CITY OF TUMWATER
URBAN FORESTRY
MANAGEMENT PLAN

"The Right Tree in the Right Place"

City of Tumwater City Council
Adopted March 2, 2021 by Ordinance No. 2020-004

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An urban forest consists of all trees and understory plants on public and private property in a City. It includes a diverse mix of vegetation, managed by a broad group of individuals and groups, and located in a range of urban and natural settings including private properties, developed parks, rights-of-way, conservation areas, and other public lands.

Benefits of the Urban Forest

Trees and their understory are an essential part of the character of the City. A healthy urban forest provides benefits including pollution mitigation, habitat for wildlife, carbon sequestration, stormwater runoff reduction, as well as socioeconomic and aesthetic benefits. Urban and natural forests work constantly to mitigate the negative effects of urbanization and development, while protecting and enhancing lives within the community. (Jo and McPherson 1995)

Direction by the City Council

The City Council established "Be a Leader in Environmental Sustainability" as one of its Strategic Priorities in the *City of Tumwater Strategic Priorities 2019-2024* with the goal of "Develop new approaches to tree preservation and urban forestry management." To achieve this goal, the Tree Board prepared the *Urban Forestry Management Plan* with the support of stakeholders and Community Development Department staff.

The intent of the Plan is to build on the 1996 *Urban Forestry Plan* and 2002 *Comprehensive Street Tree Plan*. The Plan will also provide recommendations for updating Tumwater Municipal Code (TMC) 16.08 *Protection of Trees and Vegetation* as well as TMC 12.24 *Street Trees* and TMC 18.47 *Landscaping* with the primary goal of ensuring "The Right Tree in the Right Place," as well as establishing a number of other implementation Actions.

ORGANIZATION OF THE PLAN

The *Urban Forestry Management Plan* is organized into three chapters and series of appendices.

> **Chapter 1 – Introduction** talks about the reasons why the City developed the Plan, its benefits, and its purpose.

Chapter 2 – Inventory and Assessment – *What Do We Have?* discusses the community engagement and the inventory and evaluation work done to prepare the Plan.

Chapter 3 – Strategic Planning, Implementation, and Monitoring addresses the three components of the Plan that will do:

- **Strategic Planning –** *What Do We Want?* outlines the Plan's Vision, Concepts, Goals, Objectives, and Actions to address inventorying, protecting, establishing, maintaining, and enhancing the community and urban forest through resource management in City operation, permitting, and enforcement activities as well as community outreach and education.

- *Implementation – How Do We Get There?* summarizes what will need to be done to translate the Plan's Vision, Concepts, Goals, Objectives, and Actions into reality over the 20-year term of the Plan.

- *Monitoring – How Are We Doing?* describes the monitoring and adaptive management program that will be used to evaluate progress towards the Plan's Vision, Concepts, Goals, Objectives, and Actions.
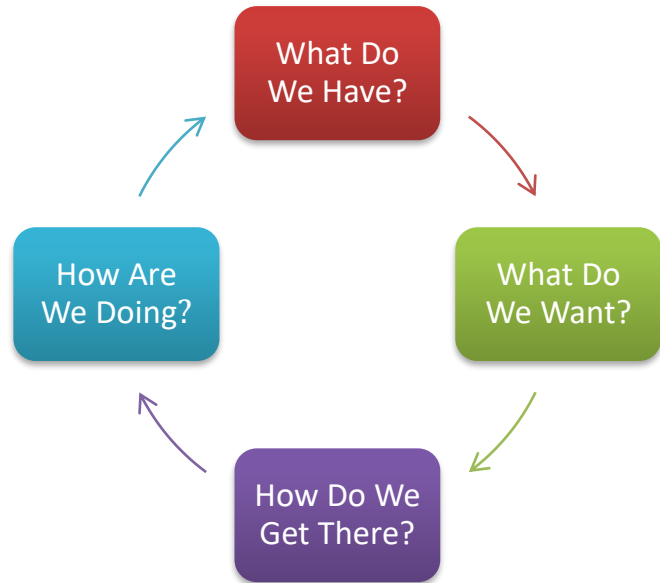
Appendices include the technical reports used to prepare the Plan as well as other materials that will direct implementation of the Plan.

ONGOING MANAGEMENT AND MONITORING

The urban forest in the City did not simply grow untended or unplanned. Although the landscape, which makes up the City today, is naturally heavily wooded, most of the original trees were clear-cut by the late 1800s. The existing urban forest in the City is mostly human-made and requires active stewardship to remain healthy. The Plan is intended to have a 20-year term, with smaller evaluation time segments established in the Implementation and Monitoring phases.

COVID-19 Pandemic and the Urban Forestry Management Plan

Most of the work on the Urban Forestry Management Plan was completed in 2019 and early 2020, then the COVID 19 pandemic arrived, and delayed the final adoption of the Plan by one year.

Many things happened in that year that will affect the implementation of this Plan: the City and its regional partners completed and accepted the Thurston Climate Mitigation Plan, joined together in the Regional Housing Council to address homelessness, and worked on a Housing Action Plan to address the lack of affordable housing in the region. No less important, there is a heightened awareness in the City of the need to bring diversity, equity, inclusion, and respect to the forefront of all our planning efforts to ensure the needs of all our residents are addressed.

As the Plan is implemented through policies, regulations, and actions by electeds, board members, staff, and volunteers, adjustments will need to be made to reflect the changes this past year caused by COVID 19 and all these other undertakings. Most importantly, implementation of the Urban Forestry Management Plan will need to account for Goal 4 of the Plan:

> *Goal 4: Balance the protection and support of the community and urban forest with other City strategic priorities, which include, in part, providing affordable housing, developing a walkable urban community, economic development, addressing climate change, and protecting endangered species.*

CHAPTER 1 – INTRODUCTION

1.01 – WHAT IS THE COMMUNITY AND URBAN FOREST?

The community and urban forest in the City consists of all trees and understory plants on private and public property in the City. It includes a diverse mix of vegetation, managed by a broad group of individuals and groups, located across a range of urban and natural settings and ecosystems, including private property and public lands such as developed parks, rights-of-way, conservation areas, and other lands.

1.02 – BENEFITS AND VALUE OF THE COMMUNITY AND URBAN FOREST

Trees and their associated vegetation are an essential part of the City. A healthy community and urban forest grown within the City provides many environmental, economic, and community benefits. Urban forests work constantly to mitigate the negative effects of development, while protecting and enhancing lives within the community. Seeing the community and urban forest as a diverse system allows the City to manage the individual components of that system to meet other legislative and strategic priorities such as economic development, affordable housing, and protection of critical areas and endangered species.

1.02(A) – Environmental Benefits

STORMWATER, WATER QUALITY, FLOODING, AND EROSION

Urban stormwater runoff is a major source of contamination for riparian areas throughout the City, threatening both human health and wildlife, including salmon populations, resident orca, and aquatic communities locally and in

The term **community and urban forest** is defined in RCW 76.15.010 and used by the Washington State Department of Commerce in their 2009 publication *A Guide to Community and Urban Forestry Programming* as:

> *"…that land in and around human settlements ranging from small communities to metropolitan areas, occupied or potentially occupied by trees and associated vegetation. Community and urban forest land may be planted or unplanted, used or unused, and includes public and private lands, lands along transportation and utility corridors, and forested watershed lands within populated areas"*

In the *City of Tumwater Urban Forestry Management Plan*, the term **urban forest** is used interchangeably with **community and urban forest**.

the Puget Sound. Incorporating the right mix of urban trees and understory into stormwater management planning reduces peak stream flows, which traps sediment and other contaminants. Urban trees reduce runoff volumes and buffer flood events, which lessen the cost and need for constructing stormwater management and treatment facilities to remove sediment and other pollutants. (Fazio n.d.)

Trees improve and protect water quality by:

Intercepting rainfall – The canopy of trees and understory vegetation intercept rainfall, allowing water to evaporate from the canopy and soak into the ground slowly, reducing the total amount of runoff. (Q. Xiao, et al. 2000)

Increasing soil capacity and infiltration – Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and snowmelt, which results in slower runoff rates and increases in the filtration of contaminants. (Q. Xiao, et al. 2007) It also enhances the uptake of certain elements such as nitrogen and carbon, which are critical for tree growth.

Reducing soil erosion – Tree roots reduce the flow and volume of stormwater runoff, reduce landslide risks, help to lessen erosion, and prevent sediments and other pollutants from entering the City streams, rivers, and lakes in the City. (Stokes, et al. 2009)

AIR QUALITY

Trees improve air quality in four fundamental ways:

Reducing particulate matter by acting as cleaning agents that trap dust and other airborne particulate matter.

Absorbing gaseous pollutants, trees absorb greenhouse gases such as nitrogen oxides, carbon monoxide, carbon dioxide, and ozone.

Mitigating power plant emissions by sequestering pollutants and carbon and helping to mitigate the negative effects of global warming on the environment. Shade provided by properly planted trees reduces the use of air conditioning in the summer.

Increasing oxygen levels and other natural gases through the process of photosynthesis, resulting in cleaner air to residents in close proximity to trees, and improving overall air quality in the City reducing common adverse health effects from pollutants, such as asthma.

WILDLIFE, FISH, AND HABITAT

Trees provide habitat for a number of mammals, birds, and insects, thus increasing biodiversity in the urban setting. In riparian habitats, such as areas near waterbodies, trees reduce the quantity of pollutants reaching waterways and cool the water, creating a positive effect for threatened aquatic life including salmon and the Oregon spotted frog. (Karl 2010) The community and urban forest provides shelter for a number of small mammals as well as a variety of migratory and non-migratory birds, along with opportunities for recreation, offering a healthful respite from the pressures of work and everyday stress.

The City contains many different kinds of ecosystems ranging from forest to prairies. Diversity of trees and associated plant and animal species provide critical habitat for wildlife. For example, Puget Sound prairie-oak plant communities support habitat for the threatened Olympia Mazama pocket gopher (*Thomomys mazama pugetensis*), Taylor's checkerspot butterfly (*Euphydryas editha taylori*), and the streaked horned lark (*Eremophila alpestris strigata*).

CLIMATE CHANGE

The community and urban forest absorbs and transforms atmospheric carbon, which reduces greenhouse gases. The atmospheric carbon dioxide (CO_2)-related function of trees is measured in two ways: directly and indirectly.

> **Directly** – Through storage and the annual sequestration of carbon dioxide (CO_2) through annual growth rings of new wood.

> **Indirectly** – By lowering demand for heating and air conditioning, thereby reducing the emissions associated with electric power generation and natural gas consumption. (Karl 2010)

The community and urban forest reduces heat island effect within the City through shade and transpiration of cooling moisture. The National Science Foundation states that if trees shade at least 40% of a city block then the cooling impact of the shade is significant. In a paper published in the journal *Proceedings of the National Academy of Sciences*, Carly Ziter and co-authors report that when canopy cover reaches at least 40% of a city block, temperatures begin to drop dramatically. (Ziter, et al. 2019)

SOUND CONTROL

The community and urban forest can buffer urban noise caused by traffic or industrial production. (Bentrup 2008) Evergreen trees and shrubs provide noise buffering between different land uses. Natural sounds such as rustling leaves and birdcalls provide a more calming environment and improve the mental well-being of those who live in the City.[1]

1.02(B) – Economic Benefits

ECONOMIC DEVELOPMENT AND AESTHETICS

The community and urban forest provides economic development and aesthetics benefits in the following ways:

The resale values of residential properties across entire city blocks are increased through the presence of large trees on private property. A property with the tree increased in value, but so did the surrounding properties who shared the benefits of the tree. (Butry and Donovan 2010)

Consumers of central business districts with abundant, well-maintained street trees and landscaping are willing to pay more for goods purchased, and shop for longer durations. (K. L. Wolf, Business District Streetscapes, Trees, and Consumer Response 2005) (K. L. Wolf 2006)

Studies by the University of Washington have shown that consumers are willing to spend more in shopping areas with healthy tree canopy that provides a pleasant shopping experience. (K. L. Wolf 1999)

Potentially fewer accidents on roads with trees because people tend to drive slower and are generally less distracted on streets that have traffic calming integrated into their design; trees can be utilized as traffic calming devices**.** The University of Washington and U.S. Forest Service sponsored website *Green Cities: Good Health* mentions, **"**There is a slowly growing body of evidence suggesting that the inclusion of trees and other streetscape features in the roadside environment may actually reduce crashes and injuries on urban roadways." (K. L. Wolf 2010) The website also lists the pertinent studies and gives summaries of their results and conclusions**.**

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[1] Leonard and Parr (1970) and Reethof (1973) found that a dense belt of trees and shrubs between 15-30 m wide could reduce sound levels by as much as 6-1OdB. Cook and Yan Haverbeke (1972) also found reductions in noise level of 5 - 10dB for belts of tree between 15-30m wide. Playing 'natural sounds' affects the bodily systems that control the flight-or-fright and rest-digest autonomic nervous systems, with associated effects in the resting activity of the brain, new research shows. (Sussex 2017)

The retention of trees on new development projects attenuates stormwater and maintaining stormwater capacity, decreasing the need for expensive drainage infrastructure. Urban forest ecosystem analysis has shown that urban forest canopy cover provides significant savings in construction costs for stormwater retention capacity. In addition, as trees grow annually the stormwater attenuation increases in capacity, unlike engineered solutions.

Increases in urban forest canopy cover remove thousands of pounds of harmful air pollutants and directly improve respiratory health, thus lowering health care costs.

Trees protect asphalt from solarization, weather damage, and temperature fluctuation, which leads to longer pavement life and reduced roadway maintenance costs to the City.

Damage caused from tree roots is mitigated through designing streets with adequate rooting volume, thoughtful tree selection, and accurate placement of trees. "The Right Tree in the Right Place" coupled with streets and sidewalks designed for trees offsets nearly all hardscape damage issues.

A single long-lived and large tree may return as much as $90,000 of environmental, human health and social benefits over the course of its lifespan, emphasizing the importance of trees to the economic vitality of cities.

ENERGY SAVINGS

The community and urban forest modifies the environment and conserves energy in four principal ways:

Providing shade during warmer seasons to reduce heat island effects of urban development, this lowers temperatures and reduces the need for air conditioning. (McPherson and Simpson 2003)

Transpiration releases water vapor from tree canopies, cooling the surrounding area. Through shade and transpiration, trees and other vegetation within an urban setting modify the environment and reduce heat island effects. (Akbari 2005)

Properly planted trees absorbing cold wind energy and insulate buildings in the winter.

Blocking wind or diverting it to areas that need cooling.

1.02(C) – Community Benefits

While perhaps the most difficult to quantify, the aesthetic and socioeconomic benefits from trees may be among their greatest contributions, including:

- Beautification, comfort, and aesthetics
- Shade and privacy
- Opportunities for recreation
- Reduction in crime[2]
- Creation of a sense of place and history (Aspinall, et al. 2013)
- Human health, both physical and psychological (Berman, et al. 2012)
- Reduced illness and reliance on medication and quicker recovery from injury or illness[3]

1.03 – HISTORICAL BACKGROUND

1.03(A) – The Community and Urban Forest: The Early Years

Over one hundred years ago, the City contained a variety of native tree species. Maple, alder, cedar, ash, hazelnut, hemlock, fir, pine, willow, and Garry oak were predominant. In addition, the early settlers planted orchards for food and planted trees from their homelands for beauty, shade, and historical significance. The Mills and Mills Funeral Home and Memorial Park next to Pioneer Cemetery on Littlerock Road SW have ancient American chestnut (*Castanea dentata*) trees, a relic from the most abundant tree on the eastern coast before the 1900s.

Since then, houses were built and businesses developed, which required streets, parking lots, and necessary utilities. Historically, people used trees to cool buildings and other areas by shading, but eventually trees were required to be planted for aesthetics and buffers between different uses as development increased.

1.03(B) – Sustaining the Legacy

Before the adoption of the *Urban Forestry Management Plan*, the *Urban Forestry Plan* (1996), *Comprehensive Street Tree Master Plan* (2002), and Tumwater Municipal Code (TMC) 12.24 *Street Trees*, TMC 16.08 *Protection of Trees and Vegetation* (2006), and TMC 18.47 *Landscaping* guided the management and preservation of the community and urban forest in the City.

In the years since these plans and regulations were adopted, the City has grown considerably in size and population and it faces new challenges in planning for growth as development in Thurston County intensifies. Other considerations include the Growth Management Act,

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[2] (Donovan and Prestemon 2012) (Sullivan, Kuo and DePooter 2004), and (K. L. Wolf 2010)

[3] (Kaplan and Kaplan 1989), (Urlich 1986), (Kuo and Sullivan 2001), (Ulrich 1984), (Berger 2013), and (Kuo and Sullivan 2001)

Critical Areas Ordinance, and the protection of species listed under the Endangered Species Act in the City and its Urban Growth Area.

In the *City of Tumwater Strategic Priorities 2019-2024*, the City Council identified developing new approaches to tree preservation and urban forestry management as one component of their "Be a leader in Environmental Sustainability" strategic priority. Preparation of the *Urban Forestry Management Plan* is one of the primary goals of the Tree Board with the support of Community Development Department staff, in cooperation with the Parks and Recreation and Public Works Departments, and the involvement of the City residents.

The intent of the Plan is to build on the work begun in the 1996 *Urban Forestry Plan* and 2002 *Comprehensive Street Tree Plan*, by ensuring "The Right Tree in the Right Place" in providing recommendations for updating TMC 16.08 *Protection of Trees and Vegetation* as well as TMC 12.24 *Street Trees* and TMC 18.47 *Landscaping*.

1.04 – PURPOSE AND SCOPE OF THE PLAN

The purpose of the *Urban Forestry Management Plan* is to guide the maintenance, management, and improvement of the community and urban forest in the City for the benefit of the entire community over the next 20 years to ensure "The Right Tree in the Right Place." The Plan will provide Concepts, Goals, Objectives, and Implementation Actions to preserve, restore, and enhance trees, understory, and forests on public and private land.

The Plan will serve as the policy basis for amendments to the City's regulations that address street trees, the protection of trees and vegetation, and landscaping in the Tumwater Municipal Code. These regulations establish the minimum requirements and standards for development and redevelopment of individual properties in the City as it relates to the urban forest.

The information needed to prepare this Plan came from multiple sources, including public meetings, inventories, and surveys. The Peninsula Environmental Group completed inventories and assessments, which included community and City staff surveys, a street tree and historic tree inventory, a green space and natural area inventory, and a citywide urban canopy coverage assessment under the guidance of the Tree Board and stakeholders.

The community and urban forest requires careful management to ensure its preservation, restoration, and enhancement. Community and urban forest management goals such as increasing tree canopy, improving public safety, and providing native habitat, as well as recreational and educational opportunities, must be balanced with other urban goals such as accommodating economic growth, providing housing, facilitating infrastructure, and protecting

endangered plant and animal species. The Plan is the City strategy for integrating management of the many issues and opportunities posed by community and urban forest resources.

Additionally, all natural and built systems change over time. Adaptive changes must be actively planned, managed, and maintained over the course of the Plan's duration to result in effective and enhanced community and urban forest benefits. Studies repeatedly support the fact that community and urban forests deteriorate when human intervention is not a proactive part of community and urban forest management and maintenance. This decline can be seen in many City greenbelts where invasive English ivy is strangling trees and preventing native species from establishing. Lack of planning and management is also evident where trees are planted in places that do not allow for growth, which can lead to conflict with sidewalks and utilities. Proactive planning, management, and maintenance are needed to keep trees in the City sustainable and in balance with other urban priorities.

Community and urban forests are valued because they provide environmental, economic, and community benefits. Urban trees and forests are directly affected by their locations and conditions in developed urban areas. Given this fact, additional management intervention and maintenance is necessary to keep the trees and forest in the City sustainable. The Plan uses a planning model framework built on a basic understanding of the unique characteristics of community and urban forests.

The conditions under which trees grow in the City are often less than optimal. The soils in developed areas are often severely compacted, low in organic content and may contain construction debris. Trees often have restricted rooting space, and the space they do have is often covered with concrete or asphalt, reducing access to water and gas exchange from the soil to the air, critical to tree health.

Because the urban environment is a complex combination of human growth and disturbed environments, the selection of trees used to create a healthy, sustainable urban environment should include a mixture of native and non-native trees, with no single species dominating. The predominance of a single species will increase the susceptibility of the community and urban forest to pests or disease.

1.04(A) – Recognizing Different Subareas in the City

Taking "The Right Tree in the Right Place" another step, the *right forest in the right area of the City* is a critical part of this Plan. It is the intent of this Plan to recognize that there are different community and urban forest subtypes that require different approaches to management throughout the City based on:

Environmental conditions – Soil types, hydrology, microclimates, local pollutants, whether an area was historically forested or prairie, what tree species and plant types are most appropriate for the site and its physical & biological constraints, and

Land use – Development and redevelopment guided by the *Comprehensive Plan*:
- Higher density urban level development, such as the Brewery District, Capitol Boulevard Corridor, Town Center, Littlerock subarea, and the industrial areas around the Olympia Regional Airport.
- Medium density suburban residential and commercial development.
- Lower density parks, open space, critical areas, or natural resource lands.

CHAPTER 2 – STATE OF THE COMMUNITY AND URBAN FOREST – *WHAT DO WE HAVE?*

2.01 – EXISTING POLICIES AND REGULATIONS

Table 1: Existing Policies and Regulations

City Tree Board	TMC 2.66 *Tree Board* establishes the Tree Board as an advisor to the City Council for development, updating, and facilitation of a plan and implementation strategy for the advancement, conservation, and care of the community and urban forest.
City Urban Forestry Plan (1996)	The *Urban Forestry Plan*, adopted in 1996, was the previous guide to the stewardship of trees within the City. It focused primarily on effective management of trees on City property while assisting private property owners through outreach and education programs to manage trees on private lands.
City Comprehensive Street Tree Plan (2002)	The *Comprehensive Street Tree Plan*, adopted in 2002, provides guidance on and selection, design and maintenance of City street trees and represents a commitment to establish and protect "…a healthy, diverse and important community asset." In 1997, a limited street tree inventory was performed after the 1996 *Urban Forestry Plan* was developed. This inventory would eventually provide data and consideration to the 2002 *Comprehensive Street Tree Plan*. Of the 2,340 trees inventoried, the most prevalent species were flowering plum cultivars (*Prunus cerasifera*). During the 2018 street tree inventory, this species dropped to just four percent of City-owned street trees.
Protecting Trees and Planting Vegetation	TMC 12.24 *Street Trees* establishes the requirements for planting and removal of trees in public space. The City last substantially updated this code chapter in 2011. TMC 16.08 *Protection of Trees and Vegetation* codifies tree protection standards and establishes a "tree account" for the purposes of acquiring, maintaining, and preserving wooded areas, and for planting and maintaining trees in public spaces. The City last substantially updated this code chapter in 2006. TMC 18.47 *Landscaping* establishes the landscaping requirements. The City last substantially updated this code chapter in 2008.

| Other Relevant City Documents | *Comprehensive Plan* – Identifies policies to protect and conserve natural resources, fund capital improvements, guide land use, and retain and develop recreation and open space in the City.

Development Guide – Includes regulations affecting both private and public development activities.

Subarea Plans – Provide more detailed land use and transportation polices to guide development. There are four subareas in the City: Brewery District, Capitol Boulevard Corridor, Littlerock Road, and the Town Center. |
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2.02 – EXISTING PROGRAMS

Current City programs are based on City policies and regulations that include the following:

Table 2: Existing City Programs

City Department or Board	Primary Community and Urban Forestry Related Policies/Regulations	Activities
Community Development Department	*Comprehensive Plan*

Brewery District Plan

Capitol Boulevard Corridor Plan

Littlerock Road Subarea Plan

Town Center Street Design Plan

Shoreline Master Program

Urban Forestry Management Plan

Tumwater Historic District Master Plan

Title 16 *Environment*

Title 18 *Zoning*

TMC 16.08 *Protection of Trees and Vegetation*

TMC 18.47 *Landscaping*

Citywide Design Guidelines | General development permits

Tree removal permits

Land clearing permits

Staff Tree Board

City Forester, who is contracted as needed

City forestry website |

City Department or Board	Primary Community and Urban Forestry Related Policies/Regulations	Activities
Tree Board	*Urban Forestry Management Plan* TMC 2.66 *Tree Board*	Annual Arbor Day event Tree City USA Community engagement and stewardship
Finance Department	TMC 16.08.40 *Tree Account*	Maintains tree account with City Council direction on appropriation
Fire Department	*Natural Hazards Mitigation Plan for the Thurston Region* TMC 8.16 *Fire Safety*	Removal of hazardous grasses, weeds, or brush
Parks and Recreation Department	*Capital Facilities Plan* *Parks, Recreation, and Open Space Plan* Title 12 *Streets, Sidewalks and Public Places*	Developed parks and facilities Open space and green space City-owned property management
Police Department	TMC 8.04 *Nuisances*	Code enforcement
Public Works Department	*Black Hills Subarea Transportation Plan* *Capital Facilities Plan* *Lands for Public Purposes Element* *Transportation Plan* *Town Center Street Design Plan* Title 12 *Streets, Sidewalks and Public Places* TMC 12.24 *Street Trees* Title 13 *Public Services* *Development Guide*	Transportation and utility rights-of-ways Stream Team program

2.03 – DEVELOPING THE PLAN

2.03(A) – Community Engagement

PUBLIC ENGAGEMENT PLAN

To encourage and facilitate community participation in development of the Plan, the City used a range of public engagement strategies identified in the *Public Engagement Plan*, which employed multiple tools and platforms to inform and engage the community, stakeholders, and interested parties.

For more detail, see the *Public Engagement Plan* in Appendix A.3.

STAKEHOLDERS AND INTERESTED PARTIES

City staff worked with the Tree Board and elected officials to identify a small group of stakeholders to work on the project with the Tree Board. A larger list of interested parties was also identified, who were invited to comment at various points in the process. Stakeholders and interested parties were engaged at multiple phases of the project, through e-mail, Tree Board meetings, and later through public open houses. The stakeholders and City staff who participated in development of this Plan are listed in the Acknowledgments.

PRESENTATIONS, COMMUNITY MEETINGS, AND OPEN HOUSES

City staff presented information on the preparation of the Plan to the Tree Board, Planning Commission, General Government Committee, and City Council at meetings throughout the Plan development process. Stakeholders and interested parties primarily used monthly Tree Board meetings to participate throughout the process.

In addition to monthly Tree Board meetings, three open houses were held during the Plan development process to present information and to solicit public input. City staff presented overviews of the Plan development process, the results of the inventory and assessment, draft elements of the Plan, and next steps to the public prior to the start of the legislative adoption process at the open houses. Information about the open houses and other key meetings were widely distributed through media releases, the *Olympian* newspaper, the City website, social media, and e-mail contact lists.

2.03(B) – Data Collection

In addition to Tree Board meetings and public open houses, City staff collected information for the Plan through community and staff surveys, and public tree and green space inventories, assessments, and evaluations. Throughout the Plan development process, City staff maintained a list of ongoing discussion items to help the Tree Board and stakeholders track ideas and determine when to address them in the process.

SURVEYS

City staff conducted a community survey and a City staff survey to help better understand the priorities of people who live and work in the City concerning the community and urban forest, as directed by the *Public Engagement Plan*.

COMMUNITY SURVEY

The community survey gauged community perceptions on such topics as tree health and maintenance, the benefits of the community and urban forest, and tree canopy in the City. The community survey was available from April 20 until May 7, 2018 on the City website. One hundred and twenty people responded to the community survey out of a total Tumwater population of nearly 23,000. The survey data guided City staff, the Tree Board, and stakeholders in making long-term community and urban forestry management goals that will help to protect the quality of life in the City for future generations. Appendix A.4 summarizes the results of the community survey.

CITY STAFF SURVEY

A City staff survey was conducted from May 4 through May 18, 2018 to find out what issues City staff face in their work with the community and urban forest and what additional tools or training would help them be more effective and efficient in their work. Forty-two out of nearly 200 staff responded to the City staff survey. Appendix A.5 summarizes the results of the City staff survey.

COMMUNITY AND URBAN FOREST INVENTORIES, CHARACTERIZATIONS, ASSESSMENTS, AND EVALUATIONS

City staff and their consultant, Peninsula Environmental Group, undertook three types of community and urban forest assessments and inventories in 2018 and 2019 in preparation of the Plan: a comprehensive street tree inventory, a geospatial canopy assessment, and a green spaces characterization. See the Peninsula Environmental Group *Technical Report* in Appendix A.1 for the results of this analysis.

Table 3 below summarizes the geographic focus, scale, strategies, and methods of each inventory, characterization, assessment, and evaluation.

Table 3: Community and Urban Forest Assessments Completed

	Green Spaces Characterization	Street Tree Inventory	Canopy Assessment
Geographic Focus	Urban, suburban, rural	Urban	The City and its Urban Growth Area
Assessment Results	Forest, natural area, green space and park characterizations and rapid assessment	Street tree metrics and gray infrastructure conflicts	Vegetation classification across the City and City Urban Growth Area using satellite imagery
Performance	Professional field surveys of forested and natural area management units	Professional arborist inventory and participation opportunities for volunteers	Geographic information systems (GIS) analysis incorporating land-use mapping
Methods and Data	Evaluated forest / natural space composition and health using rapid assessment tools (Forested Landscape Assessment Tool)	Street tree data gathered consistent with i-Tree and City department needs	Adapted City LiDAR[4] to differentiate canopy layers
Outcomes	Natural area and forested zone management prioritization framework	Data based street tree and related infrastructure maintenance, management planning and scheduling. Estimated environmental and economic values derived from data	Equitable City-wide planning for equitable environmental access, wildlife habitat, and stormwater management

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[4] LiDAR stands for Light Detection and Ranging. It is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. These light pulses, combined with other data recorded by the airborne system, generate precise, three-dimensional information about the shape of the Earth and its surface characteristics. (Source: National Oceanic and Atmospheric Administration)

STREET TREE INVENTORY

In the summer of 2018, more than 25 community volunteers, Tree Board members, consultant staff, and City staff inventoried, measured, and catalogued more than 3,500 street trees using geographic information systems (GIS) and global positioning systems (GPS). Trees were identified by species, measured trunks at diameter breast height or four and a half feet above the ground, and canopy width, and rated for structure, condition, and health. The street tree inventory included most City-owned trees planted in rights-of-way between a public sidewalk and a City street. In addition to common tree measurements described above, the inventory teams collected data on sidewalk displacement and planting location types in order to study relations between tree species and types of hardscape damage.

I-TREE ECO

Data gathered through the street tree inventory was analyzed using the U. S. Department of Agriculture Forest Service's i-Tree Eco program to estimate the value of ecosystem services currently provided by City-owned street trees. See the Peninsula Environmental Group *Technical Report* in Appendix A.1 for the results of this analysis.

GREEN SPACES CHARACTERIZATION

In order to prioritize management opportunities of green spaces and natural areas, the consultant assessed City-owned properties, including undeveloped natural areas, developed parks, and hybrid locations, using a modified Forest Landscape Assessment Tool (FLAT). Highly effective were identified, as well as landscapes and threats to those landscapes from forest pathogens and invasive non-native vegetation. In addition to rapid green space assessment and applied management perspectives, FLAT allows the City to evaluate green space equity and its associated environmental justice issues. Understanding the benefits to schools, neighborhoods, and community transit corridors to these green spaces provides data for long-term planning and green space investment.

GEOSPATIAL CANOPY ASSESSMENT

The consultant performed a citywide canopy assessment that included the Urban Growth Area through remote sensing datasets and tools. The assessment used multiple methods of geospatial analysis of imagery from 2017 and 2018, including LiDAR, to identify tree and shrub canopy in identified land-use areas. LiDAR provided the capacity to approximate canopy heights and differentiate low-growing natural areas and shrubs from taller trees. See the Peninsula Environmental Group *Technical Report* in Appendix A.1 for the results of this analysis.

However, the methodology used in the consultant's analysis was difficult to replicate by City GIS staff using readily available data and processes. As a result of input received from the Mayor and City Council at the August 25, 2020 joint worksession with the Planning Commission

and the Tree Board, in the fall of 2020 City staff worked with the City GIS staff to develop a process that could identify the community and urban forest canopy cover in the City and its Urban Growth Area and be repeated every five years using readily available data. The City GIS staff explored a number of options to measure canopy cover, including aerial photography from 2017, 2018, and 2019 and LiDAR data from 2018. The results of the City GIS staff's analysis can be found in their *Tree Canopy Cover Analysis* in Appendix A.2.

2.03(C) – Analysis

ISSUES AND TRENDS IN COMMUNITY AND URBAN FOREST SUSTAINABILITY

The issues and trends facing the sustainability of the community and urban forest in the City will be addressed in three parts:

- Vegetative Resources

- Resource Management

- Community Framework

These issues and trends will then be integrated into the Concepts, Goals, Objectives, and Actions in Chapter 3 – *Strategic Planning, Implementation, and Monitoring*.

VEGETATIVE RESOURCES

This subsection identifies recommendations regarding sustainable vegetative resources for the community and urban forest in the City.

Table 4: Criteria for Sustainable Vegetative Resources

Criteria	Key Purpose
Canopy Cover	Achieve climate and region appropriate tree cover, community-wide.
Street Tree Age	Provide for uneven age distribution.
Street Tree Diversity and Abundance	Provide for species diversity.
Native Vegetation	Preserve and manage regional biodiversity. Maintain the biological integrity of native remnant forests and other ecosystems. Maintain wildlife corridors in the City.

Criteria	Key Purpose
Climate Change	Account for changes to climate in managing the urban and community forest.

CANOPY COVER

Although the ideal amount of canopy cover varies by climate and region and perhaps by land use type, there is an optimal degree of canopy cover for the City.

The term 'canopy cover' means the area currently covered by tree and vegetation canopy of street trees, areas of native forest, and trees in parks, green space, and landscaping on private property; usually expressed as a percentage of the total area of the City.

In order to determine the canopy cover in the City, the consultant and then City GIS staff first looked at the entire tree cover of the City, associated vegetation, ornamental landscaping, grasses, and shrubs. The results of the consultant's analysis can be found in Peninsula Environmental Group *Technical Report* in Appendix A.1.

As noted, the methodology used in the consultant's analysis was difficult to replicate using readily available data and processes. Therefore, City GIS staff developed a process that could identify the community and urban forest canopy cover in the City and its Urban Growth Area and be repeated every five years using readily available data. The results of the City GIS staff's analysis can be found in their *Tree Canopy Cover Analysis* in Appendix A.2 and is the basis for Table 6 – *Canopy Cover Targets by Land Use Type*.

Measuring and evaluating canopy cover allows the City to use canopy cover change over time to determine the performance of the community and urban forest in the City policies and regulations. In 2019, canopy cover covered 42% of the City. Tree canopy percentage varied significantly between different land use designations. For example, the percentage of canopy cover in the Single Family Low Density land use designation is 52% and 40% in the Multi-Family High Density land use designation.

Because each land use designation has different policies and regulations governing the type and intensity of development, the Plan has identified different canopy cover targets for its land use designations in Table 6 – *Canopy Cover Targets by Land Use Type* to allow the City to meet a range of other legislative and strategic policies.

The canopy cover targets by land use type are intended to be used a measure of the progress of the Plan over the next 20 years. In addition, the canopy cover targets provide policy guidance for amendments to the City's regulations that address street trees, the

protection of trees and vegetation, and landscaping in the Tumwater Municipal Code. In turn, these regulations establish the minimum requirements and standards for development and redevelopment of individual properties in the City as it relates to the urban forest.

ZONING AND LAND USE

Zoning within the City of Tumwater helped inform similar land use policies for the urban tree canopy analysis. Twenty-three different zone district designations were consolidated to eleven. This effort to reduce zoning district designations into concentrated land use elements aligns with citywide policies, land use development types, and planting availability.

Table 5: Tumwater Zoning by Land Use Type

	Tumwater Expanded Zoning	Acres	Zoning by Land Use Type		Acres of Canopy in 2019
1	Port of Olympia - Olympia Regional Airport	806	**Port of Olympia - Olympia Regional Airport**	1	24
2	Port of Olympia - Industry	690	**Port of Olympia - Industry**	2	282
3	Light Industrial	2,335	**Industrial**	3	771
4	Heavy Industrial	107			
5	Brewery District	180	**City Core Mixed Use**	4	143
6	Capitol Boulevard Community	141			
7	Town Center	205			
8	Mixed Use	100	**Other Mixed Use**	5	41
9	Neighborhood Commercial	39			

Tumwater Expanded Zoning		Acres	Zoning by Land Use Type		Acres of Canopy in 2019
10	Community Services	41	General Commercial	6	302
11	Business Park (UGA Only)	76			
12	General Commercial	499			
13	Historic Commercial	85			
14	Commercial Development (UGA Only)	22			
15	Residential/Sensitive Resource	774	Single-Family Residential	7	3,253
16	Single-Family Low Density	3,677			
17	Single-Family Medium Density	1,738			
18	Manufactured Home Park	123			
19	Multifamily High Density	117	Multifamily Residential	8	328
20	Multifamily Medium Density	696			
21	Open Space	1,083	Open Space & Green Belt	9	714
22	Green Belt	367			
	Total	13,901	–		5,859

CANOPY COVER TARGETS

Assessed canopy cover from the *Tree Canopy Cover Analysis* in Appendix A.2 was used to identify the following canopy cover targets across *Comprehensive Plan* land use designations. Tree canopy cover is directly correlated to community and urban forest ecosystem functionality and benefits. Tree canopy cover is an efficient and quick qualitative measurement of a community and urban forest. With appropriate land use type specific canopy cover targets, Tumwater can target funding and prioritize management to have the most impact in areas where canopy needs to be increased.

In Table 6 – *Canopy Cover Targets by Land Use Type*, "developed areas", undeveloped area" and "undevelopable areas" were based on work by the Thurston Regional Planning Council to determine areas of potential development over a 30-year timeframe.

- "Developed areas" are those properties that are unlikely to redevelop substantially in the next thirty years.
- "Undeveloped areas" are those properties that are likely to redevelop substantially in the next thirty years.
- "Undevelopable areas" are those properties that are unlikely to develop in the next thirty years because of existing critical areas or open water.

Table 6: Canopy Cover Targets by Land Use Type

Land Use Type	Tree Canopy Cover Percentages				
	2019 Developed Area	2019 Undeveloped Area	2019 Undevelopable Area	2019 Total Area of City and UGA	Recommended 2040 Goal
Port of Olympia - Olympia Regional Airport	2%	53%	6%	3%	3%
Port of Olympia - Industry	18%	54%	49%	41%	25%

Land Use Type	Tree Canopy Cover Percentages				
	2019 Developed Area	2019 Undeveloped Area	2019 Undevelopable Area	2019 Total Area of City and UGA	Recommended 2040 Goal
Industrial	17%	40%	39%	32%	25%
City Core Mixed Use	23%	43%	25%	27%	25%
Other Mixed Use	27%	34%	22%	30%	25%
General Commercial	22%	55%	50%	41%	30%
Single-Family Residential	45%	58%	54%	52%	50%
Multifamily Residential	34%	45%	51%	40%	40%
Open Space & Green Belt	61%	59%	46%	49%	55%
TUMWATER + URBAN GROWTH AREA	31%	50%	48%	42%	39%

STREET TREE AGE

A mix of young and mature trees is essential if canopy cover is to remain relatively constant over time. To ensure sustainability, an on-going planting program should go hand in hand with the removal of trees that are towards the end of their lifecycle. Maintaining a tree inventory will make monitoring for this indicator easier. Small privately owned properties pose the biggest challenge for inclusion in a broad monitoring program.

The 2018 comprehensive street tree inventory cataloged the composition and distribution of street trees in the City. See the Peninsula Environmental Group *Technical Report* in Appendix A.1 for detailed analysis.

To determine an approximate tree age composition of the over 3,500 inventoried trees, the measured diameters were analyzed using a tree age model. (Łukaszkiewicz and Kosmala 2008) The model estimated that 53% of the inventoried trees were less than ten years old and 82% were less than 25 years old. Most City-owned street trees are young, and some have completed only one-quarter of their life span. Proper care and maintenance of these young trees will support long-term growth of ecosystem services, community and urban forest health, and access to green equity across the City. (Łukaszkiewicz and Kosmala 2008)

STREET TREE DIVERSITY AND ABUNDANCE

Species diversity is an important element in the long-term health of community and urban forests. Experience with species-specific pests has shown the folly of depending upon one species. Unusual weather patterns and pests may take a heavy toll on trees in the City. It is often recommended that no more than ten percent of the City tree population consist of one species. The 2018 City street tree survey found that the top three City street trees each accounted for more than ten percent of the City street tree population.[5]

Diversity and abundance of street trees are important in developing a resilient community and urban forest. High species diversity has a direct correlation to ecosystem resilience to disturbance. Disturbances from the environment (wind and ice storms, pollutants), pests, and diseases can devastate monocultures but have significantly less impact on diverse stands of trees. In general, no street tree species should represent more than 8 to 15% of a community and urban forest community. The updated *Street Tree and Landscape Tree Planting Lists* in Appendix A.9 provide lists of recommended tree species for different growing conditions in the City to support tree diversity within the urban ecosystem.

NATIVE VEGETATION

Where appropriate, preserving native trees in a community adds to the sustainability of the community and urban forest. Native trees are well adapted to the climate and support native wildlife. Replanting with nursery stock grown from native stock is an alternative strategy. Planting invasive species can threaten the ability of native trees to regenerate in

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[5] The top three City street tree species according to the 2018 City street tree survey were Acer platanoides (Norway maple) (21.00%), Pyrus calleryana (Callery pear) (13.40%), and Acer rubrum (red maple) (12.5%). See the Peninsula Environmental Group *Technical Report* in Appendix A.1 for detailed analysis.

greenbelts and other remnant forests. Invasive species might require active control programs.

Native vegetation in natural areas and parks plays an important role in the canopy coverage in the City and in the urban ecosystem. Through its interactions with nutrient cycling, soil formation, stormwater attenuation, wildlife habitat, and food sources, native vegetation is critical to a thriving ecosystem. This includes all the constituents of the remnant and restored native forests in the City from the herbaceous plants growing in forest openings and wetlands to the native grasslands and prairie communities to the large native trees that comprise much of the biomass of the community and urban forest in the City. Only a relatively small proportion of regional native plant tree species, however, are represented in the City.[6]

CLIMATE CHANGE

Climate change is driving changes in native vegetation composition throughout Washington State. Successful community and urban forest managers must consider climatic trends in relation to tree species diversity and consider new options for successful tree establishment and equitable distribution of tree benefits. The updated *Street Tree and Landscape Tree Planting Lists* in Appendix A.9 include tree selections that are suited to tolerate weather extremes and urban stresses. The lists will be updated as new tree species are tested for climate tolerance and urban suitability.

Climate change is slowly concentrating annual precipitation into smaller windows of time during the year in Thurston County. The number of days of rainfall per year is decreasing, although not the total amount of precipitation. This change is forcing plants to adapt to warmer, drier summers, while at the same time experiencing wetter rainy seasons. (Snover, et al. 2013)

In the coming century, the average annual temperatures in Washington State are projected to rise at a rate of 0.1 to 0.6 °C (0.2 and 1.0 °F) per decade. Precipitation forecasts are generally more uncertain; in general, winters are projected to be wetter and summers are projected to be drier. (Lawler and Mathias 2007)

These predicted climate changes will affect community and urban forest resilience, regeneration, diversity, and spatial distribution of trees and tree canopy. Changes are expected in the length of growing season, plant and animal composition and distribution, water availability and duration, along with an increase in drought conditions during the

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[6] Approximately 2.22% of the City street trees in the 2018 City street tree survey were native to western Washington. See the Peninsula Environmental Group *Technical Report* in Appendix A.1 for detailed analysis.

summer and fall. The single greatest forest management action at the local scale to keep trees healthy and foster vigorous growth to capture and sequester carbon is to manage trees for density, regeneration, and resiliency. (Lawler and Mathias 2007) Resiliency through species diversity and best management practices is the most important management action for the portion of the community and urban forest made up of street trees and single trees in maintained landscaped areas.

RESOURCE MANAGEMENT

This subsection identifies recommendations regarding sustainable resource management for community and urban forest in the City.

Table 7: Criteria for Sustainable Resource Management

Criteria	Key Purpose
Management Plan	Develop and implement a management plan for trees on public and private property.
Funding	Develop and maintain adequate funding to implement a citywide management plan.
Staffing	Employ and train adequate City staff to implement a citywide management plan.
Assessment Tools and Data Management	Develop methods to collect information about the community and urban forest on a routine basis.
Species and Site Selection	Provide guidelines and specifications for species use, on a context-defined basis.
Standards For Tree Care	Adopt and adhere to professional standards for tree care.
Public Safety	Maximize public safety with respect to trees.
Reuse	Create a closed system for tree waste.

MANAGEMENT PLAN

The *Urban Forestry Management Plan* will add to a community and urban forest's sustainability by addressing important issues and creating a shared vision for the future of the community and urban forest. Elements may include species and planting guidelines; performance goals and standards for tree care; requirements for new development such as tree preservation and planning, and specifications for managing natural and open space areas.

SUBDISTRICT MANAGEMENT AREAS

- Manage the community and urban forest in the City by using different zones based on future land use, soil, and climate.

REGULATORY UPDATES

- Update TMC 12.24 *Street Trees*
- Update TMC 16.08 *Protection of Trees and Vegetation*
- Update TMC 18.47 *Landscaping*
- Update the *Development Guide*

MANAGED RESOURCE FOREST NEEDS

- Managed resource forests, where forests are managed for regular harvest, require Type I – III Forest Practices Act approvals from the Washington State Department of Natural Resources.
- Managed resource forests in the City will require identification as forest lands in the *Conservation Element* of the *Comprehensive Plan*.
- Forested areas that are converting to another non-forest use require a Type IV Conversion Permit Forest Practices Act approval from the City.

FUNDING

Since community and urban forests exist on both public and private land, funding must be both public and private. The amount of funding available from both sources is often a reflection of the level of education and awareness within a community for the value of its community and urban forest.

Seek additional funding to support community and urban forest health and function:

INTERNAL COSTS

- Community Development Department
  - Investment in street tree spacing designs
  - Improvements in street tree health and longevity through regulations and inspections that ensure proper cultivation in large and effective planting spaces that promote healthy tree root growth
- Public Works Department
  - Operations and maintenance costs for street trees
  - Stream Team program
  - Maintaining geographic information systems (GIS) data
  - Staff training
- Parks and Recreation Department

      ○ Operations and maintenance costs for trees and understory in parks, facilities, and open space

      ○ Staff training

SOURCES OF FUNDING

- **General Fund** is the most common source of funding for community and urban forest programs. Ongoing biennial City funding can be requested for the community and urban forest.

- **Special Improvement Districts** can be formed by a group of neighbors or businesses who vote to assess themselves for street tree or natural space enhancements. This funding source is feasible only when the City encourages public involvement by creating volunteer associations and activities, such as "tree steward" or "teens for greens" associations. Establishing special improvement districts takes City staff involvement but can pay off in-long term public "ownership" of green assets.

- **Stormwater Utility Fees** through the Public Works Department enable many cities to both improve the community and urban forest and reduce long-term impacts on aging stormwater infrastructure, or offset costs on new infrastructure.

- **Revenue for green space investment** is achievable through the Parks and Recreation Department. Active recreation and urban retreat on these green spaces could include specialized camping, trail running events, etc.

- **Federal and State Government Grants** are available from numerous public organizations.
  - Washington State Department of Natural Resources Urban & Community Forest Community Forestry Assistance Grants
  - Washington State Salmon/Orca recovery-related grants
    - Washington State Department of Ecology
    - Washington State Department of Fish and Wildlife
    - Puget Sound Partnership
  - U.S. Environmental Protection Agency
  - U.S. Department of Agriculture and U. S. Forest Service

- **Fees, Taxes, Assessments, and Special Tax Districts**
  - Tree mitigation fees

- **Corporate and Private Foundations and Local Civic Organizations** can help sustain the community and urban forest through endowment funds, in-kind and monetary donations and community and public engagement.
  - Endowment funds.

- o Volunteers and in-kind donations help many municipal programs through employee volunteer requirements and student volunteer requirements.
- o Donations from businesses, organization, societies, and individuals can be used to offset costs or fund street tree plantings, a community tree endowment, or green-space acquisition.
- **Big-box store grants and donations**.
- **Explore programs for selling carbon credits** issued by City Forest Credits, such as the City of Seattle, to local or national businesses to fund projects that support restoration, reforestation, or the stewardship of urban trees.
- **Volunteers.**

CITY STAFFING

A community and urban forest's sustainability is increased when all City tree staff, utility and commercial tree workers, and arborists are adequately trained. Continuing education in addition to initial minimum skills and/or certifications is desirable.

- The City currently retains a consulting urban forester on an as needed basis for development review questions and tree risk evaluations. It is recommended that increased funding for this service is provided or an Environmental Manager position is added to City staff whose responsibilities would include urban forestry.
- Public and private developments, which include Landscape Master Planning and street tree installation requirements, should be inspected by an independent International Society of Arboriculture (ISA) Certified Arborist. Criteria for compliant street tree installations include:
  - o Species identified by ISA Certified Arborist are same tree species indicated on approved Landscape Master Plan or the updated *Comprehensive Street Tree Plan*.
  - o Tree installation is compliant with the most current version of American National Standards Institute (ANSI) A300 *Tree, Shrub and Other Woody Plant Management Standard Practices for Planting and Transplanting*.
  - o Trees are correctly mulched and irrigated, if necessary, as per approved Landscape Master Plan or the updated *Comprehensive Street Tree Plan*.
- Current and future City staff should receive training regularly in basic tree care to ensure that they understand the importance of proper tree care and can perform tree care techniques correctly.
- City staff with a high interest in trees and their care should be encouraged to seek further training and education, with the intention of becoming an ISA Certified Arborist.

- Maintenance of the City-owned portion of the community and urban forest, in terms of both City staff and resources, is an important ongoing responsibility that should become an explicit part of the ongoing City biennial budget process.

ASSESSMENT TOOLS AND DATA MANAGEMENT

By using canopy cover assessment, tree inventories, aerial mapping, geographic information systems (GIS), and other tools, it is possible to monitor trends in a community and urban forest resource over time.

- Common forestry and urban forestry tools and instruments should be used to measure individual street trees and record data in easily analyzed formats. These might include measuring tapes, clinometers, range finders, global positioning systems (GPS) and geographic information systems (GIS), and tablet computers or smart phones.
- Each individually inventoried tree should be assessed using methods described by the International Society of Arboriculture (ISA), performed by ISA Certified Arborists. Reference the Peninsula Environmental Group *Technical Report* in Appendix A.1 for a full description of the street tree inventory methods used in development of the Plan.
    - Tree Risk Assessment Qualifications should be engaged to ensure thorough professional assessment of trees as well as prescriptive risk abetment measures.
    - Review the ISA's *Tree Inventory Best Management Practices* in Appendix A.8.
- The FLAT priority matrix should be used to prioritize management and ecosystem improvement activities within green spaces, natural areas, and open spaces.
- Assure quality data through consistent data collection methods.
- Develop quality control measures for data management.
- Research options for municipal tree asset management software
    - Lucity
    - Geographic information system (GIS)
    - TreePlotter
    - TreeWorks

ONGOING STREET TREE INVENTORY

- Build on the success of the Stream Team program's 'citizen science' platform to engage community members in street tree inventory on a long-term basis.
- Develop a citywide work order system that enters all tree work automatically as performed to ensure an accurate progressive tree inventory.

SPECIES AND SITE SELECTION

Providing good planting sites and appropriate trees to fill them is crucial to sustainability. Allowing adequate space for trees to grow and selecting trees that are compatible with the site will reduce the long- and short-term maintenance requirements and enhance their longevity. Avoiding species known to cause allergenic responses is also important.

When selecting trees to plant in the City, it is important to understand the functional, biological, and physical limitations of each site. Choosing "The Right Tree in the Right Place" and caring for it properly are paramount in cultivating and establishing trees.

Minimum tree rooting and soil volumes per species of tree should be established in master design plans for street trees and other green infrastructure, and communicated to developers, builders and landscapers early and often.

Use Appendix A.9: *Street Tree and Landscaping Planting Lists* for an ideal soil volume for specific tree species. This information will in turn inform how sidewalk sizes are determined in Appendix A.10: *Street Design Recommendations.*

STANDARDS FOR TREE CARE

Adhering to professional standards such as the Tree Pruning Guidelines (ISA) and ANSI Z133 and ANSI A300 publications will enhance sustainability.

- Tree Worker Safety: ANSI Z133 – *American National Standard for Arboricultural Operations – Safety Requirements*
    - All tree service contractors who do business in the City must follow safety standards set forth in most current version of ANSI Z133.
    - Refer to the Washington State Department of Labor and Industries to ensure compliance with Washington State safety requirements.
- Tree Maintenance and Management: ANSI A300 – *Tree, Shrub and Other Woody Plant Management for Tree Care Operations*
    - All work performed on trees within City rights-of-way, City-owned trees in Parks and other facilities, and trees within commercial, industrial, and institutional lots should be done according to the standards identified in ANSI A300 – *Tree, Shrub and Other Woody Plant Management for Tree Care Operations.*
    - Trees on private property should be free of tree disfigurement, mal-pruning, and tree topping.
    - The City shall develop and periodically update a *City Tree Care Manual* that defines, promotes, and provides for enforcement of proper tree planning,

planting and maintenance for residential developers, owners' associations, and homeowners.

- o To ensure structurally stable and healthy trees, proper tree pruning should be defined and regulated in the Tumwater Municipal Code (TMC) and *Development Guide*.
- o The City will develop a program to educate residential property owners on proper tree maintenance.

PUBLIC SAFETY

In designing parks and other public spaces, public safety should be a key factor in placement, selection, and management of trees. Regular inspections for potential tree hazards are an important element in the management program.

To ensure public safety in and around urban trees, the removal of trees identified as *high-risk* through evaluation by an ISA Certified Arborist who is Tree Risk Assessment Qualified (TRAQ) should continue to be allowed. All tree risk assessments should identify and rate potential targets the tree could affect, including buildings and infrastructure, emergency service routes, etc. Assessment reports should include mitigation options, if feasible, and attempts to reduce risk through the least destructive methods available, such as arboricultural methods and techniques, which reach desirable risk outcomes through pruning, bracing and cabling, wildlife snag conversion, or similar methods less impactful than complete tree removal. It is also the intention of the City to enhance and maintain wildlife habitat, which includes preserving dead trees and creating wildlife snags where reasonable to preserve wildlife habitat.

REUSE

A sustainable community and urban forest is one that reuses its products by composting, recycles chips as mulch and/or fuel and using wood products as firewood and lumber.

Urban wood reuse presents an opportunity for the City to close the loop in community and urban forestry management and sustainability by making best possible use of removed City resources, such as trees. Branches and leaves may be chipped for municipal landscape use while tree trunks may be salvaged for a number of value-added ecosystem enhancement projects, such as riparian and wetland habitat enhancement, artisan handwork, and milled lumber for City or school use. A wide variety of other possibilities might also be explored as potential funding sources through urban tree care.

COMMUNITY FRAMEWORK

This subsection identifies recommendations regarding the sustainable community framework for the City community and urban forest.

Table 8. Criteria for the Sustainable Community Framework

Criteria	Key Purpose
Public Agency Cooperation	Ensure all City departments and other jurisdictions that have facilities in the City operate with common goals and objectives
Involvement of Large Private and Institutional Landholders	Large private landholders embrace citywide goals and objectives through specific resource management plans.
Green Industry Cooperation	The green industry operates with high professional standards and commits to citywide goals and objectives.
Neighborhood Action	At the neighborhood level, the public understands and participates in community and urban forest management.
Citizen- Government-Business Interaction	All constituencies in the community interact for the benefit of the community and urban forest.
Awareness of the Urban and Community Forest as a Community Resource	The public understands the value of the community and urban forest to the community.
Regional Cooperation	Provide for cooperation and interaction among neighboring communities and regional groups.

PUBLIC AGENCY COOPERATION

City departments and other jurisdictions that have facilities in the City should operate with common goals and objectives regarding the community and urban forest. Achieving this cooperation requires involvement of the City Council and the Tree Board.

Work to ensure the cooperation of both internal City departments as well as other public agencies, such as:

- City Departments
  - Community Development
  - Executive
  - Finance
  - Fire
  - Parks and Recreation
  - Police
  - Public Works
- Tumwater and Olympia School Districts
- Port of Olympia

- Washington State
- Thurston County
- LOTT
- Economic Development Council
- South Puget Sound Community College
- The Evergreen State College
- Washington State University Extension and the Washington State University Extension Master Gardeners
- Regional Cooperation (U.S. Environmental Protection Agency 2013)

INVOLVEMENT OF LARGE PRIVATE AND INSTITUTIONAL LANDOWNERS

Private landholders own and manage most of the community and urban forest. Their interest in, and adherence to, resource management plans is most likely to result from a community-wide understanding and valuing of the community and urban forest. In all likelihood, their cooperation and involvement cannot be mandated.

Institutional and non-government public facilities play an important role in green space continuity and accessibility, in addition to community and urban forest diversity. Public colleges, hospitals, museums, and state agencies should be relatively cohesive in their management of native plants and climate resilient trees.

GREEN INDUSTRY COOPERATION

From commercial growers to garden centers and from landscape contractors to engineering professionals, the green industry has a tremendous impact on the health of the community and urban forest in the City. The commitment of each segment of this industry to high professional standards and their support for citywide goals and is necessary to ensure appropriate planning and implementation.

The City should explore cooperation with the following:
- Non-profit environmental organizations
- Green industries

NEIGHBORHOOD ACTION

Neighborhoods are the building blocks of cities. They are often the arena where individuals feel their actions can make the biggest difference in their quality of life. Since the many urban trees are on private property (residential or commercial), neighborhood action is a key to community and urban forest sustainability.

The City should explore cooperation with the following:
- Neighborhood action groups

- Homeowners associations
- Community groups

CITIZEN-GOVERNMENT BUSINESS INTERACTION

Having public agencies, private landholders, the green industry, and neighborhood groups all share the same vision of the community and urban forest in the City is a crucial part of sustainability. This condition is not likely to result from legislation. It will only result from a shared understanding of the community and urban forest's value to the community and commitment to dialogue and cooperation among the stakeholders.

The City should explore cooperation with the following:
- Thurston Chamber of Commerce
- Tumwater Area Chamber of Commerce
- The Olympia Tumwater Foundation
- Olympia-Lacey-Tumwater Visitor & Convention Bureau
- Service organizations
- Private educational institutions

AWARENESS OF THE URBAN AND COMMUNITY FOREST AS A COMMUNITY RESOURCE

Fundamental to the sustainability of the community and urban forest in the City is the public understanding of the value of its trees. People who value trees elect officials who value trees. In turn, officials who value trees are more likely to require the agencies they oversee to maintain high standards for management and provide adequate funds for implementation.

REGIONAL COOPERATION

Community and urban forests do not recognize geographic boundaries. Linking City efforts to those of neighboring communities enables consideration and action on larger geographic and ecological issues, such as water quality and air quality.

CHAPTER 3 – STRATEGIC PLANNING, IMPLEMENTATION, AND MONITORING

3.01 – STRATEGIC PLANNING – WHAT DO WE WANT?

The strategic plan hierarchy shown below is used to organize the Plan. The graphic below moves from the broad Vision to specific Actions. The Sections that follow explain what each level of the strategic plan hierarchy does.
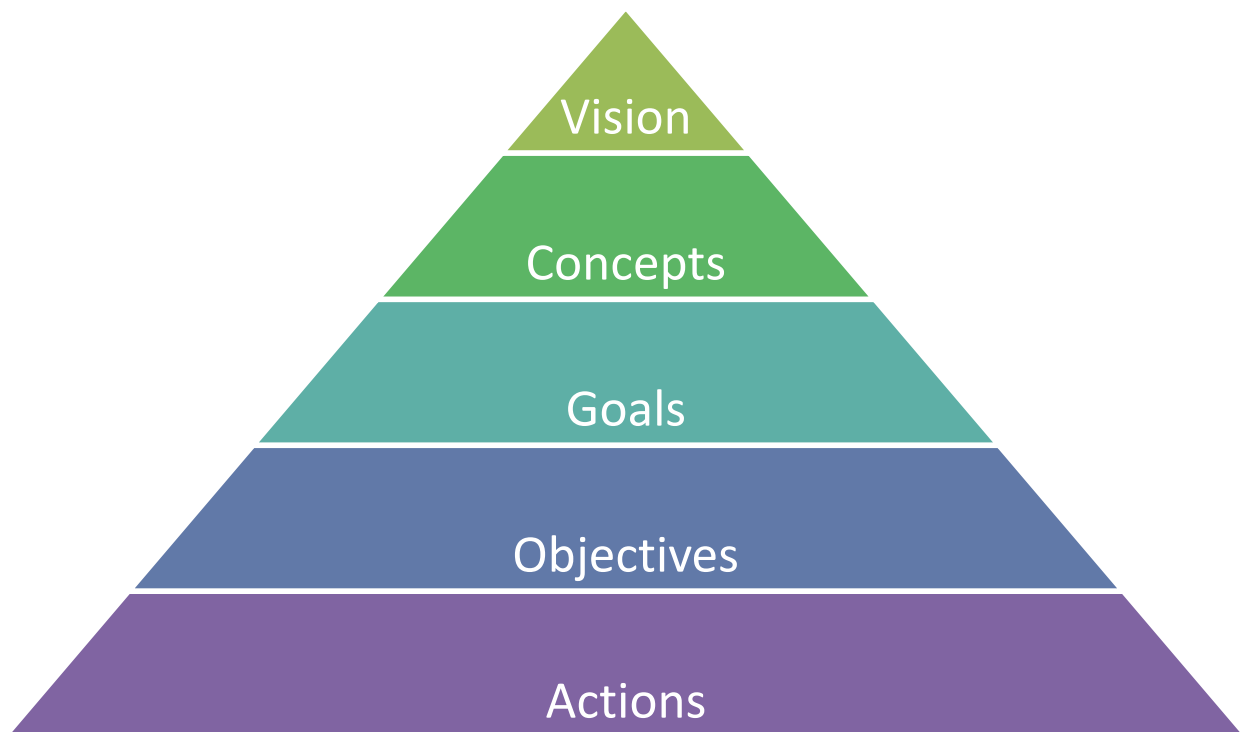
3.01(A) – Vision Statement

Visioning is a planning process through which a community creates a shared vision for its future and begins to make it a reality. The Tree Board took the responses generated by the responses to the question: "What do you want the community and urban forest to look like as a result of the Plan?" as well as the community and City staff surveys and the inventory and analysis work performed by the consultant, and adopted the following vision for the Plan:

The City of Tumwater will align resources to enhance and manage its healthy community and urban forest to enable the ongoing development of the community while protecting its unique environment.

The vision statement will ensure "The Right Tree in the Right Place" to enable the ongoing development of the community while protecting its unique environment.

3.01(B) – Concepts

Concepts are the five general statements indicating a desired end or direction the City will follow to achieve that end. The five concepts expand on the three issues and trends discussed in Section 2.03(C) – *Analysis* of Chapter 2 – *State of the Community and Urban Forest*: vegetative resources, resource management, and community framework. The five Concepts are interconnected as shown below.
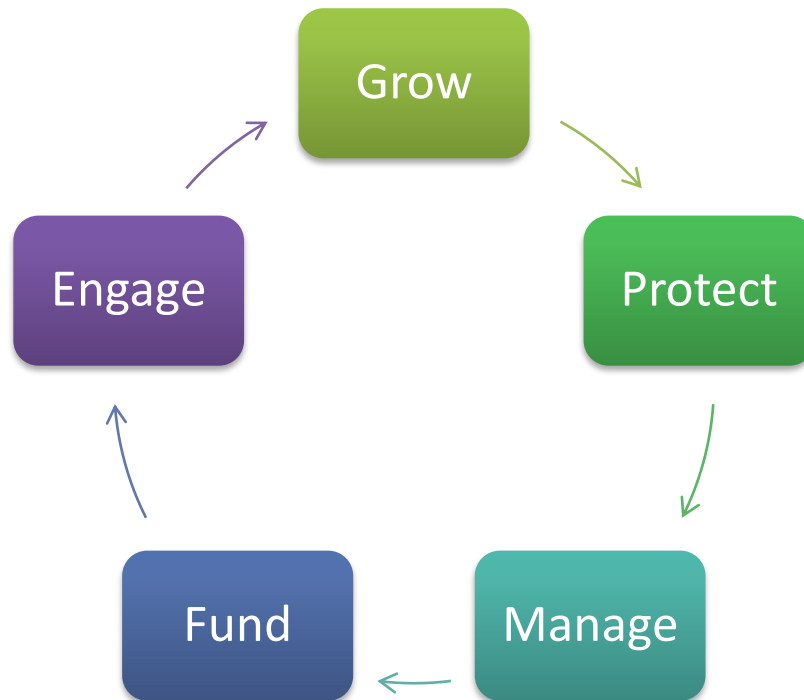
1. **Grow** the community and urban forest through new plantings to maximize the social, economic, and environmental benefits of urban trees and vegetation.

2. **Protect** the community and urban forest from threats and loss by preserving existing trees and understory in the City.

3. **Manage** the community and urban forest through coordinated planning, design, and maintenance to ensure its long-term health and sustainability.

4. **Fund** the community and urban forest by establishing a long-term City finance strategy.

5. **Engage** residents, public agencies, community groups, and the private sector in caring for the community and urban forest and fostering their deeper connection to nature.

3.01(C) – Goals

Goals are general statements indicating a desired result, or direction the City will follow to achieve that intent. Goals frame how the City, residents, and others should work towards meeting what has been identified as community and urban forestry needs. Building on the inventory and analysis work done for the Plan, the Tree Board adopted the following Goals for the Plan. The Goals are grouped under the Concepts outlined above and are developed with Objectives and implementing Actions below.

1. Restore and enhance the community and urban forest.

2. Protect and preserve the community and urban forest, which includes trees, understory, habitat, and soils.

3. Manage City-owned community and urban forestry resources for maximum benefit.

4. Balance the protection and support of the community and urban forest with other City strategic priorities, which include, in part, providing affordable housing, developing a walkable, urban community, economic development, and protecting endangered species.

5. Promote the use of incentives to leverage community and urban forestry aims.

6. Promote community and urban forest stewardship, education, and achievement.

7. Optimize opportunities for partnerships in community and urban forest preservation and enhancement.

8. Give community and urban forest resources an appropriate emphasis within City government and across the community.

3.01(D) – Objectives and Actions Addressing the Goals

Objectives are items specific to the City that support achieving the Goals. They identify the specifics of the City position and define paths to implement Goals.

Actions are specific implementation tasks that fulfill Objectives and support annual work program development.

3.02 – IMPLEMENTATION – HOW DO WE GET THERE?

3.02(A) – Implementation Program

Section 3.01 - *Strategic Planning* established the Plan's Vision, Concepts, Goals, and Objectives, which provide the overall direction of the Plan building on the three issues and trends discussed

in Section 2.03(C) – *Analysis* of Chapter 2 – *State of the Community and Urban Forest*. The Section also listed Actions needed to accomplish the Goals and Objectives.

Section 3.02 - *Implementation* describes how these Actions will be carried out. It is likely that the Actions in the section will be revised based on the monitoring described in Section 3.03 – *Monitoring*.

For each Action, the implementation plan specifies:

- Priority

- Leads

- Timing

3.02(B) – Priorities

Priorities are intended to be used to phase Actions over time so that higher-priority Actions are completed before lower-priority Actions. Priorities are assigned a qualitative value of low, medium, and high.

3.02(C) – Leads

Leads are the primary and secondary City departments, boards, or staff who will be responsible for administering and carrying out the Actions. Leads are identified as being either Primary (P) or Secondary (S).

3.02(D) – Timing

Timing establishes whether Actions will occur on an ongoing basis or every one, three, five, or ten years.

3.02(E) – Funding

Funding to support urban forestry and arboriculture programs can come from a variety of programs for capital and operations, including public and private funds. Funds for capital include support of tree planting, such as standalone projects or as part of another public or private project and major projects to address tree problems, such as removal and replacement of sidewalks and street trees, major tree removal. Operations funds support tree care and maintenance, staff and public education, staffing, and support for Tree Board.

Presently, the City's Street Fund, which is primarily reserved for tree planting and major tree replacement) generates funds from development which pays into the fund in lieu of on-site tree preservation. Aside from the Tree Fund, there is no dedicated tree funding source.

Currently, funding for capital activities comes from street projects (City Street Fund and grants), capital projects (parks, facilities, etc.), and the Tree Fund. New private development is also responsible for tree planting in compliance with the City's tree preservation, landscaping, and design regulations. Operations are directly funded from the City's General Fund (primarily tax supported) to support staff to the Tree Board and tree care in parks, streets and facilities. If trees are located on enterprise fund properties (golf and utilities), the tree care is covered by those funds.

Specific funding initiatives include:

Capital

- Establish a dedicated Tree Fund and Restricted General Fund Sub-Account to replace the current Tree Fund, which is part of the Impact Fee Account. Establish written policies for the use of those revenues generated by mitigation of tree removal.
- Establish regular funding for the Tree Board to support on-going tree projects, similar to the Historical Commission and Parks Board.
- Utilize the City's Capital Facility Plan (CFP) to include specific tree planting projects.
- Establish a formal memorial tree program where the public can donate funds to plant trees.
- Seek grants, from government and private sources, to support tree planting; particularly, look to climate change and global warming mitigation programs for grant opportunities.
- Establish standards for City projects to include tree planting elements in order to leverage funds from capital project.
- Develop a partnership relationship with the Stormwater Utility to support capital projects based on the role that trees play in stormwater mitigation.
- Develop a City culture that values and supports the planting of trees within the City on City property
- Encourage the private planting of trees as a part of private development and on-going private property activities.

Operations

- Assign a fixed amount of the General Fund to support urban forestry activities.
- Look to alternative funding sources, such as the Metropolitan Parks District, Transportation Benefit District, and utilities, to support urban forestry and reduce major maintenance to roads, sidewalks, parks, and utilities.

- Develop a partnership with the Stormwater Utility to support maintenance of the City's urban forest and staffing.
- Create a tree-care endowment fund supported with private donations, an overhead charge on City projects that include trees, and contributions from years when there is surplus one-time revenue that can be dedicated.

As the City Council makes choices of projects and initiatives to implement this Plan, they will have to select from these funding options to support their actions.

3.03 – MONITORING – HOW ARE WE DOING?

3.03(A) – Program for Monitoring and Adaptive Management

The possible situations that may arise over the course of a 20-year period of the *Urban Forestry Management Plan* cannot all be accounted for in this Plan. Concepts, Goals, Objectives, and Implementation Actions will need to be adjusted over time. By monitoring the community and urban forest system, information can be gathered to make these adjustments, which is known as adaptive management.

The goal of the monitoring program is to provide data needed to understand what is happening, why it is happening, and how specific management adjustments will change the outcome. Monitoring is designed to measure progress towards the Concepts, Goals, Objectives, and Actions established in Section 3.01 – *Strategic Planning* and the application of Actions in Section 3.02 – *Implementation*.

3.03(B) – Monitoring Actions

Monitoring Actions are intended to be a quantitative way of measuring whether an Action is achieving the Objective.

3.04 – FORMAT OF CONCEPTS, GOALS, OBJECTIVES, AND ACTIONS

The following is an example of the format used in the Plan to group and organize Concepts, Goals, Objectives, and Actions.

#.01(A) – Concept

A Concept is a general statement indicating a desired end or direction the City will follow to achieve that end.

Goal #. **A Goal is a general statement indicating a desired result or direction the City will follow to achieve that intent. Goals frame how the City, residents, and others should work towards meeting what has been identified as community and urban forestry needs.**

Objective #.1. **An Objective is specific to the City that supports achieving a Goal. They identify the specifics of the City position and define paths to implement Goals.**

Action A. **An Action is a specific implementation task that fulfills an Objective and supports annual work program development.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
A **Priority** is used to phase Actions over time so that higher-priority Actions are completed before lower-priority Actions. A priority is assigned a qualitative value of #1 (high), #2 (medium), and #3 (low). The Tree Board, Planning Commission, and staff identified their top twenty-seven Actions with the ✓symbol.	A **Lead** is the primary and secondary City departments, boards, or staff responsible for administering and carrying out the Actions. Leads are identified as being either Primary (P) or Secondary (S).	**Timing** establishes whether Actions will occur on an ongoing basis or every one, three, five, or ten years.	A **Monitoring Action** is intended to be a quantitative way of measuring whether an Action is achieving the Objective.

3.05 – PLAN CONCEPTS, GOALS, OBJECTIVES, AND ACTIONS

3.05(A) – Grow

Grow the community and urban forest through new plantings to maximize the social, economic, and environmental benefits of urban trees and vegetation.

Goal 1.   **Restore and enhance the community and urban forest.**

Objective 1.1.   **Increase canopy cover in the City to expand the community and urban forest.**

Action A.   **Establish tree-canopy cover targets for the City and its neighborhoods to increase canopy cover in appropriate areas, taking into account land uses established by the *Comprehensive Plan*, community desires, tree functions, climate, and ecosystems.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Public Works (P) Tree Board (S)	Review every five years based on City cycle for acquiring updated LiDAR or equivalent	Measure Tree canopy cover (Percentage of total City land covered by tree canopy and percentage of land use designation and/or neighborhoods covered by tree canopy every five years) Plan includes targets in Chapter 2, Table 5 *Canopy Cover Targets by Land Use Designation* based on 2018 Plan development work

Action B.   **Ensure that landscaping regulations provide for the preservation of trees with potential and the planting of new trees and understory when removing existing trees and understory on public and private properties.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (S)	Review and revise TMC 18.47 *Landscaping* in Winter 2022 and determine if updates are needed every five years thereafter	Evaluate effectiveness of regulations and how they are administered as compared to the Goals, Objectives, and Actions of the Plan

Action C.   **Require appropriate tree planting in new development and redevelopment, by emphasizing proper planning for trees, correct planting techniques, and aftercare that supports the healthy establishment of newly planted trees.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Public Works (S) Tree Board (S)	Review and revise TMC 12.24 *Street Trees* in Fall 2021*, and* TMC 16.08 *Protection of Trees and Vegetation* and TMC 18.47 *Landscaping* in Winter 2022 and determine if updates are needed every five years thereafter	Evaluate effectiveness of regulations and programs as compared to the Goals, Objectives, and Actions of the Plan

Action D.   **Explore non-regulatory programs and incentives to engage the community, plant more trees, and reforest property owned by the City.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (P)	Tree Board work program in 2021 and Tree Board will determine schedule thereafter	Evaluate effectiveness of the programs and incentives as compared to the Goals, Objectives, and Actions of the Plan

Action E. **Support and incentivize the use of large-canopy trees in appropriate areas to provide maximum benefits.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (P) Parks and Recreation (S) Public Works (S)	Tree Board work program in 2023 and Tree Board will determine schedule thereafter	Evaluate effectiveness of the incentives as compared to the Goals, Objectives, and Actions of the Plan

Action F. **Promote the use of native tree and understory species on public and private property to enhance desired wildlife habitat in the City.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (P) Parks and Recreation (S)	Tree Board work program in 2025 and Tree Board will determine schedule thereafter	Review percentage of species distribution on City properties and public rights-of-way

Objective 1.2. **Improve and maintain an optimal level of age distribution and species diversity of trees in the community and urban forest by increasing the use of desirable trees.**

Action A. **Designate tree species based upon specific purposes and site conditions for each project and maximize the benefits of trees while maintaining species diversity.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Parks and Recreation (P) Public Works (P) Tree Board (S)	Ongoing permit review process and City planting work program, determine if Street Tree List and Landscaping Tree List updates are needed every five years	Review percentage of trees in population considered suitable species and diversity ratio of species, genus, and family, especially within City parks and rights-of-way

Action B.   **Stagger new and replacement tree plantings to encourage age distribution and species diversity.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate percentage distribution of trees by diameter at breast height and diversity ratio of species, genus, and family, especially within City parks and rights-of-way

Action C.   **Consider whether planting of edible landscaping such as berry plants and fruit trees would be appropriate in City parks or open spaces, taking into consideration factors such as public safety, attraction of vermin, disease transmission, and maintenance ability and costs.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (P) Parks and Recreation (S) Public Works (S)	Tree Board work program in 2025 and Tree Board will determine schedule thereafter	Calculate health and maintenance costs

Objective 1.3.   Establish a full complement of beautiful, healthy trees in the City by planting trees in locations that maximize their ability to grow while minimizing damage to the essential infrastructure of the City.

Action A.   Plan citywide for trees along City streets and in City parks and open spaces, maintain an approved City planting list, and designate nuisance trees for removal and replacement.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Fall 2021 as a work program item using data gathered for Plan and evaluate every five years thereafter	Determine percentage distribution of trees by diameter at breast height, diversity ratio of species, genus, and family, and damage to infrastructure within City parks and rights-of-way

Action B.   Develop a partnership with the City Stormwater Utility to support maintenance of the City's urban forest and staffing.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Public Works (P) Community Development (S))	Start in Fall 2021 as a work program item and evaluate every five years thereafter	Evaluate effectiveness of the recommendations

Action C.   Look at enlarging planting sites to capture stormwater, benefit trees, and reduce hardscape damage such as sidewalk failures or gratings not fitting due to confined growing space for trees. Consider increasing resources to prioritize repairing sidewalk damage.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Public Works (P) Community Development (S) Parks and Recreation (S)	Start in Fall 2021 as a work program item and evaluate every five years thereafter	Evaluate effectiveness of the requirements

Action D. **Encourage engineering solutions in planting sites such as silva cells, automatic watering systems, or similar options to ensure the healthy growth of trees.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Public Works (P) Community Development (S) Parks and Recreation (S)	Start in Spring 2025 as a work program item and evaluate every five years thereafter	Evaluate effectiveness of the recommendations

3.05(B) – Protect

Protect the community and urban forest from threats and loss by preserving existing trees and understory in the City.

Goal 2. Protect and preserve the community and urban forest, which includes trees, understory, habitat, and soils.

Objective 2.1. Use regulatory and non-regulatory approaches to protect and retain the community and urban forest to the extent practicable within the context of necessary growth and development.

Action A. Enforce tree protection regulations to protect healthy existing trees and forested areas and replace on public and private properties.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Police (S)	Evaluate every five years after Plan approval	Determine annual number and type of enforcement actions

Action B. Enforce landscaping regulations to preserve existing trees and understory as well as replace on public and private properties.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P)	Evaluate every five years after Plan approval	Determine annual number and type of enforcement actions

Action C. **Implement tree-pruning standards for trees on public property such as street trees, trees in critical areas, public land, parks, and trees in natural areas and remnant forests.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Parks and Recreation (P) Public Works (P) Community Development (S)	Start in Fall 2021 with full implementation in two years and determine if updates are needed every five years thereafter	Determine percentage of street trees following standard pruning standards and evaluate the effectiveness of the standards as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Explore non-regulatory programs and incentives to engage the community and allow for the retention, planting, and replanting of more trees.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (P)	Tree Board start work in 2021 and Tree Board will determine schedule thereafter	Evaluate effectiveness of the incentives as compared to the Goals, Objectives, and Actions of the Plan

Action E. **Develop incentives to promote tree retention, planting, and replanting.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (P)	Tree Board start work in 2021 and Tree Board will determine schedule thereafter	Evaluate effectiveness of the incentives as compared to the Goals, Objectives, and Actions of the Plan

Action F.   **Put into practice tree pruning requirements and standards.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S)	Start in Spring 2023 with full implementation in two years and determine if updates are needed every five years thereafter	Evaluate effectiveness of the requirements and standards as compared to the Goals, Objectives, and Actions of the Plan

Action G.   **Implement, in coordination with the Noxious Weed Board and the Washington State Department of Fish and Wildlife, an invasive flora and fauna species control strategy citywide to safeguard the health of the community and urban forest.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S)	Start in Spring 2023 with full implementation in two years and monitor biennially thereafter	Evaluate percentage of invasive plant and animal species distribution on City properties and public rights-of-way

Action H.   **Coordinate with the Fire Department on actions to minimize fire risks associated with urban forestry.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Fire (P) Community Development (S) Parks and Recreation (S) Public Works (S)	Start in Spring 2023 with full implementation in two years and monitor biennially thereafter	Evaluate effectiveness of the requirements and standards as compared to the Goals, Objectives, and Actions of the Plan

Action I.   **Remove trees and understory in specific situations identified in the Tumwater Annex to the *Natural Hazard Mitigation Plan for the Thurston Region* to guard against wildfire.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S) Fire (S)	Start in Spring 2023 with full implementation in two years and determine if updates are needed every five years thereafter	Track annual removals

Action J.   **Designate, register, and promote heritage trees.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Spring 2023 based on Peninsula Environmental Group work and update every five years thereafter	Track number of trees considered heritage trees on an ongoing basis

Action K.   **Prioritize replacement of dead, diseased, or dying trees, as well as those damaged or removed for other reasons, such as motor vehicle collisions and construction projects.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S) Fire (S)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Track number of replacements annually

Objective 2.2.   Develop a City street tree-trimming program.

Action A.   Develop tree-trimming areas based on optimal equipment mobilization, priority locations, current tree inventory, and best management practices.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Parks and Recreation (P) Public Works (P)	Start in Fall 2021 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Objective 2.3.   Respond to view blockage complaints regarding City trees blocking private views.

Action A.   Thin and skirt trees before considering removal.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action B.   Develop criteria and findings in order to make consistent decisions for requests to alter trees for view purposes.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Prohibit inappropriate tree topping using education and enforcement. Where overhead power lines are creating conflicts, consider replacing the trees with shorter species or burying the power lines to reduce such conflicts.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Consider tree growth patterns as a factor prior to planting, especially in instances where a dense sight obscuring barrier or exceptionally large tree is not desirable, such as in front of a business.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Parks and Recreation (P) Public Works (P)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Objective 2.4. **Support managed resource forests where they exist.**

Action A. **Document managed resource forests in the City.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P)	Start in Spring 2025 with full implementation in two years and track every five years thereafter	Track managed resource forests

Action B. **Allow the harvesting of trees in managed resource forests if the management practices of these forests follow Washington State Department of Natural Resources Forest Practices Act rules and provide for continued growth and health of managed resource forests.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P)	Start in Spring 2025 with full implementation in two years and track every five years thereafter	Track harvests

Action C. **Consider only allowing sustainable harvest methods such as selective logging along with replanting as a way to reduce impacts associated with tree harvesting in managed resource forests and City-owned forests.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Allow the harvest of trees if done in support of *Comprehensive Plan* policies for new or expanded agricultural uses that grow or raise food for at least ten years.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P)	Start in Spring 2025 with full implementation in two years and track every five years thereafter	Track harvests

Action E.   **Designate tax revenues, such as the business and occupation tax, from timber harvests in managed resource forests specifically for tree related projects and programs within the City.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Executive (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

3.05(C) – Manage

Manage the community and urban forest through coordinated planning, design, and maintenance to ensure its long-term health and sustainability.

Goal 3.   Manage City-owned community and urban forestry resources for maximum benefit.

Objective 3.1.   Promote efficient and cost-effective management of the community and urban forest by selecting, situating, and maintaining urban trees appropriately to maximize benefits and minimize hazards, nuisances, hardscape damage, and maintenance costs.

Action A.   Ensure that future development of City property is consistent with the *Urban Forestry Management Plan*.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (P) Parks and Recreation (P) Public Works (P)	Start in Spring 2021 with full implementation in two years and review every five years thereafter	Tree Board review

Action B.   Develop and enforce design phase and preconstruction coordination protocols to ensure "The Right Tree in the Right Place."

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Public Works (P) Parks and Recreation (S)	Start in Spring 2021 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the protocols as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Define and assign street tree maintenance and care responsibilities and publicize for greater awareness and compliance.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Public Works (P)	Start in Fall 2021 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Prioritize and schedule City-assigned street tree maintenance activities according to inventory-documented needs.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Public Works (P)	Start in Fall 2021 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program using GIS data as compared to the Goals, Objectives, and Actions of the Plan

Action E. **Develop a program to work with public and private property owners in maintaining and providing for public safety with the community and urban forest.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Objective 3.2. **Adopt best management practices and resource management assessment tools and data management to improve City tree maintenance to manage City-owned community and urban forest areas.**

Action A. **Maintain an ongoing training program for City staff to retain the expertise and professional qualifications to manage the City-owned portion of the community and urban forest.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Parks and Recreation (P) Public Works (P) Community Development (S)	Start in Fall 2021 with full implementation in two years and evaluate every five years thereafter	Track annual number of community and urban forestry training hours per full time equivalent staff annually

Action B. **Regularly review and update the Public Works standards, the *Development Guide*, and facilities procedures for the maintenance of City trees and the community and urban forest and modify to reflect best tree management practices and employee safety.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the standards and requirements as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Develop a program to eliminate deferred maintenance while being mindful of budgetary constraints.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Executive (S)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Train staff in City departments who work with trees in basic tree biology, minimum requirements for health and stability, tree care, and other topics as pertinent to assigned staff duties.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action E. **Train City staff interested in more advanced arboriculture and support development of an in-house professional team to plan and care for City-owned trees.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action F. **Develop resources for proper tree care that are available to the public, simple to reference, and easily understood.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Objective 3.3.   Improve the health and care of City trees through good horticultural practices.

Action A.   Develop the recommended City Street Tree and Landscaping Tree Lists based on local experience.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	*Street Tree List* and *Landscaping Tree List* in the Plan and evaluate every five years thereafter	Evaluate effectiveness of the lists as compared to the Goals, Objectives, and Actions of the Plan

Action B.   Encourage the planting of City trees that have the potential for good local performance and over time will achieve a diversity of species for greater stability of the community and urban forest.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Determine diversity ratio of species, genus, and family, especially within City parks and rights-of-way

Action C.   Monitor the composition and performance of existing trees on City property and assess their sustainability.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Parks and Recreation (P) Public Works (P)	Start in Spring 2025 with full implementation in two years to review street trees after planting to see if they are still healthy and appropriate for the location after five and then ten years	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Develop an experimental species program to identify and plant new tree species.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) City Tree Professional (S) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action E. **Consider the implications of having the City assume maintenance responsibilities for all street trees in City rights-of-way.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Public Works (P) Community Development (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate cost and effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Objective 3.4. **Establish or enhance the character of City streets using trees in City rights-of-way, where adequate rights-of-way exist.**

Action A. **Use the updated *Comprehensive Street Tree Plan* to guide the enhancement of the visual appeal of the City.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Public Works (P) Community Development (S) Tree Board (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the Plan as compared to the Goals, Objectives, and Actions of the Plan

Action B. **Maintain and regularly update an ongoing planting plan for vacant street tree sites based on inventory data, which includes designating species for new and replacement trees based on the Street Tree List that focuses on filling canopy gaps to produce equitable access to tree benefits and green space throughout the City.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Parks and Recreation (P) Public Works (P)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the Plan as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Consider developing unified street tree themes as part of the *Development Guide* update.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Public Works (P) Community Development (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Determine whether themes are established

Action D. **Incorporate street trees and landscaping when the City reconstructs streets to the extent feasible.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Public Works (P) Community Development (S)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate effectiveness of the Plan as compared to the Goals, Objectives, and Actions of the Plan

Objective 3.5.   Reuse all green products from City trees considering highest and best use such as lumber for wood products down to mulch for planting areas.

Action A.   Establish a program with protocols for collecting materials from tree removals and distributing them to local users, such as other public agencies, schools, green industries, or woodworkers.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Parks and Recreation (P) Public Works (P) Community Development (S) Tree Board (S)	Start in Spring 2025 with full implementation in two years and evaluate every five years thereafter	Evaluate cost and effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Objective 3.6.   Measure the ecological, environmental, and economic benefits of the community and urban forest.

Action A.   Maintain the citywide street tree inventory data on an ongoing basis by using municipal tree asset management software such as Lucity, TreePlotter, or TreeWorks with the geographic information system (GIS).

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Public Works (P) Community Development (S) Parks and Recreation (S)	Start in Fall 2021 with full implementation in two years and evaluate every five years thereafter	Evaluate cost and effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action B. **Use a citywide work order system that enters all street tree work automatically as performed to assure quality data through consistent data collection methods and ensure an accurate progressive tree inventory.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Public Works (P) Community Development (S)	Start in Spring 2023 with full implementation in two years and evaluate every five years thereafter	Evaluate cost and effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Update the street tree inventory data with major surveys regularly coinciding with the review and update of the *Comprehensive Street Tree Plan*.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and then every six years thereafter	Evaluate cost and effectiveness of the program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Take the tree health assessment prepared for the *Urban Forestry Management Plan* and identify specific varieties regularly that will survive the urban environment, climate impacts, and winter wind and ice storms.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and then every six years thereafter	Track whether assessment is completed

Action E. Calculate the economic benefits of the community and urban forest in the City regularly.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Public Works (S)	Start in Spring 2025 and then every six years thereafter	Track whether assessment is completed

Action F. Assess the benefits of the community and urban forest, and potential benefits from new and replacement plantings, including carbon storage, increased canopy cover, stormwater captured, energy saved, and aesthetics regularly.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Public Works (S)	Start in Spring 2025 and then every six years thereafter	Track whether assessment is completed

Action G. Integrate the community and urban forestry into the City framework for sustainability.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and then every six years thereafter	Track whether assessment is completed

Action H. Consider the effects of climate change when reviewing the long-term health and suitability of the community and urban forest in the City to manage diseases and pests.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and then every six years thereafter	Track whether assessment is completed

Action I. **In measuring the ecological and environmental benefits, periodically review similar findings of the Thurston County and Cities of Lacey and Olympia forest management plans.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and then every six years	Track whether assessment is completed

Goal 4. **Balance the protection and support of the community and urban forest with other City strategic priorities, which include, in part, providing affordable housing, developing a walkable urban community, economic development, addressing climate change, and protecting endangered species.**

Objective 4.1. Update the *Urban Forestry Management Plan* and supporting regulations regularly and ensure they work in harmony with other City strategic priorities.

Action A. **Ensure that mitigation and conservation areas created under an approved Habitat Conservation Plan are exempt from tree preservation regulations.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P)	Start in Winter 2022 and evaluate every six years thereafter	Evaluate the Plan as compared to the Goals, Objectives, and Actions of the Plan

Action B. **Review the *Urban Forestry Management Plan* regularly to monitor its progress, maintain its schedule, revise based on new information, and ensure that it is working with other City strategic priorities, plans, and regulations.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Spring 2023 and then every four years	Evaluate the Plan as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Use adaptive management to review the effectiveness of specific Actions during the *Urban Forestry Management Plan* timeline.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Public Works (S) Tree Board (S)	Start in Spring 2025 and then every six years	Evaluate the Plan as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Review tree preservation, landscaping, and street tree regulations regularly to ensure that they are working with other City strategic priorities, plans, and regulations, responding to changes in climate, and implementing the *Urban Forestry Management Plan*.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Spring 2023 and then every four years	Evaluate regulations as compared to the Goals, Objectives, and Actions of the Plan

Action E.   **Review and update the *Comprehensive Street Tree Plan* regularly to reflect "The Right Tree in the Right Place" strategies, including plantings in planter strips and medians and encourage planting of native tree species, where appropriate.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Public Works (S) Tree Board (S)	Start in Spring 2023 and then review 20% of the City annually	Evaluate the Plan as compared to the Goals, Objectives, and Actions of the Plan

Action F.   **Review the Street Tree List and Landscaping Tree List regularly to ensure plant choices and tree selection implement the *Urban Forestry Management Plan*.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2025 and then every six years	Evaluate lists as compared to the Goals, Objectives, and Actions of the Plan

Action G.   **Review regulations to allow the continued operation of managed resource forests.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 and then every six years	Evaluate the regulations as compared to the Goals, Objectives, and Actions of the Plan

3.05(D) – Fund

Fund the community and urban forest by establishing a long-term City finance strategy.

Goal 5. **Promote the use of incentives to leverage community and urban forestry aims.**

Objective 5.1. **Develop a stable funding source and budget for activities that support the community and urban forest.**

Action A. **Develop a stable funding source and budget for annual maintenance and selective harvest of trees within developed landscaped City property, such as City street trees and City facilities and parks.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Parks and Recreation (P) Public Works (P) Community Development (S) Executive (S)	Start in Spring 2021 and then biennially thereafter	Review City Budget

Action B. **Develop a stable funding source and budget for maintenance of natural forests on City lands such as critical or shoreline areas and their buffers and other such areas.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Parks and Recreation (P) Public Works (P) Community Development (S) Executive (S)	Start in Spring 2021 and then biennially thereafter	Review City Budget

Action C.   **Secure funding for a four-year cycle of tree trimming.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Executive (S)	Start in Spring 2023 and then every four years thereafter	Review City Budget

Action D.   **Conduct, budget, and report to City staff on an inventory of trees for species, number, condition, and maintenance needs in developed landscaped areas on City property, such as City street trees and trees in City facilities and parks.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S) Executive (S)	Start in Spring 2023 and review City Budget biennially	Evaluate regulations as compared to the Goals, Objectives, and Actions of the Plan

Action E.   **Provide a budget for training, education, and public outreach in regards to best management practices for tree trimming.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S) Executive (S)	Start in Spring 2025 and review City Budget biennially	Review City Budget and base on annual number of community and urban forestry training hours per full time equivalent staff

Objective 5.2. **Fund and manage the community and urban forest to maximize community benefits for all.**

Action A. **Establish consistent City staffing and resources to sustain the *Urban Forestry Management Plan* and maximize benefits for the community.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Executive (S) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Fall 2021 and review City Budget biennially	Review City Budget

Action B. **Establish new community and urban forestry maintenance enhancement funding sources.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S) Executive (S) Tree Board (S)	Start in Spring 2023 and review City Budget biennially	Review City Budget

Action C. **Work with City departments and other public agencies that have facilities in the City to make tree preservation and tree planting a priority in their plans and operations.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Parks and Recreation (P) Public Works (P) Community Development (S) Executive (S)	Start in Spring 2023 and review City Budget biennially	Evaluate work compared to the Goals, Objectives, and Actions of the Plan and review City Budget

Action D. **Hire an urban forester, certified arborist, or urban ecologist on City staff or look to share that position with other jurisdictions or departments or as part of a wider City environmental manager position to manage the community and urban forest to assist in development review, respond to inquiries, and assess individual tree-health issues.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Executive (S) Parks and Recreation (S) Public Works (S)	Start in Spring 2023 and review City Budget biennially	Review City Budget

3.05(E) – Engage

Engage residents, public agencies, community groups, and the private sector in caring for the community and urban forest and fostering their deeper connection to nature.

Goal 6.   Promote community and urban forest stewardship, education, and achievement.

Objective 6.1.   Increase awareness and engage the community in active stewardship of the community and urban forest as a community resource.

Action A.   Communicate how the community and urban forest is integral to quality of life in the City and affirm that it is considered when the City Council establishes strategic priorities and makes budget and regulatory decisions; City boards and commissions make development and regulatory recommendations; City staff implement adopted plans and codes; and City residents, property owners, and business owners make landscaping decisions.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action B.   Actively maintain the City Tree webpage to educate the public on the importance of trees, property care and maintenance, and other tree related information.

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Fall 2021 and evaluate every five years thereafter	Evaluate webpage as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Use the *Urban Forestry Management Plan* as a springboard for a citywide habitat and stewardship strategy.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Work with schools, nurseries, or other public and private landowners to construct tree species test plots.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Objective 6.2. **Maintain a community and urban forestry educational program.**

Action A. **Look for opportunities to build on and expand existing City educational outreach programs to increase the understanding of the value of the community and urban forest, as well as the responsibilities of the public and private landowners regarding its planting, maintenance, thinning, and harvest.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2021 and evaluate every five years thereafter	Measure number of programs and evaluate as compared to the Goals, Objectives, and Actions of the Plan

Action B.   **Develop a citywide volunteer planting program.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action C.   **Compile and publicly distribute a list of recommended tree species and their potential uses in the community and urban forest, which would include notable traits, such as whether they produce an allergic response, and appropriate locations for planting individual species.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action D.   **Collaborate with non-profit groups, such as schools or other organizations to provide community and urban forestry education.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action E. **Enhance awareness of trees within the City by providing interpretive species labels at prominent City locations and along key pedestrian streets. This could include botanical name, origin, common name, and date planted.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Objective 6.3. **Provide education and incentives for maintaining and enhancing the number of trees in community and urban forests on private property.**

Action A. **Develop education and incentive programs focused on maintaining the community and urban forest found on private property.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Fall 2021 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action B. **Share best tree maintenance practices with private landowners.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Provide educational material on-line regarding tree selection and care.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Encourage additional tree planting on private properties.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action E. **Work with homeowner associations to manage designated tree areas in subdivisions.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Objective 6.4. **Improve communication and coordination regarding the community and urban forest.**

Action A. **Retain "Tree City USA" status by complying with Arbor Day Foundation requirements.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (S)	Annually, starting in 2021	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action B. **Hold annual meetings between City department representatives and the Tree Board as part of the implementation of the *Urban Forestry Management Plan*.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (P) Public Works (P) Tree Board (P)	Annually, starting in 2021	Track number of annual meetings

Action C. **Establish administrative procedures to enhance City interdepartmental communications and aid in the further success of the *Urban Forestry Management Plan*.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2023	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action D. **Prepare and distribute a "State of the community and urban forest" regularly.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2025	Track number of reports prepared

Action E.   **Connect with residents by hosting a citywide celebration of community and urban forests in the City every year on Arbor Day.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (P)	Annually, starting in 2021	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Goal 7.   **Optimize opportunities for partnerships in community and urban forest preservation and enhancement.**

Objective 7.1.   **Promote collaborations between residents, neighborhood associations, governments, nonprofits, and businesses.**

Action A.   **Maintain and support the Tree Board.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#1 ✓	Community Development (P) Tree Board (P)	Annually, starting in 2021	Track number of Tree Board meetings held annually

Action B.   **Formalize relationships with organizations and green industries that share common aims affecting community and urban forest sustainability.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Spring 2023 and track every five years thereafter	Track number of affiliations or partnerships with regional and national organizations

Action C.   **Collaborate with service organizations to plant City street trees and trees in City parks and open spaces.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan and track number of volunteer hours supporting community and urban forestry

Action D.   **Build on and support the improvements made to the tree cover by the Stream Team program, the Parks and Recreation Department, and other organizations that meet multiple City aims.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan and track number of volunteer hours supporting community and urban forestry

Action E.   **Work with neighborhood and homeowner associations in community and urban forestry activities.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Public Works (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action F.   **Collaborate with local tree and landscape contractors to distribute informational materials.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and track every five years thereafter	Track number of businesses contacted who are licensed to practice arboriculture

Action G.   **Work with the Tree Board to develop a prioritized list of community and urban forest enhancement opportunities and projects citywide.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (P) Parks and Recreation (S) Public Works (S)	Start in Spring 2025 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action H.   **Involve volunteers in the tree inventory of all City street trees and trees in City parks performed regularly.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Tree Board (S)	Start in Spring 2025 and evaluate every six years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action I.   **Work with representatives of the Native Plant Salvage Project to accomplish tree-planting projects.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#3	Community Development (P) Public Works (S) Tree Board (S)	Start in Spring 2025 and evaluate every six years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action J. **Work with local tree and landscape contractors, as well as retail and wholesale landscaping firms, to stock trees suitable for the urban environment.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2023 and evaluate every six years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Goal 8. **Give community and urban forest resources an appropriate emphasis within City government and across the community.**

Objective 8.1. **Provide an example through the highest standard of care and management for all City-owned trees, in order to ensure the perpetuation of the community and urban forest.**

Action A. **Use the City website and social media for periodic articles on the proper care and maintenance of trees on public and private property.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Tree Board (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action B. **Identify tree specimens, including heritage trees, on City property that illustrate proper tree care and discuss in articles on the City website and social media.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

Action C. **Compile and distribute a list of local tree species and their performance under known conditions.**

Priority	Leads [Primary (P) & Secondary (S)]	Timing	Monitoring Action
#2	Community Development (P) Parks and Recreation (S) Public Works (S) Tree Board (S)	Start in Spring 2023 and evaluate every five years thereafter	Evaluate program as compared to the Goals, Objectives, and Actions of the Plan

APPENDICES

A.1 – PENINSULA ENVIRONMENTAL GROUP TECHNICAL REPORT

URBAN FOREST ASSESSMENT RESULTS

Prepared for the City of Tumwater
January 2020

PENINSULA ENVIRONMENTAL GROUP, INC.
Community Specific — Resource Specific Planning

Urban Forest Assessment Results

January 2020

Prepared for:

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1. INTRODUCTION

Trees measurably improve the livability of cities as they amplify human experience and wellbeing through environmental, economic and social benefits. Accessible, accurate and actionable urban forest and tree resource planning accelerates and strengthens the benefits received from urban and community forests. With this understanding, the City of Tumwater Tree Board commissioned a study on urban forest resources within the City. This report outlines the purpose, methods and results of multiple urban forest assessments and inventories undertaken by the City of Tumwater and Peninsula Environmental Group, Inc. in 2018 and 2019. Information presented in this report will guide leaders, planners and the community towards successful urban forest planning and resilient resource management.

Tumwater's historical and geographical context, as one of Washington's first settlements and the southernmost point of the Puget Sound and terminus of the Deschutes River, are important factors when understanding the emphasis, it's leaders place on natural resources, of which the urban forest is an important element. To reinforce this importance, City of Tumwater's leaders identified the desire to *Be a Leader in Environmental Sustainability* as a Strategic Priority and Goal for 2019-2024[7].

The City's Urban Forestry Consultants (UFC) conducted urban forest assessments and inventories including a significant street tree inventory, two geospatial urban tree canopy assessments, and a green spaces inventory. This report will be used in preparation of the 2020-2040 Tumwater Urban Forest Management Plan. **Table 9** summarizes the different scales, geographic focuses, strategies and methods for each different assessment. Each section within this document describes the purpose, methods, brief data analysis and summary.

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[7] City of Tumwater Council Resolution R2018-020

A STREET TREE INVENTORY was conducted on all trees growing within or near sidewalks in Tumwater. These include all residential trees installed in sidewalks and street trees on the sides of main roads. In total roughly 3,500 trees were identified and inventoried. Our inventory data aligned with the United States Forest Service's (USFS) i-Tree protocol for easy data migration into the software. In addition to the i-Tree data points, the urban forest team collected data on sidewalk displacement and planter types in order to study relations between tree species and hardscape damages.

GREEN SPACES owned by the City of Tumwater, including undeveloped natural areas, developed parks, and hybrid locations, were inventoried and assessed to prioritize their management. The urban forest team identified highly effective landscapes and those landscapes tolerance and associated threat in relation to forest pathogens and noxious weeds. In addition to rapid green space assessment and applied management perspectives, this inventory allows the City to understand green space equity and associated environmental justice. Understanding spatial proximity these healthy and unhealthy green spaces to schools, neighborhoods, and transit corridors allows for long-term planning of zoning and green space investment.

URBAN TREE CANOPY ASSESSMENTS were conducted using 2011 and 2017 datasets, with an auxiliary analysis on 2018 information. The goal of the Tumwater urban tree canopy (UTC) assessment is to aid in City-wide and long-term management decisions influencing the percentage of urban forest canopy across the city. This geospatial assessment works with image classification software utilizing recent aerial orthoimagery, near-infrared imagery, and LiDAR, to differentiate land cover types.

On additional inventory was conceptualized but not carried out: an i-Tree Eco plot-based ecosystem services inventory. This inventory is similar to the i-Tree Eco Street Tree inventory, but incorporates other components of the urban landscape, including hard surfaces and built infrastructure. The result is a more in-depth understanding of urban ecosystem services beyond the benefits of street trees.
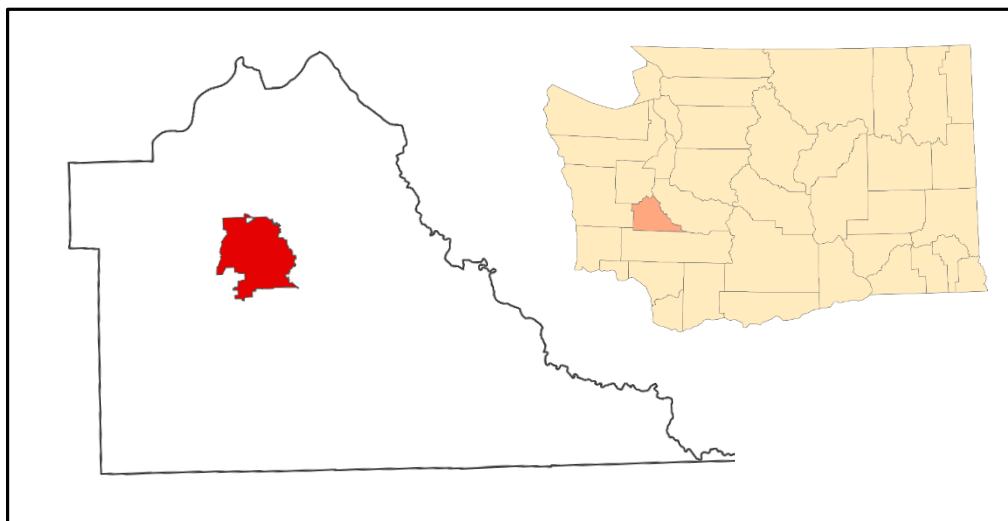
Figure 1: Tumwater is part of Thurston County in the South Sound of Washington.

Table 9: Summary Comparison of Methods Used and Proposed in Tumwater's Urban Forest Assessments.

ASSESSMENT	SCALE	INFORMS
STREET TREE INVENTORY	Individual trees	• Provides location, condition, and maintenance objectives on street trees. • Identifies infrastructure conflicts with trees. • Can be used with asset management software for informing in real-time. • i-Tree analysis on individual trees.
GREEN SPACES INVENTORY	Forested and natural management units	• Forest management prioritization framework. • Identified high and low priority management units.
URBAN TREE CANOPY ASSESSMENT	Tumwater urban growth area and land use	• Informs tree canopy preservation and planting goals across multiple zoning and land use boundaries. • Used in City-wide Canopy Cover Goals.
ECOSYSTEM SERVICES INVENTORY	Tumwater urban growth area and land use	• Model estimates ecosystem functions and economic values based on collected data. • i-Tree Eco plot driven ecosystem service tabulation, including urban forest values.

2. STREET TREE INVENTORY

2.1. PURPOSE & EXTENT

An extensive street tree inventory was conducted in 2018 to capture information on tree assets growing in or affecting the public right-of-way. All street trees and street tree stumps on city sidewalks in the City of Tumwater and Urban Growth Area (UGA) were inventoried. Criteria for street tree selection were trees growing between a street and a sidewalk, or within a sidewalk. This includes trees planted in cutouts, sidewalk strips, boulevards, or freeform planting areas. We did not inventory trees on the interior, or landowner side, of sidewalks but rather only those facing the street right-of-way. Large, landmark and historical trees throughout the City were inventoried where they were recognizable and accessible via the public right-of-way, or on city-owned property.

Data collected from trees followed the specifications of the United States Forest Service's (USFS) i-Tree Eco software. Beyond the USFS i-Tree Eco required data, additional information was collected planter type, the proximity of the tree to curbs, streets and sidewalks, and any damage to those hard surfaces.

Street trees often substantially affect human lives and wellbeing due to their accessibility. These factors make the sustainable management and proper care and maintenance of street trees important. Through this base-line inventory, Tumwater can begin managing street trees as assets similar to other essential city infrastructure.

2.2. METHODOLOGY

The City of Tumwater provided a GIS layer depicting locations of all public, city-owned sidewalks. Using this layer, and 2017 aerial imagery, sidewalks across the city were assessed remotely to determine

presence of trees. These areas were divided into subsets for inventor crews. The City advertised and facilitated Urban Forestry volunteer groups between July 2018 and September 2018. These volunteer

groups were led by UFC arborists or foresters, with data collected on tablets with survey software developed by UFC.

Volunteer events were carried out one weekend a month in June, July, August, and September of 2018. Volunteers were trained with a brief training and safety meeting held at Tumwater City Hall the morning of the events. Trees in busy commercial and industrial areas were inventoried solely by the UFC to

minimize exposure to volunteers. After the primary inventory phase, the UFC and City of Tumwater staff identified any areas which still required surveying, and they were assessed for matching criteria.

The volunteer field crew's tools included a tablet with connectivity, a Bluetooth GPS sensor, a Biltmore stick, yard sticks, compass and a rangefinder. A complete list of data points collected, their definitions, and their available attributes, are in the appendix.

2.3. RESULTS

In total around 3,500 trees were inventoried. The vast majority of street trees inventoried (roughly 97%) were deciduous broadleaf trees, and generally young to adolescent (53% identified as less than 6″ diameter.). Acer (maple), Prunus (apples, cherries,

plums) and Pyrus (pears) represent over 50% of the total species identified. Conditions of the street trees averaged 3.85 for the top 10 tree species, where Good is 4 and Fair is 3.
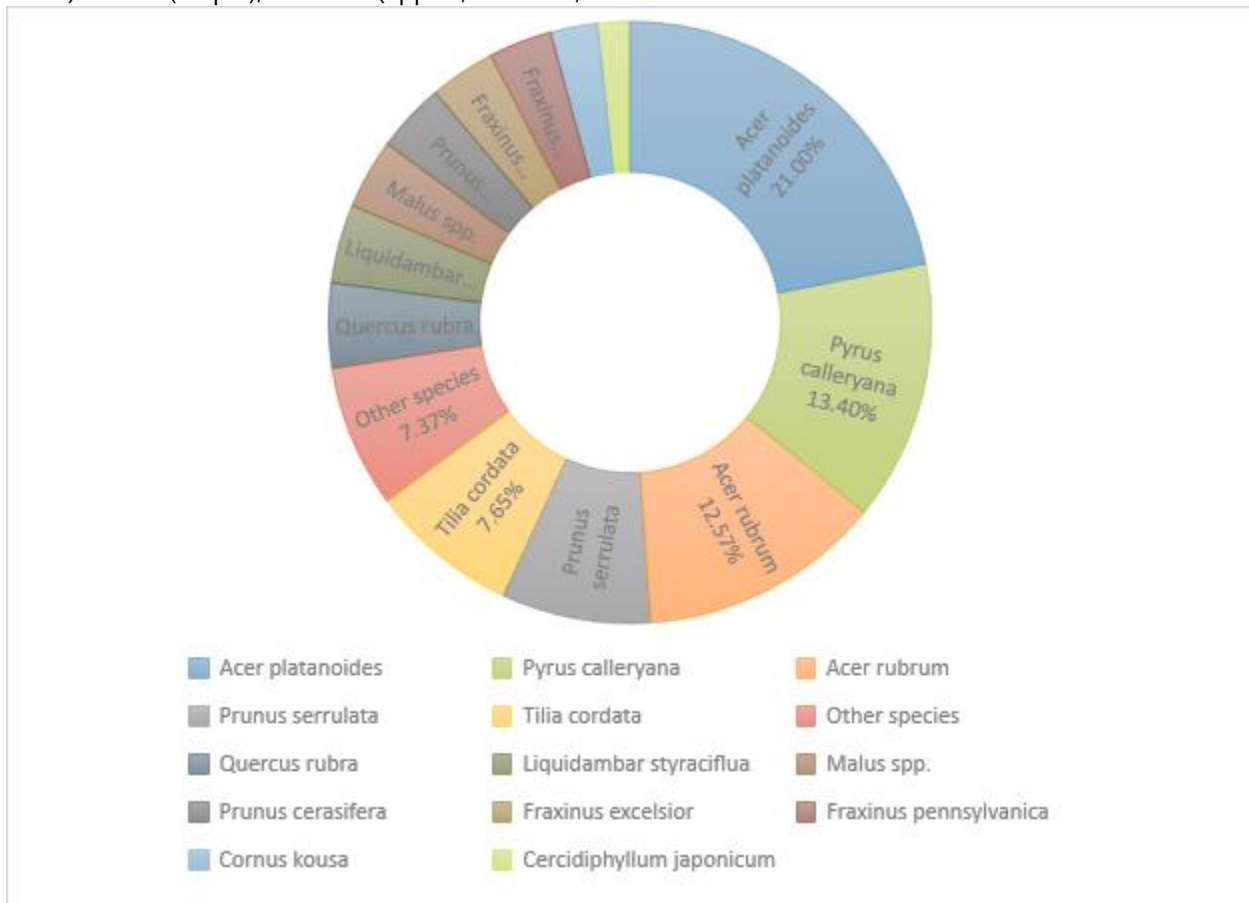
Figure 2: Top 15 street tree species

Figure 3: Street tree percentage by Tumwater Zone District.
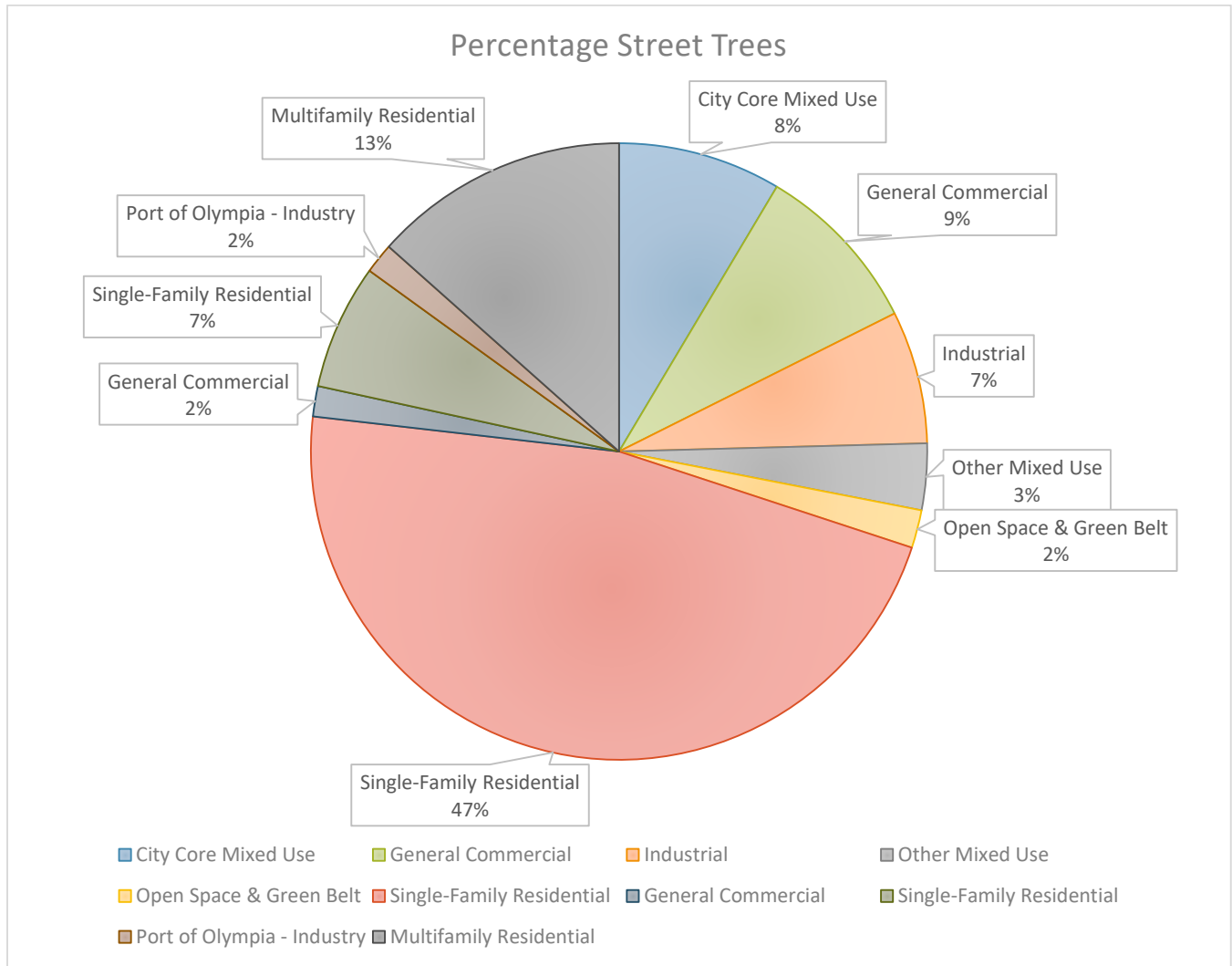
Street trees inventoried across Tumwater primarily lay in the Singe-Family Residential areas, followed by Multifamily Residential areas. The comprehensive 2018 street tree inventory cataloged the composition and distribution of Tumwater's street trees. The 10 top tree species inventories include of maple, pear, cherry, linden among others. Their conditions generally ranged from poor to good out of seven total condition classes. These condition classes were taken directly from the i-Tree Eco Street Tree protocol and include excellent, good, fair, poor, critical, dying and dead.

Results from the i-Tree Eco analysis on tree benefits indicate 587.3 pounds of air pollution are intercepted by street trees annually. These same street trees sequester 10.44 tons of carbon annually while total sequestered carbon among street trees is 291 tons. Avoided stormwater runoff is primarily achieved through larger trees, including the Norway maple while consists 21% of Tumwater's street trees. These maples reduce surface water runoff by approximately 28,000 cubic feet per year.

To determine an approximate tree age composition of the 3,500 inventoried trees, the measured diameters were analyzed using a tree age model (Łukaszkiewicz and Kosmala 2008[8]). The model estimated that 53% of the street inventoried trees were less than 10 years old and 82% were less than 25 years old. This means the majority of Tumwater's street trees are young and some have achieved only one-quarter of their life span.

Proper care and maintenance of Tumwater's young and adolescent trees will support long-term urban forest health and green space access across the City.

RANKING	SPECIES	%
1	Norway maple	21%
2	Callery pear	13%
3	Acer rubrum	12%
4	Flowering cherry	8%
5	Littleleaf linden	8%
6	Northern red oak	4%
7	Sweetgum	4%
8	Flowering apple	4%
9	Cherry plum	4%
10	European ash	3%

Table 10: Above, top 10 Street Tree Species

Figure 4: Below, average conditions of top 10 species.
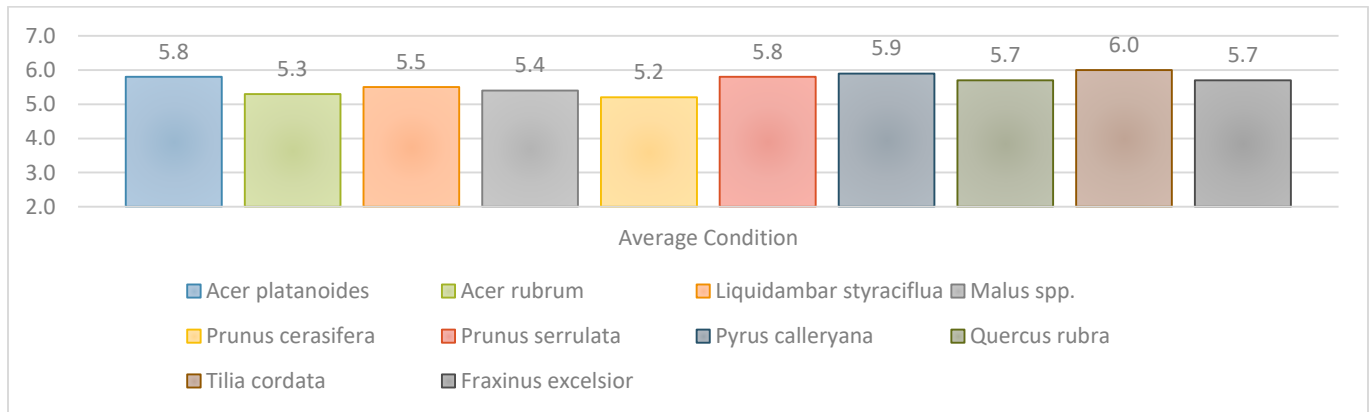
Diversity and abundance of street tree species are important in developing a resilient urban forest. A diverse ecological community is a strong one. Pests and diseases affect diverse plantings less than monocultures. In general, no single landscape (non-native) tree species should represent more than 8 to 15% of an urban forest. The City's updated approved street tree list provide lists of recommended tree species for different growing conditions in the City to support tree diversity within the urban ecosystem.

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[8] Łukaszkiewicz, Jan & Kosmala, Marek. Determining the Age of Streetside Trees with Diameter at Breast Height-based Multifactorial Model. Arboriculture and Urban Forestry. May 2008. 137

Figure 5: Street tree diameter distribution.
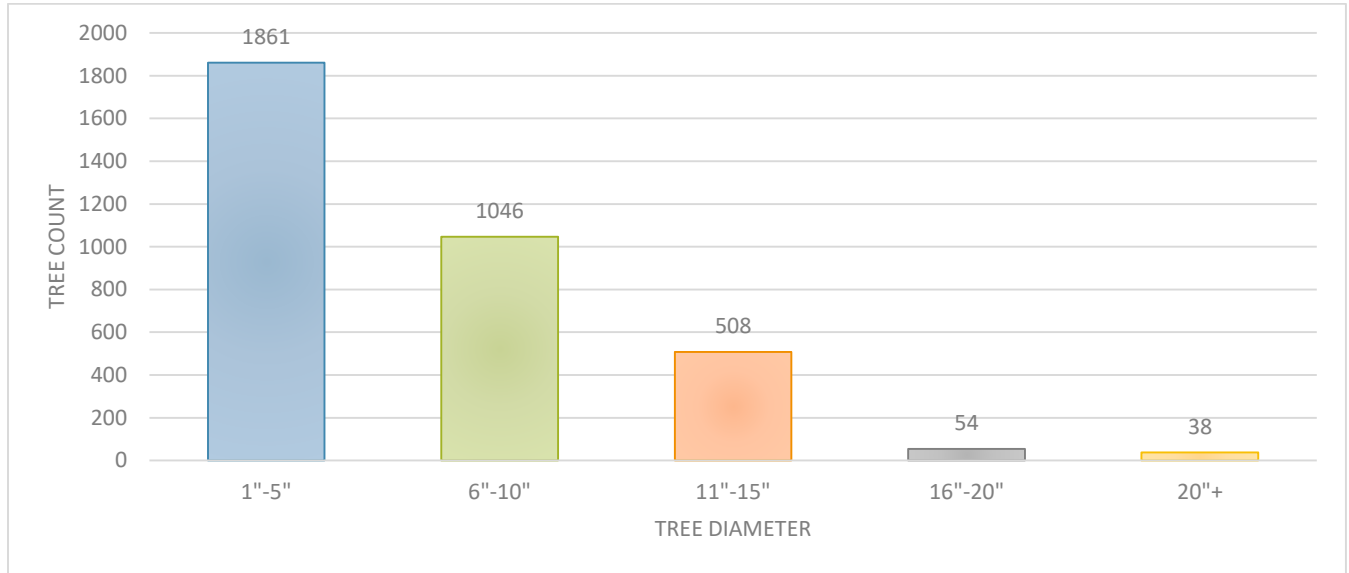
Figure 6: Average sidewalk displacement by street tree species.
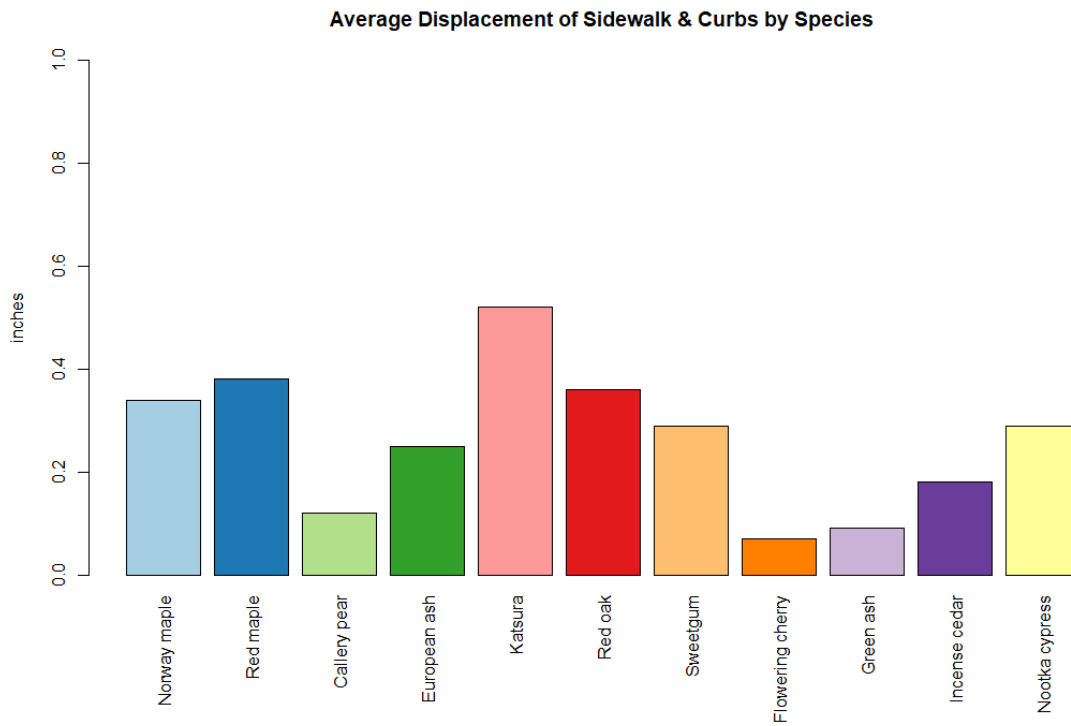
3. GREEN SPACES INVENTORY

3.1. PURPOSE

The Urban Forestry Consultants applied the United States Forest Service's (USFS) Forest Landscape Assessment Tool (FLAT) to green spaces, open spaces, natural areas and parks in Tumwater. FLAT is a biological data collection protocol, used to rapidly characterize and prioritize management of natural areas. FLAT enables quick, qualitative comparisons of natural areas and forested landscapes which facilitates easy benchmarking and progress reports. The UFC captured canopy characteristics, primary and secondary understory species, invasive species presence, and several overstory forest health indicators. A rapid assessment is one where natural resource professionals collect landscape conditions while walking through an area rather than utilizing traditional forestry plots.

FLAT was selected based on its success in sampling Washington's Puget Sound region. The tool can be expanded and adapted for use in a wide variety of ecosystems and specific needs. Equally, given FLAT models are being applied throughout the Puget Sound ecoregion, it allows for long-range planning across city lines.

3.2. METHODS

Each green space is separated into one or more Management Units (MUs). These areas are assessed for their capacity to sustain certain types of canopy cover and their invasive plant species abundance and composition. Management Units are examined by a natural resource professional and estimates for forest stocking levels, canopy closure estimates, species regeneration and forest health indicators are tracked in a geodatabase. From these data, landscape functionality and thread are scored and ranked. Highly effective landscapes are identified in relation to their threat of noxious weed and restoration needs.

The value provided at the intersection of these highly functional landscapes and their threat levels provide us a Tree-iage number, one through nine. **Figure 9** below shows Tree-iage totals and provides sample

management recommendations for those areas. Tree-iage numbers provide an indicator of how well a specific management unit is achieving its potential function.

Tumwater can use this priority matrix to assign broad management goals to individual management units within each green space. The results are a visualization of landscape conditions in a clear, color coded and standardized map. The priority matrix results can be used to inform city-wide green space management decisions to achieve improved ecological function, enhanced ecosystem services, and prioritize funding of restoration activities. Green space goals can range from monitoring and stewardship, long-term evaluation and planting, major invasive plant reduction, to a variety of other broad management goals. This allows cities to make informed management decisions that consider green space priorities for management, and how they fit on the landscape as a whole.

Our adaption of the FLAT assessment was divided into three phases:

PHASE 1: LANDSCAPE TYPE MAPPING. Aerial imagery and parcel information are used from a desktop to geographically identify large scale forest and land types within each parcel of land. These largescale landscape features are divided into one or more Management Units (MUs), which are spatially referenced, numbered and broadly categorized into Forested, Vegetated/Natural, Open Water, Hardscape or Modified Landscape/Recreation.

PHASE 2: FIELD ASSESSMENT. Our trained foresters and natural resource professionals evaluate and interpret the parcel landscape to collect attribute information for each of the MUs previously typed and mapped. This is where we collect biological data necessary to identify landscape priorities. Lastly, our team ground truths MU boundaries and revisions are made as necessary.

PHASE 3: MANAGEMENT STRATEGIES AND PRIORITIZATION PHASE. Our last phase integrates the data collected in the field. This classifies the ecological conditions and landscape functionality of the parcel. Some landscapes are classified as highly functional and some function at reduced levels. Equally, some landscapes are minimally threatened by noxious weeds and invasive plants, while some are highly threatened. Within Phase 3, our classifications can be ranked for each MU and can be observed spatially.

FLAT uses a ranking scale of 1 to 9 (Tree-iage number) to indicate a balance of species composition value, which favors larger, long lived native trees, and the degree of health threat. For Tumwater, the main threat identified was invasive plant species cover, so that is used in the Tree-iage matrix for forest health threat. The Tree-iage matrix is how the data from the FLAT analysis can be displayed in a priory matrix, using forest composition level (high, medium, low), and invasive plant species cover (high, medium, low).

3.3. PROPERTIES ASSESSED

Green spaces for this project were defined as properties owned by the City of Tumwater and include:

- Unimproved/undeveloped natural areas and forests

- Improved/developed natural areas and forests, to include public and accessible stormwater infrastructure, and other green space assets.
- Developed City parks.
- Hybrid parks which contain both developed areas and natural areas.
- City owned buildings which rest on 5+ acres of natural area, which could be accessed by the public.

3.4. INTERPRETING TUMWATER GREEN SPACES MAP

Each green space assessed in Tumwater has an associated map that displays the management units within that green space, land classifications within the MUs, and what the Tree-iage priority matrix rating is, if applicable. The title on the top left of the map sheet is the name of the park shown on the map. ***Table 11*** below shows the definitions of the classification types, Forested, Vegetated/Natural, Open Water, Hardscape, and Modified Landscape/Recreation. The priority matrix shown on the top middle of the map sheet provides a color legend for ranking.

A matching color for a management unit indicates that it is a natural area (either Forested or Natural)

that has the priority ranking (1-9) of the associated color. All other classifications types do not have a priority ranking. The simple light green map at the top right of the green spaces map sheet shows the extent of Tumwater's Urban Growth Area, and where the subject green space is located within the City's UGA. The table at the bottom of the map sheet corresponds to the management units on the map, with the MU column matching the labels on the map. The table provides the classification type, which matches the legends, the priority matrix value, if applicable, and the acreage of each individual management unit.

Figure 7: Native garry oak in Tumwater facilities.

Table 11: Natural Area Data Attributes and Definitions.

Data attribute	Explanation
FORESTED	Landcover with canopy cover greater than or equal to 25 percent
VEGETATED/NATURAL	Landcover with area less than 25 percent forest canopy cover
OPEN WATER	Water, no woody vegetation
HARDSCAPE	Buildings, parking, impervious surfaces
MODIFIED LANDSCAPE & RECREATION	Landscaped or mechanically maintained landcover, including those areas maintained for recreation (ex: ball fields)
INVASIVE SPECIES	Designated nonnative plant species of importance
INVASIVE SPECIES COVER	Land coverage of invasive plant species
HIGH INVASIVE COVER	Invasive plant covers greater than 50 percent
MEDIUM INVASIVE COVER	5 to 50 percent invasive plant cover
LOW INVASIVE COVER	Less than 5 percent invasive plant cover
FOREST COMPOSITION	Forest composition refers to all plant species found in an area, focusing on trees in this case.
HIGH COMPOSITION	Greater than 50 percent conifer/madrone; or less than or equal to 50 percent conifer madrone with no capacity for restoration (includes wetlands)
MEDIUM COMPOSITION	1-50 percent conifer/madrone with capacity to support restoration; or less than 25 percent native cover with capacity to restore up to 50 percent conifer
LOW COMPOSITION	Less than 25 percent native cover with capacity for full restoration planting; or no conifer/madrone with capacity for full restoration
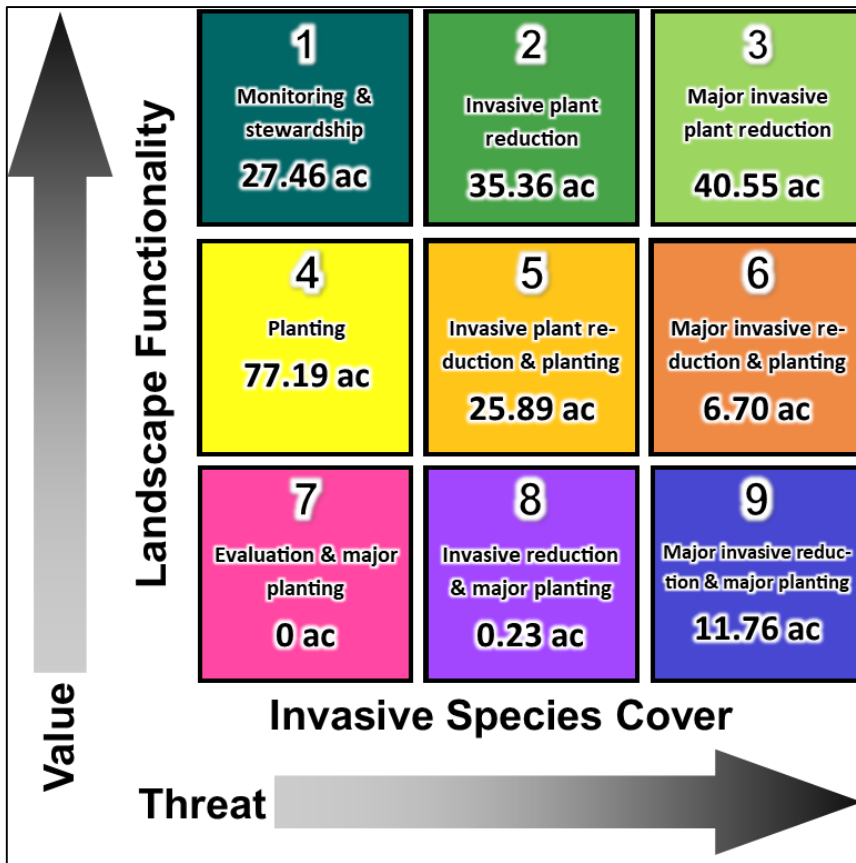
Figure 9: Green Space Tree-iage priority matrix showing total area in acres and potential management recommendations for those areas.

Figure 8: Example of Green Space map identifying land use types.

Table 12: Priority Matrix Value by Classification, with Sum and Average of Acreage.

Tree-iage Number	Number of Units	Total Acres
FORESTED	**25**	**148.47**
1 – Low Priority	8	10.26
2	5	13.79
3	3	34.86
4	3	76.64
5	4	9.1
6	2	3.82
7	0	0
8	0	0
9 – High Priority		
NATURAL AREA	**20**	**76.63**
1 – Low Priority	3	17.2
2	4	21.57
3	2	5.69
4	2	0.55
5	4	16.79
6	2	2.84
7	0	0
8	1	0.23
9 – High Priority	2	11.76

Table 13: Number of Management Units (MU) by Land Classification.

Land Classification	Total Acres	Number of Units
FORESTED	148.47	25
NATURAL AREA	76.63	20
HARDSCAPE	28.38	22
LANDSCAPE/RECREATION	227.58	21
OPEN WATER	9.88	7

4. URBAN TREE CANOPY ASSESSMENT
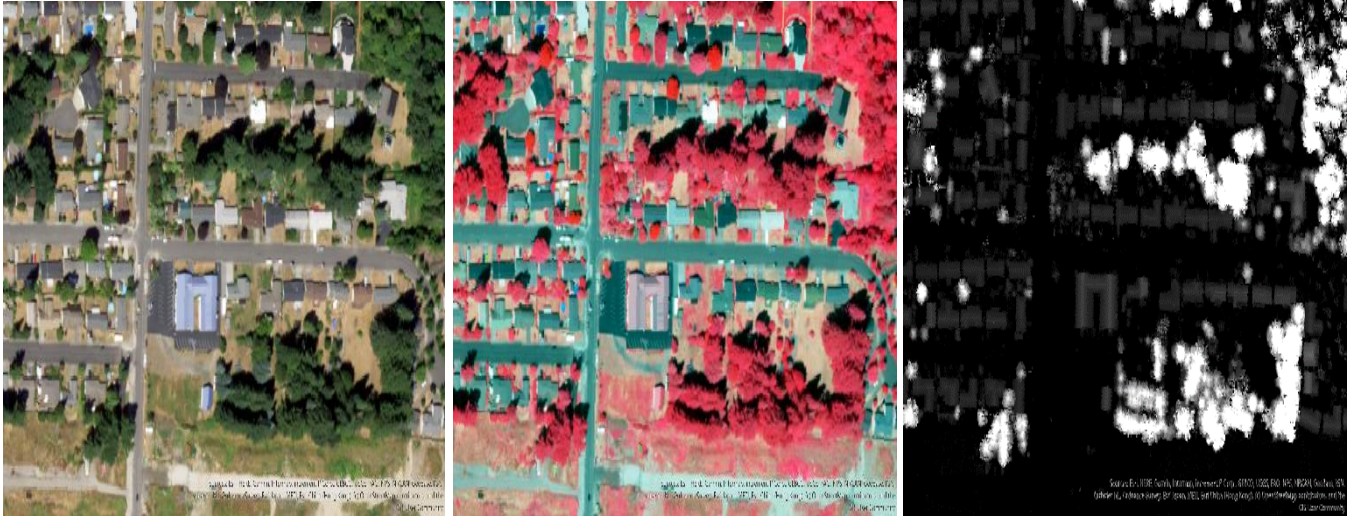
4.1. PURPOSE

The goal of the Tumwater urban tree canopy (UTC) assessment is to aid in citywide, regional and long-term management of urban forest canopy. Decisions influencing the percentage of urban tree canopy across the city play into tree preservation goals and tree planting goals. Applying urban tree canopy covers to zoning and census data informs decision makers and stakeholders of urban tree canopy cover distribution according to social demographics like income and people of color, affirming the City's commitment to environmental justice.

Urban tree canopy give insight to large-scale ecosystem services within the City. UTCs are benchmarkable and can generally be used over-time

to inform long-term swings in urban tree canopy. Interpretation of UTC percentages and goals are normally on large scales – across land use designations and entire cities. By spatially identifying the distribution of canopy across different neighborhoods or zones we enable more informed decision making related to the urban forest.

This geospatial assessment works with object-based image analysis software utilizing high-resolution multispectral imagery and LiDAR to differentiate land cover classes and object heights. After land cover classes are stratified LiDAR is used to identify object heights.

4.2. BOUNDARIES

Three distinct geographical and geophysical boundaries were used in this UTC to provide actionable information at multiple scales and for a diverse range of audiences. Analysis was performed at the following boundaries:

1. Tumwater Urban Growth Area
2. Sub-watersheds (HUC)
3. Tumwater Land Uses images

4.3. Summary of Data

	URBAN TREE CANOPY	36%	2011
		40%	2017
	IMPERVIOUS SURFACES	19%	2011
		22%	2017
	TARGET CANOPY	45%	2040

4.4. METHODOLOGY

DATA SOURCES

Multiple datasets were used in the assessment process. The main component of the 2011 and 2017 assessments were high-resolution (1-meter) multispectral imagery from the U.S. Department of Agriculture's National Agriculture Imagery Program (NAIP). Additional LiDAR data from GeoTerra, Inc. from 2018 and LiDAR data from the Washington State Department of Natural Resources derived height data. In 2018, Tumwater commissioned a high-resolution fixed-wing survey, which included multispectral imagery and LiDAR.

The 2017 NAIP imagery was obtained in the summer during leaf-on conditions and approximates the canopy cover of both deciduous and evergreen trees. The 2018 imagery was obtained from aerial imagery in March, during leaf-off, and approximates only evergreen canopy. This 2018 flight was performed in early spring, prior to leaf emergence, resulting in an examination of only evergreen plants. GIS layers for further analysis were provided by both the City of Tumwater and Thurston County.

Aerial Photography
- National Agriculture Imagery Program (NAIP), USDA. 4-band RGBir, 1meter pixel resolution, acquired July-2017 Project Name: 201707_WASHINGTON_NAIP_1X0000M_UTM_CNIR.
- GeoTerra, Inc. 0.25in pixel resolution, 4-band RGBir, 8-bit orthophotography, acquired March-12-2018. Metadata can be found on the accompanying document, GeoTerra Metadata Job #180008.

LiDAR
- Fugro EarthData, Inc. for 2011 Thurston County LiDAR acquisition project. Acquired June 2011 to July 2011. DSM and DTM sourced from WDNR LiDAR Portal.
- GeoTerra, Inc., same 2018 project as above aerial data. LAS Dataset.

LAND COVER MAPPING

Two land cover datasets, or the NAIP datasets described above, were used to classify land cover. Analyses were performed using an object-based image analysis software – ArcGIS Pro with Spatial Analyst extension. This process aligns objects spectral signatures across four spectral bands (blue, green, red, and near-infrared). Additionally, the process identifies and aligns object pattern relationships, textures and object height. This remote sensing process analyzed NAIP land cover data and LiDAR height data, results in six land cover classifications, described below in Figure 10. The output of this classification process is then further refined by retraining the classification algorithm based on human experience and known limitations.

After processing land cover classes, the resulting data is assessed for accuracy. At ~90% accuracy the assessment is considered complete. This data is then combined with zoning, and neighborhood data to get more specific information about how canopy cover is distributed within Tumwater.

SIX DISTINCT LAND COVER CLASSES WERE UTILIZED IN UTC ASSESSMENTS

TREE CANOPY COVER

NON-CANOPY VEGETATION

SOIL & DRY VEGETATION

BUILDINGS

OTHER IMPERVIOUS
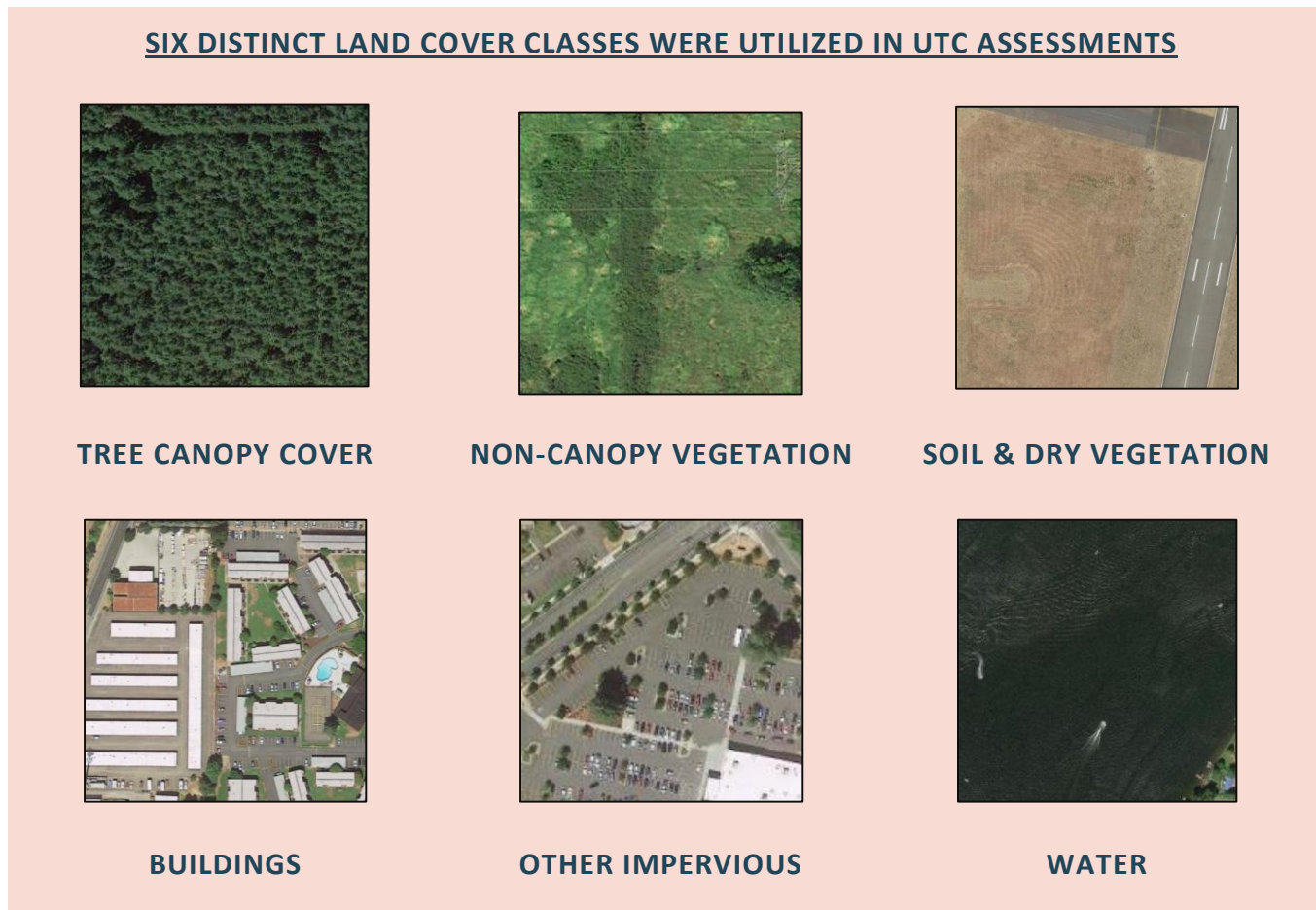
WATER

Figure 10: Land use cover classifications.

ZONING AND LAND USE

Zoning within the City of Tumwater helped inform similar land use policies for the UTC analysis. There are 23 different zoning designations which we consolidated to 11. Our consolidation was advised by the Tree Board and Department of Community Development to ensure accurate translation from zones to land use. This effort to reduce zoning designation into concentrated land use elements aligns with citywide policies, land use development types and planting availability. A map of the land use types is in the appendix.

	Tumwater Expanded Zoning	Acres	Zoning by Land Use		Acres of Canopy in 2017
1	Port of Olympia - Olympia Regional Airport	806	Port of Olympia - Olympia Regional Airport	1	24
2	Port of Olympia - Industry	690	Port of Olympia - Industry	2	290
3	Light Industrial	2,335	Industrial	3	822
4	Heavy Industrial	107			
5	Brewery District	180	City Core Mixed Use	4	141
6	Capitol Boulevard Community	141			
7	Town Center	205			
8	Mixed Use	100	Other Mixed Use	5	38
9	Neighborhood Commercial	39			
10	Community Services	41	General Commercial	6	317
11	Business Park (UGA Only)	76			
12	General Commercial	499			
13	Historic Commercial	85			
14	Commercial Development (UGA Only)	22			
15	Residential/Sensitive Resource	774	Single-Family Residential	7	3,011
16	Single-Family Low Density	3,677			
17	Single-Family Medium Density	1,738			
18	Manufactured Home Park	123			
19	Multifamily High Density	117	Multifamily Residential	8	322
20	Multifamily Medium Density	696			
21	Open Space	1,083	Open Space & Green Belt	9	710
22	Green Belt	367			
	Total	13,900	–		5,675

Table 14: Consolidation of Tumwater Zoning into Land Use

ASSESSMENT BOUNDARIES

Urban tree canopy and associated metrics were analyzed across a variety of geographical and geophysical boundaries. This diversity of scales and boundaries will assist the City, county and stakeholders in decision making locally and regionally. The following scales were used for this assessment:
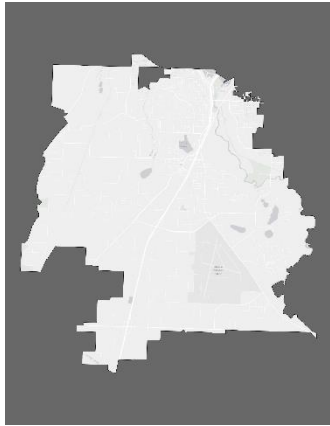
Tumwater's Urban Growth area was the primary geographical boundary to which all the data was summarized.

TUMWATER URBAN GROWTH AREA
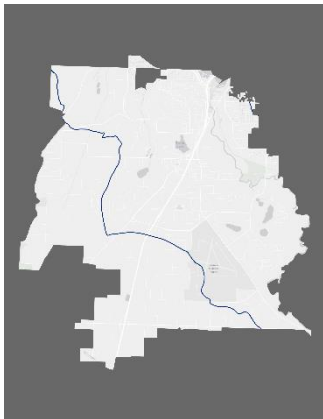
Three HUC-12 watersheds have ranges within the City of Tumwater. Ellis Creek watershed is limited to a few square meters, while Deschutes River and Upper Black Lake Comprise nearly 50% of the City.

171100190503 - ELLIS CREEK-FRONTAL BUDD INLET

171100160202 - DESCHUTES RIVER-CAPITOL LAKE

171001030501 - UPPER BLACK RIVER
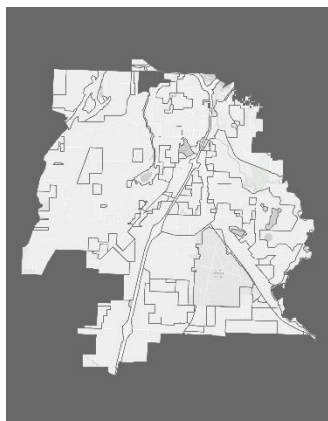
Zoning designations across Tumwater were consolidated into specific land use types as noted in Table below.

TUMWATER LAND USES

4.5. Detailed Findings
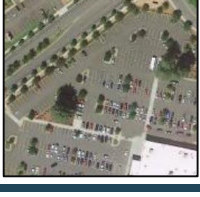
LAND COVER TYPE		2011 UTC	2017 UTC	DIFFERENCE	2040 GOAL
	Tree Canopy Cover	36%	40%	+4%	45%
	Non-Canopy Vegetation	25%	16%	-9%	
	Soil & Dry Vegetation	18%	21%	+3%	
	Buildings	5%	6%	+1%	
	Other Impervious	14%	16%	+2%	
	Water	1%	1%	0%	

Table 15: Urban tree canopy in both 2011 and 2017 per land cover type.

Land Use Type	Tree Canopy Cover			
	2011 Tree Canopy	2017 Tree Canopy	Difference	Recommended 2040 Goal
PORT OF OLYMPIA - OLYMPIA REGIONAL AIRPORT	3%	3%	0%	3%
PORT OF OLYMPIA - INDUSTRY	35%	42%	+7%	35%
INDUSTRIAL	30%	34%	+4%	35%
CITY CORE MIXED USE	22%	27%	+5%	30%
OTHER MIXED USE	23%	27%	+4%	30%
GENERAL COMMERCIAL	35%	44%	+9%	35%
SINGLE-FAMILY RESIDENTIAL	43%	48%	+5%	55%
MULTIFAMILY RESIDENTIAL	35%	40%	+5%	45%
OPEN SPACE & GREEN BELT	47%	49%	+2%	65%
TUMWATER + URBAN GROWTH AREA	36%	40%	+4%	50%

Table 16: Urban tree canopy per land use in 2011, 2017, and recommended goals for 2040.

The former two tables highlight specific information related to the urban tree canopy analysis from 2011 and 2017. First the information is presented by land cover class, or physical characteristics of objects. Secondly, information is stratified per land use type, or political and zoning classifications to areas. It's important to note, *Table 16*, specifically corresponds to tree canopy cover and not the other land covers classes. Other dynamic land cover class changes, such as water, buildings and other impervious are not represented in this report, but data is provided to Tumwater for further land use planning and analysis. See the appendix for a full table of 2011 and 2017 tabulations.

Table 17: Land use type per tree height percentage in 2011.

RANGE	PERCENT OF TOTAL	
0-25 FEET	31%	
26-50 FEET	24%	
51-100 FEET	38%	
100+ FEET	7%	

Large stature trees, those capable of growing above 50 feet in height, are important elements of the urban forest. Compared to a small-stature tree, a strategically located large stature tree has a bigger impact on conserving energy, mitigating an urban heat island, and cooling a parking lot. They do more to reduce stormwater runoff; extend the life of streets; improve local air, soil and water quality; reduce atmospheric carbon dioxide; provide wildlife habitat; increase property values; enhance the attractiveness of a community; and promote human health and well-being. Accommodating larger trees is an ongoing challenge that is complicated by the competing needs for utility lines and impervious surfaces. Some ways to incorporate large-stature trees into planting plans include transportation corridors mitigation and enhancement and incentivizing developers with a less of large-stature trees instead high quantities of small-stature trees.

Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service, Davis, California and the Southern Center for Urban Forestry Research & Information, Southern Research Station, USDA Forest Service, Athens, Georgia. 2004

City of Tumwater Urban Forestry Management Plan
Adopted March 2, 2021 by Ordinance No. 2020-004

Table 18: Watershed level urban tree canopy distribution, including evergeen and deciduous composition.

HUC Watershed	171001030501 - UPPER BLACK RIVER	171100160202 - DESCHUTES RIVER- CAPITOL LAKE	171100190503 - ELLIS CREEK- FRONTAL BUDD INLET
LAND AREA	1,039 acres	1,796 acres	3 acres
2011 TREE CANOPY	39%	34%	29%
Total Acres of Canopy	405 acres	611 acres	<1 acre
Distribution of Canopy	40%	60%	<1%
2017/18 TREE CANOPY	45%	38%	30%
Total Acres of Canopy	468 acres	682 acres	<1 acre
Distribution of Canopy	46%	67%	<1%
Evergreen Acres	332 acres	467 acres	
Evergreen Percent	32%	26%	
Deciduous Acres	135 acres	215 acres	
Deciduous Percent	13%	12%	

Table 19: Total evergreen and deciduous tree canopy composition within Tumwater + UGA based on 2017/18 UTC Assessment.

	TOTAL EVERGREEN TREE CANOPY	28% out of 40%
	TOTAL DECIDUOUS TREE CANOPY	12% out of 40%
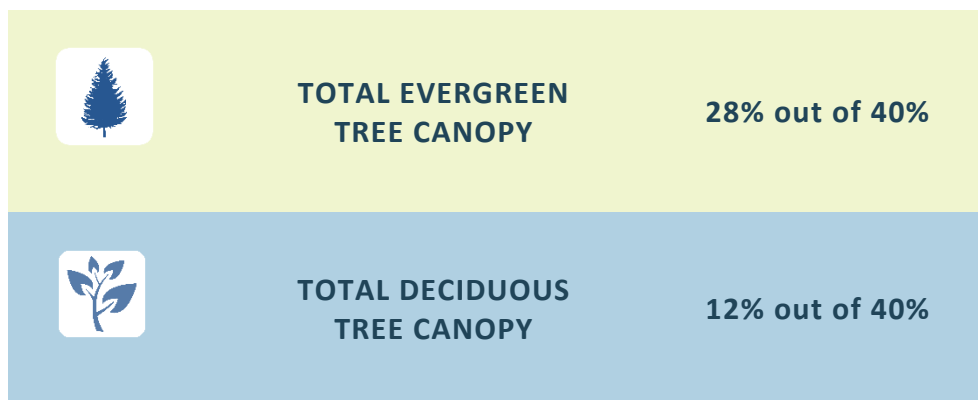
4.6. ACCURACY

Due to the season which GeoTerrra, Inc. captured imagery and LiDAR over Tumwater, the information does not contain a substantial portion of deciduous trees. The leaf-less condition of deciduous trees during the LiDAR data acquisition created imprecise segments of information in the dataset.

While the 2011 UTC may be older, it likely has higher precision due to the inclusion of LiDAR information,

allowing us to capture heights of vegetative elements throughout Tumwater.

Insofar as land cover classifications, excluding the stratification of tree canopy from its underling group of vegetation, both UTCs are at or above 90% accurate. The 2011 UTC has an accuracy rating of 93% while the 2017 UTCs accuracy is approximately 90%.

4.7. RECOMMENDED FUTURE DATASETS

Additional datasets will increase precision and accuracy of future UTC analyses in Tumwater. These additional datasets are tied to the following objectives and requirements:

Objective:	Required Information:
Informed decisions on environmental justice, canopy equity, social inequalities related to the urban forest.	**CENSUS DATA** Census data will allow City leaders, stakeholder and the community at large information on how urban tree canopy cover is distributed according to social demographics like income and people of color.
Identify square feet of canopy over impervious surfaces throughout the City. This data is used to inform data such as for use in stormwater buffer modeling and urban heat island mitigation.	**UPDATED BUILDINGS/FOOTPRINTS GIS LAYER** Accurate footprint data on buildings allows a variance measurement of visual canopy over footprint. The current building layer is from 2000 and a substantial portion of the footprint polygons are indicator marks, rather than footprint outlines.
	ROAD & SIDEWALK GIS LAYER Current street layer is made of GIS lines and street types, etc. With standard road with data for standard roads, i.e. collector, arterial, neighborhood, the street lines could be widened to reflect their precise scale. This could be accomplished for sidewalk data as well. Geospatial identification roads and sidewalks will further identify canopy cover over impervious data.
Quantify Possible Planting Areas (PPA). Consultants were unable to quantity with reasonable confidence PPA in the 2011 or 2017 UTC	**CITY OWNED/MAINTAINED PARCEL DATA** Current Thurston County Parcel GIS layer indicates property ownership for each parcel. We encountered a wide range of possible "ownership" entries when parcel was owned or maintained by the City of Tumwater.

analyses. PPA is generally measured as impervious area and unplantable areas subtracted from total UTC percentage. _PPA = UTC – Imperious – Unplantable_ _This will require identifying biophysically inappropriate landscapes and locations, and appropriateness of specific land uses for increased canopy cover._ _Identify parcels the City can proactively maintain, in comparison to private parcels where City's influence is limited to through policy, education, etc._	A solution would be a list of property owner entries that cumulative include all of Tumwater's parcels. Further information could be identified through City of Tumwater owned parks, facilities, water resources, open spaces, etc. Currently these ownerships have a variety of ownership entries in the Thurston County Parcel Layer.
	IDENTIFY DEVELOPMENT THREAT OF TREE STANDS Identifying development threat of tree stands allows the City to prioritize planting and policy. This information helps to understand what tree stands benefit the community, and how those may be altered or protected in the future.
	IDENTIFY BIOPHYSICALLY INAPPROPRIATE SITES Biophysically inappropriate planting sites in Tumwater include wetlands, estuaries, grassland prairies, municipal golf course and local farms.
	IDENTIFY URBAN CANOPY APPROPRIATENESS OF LAND USE DESIGNATIONS Land uses like the Tumwater airport and the municipal golf course may be considered inappropriate for sustaining canopy cover. Areas like improved rights-of-way, open spaces, city parks and city facilities may be considered appropriate and offer improved equity in sustaining tree canopy.
Future City acquired high-resolution datasets	**INCLUDE LIDAR IN FUTURE HIGH-RESOLUTION PHOTOGRAMMETRY** The 2018 fixed-wing aircraft high-resolution orthomosaic retained by the City of Tumwater included 4-bands (natural color and near-infrared) but did not include a LiDAR dataset. LiDAR datasets are normally available through a variety of other sources, including the Puget Sound LiDAR Consortium, Washington Department of Natural Resources, and the National Agriculture Imagery Program (NAIP).
	TIMING The 2018 Tumwater high-resolution imagery did not include deciduous tree cover. At the time of flying, deciduous trees were still bare of leaves. Flying during the summer will allow the City to accurately measure urban tree canopy of all city trees.

5. ECOSYSTEM SERVICES INVENTORY

5.1. PURPOSE

The purpose for plot-based sampling is to collect data for a large area in a reasonable time frame and with a reasonable assurance that plot data accurately depicts the conditions across the area. For a city, the best method is often to have stratified random samples, which are plots randomly generated within predefined stratifications, such as zones, neighborhoods, or land uses. This can ensure that all different areas of a city are accounted for and makes it easier to implement area-specific strategic management goals. Generally, 200 1/10th acre plots randomly distributed across a city will yield a standard error of about 10% for an estimate of the entire city.

5.2. DATA COLLECTED

As with all sampling, the amount of data collected at each plot will determine what level of analysis can be performed. For i-Tree Eco, the base required data for each tree is species and diameter at breast height (DBH), and for each plot it is the percent of the plot that was assessed, and the percent tree canopy cover in that plot. From that base level, there is a vast amount of data that can be collected for both the plots and the trees in the plots that opens up the option for additional analyses on such categories as Energy, Wildlife, Forecast, Shrubs, Plantable space, Pests, and Cover under canopy. These analyses can yield information on:

- Number of trees
- Species composition
- Leaf area and biomass
- Pollution removal and value
- Carbon storage, sequestration, and value
- Hydrology effects and value
- Volatile organic compound emissions
- Oxygen production

A specific description of what variables are required by i-Tree Eco for each analysis can be found in *Table 20*, sourced from the i-Tree Eco v6.0 Manual.

Data Variables		Description	Shrubs	Plantable space	Wildlife	Grass/Herbaceous pollution
Table 20: Plot Information (plot-based sample project). **Use this table to help guide your field data collection decisions:** *The Description column provides more information about each data variable. The extra model components shown in the right-hand columns require certain optional data to be collected. The optional data that must be collected for each extra model component are designated by an "x"*						
Minimum required fields						
Percent measured		The amount of plot than can be accessed, measured, and/or included in this study	REQUIRED			
Percent tree cover		The amount of the plot covered by tree canopy (in percent).	REQUIRED			
General fields						
Land use	Actual land use	Land use type(s) that are seen in the field				
	Percent of plot	The amount of the plot area covered by each land use				
Percent shrub cover		The amount of the plot covered by shrub canopy (in percent)	x			x
Percent plantable space		The amount of the plot area that is plantable for trees (i.e., plantable soil that is not under tree canopy or other overhead restrictions and where tree planting/establishment would not be prohibited due to land use, such as a baseball field)		x		
Plot address		Street address of plot or notes for locating plots in areas without street addresses				
GPS coordinates		Longitude and latitude of plot center				
Reference objects	Object type	Visible landmark(s), such as a stop sign or permanent structure, that are seen when standing at plot center				
	Direction	The direction from the plot center to the reference object				
	Distance	The distance from the plot center to the reference object				
	DBH	Stem diameter measured at breast height (DBH) if the reference object is a tree				
Ground cover	Ground cover	Ground cover type(s) that are seen in the field			x	x
	Percent of plot	The amount of the plot area covered by each ground cover			x	x
Shrub details	Species	Name of shrub species	x			
	Height	Average height of shrub group (i.e., mass of shrubs of the same species)	x			
	Percent of area	The amount of the shrub area in the plot covered by each shrub group	x			
	Percent missing	The percent of the shrub group volume that is missing (i.e., not occupied by leaves)	x			

Table 8 (continued): Tree Information (plot-based sample project).
Use this table to help guide your field data collection decisions:
The Description column provides more information about each data variable. The extra model components shown in the right-hand columns require certain optional data to be collected.

Data Variables		Description	Energy	Pests (IPED)	Hydro
Minimum required fields					
Species		Identify and record the species and genus names of each tree		REQUIRED	
DBH		Measure the tree stem diameter at breast height and record the measurement for each tree		REQUIRED	
General site fields					
Land use		Land use type in which tree is located			
Status		Status of tree as planted or self-seeded			
Distance to plot center		The distance from the tree to plot center			
Direction to plot center		The direction from the tree to plot center			
Street tree/non-street tree		Identify if tree is a street tree or not (Y/N)			
Public/private		The classification of each tree as city managed (public) or not (private)			
Cover under canopy	Percent impervious	The percent of the area beneath the drip line of the tree that is impervious			x
	Percent shrub	The percent of the area beneath the drip line of the tree that is shrub			x
Tree detail fields					
Total tree height		Height from the ground to the top (alive or dead) of the tree			
Crown size	Height to live top	Height from the ground to the live top of the tree			
	Height to crown base	Height from the ground to the base of the live crown			
	Crown width	The width of the crown in two directions: north-south and east-west			
	Percent crown missing	Percent of the crown volume that is not occupied by branches and leaves			
Crown health	Dieback	Estimate of the percent of the crown that is composed of dead branches			
	Condition	Estimate of the condition of the crown recorded as 100 minus the percent of the crown composed of dieback (i.e., dead branches)			
Crown light exposure		Number of sides of the tree receiving sunlight from above (maximum of 5)			
Energy	Direction	Direction from tree to the closest part of the building	x		
	Distance	Shortest distance from tree to the closest part of the building	x		
Management fields					
Maintenance recommended		User defined general maintenance recommendations (e.g. routine prune) for the tree			
Maintenance task		User defined priority maintenance tasks (e.g., pest treatment) for the tree			
Sidewalk conflict		Extent of damage to sidewalks from nearby trees defined by user			
Utility conflict		User defined potential or existing conflicts between tree branches and overhead utility lines			
User ID		Unique tree ID			

Table 8 (continued): Tree Information (plot-based sample project). Use this table to help guide your field data collection decisions: The Description column provides more information about each data variable. The extra model components shown in the right-hand columns require certain optional data to be collected. The optional data that must be collected for each extra model component are designated by an "x"			Energy	Pests (IPED)	Hydro
Data Variables		**Description**			
Management fields (continued)					
Pests (IPED)	Signs and symptoms of tree stress	Absence or presence of signs and symptoms of dieback, epicormic sprouts, wilted foliaged, environmental stress, or human stress		x	
	Signs and symptoms of foliage/twigs	Absence or presence of signs and symptoms of defoliation, discolored foliage, abnormal foliage, or insect signs and extent of foliage affected		x	
	Signs and symptoms of branches/bole	Absence or presence of signs and symptoms of insects or diseases on the branches/bole and location of signs or symptoms		x	

The level of data collected is dependent on time frame, budget, and desired level of post-sampling analysis. Some of the information will overlap with information gathered during the Street Tree Inventory, but overall the stratified random plot-based sampling can gather a much wider range of information. By not being restricted to common street tree areas such as sidewalks, plot-based sampling can assess areas that would not otherwise be captured. By gathering plot data in addition to tree data a more robust analysis can be performed for overall city ecosystem services being provided by trees and shrubs.

APPENDICES

6. STREET TREE DATA POINTS

Table 21: Data gathered during the street tree inventory, and descriptions of each data field.

GlobalID	**Unique ID for each tree**
Tree Location	GPS point at the location of the tree
Survey Date	Date tree was surveyed
Surveyor	Individual(s) who assessed the tree
Street Name	Street name of the adjacent street
Street Type	Street type based on following list: • Residential • Collector • Alley • Private Street/ Roadway • Unimproved R/W • Freeway • Principal Arterial • Commercial-Industrial Collector • Urban Collector • Minor Arterial • Arterial • "0" – currently on River Road. (Sourced from Tumwater Geospatial Layers.)
Cross Street	Closest nearby cross street.
Zoning	Zoning based on following list: • Airport Related Industry • Brewery District • Business Park • Capitol Boulevard Community • Commercial Development • Community Services • General Commercial • Green Belt • Heavy Industrial • Historic Commercial • Light Industrial • Manufactured Home Park • Mixed Use • Multi-Family High Density • Multi-Family Medium Density

	• Neighborhood Commercial • Open Space • Residential/Sensitive Resource • Single Family Low Density • Single Family Medium Density • Town Center (Sourced from Tumwater Geospatial Layers.)
Asset Type	Asset type assessed, from the following list: • Available Planting Space • Landmark Tree • Street Tree • Stump
Remnant Tree	Whether the tree was planted or is part of a pre-development forest
Common Name	Tree common name (e.g. bigleaf maple)
Scientific Name	Tree scientific name (e.g. *Acer macrophyllum*)
Tree Type	Tree type, from the following list: • Evergreen broadleaf • Evergreen conifer • Deciduous broadleaf • Deciduous conifer
Tree Form	Tree form, from the following list: • Columnar • Conical • Irregular • Open • Oval • Pyramidal • Round • Spreading • Vase • Weeping
Tree Height (ft.)	Total tree height in feet
Tree DSH (in.)	Stem diameter in inches at standard height (4.5ft), measured for all stems at standard height
Crown Height (ft):	Height of the top of the live crown of the tree, in feet
Crown Base Height (ft):	Height of the bottom of the live crown of the tree, in feet
Crown Width N - S (ft.)	Width of the crown measured on a north to south axis, in feet
Crown Width E - W (ft.)	Width of the crown measured on an east to west axis, in feet
Crown Missing (%)	Percent of crown missing from the overall canopy

Crown Dieback (%)	Percent of crown dieback from the overall canopy
Tree Condition	Tree condition, from the following list: • Dead • Dying • Critical • Poor • Fair • Good • Excellent
Fungi Type	Any indicators of fungal infection (e.g. fruiting bodies, hyphae in wood decay)
Insects Indicators	Any indicators of detrimental insect presence (e.g. infestations, tent caterpillar webs, aphid honeydew)
Previous Failures	Any indicators of previous failures (e.g. broken tops or large branches, root plate lifting)
Adaptive Growth	Any indicators of adaptive growth (e.g. reiterations, epicormic sprouting)
Chlorosis	Any indicators of chlorosis (e.g. yellowing outside of expected senescence)
Sidewalk Damage (in.)	Any sidewalk lifting due to roots, with displacement measured in 0.25 inch increments
Curb Damage (in.)	Any curb lifting due to roots, with displacement measured in 0.25 inch increments
Planter Type	Planter type asset was in, from the following list: • Cutout • Free form • Median • Planting area • Strip
Planter Length (ft.)	Length of the planter type, measured parallel to road, in feet
Planter Width (ft.)	Width of the planter type, measured perpendicular to road, in feet
Tree Grate Present	Presence of tree grate
Tree Distance to Sidewalk (ft.)	Distance of tree's main stem to the nearest sidewalk or curb edge, in feet
Utility Line Height (ft.)	Height of utility line in feet, from following list • None • <20ft • 20ft – 35ft • >35ft
Risk Evaluation	Rapid assessment to determine if a risk evaluation is required for the tree, yes or no
Vehicle Clearance	If pruning is required for vehicle clearance, yes or no
Pedestrian Clearance	If pruning is required for pedestrian clearance, yes or no
Sign Clearance	If pruning is required for sign visibility, from the following list:

	• Casual – street signs, auxiliary signs, etc. • Critical – stop signs, yield signs, do-not-enter signs, etc.
Previously Topped	If the tree was previously topped, yes or no
Recommend Removal	If the tree is recommended for removal, yes or no
Improper Mulching	If improper mulching was observed at the tree (e.g. excessive mulch touching stem of tree, "volcanoing", etc.), yes or no
Remove Tree Supports	If the tree requires tree supports to be removed, before they cause long term damage or alterations to growth, yes or no
Tree Grate Maintenance	If the tree grate requires maintenance, yes or no

7. STREET TREE DATA ANALYSIS

This is not an exhaustive list of pivot tables but provides a starting point and overview for the interpretation of the street tree inventory data.

Table 22: Tree Count by Zoning District.

Zoning District	Tree Count
Single Family Low Density	923
Single Family Medium Density	723
Multi-Family Medium Density	477
General Commercial	316
Light Industrial	248
Residential/Sensitive Resource	226
Town Center	128
Mixed Use	123
Brewery District	96
Open Space	70
Capitol Boulevard Community	69
Airport Related Industry	58
Community Services	56
Historic Commercial	2
Business Park	0
Commercial Development	0
Green Belt	0
Heavy Industrial	0
Manufactured Home Park	0
Multi-Family High Density	0
Neighborhood Commercial	0
Grand Total	**3539**

Table 23: Tree Count by Street Type.

Street Type	Tree Count	Percent
Residential	1781	50.67%
Arterial	954	27.14%
Collector	633	18.01%
0* (River Dr SE is unclassified in GIS layer.)	74	2.11%
PRIVATE STREET/ROADWAY	46	1.31%
UNIMPROVED R/W	14	0.40%
COMMERCL-INDUST COLLECTOR	13	0.37%
Grand Total	**3539**	100.00%

Table 24: Tree Count per Tree Species.

Species Richness = 58	(Species abundance)	
Tree Species	**Tree Count**	**Percent**
Abies nordmanniana	1	0.03%
Acer campestre	21	0.60%
Acer circinatum	1	0.03%
Acer ginnala	5	0.14%
Acer grandidentatum	9	0.26%
Acer grandidentatum 'Schmidt'	16	0.46%
Acer negundo	6	0.17%
Acer negundo 'Variegatum'	1	0.03%
Acer palmatum	1	0.03%
Acer platanoides	720	20.48%
Acer platanoides 'Crimson Sentry'	18	0.51%
Acer rubrum	243	6.91%
Acer rubrum 'Armstrong'	173	4.92%
Acer rubrum 'Bowhall'	4	0.11%
Acer rubrum 'Red Sunset'	22	0.63%
Acer truncatum x A. platanoides 'Warrenred'	11	0.31%
Amelanchier canadensis	9	0.26%
Betula papyrifera	4	0.11%
Betula utilis var. jacquemontii	30	0.85%
Calocedrus decurrens	44	1.25%
Carpinus betulus	9	0.26%
Carpinus betulus 'Fastigiata'	18	0.51%
Castanea dentata	1	0.03%
Cercidiphyllum japonicum	59	1.68%
Chamaecypairs nootkatensis 'Pendula'	2	0.06%
Chamaecyparis lawsoniana	2	0.06%
Chamaecyparis nootkatensis	17	0.48%
Cornus florida	57	1.62%
Cornus kousa	85	2.42%
Cupressus sempervirens	5	0.14%
Eriobotrya japonica	7	0.20%
Fraxinus angustifolia	21	0.60%
Fraxinus excelsior	119	3.39%
Fraxinus pennsylvanica	108	3.07%
Fraxinus pennsylvanica 'Summit'	7	0.20%

Liquidambar styraciflua	143	4.07%
Liriodendron tulipifera	1	0.03%
Malus spp.	127	3.61%
N/A*	5	0.14%
Nyssa sylvatica	38	1.08%
Pinus contorta	6	0.17%
Platanus occidentalis	8	0.23%
Platanus x acerifolia	4	0.11%
Populus deltoides 'Pendula'	1	0.03%
Prunus cerasifera	125	3.56%
Prunus serrulata	270	7.68%
Pseudotsuga menziesii	10	0.28%
Pyrus calleryana	470	13.37%
Pyrus calleryana 'Chanticleer'	1	0.03%
Quercus coccinea	2	0.06%
Quercus garryana	7	0.20%
Quercus macrocarpa	5	0.14%
Quercus palustris	2	0.06%
Quercus rubra	154	4.38%
Salix babylonica 'contorta'	1	0.03%
Sorbus aucuparia	2	0.06%
Styrax japonicus	5	0.14%
Thuja plicata	3	0.09%
Tilia cordata	269	7.65%
Grand Total	**3515**	**100.00%**

Table 25: Tree Count by Tree Type.

Tree Type	Tree Count	Percent
N/A*	5	0.14%
Deciduous Broadleaf	3417	97.21%
Evergreen Conifer	90	2.56%
Evergreen Broadleaf	3	0.09%
Grand Total	3515	100.00%

Table 26: Tree Count by Tree Form.

Tree Form	Tree Count	Percent
Columnar	555	15.79%
Conical	19	0.54%
Irregular	166	4.72%
Open	2	0.06%
Oval	231	6.57%
Pyramidal	102	2.90%
Round	1613	45.89%
round	68	1.93%
Spreading	77	2.19%
Vase	651	18.52%
Weeping	18	0.51%
N/A	5	0.14%
Columnar	8	0.23%
Grand Total	3515	100.00%

Table 27: Tree Count of Asset Types

Asset Type	Count
Available Planting Space*	8
Landmark Tree	11
Street Tree	3504
Stump	16
Grand Total	3539

*Available Planting Space is any cutout that had no stump and had the capacity for a street tree. This does not include all places trees could potentially be installed, such as free-form planters, strips and medians.

Table 28: Count of Curb Damage Measured from Trees in all Planter Types.

Curb Displacement in inches	Tree Count
0.5	14
1	8
1.5	14
2	7
2.5	10
3	41
Grand Total	**94**

*Height difference between curb and sidewalk.

Table 29: Count of Sidewalk Damage Measured from Trees in all Planter Types.

Sidewalk Displacement in inches	Tree Count
0.25	6
0.5	277
0.75	14
1	110
1.5	59
2	41
2.5	18
3	24
4	3
5	3
Grand Total	**555**

*Height difference between two section of sidewalk, could be two sections of sidewalk panel or a cracked single panel of sidewalk.

Table 30: Tree Count by Maintenance Task Recommendations

Maintenance Task Recommendation	Tree Count	Percent of Maintenance Tasks	Percent of Total Trees (3,515)
Risk Evaluation	18	1.61%	0.51%
Vehicle Clearance	851	76.25%	24.21%
Pedestrian Clearance	58	5.20%	1.65%
Casual Sign Clearance	19	1.70%	0.54%
Critical Sign Clearance	8	0.72%	0.23%
Previously Topped (Replace)	12	1.08%	0.34%
Recommend Removal	43	3.85%	1.22%
Improper Mulching	23	2.06%	0.65%
Remove Tree Supports	72	6.45%	2.05%
Tree Grate Maintenance	12	1.08%	0.34%
Total	**1116**	**100.00%**	**31.75%**

8. URBAN TREE CANOPY DATA SUMMARY

Table 31: Urban tree canopy assessment results by land uses, including 2011 and 2017 analysis, percent land cover and distribution of UTC across UGA.

LAND USE	LAND AREA		2011 URBAN TREE CANOPY			2017 URBAN TREE CANOPY			2040 GOAL
	ACRES	%	ACRES	%	DIST.	ACRES	%	DIST.	
PORT OF OLYMPIA - OLYMPIA REGIONAL AIRPORT	806	5.8%	21	3%	<1%	24	3%	<1%	3%
PORT OF OLYMPIA - INDUSTRY	690	5.0%	242	35%	5%	290	42%	5%	35%
INDUSTRIAL	2442	17.6%	722	30%	14%	822	34%	15%	35%
CITY CORE MIXED USE	526	3.8%	114	22%	2%	141	27%	3%	30%
OTHER MIXED USE	139	1.0%	32	24%	<1%	38	27%	<1%	30%
GENERAL COMMERCIAL	723	5.2%	250	35%	5%	317	44%	6%	35%
SINGLE-FAMILY RESIDENTIAL	6311	45.3%	2686	14 %	53%	3011	48%	53%	55%
MULTIFAMILY RESIDENTIAL	813	5.9%	287	35%	6%	322	40%	6%	45%
OPEN SPACE & GREEN BELT	1450	10.4%	678	47%	14%	710	49%	13%	65%
TUMWATER + URBAN GROWTH AREA	13,900	100%	5,032	36%	100%	5,675	40%	100%	50%

Note: The 2040 Goal in Table 31 is based on the original recommendation by the consultant as amended by discussions by the Tree Board and Planning Commission in 2020.

A.2 – CITY GIS STAFF TREE CANOPY COVER ANALYSIS

Memorandum

To: Planning Commission

From: Brad Medrud and Jennifer Radcliff

Re: *Urban Forestry Management Plan* – Revised Canopy Cover Assessment

Date: March 2, 2021

Background

The evaluation of "canopy cover" in the *Urban Forestry Management Plan* is intended to allow the City to use change in canopy cover over time as a way to measure the performance of City policies and regulations on the City's urban forest over the 20-year scope of the plan.

The term "canopy cover" means the area in the City and its urban growth area currently covered by a tree and vegetation canopy made up of street trees, areas of native forest, and trees in parks, green space, and landscaping on private property. Canopy cover usually is expressed as a percentage of the total area of the City and its urban growth area covered by tree and vegetation canopy or as a percentage of the area of individual zone districts grouped into larger general land use categories covered by tree and vegetation canopy.

Because each zone district has different policies and regulations governing the type and intensity of development, the *Urban Forestry Management Plan* identified different canopy cover targets for its larger general land use categories. In Section 2.03(B) *Data Collection* of the *Urban Forestry Management Plan*, Table 6 – *Canopy Cover Targets by Land Use Type* is intended to allow the City to meet a range of other legislative and strategic policies, by establishing different canopy cover goals for the different zone districts in the City.

The canopy cover targets by zone district are intended to be used as a measure of the progress of the *Urban Forestry Management Plan* over the next 20 years. In addition, the canopy cover targets will be used to provide policy guidance for Tumwater Municipal Code amendments address street trees, the protection of trees and vegetation, and landscaping. In turn, these regulations will establish the minimum requirements and standards for development and redevelopment of individual properties in the City as it relates to the urban forest.

Questions to Be Addressed

During the *Urban Forestry Management Plan* adoption process in the summer of 2020, the Tree Board, Planning Commission, and City Council discussed canopy cover and canopy cover targets. It was recognized that it would be difficult to achieve some of the targets as the City has multiple strategic priorities for limited urban space.

In addition, there were questions raised about how the *Urban Forestry Management Plan* technical consultant prepared the canopy cover information and whether the City's GIS Team would be able to re-create that process in order to track the progress of the Plan over the coming years. Further questions were asked about the difference in canopy cover between developed, underdeveloped, and developable properties in the City, as well as whether those differences in developed, underdeveloped, and developable properties would affect the larger canopy cover goals of the Plan.

The intent of the memorandum is to summarize the work done by City staff in the fall of 2020 to answer these questions and to allow the City Council to complete the *Urban Forestry Management Plan* adoption process early in 2021.

Technical Discussion

Explanation of Technical Processes

See the "Explanation of Processes" in the appendix on page 10 for a full description of the procedures that the City's GIS Team followed to prepare the attached spreadsheet.

The intent of the technical process was to take readily accessible data that is updated on an annual basis at about the same time of year to allow for valid comparisons of data across years to support the implementation of the *Urban Forestry Management Plan.* The data, once collected, also needed to be in a format that could be processed by the City's GIS Team and their equipment in a reasonable amount of time.

Because of these limitations, it was determined that using aerial photography typically flown on an annual basis during the late fall to early spring was the best source of data for this use. LiDAR data was considered, but it is expensive to collect, it is not collected now on a consistent basis, and it can be challenging for the City's GIS Team and their equipment to process.

Spreadsheet

The table below explains the structure of the attached spreadsheet and data in each of the columns. The totals between the consultant data and City GIS Staff's work on the total canopy

coverage for the entire City, zone districts, and developed/ undeveloped/ undevelopable areas are different because they reflect different processes used to generate the data; however, there is enough similarity to allow for comparisons.

The consultant's process included all vegetation less than five feet in height, which City GIS Staff excluded from their calculations. In addition, the data used by the City GIS staff to calculation canopy coverage for developed/ undeveloped/ undevelopable areas of the City and its urban growth area came from a slightly different source than what was used for the calculations by the entire City.

Developed/ undeveloped/ undevelopable areas were calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the draft *Bush Prairie Habitat Conservation Plan*. These areas exclude parts that are not in a zone district, such as WSDOT right-of-way.

Developed/ undeveloped/ undevelopable areas are defined as:

Developed Areas – Properties in the City and its Urban Growth Area considered already developed to its highest intensity and unlikely to redevelop in the next 30 years.

Undeveloped Areas – Properties in the City and its Urban Growth Area considered likely to develop or redevelop in the next 30 years.

Undevelopable Areas – Properties in the City and its Urban Growth Area considered undevelopable because of the presence of critical areas or open water.

Staff's Canopy Coverage Goals Recommendation

Column S in the spreadsheet contains City staff's initial recommendation for a new set of canopy coverage goals for the *Urban Forestry Management Plan*.

To determine an appropriate set of new recommended canopy coverage goals, staff looked at the proportions of the total acreages for developed/ undeveloped/ undevelopable areas to understand the potential for development in each of the larger zoning by land use categories. In some cases, a large proportion of the area in zoning by land use categories was in undeveloped areas, such as the Industrial zoning by land use category, while in other cases, it was very small, such as the Open Space & Green Belt zoning by land use category.

Staff assumed that canopy coverage in developed areas and undevelopable areas would increase slowly over time because of limited amount of development expected in these areas over the next 30 years and the proposed actions in the *Urban Forestry Management Plan* increased tree plantings and retention in these areas.

Staff then looked at the undeveloped areas, which are considered likely to develop or redevelop in the next 30 years. To develop assumptions for the level of current canopy coverage lost to development or gained by new plantings required by development regulations, staff reviewed the policies of the City's *Comprehensive Plan* and the City Council's *Strategic Priorities for 2021-2026* to get a general sense of the intensity of development and level of potential tree plantings and retention in these areas. The City's *Comprehensive Plan* is consistent with the state Growth Management Act and the County-Wide Planning Policies, which require urban areas to plan for accommodating future growth and development.

For some undeveloped areas, such as the Commercial and Industrial zoning by land use categories, more canopy was expected to be lost to development in the next thirty years than replaced by new plantings, than in some undeveloped areas, such as the Single-Family Residential zoning by land use category.

Table 32: Structure of Canopy Coverage Spreadsheet

Column	Section Title	Column Title	Explanation
B	Zone Districts	Zone Districts	Current zone districts for the City and its Urban Growth Area. Note some zone districts are only found in the Urban Growth Area.
C	Consultant *Urban Tree Canopy Assessment* (1/31/20) – Total Acres in City from Table 14[9]	Total Acres in City from Table 14[1]	Total acreage in the City and its Urban Growth Area by zone district calculated by the consultant in Table 14[1] of their *Urban Tree Canopy Assessment*, dated January 31, 2020. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
D		Acres of Canopy Cover in 2017 from Table 14[1]	Total acreage of canopy cover by zone districts, grouped into larger general land use categories for the City and its Urban Growth Area. Calculated by the consultant in Table 14[1] of their *Urban Tree Canopy Assessment*, dated January 31, 2020 from 2017 aerial photography.
E		2017 Canopy Cover Percentage from Table 16[1]	Canopy Cover percentages in the City and its Urban Growth Area by zone districts grouped into larger general land use categories. Calculated by the consultant in Table 16[1] of their *Urban Tree Canopy Assessment*, dated January 31, 2020, by comparing the total acres in the City (Column C) with the acres of canopy cover in 2017 (Column D).
F		Recommended 2040 Canopy Cover Percentage Goal	Recommended 2040 canopy cover goal by percentage of zone districts grouped into larger general land use categories in Table 14[1] of the consultant's *Urban Tree Canopy Assessment*, dated January 31, 2020.

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[9] *Urban Tree Canopy Assessment* is in Appendix A.1 in the Urban Forestry Management Plan.

Column	Section Title	Subsection Title	Column Title	Explanation
G	City GIS Staff Analysis (12/18/20) – Total Acres of Canopy Cover Divided Into Developed/ Undeveloped/ Undevelopable	Developed Area	Total Developed Area in Acres	Total acreage of properties in the City and its Urban Growth Area considered already developed to its highest intensity and unlikely to redevelop in the next 30 years by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
H			Developed Area Canopy Cover in Acres	Acreage of canopy cover from 2019 for properties in the City and its Urban Growth Area considered already developed to its highest intensity and unlikely to redevelop in the next 30 years by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
I			Developed Area Canopy Cover Percentage Tumwater GIS	Canopy cover percentages for developed properties the City and its Urban Growth Area by zone districts grouped into larger general land use categories. Calculated by City GIS staff in December 2020 and February 2021 by comparing the total developed acres in the City (Column G) with the acres of canopy cover on developed property in 2019 (Column H).

Column	Section Title	Subsection Title	Column Title	Explanation
J	City GIS Staff Analysis (12/18/20) – Total Acres of Canopy Cover Divided Into Developed/ Undeveloped/ Undevelopable (continued)	Undeveloped Area	Total Undeveloped Area in Acres	Total acreage of properties in the City and its Urban Growth Area considered likely to develop or redevelop in the next 30 years by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
K			Undeveloped Area Canopy Cover in Acres	Acreage of canopy cover from 2019 for properties in the City and its Urban Growth Area considered likely to develop or redevelop in the next 30 years by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
L			Undeveloped Area Canopy Cover Percentage Tumwater GIS	Canopy cover percentages for undeveloped properties the City and its Urban Growth Area by zone districts grouped into larger general land use categories. Calculated by City GIS staff in December 2020 and February 2021 by comparing the total undeveloped acres in the City (Column J) with the acres of canopy cover on undeveloped property (Column K).

Column	Section Title	Subsection Title	Column Title	Explanation
M	City GIS Staff Analysis (12/18/20) – Total Acres of Canopy Cover Divided Into Developed/ Undeveloped/ Undevelopable (continued)	Undevelopable Area	Total Undevelopable Area In Acres	Total acreage of properties in the City and its Urban Growth Area considered undevelopable because of the presence of critical areas or open water by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
N			Undevelopable Area Canopy Cover in Acres	Acreage of canopy cover from 2019 for properties in the City and its Urban Growth Area considered undevelopable because of the presence of critical areas or open water by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
O			Undevelopable Area Canopy Cover Percentage Tumwater GIS	Canopy cover percentages for undevelopable properties the City and its Urban Growth Area by zone districts grouped into larger general land use categories. Calculated by City GIS staff in December 2020 and February 2021 by comparing the total undevelopable acres in the City (Column M) with the acres of canopy cover on undevelopable property (Column N).

Column	Section Title	Subsection Title	Column Title	Explanation
P	City GIS Staff Analysis (12/18/20) – Total Acres of Canopy Cover Divided Into Developed/ Undeveloped/ Undevelopable (continued)	Total Area	Total Developed/ Undeveloped/ Undevelopable Area in Acres	Total acreage of properties in the City and its Urban Growth Area considered already developed, undeveloped, or undevelopable to its highest intensity and unlikely to redevelop in the next 30 years by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.
Q			Total Developed/ Undeveloped/ Undevelopable Area Canopy Cover in Acres	Acreage of canopy cover from 2019 for properties in the City and its Urban Growth Area considered already developed, undeveloped, or undevelopable to its highest intensity and unlikely to redevelop in the next 30 years by zone district. Calculated by City GIS staff in December 2020 and February 2021 based on the April 2019 developable area work prepared by the Thurston Regional Planning Council for the Bush Prairie Habitat Conservation Plan. Excludes areas that are not in a zone district, such as WSDOT right-of-way.

Column	Section Title	Column Title	Explanation
R		Total Developed/ Undeveloped/ Undevelopable Area Canopy Cover Percentage Tumwater GIS	Canopy cover percentages for developed, undeveloped, or undevelopable properties the City and its Urban Growth Area by zone districts grouped into larger general land use categories. Calculated by City GIS staff in December 2020 and February 2021 by comparing the developed, undeveloped, or undevelopable acres in the City (Column P) with the acres of canopy cover on developed, undeveloped, or undevelopable property (Column Q).

Column	Section Title	Column Title	Explanation
S	Tumwater Staff Proposal (12/18/20)	Revised Recommended 2040 Canopy Cover Percentage Goal	Revised recommended 2040 canopy cover goal by percentage of zone districts grouped into larger general land use categories by City staff in December 2020 and February 2021 from 2019 data.
T	Zoning by Land Use	Zoning by Land Use	Zone districts grouped into larger general land use categories

APPENDIX

SVM Tree Canopy Cover Analysis: City of Tumwater GIS

The City of Tumwater's GIS Team determined that the Support Vector Machines (SVM) classification method is best suited to determining tree canopy cover within the City. SVM classification is a supervised, high-level machine learning classification method that uses kernel functions and hyperplanes to classify data. Please click here to learn more about SVM.

This analysis was completed using ArcGIS Pro with the following tools: The Image Classification Wizard, Segment an Image, and Create Accuracy Assessment Points.

There were several steps to a Tree Canopy Cover analysis:

1. Create a segmented image
2. Create training samples
3. Train the classifier
4. Add additional training samples and retrain the classifier (repeat as much as necessary)
5. Create final classification
6. Create accuracy assessment points
7. Compute confusion matrix
8. Determine accuracy
9. Export raster to polygons
10. Compute tree canopy cover by zoning

To complete this analysis, the GIS Team used 6-inch 4-band State imagery from 2019 and 3-inch 4-band imagery from 2018.

First, the GIS Team created a segmented raster from the original aerial photo. The process of segmenting smooths and groups like-pixels together to create an almost "animated" looking raster. The GIS Team used the following values to create our segmented raster:

Spectral Detail	Spatial Detail	Minimum Segment Size (Pixels)
18.5	19	20

Spectral Detail: Spectral detail is used to distinguish between features that have similar spectral characteristics. For the GIS Team analysis, the team needed to distinguish between grass and deciduous trees and between shadows and fir trees.

Spatial Detail: Spatial detail determines the importance of space between features. A higher value is used when features are small and close together. In this analysis, trees were clustered around pockets of development or next to roads.

Minimum Segment Size: Segments smaller than the designated segment size are grouped with the best fitting neighboring segment.

Next, the GIS Team then created 30+ training samples for each of the following classes:

Class Name	Class Value
Tree Canopy Cover	1
Non-canopy Vegetation	2
Soil and Dry Vegetation	3
Buildings	4
Other Impervious	5
Water	6

More training samples create a higher statistical significance when classifying. Creating training samples can take up to **several hours.**

The GIS Team trained the SVM classifier using supervised, object-based classification. The GIS Team generated its classification schema from its training samples and used the segmented image as an additional input to the tool. The segmented image helps the classifier recognize like-groups of pixels more easily. This process takes varying amounts of time depending on the resolution of the image. For the 2018 aerial photo, it took **about an hour** to train the classifier. For 2019, it took **roughly half that time**. Training the classifier is an iterative process that involves adding additional training samples and re-running the trainer. For both 2019 and 2018 imagery, the classifier was trained twice.

Then, the GIS Team ran the SVM classifier using the default sample size per class, but adding on four segment attributes: active chromaticity color, mean digital number, standard deviation, and count of pixels. These attributes provided additional information about each class (tree canopy cover, water, buildings, etc.). Classification took about **½ to 1 hour** on average, but can take much longer.

When classification was complete, the GIS Team created 250 equalized stratified random Accuracy Assessment Points using the 'Classified' value from the classified raster. Then the GIS Team determined the 'ground truth' value for each point. With this information, the GIS Team were able to populate a Confusion Matrix to compute various statistics (precision, commission, error of omission, Kappa, etc.) and the accuracy of the classifier.

For 2018, the classifier was **80% accurate** at identifying tree canopy cover.

For 2019, the classifier was **97% accurate** at identifying tree canopy cover.

Next, the GIS Team exported the rasters to polygons. The export process takes **about ½ to 2 hours** on average, but can take much longer depending on the size of the raster. When the export was complete, the GIS Team exported Tree Canopy Cover to its own feature class. Using

the 'Union' tool, the GIS Team combined Tree Canopy Cover, Zoning, and Developable/ Undevelopable/Developed land categories. This enabled the GIS Team to compute the amount of tree canopy cover by zoning type and land status.

Table 33: Canopy Coverage Calculations Table

B	C	D	E	F
	Consultant's *Urban Tree Canopy Assessment* (1/31/20)			
	Total Acres in City			
Zone Districts	Total Acres in City from Table 6	Acres of Canopy Cover in 2017 from Table 6	2017 Canopy Cover Percentage from Table 8	Recommended 2040 Canopy Cover Percentage Goal
Airport Related Industry	1,496.00	24.00	3%	3%
		290.00	42%	35%
Light Industrial	2,335.00	822.00	34%	35%
Heavy Industrial	107.00			
Brewery District	180.00	141.00	27%	28%
Capitol Boulevard Community	141.00			
Town Center	205.00			
Mixed Use	100.00	38.00	27%	30%
Neighborhood Commercial	39.00			
Community Services	41.00	317.00	44%	35%
Business Park (UGA Only)	76.00			
General Commercial	499.00			
Historic Commercial	85.00			
Commercial Development (UGA Only)	22.00			
Residential/Sensitive Resource	774.00	3,011.00	48%	55%
Single-Family Low Density	3,677.00			
Single-Family Medium Density	1,738.00			
Manufactured Home Park	123.00			
Multifamily High Density	117.00	322.00	40%	40%
Multifamily Medium Density	696.00			
Open Space	1,083.00	710.00	49%	65%
Green Belt	367.00			
Tumwater + Urban Growth Area	**13,901.00**	**5,675.00**	**40%**	**43%**

B	G	H	I
	City GIS Staff Analysis (2/24/21)		
	Total Acres of Canopy Cover Divided Into Developed/Undeveloped/Undevelopable (2019)		
	Developed Area		
Zone Districts	**Total Developed Area in Acres**	**Developed Area Canopy Cover in Acres**	**Developed Canopy Cover Percentage Tumwater GIS**
Airport Related Industry - Airport	702.00	13.31	2%
Airport Related Industry – Non-Airport	237.25	41.97	18%
Light Industrial	865.99	150.27	17%
Heavy Industrial			
Brewery District	317.51	74.31	23%
Capitol Boulevard Community			
Town Center			
Mixed Use	44.73	11.86	27%
Neighborhood Commercial			
Community Services	278.02	60.27	22%
Business Park (UGA Only)			
General Commercial			
Historic Commercial			
Commercial Development (UGA Only)			
Residential/Sensitive Resource	2,307.59	1,029.3	45%
Single-Family Low Density			
Single-Family Medium Density			
Manufactured Home Park			
Multifamily High Density	388.82	130.27	34%
Multifamily Medium Density			
Open Space	244.44	148.09	61%
Green Belt			
Tumwater + Urban Growth Area	**5,386.35**	**1,659.65**	**31%**

B	J	K	L
	City GIS Staff Analysis (2/24/21)		
	Total Acres of Canopy Cover Divided Into Developed/Undeveloped/Undevelopable (2019)		
	Undeveloped Area		
Zone Districts	**Total Undeveloped Area in Acres**	**Undeveloped Area Canopy Cover in Acres**	**Undeveloped Canopy Cover Percentage Tumwater GIS**
Airport Related Industry - Airport	10.25	5.39	53%
Airport Related Industry – Non-Airport	359.02	194.92	54%
Light Industrial	1,041.80	412.24	40%
Heavy Industrial			
Brewery District	92.18	40.07	43%
Capitol Boulevard Community			
Town Center			
Mixed Use	74.70	25.37	34%
Neighborhood Commercial			
Community Services	240.47	133.09	55%
Business Park (UGA Only)			
General Commercial			
Historic Commercial			
Commercial Development (UGA Only)			
Residential/Sensitive Resource	1,728.73	995.91	58%
Single-Family Low Density			
Single-Family Medium Density			
Manufactured Home Park			
Multifamily High Density	299.57	133.72	45%
Multifamily Medium Density			
Open Space	3.04	1.78	59%
Green Belt			
Tumwater + Urban Growth Area	**3,849.76**	**1,942.49**	**50%**

B	M	N	O
	City GIS Staff Analysis (2/24/21)		
	Total Acres of Canopy Cover Divided Into Developed/Undeveloped/Undevelopable (2019)		
	Undevelopable Area		
Zone Districts	**Total Undevelopable Area In Acres**	**Undevelopable Area Canopy Cover in Acres**	**Undevelopable Canopy Cover Percentage Tumwater GIS**
Airport Related Industry - Airport	95.34	5.30	6%
Airport Related Industry – Non-Airport	92.14	45.13	49%
Light Industrial	537.94	208.78	39%
Heavy Industrial			
Brewery District	116.09	28.84	25%
Capitol Boulevard Community			
Town Center			
Mixed Use	18.97	4.23	22%
Neighborhood Commercial			
Community Services	215.15	108.6	50%
Business Park (UGA Only)			
General Commercial			
Historic Commercial			
Commercial Development (UGA Only)			
Residential/Sensitive Resource	2,270.09	1,228	54%
Single-Family Low Density			
Single-Family Medium Density			
Manufactured Home Park			
Multifamily High Density	125.22	64.03	51%
Multifamily Medium Density			
Open Space	1,224.64	564.23	46%
Green Belt			
Tumwater + Urban Growth Area	**4,695.58**	**2,257.14**	**48%**

T	P	Q	R	S
	City GIS Staff Analysis (2/24/21)			**Tumwater Staff Proposal (2/24/21)**
	Total Acres of Canopy Cover Divided Into Developed/Undeveloped/Undevelopable (2019)			
	Total Area			
Zoning by Land Use	**Total Developed/ Undeveloped/ Undevelopable Area in Acres**	**Total Developed/ Undeveloped/ Undevelopable Area Canopy Cover in Acres**	**Canopy Cover Percentage Tumwater GIS**	**Revised Recommended 2040 Canopy Cover Percentage Goal**
Airport Related Industry - Airport	807.59	24.00	3%	**3%**
Airport Related Industry – Non-Airport	688.41	282.02	41%	**25%**
Industrial	2,445.73	771.29	32%	**25%**
City Core Mixed Use	525.78	143.22	27%	**25%**
Other Mixed Use	138.40	41.46	30%	**25%**
General Commercial	733.64	301.96	41%	**30%**
Single-Family Residential	6,306.41	3,253.21	52%	**50%**
Multifamily Residential	813.61	328.02	40%	**40%**
Open Space & Green Belt	1,472.12	714.10	49%	**55%**
Tumwater + Urban Growth Area	**13,931.30**	**5,859.28**	**42%**	**39%**

Zoning By Land Use	Total Developed/ Undeveloped/ Undevelopable Area in Acres	Revised Recommended 2040 Canopy Cover Percentage Goal	Total Developed/ Undeveloped/ Undevelopable Area Canopy Cover in Acres With 2040 Goal
Port of Olympia - Olympia Regional Airport	807.59	3%	24.23
Port of Olympia - Industry	688.41	25%	172.10
Industrial	2,445.73	25%	611.43
City Core Mixed Use	525.78	25%	131.45
Other Mixed Use	138.40	25%	34.60
General Commercial	733.64	30%	220.09
Single-Family Residential	6,306.41	50%	3,153.21
Multifamily Residential	813.61	40%	325.44
Open Space & Green Belt	1,472.12	55%	809.67
Tumwater + Urban Growth Area	**13,931.69**	**39%**	**5,482.21**

Note: Percentage for Tumwater + Urban Growth Area is based on the 2040 Canopy Cover Percentage Goals for each of the Zoning by Land use Categories being added together and divided by the total area.

A.3 – PUBLIC ENGAGEMENT PLAN

Date: February 16, 2018

To: City of Tumwater Tree Board

From: Suresh Bhagavan, Associate Planner, and Brad Medrud, Planning Manager

Subject: Urban Forestry Management Plan – Public Engagement Plan

What is an Urban Forestry Management Plan?

The Urban Forestry Management Plan will provide policy guidance for the maintenance and improvement of the urban tree canopy in the City of Tumwater. The Plan will provide protocols, outcomes, and implementation actions to maintain and enhance trees, understory, and forests on public and private land.

Background

Currently, the City's *Urban Forestry Plan*, *Comprehensive Street Tree Master Plan*, and Tumwater Municipal Code (TMC) Chapter 16.08 – *Protection of Trees and Vegetation* guide the management and preservation of the City's urban forest:

City of Tumwater Urban Forestry Plan (adopted 1996) – This Plan guides the future stewardship of trees within the City by focusing primarily on effective management of trees on City property while assisting private property owners through outreach and education programs to manage trees on private lands. Goals of the Plan include minimizing loss of forest canopy cover on public lands and increasing the diversity of trees in the urban forest.

City of Tumwater Comprehensive Street Tree Plan (adopted 2002) – This Plan manages and maintains the City's street trees and represents a commitment to establish and protect "a healthy, diverse and important community asset." Street trees are considered a valuable part of the public infrastructure and are required whenever development occurs. The *Comprehensive Street Tree Plan* contains an inventory of existing trees and recommendations for maintenance and future plantings. The Plan also provides recommendations for revisions to the City land use guidelines and development codes to plan development existing street tree and urban forestry practices.

Tumwater Municipal Code (TMC) Chapter 16.08 – Protection of Trees and Vegetation (last substantial update 2006) – The standards for tree protection are codified in this chapter of TMC Title 16 – Environment.

In the 10 to 20 years since these plans and regulations were adopted, the City has grown considerably in size and population and faces new challenges in planning for growth under the Growth Management Act, while addressing the protection of species listed under the Endangered Species Act in the City and its Urban Growth Area.

The City Council's *City of Tumwater Strategic Priorities 2017-2022* identified "Develop new approaches to tree preservation and urban forestry management" as part of their "Be a Leader in Environmental Sustainability" goal and made it a priority in the *2017-2018 City of Tumwater Budget.* Preparation of the Urban Forestry Management Plan is one of the primary goals of the City's Tree Board with the support of staff from the Community Development Department.

The intent of the Urban Forestry Management Plan is to build on and plan development work done on the *Urban Forestry Plan* and *Comprehensive Street Tree Plan,* and to provide recommendations for updating TMC 16.08 – *Protection of Trees and Vegetation* and TMC 18.47 – *Landscaping.*

What Are the Project's Goals for Community Engagement?

1. Provide information to help public understanding of issues;
2. Rely on multiple communication media to share information;
3. Seek involvement from a broad range of individuals and community groups who care about urban forestry and the community;
4. Solicit feedback early in the Plan development process and at strategic points throughout the process;
5. Offer opportunities for people to provide feedback to staff, the Tree Board, and elected officials;
6. Make the process and information provided accessible and engaging for everyone;
7. Make community-driven planning the priority for the Urban Forestry Management Plan; and
8. Ensure the Tree Board, elected officials, City staff, and stakeholders understand community viewpoints and concerns that relate to the Plan development process.

Who Are the Project Stakeholders and Interested Parties?

Residents and Employees

- Residents in the City of Tumwater and the Tumwater Urban Growth Area

- Neighborhoods and Homeowner's Associations in the City of Tumwater and the Tumwater Urban Growth Area
- Employees in the City of Tumwater and the Tumwater Urban Growth Area
- Civic groups

Regulatory and Advisory Agencies or Bodies

- Tumwater City Council
- City of Tumwater Tree Board
- City of Tumwater Parks and Recreation Commission
- City of Tumwater Planning Commission
- City of Tumwater Historic Preservation Commission
- Thurston County Council and Planning Commission
- Washington State Department of Commerce
- City of Tumwater Community Development Department
- City of Tumwater Public Works Department
- City of Tumwater Parks and Recreation Department
- City of Tumwater Fire Department

Other Public Agencies

- Port of Olympia
- South Puget Sound Community College
- Thurston County Planning and Development Services
- InterCity Transit
- Tumwater School District
- LOTT Clean Water Alliance
- Chehalis Tribal Nation
- Squaxin Tribal Nation
- State Agencies located in the City – State Department of Health, State Department of Corrections, State Department of Labor and Industries, State Department of Parks, and others
- Thurston Economic Development Council
- Timberland Regional Library
- Thurston Regional Planning Council

- Washington State Department of Natural Resources – Urban and Community Forestry Program

Business and Development

- Employers
- Olympia Master Builders
- Olympia – Thurston County Association of Realtors
- Puget Sound Energy
- Tumwater Chamber of Commerce
- Thurston Chamber of Commerce

What is Our Community Engagement Process?

The City will use a range of public engagement strategies to encourage and facilitate community participation in the planning process. The process is flexible and may be changed to take advantage of events and opportunities that may arise. The communication strategy will employ multiple tools and platforms to inform and engage the community, stakeholders, and interested parties.

What Communication Strategies Will the Plan Development Include?

Stakeholders and Interested Parties

During the first phase of the project, staff will work with the Tree Board and elected officials to identify a small group of key stakeholders to help manage the project with the Tree Board and staff. A larger list of interested parties will be identified. Staff will introduce key stakeholders and interested parties to the planning process through a series of communications. Key stakeholders and interested parties will be asked to provide input on the Plan through a community survey, a utility bill insert questionnaire, digital and social media outreach.

Tree Board, Planning Commission, General Government Committee, and City Council

Staff will present information on the community engagement effort to the Tree Board, Planning Commission, General Government Committee, and City Council meetings throughout the Plan development process. Tree Board meetings will also be used as times for stakeholders and interested parties to present information and receive public input throughout the plan development process. The public will be notified of key

meetings via the City's website, the *Olympian* newspaper, social media, Tumwater On-Tap e-newsletter, and City e-mail list.

Community Workshops and Open Houses

Community workshops and open houses will allow City staff to present the draft Urban Forestry Management Plan to the public prior to the start of and during the legislative process. Staff will provide an overview of the process to date, draft goals, and next steps. Information about community workshop and open house dates and other key meeting dates will be widely distributed through media releases, the *Olympian* newspaper, the City's website, the City's Facebook page, and e-mail contact lists.

Community Survey

An online community survey will be available on the City website to assess community priorities. Members of the public will be notified of the survey by e-mail and the City's social media.

Utility bill insert questionnaires will be distributed citywide in winter 2018 to sample public opinion of City residents and businesses.

Consultation with Advisory Boards, Planning Commission, and Other Advisors

City advisory boards and commissions will be engaged throughout the plan development process. These groups, including the Planning Commission, Historic Preservation Commission, and Parks and Recreation Commission, TRPC Planners Advisory Groups, Thurston County Planning Commission will review and provide feedback on components of the draft Urban Forestry Management Plan (e.g. transportation, land use, conservation, etc.). Results of the community survey, as well as other public input, will also be shared with these advisors.

Tree Board Public Hearing

The Tree Board will conduct a public hearing to gather public comment on the final draft Urban Forestry Management Plan before developing findings of fact, conclusions, and recommendations that will be forwarded to City Council.

Public notice of the public hearing will be published in accordance with state law and Tumwater Municipal Code. In addition to the required noticing procedures, notice will also be provided through press release, the *Olympian*, the City's website, the City's Facebook page, and the e-mail contact lists.

City Council General Government Committee

The City Council's General Government Committee will periodically review and discuss the Urban Forestry Management Plan development. All meeting dates and materials will be posted on the City's website.

City Council Work Session and Consideration

The City Council will consider the public input on the draft Urban Forestry Management Plan forwarded by the Tree Board. Public notice of the meeting will be published in accordance with state law and Tumwater Municipal Code on the City's website.

What Methods Will Be Used to Ensure that the Public Is Informed and Has the Opportunity to Participate?

Website

All materials associated with the plan development, including draft documents, maps, scope of work, meeting times and locations, staff contact information, and instructions on how to submit comments, will be posted on a project-specific webpage on the City's website. Additionally, feature stories will be posted on the homepage of the City's website.

Social Media

Information on the plan development and meetings, community workshops and open houses, and public meeting and hearing times and locations, and other notices will be shared on the City's social media sites.

Media Releases

The City will issue press releases and advertise the community survey, community workshops and open houses, and public meetings and hearings in the *Olympian* newspaper, the City's website, e-mail contact lists, social media outlets, and on the local cable television channel, TCTV 26.

E-mail Contact List

The City will maintain a list of interested members of the public and stakeholders who will be notified of meetings and other information related to the update process via e-mail.

Notice Boards

The City will post public notices identifying community workshops and open houses, briefings, work sessions, and public meetings and hearing times and locations, as well as information on how to provide comment.

Table 5 – Public Involvement

Phase	Public Engagement Events and Activities	Input
Phase 1: Confirm Plan Vision and Conduct Inventory and Assessment	• Website update • Project materials available for review online or at City Hall • Stakeholder and interested party outreach • Tree Board meetings • Tree Board meetings with community workshops and open houses • General Government Committee briefing • Planning Commission briefing	• Comments via mail and e-mail • Community survey • Tree Board meetings with community workshops and open houses • General Government Committee and Planning Commission briefings

Phase	Public Engagement Events and Activities	Input
Phase 2: Prepare Plan with Implementation Actions	- Website update - Project materials available for review online or at City Hall - Stakeholder and interested party outreach - Tree Board meetings - Tree Board meetings with community workshops and open houses - General Government Committee briefing - Planning Commission briefing	- Comments via mail and e-mail - Tree Board meetings with community workshops and open houses - General Government Committee and Planning Commission briefings
Phase 3: Legislative Process	- Website update - Project materials available for review online or at City Hall - Stakeholder and interested party outreach - Tree Board hearing - General Government Committee briefing - City Council work session and consideration	- Comments via mail and e-mail - Public testimony

Where Do I Send My Comments?

Written comments are welcome at any time during the Urban Forestry Management Plan preparation process. To be considered by the Tree Board at a public hearing and City Council adoption process, formal written comments should be submitted by the deadline

included in the public notices published in the *Olympian* newspaper. Staff will address and publish all formal comments.

City of Tumwater Contact:

Suresh Bhagavan
> City of Tumwater Associate Planner
> Community Development Department
> 555 Israel Road SW
> Tumwater, WA 98501
> Phone: 360-754-4180
> Fax: 360-754-4138
> E-mail: sbhagavan@ci.tumwater.wa.us

To be notified of up-coming meetings and the Plan developments, please send an e-mail to sbhagavan@ci.tumwater.wa.us

All documents related to the Plan development are located on the City website: http://www.ci.tumwater.wa.us/departments/community-development/trees

For information on the City Tree Board, located on the City website, please go to http://www.ci.tumwater.wa.us/departments/mayor-City-council/advisory-boards/tree-board

What Is Our Community Engagement Timeline?

The plan development process will follow three general phases (Please note that exact meeting dates may change):

Phase 1: Confirm Plan Vision and Conduct Inventory and Assessment

    A. Prepare Vision Statement

        1. Tree Board meeting with stakeholders – Project kick-off meeting – January 8, 2018

        2. Initial community input.

            a. Complete online community survey.

            b. Conduct stakeholder analysis.

        3. Develop vision statement with input from Stakeholders.

        4. Tree Board meeting with stakeholders – Community workshop and open house to confirm vision – May 7, 2018

    B. Conduct Inventories and Assessments

1. Establish data collection parameters and protocols.

2. Tree Board meeting with stakeholders – Confirm data collection parameters and protocols – <u>February 12, 2018</u>

3. Data collection – Generally covering the following areas:

   a. Context

      1) History and land use changes

      2) Environment assessments – Climate zones, soil conditions, fire risks, invasive species, species of concern, and other

   b. Tree and vegetation inventory

      1) Determine total canopy cover percentage for the City.

      2) Tree canopy assessment on public land.

      3) Canopy on private land – The expectation is that this would not require fieldwork, but rely on aerial photography and GIS.

   c. Tree and vegetation management

      1) Assess how various City departments interact with each other and with the community, City Tree Protection Professional, Tree Board, Parks and Recreation Commission, Historic Preservation Commission, and other organizations involved in tree care.

   d. Plans, policies, and regulations

      1) Plans

      2) Policies

      3) Regulations

   e. Practices

      1) Review and provide comment on City Planting and Pruning Standards and Practices, including planting, pruning, tree removal, root system work, permitting, and outreach education.

      2) Review and provide comment on ANSI A300 Standards.

4. Prepare inventories and assessments summary

5. Tree Board meeting with stakeholders – Review inventories and assessments summary document at community workshop and open house – <u>June 11, 2018</u>

Additional public meeting opportunities during this time:

- General Government Committee project briefing – <u>March 6, 2018</u>

- Planning Commission briefing – <u>March 27, 2018</u>

Phase 2: Prepare Plan with Implementation Actions

<u>July 2018 to November 2018</u>

In Phase 2, feedback gathered through the online community survey, Tree Board, Planning Commission, General Government Committee, and City Council meetings and other means will be incorporated into the draft Urban Forestry Management Plan. Community workshops and open houses will provide an opportunity to review the draft Plan prior to the start of the formal legislative adoption process.

C. <u>Perform Strategic Planning</u>

1. Data analysis and synthesis

    a. Identify and address issues and trends related to urban forestry sustainability.

        1) Vegetation – tree resources, including recommendations for canopy cover, age distribution, species mix, native vegetation, and vegetation and tree resource needs.

        2) Resource management, including recommendations for citywide management plan, funding, City staffing, assessment tools, species and site selection, standards for tree care, community safety, recycling, and resource management needs.

        3) Community framework needs, including recommendations for public agency cooperation, involvement of large private and institutional landowners, green industry cooperation, neighborhood action, community-government-business interaction, general awareness of trees as community resources, regional cooperation, and community framework needs.

    b. Tree Board meeting with stakeholders – Review issues and trends – <u>July 9, 2018</u>

2. Prepare strategic plan

    a. Develop goals.

    b. Develop policies.

    c. Develop actions.

3. Tree Board meeting with stakeholders – Community workshop and open house to provide input on strategic plan's goals, objectives, and actions – <u>September 10, 2018</u>

    4. Tree board meeting with stakeholders – Review complete review of draft strategic plan – <u>October 8, 2018</u>

  D. <u>Prepare Implementation Plan</u>

    1. Develop a matrix to address who will complete the action and when.

    2. Establish monitoring plan

    3. Tree Board meeting with stakeholders – Review implementation plan – <u>November 12, 2018</u>

Additional public meeting opportunities during this time:

- General Government Committee project briefing – <u>August 7, 2018</u>
- Planning Commission briefing – <u>October 9, 2018</u>

Phase 3: Legislative Process

<u>December 2018 to March 2019</u>

The City staff will complete a final draft version of the Urban Forestry Management Plan during Phase 3.

The City Council will review the Tree Board, stakeholder, and staff recommendations on the Plan. Final revisions will be adopted by ordinance of the City Council. This phase includes required 60-day notice of Adoption to the Department of Commerce, as well as review and comment periods required under the State Environmental Policy Act (SEPA). The process will culminate in the adoption of a new Urban Forestry Management Plan.

  E. <u>Final Steps</u>

    1. Compile draft Urban Forestry Management Plan.

    2. Final Plan approval.

      a. Tree Board public hearing – <u>December 10, 2018</u>

      b. General Government Committee briefing – <u>February 5, 2019</u>

      c. City Council work session – <u>February 12, 2019</u>

      d. City Council consideration – <u>March 5, 2019</u>

A.4 – COMMUNITY SURVEY SUMMARY

Community Tree Survey

QUESTION SUMMARIES   DATA TRENDS   INDIVIDUAL RESPONSES

Q1

Using the Tumwater and Urban Growth Are map above, please describe your relationship with Tumwater? Please check all that apply.

Answered: 120   Skipped: 0
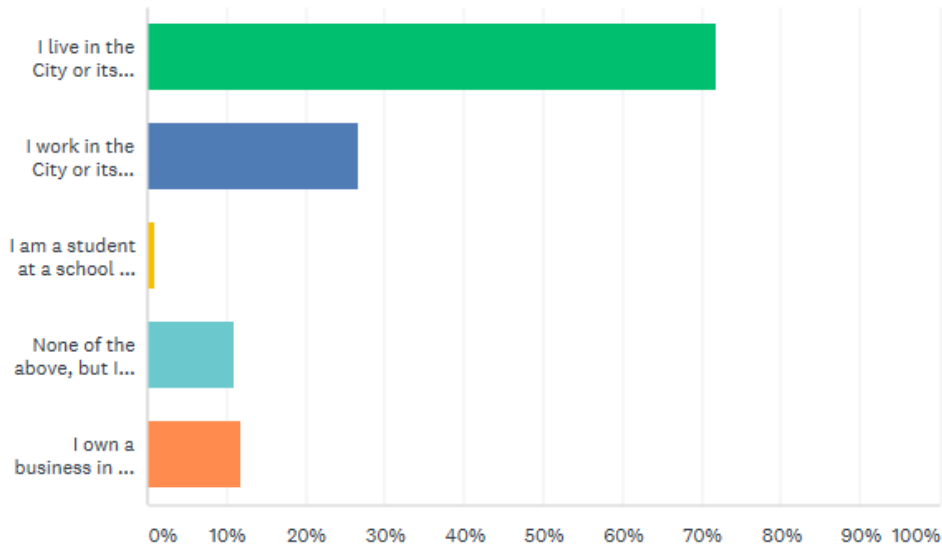
ANSWER CHOICES	RESPONSES	
I live in the City or its urban growth area.	71.67%	86
I work in the City or its urban growth area.	26.67%	32
I am a student at a school in the City or its urban growth area.	0.83%	1
None of the above, but I shop, use facilities, or attend events in the City or its urban growth area.	10.83%	13
I own a business in the City or its urban growth area.	11.67%	14
Total Respondents: 120		

Q2

If you are are business owner, please indicate the neighborhood where your business located in Tumwater or its urban growth area. Refer to the neighborhood map or the urban growth map to locate your area.

Answered: 108   Skipped: 12
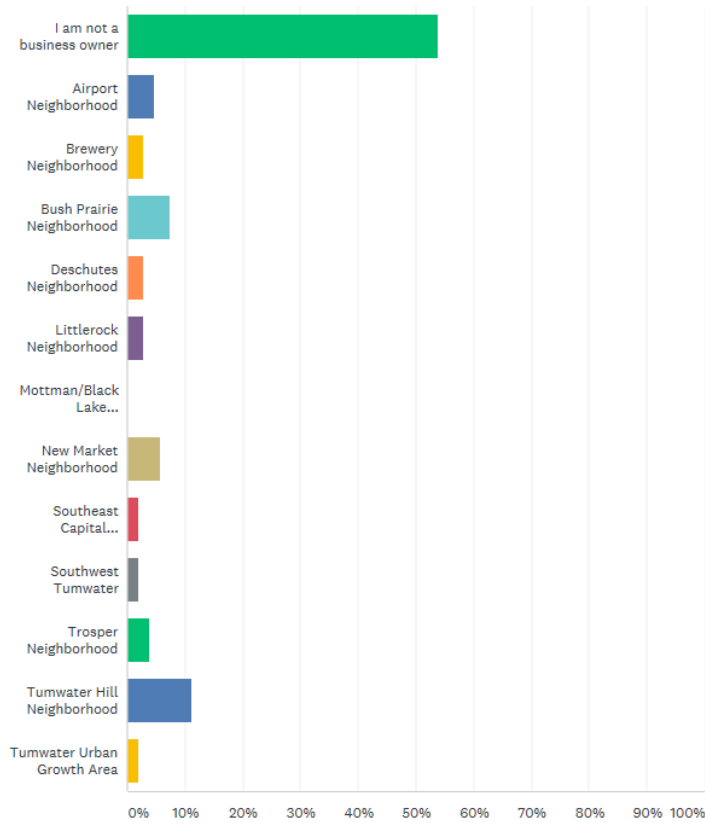
ANSWER CHOICES	RESPONSES	
I am not a business owner	53.70%	58
Airport Neighborhood	4.63%	5
Brewery Neighborhood	2.78%	3
Bush Prairie Neighborhood	7.41%	8
Deschutes Neighborhood	2.78%	3
Littlerock Neighborhood	2.78%	3
Mottman/Black Lake Neighborhood	0.00%	0
New Market Neighborhood	5.56%	6
Southeast Capital Boulevard Neighborhood	1.85%	2
Southwest Tumwater	1.85%	2
Trosper Neighborhood	3.70%	4
Tumwater Hill Neighborhood	11.11%	12
Tumwater Urban Growth Area	1.85%	2
TOTAL		108

Q3

If you are a business owner, are there street trees, parking lot trees, or landscaped areas near your business? Please check the answer that best applies.

Answered: 109   Skipped: 11
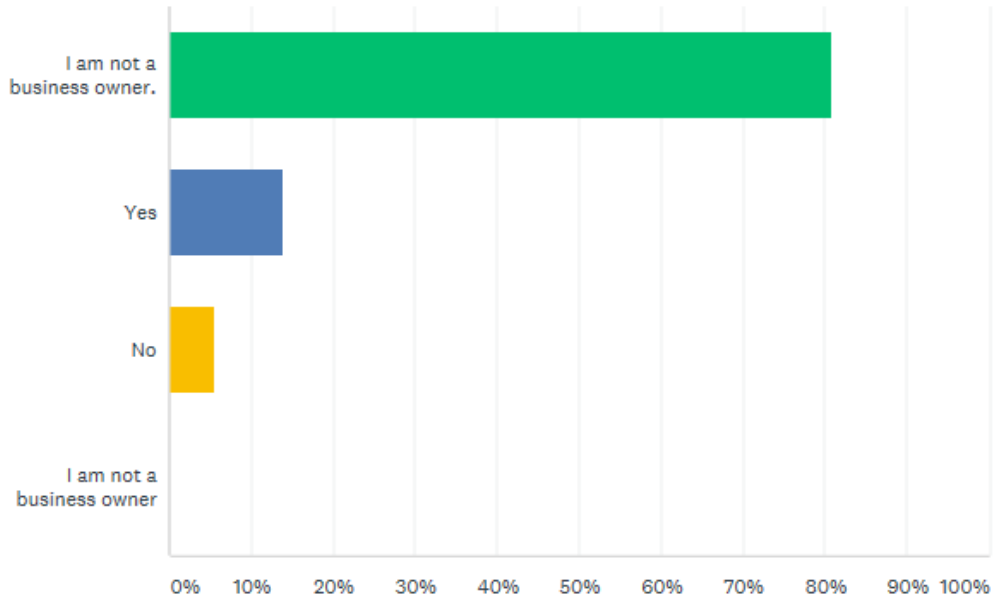
ANSWER CHOICES		RESPONSES	
I am not a business owner.		80.73%	88
Yes		13.76%	15
No		5.50%	6
I am not a business owner	Responses	0.00%	0
TOTAL			109

Q4

If you are a business owner, understanding which urban forest benefits and issues are most important to business owners, will help guide Tumwater's long-term urban forest strategies. Please rate the significance of the following tree related topics, 1 being very important to your business and 4 being not important to your business.

Answered: 99   Skipped: 21
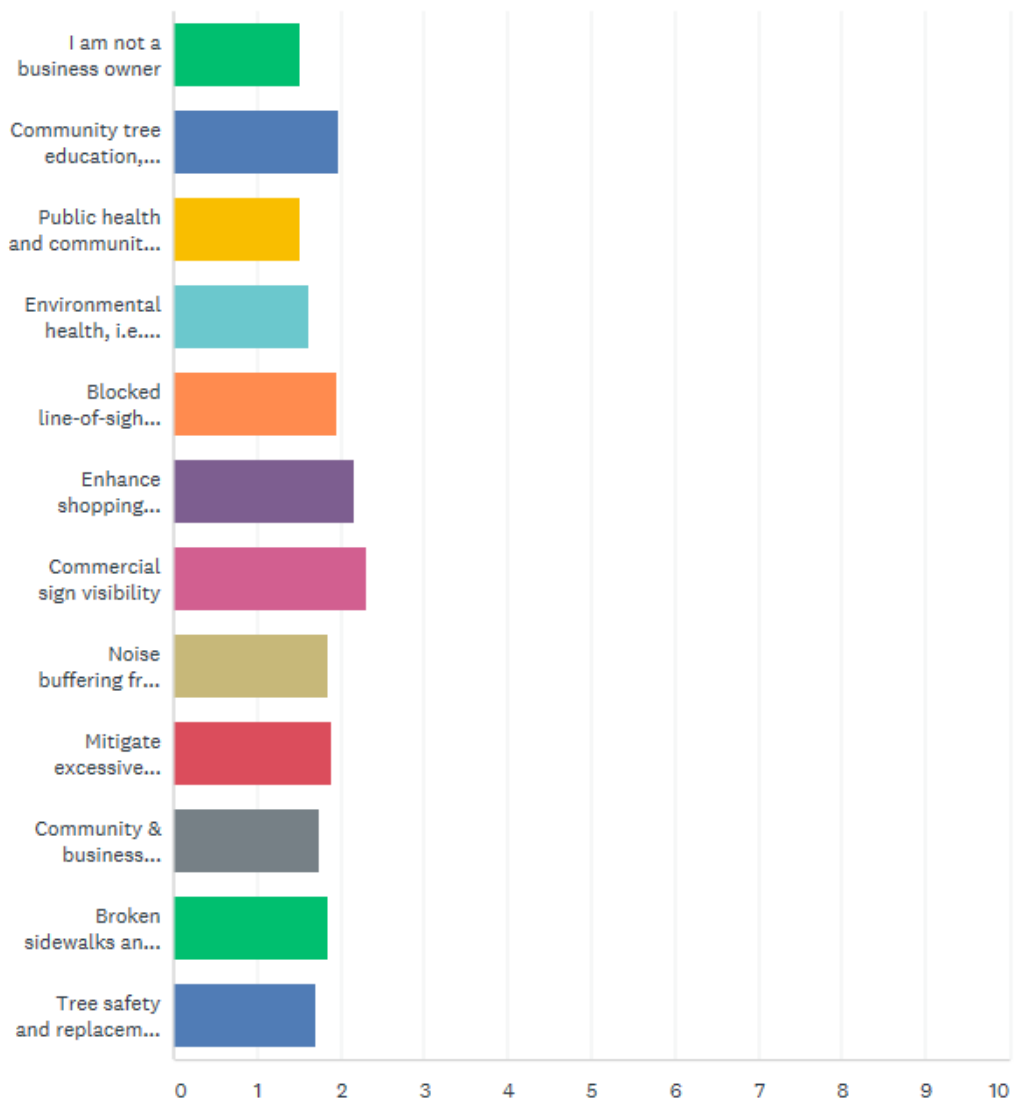
	VERY IMPORTANT	IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT	TOTAL	WEIGHTED AVERAGE
I am not a business owner	76.92% 60	7.69% 6	3.85% 3	11.54% 9	78	1.50
Community tree education, including how neighbors can properly care for some trees	38.33% 23	35.00% 21	18.33% 11	8.33% 5	60	1.97
Public health and community wellbeing, i.e., improved air quality, increased property values, neighborhood character, and aesthetics, cooling & shading, scenic values	65.57% 40	22.95% 14	6.56% 4	4.92% 3	61	1.51
Environmental health, i.e., improved water quality, reduced stormwater, carbon sequestration, wildlife/bird habitat	65.57% 40	14.75% 9	13.11% 8	6.56% 4	61	1.61
Blocked line-of-sight at driveways and street corners	45.16% 28	27.42% 17	16.13% 10	11.29% 7	62	1.94
Enhance shopping experience in business districts	34.43% 21	29.51% 18	21.31% 13	14.75% 9	61	2.16
Commercial sign visibility	30.65% 19	29.03% 18	19.35% 12	20.97% 13	62	2.31
Noise buffering from roads and highways	45.90% 28	31.15% 19	14.75% 9	8.20% 5	61	1.85
Mitigate excessive summer heat	50.00% 30	21.67% 13	18.33% 11	10.00% 6	60	1.88
Community & business district character and aesthetics	49.15% 29	33.90% 20	11.86% 7	5.08% 3	59	1.73
Broken sidewalks and curbs	37.70% 23	44.26% 27	13.11% 8	4.92% 3	61	1.85
Tree safety and replacement of unhealthy/unsafe trees	53.23% 33	30.65% 19	9.68% 6	6.45% 4	62	1.69

Q5

What is your gender?

Answered: 114   Skipped: 6
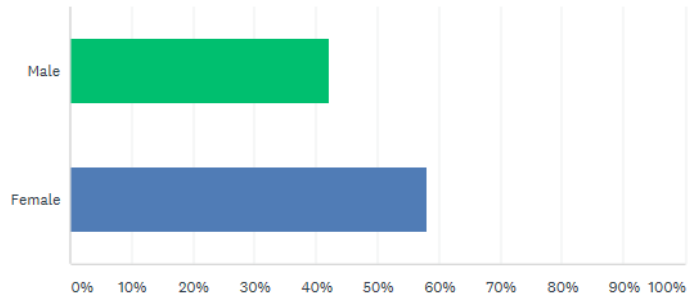
ANSWER CHOICES	RESPONSES	
Male	42.11%	48
Female	57.89%	66
TOTAL		114

Q6

What is your age?

Answered: 115   Skipped: 5
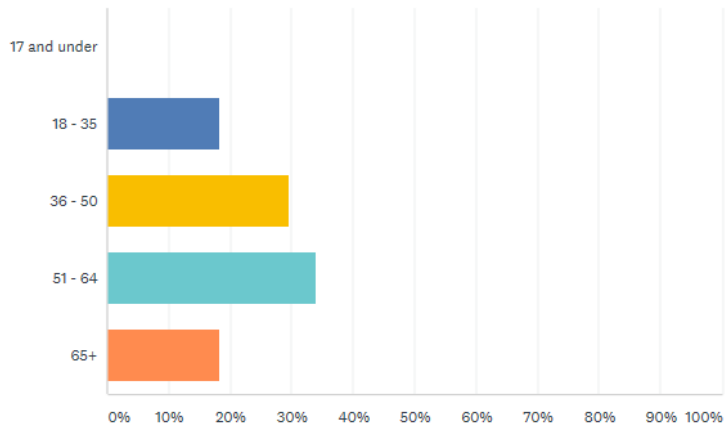
ANSWER CHOICES	RESPONSES	
17 and under	0.00%	0
18 - 35	18.26%	21
36 - 50	29.57%	34
51 - 64	33.91%	39
65+	18.26%	21
TOTAL		115

Q7

What Tumwater neighborhood do you live or work in? Please use the map above to locate your area and check the answer that best applies.

Answered: 112   Skipped: 8
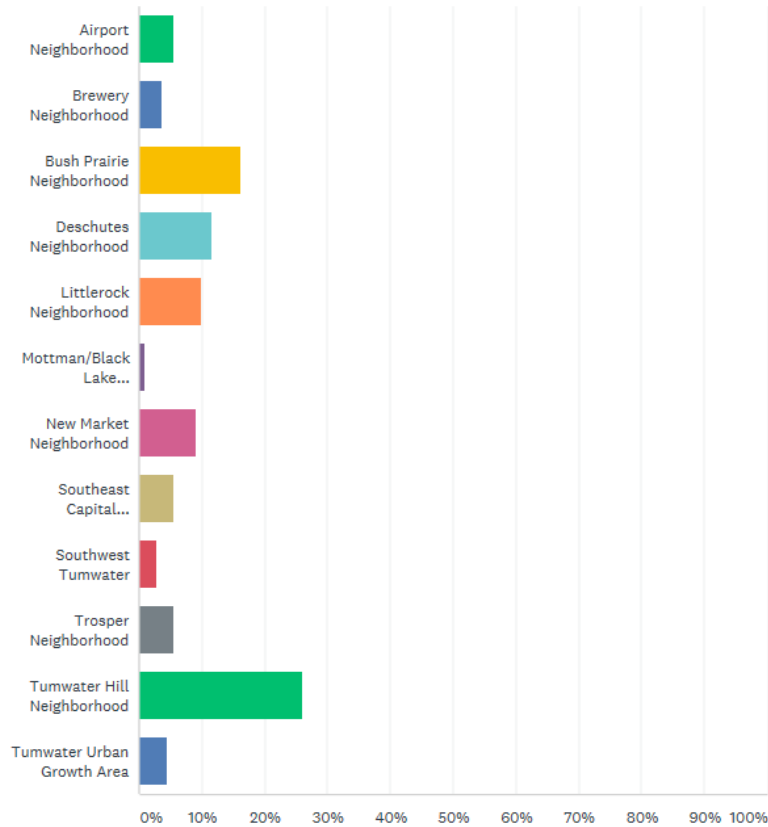
ANSWER CHOICES	RESPONSES	
Airport Neighborhood	5.36%	6
Brewery Neighborhood	3.57%	4
Bush Prairie Neighborhood	16.07%	18
Deschutes Neighborhood	11.61%	13
Littlerock Neighborhood	9.82%	11
Mottman/Black Lake Neighborhood	0.89%	1
New Market Neighborhood	8.93%	10
Southeast Capital Boulevard Neighborhood	5.36%	6
Southwest Tumwater	2.68%	3
Trosper Neighborhood	5.36%	6
Tumwater Hill Neighborhood	25.89%	29
Tumwater Urban Growth Area	4.46%	5
TOTAL		112

Q8

What type of housing do you live in? Please check the answer that best applies.

Answered: 113   Skipped: 7
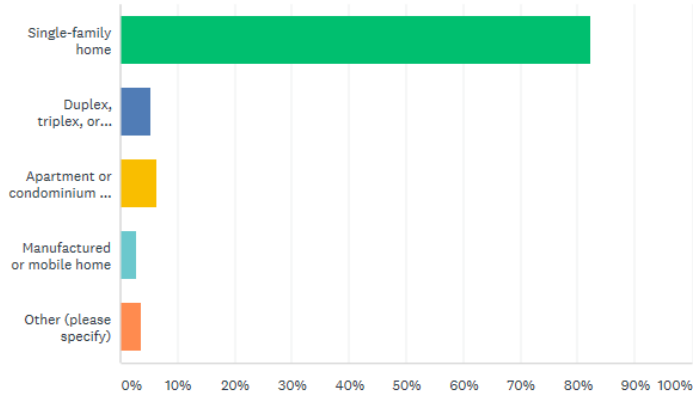
ANSWER CHOICES		RESPONSES	
Single-family home		82.30%	93
Duplex, triplex, or fourplex		5.31%	6
Apartment or condominium of five units or more		6.19%	7
Manufactured or mobile home		2.65%	3
Other (please specify)	Responses	3.54%	4
TOTAL			113

Q9

Do you rent or own your residence?

Answered: 112   Skipped: 8
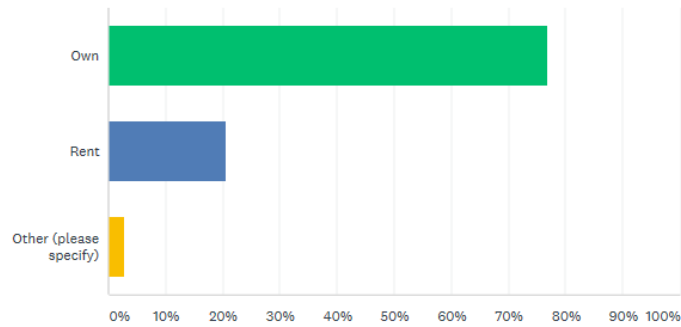
ANSWER CHOICES		RESPONSES	
Own		76.79%	86
Rent		20.54%	23
Other (please specify)	Responses	2.68%	3
TOTAL			112

Q10

Does your neighborhood have a Homeowners Association?

Answered: 113   Skipped: 7
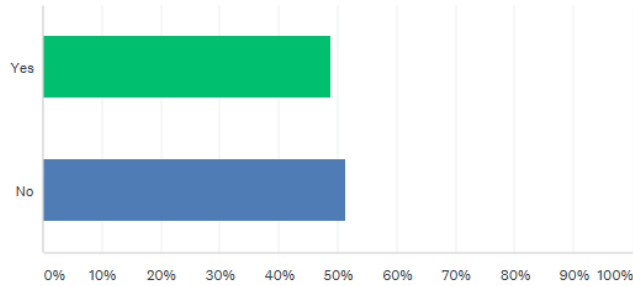
ANSWER CHOICES	RESPONSES	
Yes	48.67%	55
No	51.33%	58
TOTAL		113

Q11

Please check the answer that best applies to your Homeowners Association.

Answered: 112   Skipped: 8
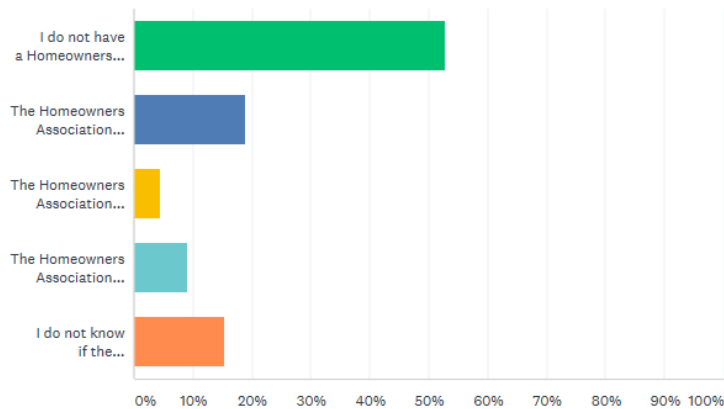
ANSWER CHOICES	RESPONSES	
I do not have a Homeowners Association.	52.68%	59
The Homeowners Association regulates trees, and those regulations actively enforced.	18.75%	21
The Homeowners Association regulates trees, and those regulations are not actively enforced.	4.46%	5
The Homeowners Association does not regulate trees.	8.93%	10
I do not know if the Homeowners Association regulates trees.	15.18%	17
TOTAL		112

Q12

If you live in the City or its urban growth area, would you like to see more trees in your neighborhood? Please check the answer that best applies.

Answered: 109   Skipped: 11
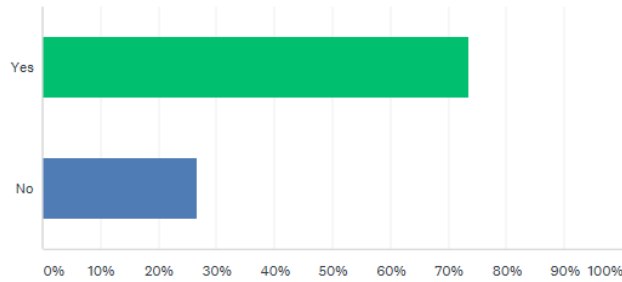
ANSWER CHOICES	RESPONSES	
Yes	73.39%	80
No	26.61%	29
TOTAL		**109**

Q13

How long have your lived or worked in the City or its urban growth area?

Answered: 112   Skipped: 8
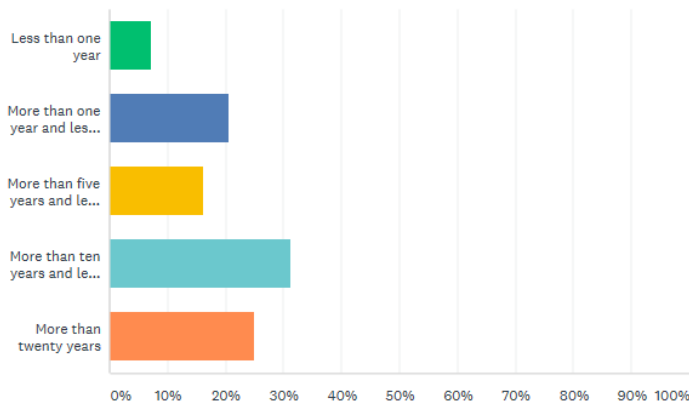
ANSWER CHOICES	RESPONSES	
Less than one year	7.14%	8
More than one year and less than five years	20.54%	23
More than five years and less than ten years	16.07%	18
More than ten years and less than twenty years	31.25%	35
More than twenty years	25.00%	28
TOTAL		**112**

Q14

How many times did you go to a park or another, less developed natural space in the City during the past twelve months?

Answered: 116   Skipped: 4
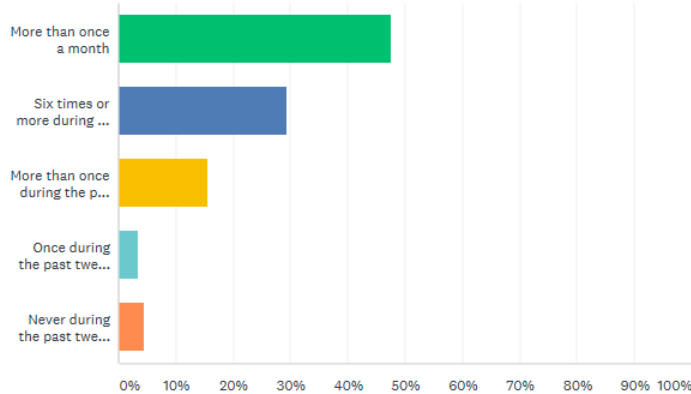
ANSWER CHOICES	RESPONSES	
More than once a month	47.41%	55
Six times or more during the past twelve months but less than once a month	29.31%	34
More than once during the past twelve months but less than six times during the past twelve months	15.52%	18
Once during the past twelve months	3.45%	4
Never during the past twelve months	4.31%	5
TOTAL		**116**

Q15

Do you live within a comfortable walking distance of a park or other natural space?

Answered: 115   Skipped: 5
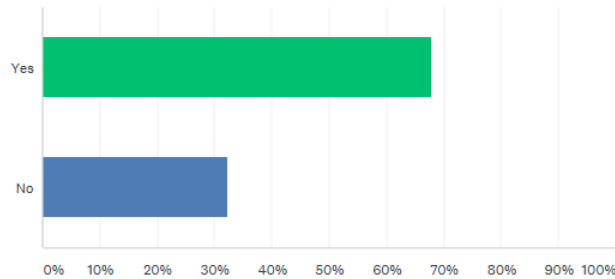
ANSWER CHOICES	RESPONSES	
Yes	67.83%	78
No	32.17%	37
TOTAL		**115**

Q16

Do live within a comfortable biking distance of a park or other natural space?

Answered: 114   Skipped: 6
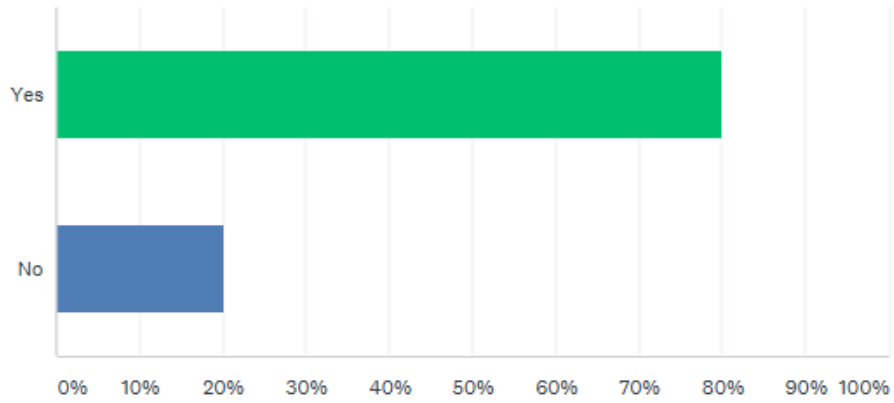
ANSWER CHOICES	RESPONSES	
Yes	79.82%	91
No	20.18%	23
TOTAL		114

Q17

Understanding which urban forest benefits and issues are most important to Tumwater residents will help the Tree Board guide Tumwater's long-term urban forest strategies. Please rate the significance of the following tree related topics, 1 being very important to you and 4 being not important to you.

Answered: 118   Skipped: 2
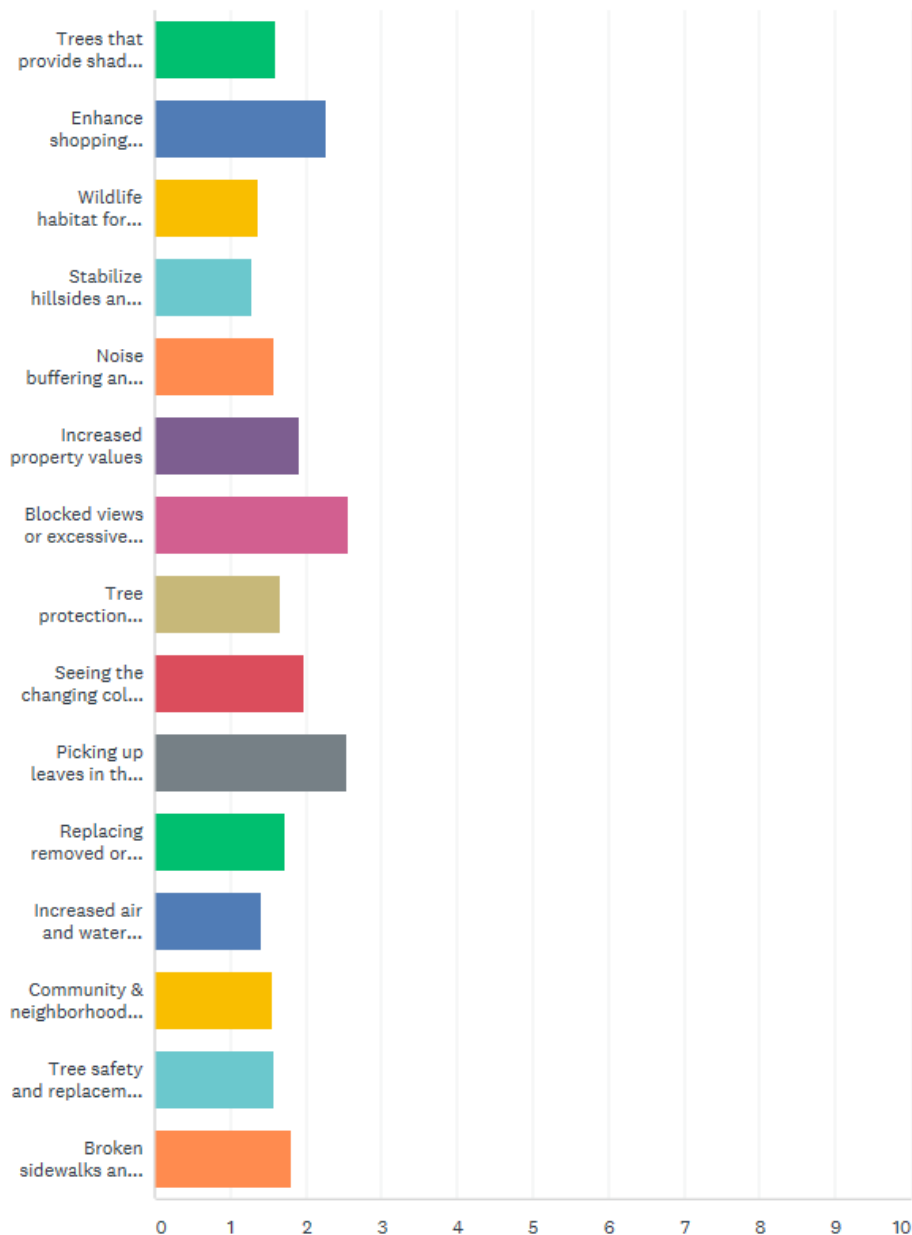
	VERY IMPORTANT	IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT	TOTAL	WEIGHTED AVERAGE
Trees that provide shade in the summer	60.68% 71	23.93% 28	11.11% 13	4.27% 5	117	1.59
Enhance shopping experience in business districts	25.64% 30	35.04% 41	28.21% 33	11.11% 13	117	2.25
Wildlife habitat for birds, animals, and fish	73.73% 87	20.34% 24	3.39% 4	2.54% 3	118	1.35
Stabilize hillsides and bluffs	77.12% 91	18.64% 22	3.39% 4	0.85% 1	118	1.28
Noise buffering and reduction	60.68% 71	26.50% 31	9.40% 11	3.42% 4	117	1.56
Increased property values	39.32% 46	37.61% 44	17.09% 20	5.98% 7	117	1.90
Blocked views or excessive shade	16.24% 19	32.48% 38	31.62% 37	19.66% 23	117	2.55
Tree protection during development and construction	57.76% 67	23.28% 27	14.66% 17	4.31% 5	116	1.66
Seeing the changing colors of trees in the fall	44.83% 52	23.28% 27	23.28% 27	8.62% 10	116	1.96
Picking up leaves in the fall	16.24% 19	35.04% 41	27.35% 32	21.37% 25	117	2.54
Replacing removed or damaged trees	46.55% 54	38.79% 45	12.07% 14	2.59% 3	116	1.71
Increased air and water quality	75.00% 87	14.66% 17	6.03% 7	4.31% 5	116	1.40
Community & neighborhood aesthetics and character	58.47% 69	29.66% 35	10.17% 12	1.69% 2	118	1.55
Tree safety and replacement of unhealthy/unsafe trees	53.85% 63	37.61% 44	7.69% 9	0.85% 1	117	1.56
Broken sidewalks and curbs	40.68% 48	41.53% 49	15.25% 18	2.54% 3	118	1.80

Q18

A healthy urban forest typically contains a diverse range of native trees and plants and a limited amount of non-native invasive species, such as Himalayan blackberries, English ivy, or Scotch broom. On a scale of 1 to 4, how would you rate the apparent health of Tumwater's urban forest? 1 being very healthy and 4 very unhealthy.

Answered: 117   Skipped: 3
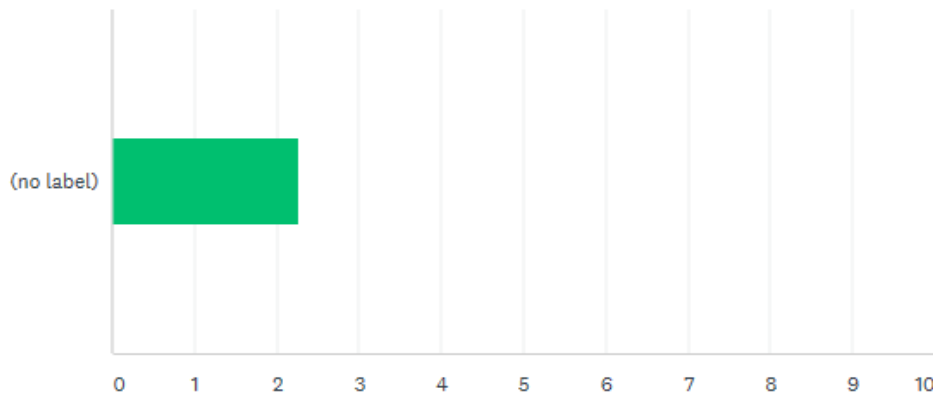
	VERY HEALTHY	HEALTHY	UNHEALTHY	VERY UNHEALTHY	TOTAL	WEIGHTED AVERAGE
(no label)	3.42% 4	68.38% 80	26.50% 31	1.71% 2	117	2.26

Q19

Please respond to the following questions as it relates to your residence, neighborhood and Tumwater.

Answered: 115   Skipped: 5
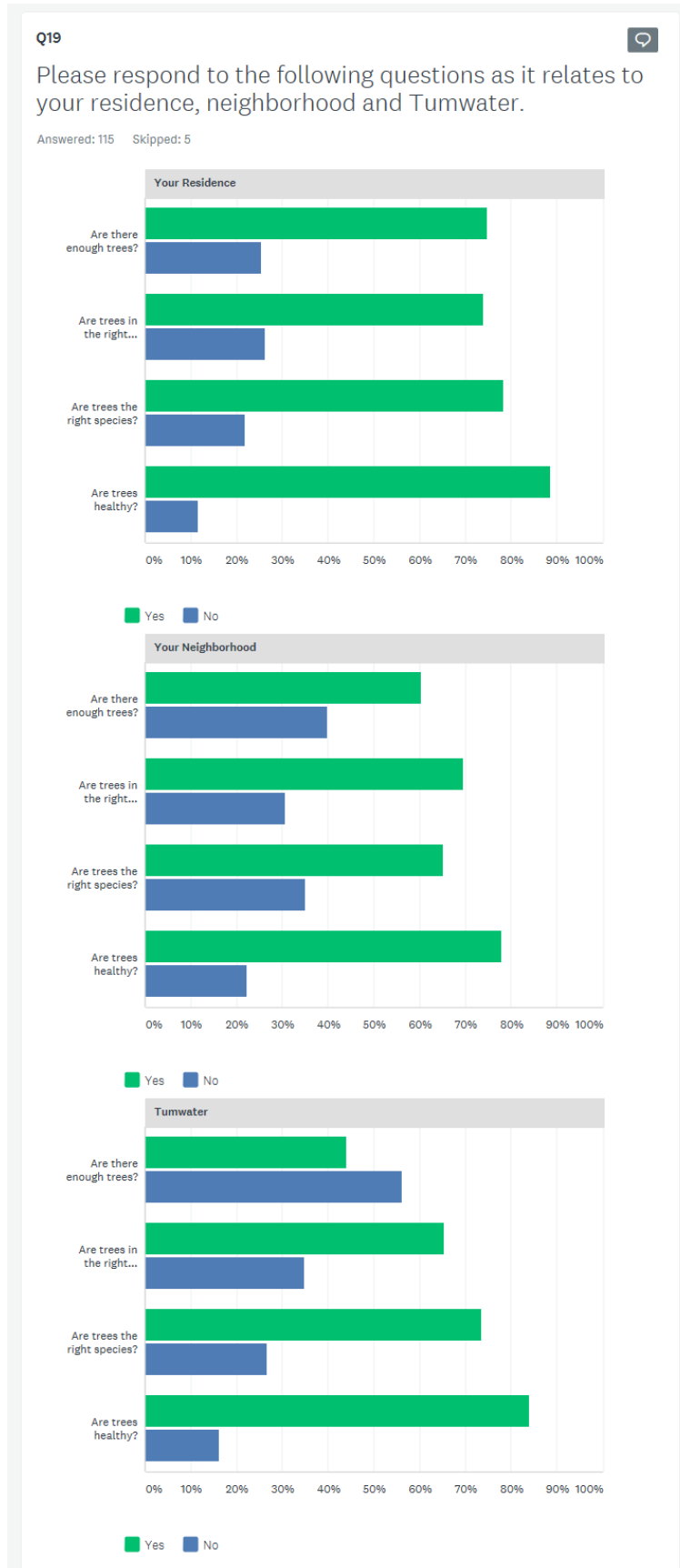
Your Residence

	YES	NO	TOTAL
Are there enough trees?	74.77% 80	25.23% 27	107
Are trees in the right location?	73.79% 76	26.21% 27	103
Are trees the right species?	78.22% 79	21.78% 22	101
Are trees healthy?	88.46% 92	11.54% 12	104

Your Neighborhood

	YES	NO	TOTAL
Are there enough trees?	60.19% 65	39.81% 43	108
Are trees in the right location?	69.52% 73	30.48% 32	105
Are trees the right species?	65.00% 65	35.00% 35	100
Are trees healthy?	77.88% 81	22.12% 23	104

Tumwater

	YES	NO	TOTAL
Are there enough trees?	43.93% 47	56.07% 60	107
Are trees in the right location?	65.35% 66	34.65% 35	101
Are trees the right species?	73.47% 72	26.53% 26	98
Are trees healthy?	83.84% 83	16.16% 16	99

Q20

What communication methods do you prefer to stay informed of urban forestry issues? Please check all the answers that apply.

Answered: 115   Skipped: 5

ANSWER CHOICES		RESPONSES	
Email or listserv		56.52%	65
Tumwater on Tap		41.74%	48
Flyer in City Utility Bill		35.65%	41
City website		40.00%	46
Newspaper		21.74%	25
Posters, notices		8.70%	10
Facebook and other social media		39.13%	45
Webinars and online presentations		8.70%	10
Next Door App		19.13%	22
Other (please specify)	Responses	3.48%	4
Total Respondents: 115			

Q21

Would you like to learn more about trees and urban forests topics? Please check all the answers that apply. We will use this information to determine the level of support for these activities.

Answered: 104   Skipped: 16
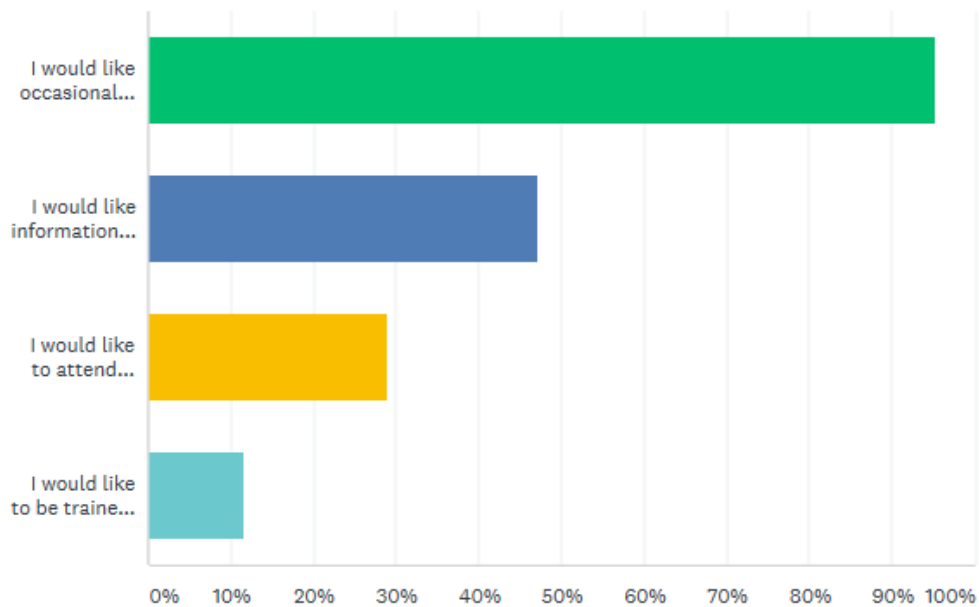
ANSWER CHOICES	RESPONSES	
I would like occasional updates about the urban forestry plan and progress.	95.19%	99
I would like information about suggested trees species.	47.12%	49
I would like to attend tree-care workshops.	28.85%	30
I would like to be trained and help educate others, such as becoming a Tree Steward.	11.54%	12
Total Respondents: 104		

Q22

Would you be willing to contribute to caring for Tumwater's trees and their understory in one of the following ways? We will use this information to develop programs and activities. Please check all the answers that apply.

Answered: 92   Skipped: 28

ANSWER CHOICES		RESPONSES	
Help plant and/or care for trees in my neighborhood and parks.		51.09%	47
Pay a small fee to help fund Citywide tree programs.		35.87%	33
Participate in a neighborhood street-tree planting.		52.17%	48
Become a Tree Steward for your neighborhood.		14.13%	13
Attend tree-care workshops.		40.22%	37
Plant trees in your yard.		45.65%	42
Participate in Arbor Day celebrations.		39.13%	36
Become a Tree Board member.		14.13%	13
Other (please specify)	Responses	5.43%	5
Total Respondents: 92			

Q23

Do you have any other comments, questions, or concerns?

Answered: 39

Skipped: 81

No

5/5/2018 2:29 PM

I love living in Tumwater and fully support this project and the city's leaders!

5/5/2018 9:29 AM

No

5/5/2018 5:56 AM

Please replant the trees that used to be along Cleveland Avenue (where it overlooks the valley and brewery areas). They were so beautiful and are greatly missed. As long as you don't plant a species that grows very tall, they won't interfere with the fireworks display put on by the city on the 4th of July every year. (And even if they did block the fireworks display somewhat, I wouldn't care because the other 364 days of the year, I'd like the view so much better than just seeing a plain old chain link fence!) Thank you!

5/4/2018 11:31 PM

Tumwater does a good job, but we can use more trees in the Capital Blvd. core area.

5/4/2018 9:31 PM

Trees provide valuable ecosystem services - especially when they are healthy and diverse. Preserve Tumwater's trees, and plant more.

4/30/2018 5:19 PM

Not at this time.

4/30/2018 2:02 PM

I've seen in the last 8 yrs. a lot of older sick tree cut down, but nothing planted in their place.

4/27/2018 7:06 PM

to many non Western Washington native plants and trees

4/27/2018 9:19 AM

☐   What happened to all beautiful cherry blossom trees used to have everywhere

4/25/2018 10:56 PM

☐   Please keep our trees and find ways for more

4/25/2018 10:26 AM

☐   Please do not become so enamored of the trees that we cannot do business or live our lives without asking permission from the government.

4/25/2018 10:20 AM

☐   I prefer native evergreen trees over deciduous species.

4/25/2018 9:34 AM

☐   No invasive species. I've spent hours clearing out blackberry bushes in parks all over Washington. They are death.

4/25/2018 9:25 AM

☐   Survey is clearly skewed to support a pro tree agenda that will impose on private property rights. If the City and citizens wants trees plant them on City or their own personal property!!

4/25/2018 9:18 AM

☐   this is touchy / feely!!! too much government!! get a clue & get a real job!! gaggy questions. hope you are doing this on non-paid .. trees are a renewable resource - like hay/wheat many people who live in Wash State missed that fact in school.. hand-outs don't work in any society.. happiness is reducing the size of govt!

4/25/2018 8:43 AM

☐   I visit Tumwater almost daily for various reasons and trees are exceptionally important. Sorry to say but this may be the worst survey I have ever taken. Did anyone think to edit it before sending it out? Parts don't make sense at all. Sorry but the poor construction may affect your results. I received this opportunity from the Thurston Chamber which means that you could get lots of responses but the information will not be as valuable as it could have been had this survey been well designed and formatted. But thanks for asking - can't have too may trees!! Try not to kill the new batch across from the new LaQuinta :)

4/25/2018 8:31 AM

☐   Some tree and landscaping near high traffic zones are excessive and create safety issues due to visual obstructions. Codes need to be changed for businesses and high volume traffic zones to require less of this which would also save on maintenance costs.

4/25/2018 8:22 AM

☐   Some of the questions I wasn't sure how to answer, for example, the one with Himalayan Blackberries, English Ivy and Scotch Broom.

4/24/2018 3:52 PM

☐   Stop having Asplundh butcher trees. More care needs to be taken with trees encroaching on utility lines.

4/24/2018 2:31 PM

☐   Survey too long and cumbersome

4/24/2018 9:55 AM

☐   To clarify, my business address is my home address. (It is a legally registered business.) I don't know if that effects your survey. The Plant Place Nursery has a wonderful selection of trees. They put them on sale in October. We planted 5 last year. Love trees! I'd love to see more well placed trees. The ones lining 2nd avenue are lovely. However, I've seen several while driving around that look to have been planted based on their at the time size, instead of based on the size they would mature to be. I would also love to see more things planted which provide winter interest. Such as plants with lovely structure, evergreen, and/or provide food for animals. (There is a type of fruiting trees which developed berries, but don't drop them, can't remember what that's called off the top of my head. Anyway, they could be a great fit for feeding wildlife without causing mess to clean up.) Would love to see more trees planted which would block the noise of I5 and 2nd ave. however, stratigically placed is also important. There are a few nice views of Mt. St. Helens which are treasured by my friends and family. Would love to keep them. I love trees, but do take issue with plants that form safety risks. There are several overgrown trees and shrubs which either partially or completely cover street signs and block visibility when pulling out. This is especially bad on Tumwater Hill. No one needs to butcher their plants, but they should be pruned appropriately for visibility and safety. And lastly, it would be nice if construction was required to not clear all trees, or at the very least plant new ones. There have been a few projects where they come in and whipe them out. :/ Something I didn't think would happen in Washington State.

4/24/2018 9:10 AM

☐   Tree health is a huge concern in our neighborhood, especially the large ones in the city buffer area. Also tree pruning which reduces road access and visibility. It would be great to get a crew to assess and prune the trees on Bay loop

4/24/2018 7:09 AM

☐   No

4/24/2018 6:03 AM

☐ The city planting trees has no financial benefits. They are costly to maintain, they can create unnecessary hazards to the public, leaves must be removed, dead or sick trees must be removed. The roots damage sidewalks and roads. Trees can block line of sight for driver's causing accidents. They expose the city to unnecessary liability. They are pretty to look at that's it. As a private land owner any additional regulations regarding trees and private timberland concern me.

4/23/2018 8:48 PM

☐ Thank you for asking for our input.

4/23/2018 8:35 PM

☐ No

4/23/2018 8:05 PM

☐ Tumwater Hill used to be beautiful. What the city allowed the developers to do is a crime. It is shameful. Ridiculous that someone thinks painting trees on the water tower makes up for all the L lost trees. The homes and condos they put it in up here are ugly. I'm so disgusted by what Tumwater has done, by allowing developers just to take over, that I'm actually planning on moving out of Tumwater in the next year. Please stop calling yourself the city of trees, because you're not!

4/23/2018 6:49 PM

☐ Maple tree suckers should not be considered as trees and should be outside the restrictions of Tree regulations

4/23/2018 3:39 PM

☐ no

4/23/2018 1:25 PM

☐ I'm concerned about the last parcels of trees being g sold off to developers. I'd like to see the city mandate that there be parcels that remain treed and wild for the sake of our wildlife, air quality and general health/happiness of our citizens. The green space is one of the things gas we treasure most about Tumwater Hill and enjoy that we still see owls, eagles, deer and coyotes along with many others.

4/23/2018 11:25 AM

☐ No

4/23/2018 10:39 AM

☐   Some very large old trees were removed many years ago so sidewalks could go in. But nothing was put into that space resulting in a more barren environment.

4/23/2018 8:52 AM

☐   Na

4/23/2018 8:47 AM

☐   No

4/23/2018 8:31 AM

☐   Capitol Blvd is sad. Street trees on Capitol would make a big difference.

4/23/2018 7:27 AM

☐   replace trees cut down on Cleveland Ave. and add more trees for sound abatement on east side of brewery property and along freeway.

4/22/2018 1:24 PM

☐   My trees are evergreens, 50+ years old and therefore probably too big and the wrong kind for the neighborhood. Lots of big old firs, etc. in this neighborhood.

4/20/2018 6:22 PM

☐   People want to save the tree on the property next to them, but we need to have development. It makes more sense to strategically save and plant trees. Plant them for shade to reduce the heatsink from roads and parking lots. Not little trees, but real ones. Find places to plant a diversity of trees around the City. Parks should have trees. I see street trees in some places, but we should be planting more trees everywhere. Create a mini arboretum in some area with unique trees.

4/20/2018 2:26 PM

A.5 – CITY STAFF SURVEY RESULTS

Q1

What is your City Department?

Answered: 42   Skipped: 0
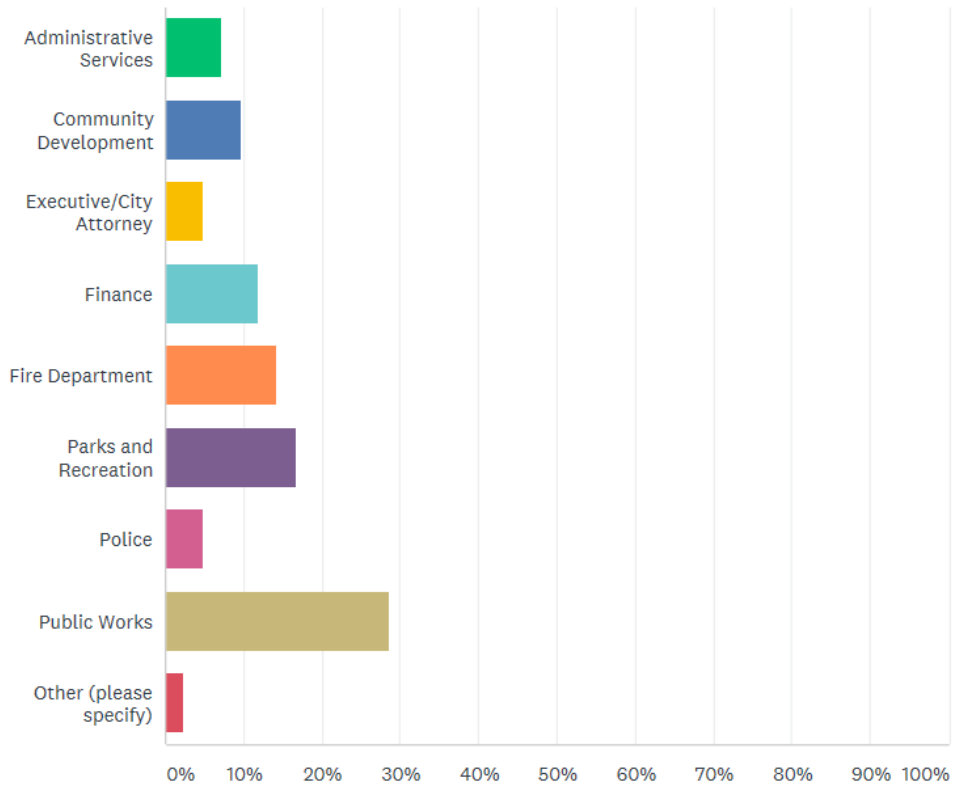
ANSWER CHOICES		RESPONSES	
Administrative Services		7.14%	3
Community Development		9.52%	4
Executive/City Attorney		4.76%	2
Finance		11.90%	5
Fire Department		14.29%	6
Parks and Recreation		16.67%	7
Police		4.76%	2
Public Works		28.57%	12
Other (please specify)	Responses	2.38%	1
TOTAL			42

Q2

How often do you work with trees and plants directly, such as pruning, removing, planting, leaf pick-up, sidewalk repair, utility work, etc.? Please check the answer that best applies

Answered: 40   Skipped: 2
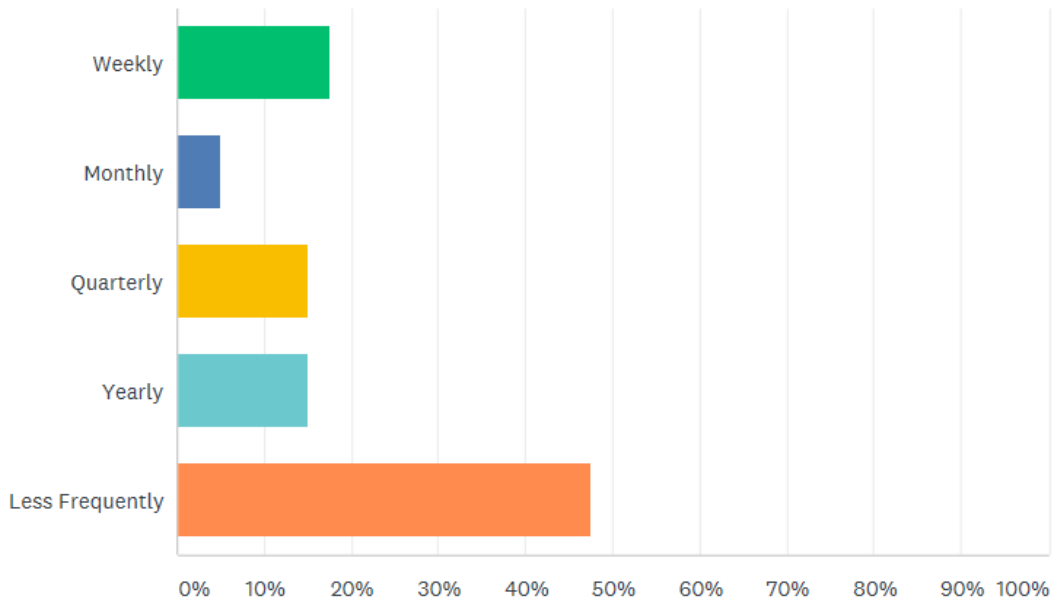
ANSWER CHOICES	RESPONSES	
Weekly	17.50%	7
Monthly	5.00%	2
Quarterly	15.00%	6
Yearly	15.00%	6
Less Frequently	47.50%	19
TOTAL		**40**

Q3

If you work with trees and plants directly, such as pruning, removing, planting, leaf collection, sidewalk repair, utility work, etc., briefly describe what you do.

Answered: 24   Skipped: 18

Pruning, removal of hazards, leaf and down branch collection,

5/17/2018 6:16 AM

Assist with removal of downed trees from roadway.

5/16/2018 3:57 PM

Just minimal gardening and weeding.

5/16/2018 8:35 AM

pruning, planting, removing, planting, evaluating

5/16/2018 8:33 AM

all

5/15/2018 12:16 PM

Maintain city buildings and utilities.

5/15/2018 9:29 AM

Treating patients that have tripped because of uneven sidewalks, treating patients that have cut themselves from pruning, help people when a tree falls into their house.

5/15/2018 7:32 AM

NA

5/14/2018 4:44 PM

This is not part of my job

5/14/2018 9:44 AM

Make sure they are the right size when their installed and root barriers are installed on the sidewalk, curb and gutter side so their root system doesn't ruin the concrete.

5/14/2018 8:34 AM

5/14/2018 8:16 AM

I occasionally remove a small amount of branches when they block access to water meters.

5/14/2018 8:06 AM

On rare occasion removal during storms

5/13/2018 7:52 AM

Clean up constantly. Repair damage to our equipment constantly caused by roots. Prune constantly to make it safe. Remove to create grasslands for birds and other wildlife. Remove branches and under storage for air circulation and light so grass can grow.

5/11/2018 7:29 PM

Park Projects - pruning, removing invasive plants such as scotch broom and plantings.

5/11/2018 2:58 PM

Prune fruit trees and removing dead leaves in my orchard on my farm and all the maintenance and repair work a twenty acre farm and home requires.

5/11/2018 2:00 PM

n/a

5/11/2018 1:52 PM

Remove and replace trees.

5/11/2018 1:40 PM

n/a

5/11/2018 1:36 PM

prune fruit trees, start different trees from seed, plant 'volunteers' on both our living property and recreational property

5/11/2018 1:18 PM

leaf collection, sidewalk repair, utility work

5/8/2018 8:21 AM

Cut back off of ROW.

5/7/2018 5:13 PM

Prune fruit trees and trim bushes in the yard

5/7/2018 8:42 AM

NA

5/7/2018 8:42 AM

Q4

How frequently do you work with trees and plants indirectly, such as through planning, design permitting, or public education? Please check the answer that best applies.

Answered: 39   Skipped: 3
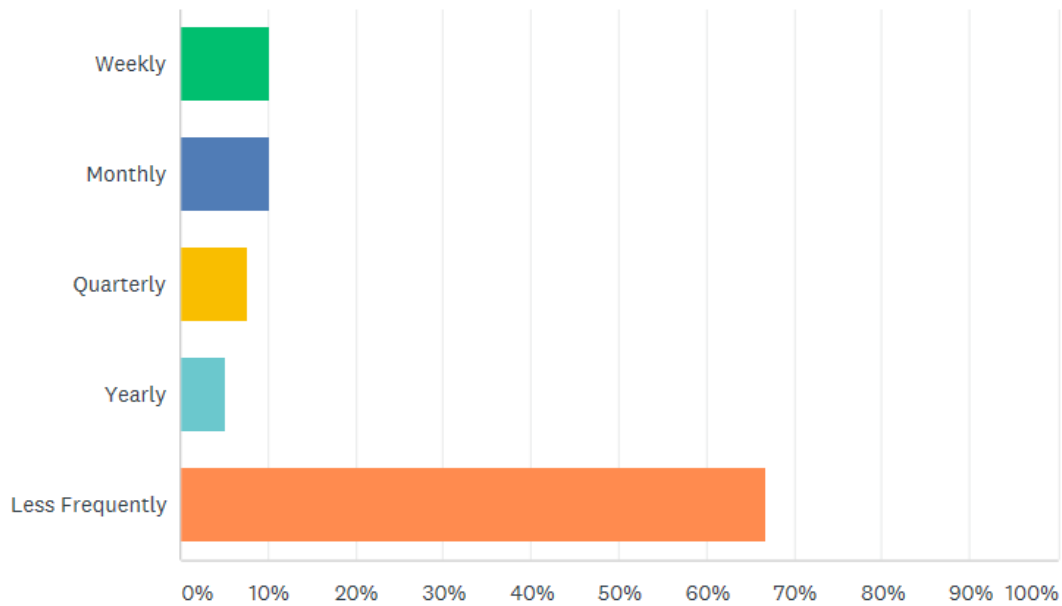
ANSWER CHOICES	RESPONSES	
Weekly	10.26%	4
Monthly	10.26%	4
Quarterly	7.69%	3
Yearly	5.13%	2
Less Frequently	66.67%	26
TOTAL		**39**

Q5

If you work with trees and plants indirectly, such as through planning, design permitting, or public education, briefly describe what you do.

Answered: 28   Skipped: 14

Exact frequency unknown (hit and miss). My involvement is mostly indirect for either project landscaping design or how to work with the issues trees/plants create from a transportation standpoint (site distance, clear zone safety, sidewalk damage, ...)

5/18/2018 6:49 AM

Planting of new trees in parks that have lost a tree or restructuring

5/17/2018 6:16 AM

N/A

5/16/2018 3:57 PM

I've participated in some Stream Team events in which I assisted the City staff member.

5/16/2018 8:35 AM

talk to the public about their tree concerns

5/16/2018 8:33 AM

all

5/15/2018 12:16 PM

No

5/15/2018 9:29 AM

Review utilities

5/15/2018 8:09 AM

NA

5/14/2018 4:44 PM

Nothing

5/14/2018 9:44 AM

Help set policy, provide guidance, support elected officials, establish budgets.

5/14/2018 8:34 AM

no

5/14/2018 8:34 AM

n/a

5/14/2018 8:16 AM

Special projects.

5/11/2018 7:29 PM

responsible for the design of landscapes, park property urban forestry, assist with city property urban forestry, tree and public safety on park lands and the removal of dead, diseased or dangerous trees city wide.

5/11/2018 4:59 PM

When new park development happens.

5/11/2018 2:58 PM

Volunteer service projects/ park improvement

5/11/2018 2:02 PM

N/A

5/11/2018 2:00 PM

n/a

5/11/2018 1:52 p.m.

Volunteered for an Arbor Day event a couple years ago handing out seedlings. Occasionally receive calls related to tree issues or disputes.

5/11/2018 1:50 PM

Prepare plans and specs.

5/11/2018 1:40 PM

I intake all of the public calls and dispatch out the PW Operations staff to directly work with the tree and plant issues.

5/11/2018 1:36 PM

Education of property owners on pruning or removing plants so that backflow assemblies are assessable to test and repair.

5/10/2018 3:29 PM

Permitting, improper pruning and removal, responding to land clearing questions and concerns, adopting new tree plans and regulations.

5/8/2018 11:05 AM

Support mapping efforts - store GIS data, map trees as needed by others.

5/7/2018 8:47 AM

N/A

5/7/2018 8:42 AM

NA

5/7/2018 8:42 AM

Tree Board, Tree regulations and policies

5/7/2018 8:14 a.m.

Q6

What issues or challenges do you face in your work with trees? Please describe below.

Answered: 33   Skipped: 9

Site distance, clear zone safety, sidewalk and road damage, ...

> *5/18/2018 6:49 AM*

Power line impingement/disruption and access issues due to fallen trees and limbs.

> *5/17/2018 11:30 AM*

When we have a hazardous tree such as a blow down we are not equipped to handle larger trees and have to call a tree service

> *5/17/2018 6:16 AM*

None

> *5/16/2018 3:57 PM*

I don't believe I have challenges. I wish there were more trees. :)

> *5/16/2018 8:35 AM*

lack of time for good tree care

> *5/16/2018 8:33 AM*

time

> *5/15/2018 12:16 PM*

They cause problems in accessing buildings as well as add extra maintenance issues to roofs and sidewalks.

> *5/15/2018 9:29 AM*

They get in the way of utilities. Cause damage to utilities. Requires lots of maintenance.

> *5/15/2018 8:09 AM*

Mostly in a storm responding to power outages, trees across road ways, blocked driveways, house numbers not visible, dark and unsafe areas with lack of light. Responding to people stuck in trees. Not to forget the cat stuck in a tree phone call

> *5/15/2018 7:32 AM*

NA

> *5/14/2018 4:44 PM*

No issues or challenges, not part of my job

5/14/2018 9:44 AM

In sufficient clear policy direction on trees and the City's view on urban forestry actions.

5/14/2018 8:34 AM

When it rains a lot in the fall we have to clear catch basins from leaves so the streets don't flood.

5/14/2018 8:34 AM

n/a

5/14/2018 8:16 AM

None

5/13/2018 7:52 AM

Answered that #3

5/11/2018 7:29 PM

$

5/11/2018 4:59 PM

Roots can cause problems with pathways, leaves and when there is a storm can cause dangerous situations with branches.

5/11/2018 2:58 PM

non

5/11/2018 2:02 PM

pests control

5/11/2018 2:00 PM

5/11/2018 1:52 PM

Knowing how to work with unhappy citizens and where to direct questions.

5/11/2018 1:50 PM

The tree root system causes damages to sidewalks and pavement. Some trees overgrows into the roadway and causes sight distance problem for the drivers and pedestrians.

5/11/2018 1:40 PM

Everyone has a different perspective of what a hazard tree or tree/plant issue looks like depending on how it is affecting them personally.

5/11/2018 1:36 PM

insects on the new trees

5/11/2018 1:18 PM

Roots tangled in water lines.

5/10/2018 3:29 PM

The existing tree retention standards are unrealistic on most sites without critical areas. Street trees are pushing up sidewalks routinely. Most street trees are maintained by adjacent property owners, sometimes badly. Unrealistic expectations of developing at urban densities without tree removal and replanting.

5/8/2018 11:05 AM

sidewalk repair

5/8/2018 8:21 AM

None yet. It may be more difficult to map trees accurately with a GPS unit since they can block the signal.

5/7/2018 8:47 AM

Keeping my trees out of power/communication lines

5/7/2018 8:42 AM

A lot of people who are cutting down trees without waivers and/or permits

5/7/2018 8:42 AM

Balancing tree protection with other City goals

5/7/2018 8:14 a.m.

Q7

On a scale of 1 to 4, how important are the following issues to your City work? 1 being very important to your position and 4 being not important to your position.

Answered: 42   Skipped: 0
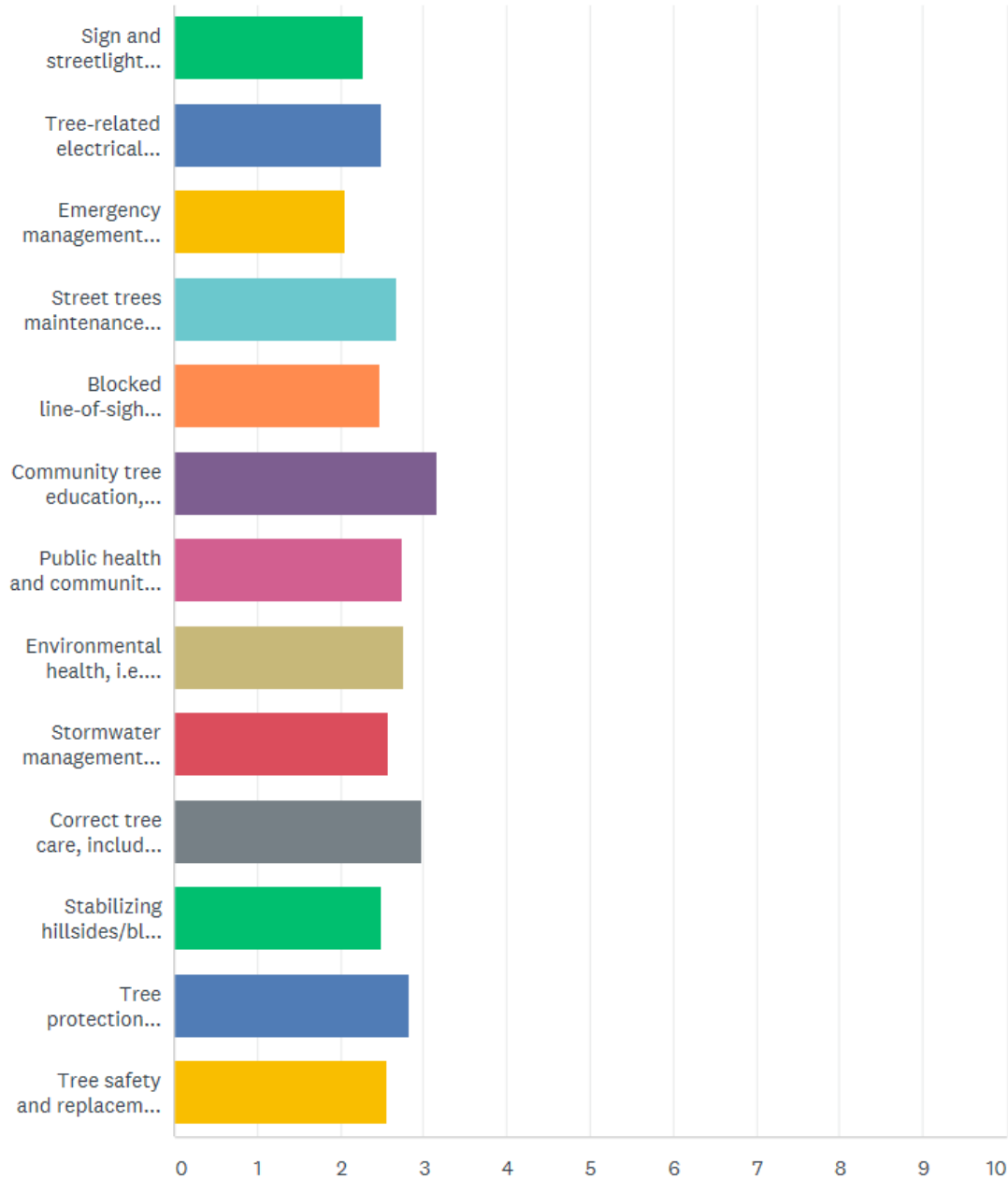
	VERY IMPORTANT	IMPORTANT	SLIGHTLY IMPORTANT	NOT IMPORTANT	TOTAL	WEIGHTED AVERAGE
Sign and streetlight visibility	45.24% 19	9.52% 4	16.67% 7	28.57% 12	42	2.29
Tree-related electrical outages	21.43% 9	33.33% 14	19.05% 8	26.19% 11	42	2.50
Emergency management during storm events	38.10% 16	33.33% 14	14.29% 6	14.29% 6	42	2.05
Street trees maintenance including pruning and sidewalk and curb issues	19.05% 8	26.19% 11	23.81% 10	30.95% 13	42	2.67
Blocked line-of-sight at driveways and street corners	31.71% 13	19.51% 8	19.51% 8	29.27% 12	41	2.46
Community tree education, including how residents can properly care for neighborhood trees	4.88% 2	24.39% 10	21.95% 9	48.78% 20	41	3.15
Public health and community wellbeing, i.e., improved air quality, increased property values, neighborhood character, aesthetics, cooling and shading, and scenic values	11.90% 5	33.33% 14	23.81% 10	30.95% 13	42	2.74
Environmental health, i.e., improved water quality, reduced stormwater, carbon sequestration, wildlife/bird habitat	11.90% 5	33.33% 14	21.43% 9	33.33% 14	42	2.76
Stormwater management issues related to trees, including tree leaves in the fall	21.43% 9	26.19% 11	26.19% 11	26.19% 11	42	2.57
Correct tree care, including pruning practices	16.67% 7	16.67% 7	19.05% 8	47.62% 20	42	2.98
Stabilizing hillsides/bluffs and erosion reduction	26.19% 11	23.81% 10	23.81% 10	26.19% 11	42	2.50
Tree protection during development and construction	12.20% 5	29.27% 12	21.95% 9	36.59% 15	41	2.83
Tree safety and replacement of unhealthy/unsafe trees	21.43% 9	33.33% 14	14.29% 6	30.95% 13	42	2.55

Comments (3)

Comments(3)

Other than answering CDD phones and helping very minimally with Arbor Day, I don't come into contact with Tree issues at work.

5/16/2018 8:35 AM

tree evaluations

5/16/2018 8:33 AM

Trees shouldn't be replaced automatically when the die or are sick. There's a reason they got sick.

5/11/2018 7:29 PM

Q8

What additional tools or training would help you be more efficient in working with trees? Please describe below.

Answered: 24   Skipped: 18

none, I can think of.

> *5/17/2018 11:30 AM*

We have most tools to deal with issues that arise and manage the trees that we have.

> *5/17/2018 6:16 AM*

Nothing identified.

> *5/16/2018 3:57 PM*

Well, this is really on me as a citizen, but I would love to know more about native trees.

> *5/16/2018 8:35 AM*

the time to take on ISA training courses

> *5/16/2018 8:33 AM*

more

> *5/15/2018 12:16 PM*

None

> *5/15/2018 9:29 AM*

A ladder truck would allow for safer access to rescue people stuck in trees.

> *5/15/2018 7:32 AM*

NA

> *5/14/2018 4:44 PM*

Nothing

> *5/14/2018 9:44 AM*

Having the plan completed will be very helpful. I hope it can articulate the some opportunities to plant more trees. It would be good for our broader goals (air quality, global warming, habitat, etc.) if we found more ways to plant more trees.

> *5/14/2018 8:34 AM*

More staff and a lift.

> *5/11/2018 7:29 PM*

don't know

5/11/2018 4:59 PM

Newer pruning equipment for Volunteer Projects.

5/11/2018 2:58 PM

better knowledge on proper pruning and pest control.

5/11/2018 2:00 PM

n/a

5/11/2018 1:52 PM

It might be nice to have something on our website that explained typical tree issues such as, a problem tree on private property, what is needed to remove a tree, blowing leaves into the street.

5/11/2018 1:50 PM

Training

5/11/2018 1:40 PM

PW Operations utilizes the City arborist to make the decisions about the trees in our community. We also have several brochures, pamphlets and tips online for citizens that want more information about their trees. I feel the City does a good job of supplying information

5/11/2018 1:36 PM

Public education.

5/10/2018 3:29 PM

Better training and definition of responsibilities for street tree installation. Better species selection for appropriate street trees.

5/8/2018 11:05 AM

safety 1st, trees 2nd

5/8/2018 8:21 AM

Knowing what others need to know about trees and if mapping all trees or street trees in GIS is worthwhile or needed, and how I can support any efforts.

5/7/2018 8:47 AM

NA

5/7/2018 8:42 AM

Q9

Do you have any additional comments? Please list below.

Answered: 11   Skipped: 31

Aesthetics are an important part of building a thriving community, as are efforts to maintain a healthy environment. Unfortunately, in these times of dwindling tax resources I think taxpayer money is better spent on more immediate issues ie; homelessness, mental health care, and generally supporting those in need. When those issues are being adequately addressed, only then can we feel good about using tax money on programs that tax payers may (rightly or wrongly) see as frivolous or ancillary.

> *5/17/2018 11:30 AM*

None

> *5/16/2018 3:57 PM*

Thanks for your work. :)

> *5/16/2018 8:35 AM*

No

> *5/15/2018 9:29 AM*

None

> *5/14/2018 4:44 PM*

no

> *5/14/2018 9:44 AM*

We have a number of dying fir tree's throughout the city of Tumwater that need to be removed before they become dangerous. The tree's are dying from the top down.

> *5/13/2018 7:52 AM*

The Audubon society says do not create a forest on your course.

> *5/11/2018 7:29 PM*

None

> *5/11/2018 2:00 PM*

put lights on all school crosswalks, and take trees out of the islands

> *5/8/2018 8:21 AM*

NA

> *5/7/2018 8:42 AM*

A.6 – SUMMARY OF MANAGEMENT RESPONSIBILITIES

Activity	Activity subclass	City Arborist	Community Development	Public Works	Parks and Recreation	Other as specified
Planting	New sites			X	X	
	Replacement plantings			X	X	
Pruning	Scheduled			X	X	
	Storm/ emergency			X	X	
	Utility clearance			X		
	Street/ equipment clearance			X		
Tree removal	Hazard trees			X	X	
	Clearance (for flood control, fire safety, etc.)			X	X	
Root system work	Sidewalk/ curb repair and replacement			X		
	Excavation for utilities			X		
	Construction			X	X	
Permitting	Planting	X	X			
	Pruning	X	X			
	Removal	X	X	X	X	
Outreach/ education	Property owners/ public	X	X	X		
	Contractors	X	X	X	X	

A.7 – BEST MANAGEMENT PRACTICES FOR TREE CARE ACTIVITIES

- Staff and Contractors will follow these approved best management practices in their daily activities.

- Pruning aims are to maintain tree health, reduce risk of failure, provide clearance, and improve aesthetics.

- Develop young and mature tree care programs.

- Tree care of insects and diseases problems will follow Integrated Pest Management practices (IPM).

1. Enhance the City's *Street Tree List* for landscape uses and encourage planting of natives where appropriate.

   - The Tree Board, Community Development Director Public Works Director, the Parks and Recreation Director, and the City's City Tree Protection Professional should revisit the City's *Street Tree List* annually for any additions or changes.

   - Generate a matrix of attributes for each tree on the approved *Street Tree List*.

   - Circulate draft to appropriate City staff for concurrence and approval, and then add to the Plan.

2. Develop an experimental species program, created by the Tree Board, Community Development Director Public Works Director, the Parks and Recreation Director, and the City Tree Protection Professional.

   - Identify new tree species throughout the year.

   - Each year in the fall, three new species of trees will be selected, and a minimum of three trees of each species will be planted in appropriate locations.

   - These trees will be monitored twice a year for five years, and if they are proven to respond well to the environment, they will be added to the recommended tree list.

3. Develop a tree care procedure based on ISA and ANSI A300 standards.

   3.1 Develop tree-pruning guidelines based on ISA and ANSI standards that are specific to the needs of the City. These address different needs of young tree maintenance, adult tree maintenance and mature tree maintenance.

- Tree Care procedures shall follow ANSI A300 Part 1 (current printing) and ISA Best Management Practice tree pruning guide.

- Have the procedures reviewed by the appropriate City staff for approval.

- Attach the procedures to a municipal ordinance.

3.2 Establish a tree-pruning program that is appropriate for the needs of the trees.

Develop a 5-year trimming schedule for the City.

3.3 Establish tree-planting specifications for both tree stock selection and for the actual planting procedure.

- Write tree-planting specifications for both tree planting and tree selection.

- Add the written specifications to the Plan.

A.8 – TREE INVENTORY BEST MANAGEMENT PRACTICES

Refer to the International Society of Arboriculture's *Tree Inventory Best Management Practices.*

A.9 – STREET TREE PLANTING LIST

What is planted where and how?

Table 34: Street Tree Planting List

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
<5	Serviceberry, Cumulus	Amelanchier x hybrida	25	15	Y	Y	Y	Y		Y			Occasional small blueberry-like fruits	
<5	Serviceberry, Lustre	Amelanchier cv. 'Rogers'	25	18	Y	Y	Y	Y		Y			Occasional small blueberry-like fruits	
<5	Serviceberry, Robin Hill™	Amelanchier x grandiflora 'Robin Hill'	20	15	Y	Y	Y	Y		Y			Occasional small blueberry-like fruits	Pyramidal form
<5	Crabapple, Ivory Spear™	Malus 'JFS KW214MX' P.A.F.	20	15	Y	Y	Y							
<5	Tuscarora Hybrid Crape Myrtle	Lagerstroemia 'tuscarora'	18	18	Y				Y	Y				Light cinnamon brown bark
<5a	Chinese windmill palm	Tracheocarpus fortunni	25	10					Y					Cold-hardy palm. Visibility around corners limited, not for street corners. Broadleaf evergreen.
<5	Bronze loquat	Eriobotrya deflexa	20	20	Y		Y		y	Y	Y		1" yellow fruit and creamy white flowers	Install only near sea level; broadleaf evergreen

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
													attract birds.	
<5a	Boxleaf azara	Azara microphylla	18	10	Y		Y			Y	Y			Multi-stemmed small tree. Use as accent where open sight lines are not necessary.
5	Amur Maackia	Maackia amurensis	25	20	Y			Y				Y	4" bean-like pods	Several cultivars are available to choose from.
5	Crabapple, Adirondack ™	Malus 'Adirondack'	18	10	Y		Y			Y			1/2" rosy crabapples; persistent	strongly upright vase-shape
5	Crabapple, Golden Raindrops™	Malus 'Schmidtcutleaf'	20	15	Y	Y	Y			Y			1/4" bright yellow crabapples; persistent	dissected foliage
5	Crabapple, Royal Raindrops™	Malus 'Royal Raindrops'	20	15	Y	Y	Y			Y			1/4" deep red crabapples; persistent	purple dissected foliage
5	Hornbeam, American	Carpinus caroliniana	25	20		Y		Y	Y				Dry hop-like fruits	smooth, grey, 'muscle-y' trunk and branches
5	Lilac, Japanese Ivory Silk	Syringa reticulata 'Ivory Silk'	20	15	Y			Y		Y				another Japanese tree lilac cultivar is

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
														'Summer Snow'
5	Maple, Tartarian	Acer tartaricum	25	20		Y							Samaras, sometimes brilliant red	
5	Maple, Trident	Acer buergeranum	20	20		Y		Y		Y			Samaras	
5	Redbud, Avondale™	Cercis chinensis 'Avondale'	10	25	Y			Y	Y	Y			3" dry pea-like pods	strongly upright vase-shape
5	Redbud, Oklahoma	Cercis reniformis 'Oklahoma'	25	30	Y			Y					2" dry pea-like pods	
5	Strawberry tree	Arbutus uendo	20	15	Y		Y	Y	Y	Y	Y			Broadleaf evergreen
5	Paperbark maple	Acer griseum	25	15		Y	Y		Y					Gingerbread' and 'Cinnamon Stick' are excellent cultivars; slow growing.
5	Victoria evergreen magnoliga	Magnolia grandiflora 'Victoria'	25	20	Y		Y		Y	Y	Y			Broadleaf evergreen
5	Korean mountain ash	Sorbus alnifolia	35	30	Y		Y						Pink/red fruit	
5	Red cascade mountain ash	Sorbus americana 'Dwarfcrown'	20	10	Y		Y	Y	Y			Y	Bright red berries in abundant clusters.	
5	Goldenrain tree	Koelreuteria paniculata	30	30	Y				Y				Lantern-esque handing seeds	Unique spring leaf color and unique fruits.

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
5	Bambooleaf oak	Quercus myrsinfolia	35	20			Y				Y			Broadleaf evergreen; fast growing; new leaves emerge as silver-purple during growing season
5	Magnolia, Rustica Rubra™	Magnolia x soulangiana 'Rustica Rubra'	25	15	Y		Y			Y			Unique fuzzy "seedpods"	
6	Cascara	Frangula purshiana	25	20		Y	Y	Y		Y			Small dark berries	
6	Dogwood, Aurora™	Cornus 'Aurora'	18	18	Y	Y				Y			Produces abundant ¾ inch, soft small and colorful fruit	
6	Dogwood, Celestial™	Cornus 'Rutdan'	20	20	Y	Y				Y			Produces abundant ¾ inch, soft small and colorful fruit	
6	Dogwood, Constellation™	Cornus 'Rutcan'	25	20	Y	Y				Y			Produces abundant ¾ inch, soft small and colorful fruit	
6	Dogwood, Satmoi™	Cornus 'Satomi'	25	20	Y					Y			Produces abundant ¾ inch, soft small and	

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
													colorful fruit	
6	Dogwood, Chinese™	Cornus kousa	20	20	Y	Y				Y			Produces abundant ¾ inch, soft small and colorful fruit	
6	Magnolia, Oyama	Magnolia sieboldii	20	15	Y					Y			Unique fuzzy "seedpods"	
6	Magnolia, Wada's Memory™	Magnolia x kewensis 'Wada's Memory'	30	20	Y								Unique fuzzy "seedpods"	
6	Maple, Henry	Acer henryi	25	25		Y		Y					Samaras	
6	Maple, Rocky Mountain Glow™	Acer grandidentatum 'Schmidt'	25	15		Y		Y					Samaras	
6	Oak, Crimson Spire™	Quercus alba x robur 'Crimschmidt'	45	15		Y	Y					Y	Acorns	Columnar variety.
6	Smoketree, American	Cotinus obovatus	25	20	Y	Y		Y						
6	Sourwood	Oxydendron arboreum	25	18	Y	Y	Y	Y				Y		General columnar growing habitat.
6	European hornbeam	Carpinus betulus 'Fastagia'	45	20		Y						Y		Columnar variety.
6	Holly oak	Quercus ilex	40	30				Y	Y		Y		Acorns	Broadleaf evergreen oak with prominent

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
														umbrella form.
6	Snowbell, Japanese	Styrax japonicus	30	30	Y		Y						3/4" dark purple acorn-like fruit	Several cultivars are available to choose from.
6	Snowbell, Fragrant	Styrax obassia	30	30	Y		Y						3/4" dark purple acorn-like fruit	
6	Amanogawa flowering cherry	Prunus serrulata 'Amanogawa'	20	8	Y	Y		Y				Y		Columnar variety.
6	Princeton Sentry Ginkgo	Ginko biloba 'Princeton Sentry'	40	15		Y			Y			Y		Columnar variety.
6	Heritage river birch	Betula nigra 'Cully'	50	30		Y	Y	Y	Y					Resistant to bronze birch borer; pyramidal growing habit.
6	Silverleaf oak	Qercus hypoleucoides	40	25			Y	Y			Y		Acorns	Evergreen broadleaf; fast grower; drought tolerant
6	California laurel; Oregon myrtle	Umbellularia californica	45	30	Y		Y	Y			Y			Evergreen broadleaf; scented leaves.
7	Crabapple, Tschonoskii	Malus tschonoskii	30	15	Y	Y	Y					Y	Rarely 1/2" green crabapples	General columnar growing habitat.

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
7	Dogwood, June Snow™	Cornus controversa 'June Snow'	30	40	Y	Y							Produces abundant ¾ inch, soft small and colorful fruit	Very broadly spreading form.
7	Dogwood, Starlight™	Cornus kousa x nuttalli 'KN 43'	30	20	Y	Y	Y						Produces abundant ¾ inch, soft small and colorful fruit	native dogwood hybrid; another native dogwood hybrid is 'Venus'
7	Elm, Frontier™	Ulmus carpinifolia x parvifolia 'Frontier'	40	30		Y							Showy samaras	requires structural pruning to maintain form and branch strength
7	Honeylocust, Shademaster™	Gleditsia triacanthose 'Shademaster'	45	35									Small, thin seed pods.	thornless and seedless
7	Ironwood, Persian cultivar	Parrotia persica	30	20		Y			Y				Dual hanging, dark fruits.	
7	Stewartia, Japanese	Stewartia pseudocamellia	30	25	Y	Y			Y				Dry lantern-esque capsules	
7	Stewartia, Tall	Stewartia monodelpha	30	25	Y	Y		Y	Y				Dry lantern-esque capsules	
7	Yellowwood	Cladrastis kentukea	30	40	Y	Y							3" dry pea-like pods	

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
7	Yellowwood, Perkins Pink American™	Cladrastis kentukea 'Perkins Pink'	40	40	Y									Copious pink flowers
7	Maple, Hedge	Acer campestre	30	30				Y					Samaras	Several cultivars are available to choose from.
7a	Bowhall™ maple	Acer rubrum 'Bowhall'	40	20		Y		Y				Y		Plant in limited quantities, except where physical/width limitations exist.
7a	Columnar norway maple	Acer platanoides 'Columnar'	45	15		Y						Y		Plant in limited quantities, except where physical/width limitations exist.
7	Hardy rubber tree	Eucommia ulmoides	50	40		Y	Y			Y				Pest-free, uncommon tree.
7	Golden chinquapin	Chrysolepis chrysophylla	50	30	Y		Y	Y			Y			
8	Maple, Pacific Sunset™	Acer truncatum x platanoides 'Warrenred'	30	25		Y							Samaras	

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
8	Tupelo cultivar	Nyssa sylvatica	35	25		Y	Y	Y					Occasional 1/4" dark purple berries	Several cultivars are available to choose from.
8	Coffeetree, Espresso™	Gymnocladus dioicus 'Espresso' (seedless)	60	40									Wide pea-pod like fruit.	Seedless cultivar.
8	Elm, Allee	Ulmus parvifolia 'Erner II'	50	35									Samaras	requires good structural pruning to maintain form and branch strength
8	Elm, Emerald Sunshine™	Ulmus propinqua 'JFS-Bieberich'	50	35									Samaras	requires good structural pruning to maintain form and branch strength
8	Honeylocust, Skyline™	Gleditisia triacanthos 'Skycole'	45	35										thornless and seedless
8	Hophornbeam cultivar	Ostrya virginiana	40	25									Dry hop-like fruits	Several cultivars are available to choose from.
8	Linden, Sterling™	Tilia tomentosa 'Sterling'	45	35		Y		Y					'helicopter' fruits, samaras	other *T. tomentosa* cultivars are available; to avoid aphid problems,

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
														DO NOT plant *T. americana* or *T. cordata*
8	Maple, Autumn Blaze™	Acer x freemanii 'Jeffersred'	50	40		Y							Samaras	
8	Oak Bur	Quercus macrocarpa	55	45			Y	Y					Acorns with 'mossy' caps	
8	Oak, Italian	Quercus frainetto	55	45			Y					Y	Acorns	Glossy deep green leaves; general columnar growing habitat.
8	Oak, Scarlet	Quercus coccinea	50	40		Y	Y						Acorns	
8	Oak, Shumard	Quercus shumardii	50	40		Y	Y	Y					Acorns	
8	Oak, Swamp White	Quercus bicolor	45	45		Y	Y	Y					Acorns	
8	Oak, White	Quercus alba	50	45		Y	Y	Y					Acorns	
8	Pagodatree, Regent™	Sophora japonica 'Regent'	50	45	Y	Y							4" dry pea-like pods	
8	Zelkova, Green Vase™	Zelkova serrata 'Green Vase'	50	40		Y							Samaras	other *Zelkova serrata* cultivars are available
8a	Japanese umbrella pine	Sciadopitys verticillata	30	20					Y	Y	Y			Accent street tree; requires consideration of utilities;

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
														very unique evergreen foliage
8a	Japanese red pine	Pinus densiflora 'Umbraculifera'	15	25					Y	Y	Y			Accent street tree; requires consideration of utilities; unique bark and evergreen foliage
8	Green Column Black Sugar Maple	Acer saccharum subsp. nigrum 'Green Column'	60	25		Y	Y					Y		Columnar variety.
8	Skyrocket oak	Quercust robur 'Fastigia'	40	15		Y	Y					Y		Columnar variety.
8	Brave bald cypress	Taxodium distichum 'Mickelson' Shawnee	55	20		Y						Y		Deciduous conifer; columnar variety.
8	Catalpa, Purple	Catalpa erubescens 'Purpurea'	50	30	Y	Y	Y						Large seed pods	New shoots are black-purple; large showy flowers.
8	Dove tree	Davidia involuctra	60	30	Y		Y		Y					Blooms resemble doves; large prominent flowers.
8	Horsechestnut, fruitless	Aesculus hippocastanum 'Baumannii'	55	40	Y	Y		Y						Fruitless variety; large prominent flowers.

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
8	London planetree, Bloodgood™	Platanus x acerifolia 'Bloodgood'	50	40		Y	Y		Y					Resistant to anthracnose; unique peeling grey/brown bark.
10a	Tuliptree	Liriondend ran tulipifera	80	50	Y	Y		Y					Samaras	Large fast growing accent tree; may require additional planting considerations
10	Maple, Autumn Blaze™	Acer x freemanii 'Jeffersred'	50	40		Y							Samaras	Accent tree; many cultivars available.
10	Zelkova, Green Vase™	Zelkova serrata 'Green Vase'	50	40		Y							Samaras	Accent tree; many cultivars available.
10	Oak, Red	Quercus rubra	80	45		Y	Y	Y					Acorns	Very large, spreading tree. Needs room to grow.
10	Incense cedar	Calocedrus decurrens	55	15			Y	Y			Y	Y	Small green cones at end of branches.	Medium sized evergreen tree.
10	Deodar cedar	Cedrus deodara	50	35			Y				Y			Large spreading evergreen; many cultivars

Minimum Planting Space (ft.)	Common Name	Botanic Name	Height	Width	Showy Flowers	Fall Color	Wildlife Food	Native/ Regional	Showy Bark/ Winter Form?	Utility Friendly?	Evergreen/ Stormwater	Columnar	Fruit/Nuts	NOTES
														exist and are appropriate.
10	Dawn redwood	Metasequoia glptosroboides	75	30		Y	Y		Y			Y		Deciduous conifer. Generally columnar in form.
12a	Douglas-fir	Pseudotsuga menziesii	100	50			Y	Y			Y			Native; stately large evergreen. Special considerations apply to planting species.
12a	Coastal redwood	Sequoia sempervirens	100	40			Y	Y			Y			Native; stately large evergreen. Special considerations apply to planting species.
12a	Giant sequoia	Sequoiadendron giganteum	100	50			Y	Y			Y			Native; stately large evergreen. Special considerations apply to planting species.

NOTE: An 'a' next to minimum width designates accent varieties. Accent varieties are not recommended to fill complete strips or areas. Install as accent pieces in select areas.

NOTE: Broadleaf evergreen trees have special importance to stormwater attenuation.

Use Appendix A.9: *Street Tree and Landscaping Planting Lists* for an ideal soil volume for specific tree species. This information will in turn inform how sidewalk sizes are determined in Appendix A.10: *Street Design Recommendations.*

A.10 – STREET DESIGN RECOMMENDATIONS

Small trees maturing to approximately 25 feet in height should have no less than 400 cubic feet of rooting volume; medium sized trees maturing to approximately 35-40 feet should have no less than 1,200 cubic feet of rooting volume; and large trees maturing over 40 feet in height should have no less than 2,400 cubic feet of rooting volume. Soils should be uncompacted, or compacted soils should be removed from the area and uncompacted soils installed. Refer to the *Soil for Urban Tree Planting Research Laboratory Technical Report* on the next page.

Use Appendix A.9: *Street Tree and Landscaping Planting Lists* for an ideal soil volume for specific tree species. This information will in turn inform how sidewalk sizes are determined in Appendix A.10: *Street Design Recommendations.*

RESEARCH LABORATORY TECHNICAL REPORT

BARTLETT TREE EXPERTS
SCIENTIFIC TREE CARE SINCE 1907
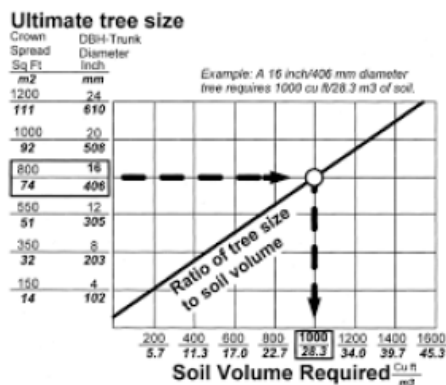
Soil for Urban Tree Planting

E. Thomas Smiley, PhD, Urban Forestry

When installing trees in an urban landscape such as an urban plaza, downtown sidewalk, street median or other location where the native soil will not support plant growth, it is important to specify and install a soil that meets the specific cultural needs of the tree species. The following are guidelines for the development of a soil that will promote growth of most woody landscape plants. This soil is also suitable for the installation in new planting beds in suburban areas, but is not intended for roof top gardens.

Soil Volume Requirements

The amount of soil installed will in large part determine the maximum size that the tree will achieve during its usable life span. To determine soil volume required, see the table below prepared by James Urban (*Up by Roots*, ISA Press, 2008). Only the upper three feet of soil should be used for calculations in this table. The example illustrated shows that to achieve a trunk diameter of 16 inches (40 cm), 1000 cubic feet (28 m³) of soil are needed.

Figure 1: Tree size to soil volume relationships (Urban 1992).

When installing the soil it should be installed in lifts or layers of ≤ 12 inches (30 cm). A subsoil mix should be installed first and this should be covered with a topsoil mix with a depth of at least 12 inches (30 cm). When installing lifts, the base soil surface should be tilled or scarified with the teeth of an excavator bucket initially and between each lift to break up any compaction that occurred.

Soil Specifications

The top soil and subsoil may be from either a naturally occurring soil or soil that has been mixed to achieve the requirements.

Texture
Both top and subsoil should be a sandy loam soil with 50-80% medium and coarse sand (<25 % fine sand), 5-20% clay, 5-35% silt.

Stones and rocks
No stones larger than 1 inch in the longest dimension are permitted. Stones ranging from 0.5 to 1 inch (1.25 to 2.5 cm) shall not exceed 5% of the soil volume, and gravel ¼ to ½ inches (0.6 to 1.25 cm) shall not exceed 5% of the soil volume.

Soil Depth

Tree soil should have a minimum depth of 3 feet (1 m). The soil can be composed of topsoil and subsoil layers.

Page 1 of 3

Debris content

Particles greater than 1 inch in the longest dimension are not allowed. This includes fragments of brick, concrete, wood, glass, metal, stone and plastic. The total volume less than 1 inch long should not be more than 5% of the soil volume.

Contaminants

The soil should have no herbicides, heavy metals, biological toxins, or hydrocarbons that will impact plant growth or are at levels exceeding the EPA's standards for soil contaminants.

Clod size

Mixed soils often contain soil clods with a high clay content. While smaller soil peds are desirable from a soil drainage perspective, larger clods are not. Therefore, it is permissible to have an unlimited amount of peds that are less than 1 inch long, but clods from 1-3 inches (2.5-7.5 cm) should make up less than 10% of the soil volume and clods 3-6 inch (7.5-15 cm) should be < 5%.

Organic matter content

Organic matter (OM) is important for retaining water, maintaining stable soil aggregates, promoting biological diversity and providing nutrients for tree growth. The top soil shall have 4-6% OM by weight. If additional organic matter is needed, compost can be added to the soil. A well composted yard waste or wood chips compost can be used as long as there is 10% OM by volume in the compost. No soil mix should contain more than 15% compost by volume so as to avoid settling/subsidence problems. Subsoil should have between 1-3% OM, but higher levels are not detrimental.

Density

Soil density needs to be high enough to avoid settling, yet low enough to allow root growth. Top soil should have a density of 1.0 to 1.4 g/cc and subsoil 1.2 to 1.5 g/cc. A vibrating plate compactor should be used between lifts to settle the soil. Number of passes required needs to be determined on site, but should be minimal. A starting point is one or two passes of a 20 inch (55 cm) impact plate vibrating compactor on a moist (not wet) soil to achieve the desirable density.

Drainage

Water should readily drain from the soil. Percolation rates of 1-2 inches (2.5-5 cm) per hour are preferred, if irrigation will be installed. A drainage system should be installed if the native subsoil has a drainage rate less than 1 inch (2.5 cm) per hour. Corrugated, slotted pipe should be used for drainage. Slots must only be on the bottom half of the pipe. If pipe has slots on the top, plastic sheeting should be taped to the top to prevent soil contamination of the pipe.

The drain pipe should be surrounded with coarse sand and should *not* be wrapped with filter fabric to avoid future clogging problems. The coarse sand trench should be at least 12 inches (30 cm) wide and 10 inches (25 cm) deep, with the pipe in the center. The pipe must go downhill to an appropriate drainage area.

Soil pH

Soil pH determines the availability of nutrients in the soil. The exact pH range is dependent on the tree species to be planted. Generally, the most desirable pH range is 5.5-6.6 in humid regions (Eastern North American, western OR, WA and BC) and 6.0 to 7.4 in arid regions (TX, AZ, CA). Optimal pH is highly dependent on the tree species to be planted and should be tested and adjusted based on species prior to planting.

Nutrients

Plant-available nutrients should be tested prior to soil installation. If they are found to be at levels that are listed as "medium" or less on the soil analysis report, the soil should be amended with the appropriate fertilizers. If nitrogen is required, the nitrogen fertilizer shall contain at least 50% of the total N applied in a water insoluble (WIN) form.

Soluble salt

Soluble salt content shall be less than 2 dS/m.

Water

Water is an essential component of keeping new transplants alive and thriving. Soil moisture should be monitored regularly and irrigation applied when needed to assure adequate moisture. Excess irrigation can also harm plants so over irrigation should be avoided. Installation of soil moisture sensors at the time of soil installation is highly recommended.

With any new planting, the trees and soil moisture should be monitored regularly. Pests can do serious damage to new transplants and are most easily managed before populations build to damaging levels. An Integrated Pest Management (IPM) program is an effective means for protecting new transplants.

Founded in 1926, The Bartlett Tree Research Laboratories is the research wing of Bartlett Tree Experts. Scientists here develop guidelines for all of the Company's services. The Lab also houses a state-of-the-art plant diagnostic clinic and provides vital technical support to Bartlett arborists and field staff for the benefit of our clients.

Soil for Urban Tree Planting

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