Strategic 20-Year Passive Open Space Plan

Environmental Services Department

City of Tacoma

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FORT&RRA

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EXECUTIVE SUMMARY

The City of Tacoma's Environmental Services Department (ESD) undertook the creation of this Strategic 20-Year Passive Open Space Plan (Plan) to provide a path forward for the active restoration and management of 496 acres of land. Restoring these lands is considered critical to the health and welfare of the citizens of Tacoma. Specifically, ESD is charged with managing these lands for purposes of stormwater quality and quantity benefit to the public.

The intent of this Plan is to articulate measurable goals and objectives, strategies for achieving these goals, and establish benchmarks for evaluating success and timing. To accomplish this, a complete analysis of all 496 acres of land managed by ESD was conducted. The results of this analysis provide the foundation for prioritizing restoration actions. To further guide prioritization and to ensure the ultimate success of this effort, a cost model was developed to determine the total cost of restoration and ongoing management of ESD passive open space lands.

This Plan will ensure the public investment of these lands is effectively and efficiently allocated across passive open space lands and that the full implementation of this Plan over the 20-year timeframe will be achieved.

The Plan objectives are:

1. All 496 acres of passive open space land under ESD management will be enrolled in active restoration and maintenance by 2036.
2. An active management program will be in place and will be implemented beyond 2036 to ensure passive open space areas remain ecologically healthy and provide surface water management benefits as well as other ecosystem benefits to the City of Tacoma.
3. A monitoring and adaptive management program will be created and implemented to ensure all passive open space lands are monitored on a three year rotating basis.
4. A Habitat Steward program will be implemented and utilized to engage volunteers with a high level of expertise in restoration techniques to leverage restoration of those areas safe and appropriate for volunteer access (slopes <40%).
5. A successful volunteer program that engages a diverse community of individuals, families, schools, businesses and non-profits will be in place.
6. Sustainable funding and staff resources to accomplish long-term restoration and management objectives will be secured.

The results of the data analysis show that four significant factors will influence the restoration of ESD passive open space lands in both prioritization and timing. The first is that about one half of all acres are located on steep slopes (≥ 40%). These areas cannot be restored using volunteer labor and must be restored and maintained with professionally trained crews. The second is that the majority of lands (90%) are impacted by invasive vegetation. Sites with a high degree of invasive cover will require multiple treatments over the course of many years. This will extend the length of time needed before these sites can enter into Phase 4, the long-term maintenance phase. The third is that access to many of the restoration sites will be challenging. Some sites are surrounded by private property and do not have paved access roads. Other sites are isolated by steep slopes or vegetation. Navigating access, especially to deliver tools and materials, will increase the length of time and effort needed to actively restore many sites. Finally, the data collection and analysis confirmed that the majority of habitat is older deciduous tree canopy with few mature conifer species and little to no regeneration of native species.

This is significant because it provides an indication of how much planting will be required to restore sites to a healthy condition. Sites with little to no natural regeneration will require more tree species plantings, especially of conifers which have a higher value for stormwater management and local wildlife habitat. Sites with older deciduous trees will need to be monitored for hazard tree conditions and may necessitate expensive tree removal on some sites. Together a site with little natural regeneration and high invasive vegetation cover will require extensive restoration, including significant invasive plant removal and installation of native plantings, extending the restoration timeline.

A cost analysis was also conducted for the 20-year timeframe to determine the total cost for work that needs to be completed. This cost analysis determined the total cost to be $21 million dollars (2015 dollars).

The process of developing a cost model involves a number of components, criteria and assumptions. The model's intent is to provide a 30,000-foot view of the associated costs of a restoration program and provide a guide for program managers. The primary components of the cost model include: field costs, program costs, and overhead/contingency. In addition, there is an estimation of volunteer labor match which allows a comparison of professional crew work verses the use of volunteer labor. Costs vary by habitat condition and phase of restoration. The model assumes a greater investment for poor habitat conditions and employs a strategy of gradually increasing program costs over time to account for increased acres enrolled in restoration per year. The cost model also provides an estimate of the ongoing annual maintenance costs (Phase 4) for all lands. It assumed that once all lands entered into Phase 4 there would be the need for a three year monitoring and maintenance rotation.

Based on the condition assessment results, this Plan establishes a method of prioritizing habitat restoration activities and provides a four phase restoration approach. Prioritization will occur based on the physical condition of the site, whether volunteer or professional crew labor will be utilized, site accessibility, and stable funding over 20 years. The four phase approach to restoration starts with invasive plant removal, initial planting of native species, a period of plant establishment, and finally long-term monitoring and care.

Successful completion of this plan will result in a system of healthy, functioning passive open spaces for improved surface water quality and other associated ecosystem benefits, such as clean air, climate change mitigation and human mental health.

CHAPTER 1: CONTEXT

> "Situated in the Puget Sound Lowlands, at the mouth of the Puyallup River Valley and the tidal waters of Commencement Bay, Tacoma's natural resources provide an array of ecologically, economically and aesthetically valuable ecosystem services."[1]

Many of the City of Tacoma's (City) natural resources are held within open space properties. Open spaces, whether associated with active parks, passive natural areas or even non-publicly accessible spaces provide numerous benefits to the City and its residents. These areas filter pollutants from the air and water, mitigate climate change, prevent urban flooding and erosion, and provide homes for our wildlife. Collectively, these benefits are known as ecosystem services and are a part of a healthy urban environment.

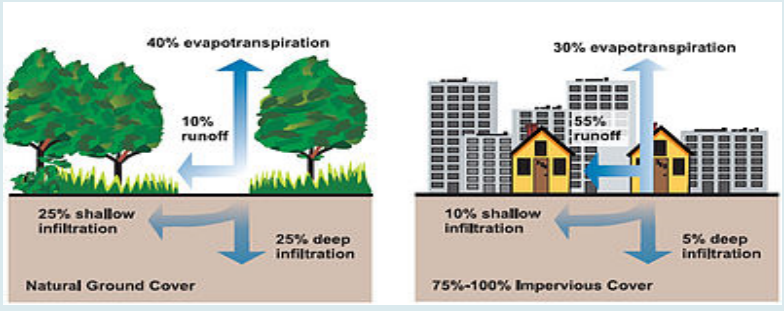
In addition to these ecosystem benefits, healthy open spaces often define our neighborhoods, improve property values and provide opportunities for people to engage and connect with nature. Frederick Law Olmsted, the designer of New York's Central Park, stated "…it is evident that in our daily lives nature must be thought of not as a luxury to be made available if possible, but as part of our inherent indispensable biological need."[2]

Historically, development was the largest threat to natural areas. Throughout the Puget Sound region, public agencies, land trusts, and nonprofits have worked to reduce this threat by purchasing and conserving available open space. Many of these properties were forests set aside to preserve natural elements with the goal of mitigating adverse human impacts by allowing nature to takes its course. People are quickly learning, however, that urban forests face unique pressures, and that passive management is often inadequate to maintain a high quality of environmental health. Invasive species, litter, pollution, changes in surrounding land use, mismanagement and fragmentation reduce the forest's ability to thrive within cities. Urban forest areas are disappearing and declining in quality and function, and with them go critical services such as the reduction of stormwater runoff volume and absorption of greenhouse gases.

The City's open spaces can significantly benefit from intervention, care and restoration to help reverse the trend of degradation and prevent major loss of habitat, trees, and ecosystem services.

Impervious Surface and the Urban Environment

In a natural setting runoff volumes are reduced and velocities are slowed by vegetation. In an urban setting impervious surfaces increase the volumes and velocities that enter the stormwater system. The "traditional" stormwater management approach is to collect and move runoff off-site as quickly as possible. New approaches include using natural vegetation to filter and slow the amount of runoff.



[1] One Tacoma: Comprehensive Plan, Chapter 4: Environment and Watershed Health, Page 4-4.
[2] Frederick Law Olmsted, in Biography, by J.E. Todd, 1982

1.1. Tacoma's Urban Forest

Tacoma's urban forest encompasses all of the trees occurring on private lots, lining our streets, and of course in our parks and public areas. The City's tree canopy is a vital part of the system of parks and open spaces in Tacoma. The tree canopy provides numerous benefits to the City including: wildlife habitat, carbon sequestration, stormwater uptake, health benefits, and others. According to a study completed in 2011 by the University of Washington, Tacoma's tree canopy coverage is 19% of the total City.[3] As identified within the City's comprehensive plan, the goal is to increase the tree canopy cover to 30% by the year 2030. Preserving, enhancing and planting additional trees within the City will aid in achieving of this goal.

1.2. Passive Open Space

The City has divided its open space properties into two categories: active and passive. Active sites are those that have formal amenities and formal active use – like a playground or ball field. Active sites are managed by the City's Real Property Services and Public Works Department.

Passive open space properties are generally undeveloped and vegetated – many are located within critical areas. Approximately 520 acres of passive open space and associated right-of-way were transferred to ESD for management in 2014. Of these 520 acres, 24 acres are classified as water, landscape or hardscape, leaving 496 acres available for upland restoration activities. This plan addresses those available acres (Figure 1-1 and Table 1-1). The reassignment to ESD is significant in that it included a funding mechanism for the maintenance and restoration work that needs to happen on the passive open space properties. Work has already begun in some of the City's most needy sites – Schuster Slope and Mason Gulch.

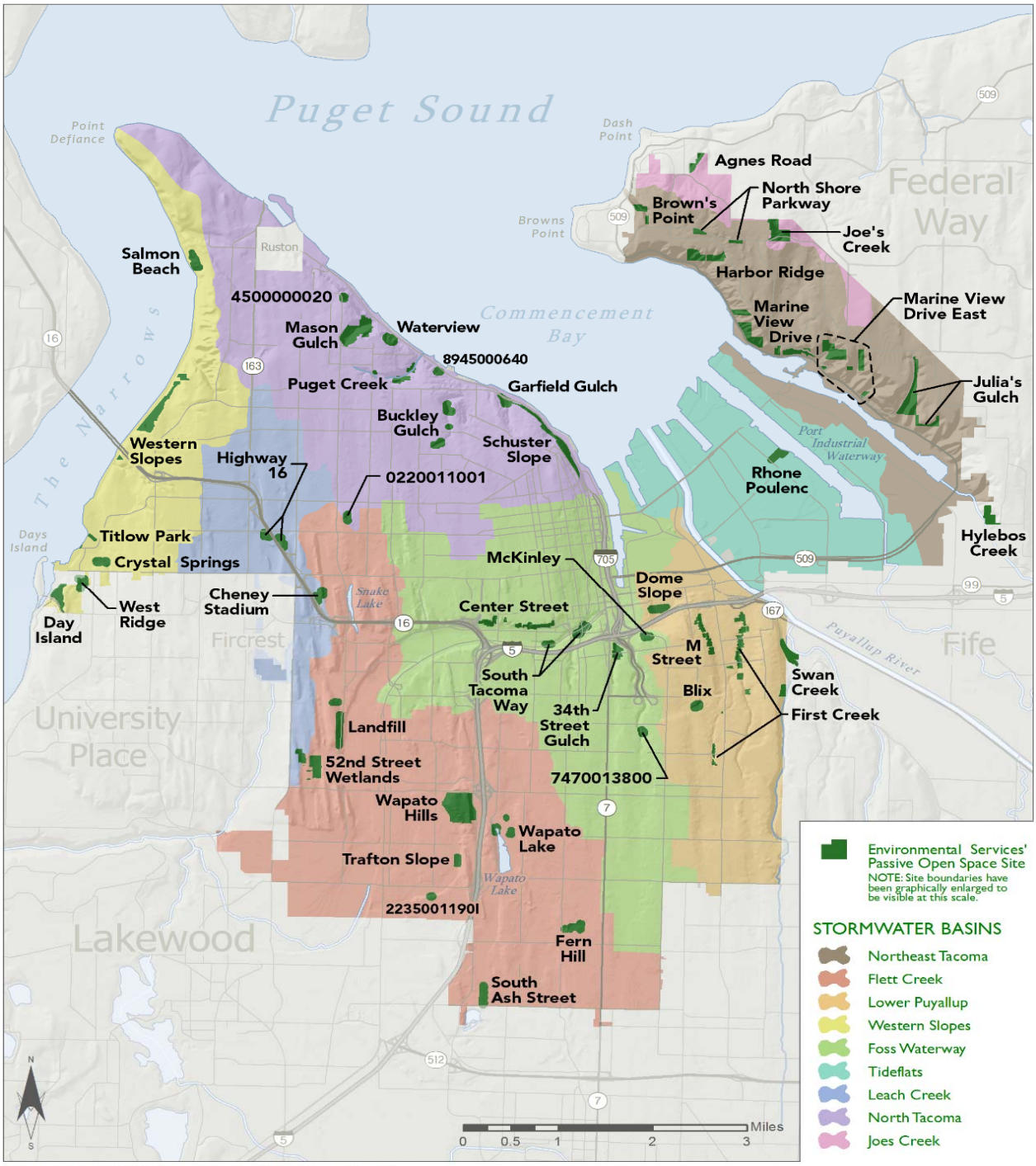
Environmental Services took on the responsibility of managing passive open space for the purposes of stormwater benefit to both water quality and quantity by absorption, interception, evapotranspiration, and erosion prevention in healthy forested areas. Evergreen vegetation intercepts stormwater year-round, greatly reducing stormwater impacts, especially during our wet and rainy winters when deciduous trees are dormant and leafless. A healthy forest floor also retains stormwater and provides significant stormwater benefits by allowing greater soil infiltration.

1.2.1. City-wide Restoration Progress

It is worth acknowledging that the City is already engaged in active restoration of many acres of land throughout the City. The City also has a long history of correcting damage to Commencement Bay and associated waterways through restoration and monitoring. Two major efforts – the Thea Foss and Wheeler-Osgood Waterways Sediment Remediation project and the Natural Resources Damage Assessment (NRDA) Consent Decree – have led to restoration of key sites in Commencement Bay. Some of the passive open space properties, like Schuster Slope, are already under active restoration. ESD seeks to manage passive open space areas on both a large scale restoration project and management plan level (i.e., Schuster Slope) to a smaller scale intervention like removing knotweed along riparian corridors (i.e., Joe's Creek). Other passive open space areas owned by the City, like Julia's Gulch and Wapato Hills Urban Wildlife Area, are being stewarded and restored through a partnership with Metro Parks Tacoma (MPT) and volunteers.

[3] http://depts.washington.edu/rsgalwrk/canopy/

Figure 1-1: Passive Open Space Map



Map created by FORTGRRA in partnership with the City of Tacoma.

Table 1-1: Passive Open Space Sites and Acres

Passive Open Space Site	Acres	Passive Open Space Site	Acres
0220011001	0.45	Swan Creek	11.43
2235001190	0.18	Titlow Park	0.06
34th Street Gulch	6.53	Trafton Slope	3.86
4500000020	0.19	Wapato Hills	65.35
52nd Street Wetlands	22.55	Wapato Lake	2.38
7470013800	0.48	Waterview	1.64
8945000640	0.22	West Ridge	2.56
Agnes Road	5.49	Western Slopes	32.30
Blix	0.89		
Brown's Point	5.26		
Buckley Gulch	4.40		
Center Street	11.91		
Cheney Stadium	1.66		
China Lake	1.46		
Crystal Springs	1.05		
Day Island	12.44		
Dome Slope	3.34		
Fern Hill	3.04		
First Creek	23.55		
Garfield Gulch	2.54		
Harbor Ridge	20.60		
Hwy 16	1.60		
Hylebos Creek	8.96		
Joe's Creek	20.73		
Julia's Gulch	44.16		
Landfill	5.10		
M Street	6.55		
Marine View Drive	43.69		
Marine View Drive East	39.22		
Mason Gulch	36.39		
McKinley	0.83		
North Shore Parkway	4.46		
Puget Creek	8.22		
Salmon Beach	3.77		
Schuster Slope	22.36		
South Ash Street	1.46		
South Tacoma Way	0.86		

1.3. Green Tacoma Partnership

In 2007, the Green Tacoma Partnership (GTP) was formed as a partnership between the City, MPT, Citizens for a Healthy Bay (CHB), Tahoma Audubon, Forterra, and community members. The main goal, as presented in the 20-year Restoration Action Plan (2011), was to place into active restoration 1,881 acres of land by 2027 – this scope included properties of various ownership and uses.

The GTP's three primary goals are:

- Improve the quality of life, connections to nature, and enhance forest benefits in cities by restoring our forested parks and natural areas
- Galvanize an informed and active community
- Ensure long-term sustainable funding and community support

The intent of this current Plan is to bring forward the City's passive open space properties into active management and build on and complement the momentum and work already accomplished by the GTP and other City restoration projects. Please note that some of the properties discussed in this plan overlap with the 2011 GTP plan but many are additional acres under the purview of ESD. Together, both plans provide an integrated picture of the conditions and strategies needed to create a system of healthy and functional passive open spaces in the City. This Plan specifically looks at site data, restoration cost estimates, and promotes community participation to achieve stated goals for the 496 acres of ESD managed passive open space lands.

1.4. Roles and Partnerships

The primary implementer and responsible entity for this Plan's success will be ESD. Complementing ESD in this effort will include numerous agencies, organizations and individuals, as discussed below.

1.4.1. Environmental Services Department (ESD)

Most project management and oversight will rest with ESD staff. This will include existing FTEs already committed to the management of passive open space and additional FTEs as the program moves forward. ESD staff will hire and manage consultants as necessary, coordinate professional crew field work, implement the volunteer and stewardship program, track and monitor restoration, create annual reports, report to City leadership, and conduct outreach and marketing of the program.

1.4.2. Metro Parks Tacoma (MPT)

MPT currently supports ESD by managing the property and volunteer efforts at Julia's Gulch and Wapato Hills by incorporating the sites into their own volunteer program, "Chip-In". This partnership is executed by a Memorandum of Understanding (MOU) agreement.

1.4.3. Washington Conservation Corps (WCC)

The City participates in Department of Ecology's (Ecology) Washington Conservation Corps (WCC) program by sponsoring crew(s). WCC is an AmeriCorp program administered by Ecology to provide youth (18-25 year-olds) with work experience and skills in the environmental field. The City's WCC crews are trained and qualified to work on steep slopes, apply herbicides and use hand tools to perform the restoration site maintenance needed. It is anticipated that the WCC crews will provide the majority of all paid crew work.

1.4.4. Consultants

Many sites pose significant challenges either through the presence of critical areas or other complexities and will require the creation of a landscape management plan. A landscape management plan often involves geotechnical engineering, erosion control treatments and other considerations that need the assistance of a third party consultant. ESD is anticipating and budgeting a significant amount of money to ensure consultant involvement.

1.4.5. Non-Profit Organizations

Several known non-profit organizations play a supporting role in the successful implementation of this plan. Some local and active organizations are: Forterra, EarthCorps and CHB. Forterra was a founding partner in the GTP and brings many years of expertise regarding all facets of restoration work. EarthCorps also provides a workforce that performs maintenance on behalf of the NRDA Trustees or others. CHB has been involved in many aspects of restoration around Commencement Bay from on the ground planting to policy decisions and have the ability to mobilize volunteers.

1.4.6. Volunteers

There is an existing cadre of volunteers eager to help restore passive open spaces identified in this Plan. There is a responsibility and need to engage the volunteer base further within Tacoma. Creating and implementing a Habitat Steward program to meet the needs of volunteers presents a challenge to ESD. Options will need to be evaluated to best meet this need and ensure effective engagement of volunteers and Habitat Stewards.

1.4.7. Private Landowners

Public land is usually surrounded at least partially by private land. Willing private land owners have an opportunity to create corridors of connected lands and/or buffer private lands from public lands with the utilization of a conservation easement. Conservation easements help establish use and maintenance requirements that protect the health of private land. Many of the pressures on passive open space areas in the City are related to human actions, which can either enhance public spaces or lead to their degradation.

While additional funding will most likely need to be sought to ensure the most effective engagement of private landowners, there are many opportunities presented by private/public partnerships that should not be missed and actively pursued when resources allow.

CHAPTER 2: CHALLENGES

2.1. Critical Areas

Historically, many passive open space areas have remained undeveloped and dedicated to open space because of terrain, the lack of development feasibility, or utility corridors. Many of our passive open space properties consist of wetlands and/or steep and unstable slopes. These areas are hard to access and require permits and additional efforts to restore. The Critical Areas Preservation Ordinance of the Tacoma Municipal Code (TMC 13.11) guides activities within critical areas (e.g., steep slopes, wetlands, wetland buffers, streams and stream buffers). This extra layer of planning will increase the cost and timeline of each project but will also ensure critical areas are protected.

As assessed, 47% of the passive open space acreage is considered a "steep" slope. Steep slope areas (≥40% slope) have special considerations that must be met before restoration work can begin. Geotechnical study, erosion control and a detailed landscape management plan must be created and permitted prior to start of work. On steep slopes, because of safety and liability restrictions, professionally trained crews must be used to complete work in these areas. Current policies do not permit volunteers to work on steep slopes.

Wetlands, streams and their buffers also require an extra layer of planning and in some cases permitting. Some restoration work like invasive removal can occur in wetland buffers at a maximum of 1,000 square feet at a time without a permit. Areas greater than 1,000 square feet require a city permit before work can begin. Coordinating work along wetlands, streams and buffers is important to ensure the health of these resources. Volunteers can work in these areas as long as the landscape management plan is followed.

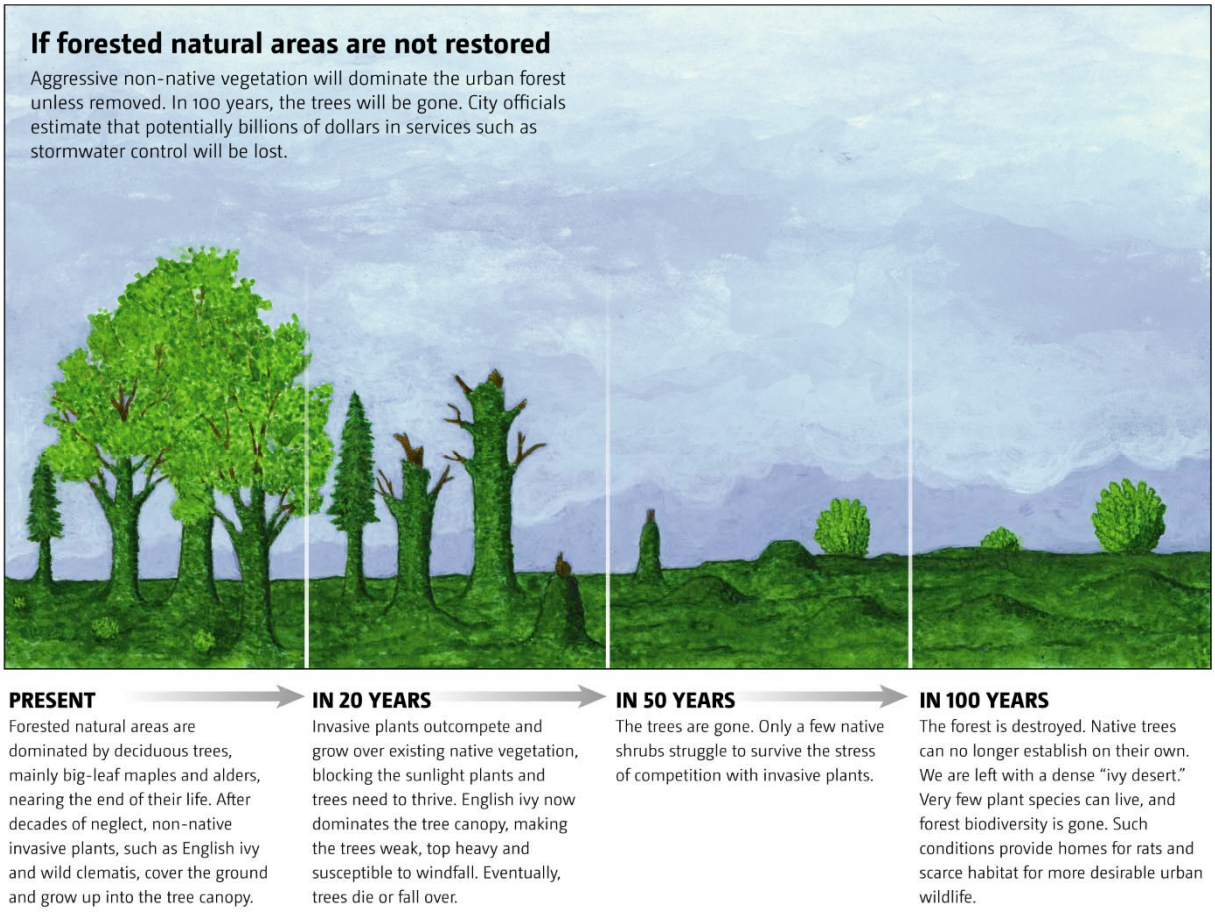
2.2. Invasive Plants

Another critical factor impacting our forested areas is invasive plants. Invasive plants are opportunistic and easily take hold when ground is disturbed. The dominance of non-native plant species, such as Himalayan blackberry, English ivy and Scot's broom is reported to be a major cause of biodiversity loss and ecosystem degradation (Pimentel et al. 2000; Soule 1991). These invasive plants lack natural population controls (e.g., predators) and are capable of rapid reproduction; they can quickly blanket the understory and prevent native plants from reseeding/regenerating (Boersma et al. 2006). The end result of invasive plant dominance is the creation of monocultures of invasive plants with little or no native plants in the understory (Figure 2-1).

2.3. Past Tree Management

In the past, many passive open space areas have been neglected and subject to mismanagement. In some areas, historic vegetation management techniques included the topping of trees which is currently prohibited within critical areas (TMC 13.11.210). This management technique was often used to enhance views and to reduce the height of a tree with minimal time or skill. However, this method starves the tree, leading to weaker and dense re-growth, and opportunities for pathogen and disease entry. This technique is not sustainable or healthy for the tree and where the tree is located on a steep slope, these actions increase the likelihood of slope instability by reducing soil binding root mass.

Figure 2-1: Conceptual Image of Forest Decline



2.4. Other Challenges

Timber trespass is also a challenge. Steep slope vegetation is sometimes illegally removed from City owned properties for the improvement of views. Policing of this activity and enforcement is difficult and the tree damage is irreparable for the short term while the safety risk is high.

Open spaces experience other undesirable activities like dumping of household waste and transient encampments. Often by initiating restoration activities and improving the site conditions through increased community involvement and concern, undesirable activities are seen to decrease.

Dumping yard waste and other material into a gulch area is also noted frequently and can be problematic on slopes as it adds weight and can cause slope instability and failure. Outreach and education campaigns can often minimize these adjacent impacts.

2.5. Resource Limitations

Tacoma, like many cities, faces a financial gap to fund the active management and restoration of passive open space areas. Many urban open spaces were left to self-manage. This management style has directly led to the declining health of our passive open space areas in the City. The care of these

properties will need to be fully funded in order to succeed in protecting, improving, and ultimately growing City passive open spaces.

This Plan establishes an implementation strategy to reverse these management problems and manage the sites more effectively and proactively. A cost estimate (Section 5.6) is provided to help guide the City in budget decisions and to identify where in the 20-year implementation process new funds will likely be needed. This Plan provides a framework, but also provides flexibility through adaptive management, allowing adjustments to be made to meet goals and address new challenges as they arise. These elements will be discussed in greater detail later in this document. The bottom line is that our passive open spaces need active long-term care and management, they cannot self-manage.

What is Active Management?

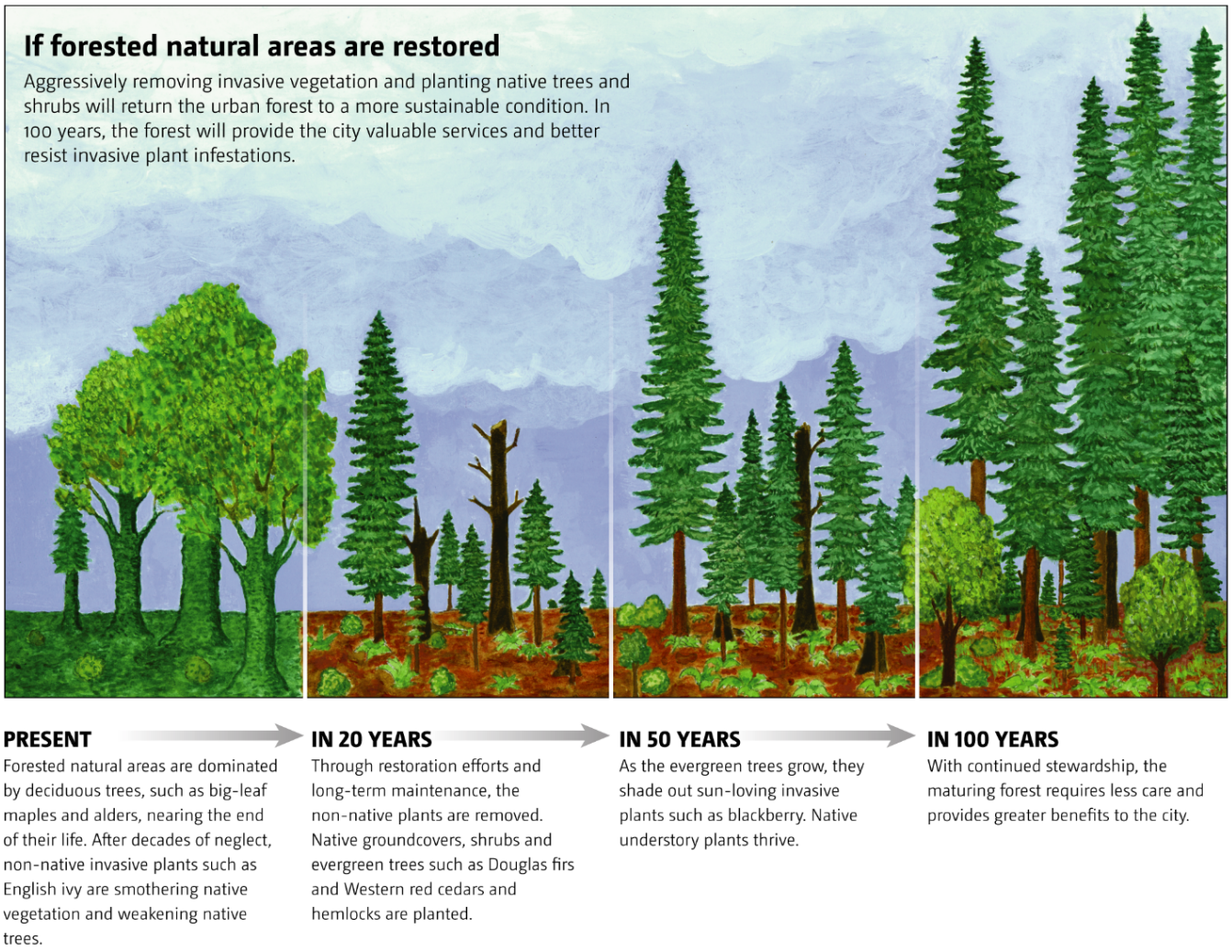
Tacoma's parks and natural areas have a variety of needs specific to urban environments, including restoration, long-term maintenance, and monitoring. Meeting these needs might mean removing invasive species, planting natives, watering, mulching, or visiting the site to check for invasive re-growth or any new problems that arise. We refer to all of these activities as active management, acknowledging that caring for urban natural areas requires a dynamic, hands-on effort in the field to counteract the urban pressures of these areas' surroundings.

CHAPTER 3: VISION, GOALS, AND OBJECTIVES

3.1. Vision

This Plan will result in a system of healthy, functioning passive open spaces throughout the City that will maximize ecosystem benefits and minimize costs. It will engage the community in stewardship where feasible. Ultimately, this system of passive open spaces will result in a healthy environment for salmon and other wildlife, individuals and families, and mitigate impacts resulting from growth and development. If fully implemented, at the completion of this Plan, 496 acres of passive open spaces will be in active restoration, managed as a sustainable and healthy conifer dominated forest (or other target habitats as appropriate) with an invasive free tree canopy, a vibrant understory and healthy soils. Slope stability will be improved, the forest will be able to regenerate, wildlife will be abundant and the City will enhance its reputation as a leader in sustainable city growth (Figure 3-1).

Figure 3-1: Conceptual Image of Forest Health



3.2. Goals

For the vision of this Plan to become reality, many goals must be achieved during the next 20 years. It is anticipated that a program re-evaluation would happen in year 10 (2026). The following goals were developed based on current program status.

Passive Open Space Program goals:

- Create annual work plans and provide yearly updates/reports
- Maintain and monitor areas enrolled in active restoration
- Establish a Habitat Steward/volunteer program to engage the community and build support
- Engage in outreach and education City-wide of the benefits and challenges of passive open space
- Identify funding and resource gaps as needed
- Ensure equitable distribution of passive open space throughout the City

Short-term goals (Years 1-10):

- Assess, identify and prioritize sites for restoration and maintenance
- Create and permit landscape management plans for complex sites
- Develop and implement tracking measures and protocols
- Create and/or update stewardship plans for sites with volunteer involvement and/or interest
- Evaluate restoration benchmarks and implement adaptive management (Year 10)

Long-term goals (Years 11-20)

- Maintain stable funding and secure funding beyond year 20
- Expand Habitat Steward program to ensure at least one volunteer steward for each site
- Maintain annual progress reports and keep public informed of activities
- Establish long-term monitoring program and implement three-year rotation of monitoring for all sites in active restoration

3.3. Objectives

It is anticipated that during the next 20 years, the following objectives will be achieved:

1. All 496 acres of passive open space under ESD management will be enrolled in active restoration and maintenance by 2036.
2. An active management program will be in place and will be implemented beyond 2036 to ensure passive open space areas remain ecologically healthy and provide surface

Schuster Slope and Mason Gulch Landscape Management Plans

In 2014, ESD launched restoration efforts on Schuster Slope with the goal to create a landscape management plan to address declining conditions and implement that plan over the next 20 years. After an extensive planning effort and public process, the Schuster Slope Landscape Management Plan was created. In 2015, permits were acquired and restoration efforts began on Habitat Management Unit 1. The majority of the site is classified as Tree-iage category 9, which means it currently has very low habitat value and is highly invaded by invasive plants, making it difficult and expensive to bring it into a healthy condition. (www.cityoftacoma.org/schuster). ESD has also taken on another difficult site in 2016, Mason Gulch. This site is also characterized by steep slopes and poor habitat conditions. The Mason Gulch planning and public process is ongoing (www.cityoftacoma.org/mason).

water management benefits as well as other ecosystem benefits to the City.

3. A monitoring and adaptive management program will be created and implemented to ensure all passive open space areas are monitored on a three year rotating basis.
4. A Habitat Steward program will be implemented and utilized to engage volunteers with a high level of expertise in restoration techniques to leverage restoration of those areas safe and appropriate for volunteer access (slopes <40%).
5. A successful volunteer program that engages a diverse community of individuals, families, schools, businesses and non-profits will be in place.
6. Sustainable funding and staff resources are acquired to accomplish long-term restoration and management objectives.

CHAPTER 4: PASSIVE OPEN SPACE CONDITION ASSESSMENT

Effective and efficient passive open space management can only be accomplished if planners, field staff and decision makers have the environmental information on which to prioritize and guide restoration actions. With systematically collected data, ESD will understand on-the-ground conditions, develop strategies, prioritize sites, and direct resource needs to accomplish the work efficiently and effectively.

In 2015, Forterra and American Forest Management, Inc. (AFM) conducted a forest habitat assessment to characterize habitat conditions across 496 acres of passive open space under management of ESD. By establishing these baseline conditions, this assessment will provide the foundation for tracking restoration progress over time. The ability of managers to track progress over the next 20 years will allow challenges and successes to be identified. In response, managers can modify or adapt the program to address and resolve those challenges.

4.1. FLAT Model

Baseline ecological data was collected during the fall of 2015 using a rapid assessment data collection protocol called the Forest Landscape Assessment Tool (FLAT) developed by the Green Cities Research Alliance (www.fs.fed.us/pnw/research/gcra; see "Urban Landscape Assessment"). FLAT is based on the "Tree-iage" model, originally developed by the Green Seattle Partnership. Tree-iage is a prioritization tool, based on the concept of medical triage that uses habitat composition (e.g., canopy cover or native plant cover) and invasive plant cover as the two parameters to prioritize restoration.

The FLAT adaptation builds on the existing framework of the Tree-iage model to characterize additional habitat attributes beyond tree canopy and invasive plant cover. These include tree age and size class, native understory species present, and forest health threat indicators. Attributes relating to forest health include low tree-canopy vigor, root rot, mistletoe, and bare soils due to erosion. The presence of regenerating trees (canopy species less than 5 inches in diameter at breast height)—which play an important role in the long-term sustainability of the forest—was also documented. In addition, each habitat management unit was deemed "plantable" or "not plantable" based on whether site conditions were appropriate for tree seedling establishment.

Rapid assessment methodologies such as FLAT produce a "snap shot" of site conditions on a landscape or city scale. The data serves as a high-level baseline from which finer-scale, site-specific restoration planning can be conducted. Site-by-site analysis will need to be done by ESD staff as work progresses to help ensure the most appropriate restoration practices and species composition are chosen for each site.

4.2. FLAT Methods

Prior to field data collection, passive open space areas were classified through digital orthophoto interpretation, dividing each area into one of five categories: forested, natural, open water, hardscaped, or landscaped. These initial stand-type delineations were ground-verified in the field, and if necessary, the delineations were corrected or the boundaries were adjusted in a map view. The delineated areas are referred to as Habitat Management Units (HMUs). All HMUs were assigned unique letters to be used

for field verification and data tracking. Attempts were made to keep each HMU a workable size. Open water, landscaped and hardscape areas are not included in the total since they are not suitable for active native vegetation management (see Table 4-1 for acreage breakdown).

In the field, each HMU was surveyed to identify its specific habitat type (e.g., conifer forest, deciduous, riparian shrubland, etc.). HMUs were also surveyed to capture information on primary and secondary overstory species and size class as well as primary and secondary understory species. (*Primary* refers to those species most abundant in the HMU, and *secondary* refers to the second-most-abundant species.) See Appendix C for the FLAT-modified data collection flowchart for the Tree-iage habitat composition component of the model.

From this data, each HMU was assigned a value (high, medium, or low) for habitat composition, according to the following breakdown.

HIGH
HMUs with more than 25% native tree canopy cover, in which evergreen species and/or madrones make up more than 50% of the total canopy; *OR*, HMUs with more than 25% native tree canopy in partially inundated wetlands that can support 1%–50% evergreen canopy; *OR*, HMUs in frequently inundated wetlands that cannot support evergreen/madrone canopy.

MEDIUM
HMUs with more than 25% native tree canopy cover, in which evergreen species and/or madrones make up between 1% and 50% of the total canopy; *OR*, HMUs with less than 25% native tree canopy cover, in partially inundated wetlands that can support 1%–50% evergreen/madrone canopy.

LOW
HMUs with less than 25% native tree canopy cover; *OR* forests with more than 25% native tree canopy, in which evergreen species and/or madrones make up 0% of the total canopy.

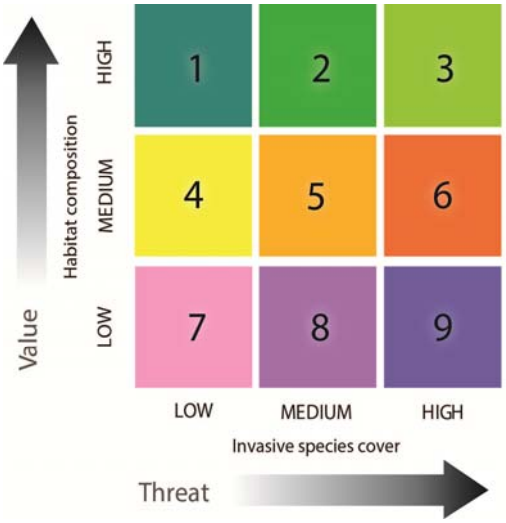
In addition, each HMU was assigned one of the following invasive cover threat values:

HIGH: HMUs with more than 50% invasive species cover.

MEDIUM: HMUs with between 5% and 50% invasive species cover.

LOW: HMUs with less than 5% invasive species cover.

Figure 4-1: Tree-iage Legend



4.3. Tree-iage Categories

After habitat composition and invasive species cover values were assigned, a matrix system was used to assign a Tree-iage category or priority rating for each HMU (Figure 4-1). Categories range from one to nine. One represents high quality habitat and low invasive species threat and nine represents low quality habitat and high invasive species threat. For example, an HMU that appears in Tree-iage category three scored high for habitat value and high for invasive cover threat. HMUs scoring low for habitat value and medium for invasive cover threat were assigned to category 8 based on the Tree-iage model.

It is important to reiterate that this data was collected to provide a broad view of the habitat conditions of Tacoma's passive open spaces. Data collection occurred at the HMU scale. But because HMUs are different sizes (range between 0.01 acre to 14 acres, with 1/3 of HMUs under 1 acre), results are presented here using average conditions associated with each HMU. Small pockets within HMUs may differ from the average across the stand. When the plan refers to specific data in a given area, the term "HMU acre" will be used.

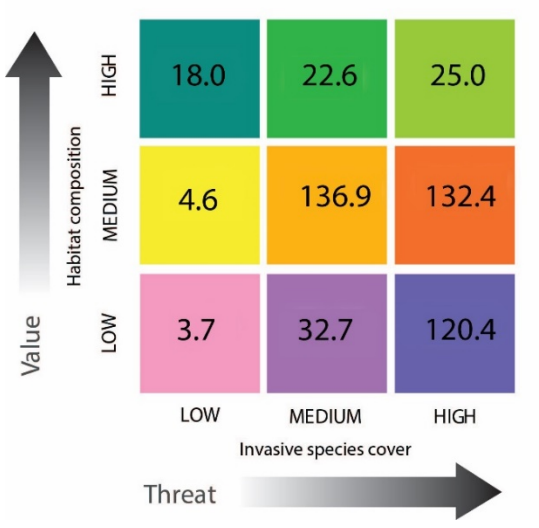
This assessment will help prioritize restoration efforts during the next 20 years. The data gathered will also serve as a baseline from which the effectiveness of restoration efforts and the long-term health of Tacoma's passive open space can be assessed in the future. City staff and/or volunteers can re-evaluate the FLAT assessment as necessary to be most relevant to tracking restoration over time.

4.4. FLAT Results

4.4.1. Tree-iage Matrix

Using the data gathered on all HMUs during the FLAT assessment, a picture of Tacoma's open space forest conditions begins to form. Figure 4-2 shows the distribution of acres in each Tree-iage category.

Figure 4-2: Distribution of HMU Acres Across Tree-iage Matrix



The highest amount of acres, 136.9 falls within the medium category for both habitat value and invasive threat represented by Tree-iage category 5. Almost one-quarter of the project area (24%) falls within the hardest category to move into active restoration (Tree-iage category 9), and in total 56% all of acres are within Tree-iage categories 3, 6 and 9, representing the highest invasive threat categories. Only 13% of the Tacoma's passive open spaces are within a high value habitat condition (categories 1, 2 and 3). Only a very small amount, 18 acres (3.6%) are in exceptional condition (Tree-iage category 1).

Another important condition that will influence the relative difficulty of actively restoring passive open space lands is whether or not the lands are on steep slopes or not. In general, slopes less than 40% can be accessed and worked on by volunteers. Slopes 40% or greater cannot be accessed by volunteers and therefore will need a professional crew to carry out the

restoration work. In addition, steep slope lands will require additional planning and permitting to carry out restoration work.

Table 4-1 provides a summary of slope conditions and the acres available for restoration activities.

Table 4-1: Available Passive Open Space Acres by Slope Category and Land Use

Slope Class	Total Acres Available for Restoration	Percent of Restoration Acres	Acres of Water	Landscaped Hardscape Acres	Total Acres
0-39.99%	260.9	52.6	11.4	11.5	283.7
40-66.99%	141.0	28.4	0.2	0.9	142.1
>67%	94.3	19.0	0.1	0.0	94.4
Total	496.2	100	11.6	12.4	520.2

Figure 4-3 illustrates non-steep slope lands across Tree-iage categories. In total 260.9 acres of land fall within this category or 52.6% of the total. From a volunteer perspective, 13.5 acres will need minimal to no invasive removal (Tree-iage categories 1, 4 and 7), while 161.4 (62%) will need considerable invasive removal effort (Tree-iage categories 3, 6 and 9). Likewise about 46.9 (18%) will require minimal native plantings to move the site into a healthy habitat condition (Tree-iage categories 1, 2 and 3). Extensive native planting will be required on 90 acres of land (35%) and represented by Tree-iage categories 7, 8 and 9.

A little less than half of the land, 235.3 acres or 47.4% are considered steep slope areas. Figure 4-4 illustrates steep slope conditions across Tree-iage categories.

Figure 4-3: Distribution of HMU Acres Across Tree-iage Matrix in a Non-Steep Slope Category

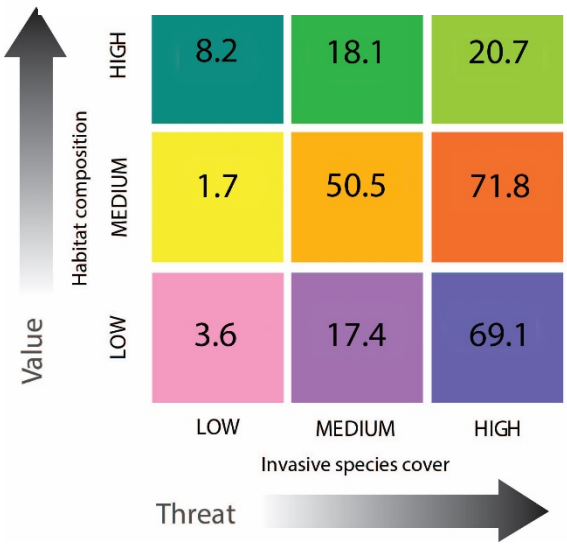
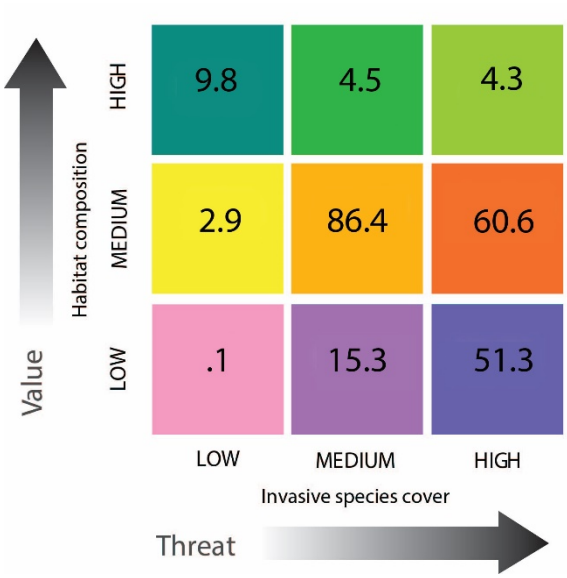


Figure 4-4: Distribution of HMU Acres Across Tree-iage Matrix in a Steep Slope Category



As expected, the vast majority of acres in a steep slope condition are also the hardest to engage in restoration. More than 90% of the steep slope sites are in Tree-iage categories 5, 6, 8 or 9. These 213.6 acres are categorized as medium or high on the invasive threat axis and have low to medium habitat value. These sites on average will require extensive invasive removal and will require extensive native plantings to bring these sites up to a healthy habitat condition. These results will be used in the following chapters to help prioritize active restoration on both steep and non-steep sloped areas.

In summary, Table 4-2 lists all sites within this Plan by slope condition and Tree-iage category.

4.4.2. Dominant Habitat Types and Risk

This habitat analysis identified twelve habitat types across 166 HMUs. The Tree-iage analysis identified only 65.6 acres of passive open space of high habitat quality and 156.8 acres of passive open space in a low (degraded) habitat quality.

Table 4-3 describes habitat conditions across HMUs and specifically looks at three risk factors that will help prioritize restoration efforts. The three risk factors include average age, evidence of mechanical failure (e.g., landslides) and evidence of significant erosion. Table 4-3 also looks at the relative abundance of habitat types by identifying the number of HMUs consisting of the given habitat type. For example, deciduous forest was the dominant habitat type found in 76 out of the 166 HMUs surveyed. Deciduous forest more than doubled the next dominant habitat type riparian deciduous, which was present in 22 HMUs. Table 4-3 illustrates that older deciduous forests dominate most HMUs. The table also illustrates that most mechanical failures and erosion issues occur in older deciduous forest types as would be anticipated.

4.4.3. Overstory Species

Understanding the presence and extent of overstory species will help ESD prioritize restoration efforts and design planting palettes for each site.

The 2015 FLAT results illustrate that Tacoma's passive open space areas are dominated by middle-aged to older aged stands of deciduous bigleaf maple. Trees were recorded in order of dominance within each HMU. *Primary* refers to acres where the species is dominant and *secondary* is second most dominant. Other deciduous tree species, including black cottonwood, red alder and Garry oak have a presence as a primary overstory species, but not to the degree of bigleaf maple. Bigleaf maple is the primary overstory species on 260 acres of passive open space, black cottonwood on 66 acres, Douglas-fir and red alder on 48 acres each, madrone on 9 acres and Oregon ash and bitter cherry on 3 and 2 acres respectively (Figure 4-5). Douglas-fir is the only conifer species that has a primary presence in any HMU. Shrub-scrub and forested wetlands are dominated by red alder and black cottonwood, and to a lesser extent Pacific willow.

In addition to HMU acres an analysis was also conducted to identify the actual number of HMUs in which each overstory species was present. Bigleaf maple was dominant in 70 of the 166 HMUs inventoried (approximately 42% of all HMUs) (Figure 4-6). Red alder and madrone both had significant spikes in HMU presence as a secondary species. Red alder was identified in 33 out of the 166 HMUs as a secondary species, while madrone was a secondary species in 23 out of 166 HMUs.

Table 4-2: Passive Open Space Sites by Tree-iage Category and Slope Class

Site Name / Tree-iage	1		2		3		4		5		6		7		8		9	
	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40
2200110010											0.4	0.0						
223500119010											0.0	0.2						
34th Street Gulch																	4.3	2.2
45000000200															0.0	0.2		
52nd Street Wetlands			9.0	0.0	0.9						12.1	0.3					0.2	
74700138000																	0.3	0.2
89450006400																	0.2	0.0
Agnes Road									1.1	4.4								
Blix											0.7	0.2						
Brown's Point							0.6	0.6	0.1	3.5	0.0	0.4						
Buckley Gulch											1.1	3.3					0.0	0.0
Center Street											3.6	3.1					2.7	2.6
Cheney Stadium			1.0	0.0					0.6	0.0								
China Lake											1.5	0.0						
Crystal Springs											1.0	0.0						
Day Island											4.2	1.6					4.5	2.1
Dome Slopes											1.1	2.3						
Fern Hill																	2.6	0.4
First Creek			1.0	0.1	1.0	0.1					10.8	5.3			1.0	0.2	3.5	0.6
Garfield Gulch											1.0	0.2	1.4	0.0				
Harbor Island									4.2	11.3	1.1	4.0						
Hwy 16	1.5	0.1																
Hylebos Creek			0.7	3.7					2.3	2.3								
Joe's Creek	6.0	5.5							5.6	3.8								

(Cont.) Table 4-2: Passive Open Space Sites by Tree-iage Category and Slope Class

Site Name / Tree-iage	1		2		3		4		5		6		7		8		9	
	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40
Julie's Gulch	0.4	4.2							9.7	18.8							8.9	2.3
Landfill	0.4	0.0	2.9	0.3	0.7	0.0											0.5	0.2
M Street													0.2	0.0			3.7	2.6
Marine View Drive									6.5	23.1	1.7	12.4						
Marine View Drive East									4.3	14.4	5.2	11.8					0.8	2.8
Mason Gulch					8.0	1.2			1.2	3.9					3.0	8.4	2.7	8.1
McKinley																	0.2	0.6
North Shore Parkway					2.8	0.0					1.5	0.2						
Puget Creek			2.3	0.4	0.1	0.4									1.0	4.0		
Rhone Poulenc																		
Salmon Beach					1.4	2.4												
Schuster Slope																	6.2	16.1
South Ash Street					1.1	0.0											0.3	
South Tacoma Way											0.5	0.3					0.0	0.0
Swan Creek			0.5	0.0			1.1	2.4	7.1	0.5								
Titlow Park													0.1					
Trafton Slope					3.9	0.0												
Wapato Hills									8.0	0.4	13.5	2.3	2.1	0.1	11.9	1.2	24.7	1.3
Wapato Lake			0.7	0.0	0.8	0.2									0.2		0.6	0.0
Waterview															0.2	1.4		
West Ridge											2.0	0.5						
Western Slopes											8.9	12.3					2.1	9.0
TOTAL	**8.2**	**9.8**	**18.0**	**4.5**	**20.7**	**4.3**	**1.7**	**2.9**	**50.5**	**86.4**	**71.8**	**60.6**	**3.7**	**0.1**	**17.3**	**15.3**	**69.0**	**51.3**

Table 4-3: Summary of Dominant Habitat Types and Risk

Habitat Type	HMU count	Age (0-29)	Age (30-49)	Age (50-99)	Mechanical failure	Erosion
Deciduous	76	5	45	26	5	19
Riparian (Deciduous)	22	0	10	12	1	2
Conifer / Deciduous	13	0	6	7	1	2
Grassland / Meadow	13	0	0	0	0	0
Shrub Scrub Wetland	8	0	0	0	0	0
Open Woodland	8	1	4	3	0	2
Conifer	7	0	2	5	0	0
Shrubland	7	0	0	0	0	0
Deciduous Forested Wetland	5	1	4	0	2	0
Emergent Wetland	3	0	0	3	0	0
Madrone (Conifer)	3	0	1	2	0	0
Madrone (Deciduous)	1	0	0	1	0	0

Figure 4-5: Overstory Species by Acres

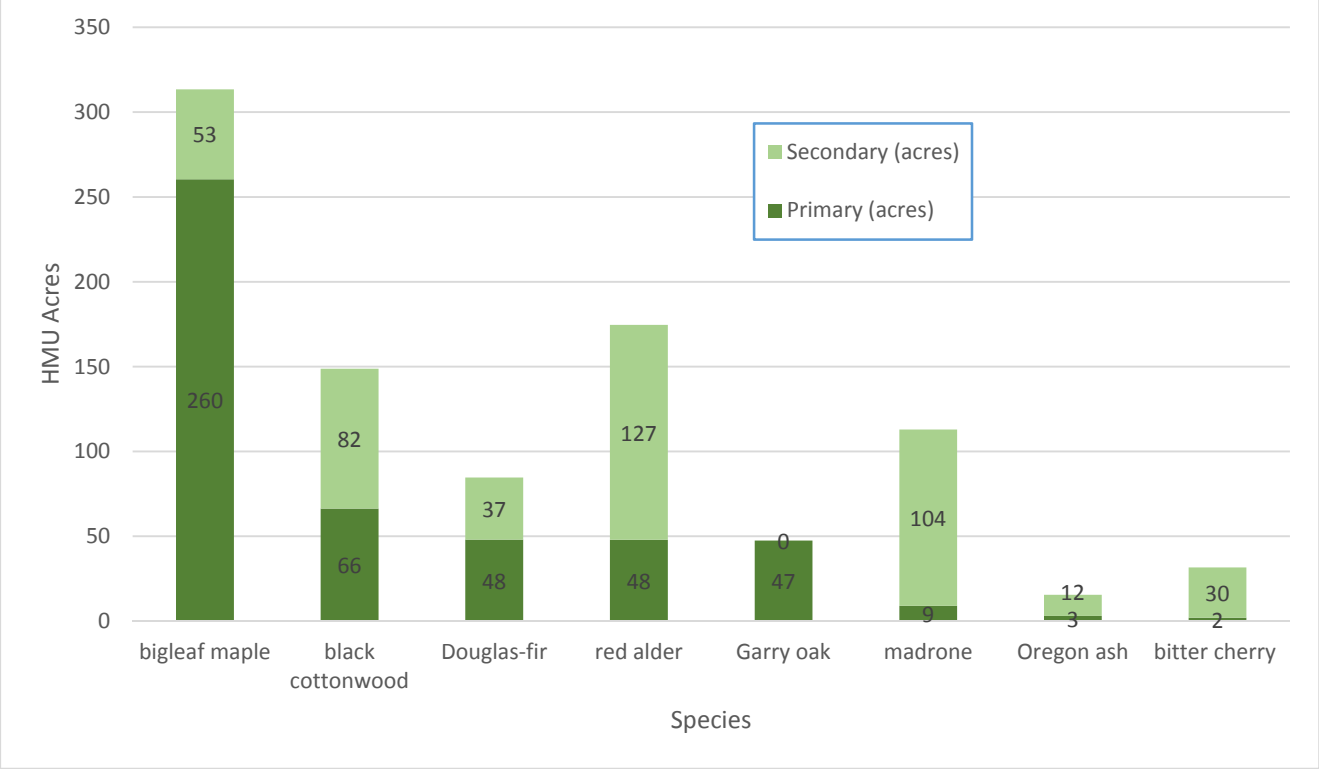
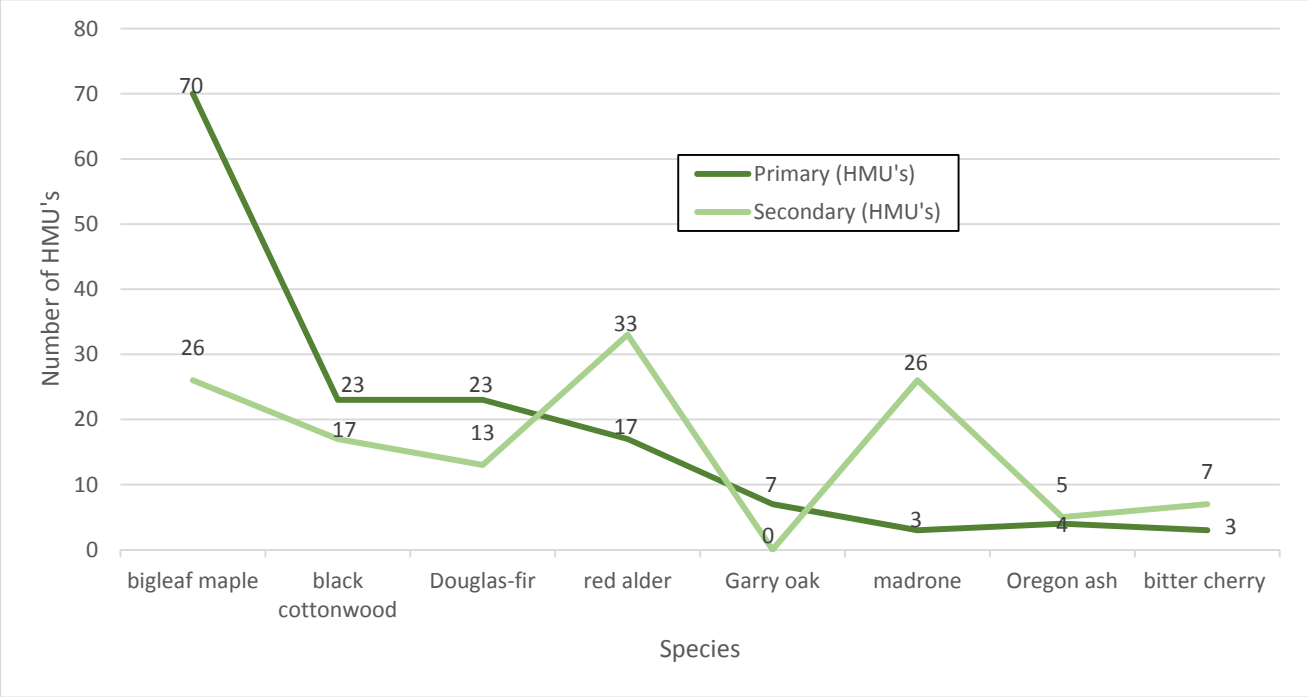


Figure 4-6: Overstory Species by HMU Count



4.4.4. Regenerating Overstory Species

Regenerating overstory species were determined as the number of small trees of each primary or secondary overstory species that were 5"dbh or less. According to the FLAT analysis there are very few regenerating trees across HMUs. Bigleaf maple and red alder were the two most frequently identified regenerating tree species, followed by madrone, Oregon ash, Pacific willow and bitter cherry. No conifer species were identified as regenerating overstory species. Out of 166 HMUs that were surveyed only 20 were found to have regenerating overstory species. This amounted to about 60 acres of potential regenerating habitat or approximately 12% of all acres.

Regenerating Conifer Species

Simply stated regeneration refers to the replacement of old trees with young trees. In a natural setting this occurs by seed dispersal and eventual growth of new trees. However, in the urban forest many factors work against 'natural' regeneration of conifers, including:

1. Lack of seed source
2. Lack of downed wood or dead trees
3. Competition from invasive species

While the urban forest will always require maintenance and intervention we need to promote successful regeneration of our conifer species to ensure healthy forests perpetuate themselves and minimize the intensity and need for ongoing human intervention. **Regeneration is one key to the long term sustainability of our urban forests.**

4.4.5. Plantable Space

The FLAT analysis also evaluated if an HMU had space available for planting new overstory species. This consisted of identifying both areas of bare ground and areas where invasive plants should

be removed. This category was identified as either yes or no. FLAT results show that 92% of HMUs have an opportunity for tree planting across most sites. Specifically, 152 out of 166 HMUs were identified as having suitable planting space.

4.4.6. Native Understory Species

Tacoma's passive open space areas have a fairly diverse and moderately healthy understory consisting of 24 native shrubs and ferns (Figure 4-7). Beaked hazelnut is the most dominant native understory plant and is the primary species on more than 150 HMU acres. Swordfern, salmonberry, salal and indian plum are also found in fairly large populations. Grass species, snowberry, Scouler's willow, trailing blackberry, Douglas spirea and Pacific willow are all primary or secondary species on more than 10 acres of HMUs.

4.4.7. Invasive Species

Native understory species account for most of the primary and secondary understory species documented per HMU. Invasive species, however, are ubiquitous throughout Tacoma's passive open space. For each HMU, the top five most abundant invasive species were documented. Figure 4-8 illustrates the most prevalent species per HMU acre. Himalayan blackberry is present in nearly 100% of the project area acres. English ivy is found in 74% of the HMUs and English holly is documented as the third highest invader, found in 46% of all HMUs.

Figure 4-7: Common Native Understory by HMU Acres

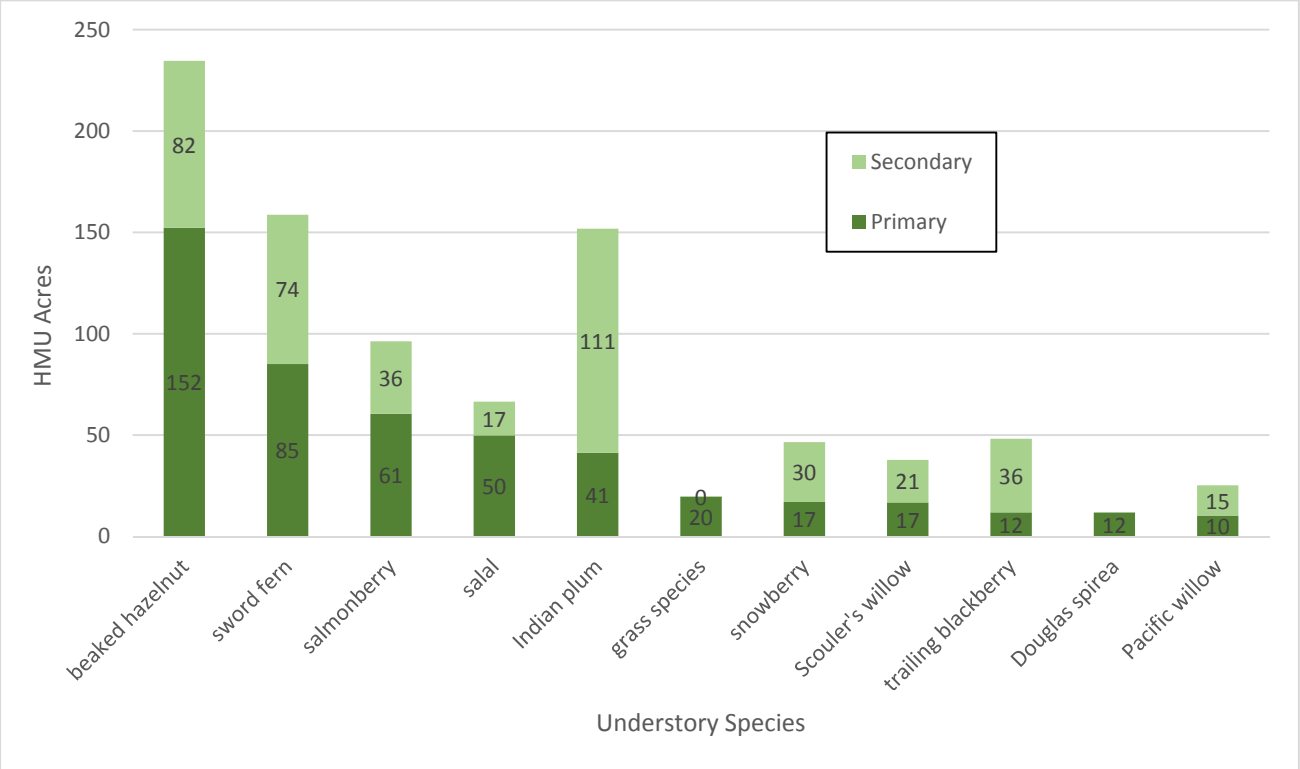
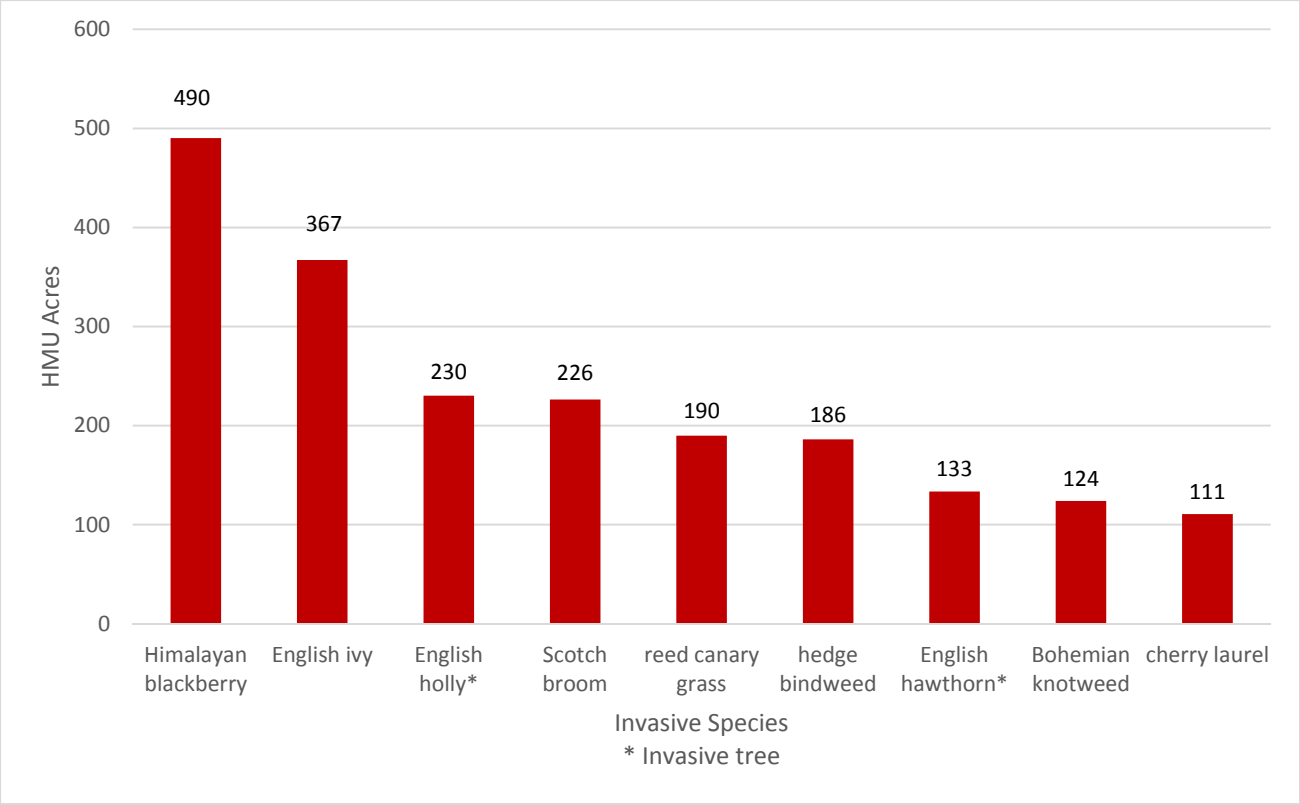


Figure 4-8: Most Common Invasive Species Distribution by HMU Acres



4.5. Watersheds

The City limits are located in two different Water Resource Inventory Areas (WRIA). These are state level designations and represent large watersheds, usually associated with a major river system. Puyallup WRIA 10, Clover-Chambers WRIA 12 are the two that overlap the City limits. To manage surface water and water quality locally, Tacoma has identified nine local watersheds delineated by topographic contours as well as collection areas from stormwater pipes (Figure 1-1). Table 4-4 below shows the acres by slope class and local watershed for each Tree-iage category.

4.6. Access to Passive Open Space Sites

Many of the sites analyzed in this Plan will provide challenges to restoration as a result of accessibility. Accessibility will need to be addressed by a site visit and will become a key factor in determining restoration site priority. Even though a restoration site may be less than 40% slope and in a Tree-iage category 1 or 2 it still may not be volunteer friendly given the lack of accessibility.

Table 4-4: Tree-iage Acres by Local Watershed and Slope Class

Tree-iage	Flett		Foss Waterway		Joe's Creek		Leach Creek		Lower Puyallup		NE Tacoma		N Tacoma		Western Slopes		Hylebos		Totals
	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	<40	≥40	
1	0.4	0.0	0.0	0.0	5.9	5.5	1.5	0.1	0.0	0.0	0.5	4.2	0.0	0.0	0.0	0.0	0.0	0.0	18.0
2	13.2	0.3	0.0	0.0	0.0	0.0	0.4	0.0	1.0	0.1	0.0	0.0	2.3	0.4	0.0	0.0	0.7	3.7	22.1
3	7.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.1	2.8	0.0	8.1	1.7	1.4	2.4	0.0	0.0	25.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.4	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	4.6
5	8.0	0.4	0.0	0.0	6.6	8.2	0.6	0.0	2.6	0.4	24.8	71.1	1.2	3.9	0.0	0.0	2.9	2.3	133.0
6	21.4	2.4	4.1	3.4	0.0	0.0	5.7	0.3	12.6	7.8	9.5	28.8	2.4	3.5	16.2	14.4	0.0	0.0	132.3
7	2.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.4	0.0	0.1	0.0	0.0	0.0	3.7
8	12.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.2	0.0	0.0	4.2	13.8	0.0	0.0	0.0	0.0	32.6
9	28.9	1.9	7.5	5.7	0.0	0.0	0.0	0.0	7.2	3.3	9.7	5.0	9.1	24.3	6.7	11.1	0.0	0.0	120.3
Totals	**93.4**	**6.6**	**11.5**	**9.1**	**12.5**	**13.6**	**8.1**	**0.5**	**26.6**	**14.2**	**47.9**	**109.7**	**28.7**	**47.6**	**24.3**	**27.9**	**3.6**	**6.0**	**491.6**

CHAPTER 5: IMPLEMENTATION

This chapter outlines a systematic approach and the metrics needed to actively restore and maintain 496 acres of passive open space for surface water benefits and to ensure the health, safety and welfare of community members. This section of the Plan provides the overall prioritization strategy for how the City will achieve the goals outlined in Chapter 3 and identifies benchmarks to ensure the City meets critical milestones over the length of the Plan. With these metrics and benchmarks in place, ESD can track the success of various activities, highlight significant progress and adapt to changing circumstances during the plan's 20-year timeframe.

This chapter addresses three interrelated elements: Field, Community, and Resources.

- The FIELD element looks at how on-the-ground strategies will be carried out to restore 496 acres of natural open spaces.
- The COMMUNITY element assesses how an engaged community and a prepared workforce will be maintained in the long term, and how private landowners will be provided information and encouraged to complement ESD efforts.
- The RESOURCE element examines how sufficient financial, staff, and volunteer resources will be garnered to implement the plan.

5.1. FIELD

There are many variables that will need to be addressed to create a plan and proceed with restoration activities on passive open space lands in Tacoma. The main variables include the physical condition of the site, whether volunteer or professional crew labor will be utilized, site accessibility and stable funding over 20 years.

The field component of this Plan is critical as it is the bulk of the work. Active management of sites will include restoration, maintenance, and monitoring. The field component of restoration follows the four phase approach presented throughout this document. The ultimate goal is to get all lands into Phase 4, long-term monitoring and maintenance.

5.1.1. Field Objective 1: Prioritizing Sites

The habitat analysis and Tree-iage results show there are 496 acres of passive open space sites in need of various levels of restoration, maintenance, and long-term stewardship. This includes 46 individual restoration sites and 166 HMUs.

ESD is currently engaged in restoration on three sites (Schuster Slope, Wapato Hills and Julia's Gulch) and there are three additional sites in the planning stages (Trafton Slope, M Street and Mason Gulch). These sites will remain a high priority for ESD moving forward. Choosing additional sites for restoration will be based on the FLAT results, available resources, and other key factors. One approach might be to focus on areas where conversion to a healthy habitat condition is easily attainable, such as Tree-iage categories 1 and 2. However, given that there are very few acres in these categories it is also likely that Tree-iage categories 4 and 7 could be the next level of priorities. These areas all have low invasive threat and can be quickly planted with new native vegetation to reach a healthy condition. Once these

categories have been committed to active restoration the goal will be to expand outward to adjacent areas while maintaining current enrolled restored acres.

Two additional factors will determine how new sites get enrolled into active restoration. This includes site accessibility and whether or not there are steep slopes present. Volunteers cannot work on steep slopes (≥40%) or in critical areas and therefore the site must be restored by professional crews. Enrolling sites with steep slopes would need to be timed to ensure professional crew availability and therefore may not initially be a high priority. Accessibility will also be a factor in determining priority. Even though a site may be a Tree-iage category 1, it may be surrounded by steep slopes or other land uses that prevent access. These sites will eventually need to be restored, but they may not be of high priority in the initial restoration efforts.

Finally, it is the goal of ESD to try and place an entire site into active restoration once restoration has started (as funding and feasibility dictate). Ultimately, the driving factor in whether a site can be prioritized will be the financial and staffing resources available to conduct restoration, support volunteers, and/or hire professional field staff. Staff is forced to balance resources with site conditions and characteristics to meet acreage restoration goals.

5.1.2. Field Objective 2: Prioritize HMUs Within Sites

As stated above, ESD's first priority will be to maintain and continue restoration in acres already enrolled in active management/restoration. This includes Schuster Slope, as well as Julia's Gulch and Wapato Hills. As new acres become enrolled into the program, maintenance of these areas should be prioritized. Recently cleared sites will also be prioritized for planting and ongoing maintenance. Particular attention should be paid to existing projects to keep restoration efforts moving forward. The second priority is to expand sites already enrolled in restoration by continuing to clear invasive species in areas contiguous with previously cleared sites.

ESD will also prioritize sites with an active Habitat Steward, a strong volunteer base or community interest, and in areas that are appropriate for volunteers (i.e., less than 40% grade). Since community engagement and education is a key component of this effort, sites with high public visibility will be chosen to extend education and program promotion, where budget and feasibility allow.

Once a site has been identified as a high priority restoration site a landscape management plan should be developed to help guide detailed activities on site. There are two options that ESD will consider when creating management plans. For difficult sites, those within Tree-iage category 9 and/or sites with significant steep slopes and other critical areas, ESD will engage in an extensive process to create the landscape management plan. This process may include geotechnical consultation, public comment period and other activities as needed. The result will be a landscape management plan that is highly detailed and proscriptive (e.g., Schuster Slope Landscape Management Plan). A second option available to ESD is the creation of a more generalized landscape management plan. Sites that do not have significant steep slopes or other critical areas, but will require significant invasive removal and native plantings will still require a landscape management plan. However, for example, geotechnical consultation would not be necessary.

Regardless of the landscape management plan approach chosen ESD will create an annual work plan for each site. Habitat Stewards would take the lead in creating these work plans for sites that are volunteer friendly. An annual work plan illustrates where on the site activities will occur and more importantly

helps the Habitat Steward identify what materials will be needed for the entire year. This is a highly valuable planning tool. Also, the creation of an annual process allows a review of the previous years' work and a mechanism for tracking and recording progress.

5.1.3. Field Objective 3: Identify Critical Areas that Require Professional Crew Support

Across all 46 sites and 166 HMUs there are approximately 235 acres of land area that fall within a steep slope category (40% or greater). Volunteer involvement on these sites is prohibited and will require the use of professional, trained field staff/crew. In addition to steep slopes, Tacoma's Critical Areas Protection Ordinance (TMC 13.11) identifies other critical areas as wetlands, wetland buffers, streams and riparian habitat, geological hazard areas and flood hazard areas. These critical areas require the expertise and training of professional staff to ensure restoration activities do not compromise public safety or the function of critical areas. In addition, some best management practices for invasive species eradication requires the use of herbicides, such as cut-stump treatments for invasive trees, or stem injections for knotweed species that aggressively invade and degrade habitat. Herbicide treatment must be conducted by licensed professional staff. ESD will utilize professional crews at many passive open space areas, primarily to conduct steep slope and herbicide work.

5.1.4. Field Objective 4: Utilize BMPs to Implement Restoration Activities

Restoration ecology is an interdisciplinary science that draws from the fields of ecology, forestry, and landscape horticulture. As more restoration projects are completed in urban environments, field practices are refined and improved. Field experience and best available science will continue to be integrated to improve techniques and restoration success now and in the future.

In 2012, the Green Seattle Partnership created a *Forest Steward Field Guide* (http://greenseattle.org/wp-content/uploads/2015/05/GSP-Forest-Steward-Field-Guide.pdf) of BMPs suitable for volunteer restoration work. This guide is periodically updated and all Green Cities programs across the region modify and adopt a version of this guide for their programs. The GTP has a version of this field guide (http://forterra.org/subpage/green-tacoma-partnership) which will be useful to ESD and their efforts to restore passive open space. Supplemental course work and training programs for BMPs and other relevant topics will be recommended for all staff, volunteers and partner organizations involved in restoration and maintenance of Tacoma's passive open space areas.

5.2. Four-Phase Approach to Restoration Fieldwork

The Green Cities Partnership developed a four-phase approach to categorizing restoration work. This generalized concept recognizes that a restoration site moves through four major phases and establishes a level of effort, cost and timeframe for each phase; acknowledging that it takes several years to move through all the phases. The phases include: 1) Invasive plant removal; 2) Secondary invasive removal and planting; 3) Plant establishment and ongoing maintenance; and 4) Long-term stewardship and monitoring.

Because each site presents unique challenges and characteristics, and some work is ongoing, not every site will start at Phase 1. Other sites may move through phases more quickly than others. Each site, however, will need to receive a thorough on-the-ground assessment before work begins to determine the appropriate phase.

5.2.1. Phase 1: Invasive Plant Removal

The first phase aims to clear the site of invasive plants, focusing on small areas at a time in order to help ensure thoroughness and manageability and minimize regrowth. Specific removal techniques will vary by species and habitat type, and it may take more than a year to complete the initial removal.

Major invasive plant reduction will be required on sites with 50% or greater invasive cover (high threat from invasive species: Tree-iage categories 3, 6, and 9). Many of these areas will require skilled field crews or special equipment. Given the extent of invasive cover, these sites will also require a large investment of both funding and community volunteers to help ensure restoration success. Areas with 5% to 50% invasive cover (medium threat from invasive species: Tree-iage categories 2, 5, and 8) will also require invasive removal. Invasive growth in these spots is patchy. Generally, projects in these sites are appropriate for community volunteers as long as slopes are less than 40%. Areas with 5% invasive cover or less (low threat from invasive species: Tree-iage categories 1, 4, and 7) require little or no removal, and Phase 1 work in these areas may simply involve walking through to check that any small invasive growth is caught before it becomes a larger problem.

5.2.2. Phase 2: Secondary Invasive Removal and Planting

Before planting, a second round of invasive removal is done to target any regrowth before it spreads, and to clear the site for young native plants to be established. Staff will work with each site on a case-by-case basis to develop an appropriate plant palette and work plan.

For example, forested habitats with more than 50% conifer canopy cover (Tree-iage categories 1, 2, and 3) will require the least amount of planting, but may need to be filled in with ground covers, shrubs, and small trees in the understory. Areas with more than 25% native tree cover but less than 50% conifer cover (Tree-iage categories 4, 5, and 6) will generally be filled in with native conifer species. Areas with less than 25% native tree canopy cover that can support tree canopy cover (Tree-iage categories 7, 8, and 9) will require extensive planting with native trees, shrubs, and ground covers. Restoration practices and planting requirements will of course vary depending on the habitat type and target native plant population. The *Green Tacoma Steward Field Guide* provides volunteer-appropriate BMPs once a planting plan has been established.

5.2.3. Phase 3: Plant Establishment and Ongoing Maintenance

This phase repeats invasive plant removal and includes weeding, mulching, and watering newly planted native plants until they are established, adequate coverage is achieved, and the threat of recolonization from invasives is low. Although native plants have adapted to the area's dry summer climate, installed container and transplanted plants both experience shock, which affects root and shoot health; therefore, most plants require at least three years of establishment care to help ensure their survival. Sites may stay in Phase 3 for many years. If the restored area happens to encompass a critical area and be under a critical area development permit, a 5-year monitoring phase will likely be required.

5.2.4. Phase 4: Long-Term Monitoring and Maintenance

The final phase is long-term site stewardship, including monitoring by volunteers and professionals to provide information for ongoing site maintenance. Monitoring may be as simple as neighborhood volunteers patrolling sites to find invasive species, or it could involve regular measuring and documentation of various site characteristics and plant survivorship rates. Maintenance will typically consist of spot removal of invasive regrowth and occasional planting where survivorship of existing plants is low. Individual volunteers or small quarterly or annual work parties can easily take care of any needs that come up, as long as they are addressed promptly before problems spread. The number of acres in Phase 4 is programmed to grow every year, with the goal that all 496 acres reach Phase 4. It is also anticipated that once all 496 acres are at Phase 4 restoration the annual cost will be approximately $148,000 (2015 dollars) and that there will be a three-year rotation to monitor all 496 acres (165 acres per year).

Without ongoing, long-term investment in monitoring and maintenance of areas in restoration, passive open space areas will fall back into neglect. For that reason, volunteer commitment needs to be paired with City resources. Work is then compared against the best available science to define optimal plant stock and sizes, watering regimes, soil preparation, and other natural open space restoration techniques.

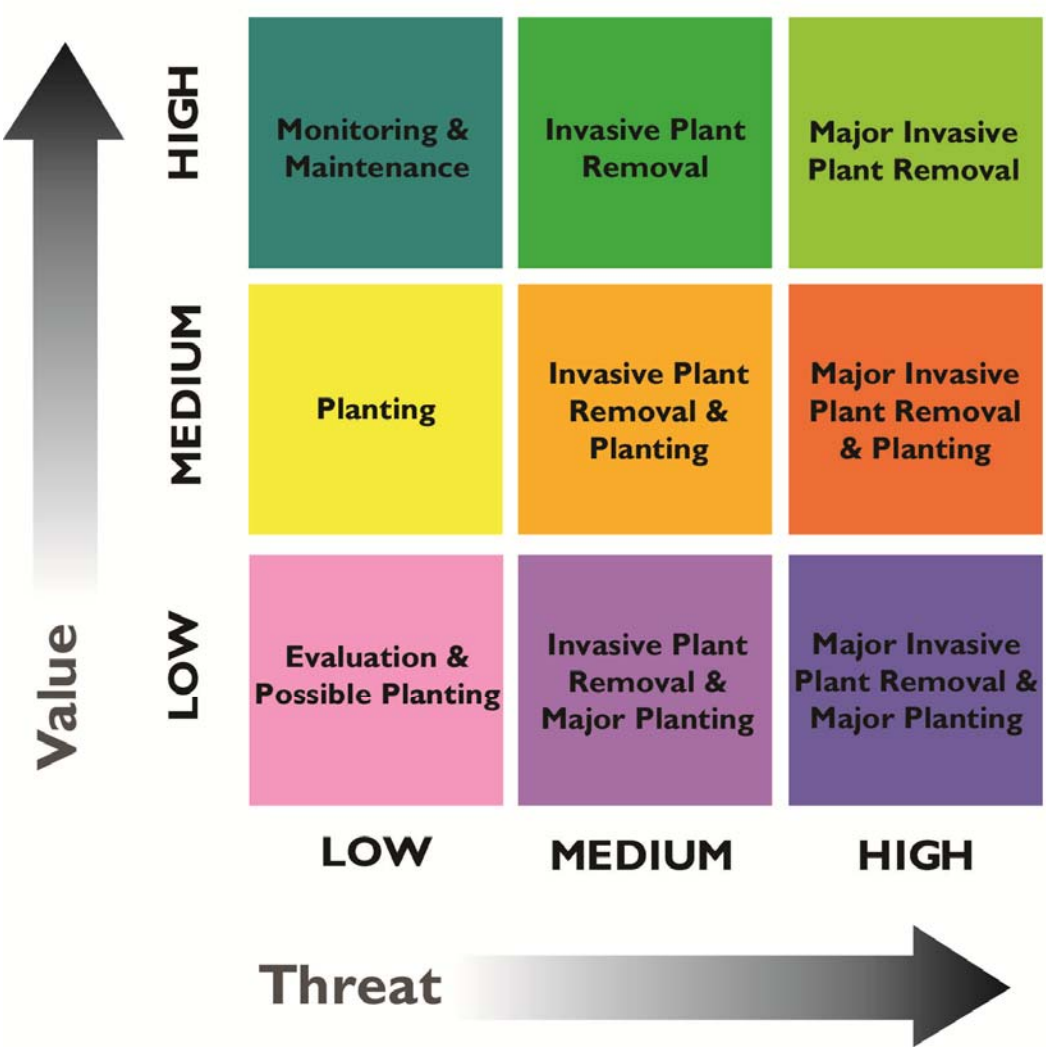
Monitoring will be conducted more frequently in the early phases of the program as the ESD discovers how the sites respond to restoration. HMUs that currently have less than 5% invasive cover and more than 50% native conifer forest cover or healthy wetland vegetation (Tree-iage category 1) may already be in Phase 4 and suitable for enrollment into a monitoring and maintenance plan. Most areas will need some preliminary restoration in Phases 1 through 3.

In 2012, the Green Cities program developed a Regional Standardized Monitoring Program in order to understand the success, value, and effectiveness of restoration activities throughout the Partnerships. These protocols provide baseline and long-term data collection procedures that can be replicated in the future to measure changes in site characteristics. You can download the regional protocols at http://forterra.org/wp-content/uploads/2015/05/Regional-Standardized-Monitoring-Protocols.pdf. ESD will be required to establish a monitoring program for sites that receive a critical areas development permit. However, a long term monitoring program to ensure the sustainability and health of passive open space sites that do not have permits will also need to be created and implemented. It is recommended that regardless of which phase a site may be in, monitoring should be conducted at least every 3 years and data be utilized to help inform adaptive management strategies and/or reprioritization.

5.3. Tree-iage Category Application

The four-phase approach can be applied to the Tree-iage categories as shown in Figure 5-1. Each Tree-iage category is discussed below in relationship to an appropriate management strategy.

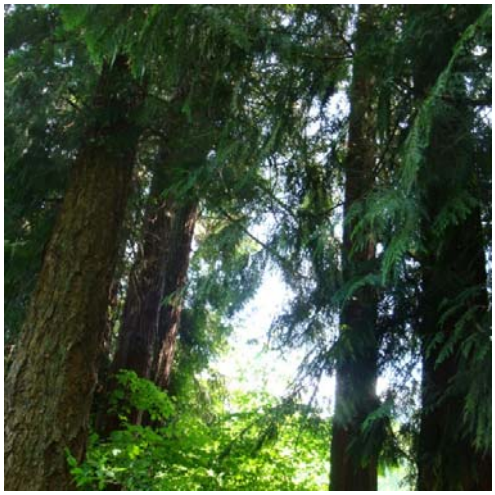
Figure 5-1: Restoration Management Strategies and Tree-iage Catogories



Tree-iage Category 1: High Habitat Composition, Low Invasive Threat

- *Total Acres in project area = 18.01*
  - *Slopes <40% = 8.24*
  - *Slopes ≥40% = 9.78*
- *Watersheds represented: Leach Creek, NE Tacoma, Joe's Creek and Flett Creek*

Condition: This category contains the healthiest forest areas. Typical stands have more than 50% canopy. This category includes stands of mature conifers and the mixed conifer/deciduous stands found in forested wetlands. In scrub-shrub or emergent wetland areas, where full conifer coverage would not be appropriate, this category has full cover by native vegetation appropriate to the site. These stands are under low threat because the invasive cover is less than 5%.



Management Strategy: *Monitoring and Maintenance*
Work is focused on protecting these areas and making sure that invasive plants do not establish themselves.

Prioritization: Tree-iage category 1 accounts for about 4% of the total passive open space area. Because of this low percentage and the high quality of the habitat condition it is a priority of ESD to place these lands into a monitoring and maintenance rotation as soon as possible.

There are four sites with Tree-iage category 1 habitats.

Site	Total Acres	<40% slope	≥40% slope
Highway 16	1.6	1.47	.12
Joe's Creek	11.43	5.95	5.48
Julia's Gulch	4.55	.40	4.16
Landfill	.44	.42	.02

Tree-iage Category 2: High Habitat Composition, Medium Invasive Threat

- *Total Acres in project area = 22.57*
  - *Slopes <40% = 18.04*
  - *Slopes ≥40% = 4.52*
- *Watersheds represented: Leach Creek, Flett Creek, Lower Puyallup, North Tacoma and Hylebos Creek (outside of City limits)*

Condition: Similar to category 1, these forest stands contain more than 50% conifer or evergreen broadleaf canopy or appropriate native wetland vegetation. Habitats in this category are at risk because the invasive cover is greater than 5%. In these areas, invasive growth is expected to be patchy with diffuse edges.

A habitat in otherwise good condition but subject to a number of moderate threats may degrade if left untreated. If unattended, this level of invasive coverage could prevent native seedlings from establishing and could compete with existing trees for water and nutrients. However, the forest would persist in good condition if threats were mitigated in a timely manner.

Management Strategy: *Invasive Plant Removal*
The main activity is removing invasive plants. These sites may also require mulching and accommodate infill planting.

Prioritization: Similar to category 1 sites, category 2 sites are considered healthy high quality habitat. As such these sites will also be of priority to ESD in the short-term. Category 2 sites account for 4.5% of the total passive open space sites.

There are eight sites with Tree-iage category 2 habitats:

Site	Total Acres	<40% slope	≥40% slope
52nd Street Wetlands	9.03	9.0	.03
Cheney Stadium	.99	.96	.03
First Creek	1.07	1.01	.06
Hylebos Creek	4.37	.68	3.68
Landfill	3.22	2.94	.27
Puget Creek	2.75	2.31	.44
Swan Creek	.47	.47	.00
Wapato Lake	.67	.67	.00

Tree-iage Category 3: High Habitat Composition, High Invasive Threat

- *Total Acres in project area = 24.98*
  - *Slopes <40% = 20.65*
  - *Slopes ≥40% = 4.33*
- *Watersheds represented: Flett Creek, Leach Creek, North Tacoma, NE Tacoma, Western Slopes and Lower Puyallup*

Condition: As in categories 1 and 2, habitats in this category have mature conifers, madrones, forested wetlands, or wetland vegetation. Category 3 areas have a high threat from greater than 50% invasive cover. Habitats in this category are in a high-risk situation and contain many desirable trees or ecologically valuable species. If restored and maintained, habitats in this category can completely recover and persist in the long term.

Management Strategy: *Major Invasive Plant Removal*
Without prompt action, high-quality forest stands could be lost. Category 3 areas require aggressive invasive reduction. Soil amendments and replanting are needed in most cases. Restoration efforts in this category also could be a top priority.

Prioritization: Lands within category 3 account for 5% of the total passive open space sites. However, the majority of these sites are on slopes less than 40% and therefore suitable for volunteers.

Tree-iage category 3 is not a high priority, but there are 10 sites with category 3 habitats

Site	Total Acres	<40% slope	≥40% slope
52nd Street Wetlands	.90	.90	.00
First Creek	1.11	1.02	.09
Landfill	.70	.69	.01
Mason Gulch	9.24	8.00	1.24
North Shore Parkway	2.82	2.81	.02
Puget Creek	.50	.08	.42
Salmon Beach	3.77	1.39	2.38
South Ash Street	1.12	1.11	.01
Trafton Slope	3.86	3.85	.01
Wapato Lake	.95	.80	.15

Tree-iage Category 4: Medium Habitat Composition, Low Invasive Threat

- *Total Acres in project area = 4.60*
  - *Slopes <40% = 1.66*
  - *Slopes ≥40% = 2.94*
- *Watersheds represented: NE Tacoma and Lower Puyallup*

Condition: Forests assigned a medium habitat composition value are typically dominated by native deciduous trees and have at least 25% native tree cover. Between 1% and 50% of the canopy is made up of native conifers. In wetland areas not suitable for conifers, these areas have between 1% and 50% cover by appropriate native wetland vegetation. Category 4 areas have low levels of invasive plants covering less than 5% of the HMU.

Management Strategy: *Planting, Maintenance & Monitoring*
We expect planting in these areas to consist of infilling with native species and establishing conifers to be recruited into the next generation of canopy. Often these sites require some invasive removal and site preparation (e.g., amending with woodchip mulch). Many of these sites could be converted to a conifer forest by the addition of appropriate trees.

Prioritization: Addressing category 4 habitats will not be a high priority during the first five years, but they are to be considered the next round of priorities. These areas account for less than 1% of the total area.

There are only two sites with Tree-iage category 4 habitats.

Site	Total Acres	<40% slope	≥40% slope
Brown's Point	1.17	.60	.57
Swan Creek	3.43	1.06	2.37

Tree-iage Category 5: Medium Habitat Composition, Medium Invasive Threat

- *Total Acres in project area = 136.86*
  - *Slopes <40% = 50.50*
  - *Slopes ≥40% = 86.36*
- *Watersheds represented: Flett Creek, Lower Puyallup, North Tacoma, NE Tacoma, Joe's Creek and Leach Creek*

Condition: Areas in this category have greater than 5% but less than 50% invasive cover. Invasive growth in these areas is expected to be patchy with diffuse edges. These areas are estimated to have greater than 25% native upper canopy cover but less than 50% upper canopy coniferous or broadleaf cover. In the case of wetland forests, it is greater than 50% native tree canopy cover. In wetland areas not suitable for conifers, these areas have between 1% and 50% cover by appropriate wetland species. These areas have between 5% and 50% cover by invasive plants. These habitats contain many desirable native trees that are under threat from invasive plants.

Management Strategy: *Invasive Plant Removal and Planting*
Sites will require invasive removal and accommodate infill planting.

Prioritization: Category 5 sites account for more than 27% of the total areas under consideration for this plan (12 sites). It is the highest category by acreage. Sites that are identified as category 5 and are adjacent to category 1, 2 or 3 sites will be given priority. Other sites in category 5 will not be considered a high priority in the first 10 years of this plan.

Site	Total Acres	<40% slope	≥40% slope
Agnes Road	5.48	1.08	4.40
Brown's Point	3.64	.11	3.53
Cheney Stadium	.66	.63	.03
Harbor Ridge	15.52	4.20	11.32
Hylebos Creek	4.59	2.27	2.32
Joe's Creek	9.30	5.55	3.75

Julia's Gulch	28.45	9.66	18.79
Marine View Drive	29.62	6.50	23.12
Marine View Drive East	18.67	4.31	14.36
Mason Gulch	5.02	1.17	3.85
Swan Creek	7.53	7.07	.46
Wapato Hills	8.38	7.95	.43

Tree-iage Category 6: Medium Habitat Composition, High Invasive Threat

- *Total Acres in project area = 132.39*
  - *Slopes <40% = 71.77*
  - *Slopes ≥40% = 60.62*
- *Watersheds represented: Flett Creek, Lower Puyallup, North Tacoma, NE Tacoma, Western Slopes, Foss Waterway and Leach Creek*

Condition: These areas are typically dominated by native deciduous trees but have at least 25% native tree cover. Between 1% and 50% of the canopy is made up of native conifers. In wetland areas not suitable for conifers, these areas have between 1% and 50% cover by appropriate wetland vegetation. Invasive plants cover more than 50% of the area.

Habitats that retain important plant elements but are already partially degraded by a high-level risk factor may still have the potential to recover if remediation is prompt. Because these stands are at greater risk than category 5 habitats, they also require greater labor investment.

Management Strategy: *Major Invasive Plant Removal and Planting*
Extensive invasive removal, site preparation (e.g., amending with woodchip mulch), and replanting are required. Initial invasive removal may be done with the aid of mechanical tools and equipment and may require professionals. Planting in these areas consists of infilling with native species.

Prioritization: Category 6 represents the highest number of sites (23) in the project area, representing 27% of the total area. There are 21 sites that have Tree-iage category 6. These sites will not be a high priority for ESD in the first 10 years unless they are adjacent to higher quality lands or on a site that is already in restoration.

Site	Total Acres	<40% slope	≥40% slope
02200110010	.45	.41	.04
223500119010	.17	.02	.15
52nd Street Wetlands	12.45	12.11	.34
Harbor Ridge	15.52	4.20	11.32
Hylebos Creek	4.59	2.27	2.32
Blix	.89	.70	.19
Brown's Point	.44	.01	.43
Buckley Gulch	4.33	1.07	3.26
Center Street	6.62	3.55	3.07
China Lake	1.47	1.46	.01
Crystal Springs	1.05	1.04	.01
Day Island	5.80	4.20	1.60
Dome Slopes	3.35	1.07	2.28
First Creek	16.14	10.81	5.33
Garfield Gulch	1.16	.96	.20
Harbor Island	5.09	1.14	3.95
Marine View Dr	14.06	1.65	12.41
Marine View Dr E	16.99	5.20	11.79
North Shore Parkway	1.64	1.47	.17
South Tacoma Way	.80	.50	.30
Wapato Hills	15.74	13.48	2.26
West Ridge	2.56	2.03	.53
Western Slopes	21.19	8.89	12.30

Tree-iage Category 7: Low Habitat Composition, Low Invasive Threat

- *Total Acres in project area = 3.74*
  - *Slopes <40% = 3.60*
  - *Slopes ≥40% = .09*
- *Watersheds represented: North Tacoma, Lower Puyallup, Western Slopes and Flett Creek*

Condition: These forests are estimated to have less than 25% native canopy cover in a setting that could support full canopy cover under good conditions. Forested wetlands will have less than 25% trees or shrubs appropriate to the site. Levels of invasive plants are low in category 7 forests.

Open spaces in this category may include recent acquisitions, areas with large canopy gaps (perhaps due to windthrow or die-off of mature deciduous trees), sites of recent landslides, unstable slopes, sites with large amounts of fill, and/or areas dominated by nonnative trees.

Management Strategy: *Evaluation and Possible Planting*
The reasons underlying these sites' low value can differ greatly, and the stands will be addressed on a case-by-case basis. Because of low levels of invasive plants, restoration may be quite cost-effective in some of the category 7 forests.

Prioritization: Category 7 represents a small proportion of total sites in the project area, less than 1%**.** These areas will not be a high priority for ESD in the first 10 years unless they are adjacent to higher quality lands or on a site that is already in restoration.

Site	Total Acres	<40% slope	≥40% slope
Garfield Gulch	1.38	1.37	.01
M Street	.19	.17	.02
Titlow Park	.06	.06	.00
Wapato Hills	2.11	2.05	.06

Tree-iage Category 8: Low Habitat Composition, Medium Invasive Threat

- *Total Acres in project area = 32.67*
  - *Slopes <40% = 17.33*
  - *Slopes ≥40% = 15.33*
- *Watersheds represented: North Tacoma, Lower Puyallup and Flett Creek.*

Condition: Areas that are estimated to have less than 25% native overstory or forested wetlands with less than 25% cover by trees and 5% to 50% invasive cover fall into this category. Invasive growth in these areas is likely to be patchy with diffuse edges. A forest in this category might be chronically degraded by a variety of threatening processes, and might have lost much of its value in terms of habitat quality or species complement.

Management Strategy: *Invasive Plant Removal and Planting*
Restoration efforts in these areas require a large investment of time and resources. These sites will require major invasive removal and site preparation, such as mulching and infill planting with native vegetation.

Prioritization: Approximately 7% of the land area is within category 8. These areas will not be a high priority for ESD in the first 10 years unless they are adjacent to higher quality lands or on a site that is already in restoration. There are seven sites in category 8.

Site	Total Acres	<40% slope	≥40% slope
45000000200	.19	.04	.15
First Creek	1.18	.99	.19
Mason Gulch	11.35	2.97	8.38
Puget Creek	4.97	1.00	3.97
Wapato Hills	13.14	11.92	1.22
Wapato Lake	.19	.19	.00
Waterview	1.64	.22	1.42

Tree-iage Category 9: Low Habitat Composition, High Invasive Threat

- *Total Acres in project area = 120.35*
  - *Slopes <40% = 68.83*
  - *Slopes ≥40% = 51.39*
- *Watersheds represented: Foss Waterway, Flett Creek, Leach Creek, North Tacoma, Western Slopes, Lower Puyallup and NE Tacoma*

Condition: Areas estimated to have less than 25% native upper tree canopy cover or appropriate forested wetland vegetation and greater than 50% invasive cover fall into this category.

Management Strategy: *Major Invasive Plant Removal and Major Planting*
Category 9 sites are not likely to get much worse during the next five years. These sites require many years of major invasive removal and site preparation in the form of mulching and infill planting, and will almost definitely require the attention of professionals.

Prioritization: Under most circumstances category 9 sites would not be a priority. However, a determination was made early in this process that there were a few key and high profile sites within this category that would be the first sites that ESD would develop Landscape Management Plans for and begin restoration activities. In 2015, ESD began restoration on Schuster Slope (22.36 acres of category 9). Mason Gulch will soon have restoration activities begin (10.77 acres in category 9). In total, sites with category 9 represent more than 24% of the total project area. After the initial surge of restoration on category 9 sites the remaining sites will not be prioritized unless they are adjacent to high quality sites or part of a site already in active restoration. There are 21 sites with Tree-iage category 9.

Site	Total Acres	<40% slope	≥40% slope
34th Street Gulch	6.53	4.29	2.24
52nd Street Wetlands	.17	.17	.00
74700138000	.47	.30	.17
89450006400	.21	.18	.03
Buckley Gulch	.07	.04	.03
Center Street	5.29	2.66	2.63
Day Island	6.64	4.53	2.11
Fern Hill	3.04	2.60	.44
First Creek	4.06	3.45	.61
Julia's Gulch	11.16	8.89	2.27
Landfill	.74	.51	.23
M Street	6.36	3.72	2.64
Marine View Dr E	3.56	.78	2.78
Mason Gulch	10.77	2.65	8.12
McKinley	.83	.21	.62
Schuster Slope	22.36	6.24	16.12
South Ash Street	.34	.34	.00
South Tacoma Way	.07	.03	.04
Wapato Hills	25.95	24.70	1.27
Wapato Lake	.57	.57	.00
Western Slopes	11.11	2.15	8.96

5.4. Community

During the next 20 years, ESD will continue to partner with other stakeholders to build a community-based stewardship program and engage all sectors of the City in passive open space restoration. Business volunteer days, neighborhood associations, faith-based organizations, youth groups, community service, and school groups are all potential partners. Committed volunteers are an essential component of success and serve as motivators, fundraisers, and an inspirational force advocating for necessary resources to achieve goals. Volunteers complete a portion of the physical restoration work, where feasible. Their committed efforts allow the ESD to meet many of its goals and benchmarks identified in this Plan. The community program area includes the following objectives:

1. Build synergy with the community and GTP to effectively engage existing and new Habitat Stewards on ESD sites.
2. Develop and implement strategies to achieve social equity and inclusion of a diverse community of volunteers.
3. Continue to provide outdoor education and service-learning opportunities to Habitat Stewards, families and community members when feasible.
4. Engage and educate private landowners as opportunities present themselves.
5. Appreciate volunteers and celebrate successes.

5.4.1. Community Objective 1: Build Synergy With the Community and GTP to Effectively Engage Existing and New Habitat Stewards on ESD Sites

The intent of the Habitat Steward program is to build an educated, engaged, and active volunteer base

around restoration, maintenance, and stewardship of Tacoma's passive open space areas throughout the City. The program provides volunteers with an opportunity to take on more leadership responsibilities, expand their skill set, tackle larger challenges associated with restoration and maintenance, and receive support and guidance to complete multi-year projects. Currently, the ESD has two passive open space areas with active Habitat Stewards and other individuals have expressed interest. In the next five years, ESD hopes to recruit, train, and retain about five or more additional Habitat Stewards, who will lead other volunteers in the field and serve as stewardship leaders in the community. Habitat Stewards will have the opportunity to do the following:

- Organize and lead volunteer events and activities at their selected park or site.
- Serve as key contacts for projects with their neighborhood.
- Attend regular trainings and workshops, as resources allow.
- Coordinate with staff to ensure the successful implementation of site-specific landscape management plans.
- Request tools, materials, and assistance, as needed.
- Track and report progress on restoration activities via work logs.

ESD staff understand that serving as a Habitat Steward is a big commitment, and that some people may want more responsibility than a regular volunteer, but not as much as a Habitat Steward. In response to this, ESD will be flexible, offering multiple opportunities for involvement and to the extent possible ensure that there are multiple Habitat Stewards at each restoration project site that can accommodate volunteer support.

5.4.2. Community Objective 2: Develop and Implement Strategies to Achieve Social Equity and Inclusion of a Diverse Community of Volunteers

Community building and an ethic of environmental responsibility are at the core of ESD's passive open space efforts, the GTP, and the Green Cities Network across the Puget Sound. Community members are welcome to participate in caring for our shared public lands, regardless of age, income, ethnicity, or the languages spoken at home. Restoration work parties provide an opportunity for neighbors, classmates, families, friends, and complete strangers to come together to restore health to their passive open spaces, build community through shared experiences, and deepen ties to the natural world and each other.

ESD will look to strengthen efforts to provide equitable and inclusive opportunities for the entire Tacoma community. Environmental conservation organizations across the country and here in Puget Sound typically struggle to engage communities of color, recent immigrants, and low-income families (*Green Cities Community Engagement Guide*, http://forterra.org/wp-content/uploads/2015/10/YF-best-practices-guide-reduced-size.pdf). ESD will need to employ additional creative strategies during the next 20 years. The following is a summary of suggested strategies to enhance social equity and diversity, with input from the City and their partners:

- Understand the demographics of Tacoma's neighborhoods as well as the needs and priorities of the communities that live there.
- Attend neighborhood association or other community-sponsored meetings, prioritizing those reaching communities of color, recent immigrants, and low-income families. Develop an

understanding of this cohort's values and goals, and how ESD can support the neighborhood's own efforts to build community.

- Work with local community groups to craft and host their own restoration events to increase inclusion in the planning process and create a strong community-driven program.
- Consider cultural competency training for staff and partners, and be mindful of differences within cultural groups. Don't make assumptions: be sensitive to the traditions and views of the groups ESD is working with.
- When working with Limited English Proficient volunteers, language interpretation should be provided throughout the volunteers' experience, including during recruitment and pre-event communication, at the restoration event itself, and following the event, in order to build future engagement.
- Look for opportunities to connect with and celebrate different community's connections to the environment, greenspaces, and/or volunteerism through cultural holidays or in other ways.
- Find new places to spread the word by asking community members where they gather and where they get news. Utilize ethnic media outlets, and post flyers in popular local businesses.
- Focus on helping more volunteers of color, recent immigrants, and low-income families move up the chain of engagement and become leaders in their own communities. Look for barriers to higher engagement and address them.

5.4.3. Community Objective 3: Provide Outdoor Education and Service Learning Opportunities to Habitat Stewards, Families and Community Members When Feasible

ESD's main goal is the restoration of passive open space for the benefit of surface water quality and quantity and to ensure the health, safety and welfare of the Tacoma community. However, a volunteer program will be part of the overall implementation of this Plan. As such, providing opportunities for community members to learn about and connect with passive open space in Tacoma will be important. If feasible, ESD will develop an outreach and education strategy that focuses on training opportunities and engagement related to passive open space restoration, maintenance and enhancement. Some opportunities that ESD may consider:

- Develop relationships with public and private school administrators and teaching staff to develop field-trip and service-learning opportunities for their students.
- Reach out to high school club/group advisors (e.g., National Honor Society) in the Tacoma School District's middle and high schools and in local private schools to develop stewardship opportunities for students.
- Engage low-income youth and families by reaching out to the Tacoma School District that predominantly serve low-income families.
- Reach out to neighborhood schools' Parent-Teacher-Student Associations to engage students and their families in ESD restoration events.

5.4.4. Community Objective 4: Engage and Educate Private Landowners

While stewardship of passive open space is an important step toward protecting habitat for wildlife, improving water quality, and providing public recreational opportunities, private lands cover a greater portion of Tacoma than do public spaces. Vegetation on private lands can greatly degrade the condition

of the City's passive open spaces despite best efforts to restore, maintain, and steward these areas. For instance, English ivy growing as a border plant in a landowner's backyard can quickly escape into a forested or natural area park either by spreading beyond the property line or by birds dispersing the seeds. Many invasive species also spread when yard waste is illegally dumped in passive open space areas. In fact, these are the most common ways passive open space areas become infested with invasive species.

Alternatively, landowners can be a great resource for their neighborhood by engaging their neighbors, schools, community groups, clubs, and businesses to help support ESD's efforts. Private land can also be a main source for retaining trees and expanding current forest canopy and habitat. Privately owned forest and natural areas in good health can serve as important buffers to adjacent public parklands and help mitigate habitat fragmentation and edge effects.

ESD will once again engage in the following opportunities as resources allow and work to connect these efforts to other restoration efforts across the City. Potential ways for ESD to educate and engage private landowners as an important constituency include:

- Developing mailings and handouts to inform community members about the problems facing passive open space areas, the benefits of removing invasive species from their properties and replacing them with native or noninvasive ornamental species, and ways to get involved in the City's efforts to protect all of its passive and active open spaces.
- Providing information about all of the restoration efforts and opportunities for engagement across the City via social media, web site and local newspapers.
- Connecting private landowners with programs such as the National Wildlife Federation's Certified Wildlife Habitat Program or Schoolyard Project.
- Training landowners in BMPs through the Green Tacoma Steward Program.

5.4.5. Community Objective 5: Appreciate Volunteers and Celebrate Partnership Successes

ESD in partnership with GTP will continue to celebrate volunteers' achievements and emphasize the crucial role they play in restoring and maintaining Tacoma's passive open space areas. Volunteers are a valuable resource and crucial for completing on-the-ground goals. Habitat Stewards and volunteers are an integral part of bringing Tacoma's passive open spaces back to a healthy condition and are valued for their expertise and the rich and diverse perspectives they bring, not only to community engagement, but also on-the-ground stewardship practices. A way to recognize these important volunteers would be to:

- Develop and implement an annual volunteer appreciation event for Habitat Stewards and volunteers working on ESD managed passive open spaces.

5.5. Financial Resources

Financial resources, staff capacity, and volunteer contributions will affect ESD's ability to restore and maintain the 496 acres identified for stewardship in this Plan. During the next 20 years (2016–2036), ESD will need an estimated $20.6 million in funding (2015 dollar value), as well as volunteer support, to accomplish the proposed goals. The needed volunteer investment is estimated at approximately 136,000 hours over the life of the program. This will bring an additional value of $3.7 million as a match

to the estimated $20.6 million in direct costs. This is an ambitious plan that relies on additional resources. The following section provides an overview of the components used to develop these cost estimates and identifies resource objectives and strategies to achieve ESD's goals.

5.6. Cost Modeling

5.6.1. Background

Over the last decade the Green Cities Partnership has developed 20-year plans for eight cities. One of the major elements of the 20-year planning process is the creation of a cost estimate for implementing restoration across all restoration sites. Creating a cost estimate for restoration activities is a complicated undertaking. The model has numerous assumptions and attempts to anticipate costs over a 20-year time period. It should be noted that these cost estimates are considered a 30,000-foot view of the field and program costs and intended to be used for planning and budgeting purposes. Detailed cost estimates will be needed to implement individual site restoration plans and ongoing active management activities.

5.6.2. The Cost Model

The cost model provides full cost estimates for implementing restoration across all ESD owned passive open space sites. This cost estimate model is based on similar models developed for Green Cities efforts across the Puget Sound, but the model was modified to address unique specifications to meet the needs of ESD.

The budget projections are based on estimated average restoration costs (both volunteer and paid labor). Costs vary by habitat/vegetative condition, phase of restoration (1-4) and steepness of slope (<40% and ≥40%). The model assumes a greater investment for poor habitat conditions and employs a strategy of gradually increasing program costs over time to account for increased effort and increased acres enrolled in restoration over time.

Also included is a built-in 15% overhead on field expenses and 7% overhead on staff time to capture some of the additional costs associated with doing business over time.

5.6.3. Cost Model Assumptions

Contractor and Field Costs

Estimated field costs include paid crews to lead volunteers and/or implement restoration work not suitable for volunteers, as well as restoration supplies, plants, and tools. Dollar values are assigned based on slope (i.e., level of difficulty and effort) and the phase of restoration (i.e., effort and length of time). These estimates were both based on actual costs (i.e., Schuster Slope for steep slope areas) and estimated costs that Forterra has documented over time for both non-steep slopes and volunteer costs. The cost model was run with two scenarios based on slope classes (<40% and ≥40%). Table 5-1 and Table 5-2 outline the assumptions built into the cost estimates for each slope class.

Table 5-1: Base Costs <40% Slope

Field Costs ($)	Phase of Restoration			
	1	2	3	4
Per Acre/Year	$10,875	$4,800	$1,750	$163
Per Acre/Half Year	$5,438	$2,400	$875	$81
Per/10th of year (for enrolling treeiage 1)	$250			

Table 5-2: Base Costs ≥40% Slope

Field Costs ($)	Phase of Restoration			
	1	2	3	4
Per Acre/Year	$15,225	$5,600	$2,450	$195
Per Acre/Half Year	$7,613	$2,800	$1,225	$98
Per/10th of year (for enrolling treeiage 1)	$300			

These are only estimated averages for the purposes of projecting the total budget needed to meet the program goals. Each actual project will vary, depending on the site conditions and who is performing the work.

Staff and Program Costs

The estimated staff and program costs include staff support for running the program; planning and development; monitoring restoration and tracking progress; recruitment, supervision, and support for Habitat Stewards; promoting work parties, social media, recruiting and coordinating general volunteers; managing paid crews and other contractors; ordering and delivering field supplies; grant writing and implementation; marketing; overhead expenses; and other operating costs.

Under this model it is assumed that the current level of ESD staff would increase as soon as this 20-year plan begins. Current staff support levels (2.25 FTEs at time of printing) are not included in this cost model. Staff FTEs are in addition to current staff FTEs and would need to be hired. Table 5-3 provides how additional ESD staff FTEs will be phased into the program.

Table 5-3: Additional Phased Staffing and Costs

Additional Program Costs	FTE	Cost	Timeline
Planning and Management	1.5	$187,500	YR 10-20
	1.0	$125,000	YR 3-9
	0.5	$62,500	YR 1-2

Consultation and Assessment
An additional expense line item was added to the cost model to capture the extensive planning and design work that has to go into restoring sites that are in Tree-iage category 9, sites that have extensive Critical Areas and to gather public input when an extensive planning and design process is undertaken. This line item is in the amount of $40,000 annually for consultant and assessment.

Estimating Volunteer Labor Match
The standard Green Cities cost model was adapted to meet the unique needs of ESD. Since roughly half of the lands contained in this plan are on steep slope areas that are inaccessible to volunteers, the total volunteer match hours were reduced by 50%. Table 5-4 illustrates the "standard" range of volunteer and paid investment per acre per phase of restoration across Green Cities estimates. It also illustrates what assumptions were used in this model for volunteer investment per acre, per phase of restoration.

Table 5-4. Range of Labor Estimates Per Restoration Phase and Volunteer Labor Estimates

Restoration Phase	Range of Labor (volunteer or paid) Investment (hours/acre)	Average Volunteer (hours/acre)
Phase 1	50–1,500	350
Phase 2	94–376	50
Phase 3	31–155	20
Phase 4	1–25	6

The volunteer match estimate is then calculated by taking the estimated number of volunteer hours needed and multiplying it by the 2014 Independent Sector volunteer labor value of $27.54/hour for Washington State (www.independentsector.org/volunteer_time). The number of volunteer occurrences and volunteer hour calculations assumes that a volunteer spends four hours on average at a volunteer work party event.

5.6.4. ESD Cost Estimates 2016–2036

This cost model assumes a gradual ramp up of acres to be enrolled in restoration over the 20-year timeframe. This strategy is to help ESD establish program protocols and to establish/expand the volunteer Habitat Steward program. One caveat to this is the Schuster Slope and Mason Gulch sites restoration efforts. Schuster Slope and Mason Gulch sites were already in the planning and design phase when this cost model was developed. As such the actuals do not match the estimated costs for the first few years of the program. It is assumed that these differences will balance out over the 20-year time period, with a slightly higher cost than projected in the first five years of the program and slightly lower total costs after five years.

Regardless of how sites are prioritized for restoration, the job ahead will be difficult. Only 41 acres fall in the highest habitat value Tree-iage categories (1 and 2), or the easiest to get into active restoration. Juxtaposed to these acres are more than 250 acres within the hardest Tree-iage categories (8 and 9). Even if the goal is to balance relatively easy acres with difficult acres on an annual basis, easy acres will

quickly be exhausted. Another way to state this dilemma, the vast majority of lands in this Plan will be difficult and require extensive intervention to get into active restoration.

Program costs peak in 2028 (year 13) at $1,547,303. Initial program costs start at $160,660 in 2016. New acres enrolled start at four acres in 2016 and peak in 2026 at 41 acres. The model assumes a balance between non-steep slope acres and steep slope acres each year.

This cost model informs the Strategies and Benchmarks, which further breaks out how acre enrollment, volunteer hours, and estimated program costs ramp up over the 20-year period based on output from the cost model. For example, the model projects a cost of $160,660 in 2016 to initiate restoration and maintenance efforts on four new acres. This accounts for staff, field expenses, and overhead needed to recruit and support an estimated 274 volunteers and 1,097 volunteer hours (a value of $16,421).

The cost per acre for each Tree-iage category is the projected total estimated cost from the time restoration and maintenance begins in 2016 until the end of the plan in 2036. Table 5-5 illustrates the estimated cost of 2016-2036 restoration per Tree-iage category. These are high-level predictions used for long-range planning and do not reflect a fine-scale analysis. The calculated average costs per acre going through the four phases of restoration are derived from a cost model that enrolls a percentage of acres from each Tree-iage category every year during the 20 years. The model estimates that initiating restoration and maintenance on all 496 acres will vary by slope classification and Tree-iage category. Tree-iage category 1 in a non-steep slope condition will cost approximately $13,900 per acre and $22,800 per acre in a steep slope condition. Tree-iage category 9 in a non-steep slope condition will costs approximately $51,000 per acre and in a steep slope condition approximately $63,950 per acre.

Based on the adjusted estimates, the model forecasts that completing proposed goals will cost approximately $20.8 million in 2016 dollars through 2036. The model also forecasts a volunteer match of $3.7 million during the 20-year time period. Figure 5-2 illustrates the relationship between direct costs, volunteer match, and the enrollment of acres per year into restoration over the life of the program.

Table 5-5. Estimated Cost of 2016–2036 Restoration (2015 dollars) per Tree-iage Category

Tree-iage Category	Volunteers & Crews (< 40% slopes)			Crews Only (≥ 40% Slopes)			Total Cost
	Acres	Cost per Acre	Subtotal	Acres	Cost per Acre	Subtotal	
1	8.23	$13,900	$114,397	9.78	$22,800	$222,984	$337,381
2	18.05	$25,000	$451,250	4.53	$35,800	$162,174	$613,424
3	20.64	$33,000	$681,120	4.33	$35,000	$151,550	$832,670
4	1.66	$21,300	$35,358	2.94	$28,800	$84,672	$120,030
5	50.51	$27,800	$1,404,178	86.37	$41,500	$3,584,355	$4,988,533
6	71.77	$40,300	$2,892,331	60.60	$42,700	$2,587,620	$5,479,951
7	3.64	$26,000	$94,640	0.10	$37,900	$3,790	$98,430
8	17.34	$37,400	$648,516	15.33	$54,000	$827,820	$1,476,336
9	69.03	$51,000	$3,520,530	51.32	$63,950	$3,281,914	$6,802,444
Totals	260.87		$9,842,320	235.30		$10,906,879	$20,749,199

**Combines estimated paid labor (contractors and staff) and program costs; does not include volunteer labor. Totals are rounded to the nearest whole number.*

5.7 Resource Objectives

5.7.1. Resource Objective 1: Continue Current City Funding and Build Capacity for Future Program Growth

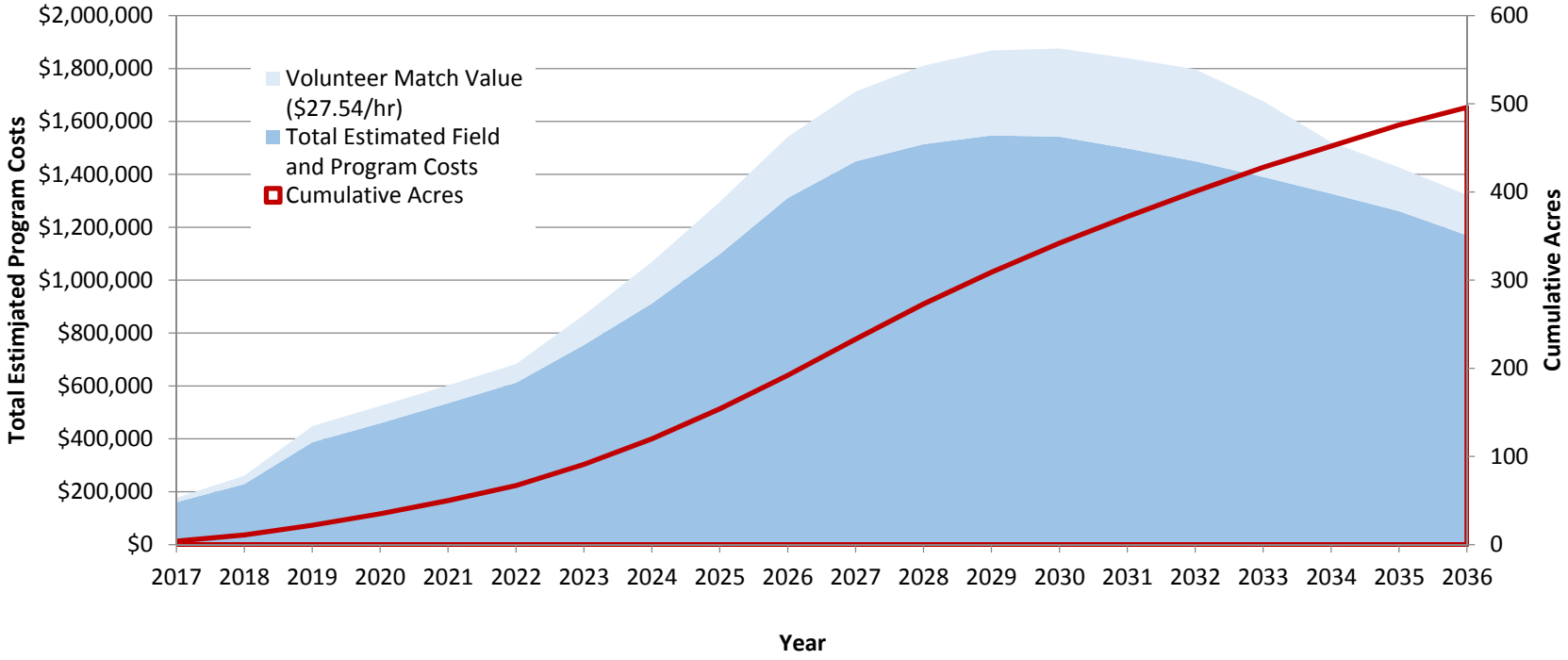
ESD is a public utility. Stable funding comes from rate-payers for services provided by ESD. To successfully implement this effort and to continue to grow the program to achieve the objectives, goals and benchmarks identified in this Plan, ESD will need to increase rates. To initiate this plan a 1% rate increase was obtained over a two year period. A second increase of 1% over two years will need to occur somewhere at year 10 or sooner depending on how implementation and adaptive management actions proceed.

In addition to funding provided by rate-payers there are other avenues of funding that ESD should seek. Corporate partners, foundations, grants, and private donors will play an important role in funding beyond the current budget.

Several possible funding mechanisms could be evaluated for consideration, either separately or in combination, to meet the funding goal, such as the following:

- Federal, state, and local grants from such entities as Washington State Recreation and Conservation Office or Washington Department of Natural Resources
- Market-based mechanisms (stormwater mitigation credits), if determined feasible
- Contributions from local corporations and businesses
- Financial contributions from the public, if volunteering is not an option

Figure 5-2: 20-Year Funding Projections and Cumulative Acres Enrolled Per Year



5.7.2. Resource Objective 2: Provide Sufficient Staff to Support Fieldwork and Program Administration as the Program Grows in the Future

Field Restoration Staff

Current ESD capacity alone cannot meet the restoration and maintenance needs of all 496 acres by 2036. Volunteer efforts and community leadership will play a major role in achieving restoration and maintenance goals, but approximately 50% of the land area is not suitable for volunteer activities. Currently ESD has committed 2.5 FTEs in support of passive open space efforts and at least one full time WCC crew working in the field. As field efforts ramp up in the coming years and the ESD enrolls more acres in restoration and maintenance there will be a need to increase FTE capacity.

The City does have a full time WCC, but this will not be enough to handle additional workload, especially for the intensive areas within Tree-iage categories 8 and 9, as well as steep slope areas located across sites. The WCC crew may be supplemented for one time or short-term projects through the hiring of a commercial or nonprofit professional crew.

Marketing and Community Outreach

Additional staff time devoted to education and outreach will be critical in helping increase volunteer capacity to more than 10,000 hours annually during the height of the program. In order to recruit volunteers and engage and educate the public, staff should commit a significant amount of time to marketing and fundraising, which would require more staff time. ESD currently does not do volunteer recruitment nor have any brochures to assist with outreach efforts. ESD should create and implement a communications and marketing plan or approach that aligns with and enhances outreach and education work. Outreach, education, communications, and marketing efforts will increase passive open space restoration visibility, build the needed volunteer base and community awareness, and increase the potential for generating additional program funding by reaching a wider audience.

Currently, ESD staff conducts fund development and overall passive open space management, with oversight from the department director. Current responsibilities include budget management, annual reporting, overseeing field and operations staff, and contractors.

As the program grows, staff will have added responsibilities including implementing a monitoring and tracking system, creating and distributing annual summary reports, facilitating the management team, grant writing, and pursuing new funding sources. As the program expands, ESD may consider establishing a separate fund development and marketing position, whose responsibilities would include supporting staff with outreach and engagement, recruiting corporate sponsors, securing funds from donors and foundations, and grant writing.

5.7.3. Resource Objective 3: Review and Update Current Volunteer and Habitat Steward Program with Partners, GTP and Other Organizations Using Volunteers to Ensure Maximum Efficiency and Utilization of Resources

Steward and Volunteer Program Management

ESD currently does not have a staff member who is dedicated to managing a volunteer program. All volunteer coordination for all lands under a restoration activity is currently managed by MPT and their "Chip-In" program. This Plan anticipates that about 50% of restoration sites will be suitable for volunteer efforts and the cost model identifies 136,000 volunteer hours will be needed to leverage other program costs over the lifetime of the program.

ESD will need to determine quickly if new staff dedicated to volunteer management will be hired or an RFP process to hire an outside consultant will be created to manage volunteer engagement.

ESD will need to recruit, train, and retain volunteers interested in a higher level of commitment than attending occasional volunteer events. This Plan allows ESD to increase on-the-ground community leadership, thereby building partner capacity to initiate restoration and maintenance. Habitat Stewards who lead volunteer events, assist with creation of activity work plans, and track restoration progress could apply for small grants to further efforts at their site; however, all grants would require staff support. Success of the Habitat Steward program depends upon staff's ability to coordinate the program, including training new Habitat Stewards, working with participants to develop activity work plans, coordinating efforts with other City staff, and keeping track of accomplishments.

As the program expands its volunteer and Habitat Steward program to meet its field objectives, ESD could be managing more than 10,000 volunteer hours annually (about 2,500 volunteers). The cost model assumes that a total of 1.5 additional FTE will be hired by year 10 (2026) to adequately support the entire program. A significant portion of this added staff will need to be dedicated to supporting volunteers both in the field and administratively.

5.7.4. Resource Objective 4: Increase Volunteer Engagement to a Cumulative Total of 136,000 Hours During the Next 20 Years and Provide Adequate Support and Materials to Volunteers and Habitat Stewards

Between 2016 and 2036, volunteer contributions are forecasted to surpass 136,000 hours, valued at $7.3 million (based on the 2014 Independent Sector valuation of a volunteer hour at $27.54 in Washington State). This Plan anticipates reaching about 4,000 volunteer hours per year in 2020, and when the program reaches its projected peak of new acres entered into restoration and maintenance in the year 2028, it is anticipated that there will be a need for nearly 10,000 volunteer hours per year. The growing contribution of volunteer time is integral to long-term stewardship. Volunteer work should be implemented in concert with ESD field staff and crews to achieve acreage goals. After proposed 20-year goals are met, ongoing maintenance resources and volunteers will be needed to maintain the health of restored passive open space areas.

The anticipated levels of volunteer contributions and fieldwork will require additional resources (funding, staff time, and materials). The projected $20.8 million budget includes added capacity for operations staff to support a growing program with additional volunteer recruitment, coordination, training, and recognition. The ability to provide additional resources will help keep volunteer productivity high and ensure a positive stewardship experiences.

Throughout the implementation of this Plan, ESD will continue to work with Habitat Stewards and volunteer groups to identify restoration and maintenance needs, obtain materials and tools, develop site-specific stewardship plans, conduct BMP trainings, coordinate large events, and write grant applications. Fieldwork efficiency can be increased by creating clear lines of communication, coordination, easy access to resources, and ample support.

ESD will provide the following resources:

- New Habitat Steward orientation, periodic training opportunities, and a *Habitat Steward Field Guide (Green Tacoma Field Guide may be appropriate).*
- Project monitoring and documentation to assess and track restoration efforts.
- Outreach materials and assistance in recruiting volunteers.
- Restoration materials such as plants, mulch and tools, as resources allow.
- Networking opportunities for Habitat Stewards to share experiences and learn from work conducted at different forested and natural area parks.
- Assistance with maintenance and tasks deemed inappropriate for volunteers by providing professional staff or crews to complete the work.

The primary goal is to restore the health of its passive open space areas and forested habitat. The Strategic 20-Year Passive Open Space Plan and benchmarks outlined here are ambitious, but as noted earlier, if the financial investment is not made during the next 20 years, the timeline will be pushed out and current ecological conditions of the restoration sites will further decline, costing even more for future restoration and ecosystem services that healthy forests and passive open spaces provide. Table 5.6 provides a summary of the Benchmarks and Milestone Year Metrics categorized by the Field, Community, Resources and Administration components.

Table 5-6 Benchmarks and Milestone Year Metrics

	2016-2026	2026	2027-2036	2036
Field	Initiate restoration on 15-25 new acres per year Maintain restoration on all acres in enrolled in active restoration	250 acres in active restoration 125 acres in Phase 4	Initiate restoration on 25 new acres per year Maintain restoration on all acres in enrolled in active restoration	All 496 acres are in active restoration 350 acres are in Phase 4
	Create landscape management plans for each new site Identify next priority sites annually (1-3 sites)	23 sites have landscape management plans Implement rotating 3 year, Phase 4 monitoring protocols for 15-23 sites	Create management plans for each new site Identify next priority sites annually (1-3 sites)	All 46 sites have landscape management plans Implement rotating 3 year, Phase 4 monitoring protocols for all Phase 4 sites
	Create annual reports for the entire program Create annual reports for individual sites	Create 10-year field progress report Update the Strategic 20-Year Passive Open Space Plan (if necessary)	Create annual reports for the entire program Create annual reports for individual sites	Create final field progress report

(Cont.) Table 5-6 Benchmarks and Milestone Year Metrics

	2016-2026	2026	2027-2036	2036
Community	Recruit 1-3 new Habitat Stewards annually Hold an annual Habitat Steward celebration Provide 1 new Habitat Steward orientation annually Provide 3 annual trainings	The program has 23 active Habitat Stewards	Recruit 1-3 new Habitat Stewards annually Hold an annual Habitat Steward celebration Provide 1 new Habitat Steward orientation annually Provide 3 annual trainings	The program has 46 active Habitat Stewards
	Each Habitat Steward leads 1-4 events annually Habitat Stewards provide timely submittal of tracking forms Habitat Stewards are involved beyond just work parties (at least one annual Habitat Steward planning meeting is held) Habitat Stewards help create annual work plan for their site with staff input	There is an average of 4 events per site across all active restoration sites All tracking metrics are up to date 23 sites have annual plans	Each Habitat Steward leads 1-4 events annually Habitat Stewards provide timely submittal of tracking forms Habitat Stewards are involved beyond just work parties (at least one annual Habitat Steward planning meeting is held) Habitat Stewards help create annual work plan for their site with staff input	There is an average of 4 events per site across all active restoration sites All tracking metrics are up to date All 46 sites have annual plans
	Provide information to the community via Facebook or other social media Provide annual reports to public		Provide information to the community via Facebook or other social media Provide annual reports to public	
	Seek community involvement opportunities focusing on three priority areas: ▪ Watershed (sites equally spread) ▪ Diverse communities ▪ High school/college	Summarize community engagement efforts (report) and re-evaluate and adjust as needed.	Seek community involvement opportunities focusing on three priority areas: ▪ Watershed (sites equally spread) ▪ Diverse communities ▪ High school / college	Write final report on community engagement, documenting final volunteer numbers, successes and lessons learned

(Cont.) Table 5-6 Benchmarks and Milestone Year Metrics

	2016-2026	2026	2027-2036	2036
Resources	Identify and apply for grants annually Help Habitat Stewards apply for smaller site specific grants	Apply for at least 10 grants total over the program's history	Identify and apply for grants annually Help Habitat Stewards apply for smaller site specific grants	Apply for at least 20 grants total over the program's history
	Track budget annually and project program costs to ensure stable funding over time	Successfully seek rate increase (if necessary)	Track budget annually and project program costs to ensure stable funding over time	Solidify stable public funding to ensure long-term sustainability of program beyond 2036

	2016-2026	2026	2027-2036	2036
Administration	Establish a management structure and hold quarterly meetings	Evaluate management team meetings and structure, adjust as necessary	Hold quarterly management meetings	Determine ongoing management team structure to ensure program sustainability
	Coordinate volunteer efforts with other stakeholders			

CHAPTER 6: ADAPTIVE MANAGEMENT

ESD's primary goal is to re-establish and maintain healthy, sustainable passive open spaces for surface water quality management. This Plan is an intensive, one-time intervention to restore the health of Tacoma's passive open spaces through community action, volunteer effort, paid crews and strategic restoration planning. After 20 years and restoration of the projected 496 acres in the program, labor and funding needs can be reduced to a maintenance level, but will continue to exist. It is estimated that the total program costs will be reduced to approximately $148,000 annually (2015 dollars) to monitor and maintain the 496 aces covered under this Plan. The goal of a healthy habitat or passive open spaces can be achieved only by careful management of resources.

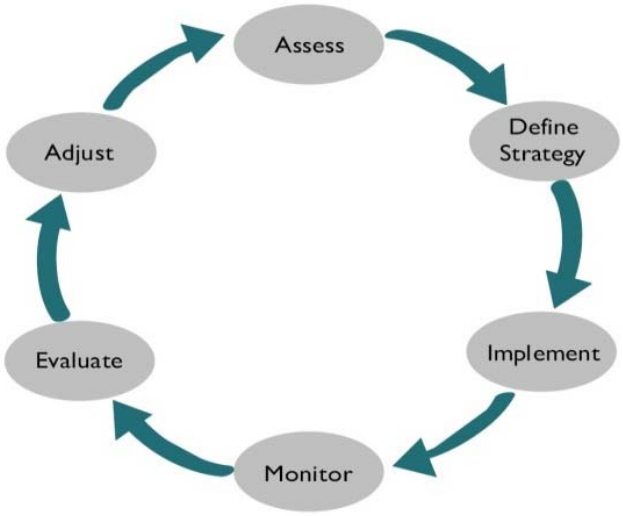


Figure 6-1. Adaptive Famework Cycle

Passive open space areas are complex ecosystems influenced both by natural factors and the human systems that surround them. These human systems that impact and ultimately must care for these ecosystems are equally complex. Any strategy to restore and maintain forested habitat and passive open spaces must systematically address all of the factors that affect the health of those lands. In response to this complexity, an adaptive management model has been developed.

Adaptive management systematically improves management policies and practices. It is a repeating cycle of six steps: problem assessment, strategy definition, implementation, monitoring, evaluation, and strategy adjustment (Figure 6-1). Once an evaluation is complete, new information gathered from monitoring is used to reassess the problem and develop new strategies as needed. Then implementation, monitoring, and evaluation occur, and the cycle begins again.

This section describes how ESD will apply an adaptive management approach to track and monitor progress, distribute resources, and report on the Plan's success. This approach to strategy development and monitoring helps assess all aspects of the program (field, community, resources, and administration) necessary to reach the goal of enrolling all 496 acres in restoration by the end of 2036. Simply monitoring the outcomes of field work would not allow staff to anticipate problems and make adjustments to other parts of the program. Adaptive management allows staff to track the resources and community support necessary for accomplishing the fieldwork.

6.1. Measuring Success

Two types of information will help in analyzing this Plan's effectiveness: program monitoring and field monitoring. Monitoring allows for improvement in each program's design and performance by measuring the effectiveness of strategies and techniques used. The results of monitoring are fed back

into planning and methodology to increase effectiveness. Monitoring and evaluation will also provide accountability to funding sources and supporters, and help ensure that goals and benchmarks are met. Benchmarks are outlined in Table 5-6, Chapter 5.

The effectiveness of program strategies needs to be tracked throughout the life of the Plan, and, through adaptive management, adjustments made when necessary.

6.1.1. Program Evaluation Plan

At the close of each year, ESD staff will continue to collect data to measure and track progress toward the annual work plan goals and benchmarks. Data management systems have been developed to record information pertinent to these measurements throughout the year so that progress can easily be summarized at year's end. For instance, each restoration event whether paid crew or volunteer will be required to submit a work log. A sample work log can be found in Appendix D. Work logs will track the phase of restoration as well as restoration activities (BMP implementation) and identify which HMU activity has occurred. Work logs can be linked to the City's GIS system allowing for a visual representation of work accomplished. Together, these tracking efforts will help with annual reporting and adaptive management decisions over the course of the effort.

6.1.2. Field Monitoring Plan

As the restoration and maintenance program proceeds, routine monitoring of restoration sites will continue to be conducted to track the condition and health of restored sites and gauge progress. Success will rely on developing and refining effective strategies to remove and control invasive plants.

To monitor field work, new acres will be tracked as they are brought into active restoration and mapped in GIS. Volunteer and skilled field crew time will be devoted to revisiting sites that have been previously worked on and assessing their ongoing needs as they move through the four phases of restoration. These forests and natural areas will always be subject to pressure from their surroundings. Although the work needed decreases dramatically each year that an area goes through the program, Phase 4 of restoration continues indefinitely.

As ESD enrolls more acres in restoration, tracking can become complicated. Managing data entry and paperwork as the program grows has proven to be expensive and often neglected. ESD will put in time up front to develop tracking and monitoring protocols, as well as GIS and database setup and management.

6.2. Resource Distribution

Funding for this Plan comes primarily from the utility rate collected with additional funding from grants as opportunities arise. These funding sources support ESD at its current capacity. As outlined in the resource objectives, ESD will need to add staff FTE and resources to fully implement the goals outlined in this Plan. Functions will include project management, planning and design, consultant hiring and management, volunteer management, marketing and outreach, grant writing, reporting, and professional field staff to meet long-term goals.

Initially the majority of funds will go to the development of landscape management plans (managing the public process) and to professional crews working on Schuster Slope and Mason Gulch. As new sites are

identified, volunteer activities will increase and additional funding will be needed primarily for managing volunteers and ensuring overall project coordination and management. ESD should always consider enhancing their public outreach as increased visibility and recognition can lead to higher levels of public and private funding, corporate and individual donations, and greater volunteer contributions. As the program continues to establish and expand its volunteer base for the program, partners may consider shifting resources to provide more support for additional new projects.

6.3. Reporting and Sharing Knowledge

ESD progress will be reported annually to stakeholders. Stewards, volunteers, and the public should also be kept up to date on progress though annual reports and potentially an annual celebration as funding permits. Annual work plans will be adjusted in response to available funding, monitoring results, and emerging knowledge of successful restoration techniques.

ESD staff will be encouraged to utilize and develop effective methods to restore and maintain passive open spaces. Staff will also utilize inventive outreach strategies, and network with regional restoration groups, which will provide an opportunity for staff to share information and learn from other agencies. ESD should take advantage of the established GTP and the more than a decade of restoration work that has occurred under the Puget Sound Green Cities program. ESD is currently a member of the Green Cities Network and part of the GTP. As such ESD will have opportunities to share successes and challenges with other cities (Seattle, Everett, Tukwila, Kirkland, Redmond, Kent, Snoqualmie and Puyallup) that are dedicated to a similar goal and vision. Written materials, including this Strategic 20-Year Passive Open Space Plan will be posted on the City of Tacoma website.

CHAPTER 7: CONCLUSION

ESD will use this Plan as a tool, resource and guide for the restoration, maintenance and stewardship of the 496 acres of land under their management and care. Passive open space areas identified in this Plan will continue to face threats from invasive species, habitat fragmentation, adjacent land impacts and other influences that prevent native species from regenerating. To maintain the overall health and ecosystem functions of these passive open space areas, ESD will engage in active management and restoration. These activities will be guided by this Plan and ensure that these lands are managed for stormwater quantity and quality benefits for the citizens of Tacoma and as charged in the mission of ESD.

The key foundation of this Plan is the documentation and analysis of the ecological state of Tacoma's passive open space areas, using the FLAT analysis approach and Tree-iage model. This analysis is a snapshot of the current conditions of these lands and provides a means to prioritize restoration actions. Ecological data collected through the FLAT analysis occurred at the HMU scale, delivering average conditions associated with each HMU. The Plan will allow ESD to prioritize which passive open spaces are placed into active restoration over the 20-year time frame, have the metrics and benchmarks in place to track progress, make necessary adjustments as needed, and have an understanding of the resources required to successfully accomplish the goals and objectives of this Plan.

Limited funding and staff time will require effective, efficient, and priority-driven restoration and maintenance activities. This Plan is a living document that will evolve as new ecological data becomes available and adaptive management strategies are implemented along the way.

Finally, this Plan builds upon the restoration that is underway and has already been completed. By engaging in this ambitious effort ESD will ensure a balance between economic growth, new development, and the care and stewardship of our ecosystem services. Ultimately, these efforts will enhance surface water quality, combat climate change, protect wildlife habitat and enhance all ecosystem benefits associated with healthy and vibrant forested habitats culminating with an engaged community and a vibrant and livable City. These passive open space areas are a major element of our City and by ensuring their care and long-term sustainability, ESD embraces Tacoma as the City of Destiny and will help ensure that Tacoma will continue to meet the needs of its current community members and attract new community members far into the future.

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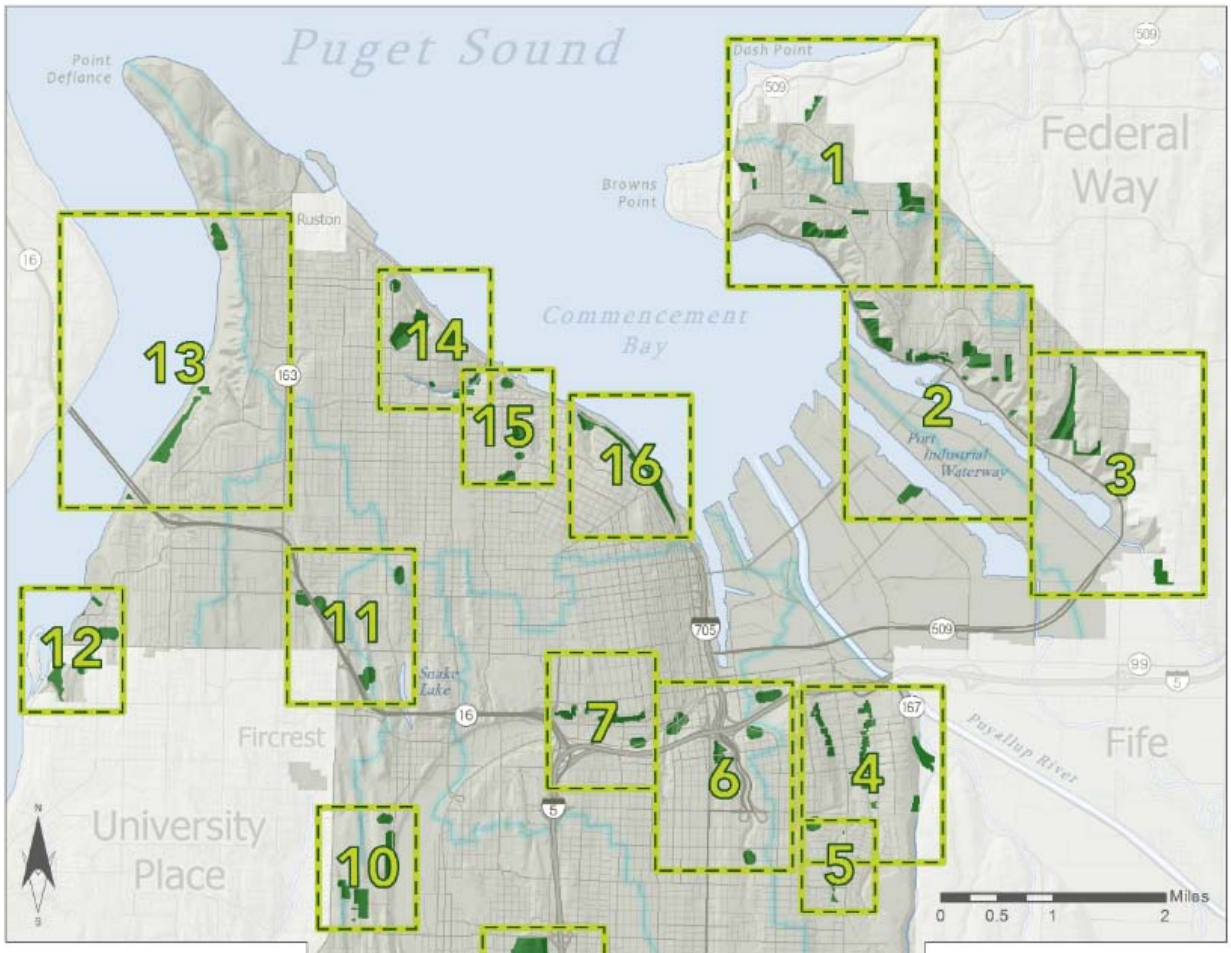
Appendix A: Tree-iage Map Index



Key to Individual Site Maps

Site Name	Map Number
0220011001	11
2235001190I	9
34th Street Gulch	6
4500000020	14
52nd Street Wetlands	10
7470013800	6
8945000640	15
Agnes Road	1
Blix	4
Brown's Point	1
Buckley Gulch	15
Center Street	7
Cheney Stadium	11
China Lake	11
Crystal Springs	12
Day Island	12
Dome Slope	6
Fern Hill	8
First Creek	4 & 5
Garfield Gulch	16
Harbor Ridge	1
Highway 16	11
Hylebos Creek	3
Joe's Creek	1
Julia's Gulch	3
Landfill	10
M Street	4
Marine View Drive	2
Marine View Drive East	2
Mason Gulch	14
McKinley	6
North Shore Parkway	1
Puget Creek	14
Rhone Poulenc	2
Salmon Beach	13
Schuster Slope	16
South Ash Street	8
South Tacoma Way	6 & 7
Swan Creek	4
Titlow Park	12
Trafton Slope	9
Wapato Hills	9
Wapato Lake	9
Waterview	14
West Ridge	12
Western Slopes	13

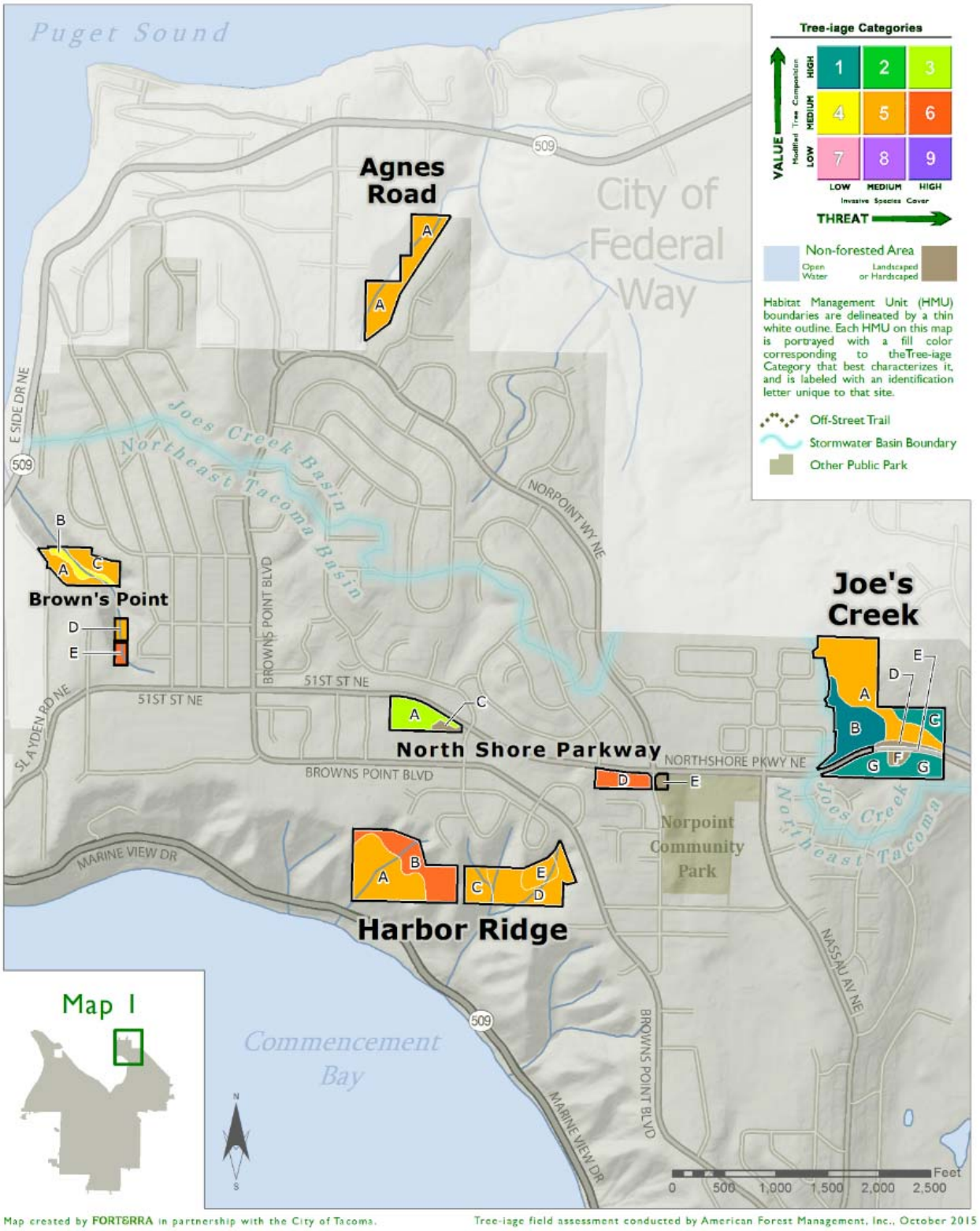
Map Legend

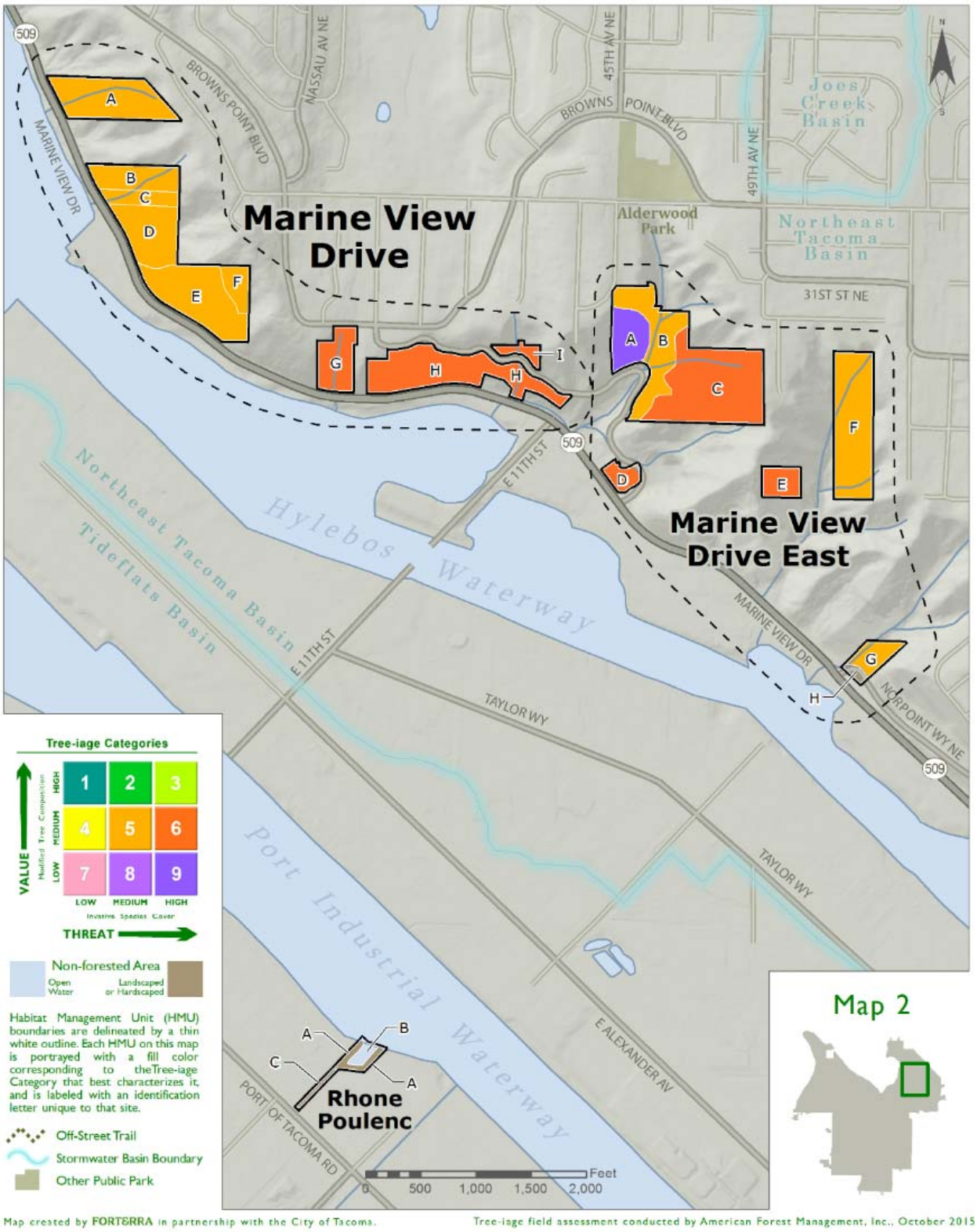
Stormwater Basin Boundary

Environmental Services Passive Open Space Site
NOTE: Site boundaries have been graphically enlarged to be visible at this scale.

Map created by FORTSERRA in partnership with the City of Tacoma.

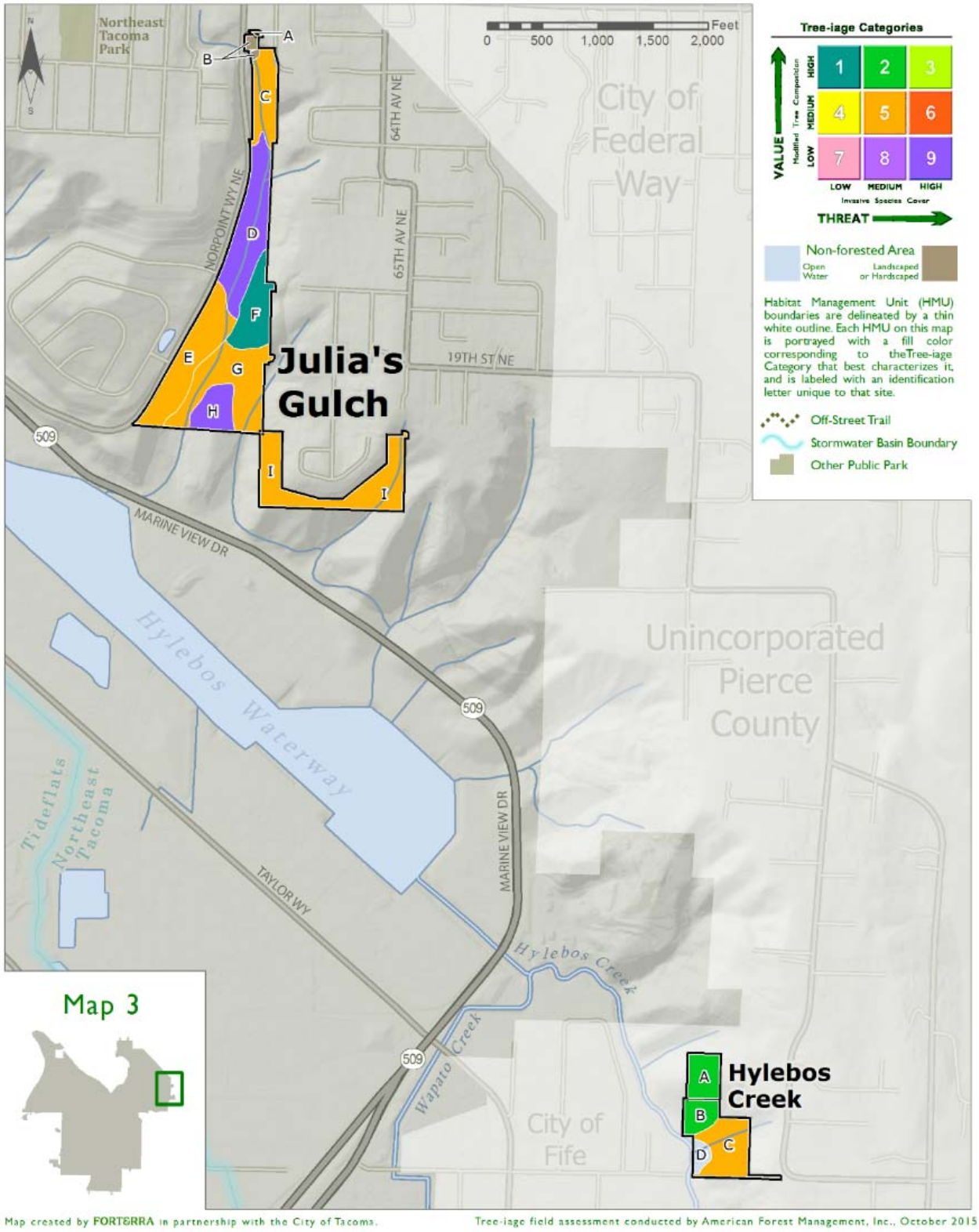
Appendix B: Neighborhood Tree-iage Maps



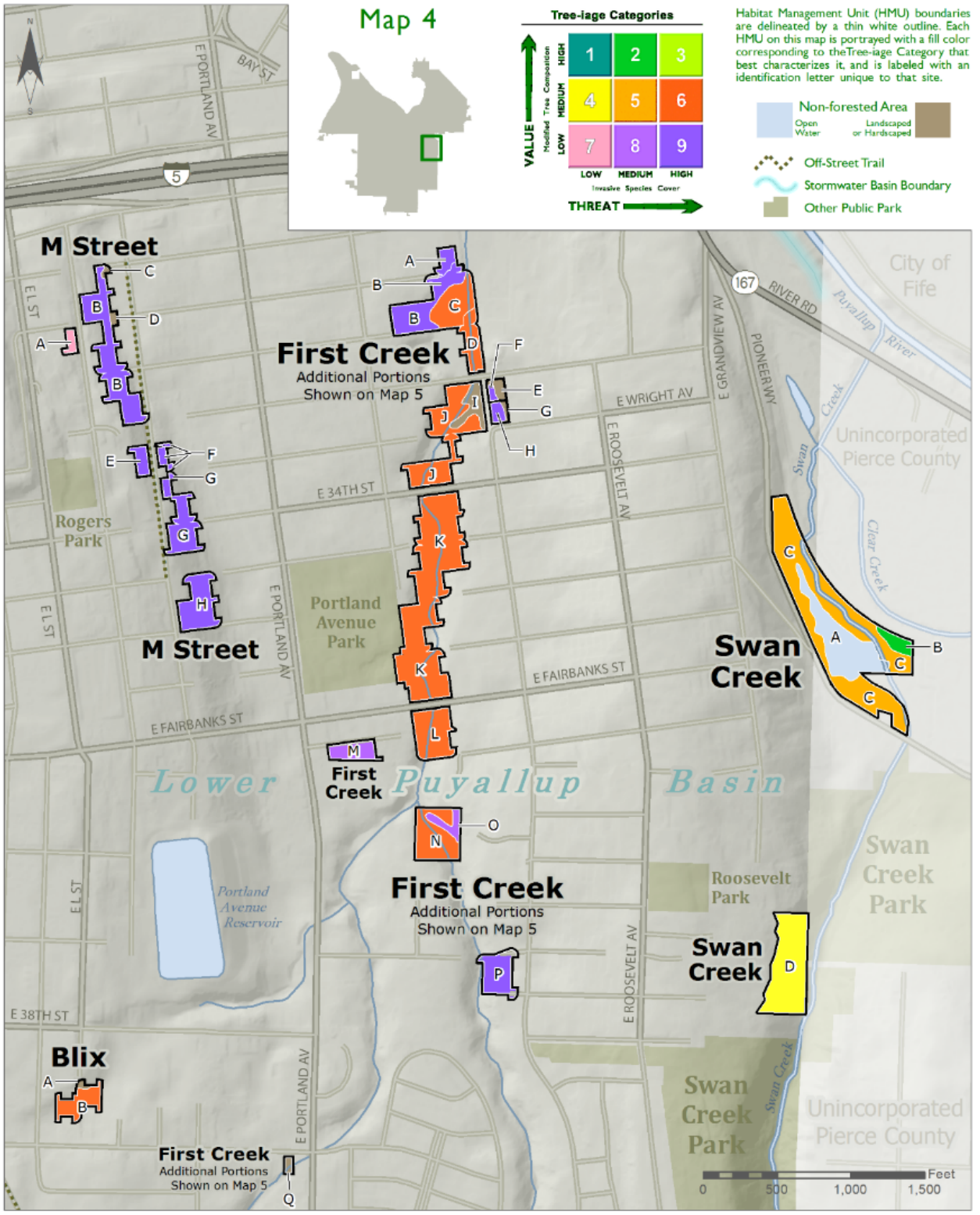


Map created by FORTSERRA in partnership with the City of Tacoma.

Tree-iage field assessment conducted by American Forest Management, Inc., October 2015

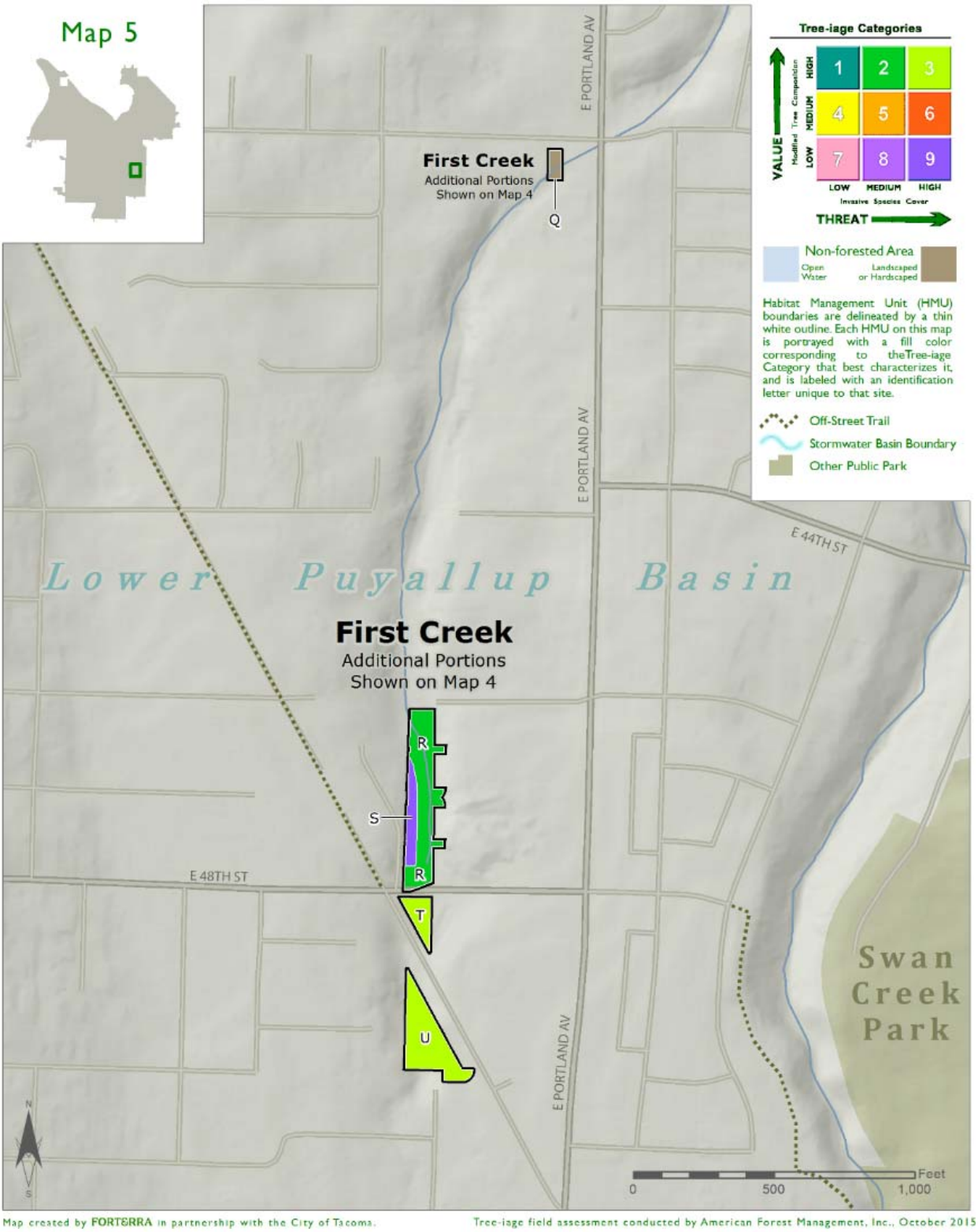


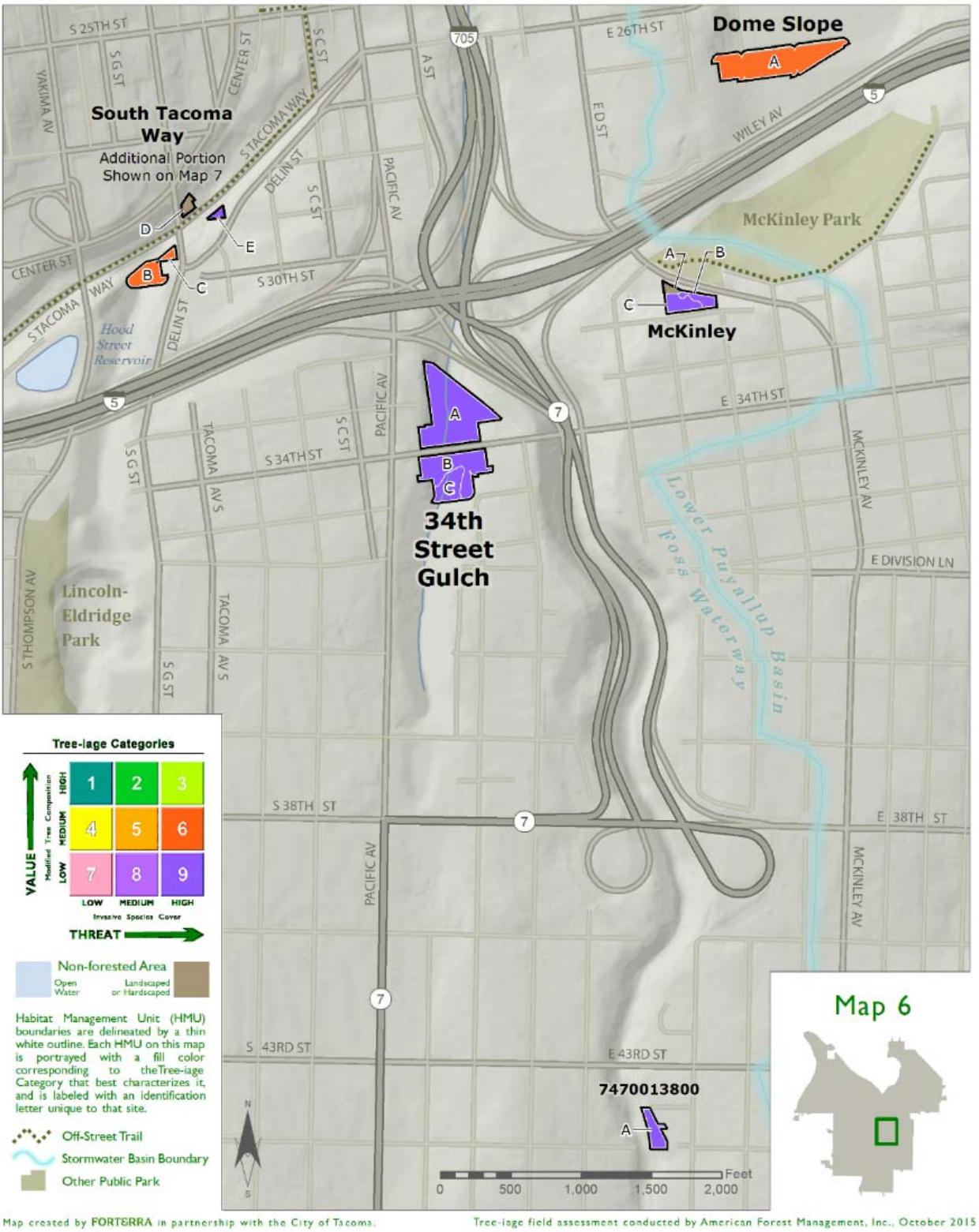
Map created by FORTERRA in partnership with the City of Tacoma. Tree-iage field assessment conducted by American Forest Management, Inc., October 2015

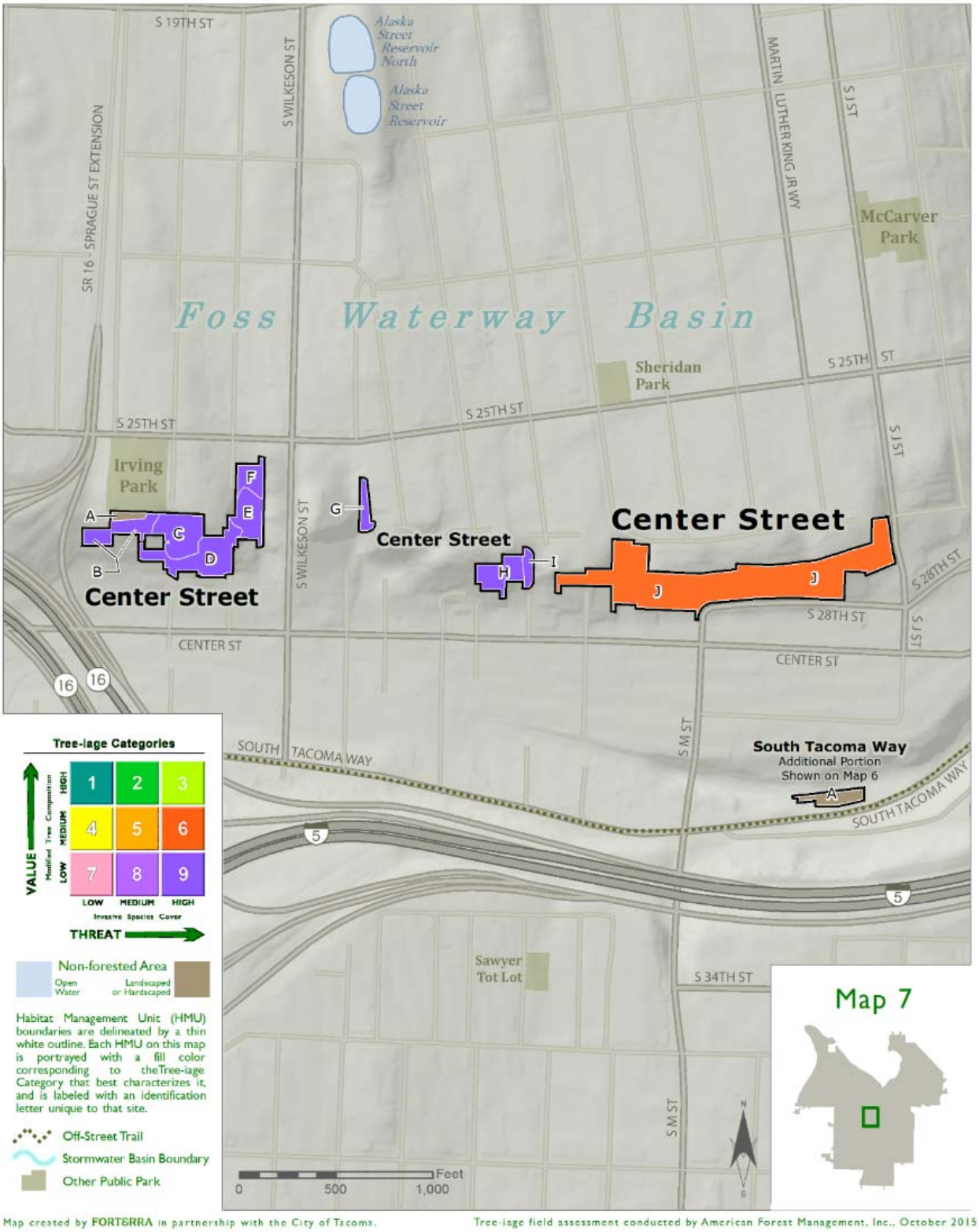


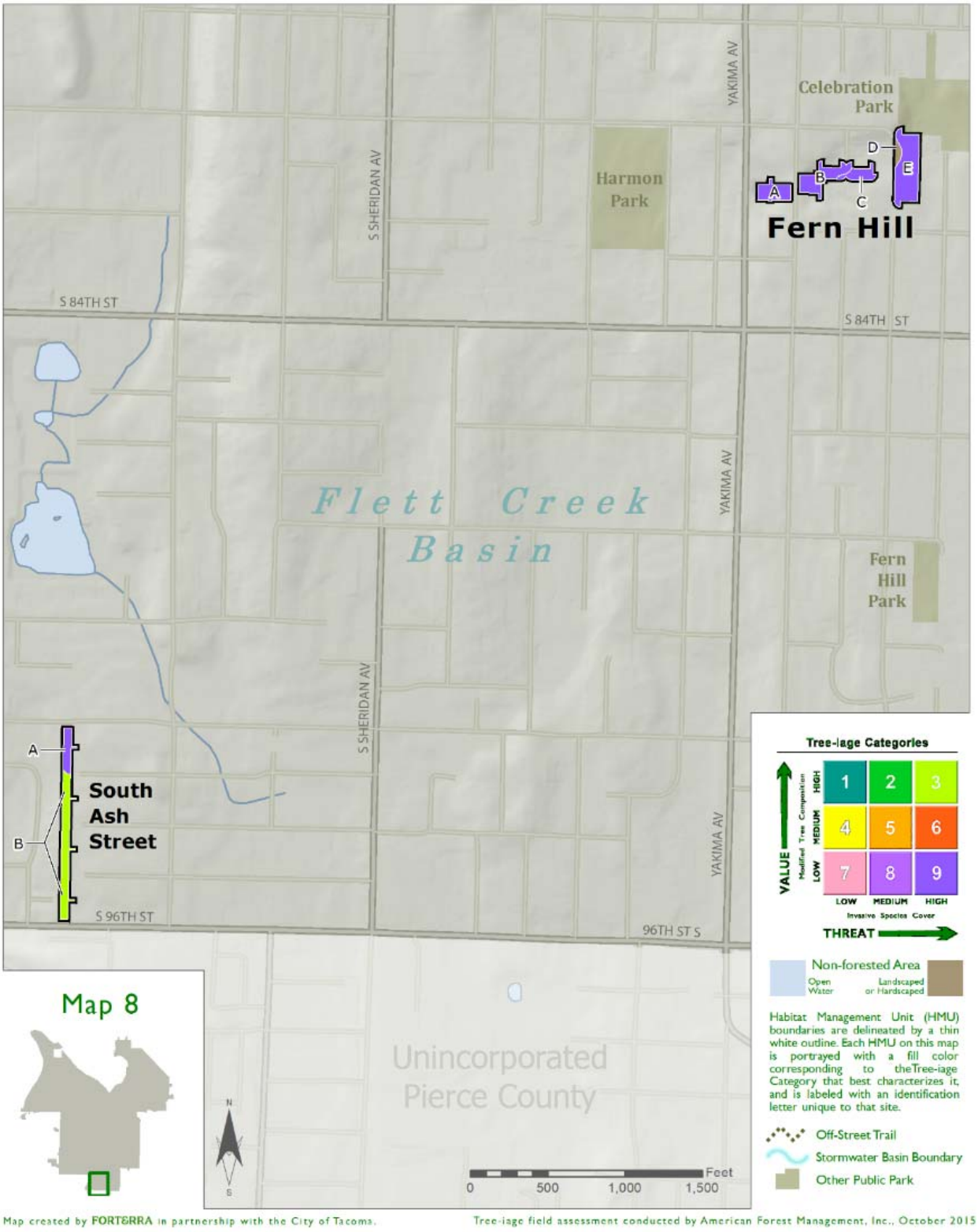
Map created by FORTERRA in partnership with the City of Tacoma.

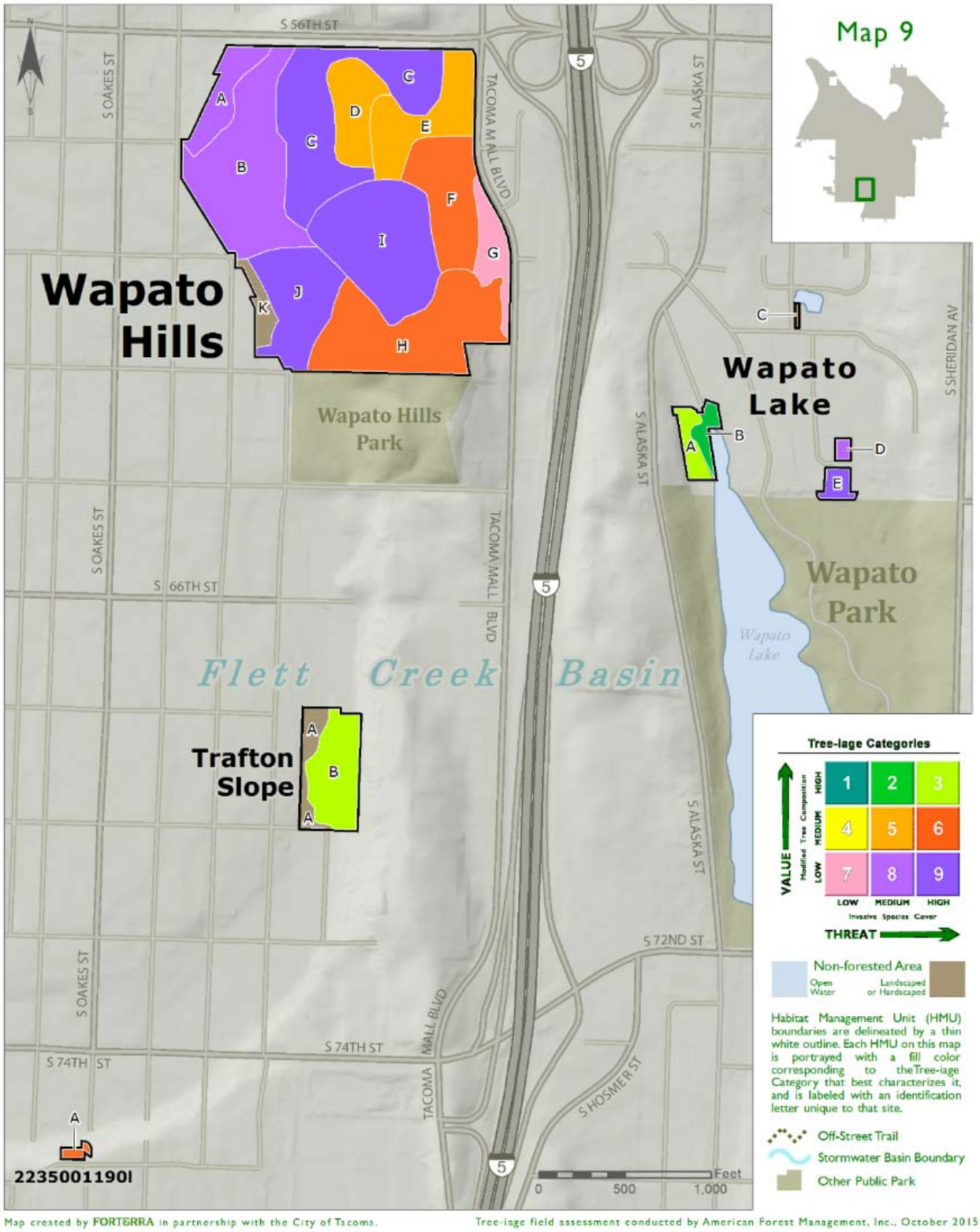
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015

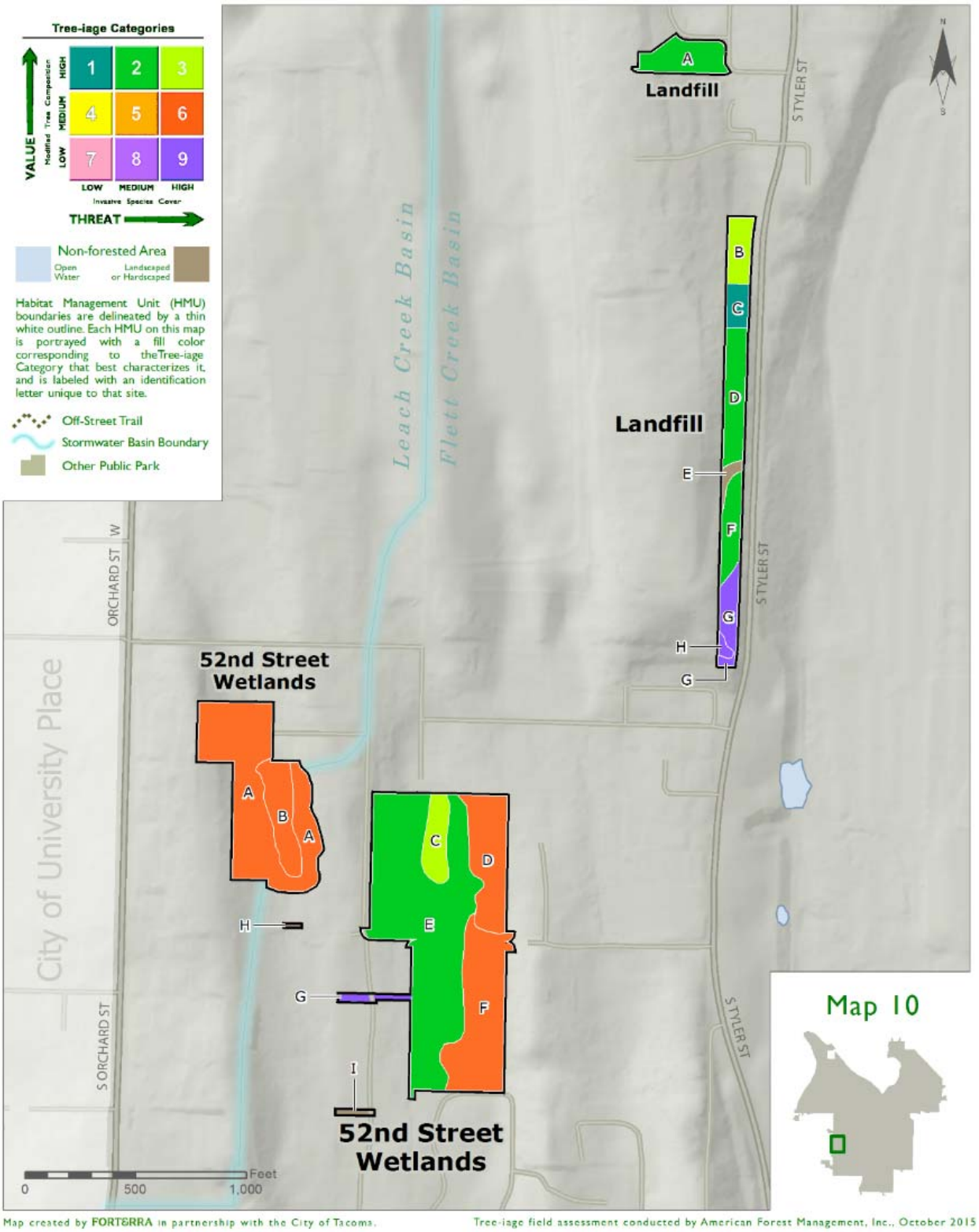

Map 5
First Creek
Additional Portions
Shown on Map 4
Q
E PORTLAND AV
Tree-iage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
1
2
3
4
5
6
7
8
9
LOW
MEDIUM
HIGH
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to theTree-iage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
E 44TH ST
Lower Puyallup Basin
First Creek
Additional Portions
Shown on Map 4
R
S
R
E 48TH ST
T
U
E PORTLAND AV
Swan Creek Park
N
W
S
0
500
1,000
Feet
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015


Dome Slope
A
South Tacoma Way
Additional Portion Shown on Map 7
D
E
B
C
McKinley Park
A
B
C
McKinley
34th Street Gulch
A
B
C
Lincoln-Eldridge Park
Hood Street Reservoir
Lower Puyallup Basin
Foss Waterway
S 25TH ST
S 30TH ST
S 34TH ST
S 38TH ST
S 43RD ST
E 26TH ST
E 34TH ST
E 38TH ST
E 43RD ST
E DIVISION LN
S CST
A ST
E D ST
PACIFIC AV
MCKINLEY AV
TACOMA AV S
S G ST
CENTER ST
S TACOMA WAY
DELIN ST
YAKIMA AV
S THOMPSON AV
WILEY AV
705
5
7
Tree-iage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
1
2
3
4
5
6
7
8
9
LOW
MEDIUM
HIGH
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to theTree-iage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
7470013800
A
N
S
0
500
1,000
1,500
2,000
Feet
Map 6
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015


S 19TH ST
S WILKESON ST
Alaska Street Reservoir North
Alaska Street Reservoir
MARTIN LUTHER KING JR WY
S 1ST
SR 16 - SPRAGUE ST EXTENSION
McCarver Park
Foss Waterway Basin
Sheridan Park
S 25TH ST
Irving Park
A
B
C
D
E
F
G
H
I
J
Center Street
S 28TH ST
CENTER ST
16
SOUTH TACOMA WAY
S M ST
South Tacoma Way
Additional Portion Shown on Map 6
5
Sawyer Tot Lot
S 34TH ST
Tree-lage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
1
2
3
4
5
6
7
8
9
LOW
MEDIUM
HIGH
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to theTree-lage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
Feet
0
500
1,000
N
Map 7
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-lage field assessment conducted by American Forest Management, Inc., October 2015

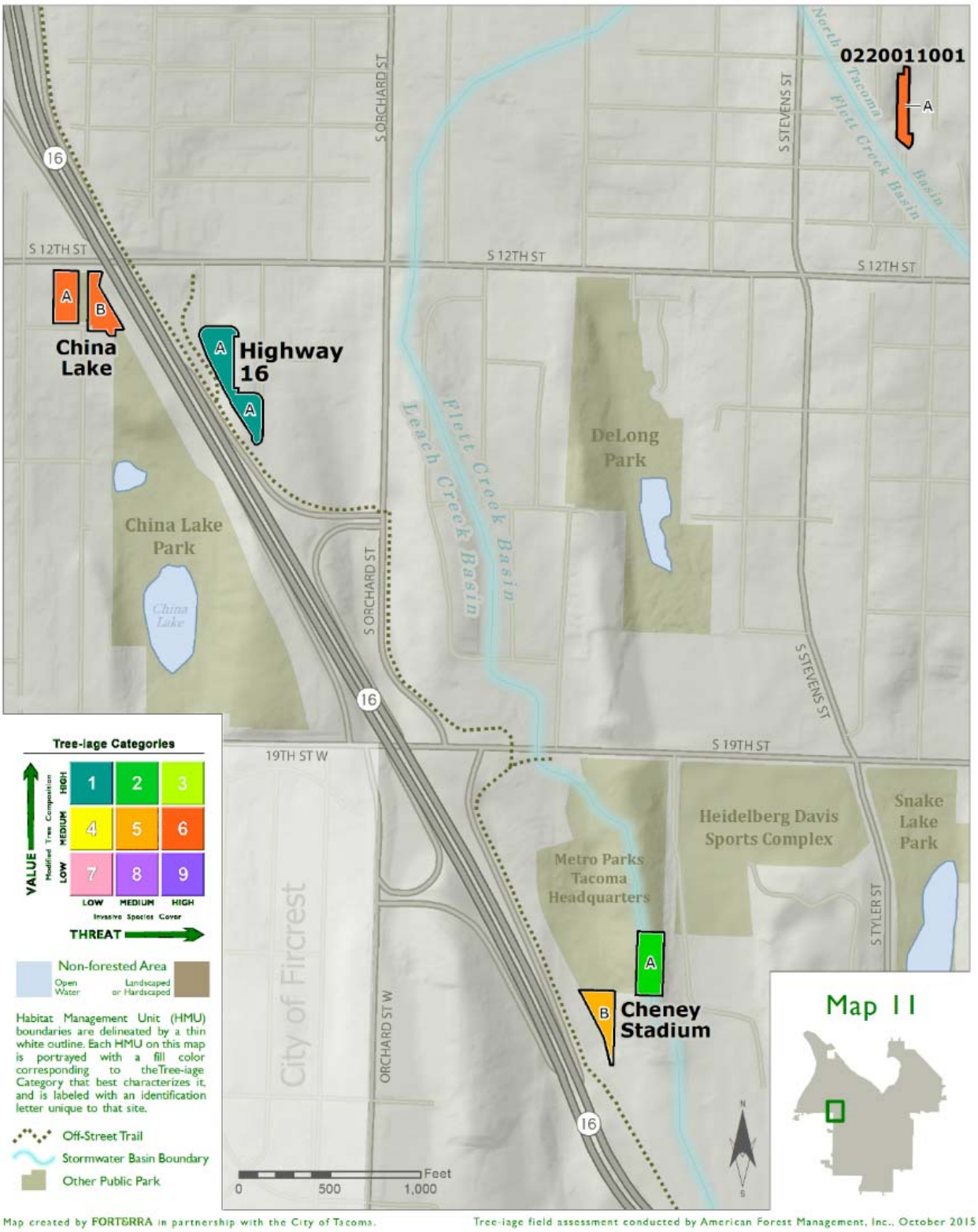

Celebration Park
Harmon Park
Fern Hill
Fern Hill Park
Flett Creek Basin
South Ash Street
S 84TH ST
S 96TH ST
96TH ST S
S SHERIDAN AV
YAKIMA AV
Unincorporated Pierce County
Map 8
Tree-iage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
1
2
3
4
5
6
7
8
9
LOW
MEDIUM
HIGH
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to the Tree-iage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
Feet
0
500
1,000
1,500
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015


Map 9
Wapato Hills
Wapato Hills Park
Wapato Lake
Wapato Park
Flett Creek Basin
Trafton Slope
2235001190I
S 56TH ST
S 66TH ST
S 72ND ST
S 74TH ST
S OAKES ST
S ALASKA ST
S SHERIDAN AV
TACOMA MALL BLVD
S HOSMER ST
Tree-lage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to the Tree-iage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
Feet
0
500
1,000
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015



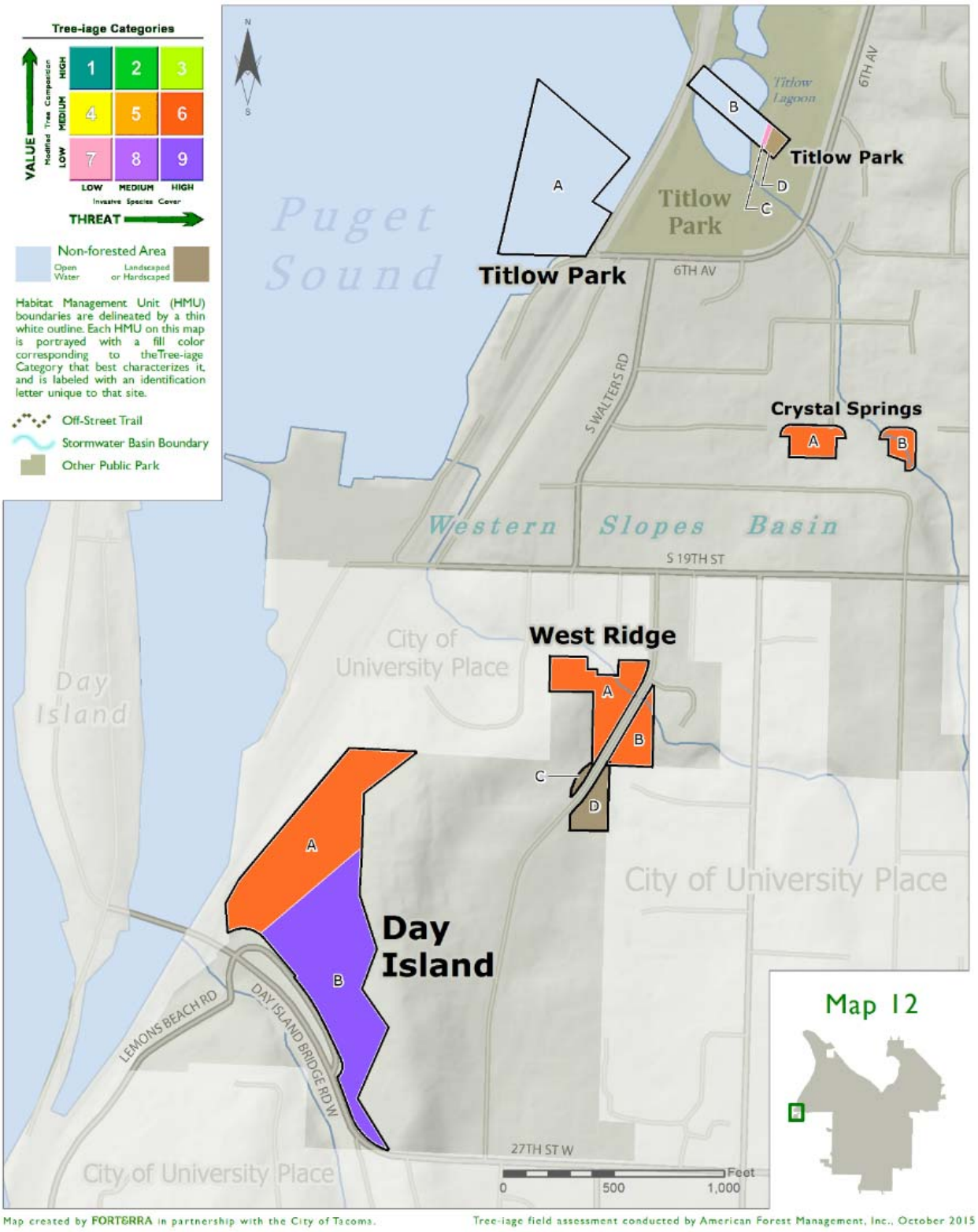
Map created by FORTERRA in partnership with the City of Tacoma.

Tree-iage field assessment conducted by American Forest Management, Inc., October 2015



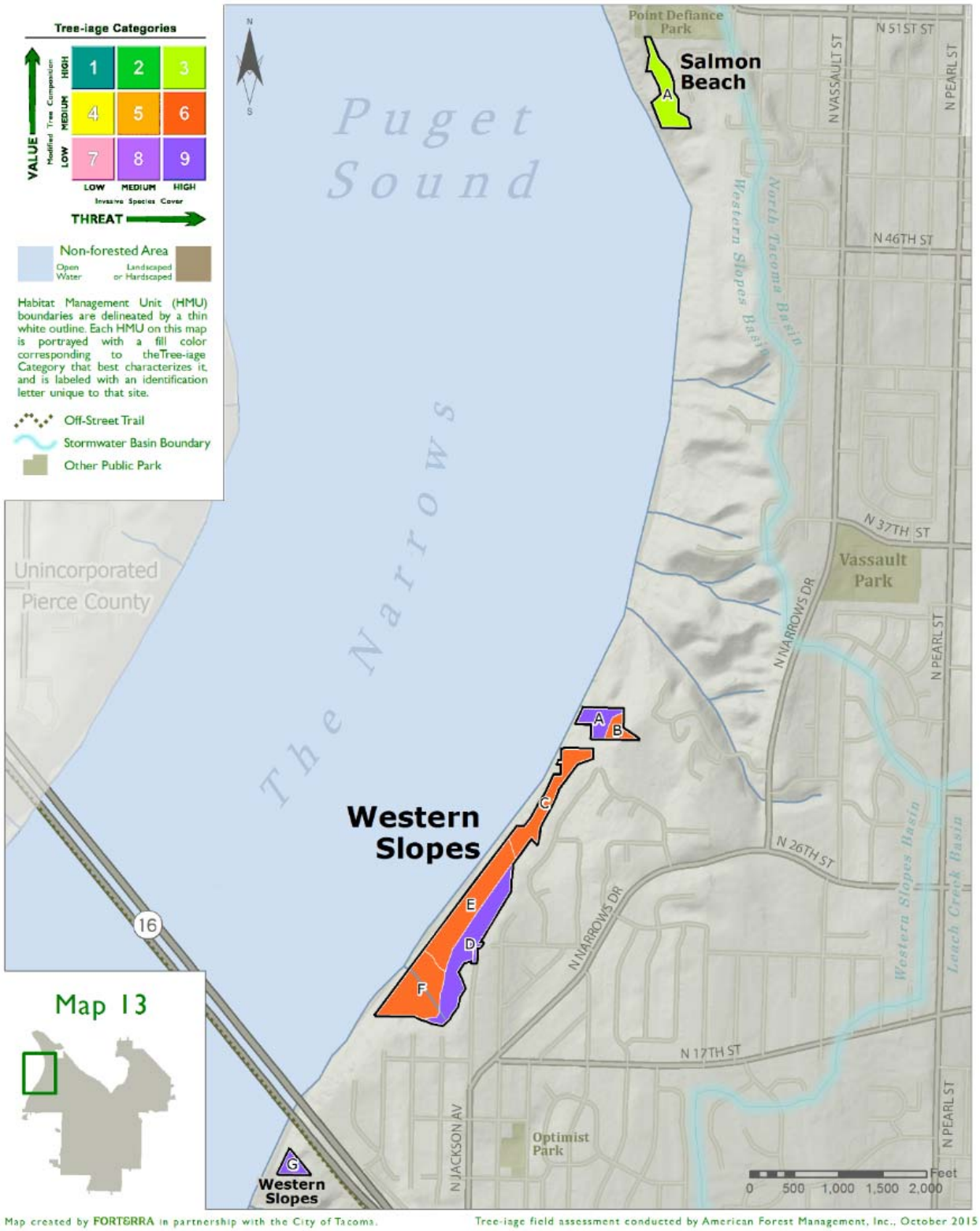
Map created by FORTERRA in partnership with the City of Tacoma.

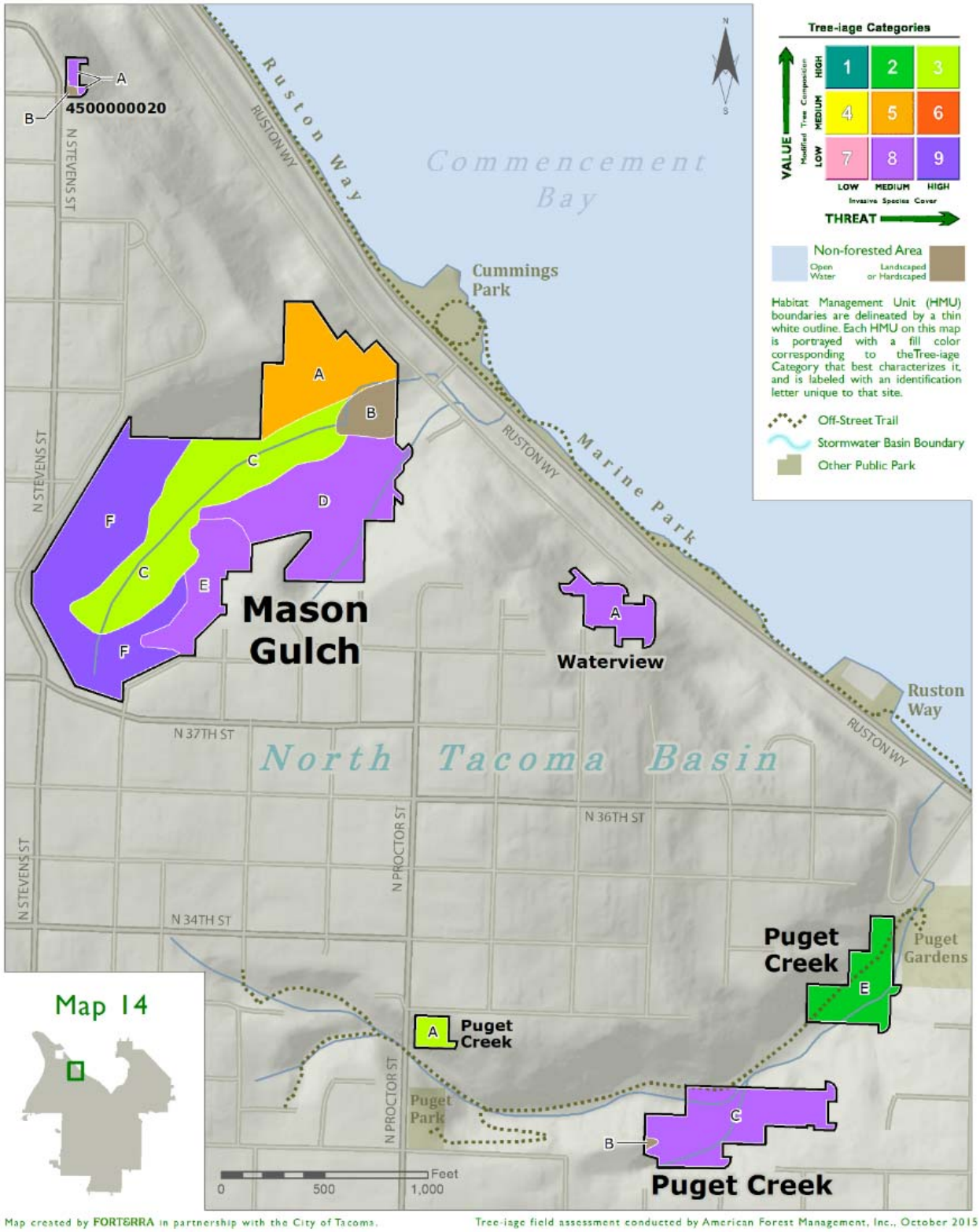
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015

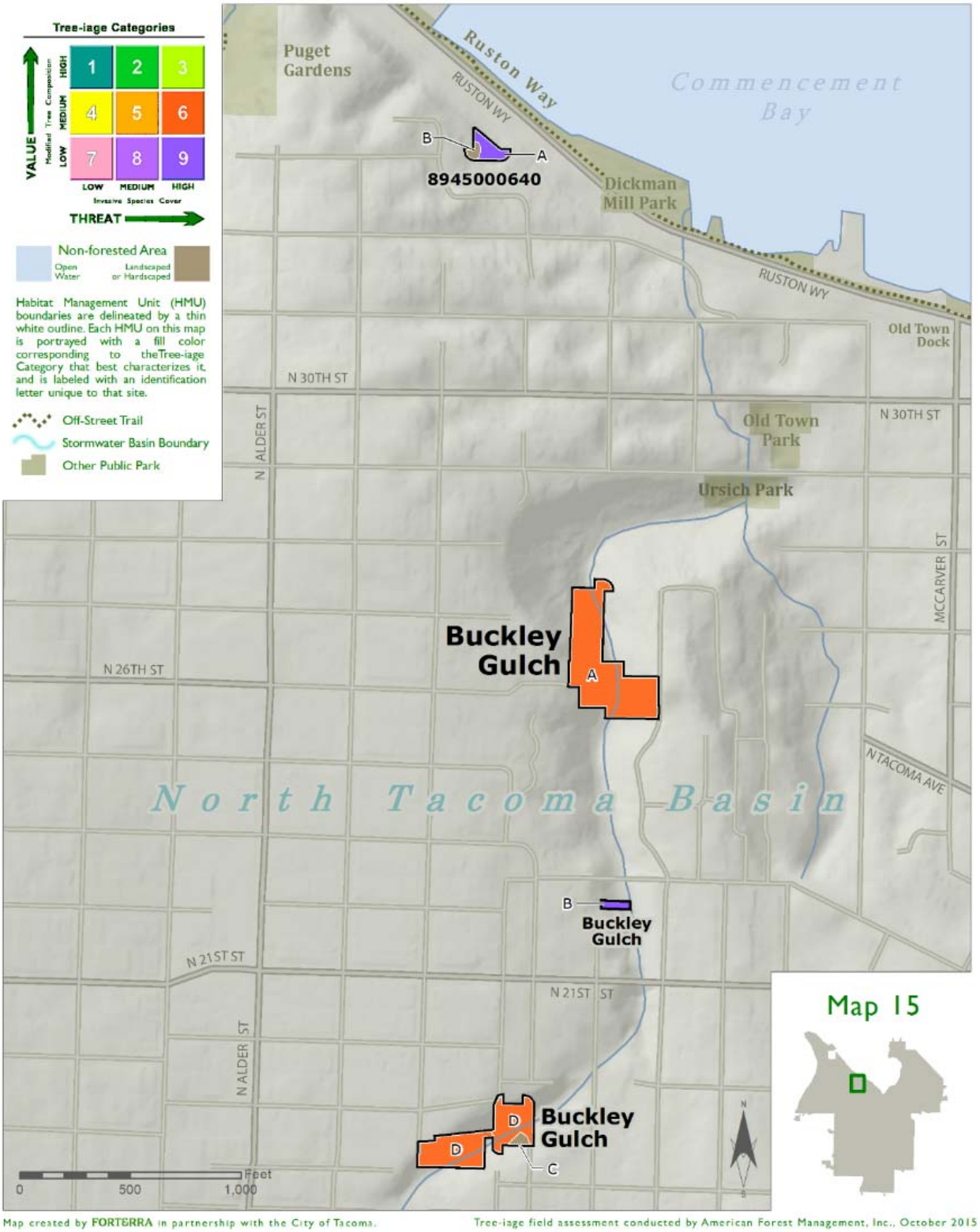


Map created by FORTERRA in partnership with the City of Tacoma.

Tree-iage field assessment conducted by American Forest Management, Inc., October 2015

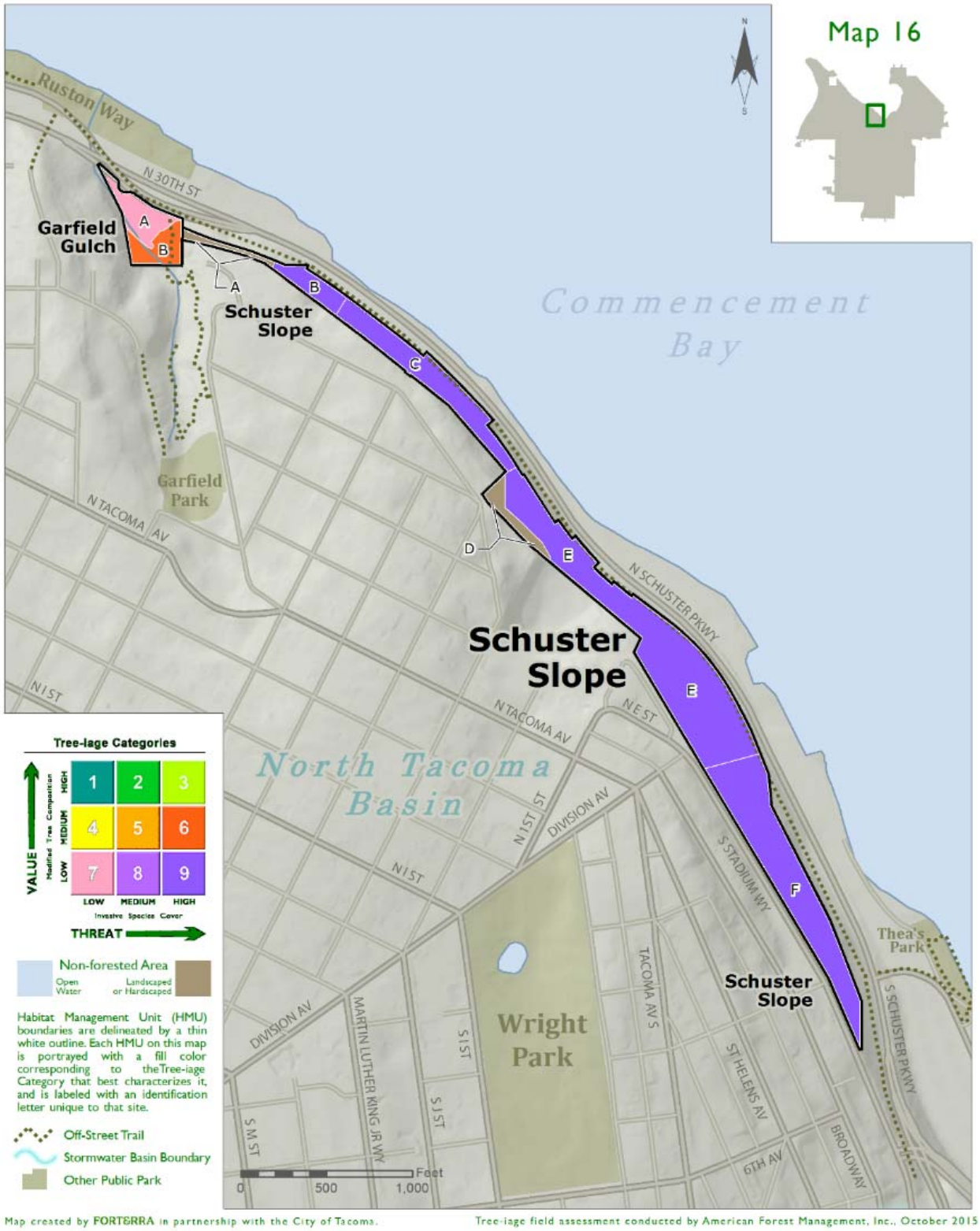

Tree-iage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
1
2
3
4
5
6
7
8
9
LOW
MEDIUM
HIGH
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to the Tree-iage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
Map 13
Puget Sound
The Narrows
Point Defiance Park
Salmon Beach
A
N 51ST ST
N VASSAULT ST
N PEARL ST
Western Slopes Basin
North Tacoma Basin
N 46TH ST
N 37TH ST
Vassault Park
N NARROWS DR
Unincorporated Pierce County
A
B
C
Western Slopes
E
D
F
N 26TH ST
16
Western Slopes Basin
Leach Creek Basin
N 17TH ST
N JACKSON AV
Optimist Park
G
Western Slopes
Feet
0
500
1,000
1,500
2,000
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015


Tree-iage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
1
2
3
4
5
6
7
8
9
LOW
MEDIUM
HIGH
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to the Tree-iage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
4500000020
Ruston Way
Commencement Bay
Cummings Park
Marine Park
Mason Gulch
Waterview
Ruston Way
North Tacoma Basin
Puget Creek
Puget Gardens
Puget Park
N STEVENS ST
N 37TH ST
N 36TH ST
N 34TH ST
N PROCTOR ST
RUSTON WY
Map 14
0
500
1,000
Feet
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015

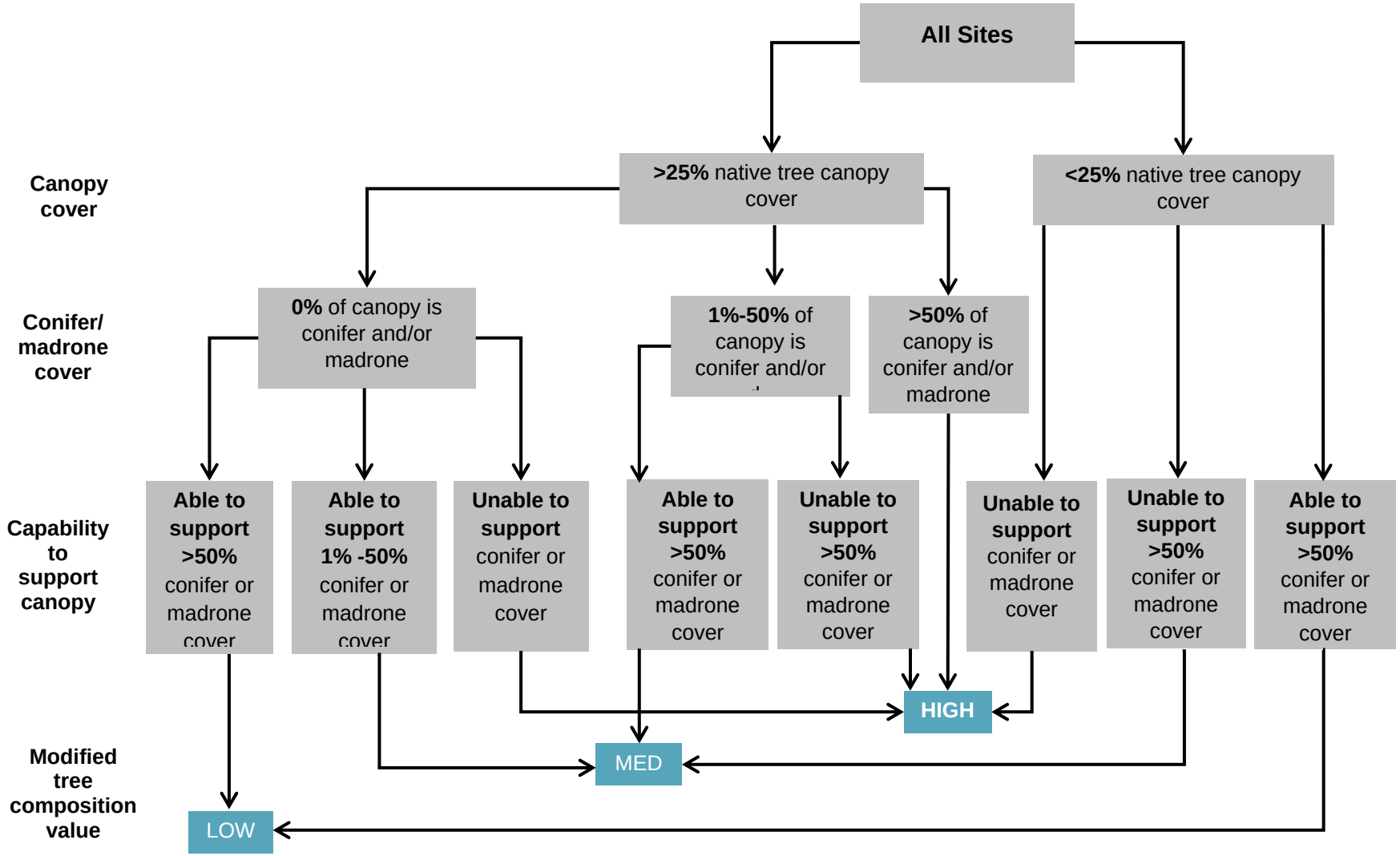


Map created by FORTERRA in partnership with the City of Tacoma.

Tree-iage field assessment conducted by American Forest Management, Inc., October 2015


Map 16
Ruston Way
N 30TH ST
Garfield Gulch
A
B
A
Schuster Slope
B
C
Commencement Bay
Garfield Park
N TACOMA AV
D
E
N SCHUSTER PKWY
Schuster Slope
N 1ST
N TACOMA AV
N E ST
E
North Tacoma Basin
N 1ST ST
DIVISION AV
S STADIUM WY
F
Thea's Park
Schuster Slope
S SCHUSTER PKWY
Wright Park
TACOMA AV S
ST HELENS AV
BROADWAY
6TH AV
S 1ST
MARTIN LUTHER KING JR WY
S 1ST
S 1ST
Feet
0
500
1,000
Tree-lage Categories
VALUE
Modified Tree Composition
HIGH
MEDIUM
LOW
1
2
3
4
5
6
7
8
9
LOW
MEDIUM
HIGH
Invasive Species Cover
THREAT
Non-forested Area
Open Water
Landscaped or Hardscaped
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to theTree-iage Category that best characterizes it, and is labeled with an identification letter unique to that site.
Off-Street Trail
Stormwater Basin Boundary
Other Public Park
Map created by FORTERRA in partnership with the City of Tacoma.
Tree-iage field assessment conducted by American Forest Management, Inc., October 2015

Appendix C: Forest Landscape Assessment Tool (FLAT) Flow Chart for Habitat Composition



Appendix D: Sample Work Log

Event Work Log - Date:

Send/email to:
Green Tacoma Partnership
Forterra
1119 Pacific Ave, Suite 1300
Tacoma, WA 98402
greentacoma@forterra.org

Park/Site Name	
Habitat Steward Lead	
Agency/Agency Contact	
Crew/Crew Lead	

	# Present	Names (if necessary)	Total Hours
Green Tacoma Staff			
Crew			

	# Present		# Present
Adult Volunteers		Youth Volunteers	

__ OTHER (Pre-Phase 1)

Please explain:

__PHASE 1 (Initial invasive removal)

INVASIVE REMOVAL

Total Area Removed (ft.^{2}) _____

□ Blackberry □ Ivy □ Holly □ Cherry laurel □ Herb Robert □ Scot's Broom

□ Other:_____

Invasive Cover Before Removal: 0-5% 6-50% 51-100% After Removal: 0-5% 6-50% 51-100%

Survival Rings Installed: _____

__PHASE 2 (Secondary invasive removal and planting)

INVASIVE REMOVAL
Total Area Removed (ft.^{2}) _____

□ Blackberry □ Ivy □ Holly □ Cherry laurel □ Herb Robert □ Scot's Broom

□ Other:_____

OR: □ None needed

PLANTING

Trees installed: _____ # Shrubs, groundcovers, and other understory plants installed: _____

Stock types used: □ Container □ Bare root □ Live stakes □ B&B □ Plugs

__PHASE 3 (Plant establishment and evaluation)

INVASIVE REMOVAL

Total Area Removed (ft.^{2}) _____

□ Blackberry □ Ivy □ Holly □ Cherry laurel □ Herb Robert □ Scot's Broom

□ Other:_____

OR: □ None needed

PLANT CARE

□ Watering □ Mulching □ Other plant care:_____

__PHASE 4 (Monitoring and maintenance)

INVASIVE REMOVAL

Total Area Removed (ft.^{2}) _____

□ Blackberry □ Ivy □ Holly □ Cherry laurel □ Herb Robert □ Scot's Broom

□ Other:_____

OR: □ None needed

Routing: Received _____ _____ Data Entry _____ _____

(Initials) (mm/dd/yyyy) (Initials) (mm/dd/yyyy)


Tacoma
SURFACEWATER SOLIDWASTE WASTEWATER
ENVIRONMENTAL SERVICES DEPARTMENT