Salmon Beach Slope
Landscape Management Plan
Draft

Environmental Services Department
City of Tacoma

October 3, 2017

Supporting analysis and expertise provided by:

EXECUTIVE SUMMARY

Salmon Beach Slope is a steeply sloped, 3.77-acre passive open space (parcel no# 6724200500) area near the west shore of Puget Sound in Tacoma (hereafter referred to as "Project Area"). Almost all of the Project Area is classified as a Critical Area under the Tacoma Municipal Code's Critical Areas Protection Ordinance (TMC 13.11) due to the presence of steep slopes and Washington State Department of Wildlife (WDFW) designated priority habitat. The Project Area has been identified under City of Tacoma Land Use Regulatory Code as an "Erosion Hazard Area" and a "Landslide Hazard Area". Approximately 90% of the slopes within the Project Areas are in excess of 25%. At the time of this report, there is little evidence of surficial erosion, and no evidence of recent deep-seated slope instability. The dominant tree species in the Project Area are native Big Leaf Maple (*Acer macrophyllum*), Douglas Fir (*Pseudotsuga menziesii*), and Madrone (*Arbutus menziesii*). The decades-long practice of topping the trees on the upper slopes has resulted in tree die-back and disease and consequently establishment of invasive shrub and groundcover species in those areas with no or little tree canopy.

In 2014, the property management authority changed within the City of Tacoma (City) to the Environmental Services Department (ESD). This transfer was accompanied by a utility rate increase that funds the active management of the Project Area as well as other passive open space properties. ESD manages open space properties for the public benefits received when healthy forested areas actively improve stormwater quality and reduce runoff quantity through ecosystem services.

The overall goal of this 20-year Landscape Management Plan (LMP) is to reestablish native vegetation communities whose composition over the long term is sustainable and maximizes ecosystem services. This document is intended to serve as a long-term management plan to secure a minor development permit from the City's Planning and Development Services Department (PDS). This permit will allow ESD and any other party acting in compliance with the permitted LMP to perform restoration work within the Project Area. This LMP will supersede the unpermitted 1995 Parkside View Management Plan.

This LMP divides the project area into six vegetative cover designations that have been prioritized for varying restoration activities and will be implemented as time and resources allow. ESD's six specific landscape management goals for the Project Area are discussed in this report as follows:

- Achieving a sustainable target ecosystem
- Maintaining slope stability and decreasing erosion
- Maximizing stormwater benefits
- Improving wildlife habitat
- Working to protect public infrastructure and public safety
- Vegetation Modification Requests for Private View Management

These goals will be achieved by developing a forest composition that improves age diversity, species diversity, and overall forest health. For each management goal, both objectives and performance measures are presented. Restoration materials, methods, Best Management Practices (BMPs), maintenance, monitoring and adaptive management, phasing, plant selection and installation, timelines and methods for plant pruning and specifications for planting are included as appendices.

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1. INTRODUCTION

KPG, a multi-disciplinary engineering, architecture and landscape architecture firm, prepared this draft Landscape Management Plan (LMP) to assist the City of Tacoma Environmental Services Department (ESD) with management of trees and vegetation in the Salmon Beach Slope Project Area, providing project management, arborist and survey support to the LMP. Grette Associates, an environmental consulting firm, provided ecological expertise to the project, and GeoDesign, a geotechnical firm, provided expertise to this plan related to steep slopes and landslide and erosion hazards. This LMP was prepared similarly to earlier plans for the management of steep slopes along Schuster Slope (2015) and in Mason Gulch (2016).

The Project Area is a 3.77 acre open space area under City of Tacoma (City) ESD ownership and management, located between Point Defiance Park and the Tacoma Narrow's Bridge in Tacoma, Washington (Exhibits 1,2 and 3). The City-owned property lies adjacent to private residences to the east; a parking lot used by Salmon Beach residents to the west; a paved access road (Salmon Beach Road) to the parking lot on the north; and vegetated sloped areas to the south (Exhibit 3). This Salmon Beach Slope LMP was developed in collaboration between the City's ESD, KPG, Grette Associates, and GeoDesign. Public outreach was completed through a series of advertised public meetings where information about the LMP was presented and the public was given an opportunity to comment. The LMP's purpose is to: propose actions and provide direction based on best available science, comply with current regulations and code, replace the 1995 Parkside View Management Plan (PVMP), and provide a transparent process for stewardship of the Project Area to address these management elements:

- Achieving a sustainable target ecosystem and overall forest health
- Geologic hazard mitigation, maintaining slope stability and decreasing erosion
- Maximizing stormwater benefits
- Improving wildlife habitat
- Working to protect public infrastructure and public safety
- Vegetation Modification Requests for Private View Management

Because approximately 90% of the Project Area consists of slopes in excess of 25% and is therefore classified as a steep slope and critical area, any work that is proposed within the Project Area, including vegetation removal or planting, will require a critical area permit.

The LMP should be updated regularly to incorporate lessons learned from implementation, evolving best management practices and new science and industry standards and environmental regulations. This plan should be viewed as a dynamic document to be updated as needed, with an in-depth analysis and re-evaluation around year ten (2027).

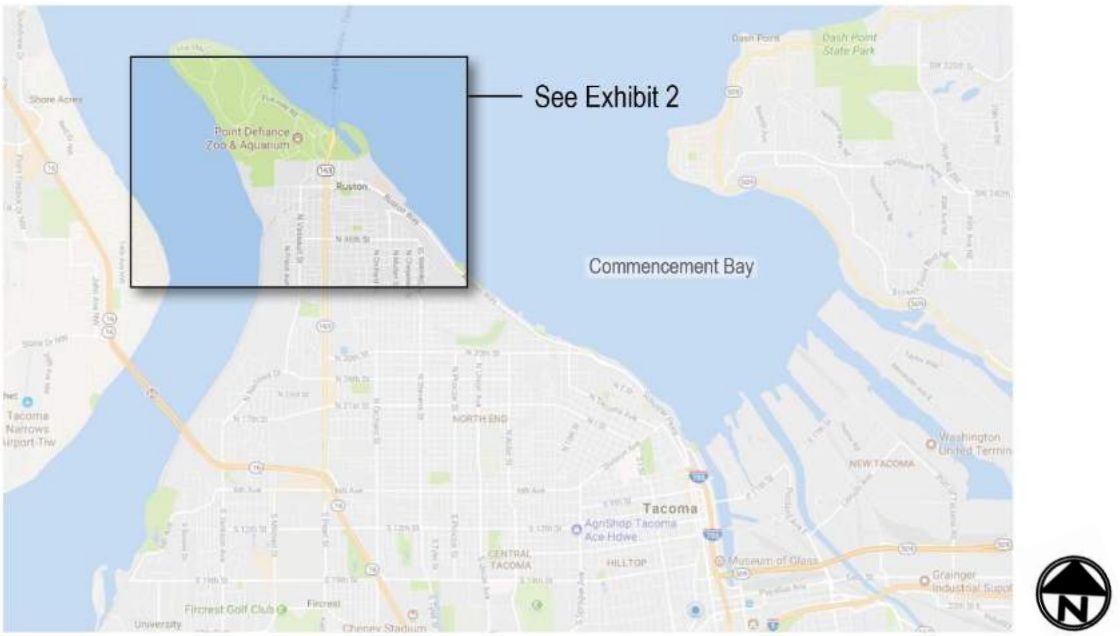

Exhibit 1. Vicinity Map

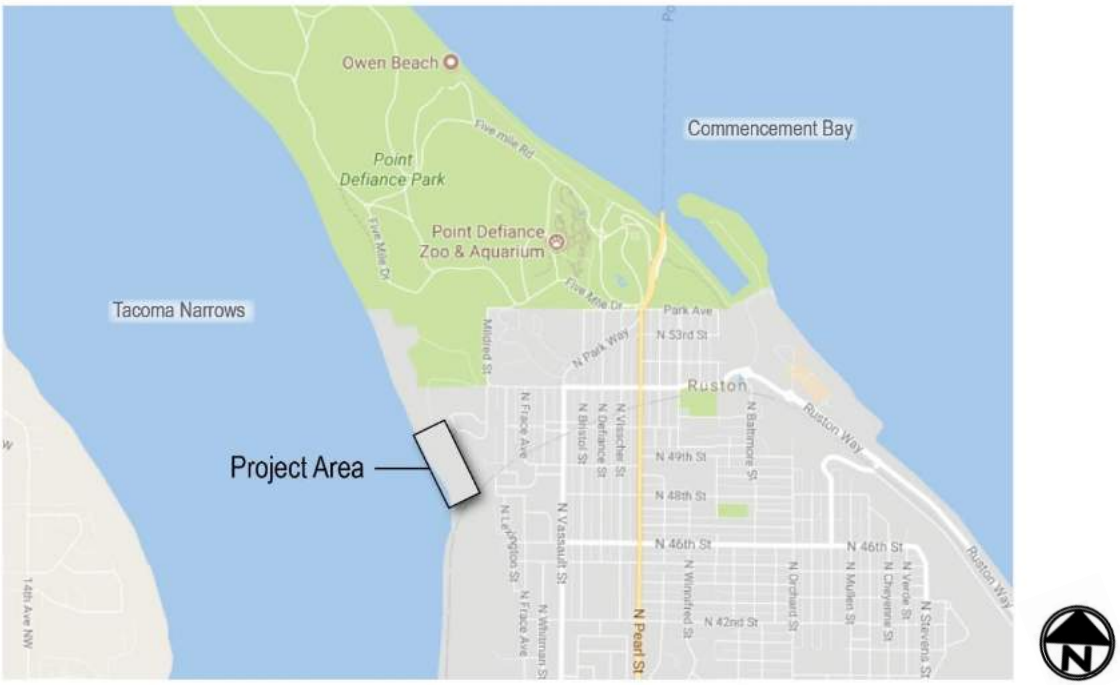

Exhibit 2. Project Area – Approximate Location

Exhibit 3. Project Area Map

2. PROJECT AREA HISTORY

Throughout geologic history, the Puget Sound basin was covered several times by the Cordilleran Ice Sheet that advanced south from what is now Canada. Specific periods in between these glaciations had a climate similar to what we have now. During the most recent glaciation (the Vashon glaciation) the ice over Tacoma was about 2,000 feet thick. As the ice sheet retreated about 12,000 years ago, the north trending deep valleys and steep sided upland areas, which were carved and deposited during the many episodes of glaciation, became exposed.

Salmon Beach Slope along the west edge of the Defiance Drift Plain exists with a general south to north alignment. The Project Area is located on the upper portion of the slope above the Salmon Beach Community and extends from the residential houses (Parkside Development) along the top of the slope down to the mid-slope bench. Within the Project Area, elevations along the top of the slope vary between elevation 210 and 216 feet above sea level. At the bottom of the slope, elevations are approximately elevation 144 – a difference of about 66 vertical feet. The Project Area is bordered by private residences to the east accessed by North Scenic View Lane; a parking lot used by Salmon-Beach residents to the west; a paved access road to the parking lot on the north; and vegetated sloped areas to the south. Steep slopes generally exist throughout the site. The slope undulates in the southern portion of the Project Area, and defined drainages separated by ridges make their way up the slope.

The upland portions of the Project Area historically contained what is known as a North Pacific Dry Douglas Fir Forest and Woodland (WDNR 2015). Late seral stands of this forest type contain an overstory canopy dominated by Douglas Fir, with Madrone and Grand Fir as codominant species. More information on this ecosystem type is presented in Section 4.1.1, Achieving a Target Ecosystem.

As Tacoma settled, established, and urbanized, the once natural state of Salmon Beach Slope was altered by development. The top of the ridge was developed into single-family homes in the early 1980's. In subsequent years, trees on the mid-to-upper reaches of the slope were topped and/or removed to maintain views from the homes to the Tacoma Narrows and Puget Sound. The Parkside neighborhood, commissioned the Parkside View Management Plan (PVMP) in 1995. Since then, a series of tree pruning activities have taken place at roughly 5-year intervals. The PVMP's stated purpose was to provide for, "existing views through selective pruning and tree removal".

Though the PVMP cites the American National Standards Institute (ANSI) A300, "Tree, Shrub and Other Woody Plant Management" as the guiding technical guide for pruning the trees within the Project Area, observations show that many trees, including Madrones, Douglas Firs and Big-Leaf Maples have been "topped" in order to limit tree growth from extending into the views of the Parkside residents. A January 2017 memorandum produced by Tree Solutions, an arboriculture consultant firm, documents on-site observations and states that most trees had been topped over the course of the last twenty years (Appendix I). Those actions had not spurred new, lower growth, but had instead led to the decline and death of many trees in the

Project Area, especially the stand of Madrone in the north-central portion of the Project Area. Also, debris from previous pruning activities appeared not to have been removed from the project area, resulting in areas of considerable slash material.

3. EXISTING CONDITIONS

3.1 GEOLOGY AND SLOPE STABILITY

Geology and slope stability of the Project Area was evaluated based on a review of existing geologic maps, aerial imagery, Light Detection and Ranging (LiDAR) imagery, and several reconnaissance visits to the Project Area to observe the existing conditions.

The Project Area is in the southern portion of the Puget Lowland, which is a structural and topographic trough bounded by the Cascade Mountains to the east and the Olympic Mountains to the west. The trough is filled with a complex sequence of unconsolidated sediments deposited during the Pleistocene (approximately 2 million to 12,000 years ago). These sediments were deposited by non-glacial and glacial processes associate with several episodes of continental glacial incursions into the area. The last episode of continental glaciation, known as the Vashon Stade of the Fraser Glaciation, receded from the area about 13,500 years ago. The ice sheet during the Vashon Stade is estimated to have been over about 2,000 feet thick in the Tacoma area (Booth, 1987).

The topography and surficial geology of the area is a product of the multiple cycles of glacial scouring and deposition, tectonic activity, landsliding, stream/beach erosion and deposition, and human activity. Glacial scouring and deposition has resulted in a prominent pattern of north trending upland drift plains with over steeped side slopes and deep valleys throughout the Puget Lowland. The upland drift plains have been impacted and modified by recessional meltwaters that cut stream channels into them, and the steep slopes on the edges have been impacted by landsliding, stream, river, and wave erosion.

3.1.1 GEOLOGY

Throughout the Project Area the ground surface is typically mantled with a heterogeneous layer of loose colluvium. Colluvium develops on sloped surfaces through the weathering and loosening of soils higher up the slope that is then gravity emplaced through soil creep and sloughing. The material is similar in composition to the underlying native material, which is typically silty sand and gravel, but also contains organic matter debris and roots and is loose and unconsolidated (Exhibit 4).

Beneath the colluvium, the surface geology of the Project Area is dominated by glacial deposits consisting of glacial till in the upland area at the top of the slope and advance outwash on the slope within the project area (Booth, 2016). These materials were deposited during the late Pleistocene (approximately 18,000 to 13,000 years ago) Vashon Stade of the Fraser Glaciation.

Glacial till consists of a very dense, heterogeneous mixture of silt, sand, gravel, cobbles, and boulders that was deposited and compacted at the base of the advancing ice sheet. It typically consists of sandy silty to silty sand with gravel, cobbles, and boulders. It is locally referred to as “hardpan”. It is very dense and characterized by high strength and low permeability.

The Advance Outwash consists of dense to very dense sand and gravel that was deposited by meltwater streams as the Vashon-age ice sheet advanced. It was consolidated by the over-riding Vashon glacial ice sheet, but, due to its gradation, it is typically permeable.

Underlying the glacial till and advance outwash deposits are older Pleistocene, Olympia and Pre-Olympia age glacial and inter-glacial deposits. The deposits include very hard fine grain lacustrine and coarse grain fluvial deposits that have been glacially overridden. These deposits are along the very steep lower slope below the Project Area. The fine grain lacustrine deposits (hard silt and clay) have a significantly lower permeability than the overlying glacial outwash material causing groundwater to become perched above the contact. The mid slope terrace, such as the one in the parking area, is situated where the slope inclination changes significantly and are commonly formed above the contact as a result of large landslides in the overlying glacial outwash or drift materials.

Our field observations of the soils exposed within the project area are consistent with the mapped geology.

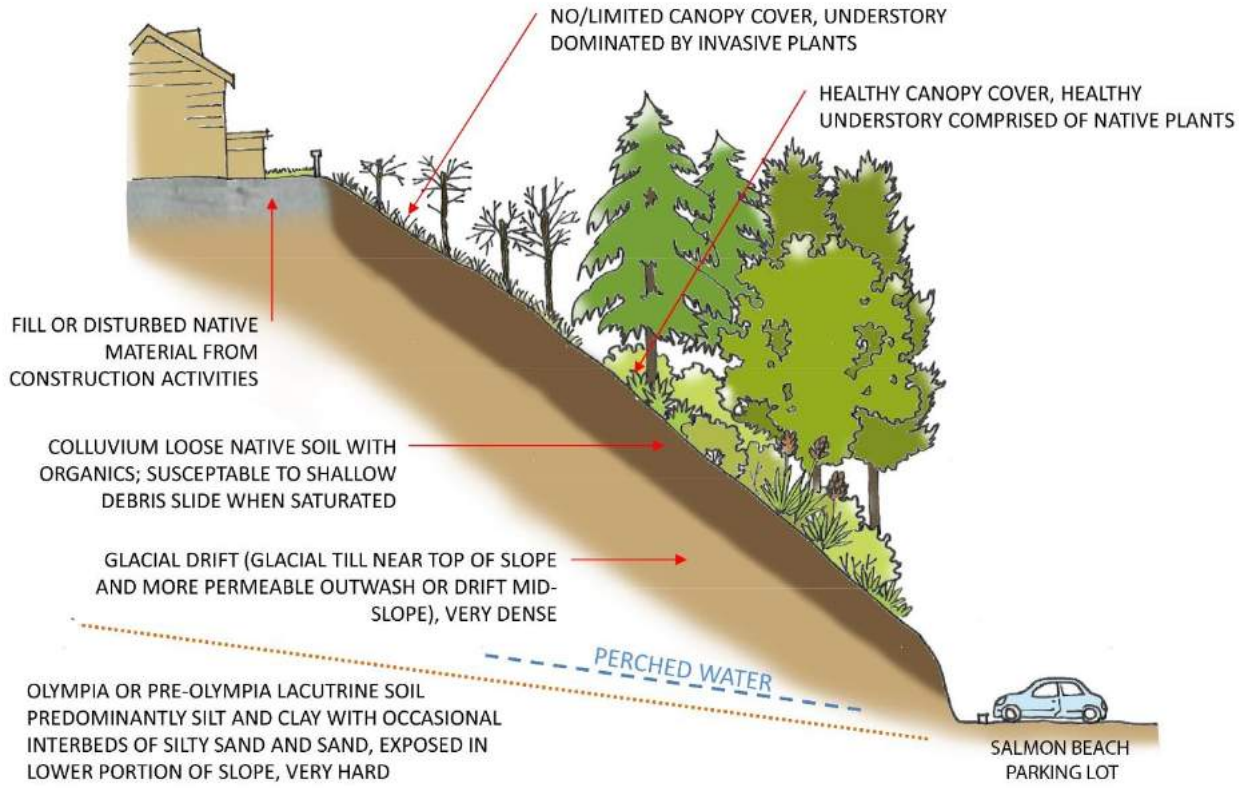

Exhibit 4. Slope Conditions Diagram

3.1.2 SLOPE STABILITY

We reviewed the Light Detection and Ranging (LiDAR) imagery for the area to evaluate the topography and performed a site reconnaissance to observe the existing conditions. LiDAR-based imagery has the ability to look through the vegetation to provide an accurate image of the earth's topographic surface or soil surface. This imagery allowed us to identify topographic features indicative of landslides, fill embankments, cut slopes, and other geomorphic structures. The LiDAR image for the Project Area is shown in Appendix J.

Slopes within the Project Area were classified based on the percent slope into the following categories: less than 25% (0.38 acres), 25% to 50% (2.29 acres), 50% to 67% (0.81 acres), and greater than 67% (0.28 acres; see Appendix B). Approximately 90% of the total Project Area consists of slopes in excess of 25%. The percent slope classifications were selected based on:

- **Applicability of erosion control measures:** The degree of slope inclination is one of the factors that should be considered when selecting temporary erosion control products/methods in areas where landscape management activities will be performed.
- **Invasive vegetation removal methods/treatment:** Slope steepness will dictate treatment methods and best management practices for invasive removal - may require herbicide use vs. physical removal.
- **Accessibility of the slope areas for work:** Identifying the slope inclination should be considered when planning revegetation activities.
- **Slope stability:** Slope inclination in addition to soil and groundwater conditions impacts stability and should also be considered in planning activities associated with vegetation management.

Topographic features indicative of recent large landslides were not evident in the LiDAR imagery. During our reconnaissance we did not observe evidence of recent landslide activity but did note a few locations where minor surficial erosion was evident as indicated on the LiDAR Map (Appendix K).

The Project Area is within the undeveloped green belt area located on the western slope of the Defiance Drift Plain in north Tacoma. The western slope of the drift plain in this area is about 200 feet in height and is a complex slope that includes a very steep concave lower segment, a mid-slope bench or terrace above which the upper slope is also concave but less inclined than the lower portion of the slope.

The Project Area is generally confined to the upper half of the slope above the terrace and does not include the steeper lower half that extends from Salmon Beach up to the parking area and Salmon Beach Road. The Project Area is fairly densely vegetated, however, historical cutting has impacted most of the trees within the upper half of the Project Area.

The lower half of the slope is outside (below) the Project Area and is generally very steep with gradients up to about 100 percent. Numerous concave shaped drainages are developed in the lower slope and are visible in the LiDAR imagery (Appendix K). These steep drainages are susceptible to episodic shallow debris flows within the colluvium material.

The Project Area on the upper half of the slope extends from Salmon Beach Road and the South Salmon Beach parking area up to the residential houses located west of North Scenic View Lane at the top of the slope.

The vertical height of the slope from the parking area up to the eastern edge of the green belt area is about 80 feet. A six foot high chain link fence separates the project area from the adjacent private properties. Short rockeries are present behind and uphill of the fence on several of the properties.

The topography in the upper half of the slope consists of a series of deep scalloped drainages separated by narrow topographic ridges (Appendix J). These features are likely the result of historic large earth slump type landslides following deglaciation. Evidence of recent deep seated activity was not observed.

The ground surface throughout the area is sloped to the west at inclinations up to about 80%, (see Appendix B). Short sections of slopes steeper than 80% are present along the east side of the parking area at the base of the slope and along the east side of Salmon Beach Road. These slopes were created by excavation cuts to establish the road and parking area. The short vertical cut slope sections that are present along the east side of Salmon Beach Road are typically less than about 4 feet in height. Along the east edge of the parking area the cut slopes are up to about 10 feet in height and at inclinations of 80% to 100%.

During our reconnaissance we did not observe evidence of deep-seated or shallow slope instability or landslides within the Project Area. The few larger diameter trees on the slope did not show significant signs of leaning or “pistol butting”, which is indicative of soil creep and surficial instability. Evidence of surficial erosion was observed in a narrow area on the upper portion of the slope in the southern part of the project area. At this location it appears that surficial erosion is occurring as a result of uncontrolled storm water drainage. This area is identified on Appendix K. This location is downhill of a pump station structure and storm drain catch basin located on the paved access driveway between the properties addressed 4914 and 4908 N Scenic View Lane. It appears that storm water is overflowing the curb at the bottom of the driveway and flows over a short rockery and down the slope. Concentrated flow from this area has resulted in a narrow zone of surficial erosion that extends midway down the slope. Repairs to the curb at the top of the slope have been made in August 2017. The area should be periodically monitored to determine efficacy of the repairs in limiting down-slope erosion. Short sections of black HDPE corrugated drainage pipes in poor condition were observed at a few isolated locations elsewhere within the Project Area near the top of the slope, but evidence of erosion associated with these pipes was not observed.

Overall the slopes within the Project Area appear stable with regards to deep seated instability. Deep seated instability refers to critical failure surfaces, with a rotational failure mechanism, that are typically arcuate in shape, extend several feet below the ground surface, and impact large areas. During our reconnaissance, we did not observe signs of significant erosion or groundwater seepage along the Project Area slopes.

The steep slopes within and below the Project Area are susceptible to shallow debris flows that typically occur within the loose colluvium material that mantles the ground surface. These types of failures are episodic and very difficult to predict. Areas susceptible to these shallow failures are typically the shallow drainage swales that have developed at isolated locations within the Project Area and the very steep drainages that are prevalent on the lower half of the slope below the Project Area. Evidence of recent shallow failures within the Project Area was not observed.

3.2 VEGETATION

Forest health is evaluated by considering forest age, structure, composition, function, presence of unusual levels of disease and pests, and resilience to disturbance based on historic land management. Although mature native trees are present in the Project Area, the overall forest health is considered moderate in regards to its structure, status, lack of species diversity (both in age and class), and ability to provide stormwater benefit. As well, vegetation in multiple areas within the Project Area appear afflicted with illness, invasive species dominate the top of the slope, and heavy pruning and topping has compromised the health of some of the mature trees within the Project Area. There are also areas within the Project Area that have a healthy amount of native vegetation; however, the vegetation is either immature or consists largely of shrubs.

Vegetation conditions vary throughout the project area in terms of species composition and stand health. The upper elevations consist largely of invasive species, predominantly Himalayan Blackberry, while the lower elevations contain mostly native species. The understory shrub layer is dense in most areas, and predominantly native in the lower elevations. Observed vegetative conditions on the slopes include:

- Invasive species
- Damaged trees and shrubs (improper pruning/topping, herbicide use)
- Tree and shrub disease
- Lack of native species diversity
- Lack of evergreen species
- Lack of successional progress
- Diminished soil binding root mass

In the City's Strategic 20-Year Passive Open Space Plan (2017), which used the Forest Landscape Assessment Tool (FLAT) as developed by American Forest Management (AFM), ranked the Project Area as a "3". This rank means it has high ecological value with regard to its overall tree composition but also high population invasive plants. It is important to preserve and improve this high ecological value as the LMP is implemented.

3.2.1 Native Species

The existing native vegetation within the Project Area is remnant of the target ecosystem. The tree canopy within the Project Area is dominated by mature Big Leaf Maple (*Acer macrophyllum*) and Douglas Fir (*Pseudotsuga menziesii*), with Madrone (*Arbutus menziesii*) dominating in stands over a few specific areas on the slope. Less dominant native tree species

present within the Project Area include Western Hemlock (*Tsuga heterophylla*), Pacific Dogwood (*Cornus nuttallii*), Western Redcedar (*Thuja plicata*) and Red Alder (*Alnus rubra*). Dominant native understory species include Salal (*Gaultheria shallon*), Beaked Hazelnut (*Corylus cornuta*), Oceanspray (*Holodiscus discolor*), Rose species (*Rosa* spp.), Willow species (*Salix* spp.) and Sword Fern (*Polystichum munitum*). Native understory is particularly dense in the lower elevations of the Project Area.

Most of the native trees within the Project Area exhibit some degree of delimbing or topping. Many exhibit a multi-stemmed growth habit or dense canopy structure typical of being inappropriately topped or delimbed. This cutting weakens the tree and reduces its lifespan, altering the natural health, growth pattern and succession of the forest. As the tree canopy is opened up or as trees die prematurely, the gaps in the tree cover allow nonnative and invasive vegetation to colonize and outcompete native vegetation, which reduces the ability of the slope to naturally manage rainfall and stormwater runoff.

Further down the slope, where topping and limbing is limited or has not occurred, the understory vegetation more resembles a native forest with dense Salal (*Gaultheria shallon*), Evergreen Huckleberry (*Vaccinium ovatum*) and Bracken Fern (*Pteridium aquilinum*). In less dense understory areas, Sword Fern (*Polystichum munitum*) and Dull Oregon Grape (*Berberis nervosa*) are present.

3.2.2 Invasive Species

Himalayan Blackberry (*Rubus armeniacus*) is the most commonly occurring invasive species within the Project Area, and dominates the upper slopes. The thick and aggressive growth of Himalayan Blackberry on the upper slopes prevents the establishment of native species, and in many locations this species is spreading to adjacent native understory areas. English Holly, Morning Glory, English Ivy and Scotch Broom were also noted in the Project Area. Scotch Broom was found sparsely throughout the Project Area in open canopy areas and sparse aggregations of Morning Glory and English Ivy were noted, primarily in the upper elevations of the Project Area next to private residences.

As defined by the Pierce County Noxious Weed Control Board, a noxious weed is an invasive plant that when established is highly destructive, competitive, or difficult to control by cultural or chemical practices.

Exhibit 5. Himalayan Blackberry Growing at the Top of the West Slope

Invasive species observed within the Project Area include, but are not limited to:

- Scotch Broom (*Cytisus scoparius*) – Class B State Noxious Weed
- Himalayan Blackberry (*Rubus armeniacus*) – Class C State Noxious Weed
- English Ivy (*Hedera helix*) – Class C State Noxious Weed
- Reed Canarygrass (*Phalaris arundinacea*) - Class C State Noxious Weed
- English Holly (*Ilex aquifolium*) - Monitor list.
- Field Bindweed (*Convolvulus arvensis*, a.k.a. Morning Glory) – Class C State Noxious Weed
- Herb-Robert (*Geranium robertianum*) – Class B State Noxious Weed

3.2.3 Trees

Management Practices

The trees along or below the slope crest, and within certain view corridors, have been routinely cut or topped to create and maintain views from private residences at the top of the hill. Topping, although previous performed under the 1995 PVMP, is no longer an acceptable practice for reputable arborists, and the practice is not allowed in critical areas per Tacoma Municipal Code 13.11.

Exhibit 6. Topped Douglas Fir near the Top of the Project Area.

The topping has primarily been observed in Douglas Fir trees, which

has resulted in abnormal weak growth, pathways for decay and produced dense crowns with multiple leaders. In addition, large areas of Madrone trees are experiencing significant crown dieback due to mismanagement and disease, particularly on the southwest slope of the Project Area. The reduced canopy coverage has enabled invasive species to take hold and crowd out the native understory, particularly along the top of the slope.

There are some areas of the slope where young volunteer Douglas Fir trees have taken hold and appear to be thriving. These should be encouraged and actively managed as they grow.

Hazard Potential

Trees are considered hazardous when all or a significant portion is likely to fail with a high risk of causing injury, damage, or disruption to a target (Smiley et al. 2011). Risk is determined when there is a target of concern within the area which would be affected if the tree were to fail. Targets specific to hazard potential include: public roadways, parking lots, sidewalks, persons and/or work crews within or adjacent to the Project Area, and critical infrastructure. Salmon Beach Road and the parking lot for the Salmon Beach community represent the only significant targets at risk of damage or disruption by hazard trees within the Project Area. Outside of the presence of a target, a tree failure is not considered a hazard. However, keeping existing trees healthy is important as damage caused by tree failure is often compounded on steep slopes, as the resulting soil disturbance has the potential to cause further erosion and slope failure.

Exhibit 7. Madrone crown dieback on the southwest slope of the Project Area.

As part of this plan, it is recommended that hazard tree assessments be conducted regularly where there are potential public targets and within active work areas, and subsequent remedial tree work be conducted as necessary to mitigate the hazards to the road, parking lot or overall slope stability, as outlined above. Hazard tree mitigation work should be conducted based on the tree risk assessment recommendations of an ISA certified arborist prior to work crews performing any vegetation management activities.

Disease

Tree disease presents a concern for slope stability, public safety and forest sustainability. As trees become diseased, both the living and structural portions of the tree can actively decay, resulting in the loss of structural integrity. Improper pruning, such as topping and repeated coppice sprout removal, is a form of damage which creates the opportunity for fungal disease to

infect trees. Fungal diseases enter through cut wounds, decay the trunks, and can spread into the rooting system.

3.3 SURFACE WATER AND GROUNDWATER

Surface water can be a major factor in the erosion and destabilization of slopes. Sources of surface water impacting the Project Area include direct rainfall, sheet flow runoff from adjacent developed and impervious areas, and storm drain discharge pipes. Our reconnaissance was completed during a period of relatively dry weather and the presence of surface water flowing to the Project Area from up-slope areas was not observed. During our reconnaissance we did observe HDPE corrugated pipes emanating from a few of the private properties at the top of the slope. Evidence of concentrated flow was observed on the slope below the City of Tacoma Sewer Pump Station, where it appeared surface water flow from the paved areas was over topping the curb. This was reported and addressed by City crews and will be monitored for future erosion.

Grette Associates conducted a wetland assessment of the Project Area in 2016 that found no wetlands or streams within the Project Area. Groundwater seepage was only observed along the east side of the parking areas at the toe of the slope in a few isolated locations. No saturated soils or “wetland” conditions were observed on the slope within the Project Area.

3.4 PUBLIC USE

The Project Area is currently inaccessible to the public but is close to Point Defiance and has an existing trail easement (potential future use). It borders an existing residential neighborhood at the top of the slope and the Salmon Beach community, located at the base of the slope along the shoreline of the Puget Sound.

3.4.1 Views

Public Views

The areas immediately adjacent to the Project Area are not publically accessible, and views from the public right of way are not impacted by the Project Area. However the Project Area is prominently visible from Puget Sound as part of a continuous greenbelt extending south from Point Defiance to the Tacoma Narrows Bridge. The forested character of the greenbelt provides significant aesthetic benefit and should be preserved and enhanced.

Private View Enhancement Requests

As of the publishing date on this LMP, TMC 9.20 is the mechanism used to evaluate pruning on City property for and by private view interests. It documents existing conditions and evaluates impacts. If the proposed pruning or vegetation removal is within a critical area (i.e. steep slope, wetland/wetland buffer, stream/stream buffer) then Tacoma's Critical Area Preservation Ordinance (TMC 13.11) applies as well. Although maintaining views from private property is not a primary goal of this LMP, a process and application for private requests to manage public vegetation to enhance private views is included in the LMP Implementation (Section 6).

Exhibit 8. Scenic View from Puget Sound

4. MANAGEMENT GOALS, OBJECTIVES, AND STANDARDS

This section identifies six management elements for the Project Area and defines overall management goals, objectives, and performance standards. The goals are used to identify the purpose of the proposed management strategy. Objectives specify the direct actions necessary to achieve the stated goal. Performance standards measure how actions taken are meeting the goals and will need to be met prior to any non-hazard vegetation removal. Landscape Management Procedures used to implement these goals, objectives and standards are located in Section 5.0.

4.1 MANAGEMENT ELEMENTS

Six management elements have been identified for the Project Area based on existing conditions and the end goal of a healthy target ecosystem. Multiple management elements may be applicable to the same location within the Project Area. These six elements are:

1. **Achieving a Sustainable Target Ecosystem:** This element should be applied throughout the entire Project Area in order to ensure long-term success and improvement of habitat and ecosystem functions.

2. **Geologic Hazard Mitigation:** This element is the main priority within areas classified as steep slopes (over 25% slope per TMC 13.11), which includes approximately 90% of the Project Area, and will be considered the top priority in areas where slopes occur above or below roadway, utility and residential infrastructure.

3. **Maximizing Stormwater Benefits**: Stormwater benefits include managing both the amount of precipitation that reaches the soil surface and runs off and the quality of stormwater runoff that reaches Puget Sound by establishing quality vegetative cover.

4. **Improving Wildlife Habitat:** The Project Area is part of a long corridor of wildlife habitat stretching from Point Defiance to the Tacoma Narrows Bridge, and is already home to a variety of birds, small mammals and even larger mammals including deer. One of the benefits of improving the diversity of native vegetation and limiting invasive vegetation (as a part of other management goals) within the Project Area is the secondary benefit of improving habitat for existing and new species potentially migrating to the area.

5. **Working to Protect Public Infrastructure and Public Safety:** Public safety includes controlling access onto steep hazardous slopes and reducing the likelihood of slope failure below existing roadways, utilities and private residences.

6. **Vegetation Modification Requests for Private View Management:** Allowing view enhancement will be a secondary management consideration after the other management elements (public safety, stormwater, slope stability, etc.) have been fully addressed to the extent of this LMP.

Typically community stewardship would be a component of the LMP. However, due to limited access and steep slopes, volunteer opportunities will likely not be available within the Project Area.

4.1.1 Achieving a Sustainable Target Ecosystem

The target ecosystem for the Project Area is the North Pacific Dry Douglas Fir Forest and Woodland (WDNR 2015). Late seral stands of this forest type contain an overstory canopy dominated by Douglas Fir (*Pseudotsuga menziesii*), with Madrone (*Arbutus menziesii*), Grand Fir (*Abies grandis*), Big Leaf Maple (*Acer macrophyllum*) and Red Alder *(Alnus rubra*) as codominants. This forest type is described in more detail in Section 3.2, Vegetation. The introduction and protection of these native coniferous tree species is essential to the recovery and future sustainability of the target ecosystem within the Project Area.

Forest health is evaluated by considering forest age, structure, composition, function, presence of unusual levels of disease, and resilience to disturbance based on land management objectives (Society of American Foresters, 1998). Although mature native trees are present within the Project Area, forest health, particularly at the top of slope, is considered poor to moderate in regards to its structure, species diversity, and ability to provide for stormwater benefit, forest sustainability, and slope stability. Identified issues associated with forest health include: invasive species, tree disease, lack of native species diversity, lack of evergreen species, tree rejuvenation, and low or threatened soil binding root mass in specific areas.

Native Vegetation

Historically, the Project Area's ecosystem consisted of the target ecosystem described above (WDNR 2011). The historical ecological system will be used as a guide for selecting native species to enhance the forest community within the Project Area. Other suitable native species and climate-adapted species may be included to meet the goals for slope stability and geologic hazard mitigation, habitat, public safety, and views from adjacent areas. City staff will maintain discretion as to the appropriateness of any particular species outside the Target Ecosystem plant palette.

The intent of vegetation management within the Project Area is to increase year-round evapotranspiration through evergreen vegetation, create a multi-layered canopy to intercept rainfall, and maintain a soil binding root mass with roots at varying depths to resist soil erosion. The establishment of a mature forest dominated by native conifers will benefit slope stability as deep-rooted conifers can generally resist slope creep and provide a deep rooting network to bind soils.

Invasive Vegetation

Ongoing control of invasive species that have a direct impact on forest health is a priority. Invasive plants are those which compete with existing native vegetation for resources in such a way that negatively impacts the native plants' health and forest conditions. Aggressive invasive plants also prohibit the natural establishment of desirable vegetation and typically do not provide

equal soil stabilizing benefits. For a list of these priority and otherwise invasive plants refer to Appendix F.

Due to the steep slopes on the site, complete removal of invasive species and their root structure is not allowed. Less invasive treatment of invasive species must include herbicide applications as a best management practice. Methods of herbicide application may include broadcast spraying and/or cutting of vegetation and application of an herbicide to the remaining cut stems. If feasible, all cut invasive plant materials will be mulched onsite. During the management of invasive species, erosion control BMPs should be implemented where required (Section 5.4). On-going monitoring and maintenance should follow treatment to prevent re-infestation. Planting vegetation and/or seeding immediately following invasive treatment will assist in providing slope stability and/or erosion control once plants are established (Section 5.3). In areas with existing erosion and slope stability issues, temporary engineering controls may be needed to assist new plants in becoming established (see Section 5.4).

Long-term management of invasive species must be supported through successful establishment of appropriate native vegetative communities, which limit opportunities for invasive species to become established. Fast-growing, shade-producing species (e.g., Grand Fir) are good choices for vegetation management because they provide canopy cover for other native species and reduce opportunity for shade-intolerant invasives, such as Himalayan Blackberry. Initial treatment of invasives in combination with monitoring and maintenance will be needed for native vegetation to become established (Soll 2004; Myers 1993).

4.1.2 Geologic Hazard Mitigation

The Project Area is classified as an “Erosion Hazard Area” and a “Landslide Hazard Area” based on the classification criteria in the City of Tacoma Title 13 Land Use Regulatory Code (City Tacoma, 2017). The Project Area is uphill from a steeper slope section above the Salmon Beach community where numerous residential houses are present along the toe of the slope adjacent to the shoreline. While the slopes within the project area currently appears stable, they are still classified as susceptible to landslide events. These types of slopes are often subject to episodic shallow debris flows, which are difficult to predict. Proper vegetation planting and management within the Project Area can help create varied depths of soil binding root mass, which will help decrease erosion and increase slope stability for the entire slope by controlling soil moisture content and runoff.

Geotechnical Considerations

Based on the research completed for this study and reconnaissance of the Project Area, activities to manage the vegetation on the slope, when completed in a controlled manner using appropriate temporary erosion and sediment control (TESC) measures, should not negatively impact the long term slope stability for shallow or deep seated failure modes.

If any non-permitted stormwater drains have been placed on the slope or where concentrated flow from uphill properties occurs, a dense ground cover will help prevent the erosion that could occur below these areas. Steps can be taken to eliminate or manage non-permitted sources or

surface water drainage. Unpermitted drain pipes or concentrated flow from uphill areas should be addressed by working with uphill property owners to route the storm drainage to appropriate discharge locations, which could include:

- Connecting to the existing storm drain system that appears to be present (City of Tacoma GIS, http://www.govme.org/gMap/MGMain.aspx) along the west side of the private properties at the top of the slope.
- Collecting it into a single system and extending the pipes to the bottom of the slope to a proper drainage location.
- Replacing the corrugated pipes with proper HDPE smooth wall pipe that is installed correctly, anchored in place, and routed to an approved storm drain collection point.
- Construction or modification of existing berms to direct water to the storm drain system, such as at the pump station location where surface water flow appears to overtopping the asphalt berm (note - this repair was completed in August 2017).
- Formal infiltration of stormwater on or at the top of the slope is not recommended.

Improving the vegetation on the slope to create a multilayered canopy and dense understory will decrease the potential for erosion and improve slope stability (Menashe, 1993). Nearly all of the literature regarding the role of vegetation and its impact on slopes documents the positive benefits of a vegetative cover in reducing the susceptibility to erosion and landslides through:

1. Soil binding root mass
2. Soil moisture reduction by evapotranspiration and interception of rainfall
3. Soil buttressing and arching between root balls. Soil buttressing results from the overlapping soil binding root masses which helps hold the soil in place. The buttressed area then helps hold the material above it in place. The buttressed areas create a rigid zone within the soil mass. Areas adjacent to the buttressed zones with less root mass are more susceptible to gravity induced movement and will have tendency to creep, which creates stresses within the soil. The stress is transferred from the yielding part of the soil to adjacent rigid zones (buttressed area) within the soil and this is referred to as soil arching.

Wind sail effects and loose soil generated from the exposed root balls of blowdowns are often cited as reason to remove trees. In cases where isolated or widely spaced trees are blown down, the exposed root wads can create a soil sediment source, but the effects are most commonly very local and temporary. Such blowdown is a natural process in a forest and does not contribute in a significant way to slope instability (Steinacher, 2009). Wind sail effects where vegetation exposed to the wind transmits forces into the slope or are blown downslope, are poorly documented and considered to be localized disturbances. The impact of wind sail effects on trees is more than compensated by the positive benefits of root reinforcement, soil moisture depletion, and buttressing. Typically, a tree that establishes on a slope adapts specifically to those existing conditions, whether it's slope, aspect, and wind or weather patterns.

Our observations of the upper one-third to one-half of the Project Area is that the trees have generally been cut off or significantly topped, and that no medium to large trees are present. Large trees can and do grow on very steep slopes and throughout the full height of slopes, the following recommendations are for the Project Area:

1. Large trees should be selectively managed so that they are widely spaced on the upper slope. The spacing between them can decrease towards the bottom of the slope where they will have a more beneficial effect on slope stability. The eventual (15-20 year) long term spacing for large diameter mature trees at the top of the slope is a maximum 40 feet. Initial planting should be denser to account for young tree mortality (Section 4.2). As trees mature, natural selection will result in end-state spacing goals.
2. We also recommend that new plantings of large trees be limited to slopes less than 67 percent to increase the probability of tree survival and to reduce the risk of blowdown effects.

Slope stability studies recommend the value of maintaining multi-layered vegetation for the greatest success in preventing erosion and increasing slope stability. Mid-story shrub layers and ground covers produce fibrous root mats that help to keep topsoil on the slope while also helping to break the impact from precipitation, thus decreasing the impact on exposed soils.

Erosion Control (excerpt from Schuster Slope Landscape Management Plan, (City Tacoma, 2015) and revised for Salmon Beach Slope Project Area*)*

The interception of precipitation by a dense, multi-layered, evergreen dominated forest is the first line of defense against surficial soil erosion and soil movement. Additionally, a well-established dense ground cover will help to slow surface water sheet flow if it develops.

Vegetation provides benefit by dissipating energy of falling rain or surface water sheet flow, which reduces the erosional impact. Unlike deciduous trees, coniferous trees retain their foliage during the wet winter months and provide greater rainfall interception, water storage, and evaporation potential (WSU 2012). Forests dominated by conifers have been observed to intercept between 18 to 51 percent of the annual rainfall, whereas forests dominated by deciduous trees have been observed to intercept between 8 to 13 percent of the annual rainfall (Herrera, 2008).

The use of irrigation to maintain plantings should not be applied on any slope area greater than 67 percent due to the increased potential for erosion. With any planting (trees, shrubs, forbs, and grasses) on steep slopes, installation of additional slope stabilization and moisture retention measures may need to be done concurrently to ensure plant establishment.

Slope Stabilization

Vegetative and engineering solutions as proposed in this management plan can decrease the potential for erosion and improve slope stability. This management plan recognizes that control of geologic processes cannot be achieved through vegetation management alone. The intent is to decrease the erosion potential and improve slope stability by promoting the establishment of a variety of vegetation that will develop a multilayered soil binding root system.

Slope stability studies recommend the value of maintaining multi-layered vegetation for the greatest success in preventing erosion and increasing slope stability. Mid-story shrub layers and ground covers produce fibrous root mats that help to keep topsoil on the slope while also helping to break the impact from precipitation, decreasing the impact on exposed soils.

Coppicing of deciduous trees that have been previously coppiced could cause a short-term increase in slope instability until new plantings develop extensive root systems. Newly planted tree seedlings won't have the same level of interception, transpiration, and root mass that contributes to stabilization as the more mature existing trees. Therefore, in order to mitigate (but not eliminate) this increased risk, careful planning and sequencing of any tree pruning and replanting is important. Coppicing is not an accepted arboricultural practice and shall not be utilized at any point during the restoration activities in the project area. The number of trees snagged per acre should be phased over time to maintain viable roots that perform a soil-binding function.

Vegetation Pruning and Planting Recommendations

- Avoid soil compaction and soil disturbance during vegetation management and planting to the extent practicable.
- Avoid irrigation due to slope stability concerns.
- Leave roots of any previously coppiced trees in place to help promote soil stability.
- To maximize rainfall interception, plant a multi-tiered vegetation community including a canopy of large conifers, shrubs. Forest litter will also help to increase interception.
- Carefully design spacing and phasing of tree trimming and plantings to reduce a short-term increase in slope instability.

4.1.3 Maximizing Stormwater Benefits

Vegetation management actions that reduce slope instability and/or reduce surface erosion will help to reduce the sediment load delivered to Puget Sound over the long term. Establishing vegetation which provides increased interception, transpiration, infiltration, and root strength, as well as increased groundcover, will help to trap sediment before it reaches Puget Sound. Establishing evergreen vegetation is particularly important for intercepting rainfall during wet winter months.

Section 4.1.2 illustrates the benefits of moving the plant communities of the Project Area toward the target ecosystem including increased interception of rainfall by conifers – especially during the winter months when it matters most.

4.1.4 Improving Wildlife Habitat

Improving wildlife habitat is an additional benefit gained from managing the Project Area toward the target ecosystem and improving slope stability. The additional diversity, density and layered structure of the plants introduced through restoration efforts will likely increase the population of wildlife species that currently use Salmon Beach Slope. In addition to removing invasive species and installing new trees, shrubs and groundcover plants, management efforts will include

leaving snags (standing dead trees) and nurse logs to increase both feeding and nesting opportunities for cavity nesting birds and other wildlife. Restoration and management of the target ecosystem within the Project Area will greatly enhance the quality and retain the connectivity of the wildlife corridor between Point Defiance and the slope along the east side of the Tacoma Narrows.

4.1.5 Working to Protect Public Infrastructure and Public Safety

Improperly pruned, dead, damaged or diseased trees may present a risk from falling branches or tree failure due to advanced decay. Vegetation composition on a slope can play a role in mitigating or exacerbating geological conditions including landslides, which pose risk to both people and infrastructure (pump station, stormwater and waste water pipes). Planting near the top of slopes should include plants that are dense and armored such as native rose species to discourage people from dangerously accessing the steep slopes.

A Level 1 tree risk assessment should be conducted annually in the spring after the winter storm season has passed to include all public areas (i.e. parking lot, work areas) with the potential to be affected by trees. A Level 1 Tree Risk Assessment is a limited visual assessment focused on identifying trees with imminent and/or probable likelihood of failure. If necessary, a Level 2 Tree Risk Assessment should be applied to all trees identified by the Level 1 Assessment to have the potential to cause damage and/or injury to a target. A Level 2 Tree Risk Assessment is a more thorough visual inspection of a specific tree and its surrounding project area (Dunster et al. 2013).

Tree risk assessments should be conducted in areas within the project areas that are immediately adjacent the parking lot and access road, and 100 to 150 feet into the project area. Tree risk assessments should also be conducted in work areas prior to commencing mitigation/ planning operations.

4.1.6 Vegetation Modification Requests for Private View Management

This element may be considered when a private landowner desires to prune trees on City property for the benefit of private view enhancement. View enhancement may occur incidentally with hazard tree removal. Tree pruning practices outlined in this LMP (see Appendix G) will allow for healthy tree development while accommodating views. Vegetation management for views in the Project Area may be permitted provided that forest health/habitat and public safety, which are directly related to slope stability, goals and objectives are met per the LMP. View enhancement will be a secondary management consideration after the other management elements (public safety, stormwater, slope stability, etc.) have been fully addressed to the extent of this LMP.

While the City recognizes that private view corridors are a sensitive issue for the neighbors along the slope crest, property owners have no common law right to a view across neighboring properties (Asche v Bloomquist, 2006). Within the Tacoma city limits, public views have been designated and acknowledged as part of the City's comprehensive plan; however, private views are not part of the comprehensive plan. Additionally, the City's charter prohibits City funds from being used for private benefit. As such, City funds cannot be used to fund pruning efforts solely

for the purpose of creating or maintaining private views. This plan provides for the ability for the public to apply to manage portions of the Project Area (City property) for the benefit of their private view.

After the LMP is permitted, any requests for view pruning will be subject to City review and approval for adherence to City regulations and applicable management plans. LMP Section 6 presents the process (currently in draft, pending approval) that a private landowner can follow in order to proceed with a Vegetation Modification Request.

4.2 MANAGEMENT STANDARDS

This section outlines the objectives and standards which will govern all work within the Project Area in order to achieve the intent of the management elements outlined in Section 4.1. All Work Areas shall meet the size requirements outlined in Section 5.1.

4.2.1 Create a self-sustaining, multi-layered canopy of native vegetation (Target Ecosystem, Section 4.1.1)

Objective 1: Create a healthy evergreen-dominated, multi-layer canopy structure of native trees shrubs, and groundcover which provides rainwater interception, erosion control, and other stormwater benefits and improves slope stability.

- **Planting Standards:**
  - Two-thirds of the tree cover will consist of large evergreen trees; one-third will consist of small deciduous trees.
  - Large trees will be planted at 15'-0" on-center triangular spacing (for containerized stock; see Appendix G); small trees will be planted at 10'-0" on-center triangular spacing.
  - Shrub layer shall consist of at least three native species, and a minimum of one species shall be a native evergreen
  - Groundcover layer will consist of at least two native species, and a minimum of one species shall be a native evergreen.

- **Plant Establishment Minimums:**

  - A 100 percent soil-binding effective tree root zone shall be established and maintained for healthy mature trees; the effective root zone shall be calculated as 1-ft radius of lateral root extent for every inch of diameter at breast height (DBH) of the tree's trunk. DBH is measured at 4.5 feet above ground level.
  - Each planted shrub and groundcover as a class will meet 80 percent survival by the end of the Establishment Period (Year 3) and 60 percent survival by end of the Monitoring Period (Year 5).
  - Mature tree canopy shall achieve and/or retain 50 percent aerial cover. Aerial coverage requirement of the mixed tree canopy may be modified based on existing aerial coverage in areas of healthy, native canopy.
  - Mature shrub and groundcover layer shall achieve and/or retain 80 percent aerial cover. Aerial coverage requirement of the understory vegetation layer may be modified based on existing aerial coverage in areas of healthy, native understory.

Timeframe: Work Area preparation and plant installation is anticipated to be completed within 1 year from start of active restoration. Initial Establishment Period shall last 3 years and Monitoring Period shall last an additional 2 years (5 years total) to observe further plant establishment and implement adaptive management.

Effort: Low effort for direct planting with minimal planting area preparation, moderate effort for planting in work areas with high planting area preparation such as invasive species removal and the installation of erosion control measures.

Objective 2: Reduce percentage of invasive species to 15 percent of the aerial coverage of vegetation or less.

- **Standard:** Cut and/or treat all invasive vegetation within each Work Area (as phased) and monitor and maintain to prevent significant populations of invasive species for a minimum period of five years.
- **Standard**: Plant area where invasive vegetation was treated with new native vegetation as outlined in Objective 1.

Timeframe: The initial treatment of invasive species per Work Area is anticipated to be completed within one year. Work areas will be staggered to minimize erosion potential. Monitoring and maintenance will be conducted over an 5-year period to control invasive species and allow for native plant establishment.

Effort: Level of effort is anticipated to be moderate to high for initial invasive species treatment with associated erosion control measures; however, level of effort may increase when working on steep slopes.

4.2.2 Provide erosion control and soil stabilization measures while vegetation establishes.

Objective 1: Implement soil stabilization and erosion control measures where applicable to allow the establishment of the target ecosystem, which will improve slope stability, decrease erosion and the associated risks with regards to public safety, infrastructure, and private property.

- **Standard:** Erosion control measures will be installed in accordance with the most current version of the City erosion control BMPs as provided in the City's Stormwater Management Manual (City Tacoma, 2016b) where applicable within work areas.
- **Standard:** Slopes 67 percent or greater over a distance of 15 ft in vertical height or greater shall be evaluated by a geotechnical consultant or an engineering geologist experienced in slope stability to evaluate for the impact of the planned work. This is recommended as slope inclinations above 67% are typically in excess of the natural angle of repose of the loose unconsolidated material that is exposed during restoration activities.

Timeframe: Erosion control BMPs should be implemented during significant land disturbing activities and for a sufficient period following the disturbance until vegetation becomes established. Implementing soil stabilization and erosion control measures on slopes 67 percent or greater requiring engineering solutions, specifically in areas where public safety and infrastructure protection are a concern, may require

a considerable amount of time to allow for slope assessment, design, permitting, and installation activities.

Effort: Low to moderate effort for the preparation and implementation of erosion control BMPs, moderate to very high effort for the design and implementation of slope stability measures, or engineering solutions, where necessary, on slopes 67 percent or greater.

4.2.3 Enhance public safety using vegetation management

Objective 1: Vegetation along the top of the slope will be maintained in areas that act as a natural barrier to slope access.

- **Standard:** Plant a dense understory of mixed evergreen and deciduous shrubs and groundcovers to discourage access.

Objective 2: Maintain public safety through proactive tree management.

- **Standard:** Conduct Level 1 tree assessments annually along all publicly accessible areas.
- **Standard:** Prune or remove risk-prone trees and branches where they can impact public areas and infrastructure.

Timeframe: The initial vegetation management within the prioritized management area is anticipated to be completed over a minimum eight-year period in phases for active management areas. Vegetation maintenance and tree assessments should be conducted annually as long as the public safety and infrastructure protection applies.

Effort: Level of effort is anticipated to be moderate for the initial vegetation management, level of effort for annual maintenance and assessment is considered low. Vegetation management for public safety should be applied to any future public areas.

4.2.4 Provide a process for a private vegetation modification request on City property to enhance a private view

Objective: Provide a transparent process where private landowners may apply to conduct landscape management activities on City property within the Project Area that are in conformance with the techniques and goals in this LMP.

- **Standard:** All management actions approved for private view management shall be conducted in accordance and compliance with the permitted LMP and all applicable regulations.
- **Standard:** Tree pruning for the purpose of view enhancement shall not be conducted until the Work Area has met all other applicable goals, objectives, and standards for invasive removal and established native vegetation as outlined in Section 4.2.1.

- **Standard:** Tree snagging or removal shall not be allowed unless the tree meets the criteria for removal outlined in Section 5.6.2 and shall not be conducted until the management area has met all other applicable goals, objectives, and standards. No tree topping will be allowed under any circumstances.

- **Standard:** Trees shall be pruned by or under the direct supervision of an ISA (International Society of Arboriculture) Certified Arborist, to current industry standards according to the most current versions of the American National Standard Institute (ANSI) Z133.1for safety of pruning operations, the ANSI A300 Standard Practices, and the Tree Pruning Guidelines of the International Society of Arboriculture (ISA). All cuttings from the pruned tree must be left onsite as outlined in Section 5.6.2.

- **Standard:** No more than 25 percent of any one tree's crown may be removed in any pruning event and for a minimum of one year following. The tree's health, age and structure must be taken into account to determine the appropriate amount of pruning. No tree topping will be allowed under any circumstance.

- **Standard**: If mitigation planting is required in order to satisfy the goals, objectives and standards of this management plan, pruning activities may not be allowed until the end of the 3-year Plant Establishment Period and until the Plant Establishment Minimums for the associated Work Area have been met.

Timeframe: Site preparation and installation of select planting areas are anticipated to be completed within 1 year of application. Monitoring and maintenance will be conducted over an 8-year period to allow for plant establishment. Plant Establishment Minimums must be achieved in order for any view management activities to be approved.

Effort: Level of effort is anticipated to be moderate for process and application, and assessment, moderate for the initial vegetation management depending upon the size and existing conditions of the area, level of effort for annual maintenance and assessment is considered low.

5. LANDSCAPE MANAGEMENT PROCEDURES

The Landscape Management Procedures chapter is intended to direct the work as determined by the management goals, objectives and standards (Section 4.0) in a way which is consistent with industry BMPs. This chapter is supplemented by the Specifications (Appendix G) of this LMP. In addition, the following management procedures have been permitted as acceptable approaches for performing work within the Project Area, which is regulated by the Critical Areas Preservation Ordinance. Any deviation from these standards must first be granted written approval from the City's permitting authority prior to the management action being approved.

5.1 WORK AREA SIZE

The total Project Area is approximately 3.77 acres. This plan recognizes that, due to funding availability, management procedures will need to be done in phases. Work Area size thresholds are needed in order to ensure that any given phase does not exceed the ability to be managed effectively if a complex issue or setback arises, for example an erosional event or a high level of plant mortality.

Disturbance is defined as permitted maintenance and management activities such as pruning, invasive removal, and planting. Project Area grading is not considered permitted maintenance and management activities through this LMP. Long-term, structured management of previously coppiced Douglas Firs, Madrones and Big Leaf Maples or other deciduous trees on specific slopes below is, however, proposed by this LMP.

5.1.1 Maximum Work Area Size

Soil conditions are fairly similar across the Project Area and we recommend the downslope length of any Work Area should be controlled based on the slope inclination and planned level of disturbance. The level of disturbance is identified as "high" and "low". For example, a high disturbance could typically result from closely spaced plant removal activities where the root ball is removed or where all surface vegetation is removed from a Work Area (i.e. C3 or U3 areas – see Section 6.1.2). We anticipate low disturbance would result from plant cutting that does not remove the root ball, but removes the above ground vegetation in isolated areas less than 25 square feet. We recommend that as the slope inclination increases the downhill length of the Work Area decreases as follows:

TABLE 1: Recommended Downhill Length of Work Area

	SLOPE		
DEGREE OF DISTURBANCE	**Up to 50%**	**50% to 67%**	**Greater than 67%** [1.]
High (stripped)	100'	50'	25'
Low (Selective Widely Spaced Plant Removal)	Unlimited	100'	40'

Note: Assumes appropriate TESC measures will be installed whenever ground disturbance results from LMP removal/planting activities. .

1. At the time of preparation of this LMP no work is envisioned on slopes greater than 67%. If conditions should change and work is required on slopes greater than 67% the recommended limitations should be used. Any proposed work on slopes 67% or greater and the proposed TESC measures should be reviewed by a CECSL or a geotechnical engineer to verify potential temporary impacts to erosion potential and slope stability are mitigated.

The proposed treatment areas are distributed across the Project Area generally in narrow bands as a result of tree cutting activities in the upper third to one half of the slope. The width of the active treatment areas is unrestricted based on geotechnical considerations. Revisions to the recommended downhill length may be considered based on planned TESC measures, project area characteristics, and should be reviewed by a CECSL or a geotechnical engineer.

5.1.2 Minimum Work Area Size

The allowable minimum project size is one of the following (whichever is greater):

1. 400 square feet; or,
2. The measurement for the 100 percent soil-binding effective tree root zone of any one tree (must be measureable by DBH method).

5.2 PLANT SELECTION

Plant selection is intended to replicate the target ecosystem. This ecosystem includes a multi-layer canopy structure with a mix of large trees, small trees, shrubs, and groundcover. Appendix G, Table 1 includes recommended plantings for specific locations, light and soil conditions within the Project Area to develop a planting palette for a specific project.

In addition to plants typical of the target ecosystem, there are native species and climate-adapted species such as plants found along the Oregon coast which may be better suited to conditions within the Project Area and have been documented as good choices for providing slope stability. This is especially true for planting the exposed upper slope where well-drained soils and the mature height of plants are considerations. A planting palette may include climate-adaptive species where slope stability or other conditions are particularly challenging.

5.2.1 Trees

Improving the diversity of the tree canopy diversity and restoring the tree canopy in areas were no canopy currently exists will help to improve the resilience of the forest ecosystem and reduce the ability of invasive species to take hold in sunny, disturbed soils. At the upper slope (above elevation 180'), in C2 and C3 Canopy Cover Areas (see Section 6.1.2), recommended species include Vine Maple (*Acer circinatum*), Cascara (*Rhamnus purshiana*), Shore Pine (*Pinus contorta var. contorta*), Grand Fir (*Abies grandis*), and Western Hemlock (*Tsuga heterophylla*). On the lower slope (below elevation 180'), mostly in the C2 Canopy Cover Areas, recommended species include Grand Fir, Douglas Fir (*Pseudotsuga menziesii*), and Western Hemlock (Tsuga heterophylla), Vine Maple (*Acer circinatum*), Cascara (*Rhamnus purshiana*) and Western Redcedar (*Thuja plicata*). Western Redcedar and Western Hemlock prefer shade to establish and so would be good options for small areas of infill within the existing healthy canopy in C2 and possibly C1 (see Section 6.1.2).

Volunteer trees may remain if native.

5.2.2 Shrubs and Groundcover

Recommended understory vegetation includes, but is not limited to: Beaked Hazelnut (*Corylus cornuta*), Oceanspray (*Holodiscus discolor*), Red Elderberry (*Sambucus racemosa*), Indian Plum (*Oemleria cerasiformis*), Evergreen Huckleberry (*Vaccinium ovatum*) , Salal (*Gaultheria shallon*), Dull Oregon Grape (*Berberis nervosa*), Sword Fern (*Polystichum munitum*), and Snowberry (*Symphoricarpos albus*). Many of these species are evergreen and will provide a dense understory cover below the forest canopy. These species can thrive in forested conditions found on the slope face and are recommended for installation in U1 and U2 Understory Cover Areas (see section 6.1.2).

Within the U3 Understory Cover Area (see Section 6.1.2) near the top of slope, the immature canopy in this area will result in direct sun conditions for shrub plantings. Understory vegetation for this area includes Pacific Wax-myrtle (*Myrica californica*), Beaked Hazelnut (*Corylus cornuta*), Oceanspray (*Holodiscus discolor*), Nootka Rose (*Rosa nutkana*), Tall Oregon Grape (*Berberis aquifolium*), Snowberry (*Symphoricarpos albus*), and Kinnikinnick (*Arctostaphylos uva-ursi*).

5.2.3 Edge Habitat

Vegetation within edge areas and openings should consist of native species which can tolerate diverse light and low soil moisture conditions, while providing for fast, aggressive growth in order to compete with invasive species such as Himalayan Blackberry. In addition to planting evergreen trees, which will eventually provide a shaded cover and restrict the growth of Himalayan blackberry, aggressive, fast growing shrubs such as Nootka Rose (*Rosa nutkana*), Snowberry (*Symphoricarpos albus*), and Red Elderberry (*Sambucus racemosa*) will help to crowd out invasives.

5.2.4 Upper Slope

Planting areas which have the potential to impact views include the top of slope (above elevation 180', see Appendix D). Therefore, the planting focus at the top of slope should consist of a well-developed understory cover of evergreen and deciduous shrubs as well as lower-growing deciduous trees and some mid-size and large-size conifers in order to retain topsoil and prevent surface stormwater runoff from eroding the top of the slope.

Also, the use of irrigation to maintain plantings should not be applied on any slope greater than 60 percent (Myers 1993) due to the increased potential for slope failure and erosion. With any planting (trees, shrubs, forbs, and grasses) on steep slopes, installation of additional slope stabilization and moisture retention measures may need to be done concurrently to ensure plant establishment. Consideration of the possibility of erosion due to irrigation system failure (broken lines) should be taken into account prior to employing it. Steps such as leak sensors, automatic shut off valves, or drip versus spray could be used to mitigate the risk.

5.2.5 Lower Slope

Planting on the lower slopes should consist of a well-developed understory cover of evergreen and deciduous shrubs as well as mid-size and large-size deciduous trees and some mid-size and large-size conifers in order to retain topsoil and prevent surface stormwater runoff from eroding the lower slope. The same considerations regarding irrigation installation for the upper slopes should be taken into account on the lower slopes.

5.3 PLANT INSTALLATION

Plant installation on steep slopes requires additional care and planning. Soil disturbance associated with installation has the potential to increase erosion of surface soil, which could damage existing understory vegetation or plantings installed downslope. This effect can be minimized by limiting the total time spent on the slope for installation through careful planning and adhering to the following procedures (Myers 1993):

- Avoid planting in excessively wet weather conditions.
- Identify planting areas and establish minimal access routes for installation.
- Dig planting pits concurrently with plant installation (this limits the number of trips into and out of the project area).
- Use the smallest plant stock (e.g., seedling stock or stakes) available whenever feasible to minimize soil disturbance.

5.3.1 Planting Stock

Plant stock may include containerized stock (up to one-gallon size), bare root stock, and seedlings and are installed by planting the material into excavated holes in the soil surface. Well-developed rooted plant material creates root mass faster than other methods (such as seeding), especially when planting species with varied rooting characteristics (Myers 1993). Disturbance to the slope can be minimized by using the smallest feasible planting stock and the least intrusive planting method. Additionally, smaller (a.k.a. younger) plant material often adapts more quickly after transplant. Larger plantings require regular care and maintenance (such as irrigation) which should not be applied to steep slopes. Younger plant material is also easier to carry and handle, less expensive, and requires less soil disturbance during installation.

5.3.2 Seeding

Seeding for vegetative cover can be used for forbs, grasses, shrubs, and trees. Seeding alone will not repair eroding slope areas (Myers 1993); however, when applied with other soil stabilizing or engineering techniques, seeding may be appropriate. Seeding methods which may be applicable on slope areas include:

- Hydroseeding is a very common application method and involves mechanically broadcasting a mix of seed, water, fertilizer, mulch, and bonded fiber matrix onto the slope. Locations where hydroseeding is applicable in the Project Area is limited due to access; however, it may be applicable within areas of the slope crest.

- Broadcast seeding scatters seeds uniformly by hand onto the slope. Seed germination will be more successful if the soil has been roughened slightly and should be mulched immediately with compost to help retain the seed and to keep the surface soil moist (Myers 1993).

Seeding should primarily be used for erosion control (Section 5.4), such as the use of grasses to stabilize surface soil. Seeding alone on steep slopes (greater than 60 percent) is not recommended, as seed applied to the soil surface tends to be easily "transported" by surface runoff.

5.4 EROSION CONTROL

Erosion control Best Management Practices (BMPs) should be used to control erosion where Vegetation Management activities disturb the ground and expose soil. These measures will help prevent sediment erosion and aid in plant establishment. Erosion control BMPs for the anticipated work may include (but are not limited to) the use of mulch, erosion control nets and blankets, and straw wattles or log erosion barriers. Seeding is also a preferred BMP for erosion control and is discussed in Section 5.3.2.

The anticipated TESC BMPs identified above generally require low to moderate installation effort and should be applied in accordance with the most current version of the City of Tacoma Stormwater Management Manual's erosion control BMPs (City of Tacoma, 2016b).

TESC BMPS applicable to the vegetation management activities are discussed below. It should be noted that these are temporary measures and that maintenance and monitoring of them should be included until permanent vegetation becomes established. Additional information on these and other available TESC measures is provided in USDA's "Erosion Control Treatment Selection Guide", published in December 2006.

5.4.1 Mulching and Erosion Control Blankets

Mulching is the application of certified weed-free straw, wood chips, or other suitable materials on the surface of a slope. Mulch provides soil and seed coverage and reduces splash erosion. Mulching is also beneficial when included with plant installation, as it increases moisture retention, provides insulation from heat and cold, and can reduce the competition from grasses when mulch is placed around woody plantings. It can improve soil structure and nutrients and can absorb a help detain and slow runoff. Mulch is suitable for use on slopes less than 50 percent and may be placed by hand or by a machine. The use of soil netting to anchor the mulch in place can extend its use on slopes up to 100 percent.

5.4.2 Rolled Erosion Control Products

Rolled Erosion Control Products (RECPs) include a variety of flexible organic or synthetic nets or mats that are manufactured and come in rolls. They vary from simple rolls of biodegradable organic coir and jute mats to permanent turf reinforcement mats that consist of nondegradable synthetic fibers and heavy weight polypropylene nets sewn together with UV stabilized thread.

The RECPs are mechanically, structurally, or chemically bound together to form a continuous matrix to facilitate vegetation establishment and provide varying degrees of erosion control, depending on product type. They are effective on steep slopes and provide a more durable and longer lasting erosion control benefit than mulch products. Biodegradable erosion control blankets may typically be used on slopes 100 percent and flatter, although a few of the permanent heavy duty turf reinforcement mats that are anchored in place can be used on slopes up to 200 percent. For slopes over 100 percent that require permanent erosion control, the proposed work and TESC measures should be reviewed by a CECSL inspector or geotechnical engineer. Uses vary depending on product type and can include:

- Surface erosion protection and moderate flow velocity
- Anchoring loose mulch in place to extends its use on steep slopes
- Lining channels, drainage swales, or steep slopes
- Providing longer-term reinforcement over organic products

5.4.3 Wattles

Wattles are tubular temporary erosion control barriers, up to about 12 inches in diameter, which are used to reduce surface or sheet flow velocities to control surface erosion until permanent vegetation can be established. Wattles consist of wood fibers or straw that are encased in an organic or biodegradable plastic material. Seed mixes can be incorporated in with the wood or straw material to promote vegetation. Wattles are typically placed in shallow trenches and anchored using wood stakes or "U" shaped rebar staples along the contour of a slope. The effectiveness of wattles is highly dependent on correct installation. Wattles can be used on slopes up to 100 percent but it should be noted that they are difficult to carry and install on terrain steeper than 50 percent. Vertical spacing on the slope is based on the slope inclination and soil exposure. Typical spacing of wattles is provided in Table 2 below:

TABLE 2: Recommended Wattle Spacing on Slope Contour

Slope Inclination (Rise/Run x 100)	Distance Wattle Row Placed Along Contour (feet)
25%	40
33%	30
50%	20
100%	10

Log erosion barriers (LEBs) are also a type of wattle that can be made from logs generated from previous cutting and topping of trees within the Project Area or during vegetation management activities. They are placed similar to wattles, but are generally restricted to slope inclinations less than 67%.

5.4.4 Engineering Solutions

Engineering solutions typically are inert structural designs to slow or arrest the creep behavior of the surface soil on steep slopes, thus allowing vegetation to become established. These

methods have a high level of effort and cost, as these methods generally require geotechnical engineering for design and construction crews for installation. Engineered solutions can include soil anchoring techniques including the use of flexible facing elements. The slopes within the Project Area are not anticipated to warrant engineered solutions for addressing creep or ground disturbance during vegetation management activities.

5.4.5 *Anticipated Minimum TESC Measures*

Activities within the proposed management areas will range from complete removal of invasive species, such as Himalayan Blackberry, to selective removal of specific plants, resulting in ground disturbance varying from "High" to "Low". Where resulting ground disturbance is classified as "High", minimum TESC measures should consist of mulch cover over disturbed areas coupled with a rolled erosion control net or blanket. Staking to anchor the blanket in place should be completed on all slopes and it should be installed tight to the ground. Typical biodegradable netting or erosion control blankets used in the area include jute matting, burlap mesh, coconut (Coir) ECB's, and straw and excelsior blankets. The use of coir or straw blankets will help facilitate ground cover plant growth. Wood fiber or straw wattles anchored in place with wood stakes, should be placed along a contour through about the middle of each treatment area.

In areas with "Low" ground disturbance isolated areas of disturbed ground may require less extensive TESC measures. Straw mulch or small sections of jute/burlap matting may be used to protect the disturbed areas from surficial erosion.

The TESC measures should be determined on a case by case basis with consideration to level of disturbance, slope, and length of time required for vegetation to become established. A TESC plan should be submitted with each proposed Work Area.

Additionally, The TESC measures should be inspected intermittently by a City of Tacoma inspector with CECSL certification throughout the following wet season until the vegetation is established and permanently stabilized.

5.5 INVASIVE SPECIES CONTROL

Effectiveness of the various short-term control methods of invasive plants varies depending on species, density, and project area access (King County 2008a, b). Manual removal is effective when dealing with small populations or isolated invasive plants. Mechanical removal is effective for large-scale control especially when incorporated with engineering solutions; however, it may not be feasible on steep slopes or areas with limited access. Covering, sometimes referred to as "sheet mulching" is effective with small populations in targeted areas; however, covering may be impractical for larger areas, especially on slopes, because the process of cutting vegetation, covering the area and ensuring that the covering remains in place is labor intensive and may be cost prohibitive.

In accordance with the US Environmental Protection Agency's (EPA) guidance on Integrated Pest Management, the least invasive method of invasive control shall be employed, which may

include herbicide use if the situation dictates that it is infeasible to use other control methods. Foliar herbicide treatment is not recommended for small patches of invasives surrounded by native vegetation since many herbicides are non-selective. If it is determined that the preferred removal practice of the large stands of invasive species is through the application of an herbicide, the limitations to herbicide use shall be in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and specific restrictions of the EPA and State Department of Agriculture, WDFW, and Ecology. Note, certain pesticides are considered Restricted-Use Pesticides under FIFRA, and may be applied only by or under the direct supervision of specially trained and certified applicators and restricted from certain areas (i.e. wetlands, streams and other aquatic areas). For specific control methods for the priority invasive species, refer to Appendix F.

Due to the steep slopes on the site and the goal to minimize soil disturbance, invasive species control will entail the cutting of vegetation above the soil surface, and then applying an approved herbicide to the remaining cut stem. Extreme caution must be used if applying the herbicide through spraying, as existing native vegetation may be affected by overspray. The preferred method is wicking the cut stems with a topical herbicide. Herbicide application must be conducted by a licensed applicator adhering to all applicable laws and procedures, as above. All cut materials from invasive species will be mulched onsite if feasible.

Non-native volunteer trees should be removed in the manner least likely to cause soil disturbance or damage to adjacent desirable species or infrastructure.

5.6 PUBLIC SAFETY/ ACCESS

5.6.1 Access Control

Access control is the concept of physically guiding users to intended access areas and limiting opportunities for access into unintended areas (Virginia Crime Prevention Association 2005). Access control is intended to reduce opportunities for the public to enter areas not intended for public use, both to protect steep slope vegetation and also to discourage illicit use of areas that are infrequently monitored. For the Salmon Beach Slope Project Area, access control should include repairing damage to the existing perimeter fence, especially in the vicinity of the Salmon Beach parking lot and at the top of the site. Additionally, three gates could be installed, one each in the fence next to the north and south corners of the parking lot, and one at the top of the slope vicinity the Sewer Pumping Station (see Exhibit 3). These gates should only be accessible to authorized personnel accessing the Project Area for work crews and inspections (see Exhibit 3).

5.6.2 Selective Pruning and Removal

Proper pruning can be a tool in creating and improving views. Selective pruning should follow the guidelines presented in the *Open Space Management Plan for Stadium Way – Schuster Parkway* (Van Pelt 2000, "Chapter IV Vegetation Management; Section C Recommended Tasks for View Enhancement")- see Appendix G. For conifer species, selective pruning includes methods such as windowing (removing select branches), inter-limbing (removing select branch whorls), and skirting up (removing lower branches; Menashe 1993). The pruning of broad leaf trees is usually more complicated and includes the select removal of branches and thinning of the crown. When completed correctly by a trained arborist, the tree's health is maintained; however, incorrect pruning can cause severe damage to the tree and can increase the likelihood of failure. Practices such as topping, of both conifers and broad leaf species, leave multiple areas for disease entry and trigger superfluous growth known as "coppice sprouting" which creates dense clumps of multiple stems with weak attachments. Additionally, excess removal of crown vegetation leaves large openings in the canopy, which can encourage invasive species such as Himalayan Blackberry and allow for increase erosion due to lack of vegetative cover.

Dead trees and topped Douglas Fir trees should be snagged to 10-15 foot height to provide snags for wildlife habitat. Topped Madrone trees that are not considered hazardous should remain and their canopies managed using pruning guidance in Appendix G.

Trees shall only be removed if deemed a hazard tree by a certified arborist using the Tree Risk Assessment Qualification (TRAQ) criteria and when all or a significant portion is likely to fail with a high risk of causing injury, damage, or disruption to a target of concern such as public roadways, parking lots, sidewalk, persons and/or work crews (Section 4.1.5).

Where feasible, the downed wood from pruning or trimming should remain in place so as to minimize the land disturbance that would otherwise be caused by the removal of the large debris from the Project Area. If a tree is designated for removal, it is often best to leave a portion of the trunk in place as a "snag" 10-15 feet tall to provide for additional forest habitat. This should only be done with consideration to targets and potential conflicts with adjacent infrastructure or public areas.

New and existing slash should be cut into pieces so that they make contact with the ground plane to assist in the establishment of wildlife habitat and allow easier access for work crews. Care must be taken so this material does not smother new or existing native vegetation.

6. LANDSCAPE MANAGEMENT PLAN IMPLEMENTATION

It is intended that this LMP will be implemented over a period of at least 20 years. Ongoing monitoring and maintenance will need to continue for the life of the landscape in order to ensure that the Project Area will continue to thrive in a healthy and safe condition.

Implementation of this plan will generally be carried out in one of two ways: through City led actions in accordance with the prioritization of the Work Area as described in Section 6.1 or, through privately initiated actions as described in Section 6.2. City led actions will be implemented as resources are available, and will specifically focus on slope stability, public safety and forest health. The privately initiated actions (Section 6.2) are those which are driven by private interests that would like to make modifications to vegetation in accordance with this LMP on a shorter timeframe than City resources can complete on its own.

6.1 CITY LEAD ACTIONS

As previously discussed in this LMP, the restoration of the Project Area to its ideal, sustainable target ecosystem can only be achieved through adaptive management techniques and best management practices at the time of implementation. Section 6.1 is reflective of the known data, industry standard practices, and compliance with regulations at the time of publishing (2017).

6.1.1 Prioritization

Vegetation Condition and Invasive Species Presence

The condition of existing vegetation is critical to management considerations and the level of effort moving forward. Any area with limited native tree canopy dominated by invasive plants should be addressed before proceeding with restoration of other areas because of the likelihood of invasive plants spreading to active restoration areas.

Scenic View Potential from Private Property

The City recognizes the benefits that high quality scenic views can provide when achieved in a responsible manner

The enhancement of scenic view opportunity will implemented by gradually replacing previously topped trees with a mix of tall-growing and lower-growing trees – mostly conifers. Careful consideration is given to the mature height of trees and shrubs to attempt to control the amount of potential view blockage as planted trees and shrubs mature. It is anticipated that future views will be framed by tall-growing conifers.

6.1.2 Vegetative Cover Designations

The 3.77 acres of land within the project area are divided into six vegetative cover designations that address issues at two levels: tree canopy level and the understory/ shrub/ groundcover level (Appendices C and D). Though represented separately, there is often a correlation between both the canopy and understory conditions (i.e. poor tree canopy paired with invasive understory growth). For example, the upper slopes on the eastern edge areas of the Project Area whose canopy contains topped, dead or removed trees and whose understory contains significant invasive are a separate vegetative cover designation (U3) that will require much more intensive restoration efforts than areas of generally healthy canopy and moderate to no invasive in the understory of the Project Area which is predominantly intact native forest (C1). The vegetative cover designations are also designed to allow restoration work by trained crews in all of the designations. In addition, restoration work can proceed in different vegetative cover designation areas simultaneously without risk of destabilizing steep slopes or other unintended results. Restoration work on steeper slopes will be phased according to guidance in section 5.1.1 to avoid the risk of slope failures.

Canopy Cover Designations

C1 - Healthy Native Canopy

This Vegetative Cover Designation is located in the southern portion of the Project Area (Appendix C). The canopy primarily consists of Big leaf Maple (*Acer macrophyllum*), Madrone (*Arbutus menziesii*) and Douglas Fir (*Pseudotsuga menziesii*). There may be selective dead or dying trees in the area that do not warrant intervention unless they are determined to be a hazard tree. No restoration activities are warranted; however the area must remain under periodic observation to determine if canopy health is changing or invasives are establishing.

C2 - Moderate Canopy Health- Selective Pruning and Removals

The canopy in these areas consist of a mixture of healthy native trees of various heights and ages with a number of dead, dying or topped trees (Appendix C). Pruning of dead, diseased or dying branches should be performed on a case-by-case basis by a certified arborist using the latest industry practices and guidance in this report. Dead trees and previously topped Douglas fir trees could be cut to 10-15 foot heights to provide snags for wildlife habitat. Topped Madrone trees that are not hazardous are deemed healthy and should remain and their canopies managed using pruning guidance in Appendix G.

C3 – No/ Poor Canopy

These areas are found on the western edge of the Project Area (Appendix C). All native trees have been removed, are dead/ dying, or there is a predominance of a single non-conifer tree species. Remediation steps are covered under Understory Cover Designation U3.

Understory Cover Designations

U1 - Healthy Understory

This Vegetative Cover Designation is located in the south and southwest portion of the Project Area (Appendix D). It typically consists of dense, native shrub and groundcover vegetation of varying heights, with minimal presence of nonnative or invasive vegetation. This unit should be periodically monitored for the presence of nonnative or invasive vegetation. Where contiguous areas of invasives exceeding 10 square feet are found, these should be treated and replaced with native plantings consistent with LMP Section 5.

U2 - Moderate Invasives

This Vegetative Cover Designation is found in three distinct areas within the Project Area: east of the northern portion of the parking lot, immediately south of the parking lot, and near the south extent of the Project Area (Appendix D). This designation typically occurs beneath a modified canopy, either through limbing/topping of trees or through disease of canopy vegetation. This thinning of the canopy has allowed increased light penetration into the understory, resulting in the colonization of nonnative and invasive vegetation in these units. Furthermore, the diseased Madrone canopy in the southwest portion of the Project Area is likely contributing to a "die-off" of native Salal (*Gaultheria shallon*) particularly in the smaller units to the south.

Management of these areas should consist of treatment of nonnative and invasive vegetation and replanting with native species. Care must be taken to ensure disturbance to native species and their root structures is limited. Invasive vegetation cuttings will be mulched onsite. Similarly, areas of dead Salal should be cut at the soil surface and replanted with native vegetation, including Salal.

Regular monitoring and maintenance should be conducted to ensure replanted areas are not recolonized by invasive species. It may take several seasons of treatment to fully eradicate some invasive species from this unit. Monitoring should also be conducted in the die-off areas to ensure the planted native vegetation is thriving.

U3 – Severe Invasives

This Vegetative Cover Designation occurs along the top of the slope adjacent to the east property line, in conjunction with the heaviest tree topping and limbing activities (Appendix D). This designation consists of dense, nonnative and invasive species, most prominently Himalayan blackberry, with little to no canopy. Management of these areas should consist of treating all invasive and nonnative competitive vegetation and replanting with a diverse palette of native canopy and understory species. All cuttings from invasive vegetation will be mulched on site if feasible. Annual monitoring should also be conducted to verify eradication of the invasive vegetation. These areas will likely require repeated treatment of invasives for several growing seasons before the areas remain clear of undesirable vegetation. Invasive species pressure on this area will remain high while the replanted canopy is immature.

6.1.3 Management Units

The Salmon Beach Slope project area is divided into 7 Management Units (MU). Unlike the Vegetative Cover Designations described in 6.1.2, the Management Units are strictly geographical designations within the project area to help locate and manage the work. The Management Units vary in size, but are generally 200 feet in length running north to south (see Appendix E). The boundaries between the Management Units are tied to existing features on the site, such as access points, locatable changes in the perimeter fence, or distances from known points that can be measured in the field. Any single Management Unit may contain multiple types of Vegetative Cover Designations. Restoration work on steeper slopes will be phased according to guidance in Section 5.1.1 to avoid the risk of slope failures.

TABLE 3: Vegetative Cover Designations within Management Units

		Management Unit (MU)						
		MU-1 7,890 SF	**MU-2** 16,750 SF	**MU-3** 24,855 SF	**MU-4** 22,085 SF	**MU-5** 23,055 SF	**MU-6** 42,005 SF	**MU-7** 22,635 SF
Vegetative Cover Designation	**C1**	0%	0%	46%	38%	12%	0%	0%
	C2	0%	57%	13%	0%	51%	78%	67%
	C3	100%	43%	41%	62%	37%	12%	33%
	U1	0%	0%	24%	70%	48%	74%	67%
	U2	0%	42%	34%	0%	11%	13%	33%
	U3	100%	58%	42%	30%	41%	13%	0%

6.1.4 City Action Plan

Vegetative Cover Designation Prioritization

The Vegetative Cover Designations C3 and U3 should be the top priority in restoration in order to remove the source of weed infestation and reestablish a tree canopy that will promote long-term slope stability and healthy understory growth. Next, Vegetative Cover Designation U2 should undergo a restoration. The Vegetative Cover Designation C2 is less of a priority and can be executed over a longer period of time, and could have restoration work occurring simultaneously with the C3 and U3 areas depending on the resources available. Monitoring will be conducted for each Vegetative Cover Designation area in order to evaluate the effectiveness of the restoration strategies and techniques used. This monitoring information will be used to adaptively manage future restoration work. Monitoring visits should be conducted every two years at a minimum and should include areas of Vegetative Cover Designation C1 and U1 to ensure that these areas are continuing to thrive.

6.2 PRIVATELY INITIATED ACTIONS

One of the goals of the Salmon Beach Slope LMP is to allow for a transparent process for private landowners to perform work on City-owned property, with professional oversight. The process is intended to supplement the current TMC 9.20 Trees and Shrubs – View Blockage process and requirements to remove and/or prune trees on City-owned property.

The Project Area contains Critical Areas as defined by TMC 13.11 Critical Areas Preservation, and all management actions are therefore governed by the requirements of the TMC and require a Minor Development permit from the City's Planning and Development Services (PDS) Department. This permit will allow ESD and other parties acting in compliance with this permitted LMP to perform work within the Project Area.

Proposed pruning projects located within areas above 67 percent slope may need additional City staff and/or geotechnical review. All proposals must comply with the Objectives and Standards as set forth in the final permitted LMP.

Process and submittal requirements are further defined in the Vegetation Modification Requests for Private View Management (Appendix H – draft pending approval).

7. CONCLUSION AND RECOMMENDATIONS

The Salmon Beach Slope LMP is designed to address landscape and vegetative challenges identified for Salmon Beach Slope and to provide strategies to prevent slope erosion, improve forest health and stormwater benefit, ensure public safety and provide a process to request private view improvement. Included in this LMP are management goals, objectives, and standards with management options and implementation tools to ensure the best possible approach to managing this Project Area with the above priorities in mind.

This report is written to provide the City and the public with specific vegetation management prescriptions for the Project Area, and is not intended to provide blanket approval for all work within environmental critical areas. Work within these critical areas may require additional review and documentation. Additional review and approval will be required by the City for any management activities that are proposed as being compliant with this document.

This LMP is prepared in order to obtain a minor development permit per the TMC, 13.11 Critical Areas Preservation to implement the management strategies contained within this LMP. In addition, the LMP is intended to provide the City with the tools necessary to manage the landscape in a manner which will not further degrade the Project Area. To ensure that the intent of the Critical Areas Preservation Code is met, periodic review of this landscape management plan, adaptive management implementation and any subsequent project proposals should be conducted by City staff on a regular basis. Please note that any vegetation removal will decrease the soil binding root mass and could increase the likelihood of slope failure. The LMP however, presents specific actions and mitigation methods that make vegetation management in the Project Area an acceptable risk by the City.

8. GLOSSARY

ANSI A300 Standards: Industry developed standards of practice for tree care; acronym for American National Standards Institute.

ANSI Z60.1 Standards: Industry developed standards for nursery stock sizing and describing plants to facilitate the trade in nursery stock; acronym for American National Standards Institute.

ANSI Z133.1: Industry developed safety standards for tree care operations.

Arborist; also see Certified Arborist: An individual engaged in the profession of arboriculture who, through experience, education and related training, possesses the competence to provide for or supervise the management of trees and other woody plants.

Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

Bare Root Stock: Plants grown in the ground in the nursery without artificial root restriction devices, such as containers or fabric bags. When dug the soil is removed from the root systems and the plants are transported and sold without soil.

Caliper: Diameter of a tree's trunk or stem measured at a point 6 inches above finish grade if the resulting measurement is up to and including 4 inches. If the resulting measurement is more than 4 inches the point of measurement shall be relocated to 12 inches above finish grade.

Central Branch; Central Leader: A singular, dominant, upright branch or stem which does not have any stems arising from a common junction having nearly the same size and diameter.

Certified Arborist: An individual who has achieved a level of knowledge in the art and science of tree care through experience and by passing a comprehensive examination developed by some of the nation's leading experts on tree care. Certified Arborists must maintain their certification and be in good standing with the International Society of Arboriculture (ISA), or equivalent agency.

Climate adapted: Both native and non-native plant species which are able to thrive in the local climate and soil conditions of a specific region. The two most authoritative references on climate adaptation for plants are the USDA Plant Hardiness Zones and the Sunset Climate Zones. Plants that are considered climate adapted shall be selected in accordance with one or both of these resources.

Codominant Branches; Codominant Leaders: Branches of stems arising from a common junction, having nearly the same size diameter.

Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when

removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant.

Coppicing: Is a pruning technique where a tree or shrub is cut to ground level. This method results in regeneration of new sprouts from the base. Coppicing is done in winter before trees come into active growth.

Topping: The practice of periodically cutting back the living, above ground portions of trees or shrubs to ground level or to a stump. This practice had been used on the west slopes of Salmon Beach Slope slope to accommodate for views.

Critical Root Zone (CRZ): The area under a tree whose diameter measures one foot per one inch of DBH from the trunk outwards and twenty-four inches in depth.

Deciduous: A plant that loses its leaves and remains leafless for some months of the year, usually in winter (temperate zones) or the dry season (tropical zones).

Diameter at breast height (DBH): A tree's trunk or stem diameter measured at four and one-half feet above the ground.

Drip Line: The area on the ground below the tree in which the boundary is designated by the edge of the tree's crown.

Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

Ecosystem Type: An Ecosystem is the combination of two words (ecological and system), which describes the collection of abiotic and biotic components and the process that governs behavior found therein. There are two types of ecosystems found on Earth: terrestrial and aquatic. All sub-types of ecosystems fall under these two categories.

Establishment Period: A minimum of a three year time period following the transplanting/installation of vegetation wherein maintenance is critical to the survival of the vegetation.

Evergreen: A plant that bears leafs throughout the year.

Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with a well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

Feeder Bluff: The term applied to certain coastal cliffs or headlands that provide sediment to down-current beaches as the result of wave action on the bluff.

Feeder Root Zone: The area under a tree whose diameter measures two feet per one inch of DBH from the trunk outwards and twenty-four inches in depth. For example, for a ten-inch DBH tree, the Feeder Root Zone is at least twenty feet in diameter and 24" deep.

Groundcover: Low and dense growing plants that cover the ground which can be planted for ornamental purposes, habitat or to prevent soil erosion. Turf lawn and mulch do not count as groundcover.

Hardiness Zones; USDA Plant Hardiness: Developed by the U.S. Department of Agriculture, Plant Hardiness Zones divide North America into geographic zones based on average winter lows.

Invasive Weeds; Noxious Weeds: Non-native plant species which have been proven to have a negative impact on the environment and are highly destructive, competitive, and difficult to control or eliminate. For a current listing of Pierce County Invasive/Noxious weeds consult the Pierce County Noxious Weed Control Board.

Perennial: A plant having a life cycle lasting three or more years.

Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, herbicides, fungicides, rodenticides, and molluscicides.

Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

Planting Area: Locations on private property or the public right-of-way proposed or required to be planted.

Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that that may be modified with soil amendments to produce a soil mixture best suited for plant growth.

Plants; Plant; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, groundcovers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

Root Flare; also called trunk flare: The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

Shrub: A woody perennial plant that is generally less than fifteen feet in height at maturity.

Slope Face: The sloping portion of a high bank, typically the area between the slope crest and the slope toe.

Slope Toe: The point where the base of a slope meets flat ground.

Soil-Binding Root Zone; Effective Tree Root Zone; 100 Percent Soil-binding Effective Tree Root Zone: calculated as 1-foot radius of lateral root extent outward from the trees trunk for every one inch of DBH of the tree's trunk. See "Critical Root Zone".

Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Stormwater Benefit: A term used to define stormwater management solutions aimed at improving water quality, restoring both terrestrial and aquatic ecosystems and controlling flooding and erosional issues.

Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

Surface Soil: Soil that is present at the top layer of the existing soil profile at the project project area. In undisturbed areas, the surface soil is typically the topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Top of Slope: area above the slope extending to the point of slope crest.

Tree Protection Zone (TPZ): The area surrounding the trunk of a tree intended to protect roots and soil within the Critical Root Zone and beyond, to ensure future tree health and stability. The location of the Tree Protection Zone is at the edge of the Critical Root Zone or Drip Line, whichever is greater.

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Appendix A: Selected Site Photographs

Image index. See images that correspond to letters on following pages.

A. Previously topped Douglas fir tree, now dead.

B. Madrone trees located in the northern portion of site, dead or dying.

C. Previously topped Douglas fir trees, dead or dying.

D. Previously topped Douglas fir tree.

E. Invasive overgrowth on upper slopes devoid of canopy trees.

F. Current view from vantage point of private homes, midway along slope looking west (el. 240).

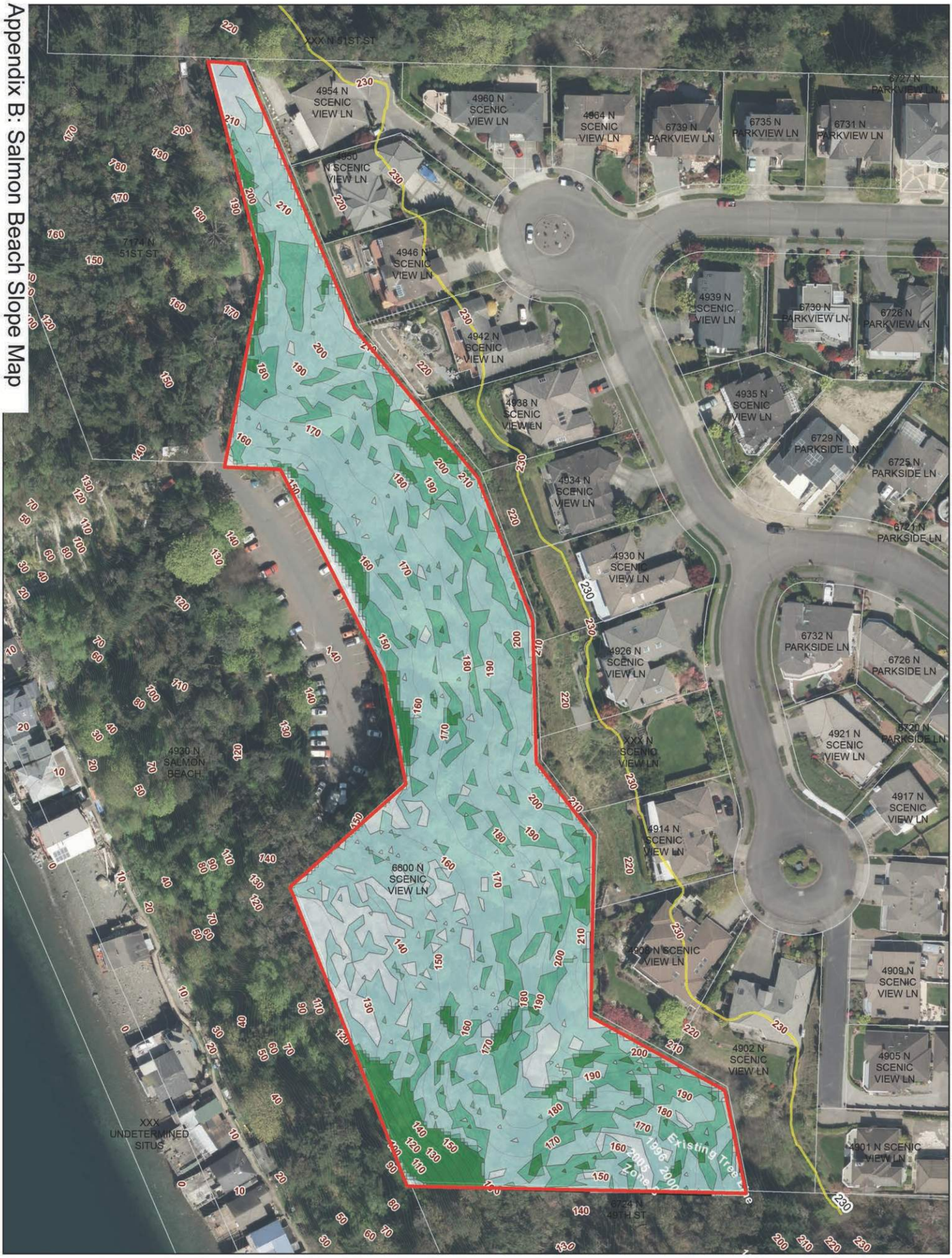
G. Current view from vantage point of private homes, southern end of project area looking southwest (el. 240).

H. Aerial view down of dead or dying Douglas fir near top of slope.

Appendix B: Salmon Beach Slope Map

Salmon Beach Slope Map

Appendix B: Salmon Beach Slope Map



Percent Slope

- 0-25%
- 25-50%
- 50-67%
- 67% Up

Parcel 6724200500

Slope Percent	Total Acres
0-25	.38
25-50	2.29
50-67	.81
67-UP	.28

0 50 100 200 Feet

Map Date: 7/6/2017
Source: Science and Engineering Division, Environmental Services Department
City of Tacoma
Environmental Services/ Science & Engineering
326 East D Street, Tacoma WA 98421
(253) 591-5588

Using 2010 BE Lidar Data at < 15 cm accuracy

Map by: Alexa Brockamp

S:\Projects\2017\P0004_SalmonBeachSlopeMap\doc\SalmonBeachPVMPZoneMap4.mxd

Appendix C: Canopy Cover Designations Map

APPENDIX C - CANOPY COVER DESIGNATIONS

0 50 100 200 300
SCALE IN FEET

Tacoma

Appendix D: Understory Cover Designations Map

APPENDIX D - UNDERSTORY COVER DESIGNATIONS

0 50 100 200 300
SCALE IN FEET

Tacoma

Appendix E: Management Unit Map

APPENDIX E - MANAGEMENT UNITS (MU)

0 50 100 200 300
SCALE IN FEET

Tacoma

Appendix F: Invasive Species Control Guidance


Washington State NWCB website 2010

English Holly

(*Ilex aquifolium*)

English holly is a suspect weed on the monitor list. Although slow-growing, this species survives in both sun and shade and can reach 15 to 50 ft in height and 15 ft in width. This growth can create dense thickets and suppress the establishment of native species. It reproduces via seed dispersal by birds or vegetatively through suckering or layering.

Control:

0-39% slopes [Washington State Noxious Weed Control Board (2010)]

- **Manual:** Small plants can be dug or pulled up when soil is moist. Be aware that mature trees have deep and extensive roots; digging large holly trees or thickets is labor-intensive and results in considerable soil disturbance if all the roots are removed. Weed wrenches can be used on larger shrubs to pry up the entire plant.
- **Mechanical:** Cutting holly trees at the base usually results in re-sprouting, but with monitoring and follow up the holly can be suppressed.
- **Chemical:** When dealing with large trees or thick stems, chop or cut the holly as close to the ground as possible and apply a herbicide with the active ingredient glyphosate (such as Roundup) directly into the cut portion. Frilling (making deep cuts at 45 degree angles into the tree's bark using an axe or sharp chisel) and pouring glyphosate into the cuts immediately afterward is also effective. Always follow label rates and instructions. Monitor for seedlings and root re-sprouting. Foliar herbicide treatment (spraying herbicides directly on the leaves) is not recommended due to holly's thick, waxy leaves which prevent the chemicals from being absorbed.

40-67% slopes

- **Manual:** Small plants can be dug or pulled up when soil is moist, as long as slope damage or excessive soil erosion does not occur. Manual removal of mature trees with deep and extensive roots on steep slopes is not recommended.
- **Mechanical:** See 0-39% slopes.
- **Chemical:** See 0-39% slopes.

Greater than 67%

- **Manual:** Not recommended unless incorporated with engineering solutions or an erosion control program.
- **Mechanical:** See 0-39% slopes.
- **Chemical:** See 0-39% slopes.

References and Additional Information

King County. 2008. *King County Noxious Weed Control Program Weed Alert: English Holly*. http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/Brochures/English-Holly-Fact-Sheet.pdf. November.

Washington State Noxious Weed Control Board website. 2010. *English Holly*. http://www.nwcb.wa.gov/detail.asp?weed=152. Accessed February 12, 2015.

Washington State NWCB website 2010

English Ivy

(*Hedera helix*)

English ivy is a Class C noxious weed. A shade tolerant vine species which is inhibiting the regeneration of native understory plants, this species produces adventitious roots that allow the vines to anchor to tree trucks, creating heavy foliage growth in the tree crown. This increases the weight of the tree canopy and increases the trees' potential for failure.

This species is a woody evergreen perennial. It grows as a vine when young (can reach up to 99 feet) and as a shrub after it matures. Its adventitious roots allow vines to anchor to a variety of surfaces. English ivy is capable of growing in a varying soil and light conditions, spreading rapidly by vegetative stem growth and, once mature, by seed (approximately 70% of seeds are viable).

Control:

0-39% slopes [Washington State Noxious Weed Control Board (2010)]

- **Manual:** Plants can successfully be pulled by hand or dug out. In the case of plants climbing on trees, vines can be cut at a comfortable height (ivy rings) to kill the upper portions of the vine.
- **Cultural:** Burning plants and re-sprouts at regular intervals with a blow torch will eventually deplete the plant's energy.
- **Chemical:** Please refer to the PNW Weed Management Handbook (see below).

- **40-67% slopes**
  - **Manual:** Small plants can be pulled up when soil is moist, as long as slope damage or excessive soil erosion does not occur. The implementation of erosion control measures may be necessary for large scale removals from the ground surface.
  - **Cultural:** See 0-39% slopes.
  - **Chemical:** See 0-39% slopes.
- **Greater than 67%**
  - **Manual:** Not recommended unless incorporated with engineering solutions or an erosion control program.
  - **Cultural:** See 0-39% slopes.
  - **Chemical:** See 0-39% slopes.

References and Additional Information

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Washington State NWCB website 2010

Himalayan Blackberry

(*Rubus armeniacus*)

Himalayan blackberry is a Class C noxious weed. An aggressively growing species with large hooked thorns, it creates dense thickets which severely impacts native vegetation. Its ability to reproduce from a variety of vegetative pieces increases its risk of creating monocultures in disturbed, sunny areas and inhibiting the growth of native understory.

This species is a woody evergreen, perennial shrub that can grow to 13 feet tall. Canes can reach 20-40 feet in length and root at the tip when they contact the ground. Himalayan blackberry also spreads via seeds, vegetative fragments, and re-sprouting rootstalks.

Control:

0-39% slopes [Washington State Noxious Weed Control Board (2010)]

- **Manual:** Mechanical control methods include repeatedly digging out root crowns and large roots and repeated removal of above ground growth several times a year 3.
- **Chemical:** Please refer to the PNW Weed Management Handbook (see below).

Slopes 40% and greater

- **Manual:** Not recommended unless incorporated with engineering solutions or an erosion control program.
- **Chemical:** See 0-39% slopes.

References and Additional Information

Pacific Northwest Weed Management Handbook website. 2015. *Blackberry Vines, wild (Rubus spp.).* http://pnwhandbooks.org/weed/other-items/control-problem-weeds/blackberry-vines-wild-rubus-spp. Oregon State University. Accessed January 6.

Soll, J. 2004. *Controlling* Himalayan Blackberry (*Rubus armeniacus* [*R. discolor, R. procerus*]) *in the Pacific Northwest*. The Nature Conservancy. http://www.invasive.org/gist/moredocs/hedhel02.pdf. March 30.

Washington State Noxious Weed Control Board website. 2010. *Himalayan Blackberry*. http://www.nwcb.wa.gov/detail.asp?weed=111. Accessed January 6, 2015.

Washington State NWCB website 2010

Japanese Knotweed

(*Polygonum cuspidatum*)

Japanese knotweed is a Class B noxious weed. Once established, it is difficult to control this species. It can form dense stands that crowd out native vegetation and degrade wildlife habitat.

This species is a shrubby perennial and spreads via long, stout rhizomes. It is commonly found in disturbed, sunny areas near the slope crest and can reach 4-8 feet in height.

Control:

0-39% slopes [Washington State Noxious Weed Control Board (2010)]

- **General:** Mowing or cutting plant shoots is ineffective alone; however, mowing followed by herbicide treatments will provide some control. Methods must be repeated if infestation is very large. Care must be taken not to produce new plants. All plant material should be removed. New plants can sprout from very small fragments.
- **Mechanical:** Grubbing out small clumps when discovered can prevent new colonies from establishing. Rhizomes and fragments left in the ground, or nearby, can regenerate and spread infestations. The entire root system must be removed since re-sprouting can occur from rhizomes.
- **Biological:** There are currently no registered biological control agents for use on any of these Polygonum species. Grazing may be an effective strategy to prevent establishment. Any grazing strategy should be carefully controlled to prevent damage in critical areas.
- **Chemical:** Please refer to the PNW Weed Management Handbook (see below).

Slopes 40% and greater

- **Mechanical:** Not recommended unless incorporated with engineering solutions or an erosion control program.
- **Biological:** Not recommended due to steep slope conditions.
- **Chemical:** See 0-39% slopes.

References and Additional Information

King County. 2008. *King County Noxious Weed Control Program Best Management Practices: Invasive Knotweeds*. http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/BMPs/Knotweed-Control.pdf. January.

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Soll, J. 2004. *Controlling* Knotweed (*Polygonum cuspidatum, P. sachalinense, P. polystachyum* and hybrids) *in the Pacific Northwest*. The Nature Conservancy. http://www.invasive.org/gist/moredocs/polspp01.pdf. January 16.

Washington State Noxious Weed Control Board website. 2010. *Japanese Knotweed*. http://www.nwcb.wa.gov/detail.asp?weed=103. Accessed January 6, 2015.

Washington State NWCB website 2010

Old Man's Beard

(*Clematis vitalba*)

Old man's beard is a Class C noxious weed. This species grows rapidly and blankets all layers of the forest, smothering vegetation and increasing the potential for tree failure.

Old man's beard is a deciduous perennial. Its climbing vines become woody and can grow up to 65 feet long. This species spreads via seed (each plant produces approximately 100,000 seeds, which are viable for up to five years) or stem fragmentation and prefers to have shaded roots but will grow quickly in full sun. Its taproot can reach several yards as well (King County 2010).

Control:

0-39% slopes [Washington State Noxious Weed Control Board (2010)]

- **Mechanical:** Seedlings can be hand pulled. Larger stems need to be cut and removed from the area.
- **Chemical:** Please refer to the King County Noxious Weed Control Program (see below).

40-67% slopes

- **Mechanical:** Small plants can be dug or pulled up when soil is moist, as long as slope damage or excessive soil erosion does not occur. The implementation of erosion control measures may be necessary for large scale removals from the ground surface.
- **Chemical:** See 0-39% slopes.

Greater than 67%

- **Mechanical:** Not recommended unless incorporated with engineering solutions or an erosion control program.
- **Chemical:** See 0-39% slopes.

References and Additional Information

King County. 2010. *King County Noxious Weed Control Program Best Management Practices: Old Man's Beard*. http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/BMPs/Old-mans-beard-Clematis-vitalba-control.pdf. January.

Washington State Noxious Weed Control Board website. 2010. *Old Man's Beard.* http://www.nwcb.wa.gov/detail.asp?weed=37. Accessed January 6, 2015.

Washington State NWCB website 2010

Reed Canarygrass

(*Phalaris arundinacea*)

- Reed canarygrass is a Class C noxious weed. This perennial grass can grow three to six feet in height and often forms dense monotypic stands in wetland ecosystems that provide little value to the wildlife habitat and prevent the establishment of more beneficial native species. Monocultures can withstand extended periods of inundation, and reproduction occurs via seeds, creeping rhizomes, or sprouting nodes of freshly cut stems.

Control:

0-39% slopes [Washington State Noxious Weed Control Board (2010)]

- **Manual:** Hand pulling and digging is only practical for small patches, be sure to remove the entire root mass. Infestations can be controlled by smothering with heavy cardboard and compost prior to the growing season, then planted with desired native species; however, this will not completely eliminate the infestation, only reduce the density.
- **Mechanical:** Mowing may be a valuable control method, since it removes seed heads before seed maturation and exposes the ground to light, which promotes the growth of native species. Studies in Wisconsin indicated that twice-yearly mowings (in early to mid-June and early October) led to increased numbers of native species in comparison to reed canarygrass-infested plots that were not mowed.
- **Chemical:** Please refer to the PNW Weed Management Handbook (see below).

- **40-67% slopes**
  - **Manual:** See 0-39% slopes. Erosion control BMPs may be necessary for larger areas.
  - **Mechanical:** See 0-39% slopes.
  - **Chemical:** See 0-39% slopes.

Greater than 67%

- **Mechanical and Manual:** Not recommended unless incorporated with engineering solutions or an erosion control program.
- **Chemical:** See 0-39% slopes.

References and Additional Information

King County. 2011. *King County Noxious Weed Control Program Weed Alert: Reed Canarygrass*. http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/Brochures/Reed-Canarygrass-factsheet.pdf. August.

Tu, Mandy. 2004. *Reed Canarygrass (Phalaris arundinacea L.) Control and Management in the Pacific Northwest*. The Nature Conservancy's Wildland Invasive Species Team. http://www.invasive.org/gist/moredocs/phaaru01.pdf. June 7.

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Washington State Noxious Weed Control Board website. 2010. *Reed Canarygrass*. http://www.nwcb.wa.gov/detail.asp?weed=100. Accessed February 12, 2015.

Washington State NWCB website 2010

Scotch broom

(*Cytisus scoparius*)

- Scotch broom is a Class C noxious weed. This species is a multi-branched perennial shrub that can range from 3 to 10 feet tall. It can produce thousands of seeds each year, which are poisonous to some animals and have the potential to remain viable up to 80 years in the soil. Scotch broom spreads aggressively in sunny, dry areas, outcompeting understory vegetation and young trees.

Control:

- **0-39% slopes** [Washington State Noxious Weed Control Board (2010)]
  - **General:** Because plants can produce thousands of seed each year and these seeds can survive for a long period of time in the soil, methods must be repeated for many years. Continue to monitor areas for seedlings after plants have been controlled. Soil disturbance can cause a flush of seed germination. Aim to control plants before seed pods mature.
  - **Mechanical:** Hand pulling and digging up plants are an option for small infestations. Use a tool like a Weed Wrench, Extractigator, or Uprooter to leverage plants out of the ground, along with their roots. Chopping, cutting or mowing is an option for flat areas. Cutting plants close to the ground when they are drought stressed, late summer, can provide control on plants with stems wider than 2 inches. Monitor plants for resprouts. Cutting followed by an herbicide application on new growth can also be effective.
  - **Biological:** The Scotch broom seed weevil, Exapion fuscirostre, larvae feed on seeds of Scotch broom in developing seed pods. The adults also feed on flowers and the tips of stems, though their damage is not significant. The Scotch broom bruchid, Bruchidius villosus, larvae feed on developing seeds and impact the plant's reproduction.
  - **Chemical:** Please refer to the PNW Weed Management Handbook (see below).
- **40-67% slopes**
  - **Mechanical:** Small plants can be dug or pulled up when soil is moist, as long as slope damage or excessive soil erosion does not occur. Manual removal of mature shrubs with deep and extensive roots on steep slopes is not recommended without the implementation of erosion control BMPs.
  - **Biological:** See 0-39% slopes.
  - **Chemical:** See 0-39% slopes.

- **Greater than 67%**
  - **Mechanical:** Not recommended unless incorporated with engineering solutions or an erosion control program.
  - **Biological:** See 0-39% slopes.
  - **Chemical:** See 0-39% slopes.

References and Additional Information

King County. 2008. *King County Noxious Weed Control Program Best Management Practices: Scotch Broom, Scot's Broom*. http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/BMPs/Scotch-Broom-Control.pdf. January.

Huckins, E and J. Soll. 2004. *Controlling Scotch (Scots) Broom (Cytisus scoparius) in the Pacific Northwest*. Lincoln County Soil and Water Conservation District and The Nature Conservancy. http://www.invasive.org/gist/moredocs/cytsco01.pdf. April 5.

Pacific Northwest Weed Management Handbook website. 2015. *Broom, Scotch (Cytisus scoparius).* http://pnwhandbooks.org/weed/other-items/control-problem-weeds/broom-scotch-cytisus-scoparius. Oregon State University. Accessed February 12.

Washington State Noxious Weed Control Board website. 2010. *Scotch Broom*. http://www.nwcb.wa.gov/detail.asp?weed=44. Accessed February 12, 2015.

Field bindweed aka Morning glory (*Convolvulus arvensis*)

Field bindweed is a Class C noxious weed. This species is a perennial herbaceous plant with creeping and twining stems that grow along the ground and up through other plants and structures. It has an extensive system of rhizomes that can grow deep into the soil. Once established it can be nearly impossible to eradicate. It forms an extensive root system, often climbing or forming dense tangled mats.

Control:

- **0-39% slopes** [King County Noxious Weed Control Board (2007)]
  - **General:** Since field bindweed seeds can survive in the soil for many decades, total eradication is not a realistic short-term goal where seeds lie dormant. For best results, control methods should be used throughout several growing seasons; success in controlling this weed requires the prevention of seeds, competition from more desirable vegetation and vigilance in removing new growth.
  - **Mechanical:** Avoid digging or tilling the soil around mature field bindweed roots; roots or rhizome fragments left behind may resprout. Repeated hand pulling works eventually, but is highly labor intensive. It is best to limit hand pulling and tilling to seedlings; do in early spring when the ground is wet. Smothering plants with mulch, black plastic or plastic-fiber mats (geotextiles) is another option, but the covering must be kept in place for several years. Success may be somewhat limited as field bindweed can persist without light, sending its underground roots beyond the edge of the covering to start a new infestation. If using coverings, check often for cracks or openings; pull or spot spray any new growth coming up through the covering.
  - **Biological:** The bindweed gall mite, *Aceria malherbae*, form galls on leaves, leaf stems, and shoot tips resulting in stunted plants and reduced flowering. Nymphs and adults overwinter on bindweed root buds. For more information, refer to WSU Extension Integrated Weed Control Project (see below).
  - **Chemical:** Please refer to the PNW Weed Management Handbook (see below).

- **40-67% slopes**
    - **Mechanical:** Small plants can be dug or pulled up when soil is moist, as long as slope damage or excessive soil erosion does not occur. Manual removal of mature plants with deep and extensive roots on steep slopes is not recommended without the implementation of erosion control BMPs.
    - **Biological:** See 0-39% slopes.
    - **Chemical:** See 0-39% slopes.
- **Greater than 67%**
    - **Mechanical:** Not recommended unless incorporated with engineering solutions or an erosion control program.
    - **Biological:** See 0-39% slopes.
    - **Chemical:** See 0-39% slopes.

References and Additional Information

King County. 2007. *King County Noxious Weed Control Program Best Management Practices: Field Bindweed (aka Morning Glory*). http://www.nwcb.wa.gov/pdfs/Bindweed_factsheet_King.pdf. Revised September 2007.

Morishita, D., R. Callihan, C. Eberlein, J. McCaffrey, & D. Thill. October 2005. Field Bindweed. In: Peachey, E., editor. Pacific Northwest Weed Management Handbook [online]. Corvallis, OR: Oregon State University. https://catalog.extension.oregonstate.edu/pnw580 (accessed 29 June 2017).

Washington State Noxious Weed Control Board website. 2017. *Field Bindweed*. http://www.nwcb.wa.gov/weeds/field-bindweed. (accessed 29 June 2017).

Washington State University Extension. 2017. Integrated Weed Control Project: Biological Control Agents [online]. Puyallup, WA: WSU Extension. http://invasives.wsu.edu/biological/aceriamalherbae.htm. (accessed 29 June 2017).

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Appendix G: Specifications

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1.0 GENERAL

These specifications shall be reviewed prior to vegetation enhancement within the Salmon Beach Slope Project Area to ensure the parties involved understand the intent and the specific details related to the *Salmon Beach Slope Landscape Management Plan (LMP), Tacoma, Washington*. The Project Area is identified on Exhibits 1 – 3 of the Landscape Management Plan. All work implemented under these specifications shall be conducted under the review and approval of the City of Tacoma (City).

1.1 APPLICATION

Specifications are provided for the following management elements as identified in the Landscape Management Plan:

- Achieving a Sustainable Target Ecosystem (Report Section 4.1.1)
- Geologic Hazard Mitigation (Report Section 4.1.2)
- Improving Wildlife Habitat (Report Section 4.1.4)
- Protecting Public Infrastructure and Public Safety (Report Section 4.1.5)
- Vegetation Modification Requests for Private View Management (Section 4.1.6).

Applicable management elements will be considered within each management unit (MU1-MU7) located in the Salmon Beach Slope Project Area. Allowable and recommended actions within each management unit are dictated by slope gradient and location on the slope and broken down as follows:

- Slope gradient:
  - Slopes (0 to 50 percent)
  - Slopes (50 to 66 percent)
  - Slopes (67 percent and greater);
- Slope location:
  - Upper Slope (above approx. elevation 180)
  - Lower Slope (below approx. elevation 180)

Slope gradients are shown on Appendix C of the Landscape Management Plan.

2.0 PLANT SELECTION AND INSTALLATION

This section provides specifications for the selection and installation of plantings to meet the management goals, objectives and standards and to supplement the landscape management procedures provided in Sections 5.2 and 5.3 of the Management Plan.

2.1 PLANT MATERIALS

Plant materials should consist of containerized plantings (1 gallon size or larger), seedlings, live stakes, and seeding. Once plantings have been installed, the planting area should be monitored for a 5-year period to evaluate plant establishment as outlined in Section 4.0 Maintenance and Monitoring of these specifications. The planting material recommended for slope conditions are described below:

- **Containerized Plantings:** Containerized trees and shrubs (1 gallon size or larger) are appropriate to be used adjacent to accessible areas with slope conditions up to 67 percent or as approved by the City.
- **Seedlings:** Bare root or containerized plug seedlings of trees and shrubs are appropriate to be used within accessible areas with slope conditions up to 67 percent and with slope stabilization measures as approved by the City.
- **Live Stakes:** Live stakes (also known as live cuttings) of trees and shrubs are appropriate to be used in all accessible areas with appropriate soil moisture, and can be used with erosion control or slope stabilization measures as approved by the City.
- **Seeding:** Seeding is appropriate to be used within accessible areas with slope conditions up to 67 percent and with erosion control and slope stabilization measures as approved by the City.

Plant materials shall be native to Pierce County, locally grown (western Washington, western Oregon, or western British Columbia), healthy, bushy, in vigorous growing condition, and be guaranteed true to size, name, and variety. Plants shall be free from disease, injury, insects, insect eggs, root weevils and other types of weevils, larvae, weed roots, and defects such as knots, sun scald, injuries, abrasions, disfigurements, and irregular growth arising from frost damage. Local genetics shall be confirmed by a signed letter from the nursery. To acclimate plant materials to Northwest conditions, all plant materials used on a project shall be grown continuously outdoors north of the 42nd parallel north (Oregon-California border) from August 1 of the year prior to the time of planting.

Plant materials shall meet the requirements of the current edition of the American Standard for Nursery Stock (American Horticulture Industry 2014) and state and federal laws with respect to

plant disease and infestations. Inspection certificates, as required by law, shall accompany each and every shipment and shall be submitted for approval by the City upon the receipt of plant materials.

2.1.1 RECOMMENDED PLANTINGS

The location for the recommended plantings will be based on the slope location (top of slope, slope face, slope toe), and amount of light received (shade, part shade, sun). Substitutions of plant species, sizes, and composition (percent of plantings) may be permitted, but only with prior written approval by the City. Resources identifying appropriate native plantings include:

- Washington Department of Ecology Plant Selection Guide for slope stabilization projects. Accessible at: http://www.ecy.wa.gov/programs/sea/pubs/93-30/table3.html.
- Pierce County Department of Planning and Land Services Northwest Native Plant List. Accessible at: http://www.co.pierce.wa.us/DocumentCenter/View/4363.

Recommended plantings for the project area are provided in Table 1 below. The following table provides the recommended plantings for the following locations:

- Lower Slope, dry soils, shade to part shade
- Lower Slope, dry soils, sun
- Upper Slope, dry to moist soils, sun
- Upper Slope, dry to moist soils, shade to part shade.

TABLE 1
RECOMMENDED PLANTINGS

Lower Slope – below elev. 180 **Dry Soils, Shade to Part Shade - below elev. 180**					
Scientific Name	**Common Name**	**Form**	**Mature Height**	**Stock Type and Spacing O.C.**	**Percent of Plantings**
Tree Layer					
Abies grandis	Grand Fir	Evergreen Large Tree	100 ft	C (15'-0"), S (6'-0")	30
Acer circinatum	Vine Maple	Deciduous Small Tree	20 ft	C (12'-0"), S (5'-0")	20
Rhamnus purshiana	Cascara	Deciduous Small Tree	30 ft	C (12'-0"), S (5'-0")	15
Thuja plicata	Western Redcedar	Evergreen Large Tree	100 ft	C (15'-0"), S (6'-0")	20
Tsuga heterophylla	Western Hemlock	Evergreen Large Tree	70 ft	C (15'-0"), S (6'-0")	15
Shrub Layer					
Corylus cornuta	Beaked Hazelnut	Deciduous Shrub	12 ft	C (6'-0"), S (4'-0")	10
Holodiscus discolor	Oceanspray	Deciduous Shrub	12 ft	C (6'-0"), S (4'-0")	15
Sambucus racemosa	Red Elderberry	Deciduous Shrub	10 ft	C (6'-0"), S (4'-0")	20
Oemleria cerasiformis	Indian Plum	Deciduous Shrub	15 ft	C (6'-0"), S (4'-0")	15

Gaultheria shallon	Salal	Evergreen	Shrub	3 ft	C (4'-0"), S (2'-0")	25
Vaccinium ovatum	Evergreen Huckleberry	Evergreen	Shrub	6 ft	C (4'-0"), S (2'-0")	15
Ground Cover Layer						
Berberis nervosa	Dull Oregon Grape	Evergreen	Ground cover	2 ft	C (3'-0"), S (2'-0")	35
Polystichum munitum	Sword Fern	Evergreen	Fern	3 ft	C (3'-0"), S (2'-0")	35
Symphoricarpos mollis	Trailing Snowberry	Deciduous	Ground cover	1 ft	C (3'-0"), S (2'-0")	30

C = Containerized 1 gallon or larger
ft = Feet
O.C. = On center spacing in feet (ft)
S = Seedling

Lower Slope

Dry Soils, Sun – below elev. 180

Scientific Name	Common Name	Form		Mature Height	Stock Type and Spacing O.C.	Percent of Plantings
Tree Layer						
Abies grandis	Grand fir	Evergreen	Large Tree	100 ft	C (15'-0"), S (6'-0")	30
Arbutus menziesii	Madrone	Evergreen	Large Tree	60 ft	C (15'-0"), S (6'-0")	0[1]
Rhamnus purshiana	Cascara	Deciduous	Small Tree	30 ft	C (12'-0"), S (5'-0")	15
Pinus contorta	Shore Pine	Evergreen	Large Tree	40 ft	C (15'-0"), S (6'-0")	20
Pseudotsuga menziesii	Douglas Fir	Evergreen	Large Tree	100 ft	C (15'-0"), S (6'-0")	35
Shrub Layer						
Corylus cornuta	Beaked Hazelnut	Deciduous	Shrub	12 ft	C (6'-0"), S (4'-0")	25
Holodiscus discolor	Oceanspray	Deciduous	Shrub	12 ft	C (6'-0"), S (4'-0")	25
Berberis aquifolium	Tall Oregon grape	Evergreen	Shrub	8 ft	C (4'-0"), S (2'-0")	35
Rosa nutkana	Nootka Rose	Deciduous	Shrub	10 ft	C (6'-0"), S (4'-0")	15
Ground Cover Layer						
Arctostaphylos uva-ursi	Kinnikinnick	Evergreen	Ground cover	< 1 ft	C (2'-0"), S (1'-0")	50
Symphoricarpos mollis	Trailing Snowberry	Deciduous	Ground cover	1 ft	C (3'-0"), S (2'-0")	50

C = Containerized 1 gallon or larger
Ft = Feet
O.C. = On center spacing in feet (ft)
S = Seedling
[1] Madrone can be installed, however, due to its high transplant mortality it is not recommended as a primary planting. Volunteer trees should be encouraged.

Upper Slope – above elev. 180 Dry Soils, Sun						
Scientific Name	**Common Name**	**Form**		**Mature Height**	**Stock Type and Spacing O.C.**	**Percent of Plantings**
Tree Layer						
Abies grandis	Grand Fir	Evergreen	Large Tree	100 ft	C (15'-0"), S (6'-0")	20
Acer circinatum	Vine Maple	Deciduous	Small Tree	20 ft	C (12'-0"), S (5'-0")	10
Arbutus menziesii	Madrone	Evergreen	Large Tree	60 ft	C (15'-0"), S (6'-0")	0[1]
Rhamnus purshiana	Cascara	Deciduous	Small Tree	30 ft	C (12'-0"), S (5'-0")	25
Pinus contorta	Shore Pine	Evergreen	Large Tree	40 ft	C (15'-0"), S (6'-0")	45
Shrub Layer						
Corylus cornuta	Beaked Hazelnut	Deciduous	Shrub	12 ft	C (6'-0"), S (4'-0")	15
Holodiscus discolor	Oceanspray	Deciduous	Shrub	12 ft	C (6'-0"), S (4'-0")	15
Myrica californica	Pacific Wax-Myrtle	Evergreen	Shrub	15 ft	C (6'-0"), S (4'-0")	20
Berberis aquifolium	Tall Oregon Grape	Evergreen	Shrub	8 ft	C (4'-0"), S (2'-0")	30
Rosa nutkana	Nootka Rose	Deciduous	Shrub	10 ft	C (6'-0"), S (4'-0")	20
Ground Cover Layer						
Arctostaphylos uva-ursi	Kinnikinnick	Evergreen	Groundcover	< 1 ft	C (2'-0"), S (1'-0")	50
Symphoricarpos mollis	Trailing Snowberry	Deciduous	Groundcover	1 ft	C (3'-0"), S (2'-0")	50

C = Containerized 1 gallon or larger
ft = Feet
O.C. = On center spacing in feet (ft)
S = Seedling

[1] Madrone can be installed, however, due to its high transplant mortality it is not recommended as a primary planting.

Upper Slope – above elev. 180 Dry Soils, Shade to Part Shade						
Scientific Name	**Common Name**	**Form**		**Mature Height**	**Stock Type and Spacing O.C.**	**Percent of Plantings**
Tree Layer						
Acer circinatum	Vine Maple	Deciduous	Small Tree	20 ft	C (12'-0"), S (5'-0")	35
Pinus contorta	Shore Pine	Evergreen	Large Tree	40 ft	C (15'-0"), S (6'-0")	20
Rhamnus purshiana	Cascara	Deciduous	Small Tree	30 ft	C (12'-0"), S (5'-0")	20
Tsuga heterophylla	Western Hemlock	Evergreen	Large Tree	70 ft	C (15'-0"), S (6'-0")	25
Shrub Layer						
Corylus cornuta	Beaked Hazelnut	Deciduous	Shrub	12 ft	C (6'-0"), S (4'-0")	15
Holodiscus discolor	Oceanspray	Deciduous	Shrub	12 ft	C (6'-0"), S (4'-0")	15
Myrica californica	Pacific Wax-Myrtle	Evergreen	Shrub	15 ft	C (6'-0"), S (4'-0")	20
Oemleria cerasiformis	Indian Plum	Deciduous	Shrub	15 ft	C (6'-0"), S (4'-0")	15
Gaultheria shallon	Salal	Evergreen	Shrub	3 ft	C (4'-0"), S (2'-0")	20
Vaccinium ovatum	Evergreen Huckleberry	Evergreen	Shrub	6 ft	C (4'-0"), S (2'-0")	15
Ground Cover Layer						
Berberis nervosa	Dull Oregon Grape	Evergreen	Groundcover	2 ft	C (3'-0"), S (2'-0")	35
Polystichum munitum	Sword Fern	Evergreen	Fern	3 ft	C (3'-0"), S (2'-0")	35
Symphoricarpos mollis	Trailing Snowberry	Deciduous	Groundcover	1 ft	C (3'-0"), S (2'-0")	30

C = Containerized 1 gallon or larger

ft = Feet
O.C. = On center spacing in feet (ft)
S = Seedling

2.1.2 TEMPORARY STORAGE

Plants must be stored in the manner necessary to accommodate their horticultural requirements. Protect plant material stored on site from weather damage, construction activity, and vandalism. Protect bare roots by covering with moist soil, mulch, or sawdust. Water as required to keep roots moist. Keep plants moist and shaded until the actual time of installation. Highly perishable live cuttings and bare root plants must be stored in shaded, cool, moist conditions before planting. Live cuttings should be placed in a bucket with bottoms under water. Make sure that stakes are placed in the bucket right-side-up. Do not allow any plants or stakes to be exposed to freezing temperatures prior to planting.

2.2 SITE PREPARATION

Prior to planting, the project proponent will verify that soil conditions are suitable within the work areas, including soil composition, degree of compaction, and final elevations. Soil moisture additives, compost, and soil amendments may be added to improve plant survivability if site irrigation cannot be conducted due to slope conditions. Any unsatisfactory conditions (such as compaction or lack of organic matter) shall be corrected prior to the start of work. The City shall be notified when conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions.

2.2.1 NOXIOUS WEED MANAGEMENT

In the planting areas, noxious weed species will be cut and treated prior to plant installation. A complete list of noxious weed species can be found at the Washington State Noxious Weed Control Board website; noxious weed control information and resources are located in Section 5.5 and Appendix F of the Landscape Management Plan. Other invasive weed species that threaten the success of the desired native plantings may be identified and treatment may be required.

2.2.2 EXISTING NATIVE VEGETATION

Existing native vegetation to include native trees, shrubs, ferns, and forbs shall be retained and protected to the greatest extent possible. Trees and vegetation will be managed in order to provide for public safety and infrastructure protection in accordance with Section 7.0 Public Safety and Infrastructure Protection of this specifications appendix.

2.2.3 INSTALL EROSION PROTECTION

Erosion protection shall be installed (as applicable) in accordance with Section 5.0 Erosion Control prior to any site disturbance, including planting.

2.3 PLANT INSTALLATION

Plants shall be installed in a random, natural pattern determined by site conditions and locations of existing vegetation. Preliminary planting layout will require prior approval by the City.

The total time spent traversing and active within the project area for plant installation should be minimized to reduce the effect of soil erosion and compaction. Plant installation requires prior planning and adhering to the following procedures:

- Avoid planting in wet weather conditions
- Clearly identify planting limits and establish an access route for installation
- Conduct digging and excavations concurrently with plant installation
- Use seedling stock or stakes whenever feasible to minimize soil disturbance.

Detailed directions for planting containerized plants, seedlings, live stakes, and seeding are described below.

2.4 REFERENCE DOCUMENTS

The project specifications are based on the following Standard Specifications:

1. American Standard for Nursery Stock, ANSI Z60.1-2014. American Horticulture Industry Association, 2130 Stella Court, Columbus, Ohio, 43215.
2. Hortus Third. Liberty Hyde and Ethel Zoe Bailey. 2000. MacMillan Publishing Co., New York, New York.
3. Creating the Urban Forest: The Bare Root Method. 2009. Urban Horticulture Institute, Department of Horticulture, Cornell University.
4. Washington State Noxious Weed Control Board website. 2015. *Noxious Weed Search*. http://www.nwcb.wa.gov/default.asp. Accessed February 18.
5. International Society of Arboriculture website. 2015. *International Society of Arboriculture*. http://www.isa-arbor.com/. Accessed February 18.
6. USDA, NRCS website. 2015. *Plant Materials Program*. http://www.nrcs.usda.gov/wps/portal/nrcs/site/plantmaterials/home/. U.S. Department of Agriculture Natural Resource Conservation Service Plant materials Program. Accessed February 18.

3.0 INVASIVE SPECIES MANAGEMENT

This section provides specifications for invasive and noxious weed species management to meet the goals, standards and objectives of the Landscape Management Plan (Section 4) and to supplement the landscape management procedures provided in Section 5.0 of the Management Plan.

3.1 INVASIVE TREATMENT

In the planting areas, all noxious and identified invasive weed species will be cut and treated prior to plant installation. A complete list of noxious weed species can be found at the Washington State Noxious Weed Control Board website; additional noxious weed species control information and resources are located in Section 5.5 and Appendix F of the Landscape Management Plan.

Noxious weed species identified within the project area which control and management shall be considered a priority include:

Class B

- Scotch Broom (*Cytisus scoparius*)
- Herb-Robert (*Geranium robertainum*)

Class C and Monitor List as Noted

- English Ivy (*Hedera helix*)
- Himalayan Blackberry (*Rubus armeniacus*)
- Field Bindweed (*Convolvulus arvensis*)
- Reed Canarygrass (*Phalaris arundinacea*)
- English Holly (*Ilex aquifolium*) - Monitor list.

4.0 MAINTENANCE, MONITORING, AND ADAPTIVE MANAGEMENT

This section includes requirements for maintenance and monitoring of planted areas. Planted areas will be monitored and maintained for a minimum of 5 years post-installation to verify plant establishment.

4.1 MAINTENANCE

This section includes maintenance items that are required during the 5-year monitoring period, including, but not limited to:

- Mulching
    - Mulch can be added within the planting area or around plants to increase soil moisture retention. Mulch must be kept away from the plant stem.
- Watering and Irrigation
    - Watering and irrigation can be applied to accessible areas up to 60 percent slope only if authorized by the City and demonstrated that watering and irrigation activities will not cause soil erosion or impact slope stability.
- Correction of erosion and drainage problems
    - Under the direction of the City, correct any erosion and drainage problems throughout the 5-year monitoring period.
- Weeding
    - Aerial cover of noxious and/or invasive weed species should not exceed 15 percent. A list of noxious weeds and non-native, invasive species identified within the project area are provided in Section 3.0 Invasive Species Management of these Specifications. Additional listings can be found at the Washington State Noxious Weed Control Board website. Additional noxious weed species control information and resources are located in Appendix F of the Landscape Management Plan. Mechanical weed trimmers should not be used after the installation of native plantings to prevent damage to plantings. Herbicidal application can be applied only in a manner in which it will not damage surrounding native vegetation or installed plantings and as required by all governing regulations regarding herbicide use.
    - Special attention should be paid to the “edges” of project areas, where invasive insurgence and plant success may be problematic.
- Maintenance of Trees and Shrubs
    - Pruning shall be conducted in accordance with Section 9.0 Pruning of these specifications.
- Resetting plants to proper grade and upright position (if applicable).
- Replacements shall be completed during the periods set out as planting periods; shall be subject to the same conditions; and shall be made in the same manner as specified for the original planting area unless otherwise approved by the City.
- Removal of temporary erosion control.

4.2 MONITORING

A monitoring plan will be implemented by the project proponent or project proponent's representative to document the progress and challenges of the plants and project area according to the objectives and performance standards for the management element(s) as defined in Section 4.1 of the Landscape Management Plan. Monitoring must be conducted by a Certified Horticulturalist, Restoration Ecologist, Professional Wetland Scientist, Certified Arborist, Landscape Architect or other qualified professional as approved by the City. Monitoring will also assist in identifying adaptive management needs. Each planting area will be monitored for a minimum period of 5 growing seasons from the date of installation. The project will be specifically monitored for the survival of the planted material within the planting area, the aerial coverage of noxious or invasive weed species, soil erosion, vandalism, disease, survivability, human activity, and slope failure.

Monitoring of the restoration site will include the following:

- Establishment of at least one 50 foot monitoring transect per quarter acre of planting area to monitor survival of plantings, percent cover of plantings, composition of the plant community, and noxious/invasive weed species coverage. Noxious weed coverage will also be qualitatively described, with recommendations for control activities.
- Percent survivability will be monitored using randomly selected but permanent sample plots located along the established permanent transect (2 sample plots per 50 foot transect). Sample plots will consist of a 9 foot radius circle from a stationary point along transect.
- Photographs will be collected from each transect end and each sample plot point to compare vegetation density and compositions from year to year.
- Observations of the project area for excessive erosion, slope instability, vandalism, disease, plant stress, human activity and debris, as well as general observations of the entire planting area and/or areas directly adjacent.

4.2.1 METHODS

4.2.1.1 PHOTOPOINTS

1. Photopoints provide a visual record of the mitigation site over time. General photographs provide a representative view of the entire area and are helpful to document large-scale changes over time.

2. Select one or more locations (depending on the size of the restoration area) from which you can capture the majority of the site. Mark this spot in the field so that you can find the exact location from year to year. You may wish to drive a steel or wooden stake in the ground at this location. May be located off-site for the best view. If your camera has the capability to imprint the date on the photograph, take advantage of this.

3. Identify the location of photopoints and the direction (north, south, east, and west) in which the photo was taken on your site plan.

4.2.1.2 LINE INTERCEPT METHOD

The line intercept method is used to estimate the percent cover of trees and shrubs.

1. Establish permanent 50-foot transect lines – one per every quarter acre of project area. Transects will be permanently established and used for the entire monitoring period. To establish transects, stretch a 50-foot tape measure between two points through an area planted with trees and shrubs. This same transect may be used to collect data for any of the methods.

2. Show the location of the transect on your site plan.

3. Begin at the zero end of the tape, walk along the tape, noting and recording the length that each plant intercepts the transect line.

4.2.2 PERFORMANCE STANDARDS

Monitoring of the planting area must be tied to performance standards in order to consistently evaluate progress or identify areas needing improvement. If a performance standard is not met, site conditions shall be re-evaluated to identify remedial actions that can be implemented to help ensure that the project ultimately meets its goals and final success criteria. Performance goals, objectives, and standards are provided for each management element in Section 4.1 of the Landscape Management Plan:

- Achieving a Sustainable Target Ecosystem
- Geologic Hazard Mitigation
- Improving Wildlife Habitat
- Maximizing Stormwater Benefits
- Protecting Public Infrastructure and Public Safety
- Vegetation Modification Requests for Private View Management

4.2.3 SUCCESS CRITERIA

The planting area will be considered a success if it meets the performance standard criteria for the applicable management elements. Additionally, vegetation in the planting area should be self-sustaining without irrigation or weeding per coverage standards. If the success criteria are not met, the monitoring program may be reviewed and extended by the City.

4.3 ADAPTIVE MANAGEMENT

Restoration is an inexact science. Adaptive management must be considered when the site fails to meet performance measures. Adaptive measures could consist of, but are not limited to:

- Substitution of plant species
- Employing alternative erosion control methods
- Site security measures

5.0 EROSION CONTROL

This section provides specifications for erosion control best management practices (BMPs) to meet the management goals, objectives and standards for geologic hazard mitigation (Report Section 4.1.2) and to supplement the landscape management procedures provided in Report Section 5.5 of the Landscape Management Plan. Erosion control BMPs also apply during and following plant installation and noxious weed species removal.

5.1 BEST MANAGEMENT PRACTICES FOR EROSION CONTROL

Erosion control best management practices can be implemented to aid plants in becoming established. These include (but are not limited to) the use of short term BMPs such as erosion blanket nets, compost blankets, and seeding; moderate term BMPs such as wattles; and long term BMPs such as mulch and compost which may require re-application. Application shall be conducted in accordance with the most current version of the City erosion control BMPs as provided in the City's Stormwater Management Manual (SWMM) available at: www.cityoftacoma.org/stormwatermanual.

5.1.1 SEEDING

Temporary and permanent seeding (BMP C120: Temporary and Permanent Seeding) is intended to reduce erosion by stabilizing exposed soils. Temporary erosion control seed mix is provided in the City's SWMM for Temporary Erosion Control (Table 2-1). Seeding within critical areas such as wetland buffers and wetlands shall use native grass mix as provided on Table 2 below. Substitute native grasses can be used with written approval from the City. These seed mixes are intended to bind the surficial layer of soil, and will not be effective against deep erosion.

Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) should be used on steep slopes. BFM/MBFM products are applied at a minimum rate of 3,000 pounds per acre of mulch with approximately 10 percent tackifier as provided in the City's SWMM.

Tree and shrub seed should be included in the permanent seed mix if plantings (container, seedlings, or live stakes) cannot be installed within the planting area. Tree and shrub seed should be applied at a rate of 20 pounds per acre. Potential tree and shrub seed mixes should be based on recommendations provided in Table 1 of Section 2.0: Plant Selection and

Installation of these specifications. Coordination should be made with a seed supplier 6 months in advance to obtain tree and shrub seed, as costs and availability varies. Tree and shrub seed substitutions can be made with approval from the City. Tree and shrub seed application alone shall not be used for erosion control due to the long establishment period and variable germination rates.

TABLE 2
NATIVE GRASS MIX

Grass Mix - wet soils	
Agrostis exarata	Spike bentgrass
Alopecurus geniculatus	Water foxtail
Deschampsia caespitosa	Tufted hairgrass
Glyceria striata	Fowl mannagrass
Grass Mix - moist soils	
Danthonia californica	California Oatgrass
Deschampsia caespitosa	Tufted hairgrass
Elymus glaucus	Blue wildrye
Festuca rubra	Red fescue
Grass Mix - dry soils	
Bromus vulgaris	Columbia brome
Elymus glaucus	Blue wildrye
Festuca idahoensis	Idaho fescue
Festuca rubra	Red fescue

5.1.2 EROSION CONTROL NETS AND BLANKETS

Erosion control nets and blankets (BMP C122: Nets and Blankets) will be installed in accordance with the current version of the City's SWMM to prevent erosion and hold seed and mulch in place on slopes greater than 50 percent to protect bare soil while vegetation becomes established. Jute, straw, coconut fiber (coir) or other biodegradable materials will be used for all nets and blankets within the project area. Openings cut into the installed erosion control nets and blankets for the installation of plantings shall be conducted based on manufacturer's installation instructions.

5.1.3 MULCHING AND COMPOST

Mulching (BMP C121: Mulching) and compost (BMP C125: Compost) shall be installed in accordance with the current version of the City's SWMM to provide immediate temporary

protection from erosion and enhance plant establishment. These BMPs should not be applied on slopes greater than 50 percent without additional BMP measures to secure mulch and/or compost in place.

5.1.4 WATTLES

Wattles (BMP C235: Straw Wattles) shall be installed in accordance with the current version of the City's SWMM to spread the flow of rill and sheet runoff. This BMP can be applied on slopes up to 100 percent. Wattles shall be constructed using biodegradable material; no plastic material shall be used.

6.0 STEEP SLOPES

This section provides additional specifications for steep slopes, which are defined as slopes greater than 50 percent, to meet the management goal for geologic hazard mitigation Section 4.1.2 and to supplement the landscape management procedures provided in Section 5.4 of the Landscape Management Plan. Steep slopes are further subdivided as:

- Slopes 50 to 66 percent
- Slopes 67 to 100 percent

If stabilization of the steep slope is not feasible and sufficient space is available, a debris containment system along the toe of the slope may be applicable to contain debris from the slope above to provide public safety and infrastructure protection. Debris containment should be designed for each slope area and may include Jersey barriers; stacked, gravity block walls; soldier pile walls with wood or concrete lagging; cable restraint systems (such as Geobrugg®); or soil berms.

6.1 SLOPES 50 TO 66 PERCENT

Vegetation management on slopes 50 to 66 percent (up to the angle of repose) can include the installation of seedlings, live stakes, and seed as outlined in Section 2.1: Plant Materials of this specifications document. Containerized plantings (1 gallon in size) can be applied to small planting areas; however, due to the difficulty of installing large containerized plantings on steep slopes their installation is not recommended for general planting. Temporary erosion measures should be installed in accordance with Section 5.0: Erosion Control, if feasible. If high mortality is observed during the monitoring period (Section 4.0: Maintenance and Monitoring), the planting area should be re-evaluated to determine if a different planting technique or additional erosion control and/or slope stabilization measures are needed.

6.2 SLOPES 67 TO 100 PERCENT

Slopes 67 to 100 percent may require fixed erosion control measures to reduce slope creep in order for plantings to become established. Fixed erosion control measures generally consists of an erosion mat and geogrid material or cellular confinement material placed over the slope surface that is held in place using shallow staples or anchors (generally 36 to 72 inches in depth). The length of the anchors is dependent on actual slope conditions. Fixed erosion

control measures should be specifically designed for each planting area. Commercially available fixed erosion control systems include:

- GEOWEB® Slope Protection System (http://www.prestogeo.com/slope_protection)
- TerraFirm® (http://www.terrafixgeo.com/products/terrafirm)
- Cell-Tek® Slope Grid (http://celltekdirect.com/slope.html)
- RevetMax® (http://www.tensarnagreen.com/Systems-and-products/RevetMax)

The GEOWEB Slope Protection System and the TerraFirm can be applied to a wide variety of slope conditions, whereas the Cell-Tex and RevetMax systems are generally limited to the lower range of slope steepness.

7.0 PUBLIC SAFETY AND INFRASTRUCTURE PROTECTION

This section provides specifications to meet the management goals, objectives and standards for Protecting Public Infrastructure and Public Safety (LMP Section 4.1.5) and to supplement the landscape management procedures provided in Section 5.6 of the Landscape Management Plan.

7.1 NATURAL SURVEILLANCE

Vegetation should be managed for natural surveillance within public areas. Open views should be maintained between 3 to 8 ft above the ground surface within 10 horizontal feet of all public areas. In problem areas, where additional natural surveillance area may benefit in deterring trespassing, camping, and debris dumping; the Crime Prevention Through Environmental Design (CPTED) measures should be considered and applied beyond the 10 foot CPTED standard.

- Shrub and groundcovers within and adjacent to public areas should consist of low growing species (mature height approximately 3 ft).
- Mature existing trees should be limbed up to 8 ft in accordance with Section 9.0 Pruning.
- New tree plantings should maintain a spacing of 15 ft on center.
- Species which create dense thickets or have multi-branch growth forms with dense foliage should not be planted within 10 horizontal feet of public areas.
- All native vegetation which cannot be maintained between 3 to 8 vertical feet and noxious weed plant species within public areas should be removed provided that slope instability does not occur. Appropriate vegetation (i.e., low-growing natives) should be installed to replace all removed plantings.
- Noxious weed species shall be maintained at less than 10 percent of vegetation cover within public areas.

7.2 TREE ASSESSMENT AND MAINTENANCE

Vegetation should be maintained to provide public safety and infrastructure protection as it relates to tree hazards. Trees or limbs that pose a risk to the public should be identified and removed promptly. Tree risk assessments should be conducted in accordance with the most updated revision of the Approved American National Standard (ANSI) for Tree Care Operations – Tree, Shrub, and Other Woody Plant Management – Standard Practices (Tree Risk Assessment, a. Tree Structure Assessment; Tree Care Industry Association Inc., 2017) by a certified professional arborist.

A Level 1 tree risk assessment should be conducted annually in areas within fall hazard areas adjacent to public areas such as the Salmon Beach parking lot or access road, or prior to work party activity within the management area. The risk assessment should be conducted in the spring after the winter storm season has passed. If necessary, a Level 2 tree risk assessment should be conducted on select trees identified through the Level 1 assessment as having the potential to cause damage and/or injury. Hazard trees should be remedied based on the tree risk assessment recommendations to maintain a low risk to public targets.

8.0 VEGETATION MODIFICATION REQUESTS FOR PRIVATE VIEW MANAGEMENT

Applications for view enhancement shall be submitted in accordance with the implementation procedures provide in Appendix H of the management plan (currently in draft, pending approval). Pruning activities to include vegetation removal for view management shall follow the pruning guidelines provided in Section 9.0 of these specifications.

9.0 PRUNING

This section provides specifications for pruning. Applicable locations include:

- Public areas: After establishing understory as necessary, Pruning should be conducted in public areas to provide for public safety and infrastructure protection as provided in Section 7.0 Public Safety and Infrastructure Protection of these specifications.
- View Enhancement Area: Pruning may be permitted for view enhancement if vegetation meets the requirements provide in Section 8.0 View Management of these Specifications.

9.1 GENERAL PRUNING PRACTICES

Pruning vegetation in the landscape management area can provide public safety, infrastructure protection, and view enhancement if done properly. Pruning shall be conducted in accordance with the most updated revision of the ANSI for Tree Care Operations – Tree, Shrub, and Other Woody Plant Management – Standard Practices (Pruning Standard Practices; Tree Care Industry Association Inc. 2017) by a certified professional arborist. Pruning should be confined to only those trees which:

- Present a safety hazard due to unsafe limbs or stems
- Impact public safety by limiting natural surveillance within public areas
- Impact pedestrian or vehicle clearance
- Adversely impact views in selected and approved areas.

9.2 PRUNING SYSTEM

A Natural Pruning system shall be used as defined in ANSI A300, Clause 5.2, and Annex D, Paragraph D-2.1.

- Maintain a natural tree shape;

9.3 PRUNING FOR VIEW ENHANCEMENT

Pruning activities for views shall:

- Maintain a natural tree shape;
- Not remove more than 25 percent of the vegetative foliage of any tree, in any one year. The tree's health, age and structure must be taken into account to determine the appropriate amount of pruning:
- Not limb up more than 30 percent the tree's visible height;
- Not decrease tree stability;
- Not decrease slope stability;

- Not top trees including cuts greater than twice the diameter of remaining lateral.

9.3.1 PRUNING TECHNIQUES FOR CONIFERS

Pruning for view clearance shall only be conducted on mature conifer trees with a DBH of 8 inches or greater. Pruning techniques for conifers are shown on Figure 2 and include the following:

- Windowing: Select branches may be removed to create a window through the existing foliage of the tree's canopy, and can be conducted for large, close-up trees that block a view. Windowing on one side of a tree may be balanced with pruning on the opposite side to keep a natural appearance.
- Interlimbing: Select branches are removed throughout the canopy to allow more light to pass through and reduce the wind resistance of the tree.
- Skirting up: The tree is limbed from the bottom up, which allows for a line of sight. This technique should be used for mid-range conifers located near the slope crest.

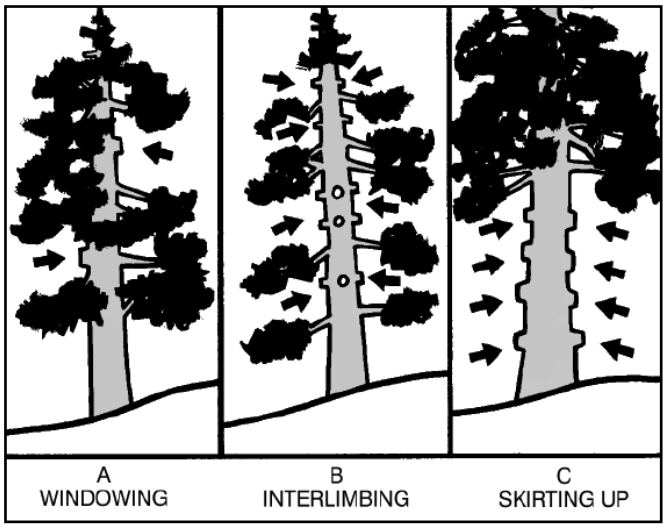

Figure 2: Alternative Pruning Practices for Conifers

Source: Menashe. 1993. *Vegetation Management: A Guide for Puget Sound Bluff Property Owners*

9.3.2 PRUNING TECHNIQUES FOR BROAD LEAVED TREES

Select branches should be removed to reduce view obstructions while maintaining a natural tree appearance as shown on Figure 3.

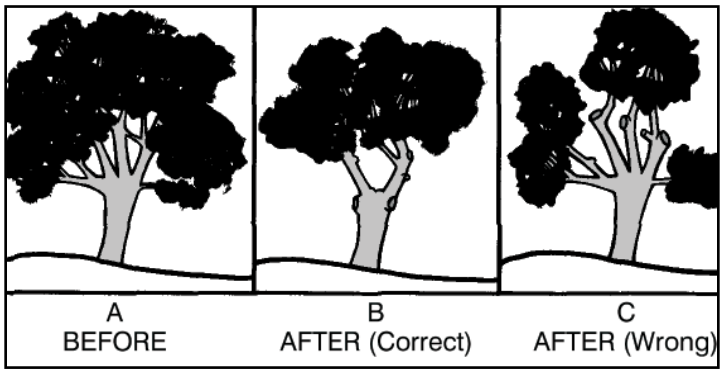

Figure 3: Pruning Practices for Broad Leaved Trees

Source: Menashe. 1993. *Vegetation Management: A Guide for Puget Sound Bluff Property Owners*

9.4 TREE REMOVAL

Tree removal should only occur to maintain public safety and infrastructure protection as outlined in Section 7.0 and conducted in a manner that selectively removes trees to increase the vigor of the native surrounding vegetation and still maintains appropriate shrub and ground cover and soil binding tree root mass. Tree root systems shall not be removed unless the species is a listed as noxious weed (Washington State Noxious Weed Control Board) and the root removal is necessary for control or the root system has the potential to impact public safety and infrastructure protection (Section 7.0). Trees shall be retained in a manner to provide 100 percent soil-binding root mass for the project area, which is calculated as one-foot radius of lateral root extent for every inch of diameter of the tree's trunk at breast height. For previously coppiced trees, each sprout diameter shall be counted and added up to determine the total DBH. Also, when pruning coppiced sprouts, the removal of branches must be distributed throughout the clump and crown (i.e. not all removals located on one side). Mature trees (those with a diameter greater than 8 inches) should not be removed as part of pruning or vegetation thinning activities to enhance views. Edge trees and trees which are identified to provide critical slope stabilization on slopes 40 percent and greater shall not be removed.

If trees are requested for removal for view enhancement, removal shall be based on the following criteria (in order of preference):

- Residual Soil Binding Root Zone: Removal shall only be considered when the residual area (after the tree has been removed) in question exhibits the 100% soil binding root zone as described in Section 4.2.1 of the Landscape Management Plan.
- Public safety and infrastructure protections: Trees which are determined to have the potential to impact public safety or infrastructure as identified during a Tree Risk Assessment (Section 7.0 Public Safety).
- Tree health: Trees containing serious defects, rot, and declining health as determined by a certified arborist and that pose a fall risk to publicly accessible areas or to work parties.
- Tree stands shall not be thinned to achieve tree spacing goals as outlined in LMP Section 4.1. Rather, natural tree mortality shall be the vehicle whereby planted and existing tree spacing is managed.
- Tree species: Retention of evergreen species (conifers and broadleaf) is preferred over deciduous species.
- Crown class: Suppressed or intermediate trees will be removed over dominant and codominant trees.

9.5 REFERENCE DOCUMENTS

The project specifications are based on the following Standard Specifications:

1. Pelt, K., M. Dalin, and K. McFarland. 2002. Open Space Management Plan for Stadium Way-Schuster Parkway. Prepared for the City of Tacoma Public Works Department. January.
2. Menashe, Elliott. 1993. Vegetation Management: A guide for Puget Sound Bluff Property Owners. Publication 93-31. Shorelands and Coastal Zone Management Program, Washington Department of Ecology. Olympia.
3. PlantAmnesty website. 2014. *Pruning Information.* http://www.plantamnesty.org/pruning-literature. Accessed February 18, 2015.City of Tacoma 2012 Edition Stormwater Management Manual
4. Menashe, Elliott. 2004. *Value, Benefits and Limitations of Vegetation in Reducing Erosion*. Greenbelt Consulting and Coastal Training Program, Washington Department of Ecology. Olympia.
5. ANSI A300 (Part 1) Tree, Shrub, and Other Woody Plant Management- Standard Practices (Pruning), 2017

Appendix H: Vegetation Modification Requests for Private View Management

Appendix H: Vegetation Modification Request for Private View Management

Currently in draft, pending approval.

Appendix I: Tree Solutions Site Inspection

Tree Solutions Inc
Consulting Arborists

Project No. TS -5673

Summary Memorandum

TO:	Desiree Pooley, City of Tacoma
SITE:	Parcel 6724200500, Salmon Beach Slope Area
RE:	Site inspection and findings
DATE:	December 21, 2016 Updated January 17, 2017
PROJECT ARBORIST:	Sean Dugan, ASCA Registered Consulting Arborist #457 ISA Board Certified Master Arborist PN-5459B ISA Qualified Tree Risk Assessor Tim Coye, Arborist Technician
REVIEWED BY:	Katie Hogan, ISA Certified Arborist PN-8078A ISA Qualified Tree Risk Assessor

Assignment

We were asked to inspect Parcel 6724200500 (aka "Tract A"), a City-owned parcel dedicated to passive open space and a wooded slope located above the Salmon Beach Community and near Pt. Defiance Park in Tacoma, WA. The parcel has experienced past tree and vegetation management at private citizen request and direction under a 1995 City management plan, "Parkside View Management Plan" (PVMP). This document has been reviewed and will be referenced in our analysis. We were tasked with:

- Assessing the current condition of trees and vegetation on the site by performing a physical site visit
- Evaluating the appropriateness of the PVMP based on the current site conditions
- Reviewing current City and State regulations and determine PVMP compliance, and
- Providing recommendations for PVMP revisions to meet compliance and site goals if needed.

Parcel Background

The subject site is a City of Tacoma owned parcel dedicated to passive open space. At the time of the parcel dedication during the development of the upslope Parkside housing development, the hearings examiner insisted that the parcel be placed under City jurisdiction to ensure the most responsible care and protection of the slope and vegetation. The parcel is a critical area as steep slope and geohazard area and therefore must comply with the City's critical areas code (Tacoma Municipal Code (TMC) 13.11).

Observations and Discussion

The purpose and intent of the 1995 PVMP is to preserve views, view corridors, and allow pruning to enhance private views for Parkside neighborhood residents. In 2017, it is necessary to ensure that the activities in the PMVP and the activities happening on site are continuing to meet regulatory requirements and adapted to accommodate on site changes in vegetation diversity and health to meet passive open space goals and the intent of the property dedication.

Various activities were prescribed by the PVMP in an effort to preserve the view of the houses at the top of the slope while maintaining healthy vegetation along the lower portions of the slope. The PMVP describes the forest canopy in 1995 to be predominantly pacific madrone with a few scattered Douglas-fir and bigleaf maple trees. The tree count was estimated to be 432 trees per acre. The madrone trees are reported to be re-sprouts from disturbance over 30 years ago. In 1995, the Pacific madrone ranged between two to 15 inches in diameter; Douglas-fir ranged from four to 16; bigleaf maple ranged from two to eight inches in diameter.

We observed very little recruitment of new trees. Pacific madrone have not been regenerating and the size range currently is between four and twenty inches. Bigleaf maple trees have also not been regenerating. The majority of these trees range from six to 16 inches in diameter. There are a number of Douglas-fir trees that have sprouted in the last ten years. These conifers range from seedlings to up to 24 inches in diameter.

The PMVP acknowledges that the pacific madrone and some of the Douglas-fir trees were topped in 1987. Overall, the PVMP states that over 95 percent of the site is covered by native shrub and tree species. According to the PVMP in 1987, the madrone trees had 80 percent of the canopy removed which contributed to the death of over 20 percent of the trees. The PMVP specifically calls out that the industry rule of thumb when pruning a tree is that no more than 25 percent of the live crown should be removed in any year's pruning. Crown removal pre-disposes the trees to infection by pathogenic fungi such as *Botryospaeria dothidea* and *Hendersomila toruloidea*, which were noted on the site.

During our assessment, we observed that at minimum 80 percent of the pacific madrone are in advanced stages of decline or have succumb to poor cultural management and disease. We noted that the vast majority of madrone and Douglas-fir trees that had greater than the 25 percent of the live crown removed are infected with a disease or are dead. I will discuss this further, later in this section of the report.

The PVMP divides the site into three main zones: Zone A, the uppermost area on the slope, but dips down to encompass the entire slope run near the parking lot ; Zone B, the lower and middle portions of the slope; and Zone C, areas in the northern and southern parts of the site which have been designated as "No Activity". The most aggressive vegetation pruning was performed in Zone A for view management, while Zone B was designated for selective tree removal. No pruning or other actions were to be performed in Zone C.

The following discussion presents the current site conditions per zone as noted on November 15, 2016 and evaluates the current status to the PVMP objectives.

Zone A consists mainly of a high density impenetrable invasive weed mass including species such as Himalayan blackberry (*Rubus bifrons*), Scotch broom (*Citysus scoparius*), and bindweed (*Calystegia sepium*) vines (see Figures 1-3). Approximately 90 percent of the area is invasive species. These weeds have likely flourished in this area since the majority of tree canopy has been removed and there has been a lack of maintenance and replacement with desirable species.

The blackberry canes and bindweed vines are climbing desirable trees within Zone B and appear to be impacting the growth of new vegetation, tree regeneration, and spread of existing native vegetation. The PVMP specifically calls out to have the blackberry removed from desirable trees. Based on the high density of invasive plants, it does not appear that any maintenance activities have been completed. It is recommended that invasive species removal and control be ongoing and native species be planted and allowed to spread. In my opinion, if not controlled, the invasive weeds will further encroach down the slope where they will likely out compete the native species.

Also, the PMVP recommends planting approximately 100 two year old shore pine (*Pinus contorta* var. *contorta*) trees along the lower section of Zone A as a future screen of the parking lot. We did not see any evidence of shore pines having been planted recently or twenty years ago. It is possible that these saplings were planted as recommended but either died or succumb to invasive weeds. However, we did find young Douglas-fir (*Pseudotsuga menziesii*) trees and seedlings in several sections around the lower edge of Zone A. We could not determine if these were planted, and judging by their clustered distribution, we believe they naturally regenerated.

Zone B primarily consists of Pacific madrone (*Arbutus menziesii*), Douglas-fir, and bigleaf maple (*Acer macrophyllum*) trees in the over story. Declining pacific madrone trees comprise at least 60 percent of the canopy in this zone. The understory consists of a high density of native small trees, shrubs and ground covers. Seventy percent of the trees within this zone have been extensively altered including crown reductions, top cuts, snagging and removals.

Madrone
The 10 year goal of the PVMP was to "create a lower canopy (ten feet – 15 feet tall) of Pacific Madrone sprouts that will maintain soil stability, provide aesthetic amenities, wildlife habitat, and protect the views in the view sensitive area." This goal has not been achieved and based on the current conditions (disease), past management (improper pruning), there is a very low probability that it can be achieved based on the existing plan.

The management plan from 1995 identifies issues with the madrone and provides a prescription to "restoring the vigor to these trees." Larger Pacific madrone trees were to be cut at approximately ten feet to invigorate re-sprouting and encourage new growth. From our observations, re-sprouting has not occurred and most of the madrone trees are in advanced decline if not dead already (see Figures 4 and 5). The deterioration of the stand is likely due to disease, aggressive pruning, and changes to the site conditions and in my opinion will not recover. No regeneration of madrone was noted.

We observed a low number of smaller madrone trees that were topped and re-sprouting (see Figure 6). The sprouts on the trees appeared to be in good health, however, the main trunks have indicators of disease. In my opinion, these trees likely have a short useful life expectancy. The plan provides guidelines to approach cutting the madrone trees including follow-up pruning to reduce the number of sprouts and cutting back to laterals at specific heights. We did not observe any indication that follow-up pruning had been performed.

The management plan prescribes in 1996 to reduce all Douglas-firs saplings to at least 2 whorls of branches to create shrubby erosion control trees. The plan also states that selected sprouts from the 1987 work need crown reduction pruning to a height of six to ten feet. Reducing the height of a tree to a predetermined level without taking into the account of the structure or physiology of the tree is considered topping.

Topping is not consistent with American Nation Standards Institute (ANSI) best management practices. The extent of pruning conducted on site is also not consistent with the PMVP where it specifically calls out that the industry rule of thumb that when pruning a tree, no more than 25 percent of the live crown should be removed in any year's pruning. While some of the trees have been able to sprout with new growth, many of them have died (see Figures 7 through 9).

The pruning guidelines outlined in the plan are stated to conform to the ANSI A300 standard and Best Management Practices, however, it is not clear to me how this specific treatment is in accord with these current standards. We would not recommend this as a management strategy as continued topping of Douglas fir trees is not sustainable and there is no guarantee that the trees will continue to survive or provide the functions of the previous erosion control root mass over time.

The plan states that 80-percent of the Douglas-fir slash should be removed from the site or chipped and all branches and stems should be lopped or scattered throughout the site. These should be cut to sections no longer than three feet in length and should be made to lie flat on the ground, not covering the healthy native plants such as salal (*Gaultheria shallon*). I agree with this approach. This may have happened in the initial pruning phase but has not occurred in recent pruning activities; instead, the dead wood appears to have been left where it fell (see Figure 10) covering native plants.

Another ANSI A300 standard and a guideline in the management plan is that no tree climbing spurs are to be used on trees that are to be pruned but can be used on trees to be removed and trees to be turned into a wildlife snag. We saw evidence of spikes being used on live trees including Douglas-fir and Pacific madrone trees (see Figure 11).

Zone C appeared to have the pruning restrictions followed, however, we did notice that some pruning was performed offsite of the designated parcel. We do not know if permission was granted to perform these reductions, but thought that our findings should be included here (see Figures 12 & 13).

In summation, based on our on-site observations, we believe the PVMP has not been followed as written and needs revisions to more accurately reflect the current site conditions, re-state current ANSI standards and comply with local and state regulations. The PVMP has clearly defined activities to be performed every 4 to 5 years, and states that management will be needed in perpetuity. Judging from what we saw on the site, we do not believe that management has been performed regularly.

Additionally, where management was performed, it did not consistently follow the guidelines as stipulated in the management plan.

Evaluation of the Parkside View Management Plan (PVMP) and Regulations

The subject site is currently designated an environmental critical area due to being a geological hazard area. Based on the review of the Tacoma Municipal Code, specifically TMC 13.11.730 A1(i) and B1(m) applying to both erosion and landslide hazard areas respectively, the code allows for "trimming and limbing of vegetation for the creation and maintenance of view corridors, removal of site distance obstructions as determined by the City Traffic Engineer, removal of hazardous trees, or clearing associated with routine maintenance by utility agencies or companies; provided that the soils are not disturbed and the loss of vegetation cover will not significantly increase risks of landslide or erosion." *(Ord. 27431, 53; passed Nov. 15, 2005)*

Vegetation is a critical component in maintaining shallow seated slope stability. This is accomplished in several different ways including reducing surface erosion by intercepting rain, strengthening soil with roots, retaining and creating new soil, and increasing soil percolation. Conifer trees such as Douglas-fir and broad leaf evergreen trees such as madrone provide year round foliage cover and are well suited to reduce surface erosion and protecting slopes. A stratified canopy including the upper, middle, understory, and ground layer provide an interconnected mass of roots for preserving soil. This canopy structure also is vital to intercepting rain and reducing the negative impacts to the slope.

There is evidence of numerous activities that have occurred on the site that do not appear to be consistent with the PVMP or compliant with current code including:

- Non-conformance with ANSI A300 guidelines and Best Management Practices such as,
  - Topping
  - Removing greater than 25 percent of the canopy in a single pruning event
  - Spur climbing trees that were pruned
- Slash was not removed, was suppressing native vegetation, and not in contact with the ground
- No re-evaluation of ongoing treatments or stand conditions.
- No shore pine trees have been planted as proposed to replace canopy removed.
- No maintenance of invasive species or protection of desirable trees.
- Pruning has occurred off-site from the designated area.

The PVMP developed in 1995 appears to have provided an accurate description of the site, forest canopy, and understory structure at that time. However, the changes in forest and vegetation composition, invasive species presence, and decrease in canopy coverage have affected the function of the site. A lower canopy profile has not been realized – trees that were topped have effectively died leaving holes for invasive species to populate. The ten year goal of the management plan to generate a lower canopy profile and retain the functions and amenities the vegetation provides has not been realized. A re-evaluation report should be completed before any additional treatments.

Another gap is the PVMP did not take into account any information regarding the health of any specific tree to be pruned but just prescribes a blanket approach. Trees in poor condition are less able to handle significant pruning than those that are vigorous and healthy. The PVMP noted the poor conditions of the

madrone trees and assumed they would vigorously re-grow. Based on my observations, sprout development was over estimated and many of these trees have died or will never regain vigor. The stand has been significantly altered.

Based on my knowledge, training, and experience, it is my opinion that portions of the PVMP were either poorly implemented or not adhered to. These oversights should have been addressed during a re-evaluation period. In many cases "pruning", especially on the Douglas-fir, did not comply with ANSI A300 standards or Best Management Practices. The PVMP indicates that trees should be cut back to lateral branches but in most cases the trees were simply topped.

Recommendations for addressing the slash, erosion control measures, and native understory vegetation have not been followed as debris was thrown on the slope. Trees planted for mitigation of lost canopy and screening from the parking lot were not visible. Tree replacement should have been recommended or monitored during a re-evaluation period. Invasive species are moving down the slope and not being managed.

Maintenance pruning on trees selected for retention does not appear to be occurring regularly, which negatively impacts the desired form and structure. If pruned in a manner similar to the past, it is likely that there will be additional tree loss/death due to the stresses associated with the removal of large parts.

The PMVP provided work guidance for a 15 year period of time, which ended in 2010. The plan acknowledges that "with any long-term vegetation management plan, it must be dynamic to adapt to any changes in the plant community that result from management activity, weather, and other influences." The PVMP does not accurately depict the existing site conditions nor does it address any of the other influences, such as current environmental regulations.

One of the prescriptions in the plan is that every four years after treatment, the site should be re-evaluated prior to future treatments. According to the plan, this should be done in perpetuity. To my knowledge, there are no additional reports from the re-evaluating periods or supplemental recommendations provided following treatments. A re-evaluation of the site and revised management plan is recommended.

Conclusion

In my opinion, the madrone trees that previously comprised 80 percent of the stand have a short safe useful life expectancy and should not be considered viable. Plans should be developed to restore the canopy and functions that have been lost due to the decline of the madrone and other trees. A contingency/mitigation and maintenance plans should be included along with updated evaluations. These plans should be used to correct the conditions that have not been achieved with the 1995 PVMP and alleviate any future issues that may develop with ongoing treatments and ensure site improvements are maintained. These plans should use best available scientific approaches and result in no additional loss of the site's functions, values, and amenities.

Recommendations

- A qualified environmental professional should perform further analysis of the parcel's loss of functions, values, and amenities and devise a management plan to try and reverse this trend.
- A Restoration plan should be developed to ensure the conditions proposed in the initial PVMP area achieved.
- A contingency/mitigation plan should be developed to address the requirements necessary to adapt to any future negative impacts that may develop following treatment activities.
- A maintenance and monitoring plan should be implemented to ensure any new plantings become established and invasive weeds overall are controlled.
- The site should be re-evaluated and a report developed and provided to the city prior to any new treatment activities.
    - Re-evaluation rates should be increased in frequency if any restoration or mitigation is required.
- A certified arborist or Registered Consulting Arborist should be onsite during any treatment activity to guide pruning and report on the work completed. The arborist should be independent of the tree service completing the work.
- Conditions should be placed on any future work if not implemented as stated in the management plan or if work does not adhere to best management practices and industry standards.


Figure 1 - Himalayan blackberry on upper slope.


Figure 2 - Scotch Broom and Himalayan blackberry over running native vegetation in Zone B.

Figure 3 - Bindweed growing on sapling Douglas-fir.

Figure 4 - Topped madrone has never re-sprouted and is now dead.

Figure 5 – Stand of madrone trees in advanced decline with little chance of recovery.

Figure 6 - Madrone showing regrowth, but no follow up management.

Figure 7 – The yellow arrows point to Douglas-fir trees that were topped and were to be managed in a shrubby form but have since died.

Figure 8 – One of the few topped Douglas-fir trees with regrowth that has not been managed.

Figure 9 - Topped Douglas-fir, one live branch surviving. The pruning does not comply with ANSI A300 standards or the pruning guidelines outlined in the management plan.

Figure 10 – Douglas-fir slash remains where it fell.

Figure 11 - Evidence of spike use on a Pacific madrone tree that was not turned into a snag and is still alive.

Figure 12 - Topped Douglas-fir across the road from the subject parcel.

Figure 13 - More trees topped across roadway.

Appendix A - Assumptions & Limiting Conditions

1. Consultant assumes that any legal description provided to Consultant is correct and that title to property is good and marketable. Consultant assumes no responsibility for legal matters. Consultant assumes all property appraised or evaluated is free and clear, and is under responsible ownership and competent management.
2. Consultant assumes that the property and its use do not violate applicable codes, ordinances, statutes or regulations.
3. Although Consultant has taken care to obtain all information from reliable sources and to verify the data insofar as possible, Consultant does not guarantee and is not responsible for the accuracy of information provided by others.

   3.1 Discussion of land area, canopy area and loss, and tree counts are estimated based on the information provided.

   3.2 Tree Solutions has only been provided with the initial 1995 plan and treatment schedule. One of the prescriptions in the plan is that every four years after treatment the site should be re-evaluated prior to treatments . According to the plan, this should be done in perpetuity. I have not received any additional reporting that appeared to be developed during the re-evaluation period or that included supplemental recommendations following treatments.
4. Client may not require Consultant to testify or attend court by reason of any report unless mutually satisfactory contractual arrangements are made, including payment of an additional fee for such Services as described in the Consulting Arborist Agreement.
5. Unless otherwise required by law, possession of this report does not imply right of publication or use for any purpose by any person other than the person to whom it is addressed, without the prior express written consent of the Consultant.
6. Unless otherwise required by law, no part of this report shall be conveyed by any person, including the Client, the public through advertising, public relations, news, sales or other media without the Consultant‘s prior express written consent.
7. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant’s fee is in no way contingent upon the reporting of a specific value, a stipulated result, the occurrence of a subsequent event or upon any finding to be reported.
8. All photographs included in this report were taken by Tree Solutions Inc. during the documented site visit, unless otherwise noted.
9. Sketches, drawings and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys. The reproduction of any information generated by architects, engineers or other consultants and any sketches, drawings or photographs is for the express purpose of coordination and ease of reference only. Inclusion of such information on any drawings or other documents does not constitute a representation by Consultant as to the sufficiency or accuracy of the information.
10. Unless otherwise agreed, (1) information contained in this report covers only the items examined and reflects the condition of the those items at the time of inspection; and (2) the inspection is limited to visual examination of accessible items without dissection, excavation, probing, climbing, or coring. Consultant makes no warranty or guarantee, express or implied, that the problems or deficiencies of the plans or property in question may not arise in the future.
11. Loss or alteration of any part of this Agreement invalidates the entire report.

Appendix J: LiDAR Map

DP DRAIN PIPE

ER SURFACE EROSION EXPOSED SOIL

CB OVERTOPPED CURB

0 50 100 200 300
SCALE IN FEET

Tacoma

Appendix J Lidar Map

Appendix K: Recommended Canopy and Understory Species

Appendix K: Recommended Canopy and Understory Species

Canopy Species

Vine maple
(*Acer circinatum*)

Cascara
(*Rhamnus purshiana*)

Hookers Willow
(*Salix hookeriana*)

Madrone
(*Arbutus menziesii*)

Shore Pine
(*Pinus contorta*)

Douglas Fir
(*Psudotsuga menziesii*)

Grand Fir
(*Abies grandis*)

Western Redcedar
(*Thuja plicata*)

Western Hemlock
(*Tsuga heterophylla*)

Understory Species

Beaked hazelnut
(*Corylus cornuta*)

Oceanspray
(*Holodiscus discolor*)

Indian plum
(*Holodiscus discolor*)

Evergreen huckleberry
(*Vaccinium ovatum*)

Salal
(*Gaultheria shallon*)

Low Oregon grape
(*Berberis nervosa*)

Sword fern
(*Polystichum munitum*)

Snowberry
(Symphoricarpos albus)

Red elderberry
(*Sambucus racemosa*)

Tall Oregon grape
(*Berberis aquifolium*)

Nootka rose
(*Rosa nutkana*)

Pacific wax-mytle
(*Myrica gale*)

Kinnikinnik
(*Arctostaphylos uva-ursi*)

Coastal Strawberry
(*Fragaria chiloensis*)