch, and stem failure; clearance for utilities, buildings, vehicles, and pedestrians; improved health and appearance; and stable structural architecture. Pruning can harm the tree's health, stability, and appearance if performed poorly. Negative consequences can also occur when pruning is not performed at all (Figure 17, 18).

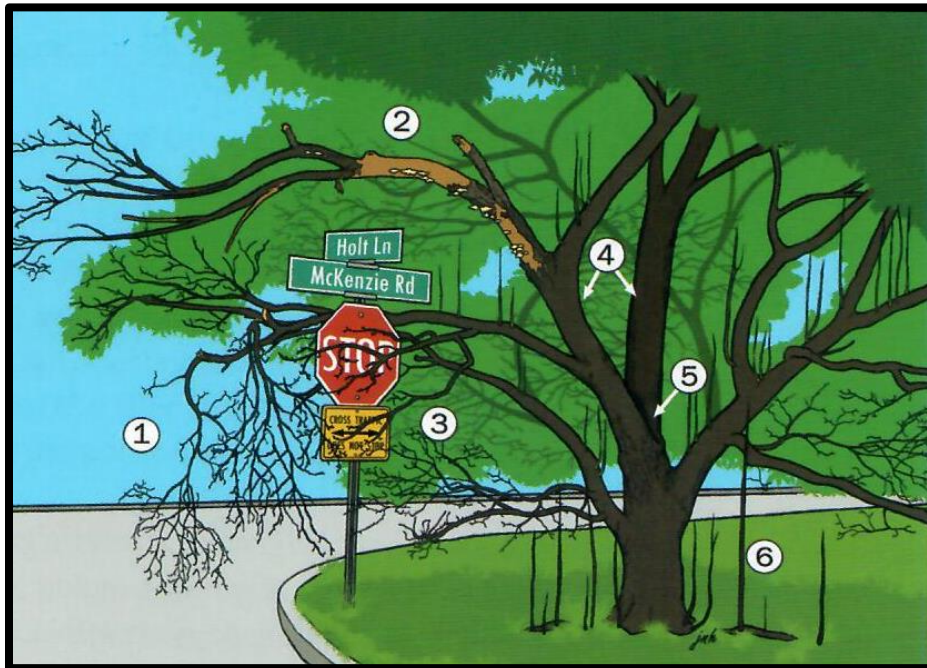


Figure 17 – Several consequences can occur when pruning is not performed at all: 1) an accumulation of broken branches; 2) dead branches; 3) branches that interfere with site functions; 4) weak, codominant stems; 5) structural defects such included bark; and 6) in some species, development of suckers. (ISA – BMP, Pruning, 3rd edition)

In an urban environment these consequences can pose risk to public safety, can threaten the health of trees, and can detract from tree aesthetics. Prior to beginning any pruning treatment an arborist should conduct a visual inspection of the trees to be pruned. Inspection should include:

- General condition/branch architecture/health,
- Identification of the type of branches to reduce or remove and location,
- Quantity of branches to be reduced or removed (number, diameter),
- Type of cuts to use (branch removal, reduction, heading),
- Signs of wildlife nesting, and
- Work safety concerns (overhead and underground utilities, bees, defects).

The inspection should be the basis for establishing the pruning system and objectives. The pruning system defines the desired long-term form of the plant. Typical pruning for street, landscape, park, and forest edge trees will use the **natural pruning system**. The natural pruning system is an informal style used to retain and promote the characteristic form of the species or cultivar in its current location. Within this system, however, trees are often pruned to coexist with people and urban environments, so trees may not have a completely natural appearance. The natural system may be used to alter the form of a tree to avoid conflicts with infrastructure, promote strong branch architecture, enhance views, and provide clearance.

Prior to pruning treatments an objective is determined to achieve pruning goals. Establishment of objectives must consider pruning system, tree health, growth habit, tree

size/age, structure, species characteristics, growth response, location, and site characteristics. The most common objectives are: improve structure, risk mitigation, provide clearance, maintain health, reduce density, restoration, size management, view obstructions, improve aesthetics, manage wildlife habitat.

- Objective
- Method
- Cut location
- Cut type
- Cut number/diameter

I. Pruning Schedule: The maintenance pruning schedule shall be dictated by the steps listed above and tree species, age, function, and placement.

- Trees less than 7 years old should receive structural pruning at the time of planting and then on a 3-year cycle.
- Trees 7-20 years old should receive structural pruning every two to five years.
- Trees 20 years old and older receive maintenance pruning every five to seven years to clean dead, diseased, dying, and defective branches from the crown.
- Trees adjacent to roadways, walkways, signs, and streetlights are annually inspected for safety and clearance issues and maintenance pruned as necessary.

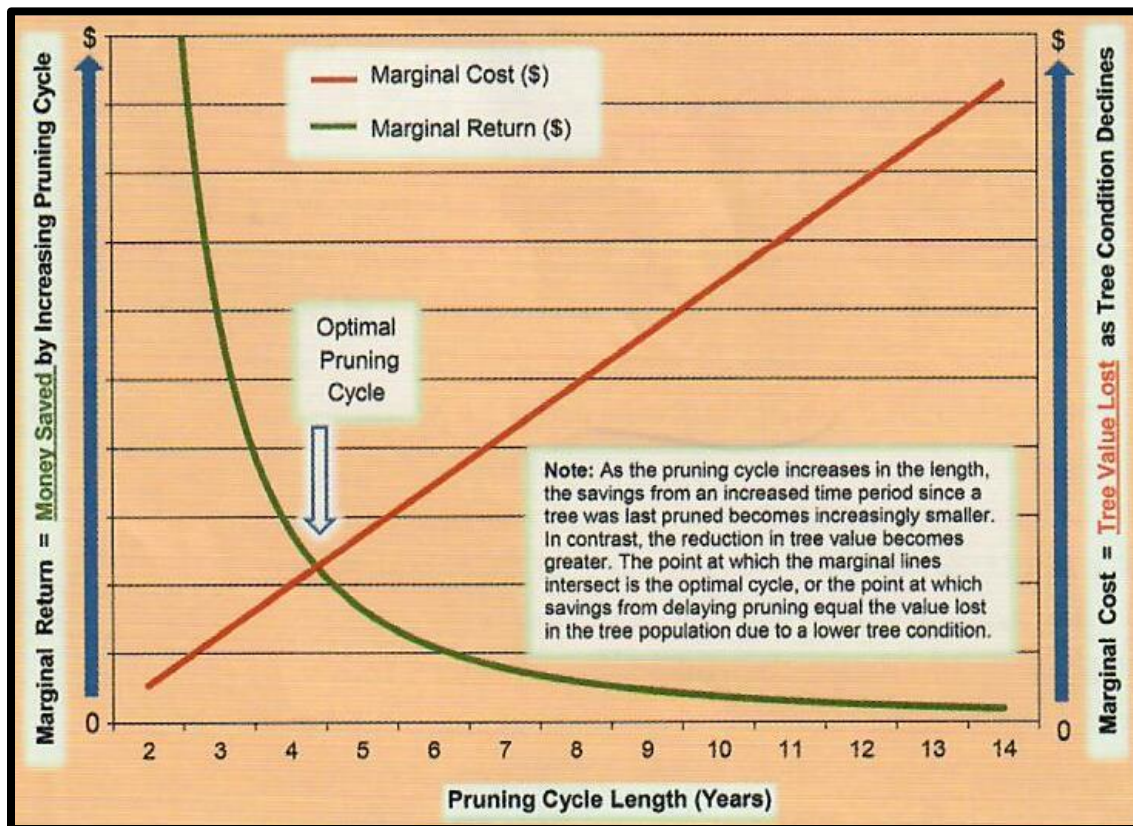


Figure 18 – Marginal cost (loss of tree value) and marginal return (savings in pruning costs) for pruning cycle lengths used to determine an optimal pruning cycle at the point that marginal lines intersect (Hauer, et. al. Arborist News, 2015)

- II. **Pruning Specifications:** Written specifications are key to good pruning because they communicate the objectives and scope of work. Specification should include the pruning systems, objectives, pruning cut type(s), size range of branches to remove, amount to remove, location of branches, photo illustrations of work to be done, and other necessary information (Figure 19).

- Plant name (common or genus and species)
- Location (address and place in the landscape)
- Pruning system to be applied (e.g., natural, pollard, topiary [hedge, shape])
- Pruning objective (e.g., manage risk, improve structure, clearance, manage size)
- Type of parts to remove (e.g., live or dead branches, fruit, mistletoe)
- Size range of branches to remove (e.g., diameter range, maximum or minimum diameter, length)
- Location within the crown of the parts (e.g., whole crown, near house, over street)
- Amount to remove (e.g., all [as with dead branches over 2 inches {5 cm} in diameter], number of branches, or a percentage of foliage [as with ~ten percent of live branches])
- Plan for disposal of debris (e.g., remove all debris, chip brush, and leave wood chips, leave firewood)
- Time frame for completion of the work (e.g., 2 weeks, over the winter, July)
- Re-inspection or pruning interval (e.g., 5 years, annual, monthly during the growing season)
- Additional information as needed (e.g., topiary shape, clearance distances, desired view)

Figure 19 – Information that should be included in written pruning specifications.

Example Specification

- Street tree 20-inch diameter red oak pruned to provide clearance and correct structural defects.
- The objective is to reduce structural issues that cause tree failure (codominance; included bark; asymmetric crown; large low branches).
- The pruning system is a modified natural system that will correct the structural issues and adjust the crown for street and sidewalk clearance.
- Dead branches greater than 1-inch diameter shall be removed throughout the crown.
- Identify the stem to become the central leader which is usually the larger stem in line with the central axis of the main trunk. The stem or branch not chosen to be the central leader should receive a reduction cut which shortens the stem or branch by removing the stem or branch back to a lateral branch that is at least 50% of the diameter of the cut stem or branch using a reduction cut.
- Living branches shall be removed from the terminal ends of the crown by eight feet with reduction cuts that do not exceed four inches in diameter.
- The total foliage removed shall not exceed 10% of the total crown foliage. The largest live branch removed shall not exceed 4-inches in diameter.
- The pruning cuts shall be branch removal or reduction cuts. The total number of cuts shall not exceed 30.
- Clean up all debris and leave wood chips scattered around tree in parking strip as mulch.

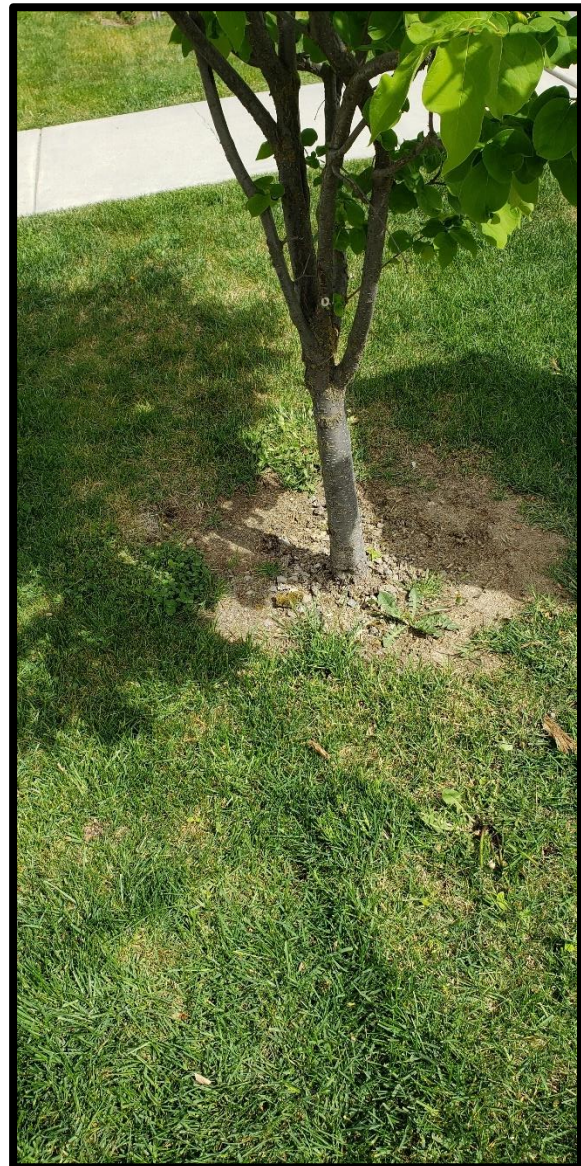
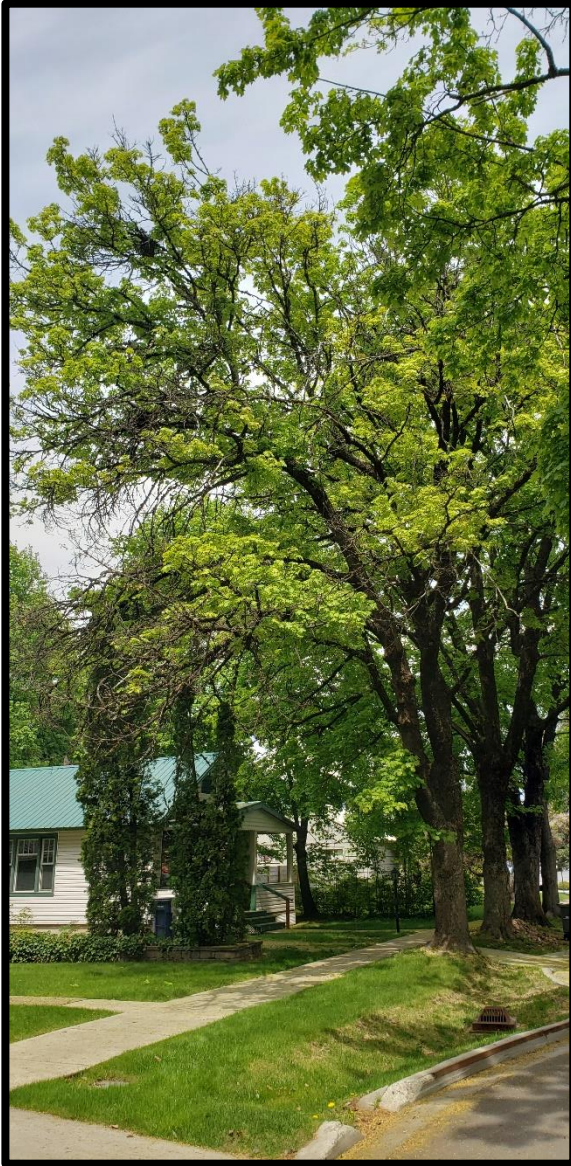


Figure 20, 21 – Many trees along streets have been pruned for clearance but no structural pruning occurred to create proper branch architecture.

All recently planted trees require subordination pruning to establish a strong central leader and proper branch architecture to avoid development of codominant stems (Figure 20, 21). This is easily accomplished without power tools or large equipment on small trees. The pruning should be performed by a skilled arborist.

TREE RESOURCE EXPANSION

Tree Resource Expansion

There is a clear need for a tree planting plan to guide the arboriculture future of Millwood's community trees. Such plans will minimize the unintended but gradual degradation of the urban forest over time, as well as maximize the potential for a

sustainable and diversified tree canopy and the associated benefits. The trees in Millwood—a relatively even-aged, limited, and undiversified population—are not only significant design elements but also represent the canopy cover at this stage.

A challenge for Millwood is to plant enough new and replacement trees each year to increase the canopy cover, maintain newly planted trees, and ensure the trees thrive. Removals without replacement and planting small trees in large spaces lead to net canopy loss (Figure 22). Without a clear plan to guide tree plantings, the City of Millwood may plant trees but not achieve a net increase in tree canopy.



Figure 22 – Small trees that mature at less than 25 feet should not be planted in larger parking strips.

Tree planting plans include input from local citizens, city staff, state agencies, organizations, businesses, planners, developers, city staff, affiliated green industry professionals, and elected officials. They are integrated with other comprehensive agency and city plans to create a blueprint for administration and management of the Millwood planting program.

The goal is to provide specific guidelines on locating, planting, and caring for trees. Critical components in the development of the tree planting plan include removing, pruning, planting, and preserving trees; educating stakeholders; and improving coordination and communication among citizens, city staff, and elected officials. A tree planting plan will help Millwood tree managers quickly determine how best to apply funding that often becomes available in small and unpredictable amounts. A plan should not only specify what (species) and where (location) but when (timeframe) and why (underlying goals).

The community tree planting plan should address some important questions about landscape design, development impacts, including the kinds of neighborhood and other landscapes that are present, their function, and their attractiveness; how the landscapes should look and function in the future; and how the landscapes should be protected or modified to reflect community goals.

Design objectives can include the following:

- Plant only the quantity of trees that can be maintained properly. If there is funding to maintain only 50 newly planted trees do not plant 100.
- Increase tree planting on Millwood owned property, including parks, public buildings, ball fields, and other developed sites.
- Promote additional street tree plantings while considering infrastructure (e.g., utility) limitations.
- Review new site development proposals to maximize tree planting and preservation opportunities.

- Encourage tree planting and preservation on private property.
- Develop guidelines for reviewing tree selection and/or location regarding the aesthetics of specific architectural and development projects in the community core.
- Consider the development of a Millwood Master Street Tree Plan to express unified visions and themes for street trees across the community.
- Define how important landscapes, such as main entrances and exits, will be identified, and considered in tree and flower planting. An overall image of Millwood will be developed through the coherent planting of trees along streets and parks.
- The final selection of trees and their placement in a landscape shall be made in the field while considering the many elements of that landscape.
- The tree species chosen for planting, besides meeting design criteria, must be biologically adapted to site conditions and well suited for the level of care they will receive.

Implementing a tree planting plan and using inventory data to prioritize planting and maintenance establishes a systematic program which reduces costs (Figure 23). This is primarily because systematic, planned maintenance in general leads to healthier trees that require less expensive maintenance over the long run than unhealthy, high-risk trees. Maintenance practices and standards for new tree plantings should be a component of the tree landscaping plan as well as strategies for funding maintenance programs. Developers should be encouraged and expected to use creative design strategies to achieve the intent of the tree planting plan.



Figure 23 - For every dollar spent on tree planting and establishment, a 250% return on investment is provided to the city in terms of the total services provided at tree maturity.

Tree planting in Millwood can significantly impact the community's landscape for years to come. Yet planting decisions, including the selection of species and location, are often made without the benefit of a long-term strategy or plan. Tree planting might occur as part of a larger capital construction project, or be driven by a donor request, or be included in a volunteer project.

As the inventory of existing trees continues, places where trees could be planted should also be noted. Knowing the number of available planting sites can help when the community is budgeting for and ordering new trees.

There are many available new planting spaces in Millwood. Planting trees is a common activity promoted by cities, local and national trade, and professional and citizen organizations. The new trees are the future environmental, economic, and social fabric for the City of Millwood. Many planting spaces exist in Millwood, but parameters will

need to be established by site in conjunction with field evaluations to determine available planting spaces (Figure 24).

The key to maintaining a healthy, sustainable community forest is the implementation of regular, annual tree plantings, regardless of grant money or catastrophic events. Many trees do not need to be planted, but a consistent annual addition of trees to the community forest is critical to maintain a perpetual canopy.



Figure 24 – There are many opportunities to plant new trees along city streets.

Objective to guide the Millwood tree planting program.

- The annual quantity of trees to plant is directly dependent on the quantity of trees Millwood staff and resources can maintain.

Tree Planting Practices

Across the country we are striving to restore our community forests but the road from nursery to working forest is arduous. The sight of new trees struggling rather than thriving in the landscape is common whether the site is residential or commercial, public, or private.

As in most cities, trees planted in the past were planted too deeply. Root collars were buried and trees in this situation fail to thrive. Installation practices need to ensure the root collar is at grade level and the root system is free of defects (Figure 25). In general, the tree-planting holes should be relatively shallow (typically slightly less deep than the measurement between the root collar and the bottom of the root plate) and quite wide (three to five times the diameter of the root system). Care should be taken so that the root collars of the new trees are at the same level or slightly higher than the surrounding soil grade (Figure 26).



Figure 25 - Maple tree planted too deeply. Note lawnmower/weedeater damage at trunk base.

In most situations, it is not recommended to add soil amendments to the planting holes, as this can lead to differences between texture and structure of soils inside the planting holes and the surrounding soil. Such differences can lead to either water being wicked away from or accumulating in the planting holes.

Tree staking or guying should be the exception and not the rule. Tree staking hardware should be installed only when necessary, to keep trees from leaning (e.g., windy sites) or to prevent damage from pedestrians and/or vandals. Stakes should only be attached to trees with a loose, flexible material, and all staking material must be removed as soon as the root system anchors the tree.

Mulching

Mulch should be applied to the surface of the soil around each newly planted tree. Mulch should never be piled up around the trunk (creating mulch volcanoes), but rather should be pulled away from the root collar (Figure 27). Mulch that buries the root collar provides shelter for insects, fungi, and mammals that could damage the tree. Mulch should be applied to an area three times the diameter of the root system to a depth of two to four inches. Mulch not only suppresses competition from grass and weeds, but also provides a zone where turf maintenance is not needed, thereby keeping lawn mowers and string trimmers safely away and thus preventing mechanical damage. Mulch also helps to hold moisture in the surface of the soil where most of the feeder roots are to be established.

Diversification

The current tree inventory data base includes about 900 trees. There are more than 50 different species found in Millwood's tree population (Table 7). This appears to be a diverse population, but distribution figures indicate the population is dominated by one genus. Fifty-two percent of the trees inventoried to date are represented by the maple genus (*Acer*).

Species diversity in new plantings throughout the city should be a primary concern. The dangers (e.g., disease and insects) of planting monocultures have proven to be devastating throughout the United States. An older, common industry guideline for maintaining species diversity in urban settings is the 10-20-30 rule. That is, no single species should make up more than 10% percent of the trees in a population, no more than 20% of any one genus, and no more than 30% of one family in the total tree population (Santamour, 1990). **Current industry standards recommend that no more than 10% of the tree population is comprised of any one genus as a guiding principle.**

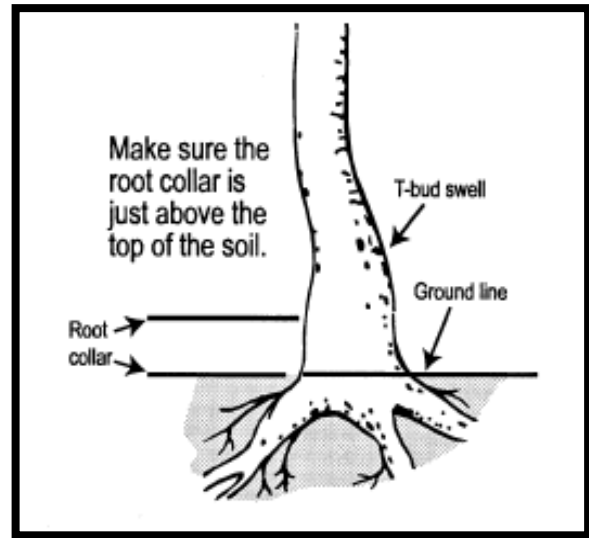


Figure 26 – Root collar at grade level



Figure 27 - Incorrect mulch applications can degrade trunk tissue causing tree mortality.

Diversity is an important measure of a forest's resilience. A more diverse forest, both in total number of species represented and in their relative abundance is better able to adapt to environmental changes as well as disease and insect infestations, particularly foreign invasive plants, pests, and diseases. When just a few species dominate the composition of a tree population, these changes or infestations will significantly impact the entire population.

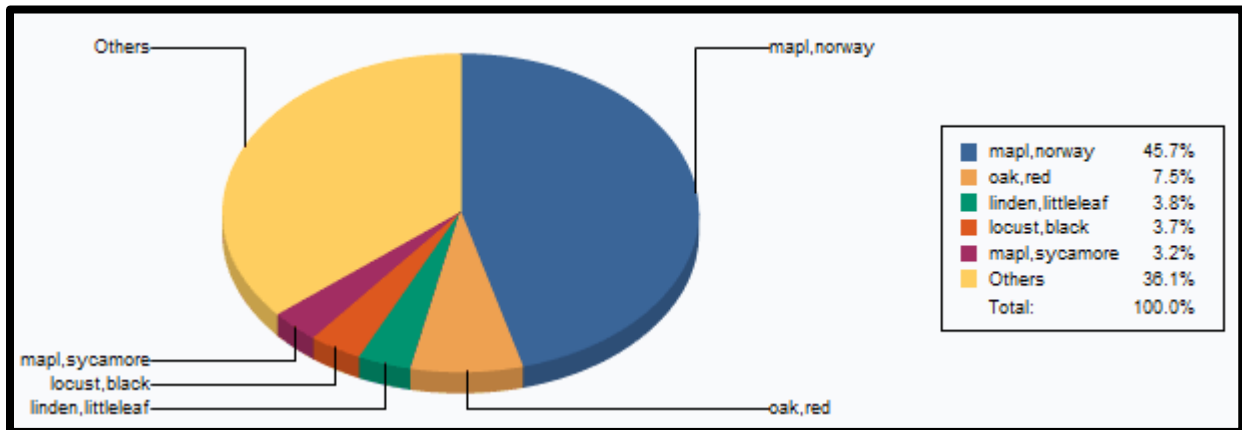


Table 7 – Species distribution. The tree population is dominated by maples (52%).

Objectives to increase species diversity.

- Millwood should adopt a tree planting diversity guide that states that no more than 10% of the tree population is comprised of any one genus as a guiding principle. **The city should enact a moratorium on planting any maple species in the public sectors.**
- Millwood should emphasize a diversity of species in the planting program. Avoid species that have high maintenance costs, invasive characteristics, high storm damage potential or a history of failure such as Siberian elm, cottonwood, and willow. See appendix C for potential trees to plant.

Diameter Distribution

A well distributed age-class helps maintain a stable canopy cover. If all the trees within a particular area or neighborhood are approximately the same age they will mature and decline at the same time, leaving that area with a deficient urban forest canopy plus expense of replanting. In many parts of Millwood, young trees of similar age class dominate the landscape. To mitigate the impacts of an even age canopy maturing at the same time, Millwood should take steps to increase the age class and species distribution where possible (Miller, et. Al., 2015; Vargas, et. Al. 2007).

For example, western cities established the following standard for desired age structure:

- 40% young (< 6-inch DBH)
- 30% maturing (6 – 12-inch DBH)
- 20% mature (12 – 24-inch DBH)
- 10% old (> 24-inch DBH)

Millwood's tree population ranges for the same categories of desired age structure:

- 15% young (< 6-inch DBH)
- 8% maturing (6 – 12-inch DBH)
- 55% mature (12 – 24-inch DBH)
- 22% old (> 24-inch DBH)

The graph (Table 8) below depicts the (DBH) diameter distribution for the trees inventoried. A population exhibiting the diameter distribution characteristics indicates Millwood has planted about 100 trees recently. This graph mimics a population that peaks in the mature diameter class. It represents a tree population that is maturing and moving towards senescence sometime in the future with few trees in the lower diameter classes to replace trees that are over mature.

The optimum diameter distribution has the largest number of trees in the smallest diameter classes. As each group of trees within a specific diameter class matures, the numbers within the group diminish through attrition. To perpetuate a specific species, the largest representation must be in the smaller diameter classes. As a rule of thumb for any given species, twice as many trees need to be planted as are removed in any one year to maintain the exponential shape of this graph. Management activities should strive to improve Millwood's population distribution to reflect current industry standards and plant species that will become large trees.

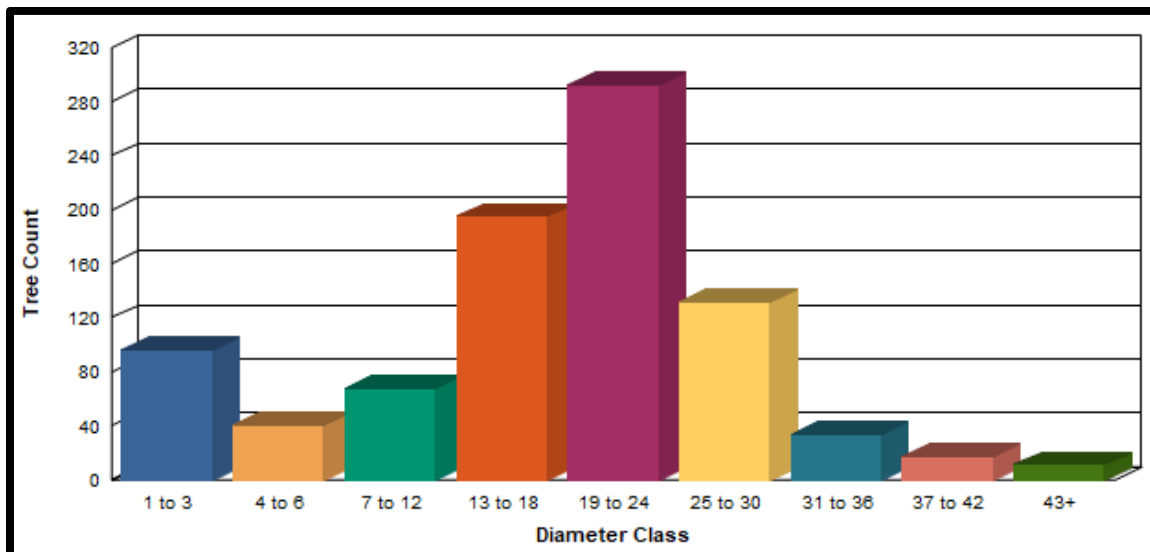


Table 8 – Diameter distribution of inventoried trees (Diameter breast height – 54 inches above grade level).

As species age the population curve is centered on the larger diameter classes. The graph (Table 9) simulates a situation in which plantings of one species have tapered off in the recent past (10 – 30 years). The population peak is centered on the larger diameter class. This species will have peaks that continue moving up the scale over time as the few smaller diameter trees move into larger diameter classes. If this graph represents willows for example, then the species will soon be missing from the

landscape. This trend is good for some species that Millwood may want to eliminate such as boxelder, black locust, or Siberian elm. However, if the oaks or lindens show this trend, it means an important species is dwindling from the landscape.

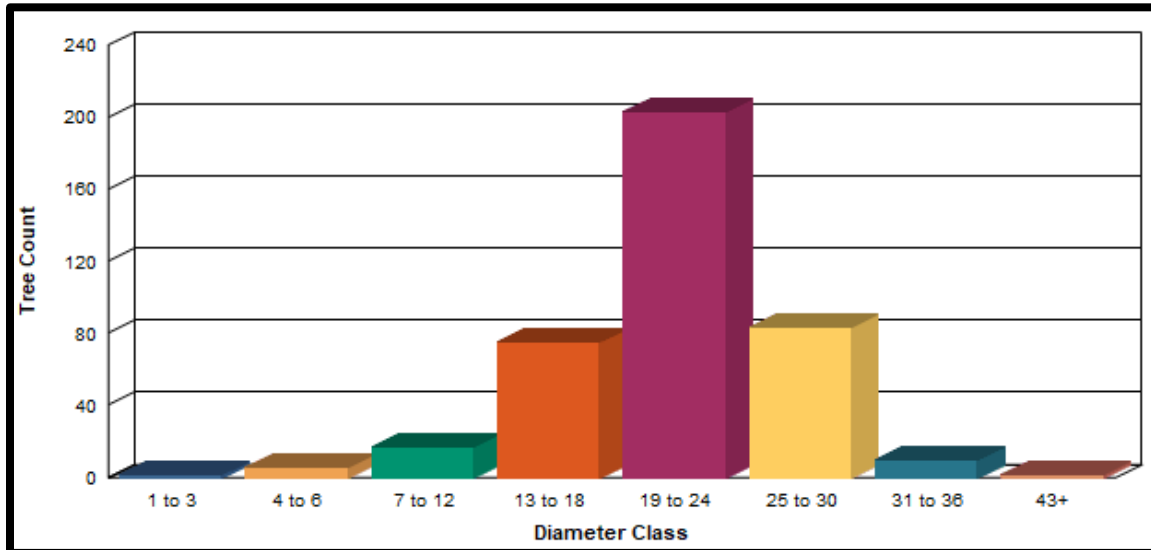


Table 9 – Diameter distribution showing population curve of species in Millwood where planting decreased in the last 40 years.

Objectives to reach industry tree population ranges.

- Millwood should increase tree planting and increase maintenance of new and existing trees until tree population ranges reflect industry recommendations listed above.

Tree Establishment Plan

Mortality of landscape trees can reach 70% in the first year after planting. There are fundamental factors and procedures critical to tree establishment. If these are fully considered and acted upon, significant reductions in transplant losses can be expected. The principal elements essential for successful tree establishment have been identified as tree physiology; root quality; plant quality; correct planting depth; and post planting maintenance.

Tree physiology considers the genetic potential of trees to establish in each environment and species characteristics which may reduce the impact of a particular stress. High plant quality is an essential foundation for any planting project, particularly root quality. Planting and post-planting practices are fundamental to establishment success. The rooting environment is critical in ensuring future resource availability in Millwood. Failure to consider fully any one of these factors increases the likelihood of a high mortality rate in a tree planting scheme.

While it is appreciated by professionals involved in urban tree management that trees are planted into suboptimal conditions for growth, the extent and diversity of stresses urban environments impose is frequently under-estimated. In view of the resource life-

history an amenity tree has in terms of irrigation, fertilizers (if applied), transport costs, planting materials, labor, etc., in addition to the actual loss of the tree, the persistence of these failure rates can no longer be accepted.

The average historical cost to plant and water a new 2-inch caliper tree for the City of Millwood is \$400.00 per tree. This figure would include trees planted in new available planting spaces and tree planting connected to a tree removal. This percentage of a tree budget dedicated to tree planting reflects average municipal tree program budgets (Hauer R. J. and Peterson W. D. 2016). This figure allows Millwood to maintain industry target goals for tree population ranges and is a quantity Millwood staff can maintain.

Objective: CFC recommends that 5% of tree management funds be dedicated to new tree planting in the initial operating plan.

Disease and Insect Issues

No significant disease issues were noted in the tree inventory data collection. In the future invasive non-native insect pests may be the primary threat to the Millwood community forest. Emerald ash borer (EAB) is highly invasive pest that has killed tens of millions of ash trees in North America. Millwood's tree inventory found about eight percent (640 trees) of the population is ash trees. The city needs to plan to deal with this destructive pest or be faced with many problems when EAB arrives. Exponential tree death occurs once ash trees are infested. Removal costs, replacement trees, public education campaigns, and treatment options for high-value ash trees should be developed before EAB arrives. The city should prepare and plan for EAB by:

- Developing an EAB preparedness management plan
- Monitor and diagnose ash tree problems
- Establish maintenance and treatment options
- Develop a public awareness and education campaign
- Establish funding to address EAB invasion

Another formidable non-native insect pest that potentially can impact the Millwood community forest is Asian long-horned beetle (ALB). It is probably less likely to cause problems than EAB in Millwood but should be considered a threat. Asian long-horned beetle has a wide host range affecting many genera particularly maples. Maples account for about 55% of the trees inventoried. Currently, the only effective means to eliminate ALB is to remove infested trees and destroy them by chipping or burning. Early detection of infestations and rapid treatment response are crucial to successful eradication. The city should approach ALB concerns similarly to EAB.

TREE RISK MANAGEMENT

Tree Risk Management

The forest is an integral part of a community's infrastructure, and trees often dominate the landscape. Trees are a very desirable landscape component of the urban and urban/rural interface. Trees provide numerous benefits to those living and working in Millwood. These benefits increase as the age and size of the trees increase if the trees are maintained properly. All trees germinate, grow, mature, decline, and eventually die. Along the way, trees may undergo all sorts of negative physical alterations naturally or aided by poor maintenance practices, such as limb loss, onset of decay, structural changes or other conditions that can predispose a tree to fail. All trees have a varying level of risk for failure. In assessing and managing trees, city staff should strive to strike a balance between the risk that a tree poses and the benefits that Millwood derives from trees.

Tree risk management is the application of policies, procedures, and practices to identify, evaluate, mitigate, monitor, and communicate risk. It is impossible to maintain trees free of risk; some level of risk must be accepted to experience the benefits that trees provide. These statements provide a foundation for balancing tree risk and the benefits that trees provide:

- Trees provide a wide variety of benefits to society.
- Trees are living organisms and naturally lose branches or fail.
- The risk to human safety is extremely low.
- The City of Millwood has a legal duty of care.
- The City of Millwood should take a balanced and proportionate approach to tree risk management.

Fortunately, tree failure is an infrequent occurrence. Serious damage, injury, or death from tree failure is rare. Tree failures during normal weather conditions are often predictable and preventable. However, any tree, whether it has visible weaknesses or not, will fail if the forces applied exceed the strength of the tree or its parts.

The trees inventoried thus far in Millwood are mature trees (greater than 17-inch DBH; 59% of the population). It is important to manage risk associated with trees. The tree inventory identified 67 trees for removal. Ultimately Millwood has the responsibility for maintaining a safe environment.

These responsibilities include high risk trees or limbs that could damage property and cause injuries or even death, trees that block required traffic sight lines and signs, or tree roots that raise sidewalks, invade segmented pipes, or disrupt activities. The human and financial impact of these problems can far outweigh the costs that an agency would have incurred in providing proper, proactive care.

No agency can budget for all removals at once, therefore a priority of work must be established and implemented to demonstrate due diligence of care. For Millwood tree risk mitigation this process begins by removing trees that have been rated an extreme risk by a Tree Risk Assessment Qualified (TRAQ) arborist.

Millwood Tree Risk Policy Statement: Millwood shall have an active policy to maintain the safety of people and property on roadways, parks, and other public property from potentially hazardous trees. The City of Millwood will strive to mitigate, in a reasonable time, trees deemed high-risk. When available fiscal and human resources limit the ability of Millwood staff to mitigate high-risk trees, priority shall be placed on trees deemed to carry the highest risk.

The standard of care for evaluating tree risk will incorporate the following International Society of Arboriculture (ISA) Guidelines: 1) ANSI A300 Pruning Standard; 2) ANSI A300 Tree Risk Assessment; 3) the International Society of Arboriculture's (ISA) Tree Risk Assessment-Best Management Practices (ISA-TRA-BMP); 4) ISA TRAQ tree risk rating system; and 5) Millwood protocol described in this document.

Goals: Tree risk assessment has two primary goals. The first is to ensure the safety of people and property that may be in the range of one or more trees with a high potential of failure by identifying and mitigating the situation before damage is caused. The second is to promote tree health and structural integrity by practicing proper tree maintenance to reduce future hazardous trees by developing a tree risk management program that takes action to reduce risk to an acceptable level. This is accomplished by taking all reasonable steps to ensure the safety of people and/or property before accidents occur. The goal is not to strive for zero risk since this is unattainable. Rather, the goal is to identify the trees that pose risk beyond an acceptable level to public.

The City of Millwood, or staff acting on their behalf, has a duty of care to ensure that the trees in their care do not create an unreasonable risk. The liability associated with trees can best be avoided by clearly assigning the responsibilities for tree inspection and care and then documenting that this responsibility is met. Cities and other property owners are expected to conduct annual work, including yearly tree inspections, removal, pruning, and other maintenance. The goal of tree risk management is to provide a systematic and defensible approach by which those risks can be assessed and managed to a reasonable level.

Objectives for the tree risk management plan that reduce exposure to liability:

- A tree inventory will be maintained. Dates of inspection, condition of inventoried trees, and pruning and other maintenance needs will be recorded.
- Annual inspections of community trees should be completed, and accurate inspection records should be kept.
- High and extreme risk trees and tree branches should be mitigated as they become known.
- Only trained, ISA qualified TRAQ risk assessors, and insured tree care professionals who follow arboriculture industry practices should be hired for any tree maintenance work on public trees.
- Millwood urban forestry staff and other city staff as needed will participate in training on tree risk awareness and management, safe arboriculture procedures, first aid, safe equipment use, and tree risk incident procedures to develop basic surveillance skills for visually scanning trees to detect and report potentially high risk/ hazardous trees.

- Visual clearance for intersections, traffic signs, and signals shall be maintained.
- Requests by city departments, property owners, and others should be responded to promptly.
- Implement a risk tree mitigation action plan based on levels of risk.
- Implement a cyclic pruning program.

Tree risk assessment can also be used as an educational tool to demonstrate the necessity for urban forest planning. Proper planting and aftercare combined with regular pruning and periodic inspections, reduces the likelihood that weaknesses or defects will become hazardous. Proper management will lead to permanent reductions in liability.

Public safety is the major concern for urban forest managers. Millwood has a legal duty to exercise reasonable care to protect residents and the public from foreseeable risks. Millwood managers, administrators, staff, and elected officials must demonstrate reasonable care to minimize the risk associated with trees in public areas (Figure 28). It is imperative for all Millwood city departments to follow established risk management policies.

Tree Inspections

Millwood has a legal responsibility to exercise due diligence that trees in parks and streets adjacent to city properties are reasonably safe. The standard of care or due diligence is the action a reasonably prudent person should exercise in same or similar circumstances. Millwood's UFMP defines the agency's standard of care for tree risk management and assessment. Millwood shall meet or exceed all arboriculture industry standards in its tree risk management program through the following actions:

- Establish, adopt, and implement UFMP and policy.
- Ensure that all tree inspectors are trained and qualified to exercise due diligence while conducting tree risk assessments for Millwood.
- Undertake systematic inspections of trees on a schedule as described in the UFMP.
- Document the inspections and communicate the results to the appropriate person as defined in the UFMP.
- Undertake/recommend appropriate risk management action according to guidelines in the UFMP to reduce tree failures in the management program.
- Adhere to industry standards for general tree care activities.



Figure 28 – Black locust street tree with split in the trunk. Regular monitoring and inspections are integral to Millwood's tree risk management.

Tree risk assessment is the systematic process to identify, analyze, and evaluate tree risk (Figure 29). It requires assessing the tree or tree parts for the likelihood of failure impacting a target and the consequences of failure impacting a target. Inspections are the first line of defense in proactive risk management and maintenance programs.

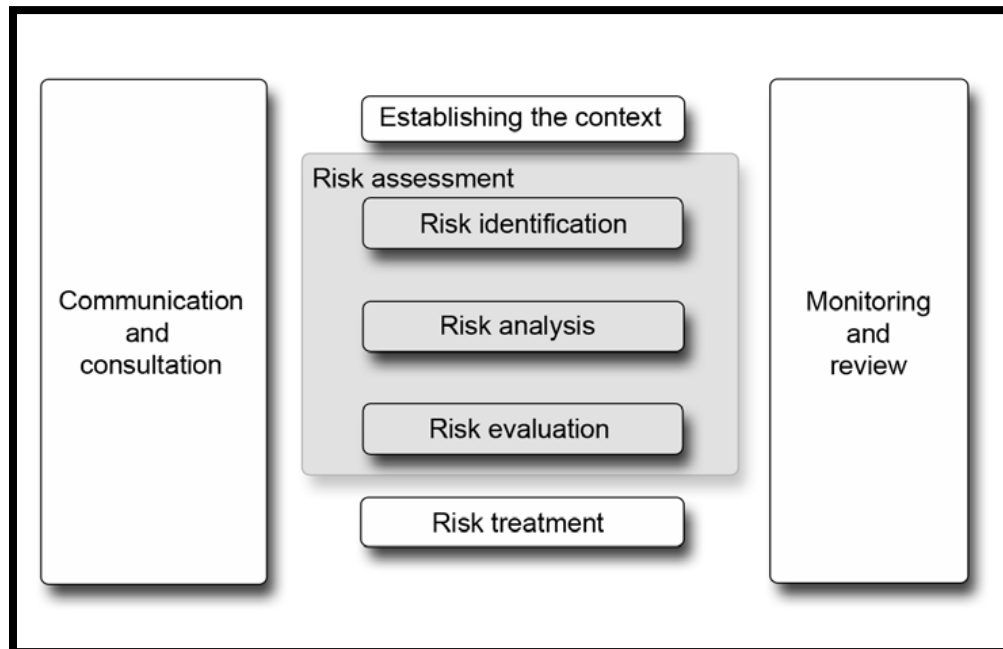


Figure 29 – Contribution of risk assessment (highlighted) to the risk management process (ISA Best Management Practices)

Major Defects and Conditions that Increase Potential for Tree Failure

- Dead parts (dead branches greater than 1-inch in diameter)
- Large broken and/or hanging branches greater than 2-inch diameter
- Cracks, splits, and cavities
- Codominant stems with weak branch attachments (included bark)
- Decayed wood or missing wood
- Unusual tree architecture – recent leans, topped trees, lack of trunk taper, asymmetric structure, excessive branch end weight
- Root loss – construction damage, under mining, decay
- Root defects – stem girdling roots, decay

Conditions affecting trees change constantly; and no one can predict every tree failure. Conducting a tree risk assessment neither assures nor requires perfection. Risk assessment should, however, ensure that all reasonable efforts have been made to identify extremely and potentially high-risk trees present at the time of assessment.

Millwood tree maintenance contracts shall include a qualified tree-care contractor with all necessary training, equipment, and qualified employees to evaluate tree risk. A list of qualified tree and available tree contractors shall be established that are available to

assist in the case of natural events that create a high-risk tree situation if the primary contractor cannot handle the work within the allotted time frame.

Tree Risk Assessor Qualifications

Each assessor shall have a current certification as an ISA Certified Arborist and qualification as an ISA TRAQ Risk Assessor with a minimum of two years' experience in the field conducting tree risk assessments.

Risk Awareness Personnel and Qualifications

Millwood staff, landscape, and tree maintenance personnel, both contractors and Millwood employees not meeting assessor qualifications shall attend an initial class on tree risk awareness, pruning maintenance, and tree risk incident procedures to develop basic surveillance skills for visually scanning the right-of-way plantings to detect and report potentially high risk/ hazardous trees.

A staff training log record verifies that Millwood staff and subcontractors are receiving ongoing and pertinent continuing education. It serves as documentation if litigation occurs and demonstrates the agency is taking a proactive rather than a reactive tree risk management program.

Inspection Cycle: The evaluation cycle or inspection interval may range between one and five years, depending on the age of the tree, level of risk, specific conditions, Millwood goals and resources, or regulations. The inspection may occur prior to normal storm seasons for the area. Mature trees and species with known failure histories may need to be inspected more frequently. Occurrence of tree or branch failures between inspections will indicate the adequacy of the interval between inspections. Additional inspections should be made following storm events. Intervals of 18 months between inspections alternate between leaf on and leaf off and provide opportunities for assessment during different growing seasons. An advantage to risk assessment during leaf off allows for a clear view of tree structure.

Risk Tree Abatement

Agencies, utilities, and property managers may have laws, ordinances, or risk management plans that define the level of acceptable risk. Safety is the priority but may not be the only basis used by the risk manager to establish acceptable levels of risk. Budget, a tree's historical or environmental significance, public perception, and other factors may come into the decision-making process.

Mitigation and Action Strategy

The risk manager assisted by a qualified tree risk assessor/forestry staff organizes a tree risk team of employees and writes an Annual Operating Plan (AOP). The goals, objectives, and activities are prioritized for the year based on funding, priorities, capabilities, assessment intervals, recent tree inventories, and previous year's failure logs.

Implementation of the AOP includes:

- Mitigation actions pending from previous year.
- Identify trees and regions that need to be assessed or re-assessed based on assessment intervals.

- Assess the tree population by risk rating and condition classes. Trees with highest risk rating, in the poorest condition class, and with multiple targets occupying the target zone are the most problematic in the short term for Millwood.
- Document removals, prunes, and other mitigation requirements.
- Assign and schedule Millwood staff and/or contractors to implement mitigation actions.
- Monitor and document work results.
- Report results of AOP and review risk management actions.

Considerations to use in setting priorities are outlined in this plan. The risk manager/city forester takes action to reduce risk to acceptable levels by implementing correction measures based on thresholds from the tree risk rating system. Remedial actions are taken dependent on what part of the tree might fail; the likelihood of failure; the potential targets; and potential damage to the target. Extreme trees shall be removed, high-risk trees may be mitigated, while moderate risk trees may be mitigated/monitored/inspected and stabilized as appropriate. Trees that are retained should be inspected on a scheduled basis. The determination of which trees to inspect, and how often, should be part of a tree risk program. Tree risk inspections should be performed by an ISA TRAQ qualified tree risk assessor.

With the initiation of a cyclic pruning program, at a minimum, each tree will be re-inspected once every cycle. Pruning crews will systematically work through the community and when they are assessing pruning needs, they can also evaluate risks. Any new risks can be added to the database and then further inspections can be requested if required. Simple risk abatement through pruning can be addressed as part of the cyclic pruning program.

OPERATING PLANS

Annual operating plans (AOP) will direct the day-to-day operations and can be used to project budget requirements for all aspects of urban forest maintenance. The annual plan will include contract inspection, contract monitoring, planting, pruning, removals, tree risk inspections, plant health care, and maintenance of the inventory. Initially, the annual plan will need to address priorities derived from the inventory, but eventually will be focused on proactive management objectives. Preparation and review of the annual plan is the responsibility of Millwood staff. An example is provided in Table 12.

The preparation of operating plans for this management plan is based on information provided by Millwood staff, Millwood historical expenditures on tree maintenance, inventory data, and regional industry standards. Operational costs also consider industry estimates for community population size, annual tree care funding, tree management policy and planning, contract tree services, tree populations, tree operations, and staffing profiles. Industry costs in part are derived from the *Municipal Tree Care and Management in the United States: A 2014 Urban & community Forestry Census of Tree Activities* (Hauer R. J. and Peterson W. D. 2016).

Operational costs are based on Millwood historical maintenance costs, the tree and available planting sites, and maintenance needs found during partial inventories provided by Millwood. Costs per tree are derived from the *Municipal Tree Care and Management in the United States: A 2014 Urban & community Forestry Census of Tree Activities* (Hauer R. J. and Peterson W. D. 2016).

Removal costs vary depending on tree size and location. Small tree removal cost is about \$600/tree. Large tree removal costs can range from \$1,500.00 to \$3,000.00/tree (Average cost \$2,250). There are 18 small tree and 49 large trees designated for removal.

Tree pruning costs are variable depending on tree size and structural issues. Small tree (< 6-inch DBH) pruning costs should average \$400.00/ tree. Large tree (> 6-inch DBH) can range from \$600.00 to \$1,200.00/tree. There are 530 large trees and 10 small trees that require some form of pruning.

PROGRAM ACTIVITY	J	F	M	A	M	J	J	A	S	O	N	D
PLANNING												
Work priorities												
Organize activities												
Modification												
TREE REMOVALS												
Review inventories												
Field inspections/Risk assessments												
Announce/hold public hearings												
Schedule tree crews - Conduct removals												
Stump grinding/reseeding												
Inspections												
TREE PRUNING												
Review inventories												
Field inspections/risk assessment												
Schedule crew - Conduct tree pruning												
Inspections												
TREE PLANTING												
Review inventories/survey potential planting sites												
Survey neighborhoods; notify adjacent property owners												
Purchase trees												
Install trees												
Water trees												
Inspections												
COMMUNITY EDUCATION AND OUTREACH												
Education programs												
Report to Park Board of Commissioners												
Arbor Day Recognition												
Neighborhood Tree Committee												
STAFF TRAINING												
Professional development												
Safety training												

Table 12 – Example of an Annual Operating Plan (AOP)

OPERATIONAL REVIEW

Operational reviews may evaluate many components of an organization's forestry program. Reviews provide summaries of existing conditions, identify short-comings, and ultimately suggest goals, guidelines, and rationale that, once adopted will serve as a gauge for the standardization and optimization of program resources.

Millwood's goal is to have a larger, healthy, diverse, functional, and structurally sound urban forest and thriving residential and business communities. The dynamics of balancing urban forest management and other city infrastructure needs, responsibilities, and assets are diverse and complex and suggest a dedicated, interdisciplinary, flexible approach and organization. However, the current constraints for comprehensive and effective urban forest management in Millwood can be considered formidable.

Technical and Professional Resources

Currently, Millwood does not have a full-time urban forester, arborist, or staff dedicated to urban forestry operations. An adequate complement of professionals who, individually or collectively, understand the technical, operational, and administrative factors in urban forest management is needed to prescribe and monitor Millwood's urban forestry activities, enforce policies and regulations, apply technical standards and practices, and review plans that affect the forest resource. Without this professional component in sufficient numbers, urban forest management decisions and actions often default to inadequately prepared decision-makers, which can have long-term, negative consequences for the forest resource. In the current environment urban forest management is in a reactive state rather than a proactive state.

- **Objective: Hire an arborist with ISA credentials or contract with individual with similar credentials**

Political Support

Support from elected officials and the citizens are critical to implement and maintain an effective comprehensive urban forest management program. The citizens own both the public and private urban forests, and without greater political support and increased citizen understanding and commitment, urban forest management in Millwood may not reach its full potential.

Budget

The consulting team reiterates that to implement this UFMP and to realize the benefits of a healthy urban forest all aspects of this UFMP the city must be adequately supported with human and financial resources. Traditional funding comes from the city's tree assessment. This source of funding is in competition with all other city services and often urban forestry is considered an amenity rather than a necessity.

Urban forestry must generate enough interest in the stakeholders to position the program for recognition and sufficient funding. The program must change how stakeholders think about urban forestry and alter their beliefs about urban forestry. The role of urban forestry staff is not to move trees up the city list of importance. It is more critical to demonstrate how trees can help each city division function whether it is police, fire, storm water management, water quality, or air quality. Urban forestry must be

thought of as a solution to community problems and an economic engine worthy of city funding. Urban forestry provides essential benefits, opportunities for investment, solutions to city problems, and connections to people. Many of the objectives and recommendations of the UFMP will assist in generating these outcomes.

Levels of Service (LOS) and Extrapolated Maintenance Costs

Levels of service are quantifiable measures of capacity, such as acres of park land per capita, labor hours per tree pruning based on DBH or visitor use per day. A budget plan is a function of the agency's priorities and preferred level of service toward achieving urban forestry objectives in the UFMP. The City of Millwood must decide on an operating level of service it wishes to provide and accept the level of risk associated with the decision.

Typical tree budget allocations found in urban forestry programs across the United States allocate funding in these areas (Figure 30). Millwood's current forestry budget allocations do not follow industry standards. These are approximations but provide an accurate representation of fund allocations. The priority should be to take care of what you have before substantially adding to the street tree population.

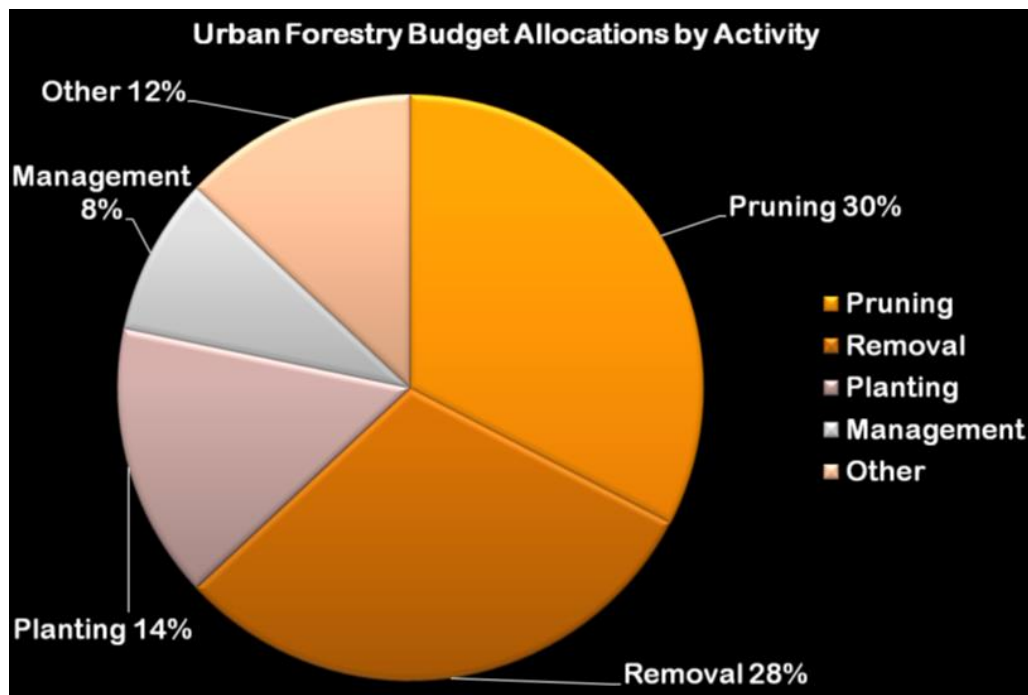


Figure 30 – Typical fund use in urban forestry tree budget allocations. Millwood should adjust these figures to current conditions as outlined in the Extrapolated Maintenance Budget (Table 13).

A report published in 1994 revealed that the average percentage of total municipal budget allocated to tree management was 0.31 percent, ranging nationally between 0.09 percent and 0.95 percent. The total annual budget in 2022 for Millwood was \$1,684,000.00. If average industry budget guidelines were applied to 2022 budget

figures 0.31 percent amounts to \$522,000.00. In Millwood, due the size of the community, 0.09 percent, represents a fundable figure for the urban forestry budget. Urban forestry funded at 0.09 of Millwood's 2022 annual budget amounts to \$152,000.00. These figures provide an indication of where the urban forestry budget in Millwood is and how it compares to industry guidelines in the cities of similar size in the Northwest.

Millwood	Current Urban Forestry Expenditures	Adjusted Industry Guidelines for Millwood
Program Areas	Operating Budget	Operating Budget
Tree Removal (no dedicated budget line)	\$4,500.00	\$22,400.00 (15%)
Parks Staff (part time management)	\$10,000.00	\$17,820.00 (11%)
Tree Pruning (no dedicated budget line)	\$0.00	\$81,000.00 (50%)
Planting (no dedicated budget line)	\$0.00	\$8,100.00 (5%)
Professional Services (arborist work, consulting, planting etc.)	\$1,000.00	\$11,340.00 (7%)
Equipment/supplies, misc.	\$2,000.00	\$11,340.00 (7%)
Totals	\$17,500.00	\$152,000.00
***Residential Property Assessment (estimate 800 homeowners)	\$21.25 annually	\$190.00 annually

Table 13 – Extrapolated Maintenance Budget. *An example of an urban forestry assessment based on property ownership to consider as a funding mechanism. The minimum budget reflects the maintenance needs determined from inventory data. The budget includes part time administrative staff and equipment. It does not include full time staff dedicated to urban forestry.**

Current Millwood resources are not sufficient to address tree issues in a reasonable, timely and safe environment if the maintenance requirements and if tree conditions found in the sample inventory were extrapolated to the entire community tree population the gap in funding would be wider.

The personnel, equipment resources, and budgets of the urban forestry operations are not sufficient to meet the tree management and maintenance needs of the street, park, trail, and community forest system. A review of tree maintenance needs, maintenance schedules, crew configurations, personnel, equipment, and training required to manage and maintain trees in the city finds city insufficient. Current resource levels place the city

in a reactive management position that increases the liability of the agency and exposes the community to an increased risk.

Many cities operate under a mode of crisis management when it comes to tree care maintenance and correcting/removing high risk trees. Information from many U.S. cities shows that the cost per unit of maintenance is generally twice as high with crisis management than it is when maintenance is performed on scheduled or programmed basis (World Forestry Center 1993). In addition to higher maintenance costs, reliance on crisis management may lead to injuries or deaths to park users and hazardous work environments for crews that eventually remove high risk trees.

Staff Training

The City of Millwood staff and residents recognize the importance of trees to their community. Proper tree maintenance is critical to public safety, tree value, and realization of the benefits of trees. It is important that staff be professionally trained in tree maintenance to perform duties that are assigned. Proper tree maintenance by city staff illustrates city leadership and reinforces the objectives of the urban forestry program.

Arboriculture and tree care maintenance and operations are very specialized fields of work. Many years of education and training are required to perform competently and safely in the field and without harm to the trees. Tree care performed by city staff or contractors to Millwood's public trees should be accomplished by ISA certified arborists or certified tree workers.

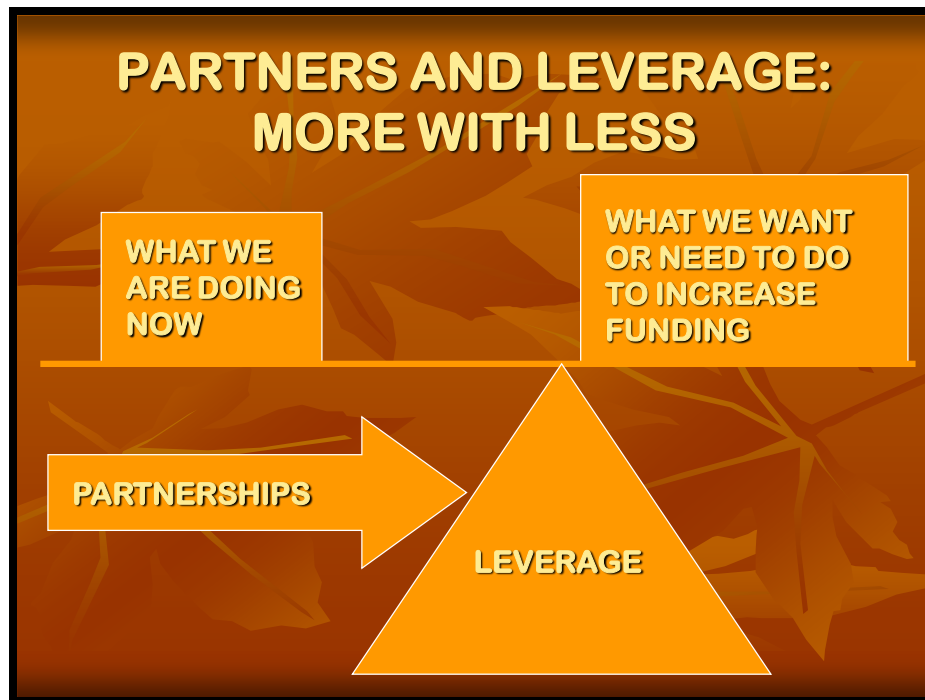
Annual training is a mandatory element in keeping staff updated on the current tree maintenance practices, risk assessment, and safety methods and practices in the arboriculture industry. Staff training is essential for working safe, efficient, following the best management practices of the arboriculture industry, and for advancing Millwood's urban forestry program into the future. **The following objective should be incorporated into Millwood's urban forestry program.**

- Annual training for urban forestry staff.

Program Funding

Millwood rests by one of the Northwest's most significant rivers, in a land of unforgettable natural beauty in part created by the tapestry of trees in the area. The Millwood urban forest is an integral part of the landscape and requires the funding commitment of elected officials, city staff, and the community to prosper and thrive.

Alternative funding sources for community forestry programs are about associative re-positioning or changing with whom you partner with to leverage resources. In the graphic below 'What we are doing represents' tax dollars supporting our programs. These are dwindling and sporadic from year to year. By developing partnerships with various groups, the city can leverage their resources to get 'What we want or need to do to increase funding'. Examples of partnerships and alternative fund sources are listed below the graphic.



Examples of alternative funding sources:

- Grants
 - Government
 - Private
- Inter-governmental charges: Maintenance fee recovery for road bond projects or right-of-way projects.
- ***Urban Forestry Assessments – (Various Montana cities); See Table 13
- Capital Improvement Funds: Trees as infrastructure cited in ordinances.
- Direct Charges
- Mitigation Payments: You damage or destroy trees; you pay for it. Use ISA appraisal formulae to recover costs of damage or destruction of public property (trees).
- Special Events
 - Festivals
 - Tree Run/Walk
 - Christmas Tree Recycling
 - Business Grand Openings and Building Dedications
 - Birthday Milestones: First, 40th, 50th, etc.
 - Arboretum Plantings and Dedications
 - Community Entrance Tree Planting
 - Church Planting Projects
 - Civic Group Planting Projects
- Sales, Merchandising & Promotions
 - Historical Tree Merchandise
 - Trail of Trees/Tree Books
 - Tree Give-A-Ways

- Firewood/Lumber/Nuts/Fruits and Other Tree Products
- Memorial, Anniversary, and Tribute Trees
- Sweepstakes/Contests
- Donations
 - Individuals
 - Utility Bill Donations
 - Donation Cans at Events
 - Trust In Agency Funds
 - Tourism Industry
 - Business Sponsorships
 - Event Sponsors
 - Carbon Credits
 - In-Kind by Citizens (NeighborWoods programs)

The City of Millwood has taken proactive steps in conducting a partial inventory and developing a management plan. To accomplish the mission and to achieve and sustain the community forestry goals, Millwood should strive to attain all aspects of this strategic management plan. The costs associated with the implementation of the management plan must be developed within the context of the overall financial structure and administration of the City of Millwood. On adoption of this strategic management plan, it is imperative that the City of Millwood and Tree Committee develop long-range budget forecasts for its implementation.

PROGRAM ACTIONS

There are five program management elements that must be addressed on an annual basis: Community Forestry Management Plan Adoption and Implementation, Tree Inventory, Proper Tree Maintenance, Tree Planting, and Risk Mitigation Program. Although each is essential to the maintenance of the community forest, an annual operating plan should be established to determine where budget dollars will be spent. Millwood staff has established public safety, responsible management of existing trees, and tree planting as high priorities.

Priority: Urban Forestry Management Plan Adoption and Implementation.

The UFMP is straightforward and comprehensive and contains appropriate goals and activities for Millwood. The objectives of the UFMP are clear and far-sighted. The goal is to change the forest as it is today into one that reflects the goals of the management plan. The 5-year plan should be reviewed annually to determine progress, review the activities accomplished, aid in the development of annual operating plans, and plan for future activities to complete the UFMP recommendations. This ensures important components of the UFMP are accomplished and progress is made towards achieving a sustainable tree program. Long-range planning time horizons can be several years or a decade, but five years is most used and is a realistic time frame for implementation of the goals and recommendations of the UFMP.

Priority: Tree Inventory Maintenance

A significant component of an urban forest program is a professional analysis of the tree population. Using an ArcGIS tree management software the inventory of all public trees

should be maintained to provide an accurate accounting of public trees. Using accurate, consistent inventory data and professional interpretation and planning, leads to healthier, safer, trees with lower maintenance costs and increased benefits to the community provided by public trees.

Priority: Proper Tree Maintenance

After planting an appropriate species at a site that can support adequate growth, maintenance practices such as mulching, watering, and pruning should be employed for three to five years. If trees are pruned properly three or four times during the first twenty years, they will need less frequent and less costly pruning in later years. Pruning promotes sound structural development of a tree's trunk and branches which usually reduces tree or tree part failure from storm damage. The most important period for pruning occurs when the tree is young. Pruning large trees is costly and usually consumes a large part of any tree program's budget. By prioritizing the proper planting and pruning of young trees, a substantial savings can be realized by the entire tree program.

Early pruning performed properly will lead to long-lived healthy and safe mature trees. Pruning young trees properly produces substantial cost savings for the city. Training young trees can provide a strong branching structure that requires less frequent pruning as the tree matures. Improved stewardship to increase the health and survival of recently planted trees is one strategy for increasing cost-effectiveness.

Additional training in young tree structural pruning and education regarding the growth habits of the various species being planted, as well as tree biology, anatomy, and physiology would be beneficial for Millwood staff responsible for this task. This training can be received through several sources, including urban forestry consultants, the state's Community Forestry Program, and the Pacific-Northwest Chapter of the International Society of Arboriculture. The tremendous aesthetic and financial benefits to be gained in the years to come from proper pruning of young trees are a strong incentive for educating personnel about proper pruning techniques. The added knowledge gained by the individuals could augment the sense of professionalism in their jobs.

Large trees are a significant component of Millwood's landscape. They form a canopy over streets, parks, and private properties. A mature tree is a costly management element, but it is important element because of safety and tree health issues. The consequences of lack of care for large trees are the creation of more risk trees and poor tree health.

Enforcing standards for pruning and other tree care is crucial in providing correct and consistent plant health care. The International Society of Arboriculture has developed pruning standards for trees. In conjunction with industry standards specifications for pruning or any other tree maintenance are required.

Crown restoration, pruning for views, and other pruning are considered specialty pruning. Other helpful sets of standards to consider and include are the ANSI Standards for Arboricultural Operations—Pruning, Trimming, Repairing, Maintaining, and Cutting Brush—Safety Requirements (ANSI Z133.1) and the ANSI Standards for Tree Care Operations—Tree, Shrub, and Other Woody Plant Maintenance—Standard Practices, Pruning (ANSI A300 (Part 1), Pruning). These safety and pruning standards are

designed specifically for tree care operations and should be incorporated into KUF standards for tree care.

The primary structural defects in trees in Millwood are codominant stems and dead branches. These are defects that caused many of the previous failure events and have the potential to cause many future failures if not dealt with in a timely manner.

Priority: Risk Management and Mitigation Program

Risk management is the application of policies, procedures, and practices used to identify, evaluate, mitigate, monitor, and communicate tree risk. Risk mitigation is the process of reducing risk using an established hierarchy based on risk ratings, budget, resources, and policies. A tree risk management program provides information to develop a systematic approach to accurately identify the high to severe risk trees and initiate the timely removal or mitigation treatment to reduce the risk to an acceptable level.

Priority: Tree Planting

New tree planting is an essential part of Millwood tree management. The health and stability of the Millwood urban forest depends in large part on judicious tree selection, location, and tree planting today, as well as regular maintenance of young trees.

The key for successful tree planting is to plant quantities Millwood can maintain. Increase new plantings each year, but in quantities that match the maintenance abilities of Millwood staff and resources.

To ensure that newly planted trees thrive and are healthy provide planting standards and specifications. These can best be expressed as general guidelines with references to technical publications. A great deal of information about the size of planting pits, staking, and other planting practices has been developed by International Society of Arboriculture. The City of Millwood and the Idaho DNRC Community Forestry Program can provide other resources and training programs to ensure successful tree planting programs.

The primary issue in tree planting is improper installation causing the root collar to be buried. This is a significant problem on trees planted recently in Millwood. Many of these trees can be replanted since they were planted recently. Root collar depth issues often cause premature death and decline in young trees. In older trees it can be a source of stem girdling roots which may lead to whole tree failure.

All new tree plantings should be added to the inventory database on a regular cycle preferably immediately following the tree installation.

CONCLUSION

Community Forestry Consultants, Inc. has completed its assignment of evaluating and making recommendations regarding the community forest of Millwood. This management plan provides Millwood with the framework to implement the best management practices for the community forest. The management and maintenance needs for a successful urban forestry program have been developed from the best management practices available in the urban forestry and arboriculture industry.

The urban forest management plan should be considered a “living,” working document. The work objectives recommended in it should be reviewed annually and adjustments made appropriately for the following year. The entire document should be revised on a five- or ten-year basis to determine if management and urban forest conditions have changed significantly.

Timely action needs to be taken to prevent tree failures, preserve tree resources, and maintain the trees of Millwood. Trees are valuable assets to Millwood. The healthier the trees are the more Millwood’s vision and livability for their community is achieved. To realize these benefits, tree planting, pruning, and removing; increased education, preservation and funding, and management is needed. The focus goes beyond the individual tree to trees throughout city.....to the working community forest.

The recommendations will help conserve Millwood’s tree resource and sustain the tree canopy for future generations. Although this commitment will come with costs, the long-term benefits are significantly greater and will result in a sustainable asset for the citizens of Millwood today and tomorrow.

APPENDIX A – Tree Ordinance Writing Resources

Urban Forest Network – Model Tree Ordinance

A step-by-step process for developing a tree ordinance.

[Model Tree Ordinance \(urbanforestrynetwork.org\)](https://urbanforestrynetwork.org)

Guidelines for Developing and Evaluating Tree Ordinances

Bernhardt, E.A. and Swiecki, T.J.

California Dept. of Forestry and Fire Protection

https://www.isa-arbor.com/education/resources/educ_TreeOrdinanceGuidelines.pdf

American Society of Consulting Arborists

A list with links for cities is available to help develop ordinances that will ensure the future of their community forests.

<https://www.asca-consultants.org/page/TreeOrdinances>

Tree Ordinance Development Guidebook

Georgia Forestry Commission

http://www.actrees.org/files/Newsroom/georgia_tree_ordinance.pdf

U.S. Landscape Ordinances: An Annotated Reference Handbook

by Buck Abbey, D. Gail Abbey

This comprehensive reference brings together and explains the planning ordinances which govern the landscapes of 300 U.S. cities. In it, the author demystifies the complex planning laws that regulate such areas as the design of parking lots, vehicular use areas, landscape buffers, and tree plantings.

Tree Ordinances by State

Presented by the Friends of the Urban Forest. Summary – Tree Planting, Preservation, and protection ordinances.

<https://friends.urbanforests.org/tree-ordinances-in-other-states/>

Tree City USA Bulletin #9 How to Write a Municipal Tree Ordinance

National Arbor Day Foundation

<https://www.arboday.org/trees/bulletins/documents/009-summary.pdf>

Tree City USA Bulletin # 31 Tree Protection Ordinances

National Arbor Day Foundation

<https://www.arboday.org/trees/bulletins/documents/031-summary.pdf>

Guidelines for developing urban forest practice ordinances Bell, P.C., Plamondon, S., and Rupp, M. Oregon Department of Forestry, Forest Practices Program, Urban and Community Forestry Program. This guide is designed to assist cities and counties in the development of urban forest practice regulations.

<https://oregonexplorer.info/content/guidelines-developing-urban-forest-practice-ordinances?topic&ptopic>

A Guide to Community and Urban Forestry Programming – Idaho

https://www.dnr.wa.gov/publications/rp_urban_guide_to_urban_forestry_programming.pdf?7c5u5

A Guide to Developing A Community Tree Preservation Ordinance. Hoefer, P.J., Himelick, E.B., and DeVoto, D.F., Urbana, IL, International Society of Arboriculture. 42 pp. Prepared in cooperation with the Municipal Arborists and Urban Foresters Society. The purpose of this manual is to be a guide for preparing new, or revising old, municipal tree ordinances.

<http://www.mnstac.org/treeordinances.html>

General Code Publishers

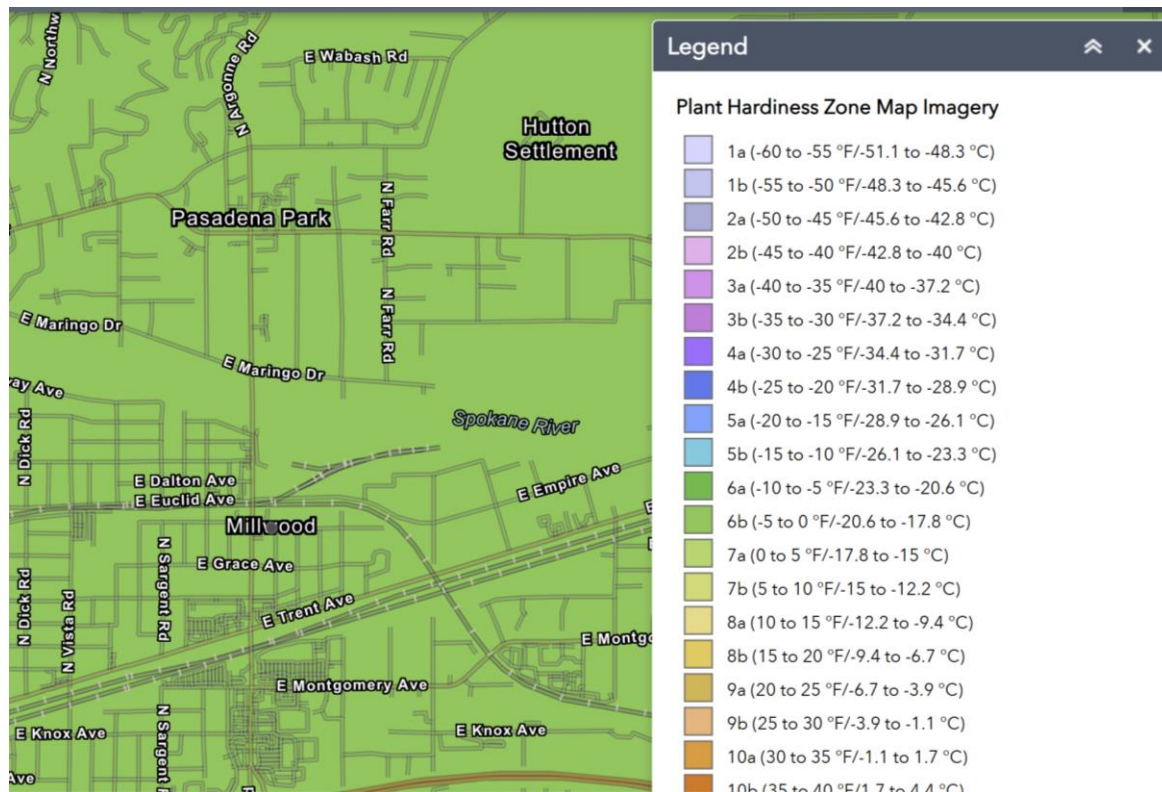
<https://www.generalcode.com/>

LexisNexis Municipal Codes

<https://www.lexisnexis.com/en-us/gateway.page>

APPENDIX B – Potential Landscape Plant List

Millwood is in USDA hardiness zone 6a. Minimum temperatures average minus five to minus ten. Average number of days above 86 degrees is thirty to forty-five according to American Horticultural Society plant heat-zone map. In Millwood, the climate is warm and temperate. The winters are rainier than the summers. Millwood summers are hot, dry, and mostly clear and the winters have moderate temperatures, mostly cloudy and changeable snowy weather. In a year, the average annual precipitation is 34 inches, most occurring during the winter. Over the course of the year, the temperature typically varies from 24°F to 84°F and is rarely below 8°F or above 93°F.



The plant list provides options to try. It is not finite and merely represents some potential choices to increase diversity in Millwood. The plant list below is composed of many species not in the tree population of Millwood or in limited quantities. These trees may be hardy to Millwood and are not natives but will adapt to the area. Diversification and willingness to try new species are the keys to a successful planting program.

CLASS I TREES

Red Buckeye

Aesculus pavia

Height: 20'

Spread: 20'

Hardiness: -20

A small tree with a rounded or shrubby habit. Lustrous dark green palmate leaves accent the red flowers in April and May. No appreciable fall colors. Some tolerance for shade, drought and poor soils.

Autumn Brilliance

Serviceberry

Amelanchier x grandiflora

'Autumn Brilliance' (treeform)

Height: 20'

Spread: 15'

Hardiness: -30

Tree form of serviceberry with an upright spreading crown, white flowers and a reliable, bright red fall color. The fruit is edible. Tolerates some drought.

Cumulus Allegheny

Serviceberry

Amelanchier laevis

'Cumulus' (treeform)

Height: 25'

Spread: 20'

Hardiness: -30

A serviceberry with a distinct upright and oval tree habit, fleecy white flowers in spring and a yellowish to orange-scarlet fall color. Smooth gray bark.

American Hornbeam

Carpinus caroliniana

Height: 25'

Spread: 25'

Hardiness: -40

A small tree with an irregular spreading habit, with a rounded outline. Dark green leaves change to yellow, orange and scarlet in the fall. Smooth, gray, irregular twisting bark adds interest in winter. Will grow in heavy shade and wet soils.

Pagoda Dogwood

Cornus alternifolia

Height: 25'

Spread: 20'

Hardiness: -30

This small tree has a distinctive horizontal branching habit and will develop a flat-topped crown. Masses of creamy white flowers are produced in early summer. Blue/black clusters of fruit in late summer. Fall foliage is a mix of yellow, to red/purple.

Kousa Dogwood

Cornus kousa

Height: 25'

Spread: 20'

Hardiness: -20

A small tree, vase shaped in youth, forming a rounded habit with distinct horizontal layering of the branches and exfoliating bark with age. Creamy, white bracts, resembling flowers, in spring, dark green leaves that change to reddish purple in the fall.

C. 'Satomi'

Pink flowered selection. Very ornate with layered branches.

Golden Glory Dogwood

Cornus mas 'Golden Glory'

Height: 20 – 25'

Spread: 15'

Hardiness: -15

More upright and free flowering than species (Corne-

lian cherry Dogwood). The tree takes on a mounded shape, like an inverted pear. Great show of yellow flowers in spring and later bright red fruit. Foliage is dark green and turns purple in fall. Excellent tree for contrast.

Lavalle Hawthorn

Crataegus x lavalleyi

Height: 25'

Spread: 20'

Hardiness: -40

A small, dense oval canopy tree with shiny dark green foliage turning to bronzy copper-red in the fall. Usually thornless or with small one-inch thorns. Quite free of rust and very adaptable.

Thicket Hawthorn

'Ohio Pioneer'

Crataegus punctata var. *inermis*

Height: 20 – 30'

Spread: 25 – 35'

Hardiness: -20

Broad-rounded tree, low branching usually becoming wider than tall at maturity. Thornless variety with excellent vigor. Foliage is gray green, contrasted by abundant white flowers in spring and dark red fruits in September and October. Fruits are usually persistent adding interest in winter.

Winterberry Euonymus

Euonymus bungeanus

Height: 20'

Spread: 20'

Hardiness: -20

A small, rounded, or shrubby tree with pendulous branches. Leaves are light green and flowers are yellow. A beautiful tree in fruit.

European Euonymus
Euonymus europaeus

Height: 15-30'

Spread: 10-20'

Hardiness: -30

A narrowly upright tree in youth broadening as it ages with a rounded outline when mature. Early leaf out with a flat dark green color turning from yellow to reddish purple in fall. Fruits ripen pink to red in September and are quite attractive.

Korean Evodia
Evodia daniellii

Height: 25 – 30'

Spread: 25 – 30'

Hardiness: -20

Interesting small tree with a rounded shape. Lustrous dark green foliage complemented by profuse white flowers borne on stalks in June and July. No major insect or disease problems. Great mix of structure and ornamental display for urban area.

Golden Desert Ash
Fraxinus excelsior
'Aureaefolia'

Height: 20'

Spread: 18'

Hardiness: -15

Small, rounded tree with bright yellow twigs and golden stems. Foliage emerges yellow and greens slowly through the spring and early summer turning back to gold in late summer. Beautiful specimen, great contrasting tree and attractive in winter.

Amur Maackia
Maackia amurensis

Height: 25'

Spread: 25'

Hardiness: -25

A small round headed tree. Leaves emerge a silvery gray and gradually become dark green. Fragrant pale white flowers light the tree in July and August. Bark peels with maturity exposing a shiny amber to brown color, becoming curly in texture. Prefers moist, well-drained soil, but is quite adaptable to environmental conditions.

Merril Loebner Magnolia
Magnolia x loebneri **'Merrill'**

Height: 30'

Spread: 30'

Hardiness: -30

An upright habit becoming round with age. Leaves are thick and rigid, dark green and turn yellow in fall. Flowering peaks in April, where the tree resembles a white cloud covered with fragrant snowy blossoms. A vigorous grower and cherished landscape tree.

Yulan Magnolia
Magnolia ***83enudate***

Height: 35'

Spread: 30'

Hardiness: -30

Tree with spreading branches somewhat irregular, producing an informal outline. Leaves are thick and resilient turning yellow in fall. Flowers are fragrant, white and 4-6 inches wide, blooming in spring.

Elizabeth Magnolia
Magnolia x 'Elizabeth'

Height: 30-40'

Spread: 20'

Hardiness: -30

Compact oval tree, tall for a magnolia. Glossy green tough leaves and yellow flower (unique for magnolias), 6 inches wide and fragrant,

bloom in spring before the leaves break.

Galaxy Magnolia
Magnolia x 'Galaxy'

Height: 20 – 25'

Spread: 15'

Hardiness: -20

A tree form magnolia with a strong central leader and pyramidal to oval shape. The foliage is lustrous green and flowers are large, 8 to 10 inches wide, blooming in spring on bare stems, pink outside and white inside. Good selection for a landscape or street where space is limited or confined.

Royal Star Magnolia
Magnolia stellata **'Royal Star'**

Height: 20'

Spread: 15'

Hardiness: -30

A hardy, compact, rounded tree with deep green foliage and yellow fall color. The large fragrant flowers bloom in early spring, before the leaves break. An excellent ornamental tree for small sites in urban landscapes.

Flowering Crabapples
Malus sp. **(Red Flowers)**

Hardiness: -20 (-30)

Malus 'Adams'

Height: 20'

Spread: 20'

Dense and rounded symmetrical habit. Pink flowers, red persistent fruit. American Masterpiece *Malus* 'Amazam'
 Height: 25'
 Spread: 18 – 20'
 Pyramidal habit. Bright red leaves emerge and mature to dark maroon. Brilliant red flowers change to unique

pumpkin orange fruits in fall that persist through winter. Klehm's Improved Crabapple
Malus 'Bechtel'
Height: 15 – 20'
Spread: 15 – 20'
Rounded form, dense dark green foliage, turning orange to orange red in fall. Large double pink flowers cover the tree in spring. Improved strain for disease resistance. Seldom fruits, very tidy tree.

Centurion Crabapple

Malus 'Centzam'

Height: 20'

Spread: 15'

Narrow upright habit, spreading slightly with maturity. Purple emerging leaves changing to bronze green. Rose-red flowers ripen to bright red fruits persisting through the winter.

Prairifire Crabapple

Malus 'Prairifire'

Height: 20'

Spread: 20'

Upright spreading habit becoming rounded. Reddish stems with foliage changing from purple to red hued green. Excellent color change from crimson buds to dark pink flowers to deep red fruits which persist through winter.

Flowering Crabapples

Malus sp. (White Flowers)

Hardiness: -20 (-30)

Malus 'Adirondack'

Height: 18'

Spread: 10'

Densely upright inverted cone shape. The cut of this cultivar combined with an overabundant white flower in spring makes this a "standard" to which other flowering crabs are compared. Bright red fruits carry interest through winter. Harvest Gold Crab

Malus 'Hargozam'

Height: 25'

Spread: 15'

Upright, moderately columnar habit. White flowers in spring are but a precursor to the golden fruits which adorn this tree through winter making it a showstopper in the landscape.

Malus 'Professor Sprenger'

Height: 20'

Spread: 20'

Stark upright habit makes for a larger statelier looking tree than other crabs. Red buds bloom white with pink tones ripening to orange-red fruits and endure on the noble frame through winter.

Malus 'Sentinel'

Height: 20'

Spread: 12'

Vase shaped, an unusual form for a crab makes its mark as an excellent street tree under power lines. Flowers are white with a touch of pink, fragrant, with bright red fruits that carry through the winter.

Malus 'Spring Snow'

Height: 25'

Spread: 20'

Dense and oval shaped, quite large for a flowering crab. Flowers are white and sterile; the tree is without fruit and is an excellent addition to the landscape where dropping fruits would be objectionable.

Sugar Tyme Crabapple

Malus 'Sutyzam'

Height: 18'

Spread: 15'

Upright spreading with a somewhat irregular oval outline. Great informal character, smothered in sweet white flowers in spring. Fruits are wine red and persist through winter.

Golden Raindrops Crabapple

Malus transitoria 'Schmidtleaf'

Height: 20'

Spread: 15'

Hardiness: -20

Upright vase shaped habit. Very unusual cherry, with a delicate appearance, slender branches are draped in uniquely cut glossy green leaves. An abundance of small white flowers ripen to tiny bright yellow fruits which hang like drops of rain from this elegant tree.

Persian Parrotia

Parrotia persica

Height: 20 – 30'

Spread: 15 – 25'

Hardiness: -20

Small single stemmed tree with upright to wide spreading branches, oval outline. Pink to purple emerging leaves blend to glossy green and turn a beautiful succession of yellow to orange to red in fall. An excellent selection for streets and landscapes, given size, color display and remarkable resistance to pests and disease.

Cascade Snow Cherry

Prunus 'Berry'

Height: 25'

Spread: 20'

Hardiness: -20

Upright spreading vase form. Large pure white flowers cover this tree in spring followed by glossy dark green foliage which turns yellowish to bronze-orange in fall. This cultivar has shown an increased resistance to diseases that affect other ornamental cherries.

Prairie Gem Pear

Pyrus ussuriensis 'Mordak'

Height: 25'

Spread: 20'

Hardiness: -30

Densely branched and compact tree with a round canopy. Leaves are bright green, thick and leathery turning golden yellow in fall. White flowers blanket the tree in early spring. Excellent pear for urban plantings.

Ivory Silk Lilac
***Syringa reticulata* 'Ivory Silk'**

Height: 25'

Spread: 15'

Hardiness: -20

Tree form lilac, oval and compact with upward curving branches. Foliage is dark green, flowering when young. Displays large white flower clusters in early July. Excellent choice for beauty and adds variety to urban landscapes.

CLASS II TREES

Italian Alder
Alnus cordata

Height: 30 – 45'

Spread: 25 – 35'

Hardiness: -15

A pyramidal to rounded tree with a rather dense canopy for alders. Leaves are spade shaped and finely toothed, dark green and lighter underneath. Trees are compared in outline to Little Leaf Lindens and Common Pear in appearance. Will tolerate poor soil conditions and does best near water. Little used, but highly recommended for urban landscapes.

Black Alder
Alnus glutinosa

Height: 40 – 50'

Spread: 30 – 35'

Hardiness: -30

Fast growing tree with a broadly pyramidal habit, somewhat irregular. Dark green leaves change to yellow

in the fall. These trees thrive near water and perform well in poor soils. Good tree for an alternative to willows and other poplars. The 'Pyramidalis' cultivar has an excellent narrow form and recommended for confined space areas.

European Hornbeam
Carpinus betulus

Height: 25 – 40'

Spread: 25 – 35'

Hardiness: -20

Pyramidal shape, quite dense with dark green leaves. Fall color is usually yellow but during cold winters can turn dark red. Heat and drought resistant.

F. 'Fastigiata', a columnar cultivar, is taller, and in youth spreads 15', but tree will eventually become wide. Branching must begin at 5' or above if planted as a street tree.

Katsuratree
Cercidiphyllum japonicum

Height: 40 – 50'

Spread: 40

Hardiness: -20

In youth pyramidal and maturing to a variety of pyramidal rounding forms. Leaves are heart shaped and emerge red-purple and change gradually to bluish green with great fall colors, yellow to apricot and sometimes crimson. Performs better if shaded from afternoon sun.

American Yellowwood
Cladrastis lutea

Height: 30 – 50'

Spread: 40 – 55'

Hardiness: -20

Round tree, often wider than tall. Leaves are bright green, resembling those of English Walnut and turn brilliant to golden yellow in Fall. The bark is smooth and gray much like a Beech. The name derived from

the color of the heartwood. Terrific displays of white flowers with a sweet fragrance in May and June.

Turkish Filbert or Hazel
Corylus colurna

Height: 50'

Spread: 30'

Hardiness: -20

Broadly pyramidal, somewhat compact. Dark green foliage with exfoliating bark when mature. Fall color of little significance. Tolerates environmental extremes and conditions exhibiting stress in other trees. No serious pest or disease problems. Stately and formal character, excellent for urban plantings.

Hardy Rubber Tree
Eucommia ulmoides

Height: 45'

Spread: 45'

Hardiness: -20

Tree with a rounded outline and ascending branches. Foliage is spectacular, glossy dark green and pest free. The bark of mature specimens adds to the trees interest. Fall color is minimal. Tolerates a variety of soil conditions. Unique tree species for cold climates.

European Beech
Fagus sylvatica

Height: 40 – 50'

Spread: 15 – 40'

Hardiness: -20

Stately tree, narrowly compact to densely pyramidal to broadly oval, branching close to the ground. Leaf color varies dramatically between cultivars. It is said that the right cultivar of this tree can enhance any landscape. Care should be used with planting lower branching trees to avoid creating a traffic nuisance.

F. 'Fastigiata' Fastigate Beech Trees deep green, tight form makes it one of the most striking columnar trees.

F. 'Riversii' Rivers Purple Beech
Broadly oval habit, foliage has striking purple shades, spring through summer.
F. 'Zlatia' Golden Beech
Upright pyramidal habit, young leaves are yellow maturing to golden green.

Maidenhair Tree

Ginkgo Biloba

Height: 40 – 55'
Spread: 15 – 35'
Hardiness: -25
Young trees are irregularly shaped but finish broadly symmetrical. Usually all marketed trees are male due to the offensive smell of the female trees in fruit. The leaves are uniquely lobed and bright green on both sides, changing to bright to golden yellow in fall. Having outlived most of its enemies Ginkgo is a fine specimen for urban planting. (Female trees produce fragrant fruit that some find offensive.)
G. 'Autumn Gold'
Very uniform and balanced pyramidal tree. Spreading at maturity.
G. 'Magyar'
Narrow pyramidal form with a strong central leader. Well-spaced branches.
G. 'Princeton Sentry'
Narrow tapering growth almost columnar. Tallest of the three.

Carolina Silverbell

Halesia Carolina

Height: 30' – 40'
Spread: 20' – 35'
Hardiness: -30
White, hanging, bell-shaped flowers are produced in May and give way to four-winged, brownish, fruit that is persistent through winter. Foliage on this broad, rounded tree will turn yellow in autumn.

Korean Mountain Ash

Sorbus alnifolia

Height: 40-50'
COMMUNITY FORESTRY CONSULTANTS, INC.
APRIL 30, 2023

Spread: 30'
Hardiness: -20
Full –Part Sun
Glossy dark green, simple leaves. The tree has an oval to rounded form. Clusters of white flower umbels develop in late spring. Orange/red berries are produced in late summer and fall. Robins and cedar waxwings love the berries when they return in late winter. Bark is gray with white markings. Leaves turn gold to orange in autumn. (Fruit set is not as abundant as the European Mountain Ash.)
S. 'Redbird'
produces red fruit and has a more columnar habit.

Tupelo

Nyssa sylvatica

Height: 30 – 40'
Spread: 20 – 35'
Hardiness: -20
Also known as Black Gum, Sour Gum and Pepperidge. In youth the tree is pyramidal but becomes rounded or oval as it ages. Leaves are glossy green and fall color is excellent, turning bright yellow, orange coppery red, or purple. Tolerates poor drainage and some drought. Makes a great park or street tree for residential areas.

American Hophornbeam

Ostrya virginiana

Height: 30 – 45'
Spread: 25'
Hardiness: -30
Rounded oval shape made up of slender branches, sometimes arching up or down. Leaves are bright green turning yellow to brown in fall often persisting adding winter interest along with the hop like fruits. Tolerates dry conditions and free of major disease and insect problems.

Amur Cork Tree

Phellodendron amurense

'His Majesty'

Height: 40'
Spread: 35'
Hardiness: -30
This is a seedless selection of a fast growing broadly vase-shaped tree. It has a good branch-ing habit with interesting cork-like bark. Yellow fall color.

Sawtooth Oak

Quercus acutissima

Height: 40 – 50'
Spread: 50 – 60'
Hardiness: -20
Tree typically develops a widely spreading and dense canopy that is rounded at maturity. May need protection in youth, but once established the trees handle harsh winters well. Emerging leaves are brilliant yellow and fall color is bronze. Deeply ridged and furrowed bark adds winter interest. Lacks pest and disease problems. The only detractor for street tree use is acorn debris. (There will be fruit drop in the fall and could be hazardous under foot.)

Chinkapin Oak

Quercus muehlenbergii

Height: 40 – 50'
Spread: 50 – 60'
Hardiness: -15
In youth the tree is rounded and somewhat irregular, but gains stature and elegance with maturity. The leaves are indented to slightly lobed, lustrous yellow green turning to various shades of yellow to orangish brown in fall. Somewhat difficult to transplant and dislikes alkali soils, but once established it performs well. (There will be fruit drop in the fall and could be hazardous under foot.)

Sassafras***Sassafras albidum***

Height: 30 – 60'

Spread: 25 – 40'

Hardiness: -20

Pyramidal shape in youth changing to an irregular flat top with an oblong outline. Bright green leaves offset yellow, often, red stems which enhance an excellent fall display with shades of yellow and orange to scarlet and purple. The mahogany bark of mature trees and fragrance are additional interests.

American Linden***Tilia americana***

Height: 35 – 50'

Spread: 20 – 35'

Hardiness: -40

Tall stately trees, cultivars generally smaller in size especially when used in urban areas. Leaves are generally 4 to 8 inches long and about as wide in a range of green shades. Bark is gray to brown with narrow lateral furrows. The wood is soft and easily pruned but is elastic enough to handle most weather extremes. These trees will entirely block the sun in their shadow so place them appropriately.

T. 'Boulevard'

Dense, narrow pyramidal habit with ascending branches.

Yellow in fall.

T. 'Legend'

Rounded pyramidal habit, yellow fall color.

T. 'Lincoln'

Slender, upright and compact form with light green leaves, 25' by 15' in 25 years.

T. 'Redmond'

Full pyramidal form, uniform with large leaves and red branches, winter interest.

Littleleaf Linden***Tilia cordata***

Height: 40 – 45'

Spread: 45'

Hardiness: -30

Trees are pyramidal, rounding with maturity. Leaves are generally smaller, 2 to 3 inches long and wide, (except Glenleven) finely serrated and turn yellow in fall. Trunks are usually straight and bark smooth. Likes well drained alkali soils, but pH adaptable and tolerates pollution well. Makes an excellent selection for any urban planting.

T. 'Chancellor'

Fastigate in youth, becoming pyramidal with age. Good branch development.

T. 'Corzam' Corinthian Linden Narrowly pyramidal, 15' spread. Yellow in fall. Excellent tree for limited space.

T. 'Glenleven' Glenleven Linden Fast growing with a straight trunk, leaves twice the size of 'Greenspire'

T. 'Greenspire'

Single straight leader, good branch angle. Tolerates difficult conditions.

T. 'Olympic'

Very symmetrical pyramid form, better branching than some other cultivars.

Sterling Silver Linden***Tilia tomentosa* 'Sterling'**

Height: 45'

Spread: 35'

Hardiness: -20

Upright pyramidal form with a superior branching frame, smooth bark and straight trunk makes it a very appealing tree for all seasons. Furry green leaves, silvery white underside, turn yellow in fall. Shows distinction from *Tilia cordata* cultivars and is an excellent addition to the Linden family.

Japanese Pagoda Tree***Sophora japonica***

Height: 40 – 60'

Spread: 40 – 60'

Hardiness: -20

Broad crown. Creamy-white to yellowish-green large

inflorescences blanket the tree anytime from early August to early September, with about a three-week bloom period. Thick green pods mature to yellow-green fruits, with the large beans appearing as knobs within the otherwise thin pods. Very urban tolerant (especially to heat, drought, pollution, compacted soils, and poor soils)

CLASS III TREES

Bitternut Hickory***Carya cordiformis***

Height: 50 – 75'

Spread: 35 – 50'

Hardiness: -20

Usually, a slender tree with an irregular oval crown, often widest at the top. The foliage is light green turning yellow to bronze in fall. This hickory is free of most major pest and disease problems and seems to do better than most in restricted sites. Recommended for Park and Boulevard use because of fruit drop and can be hazardous underfoot.

Fagus sylvatica**European Beech**

Height: 50' – 60'

Spread: 50'

Hardiness: -30

Broad pyramidal tree with wavy, shiny, dark green leaves. Foliage turns reddish/bronze in fall. Leaves persist through winter. Smooth, gray, wrinkled bark. Tree can grow very wide and branches will often touch the ground.

Kentucky Coffeetree
Gymnocladus dioica

Height: 50 – 65'

Spread: 40 – 50'

Hardiness: -30

Sharply ascending branches, rising to form a narrow oval crown. The bark is unique, developing on young stems. Spring leaves are late to emerge, their pinks and purples are a nice contrast to greening trees. Seldom bothered by pests or disease, pollution tolerant and strong, upright growth make this an excellent street tree.

Butternut
Juglans cinerea

Height: 40 – 60'

Spread: 30 – 50'

Hardiness: -30

Round topped tree with wide spreading crown of large horizontal branches and stout laterals. Leaves are dark green and woolly, white ridges and gray furrows make up the mature bark. Fruit debris may be a nuisance. Performs well in the rocky, dry and limestone-based soils, a prevalent soil type in Spokane. Usable as Boulevard and Park tree.

Swamp White Oak
Quercus bicolor

Height: 50 – 60'

Spread: 40 – 50'

Hardiness: -25

A broad openly branching tree with rounded crown on a short trunk. Leaves are smoothly lobed, leathery and dark green, changing to orange and yellow brown in fall. Better transplant success than White Oak and does well in wet sites. Useful as a Park or Boulevard tree, acorns can be a nuisance.

Shingle Oak
Quercus imbricaria

Height: 50'

Spread: 40'

Hardiness: -20

Pyramidal form when young, maturing to a rounded habit. Leaves lacking lobes, wavy, bright glossy green changing from yellowish to rusty red in fall. Tolerates dry conditions and has small acorns making it an excellent tree for streets and other urban sites.

Chestnut Oak
Quercus prinus

Height: 50 – 60'

Spread: 50 – 60'

Hardiness: -20

Rounded and dense irregular spreading canopy. Leaves are bluntly and shallowly toothed, dark yellow green turning orange yellow to yellow-brown in fall. Performs well in dry, rocky and lime-based soils, a prevalent soil type in Spokane. Great informal character, good for Parks and Boulevards where acorn debris can be managed.

English Oak
Quercus robur

Height: 50'

Spread: 40'

Hardiness: -20

Short and stout tree with a large, rounded crown of open thick branches, somewhat irregular. Leaves are variably lobed, dark green upper and pale green lower surfaces. Adapts to soils and climate types well. Acorn debris may create a walking hazard. Q. 'Fastigiata' Skyrocket Oak Narrow oval form, uniform and stately, excellent for confined sites.

Q. 'Michround'

The Westminster Globe Oak is very uniform and symmetrical tree.

Red Oak
Quercus rubra

Height: 50 – 60'

Spread: 45 – 50'

Hardiness: -30

Broad headed tree with a rounded crown. Leaves are sharply toothed dark green and turning brilliant to deep red in fall. Rapidly growing and readily transplanted giving it advantages over other Oaks for use in urban landscapes. Acorn debris may create a walking hazard.

Shumard Oak
Quercus shumardii

Height: 40 – 60'

Spread: 40 – 60'

Hardiness: -15

Pyramidal form, becoming upright spreading and broadly oval. Sharply cut dark green foliage with reliable red fall color. Adapts to soil conditions and is drought tolerant. One of the better transplanting oaks. Acorn debris may create a walking hazard.

Japanese Zelkova
Zelkova serrata

Height: 40 – 60'

Spread: 30 – 50'

Hardiness: -20

Vase habit rounding with maturity. Leaves toothed like elm (same family), usually dark green with a choice of fall color, depending on the cultivar. Bark color and texture is of interest from youth to maturity. All cultivars are resistant to Dutch Elm Disease. Beetle damage also appears to be less problematic. Handsome

trees, excellent for urban landscapes and streets.

Z. 'Green Vase'

Fast growing, graceful vase form, dapple shade tree.

Orange in fall.

Z. 'Halka'

Widening vase, with large feathery branches. Yellow in fall.

Z. 'Village Green'

Broad vase to rounded form, very vigorous. Rust red in fall.

Pioneer Elm

Ulmus x 'Pioneer'

Height: 50'

Spread: 50'

A Dutch Elm resistant cultivar that vigorously forms a rounded, spreading crown. The dark green foliage turns to yellow in autumn.

CLASS IV TREES

Shagbark Hickory

Carya ovata

Height: 100'-125'

Spread: 25'

Hardiness: -20

On mature trees the gray bark separates into interesting, wide plates that curve outward from the trunk giving it a shaggy appearance. The tree adapts well to dry or wet soil but prefers well-drained sites. The fruit is edible and gathered in the fall. It is a long-lived tree. Fruit debris may create a walking hazard.

Tulip Tree

Liriodendron tulipifera

Height: 70 – 90'

Spread: 35 – 50'

Hardiness: -20

Tree develops quickly with a tall straight trunk; several large

sinuous branches develop a narrow oval frame. The leaves actually appear tulip like medium green changing to yellow and golden in autumn.

Cucumbertree Magnolia

Magnolia acuminata

Height: 50 – 80'

Spread: 40 – 80'

Hardiness: -25

Pyramidal growth habit when young aging to a broad-rounded outline with massive spreading branches often arching towards the ground. Foliage is dark green, flowers are smaller than some magnolias, but in abundance. Makes a great tree for parks, golf courses and other open areas, where it can have room to spread.

Black Walnut

Juglans nigra

Height: 50 – 75' (100')

Spread: 50 – 75'

Hardiness: -20

Develops a rounded well-formed crown that is devoid of branches a third to two thirds the way up the tree. It will become wide spreading. Leaves are finer than Bitternut and less furry. Bark is brown to grayish black and roughly diamond shaped. May inhibit the growth of other plants near the site. Tolerates dry conditions and can be used for streets where ground clearance is needed, but performs best when used for Parks and Boulevards, due to dropping fruit.

Dawn Redwood

Metasequoia

glyptostroboides

Height: 60 – 100'

Spread: 25 – 40'

Hardiness: -20

Deciduous conifer, with a tall pyramidal or conical form. Large basal spread. Bright green foliage renewed every year. Grows rapidly and tolerate wet sites if drainage is not restricted. In winter the skeletal frame of larger trees is starkly majestic. Definitely a tree for large areas so select sites appropriately.

Bloodgood London

Planetree

Platanus x acerifolia

'Bloodgood'

Height: 50 – 80'

Spread: 40 – 60'

Hardiness: -15

Broadly pyramidal, rounding with thick spreading branches at maturity. Large basal spread. Large maple like leaves turn yellow in fall. Bark is peeling creating a brown/cream mottling with year-round interest. Better resistance to anthracnose disease than other sycamores but still can be a problem if trees are overused.

White Oak

Quercus alba

Height: 60 – 80'

Spread: 50 – 70'

Hardiness: -30

Juvenile shape is pyramidal maturing with a broad, wide spreading and majestic crown. Leaves are bluntly lobed, dark green to blue green. Autumn color varies from brown to red. A challenge to transplant and establish, but worth the effort. The tree is best when used in Parks and Boulevards, due to dropping fruit.

Bur Oak

Quercus macrocarpa

Height: 55 – 80’

Spread: 50 – 70’

Hardiness: -40

Weakly pyramidal or oval to start, developing into a large broad, rounded wide spreading tree with a massive trunk.

Foliage is partially lobed, dark green above and grayish below, turning yellow brown to

purplish in fall. Corky bark on smaller branches adds interest. Adapts to a wide range of soil types, drought and pollution tolerant, makes an excellent tree for urban areas where acorn debris can be managed.

Accolade Elm

Ulmus japonica x wilsoniana

‘Morton’

Height: 70’

Spread: 60’

Hardiness: -30

A graceful, vase shaped tree with arching branches. It is resistant to the elm leaf beetle and so is a great substitute for the American Elm. Foliage turns to yellow in the fall

Appendix C – Tree Sidewalk Conflict Resolution Options

There are several other options to address tree sidewalk conflicts in addition to those mentioned in the body of the management plan. These are discussed and illustrated below.

Pop-outs or bulbs are like curving sidewalks. Space can be increased for newly planted or existing trees by removing a section of curb and extending the planting space into the street. Sidewalk cutouts or “borrowing” space from the adjacent sidewalk creates sidewalk cutouts. This alternative minimizes the sidewalk width for a limited distance adjacent to the tree. The cutout provides a larger grow space for trees and reduces the size of the pruned roots and their proximity to the root flare. Borrowing has limitations, as the room for tree expansion before infringing on the free passage of pedestrians is minimal. Furthermore, the ADA imposes strict regulations as to the amount of free space provided.



The sidewalk cutout option can be used in some scenarios on downtown streets. The trees are shown before mulch was applied.

Sidewalk ramping allows existing roots to remain intact by re-pouring concrete over the roots to create a gradually sloped ramp. It is used when removal of roots would compromise the stability of a high-quality tree. Damaged sidewalk slabs are removed, and 4-6 inches of topsoil is placed on top of the existing grade. A sand or foam backer is placed adjacent or around the subject roots. A new sidewalk is then installed on top of this new base material. This option enables the sidewalk to be replaced in its original position. Sidewalk ramping does not prevent future damage but can delay it by five years or more.

Concrete slabs of nonstandard size or shape can increase the space available for established trees. This technique serves as a design alternative to the curving sidewalk but produces a similar result.



Sidewalk ramping raises the sidewalk over the root system.

Infrastructure-based strategies can also include the use of certain materials that provide a larger, uncompacted soil volume, such as pervious concrete, asphalt, decomposed basalt, stone dust, pavers, or rubber sidewalks, instead of concrete.

Flexible paving comes in many forms, which include:

- Interlocking pavers
- Common brick and pavers
- Rubber bricks

Flexible paving is used in conjunction with root pruning when retaining original grade is required and when the level of the paving surface is ramped above or lowered below existing grade. The selected flexible paving material is installed over a compacted sand base. Cities have utilized rubberized, reusable brick in different dimensions that is bonded together with specialized glue. Some of the newer rubberized pavers do not require glue to bind them, but instead use specially designed dowels, which hold the pavers together. Although the use of flexible paving does not prevent future damage, it does provide more time between repairs making repairs easier and less costly. These materials may be used as alternative cover treatments when removing tree grates.



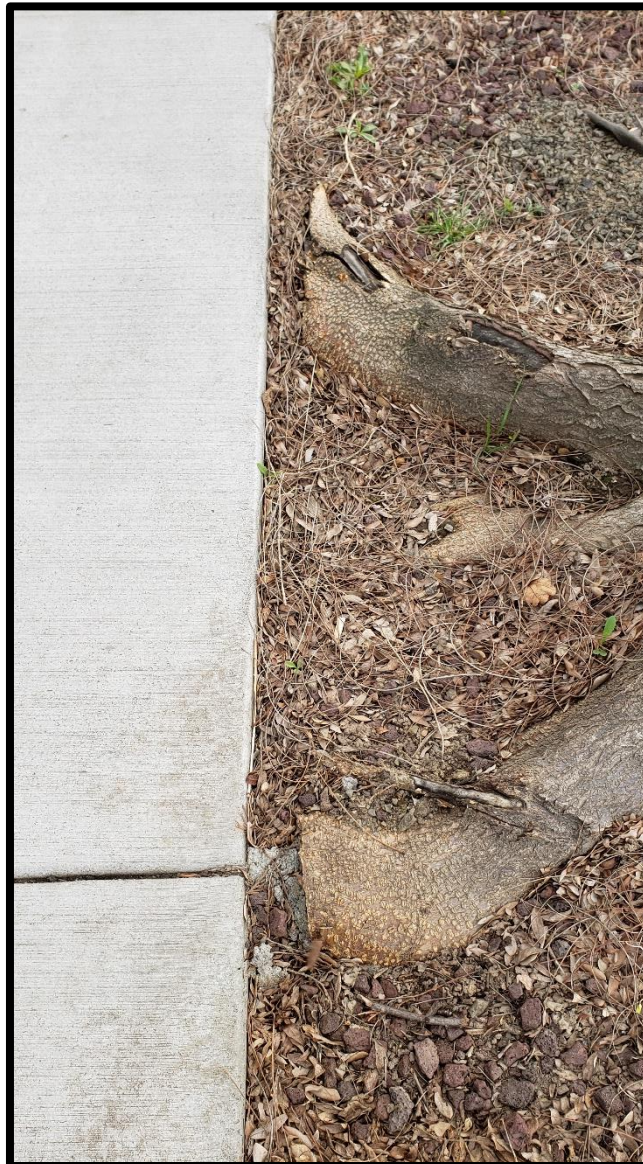
Rubber sidewalk installation.

Concrete modifications usually involve expansion joint materials such as dowels, rebar and sleeves, and articulating sidewalk joints. Sidewalk grinding can be employed as temporary measure that restores the offset or heaved portion of a sidewalk to original grade.

Root-based Strategies to Reduce Infrastructure Damage

Root-zone based strategies often use root guidance systems or soil replacement, modification, and management techniques. They include continuous trenches, engineered or structural soils, root channels or paths, steel plates, Silva cells, and root barriers.

Root pruning may be considered an option, but it is a serious wound to the tree and may affect the stability of the tree. Age, tree condition, species, root size and location, and proximity to the trunk should be considered before using root pruning as a treatment.



Root pruning should be limited or not used.

There are limitations and constraints associated with each strategy. Typically, the solution to avoiding infrastructure conflicts in downtown areas involves a combination of techniques. Trees, in light of our ecological problems, are now being recognized as significant solutions to some of our urban problems. Trees are a necessary component of urban corridors, not just street side ornaments. Too often trees are not integrated into the infrastructure design up front. Consequently, a large amount of money is spent on mitigating root-hardscape conflicts.



Silva cells utilize a modular framework of interlocking cells. An underground planter is constructed which is backfilled with a large volume of high quality, uncompacted soil. The cells meet load bearing standards and can also help manage storm water on site.

Several new practices are being used in conjunction with the extensive construction and renovation occurring in the downtown (E.g. Silva cells, large raised planters, and moveable planters for trees in places they can't be planted). Tree grates are beginning to be removed, trees in pits are being raised to grade level, mulch installation, and planting a greater variety of species is happening in the downtown currently. In each of these scenarios it is critical to start with quality nursery stock and plant the tree correctly. Without these first steps an accurate assessment of these practices cannot be made. It is important to assess each of these tree planting treatments under conditions that have followed the best management practices of the arboriculture industry consistently. It provides Millwood information about which treatments or combination of treatments succeeds in the downtown corridor.

GLOSSARY

Acceptable risk: degree of risk that is within the tolerance or threshold of the owner, manager, or controlling authority.

Advanced assessment: an assessment performed to provide detailed information about specific tree parts, defects, targets, or site conditions. Specialized equipment, data collection and analysis, and/or expertise are usually required.

Aerial inspection: inspection of parts of a tree not visible from the ground, including the trunk, stems and branches: aerial inspections may include evaluation of internal decay.

ANSI A300 standards: in the United States, industry-developed, national consensus standards of practice for tree care.

ANSI Z133.1 standards: in the United States, industry-developed, national consensus safety standards of practice for tree care.

Arborist: professional who possesses the technical competence gained through experience and related training to provide for or supervise the management of tree and other woody plants in residential, commercial, and public landscapes.

Best management practices (BMP): best available, industry-recognized courses of action, in consideration of the benefits and limitations, based on scientific research and current knowledge.

Boundary tree: a tree with the property line going through any part of the trunk.

Border tree: a tree located near a property line but has roots, branches, and leaves that extend over the property line.

Branch architecture: the normal structure of the scaffolding branches of a particular tree species compared to the tree you are assessing of the same species.

Canopy: refers to the upper layer or habitat zone, formed by mature tree crowns and including other biological organisms (epiphytes, lianas, arboreal animals, etc.).

Cavity: open or closed hollow within a tree stem, usually associated with decay.

Certified Tree Risk Assessor: An ISA Certified Arborist who has completed the Pacific Northwest (PNW) tree risk assessment course and/or ISA Tree Risk Assessment Qualification course.

Codominant stems: forked trunks, branches, or stems nearly the same in diameter, arising from a common junction and lacking a branch bark ridge.

Crown: Leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree.

DBH: diameter breast height measured on trunk (4.5 feet above soil surface)

Decay: process of degradation by micro-organisms.

Defect: an imperfection, weakness, or lack of something necessary. In trees, defects are injuries, growth patterns, decay, or other conditions that reduce the tree's structural strength.

Excellent condition: No apparent problems or maintenance required.

Exposed roots: roots growing on the surface, usually a species characteristic of compacted soil. Care not to damage exposed roots should be taken.

Fair condition: Trees in fair condition have well defined issues (dead branches; co-dominant stems) that warrant some corrective pruning or maintenance within the next pruning cycle.

Failure (tree failure): breakage of stem, branch, roots, or loss of mechanical support in the root system.

Failure potential: in tree risk assessment, the professional assessment of the likelihood for a tree to fail within a defined period of time.

Girdling roots: root that encircles all or part of the trunk of a tree, or other roots, that constricts the vascular tissue and inhibits secondary growth and the movement of water and photosynthesis.

Good condition: Trees in good condition have minor issues or defects that do not require immediate attention and maintenance could occur later in the city pruning cycle.

Harm: personal injury or death, property damage, or disruption of activities.

Hazard: situation or condition that has exceeded an acceptable threshold of risk and is likely to lead to a loss, personal injury, property damage, or disruption of activities; a likely source of harm. In relation to trees, a *hazard* is the tree part(s) identified as a likely source of harm.

Hazard tree (*synonym hazardous tree*): a tree identified as a likely source of harm.

High risk tree: The tree or part of it has reached a stage where it could fail at any time.

Impact (*verb*): striking a target causing a disruption that affects activities.

Included bark: bark that becomes embedded in a crotch (union) between branch and trunk or between codominant stems. Causes a weak structure.

Inspection frequency: the number of inspections per given unit of time (for example, once every three years).

Inspection interval: time between inspections.

Owner/manager: the person or entity responsible for tree management, or the controlling authority that regulates tree management.

Poor condition: Trees in poor condition have irreversible problems.

Qualitative risk assessment: a process using ratings of consequences and likelihood to determine risk significance levels (that is, “extreme”, “high”, “medium”, or “low”) and to evaluate the level of risk against qualitative criteria.

Quantitative risk assessment: a process to estimate numerical probability values for consequences and to calculate numeric values for risk.

Residual risk: risk remaining after mitigation.

Risk: the combination of the likelihood of an event and the severity of the potential consequences. In the context of trees, risk is the likelihood of a conflict or tree failure occurring and affecting a target, and the severity of the associated consequences- personal injury, property damage, or disruption of activities.

Risk aggregation: the consideration of risks in combination.

Risk analysis: the systematic use of information to identify sources and to estimate the risk.

Risk evaluation: the process of risk identification, analysis, and evaluation.

Risk management: the application of policies, procedures, and practices used to identify, evaluate, mitigate, monitor, and communicate tree risk.

Risk matrix: a tool for ranking and displaying risks by assigning ratings for consequences and likelihood.

Shall: A word that designates a mandatory requirement within the ANSI standards or contract documents. Compare to should.

Should: word that designates an advisory recommendation in the ANSI standards or contract documents; compare to shall.

Standard of care: degree of care that a reasonable person should exercise in performing duty of care; a measurement used to assess whether an individual acted in a reasonable manner.

Stocking level: A proportion of existing street trees to the total number of potential street trees (number of trees plus the number of available planting spaces).

Structural defect: feature, condition, any naturally occurring or secondary conditions such as cavities, poor branch attachments, cracks, decayed wood or deformity of a tree that indicates a weak structure or instability that could contribute to tree failure.

Taper: change in diameter over the length of trunks, branches or roots.

Target (risk target): people, property, or activities that could be injured, damaged, or disrupted by a tree.

Target zone: The area where a tree or tree part is likely to land if it were to fail.

Tree risk assessment: systematic process used to identify, analyze and evaluate tree risk.

Tree risk management: the application of policies, procedures, and practices used to identify, evaluate, mitigate, monitor, and communicate tree risk.

Unacceptable risk: a degree of risk that exceeds the tolerance of the owner, manager, or controlling authority.

Urban forest: management of naturally occurring and planted trees in urban areas.

Visual tree assessment (VTA): method of assessing the structural integrity of trees using external symptoms of mechanical stress (such as bulges, reactive growth, etc.) and defects (cracks, cavities, etc.).

Wood decay: the process of wood degradation by micro-organisms.

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