Burke-Gilman Trail Vegetation Management Guidelines

Revised 5/25/99

IX. APPENDICES 35

I. VEGETATION MANAGEMENT GUIDELINES OVERVIEW

The purpose of this document is to assist the Seattle Department of Parks and Recreation in the management of existing vegetation, and to facilitate restoration of key areas to functional landscapes, emphasizing the conservation of native habitat. These Vegetation Management Guidelines are based on an inventory of the vegetation found along the trail. Each section of the trail's landscape has been categorized into one of five different vegetation palettes, according to its current structure and function.

The Guidelines identify areas of critical need, based on the goals and objectives developed through the study of the landscape's functions. These areas are classified in one of two ways: issues affecting the trail as a whole are addressed in **Section VI: Vegetation Management Approaches**. Site-specific issues are addressed in **Section VII: Management and Restoration Projects**. In general, proposed projects have been developed to strengthen and diversify the overstory and understory of the trail will enrich wildlife habitats, reduce homogeneity of the landscape, and reduce non-native exotics that invade the trail. At the same time, focusing new plant selections on a well-chosen palette creates thematic continuity along the length of the entire trail.

The most pressing problem along the trail is the dominance of exotic invasive species (Appendix C). Removal of these invasive species, or at a minimum controlling them, is the main management action required to restore health to much of the landscape found along the trail.

Proposed projects identify sections of the trail that can easily be improved or have limited occurrence of invasive species, as well as areas that are in serious decline due to the dominance of invasive species. However, as approximately 72% of the trail is affected by the presence of invasive species, not all occurrences of invasive species were addressed within the projects. The intent of these projects is to provide a basis for managing the highest priority sections of the trail. Those sections not addressed by a project are considered to be lower priority, and should be re-assessed in the future.

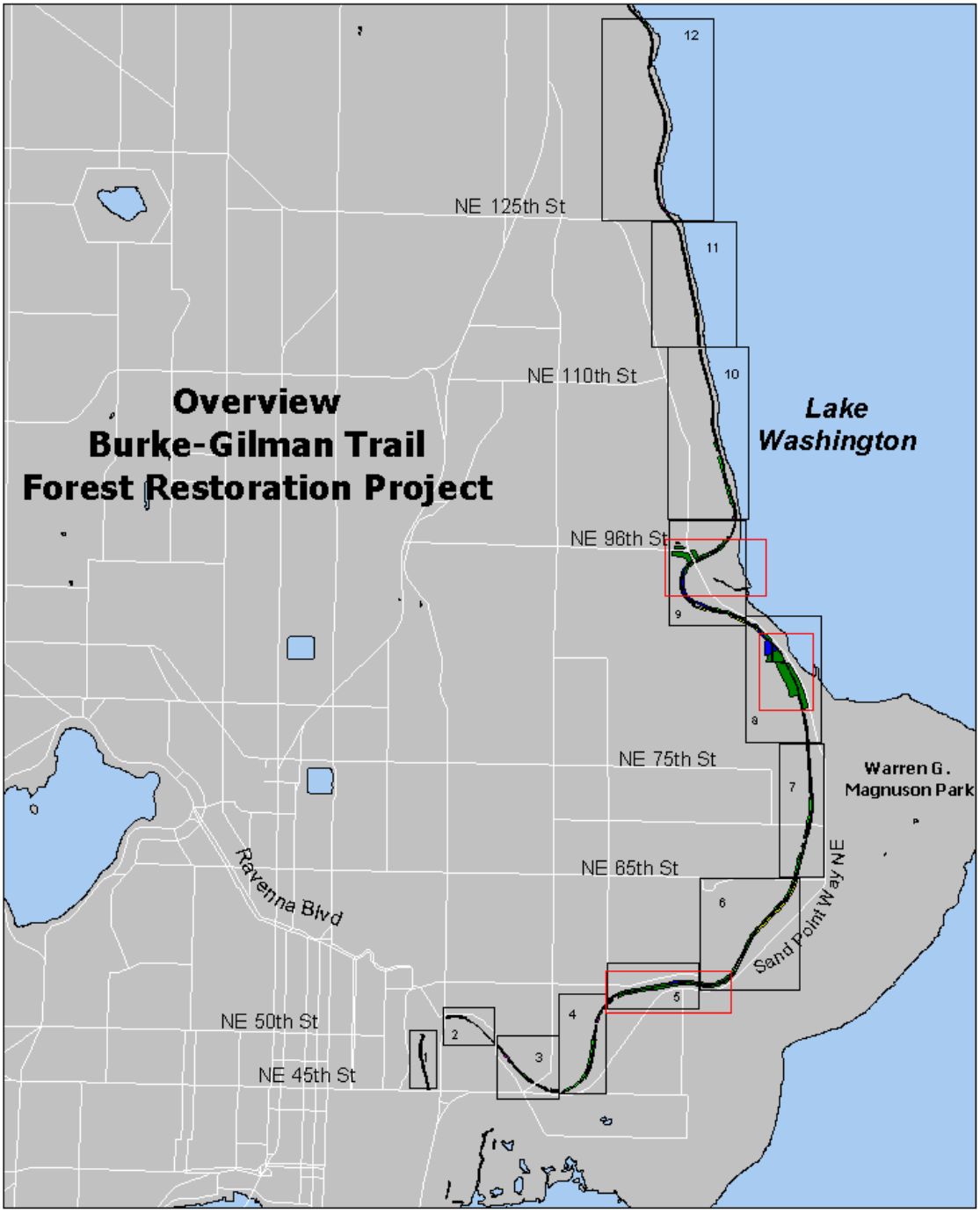

Figure 1. Burke-Gilman Trail vicinity

II. INTRODUCTION

The Burke-Gilman Trail is a 12.5-mile urban biking and hiking trail used by the citizens of Seattle, King County, and surrounding regions. Its uses range from casual walking to recreational biking and jogging, roller-blading, hiking, and bird watching. The trail also serves as an arterial route for many to their places of employment, education, and everyday activities.

Vegetation is an integral component of the trail. Whether it is the addition of aesthetic value, buffering from adjacent roads and light industry, habitat provided for wildlife, or the simple respite it provides from its urban surroundings, this narrow strip of vegetation is an important addition to the landscape of Seattle.

These Vegetation Management Guidelines deal with a 7.2-mile section of the trail which is maintained by the Seattle Department of Parks and Recreation (DPR). Winding northeasterly from the northeast corner of the University of Washington campus, this section begins at approximately 25th Avenue NE and NE 45th Street, and ends at the City of Seattle limits, the 14500 block of Riviera Place NE. (Figure 1).

The Vegetation Management Guidelines are exclusively concerned with the vegetation along the trail. This document is not a master plan or landscape design. It is intended to facilitate long-term stewardship of the existing landscape. For this reason, these guidelines lay some of the necessary groundwork required to develop landscaping and restoration projects along the trail. View corridors, trail maintenance, soil erosion and slide potential, public safety, and wildlife habitat are all impacted by vegetation. Thus, these guidelines provide plant species selections and management recommendations to properly address these considerations.

The Vegetation Management Guidelines build upon the **Schematic Design Report for the Burke-Gilman Trail** produced in 1975 by Edward MacLeod & Associates for the City of Seattle, Department of Parks and Recreation. These guidelines attempt to respond to recommendations contained within the design report, wherever possible. Mr. MacLeod's statement at the beginning of the report set a standard for how the Burke-Gilman Trail should be developed and managed:

> The Burke-Gilman report sets forth recommendations for the physical design of the facility, focusing attention on design determinants inherent in the existing social and physical conditions of the study area. We feel our recommendations reflect the city's desire for an optimum hike and bike facility, and the equally strong desire to respect input from the citizens of Seattle by providing a facility which is well integrated into abutting residential neighborhoods and minimizes impacts on the existing character of the trail. (MacLeod & Assoc.)

The history of the Burke-Gilman Trail and an overview of the Vegetation Management Guidelines follow this introduction. The Guidelines are derived from the goals and objectives outlined in the subsequent section. The document then describes existing trail conditions and management practices including vegetation, soils and geology, habitat, and constraints on management practices. Next, approaches to vegetation management and restoration are presented, including native character, views, tree planting, invasive species, soil erosion control, and hazard tree management. Finally, projects for the management and restoration of the trail are proposed.

III. HISTORY

A group of 12 investors, headed by Judge Thomas Burke and Daniel Gilman, set out in 1885 to establish a Seattle-based railroad. This initial railroad was called the Seattle, Lake Shore and Eastern Railroad. originally, the railroad was to reach as far as Spokane and link with the Canadian Transcontinental Line at Sumas. In reality, the line never went further than Arlington and by 1887 was serving solely as a logging railroad for the Puget Sound.

1913 saw the acquisition of the Seattle, Lake Shore and Eastern Railroad by Northern Pacific. The line was used quite heavily until 1963 when through-train operations were halted. In 1970, Burlington Northern came into being through the merger of Great Northern, Northern Pacific, and Burlington lines. By 1971, Burlington Northern had responded to a general decline in railroad use by applying for abandonment of an 11 mile section of railroad through the University of Washington, along Lake Washington and north to Kenmore.

The eventual acquisition of a 7.2-mile section of this abandoned railroad by the City of Seattle was largely made possible through funding from the 1968 Forward Thrust bond issue, Community Development Block Grants, and Federal Gas Tax Revenue (FAUS) funds. In 1975, Edward MacLeod & Associates designed a 7.2 mile stretch of trail along this newly acquired strip of land. The Burke-Gilman Trail was dedicated August 19, 1978. (Seattle Parks and Recreation, no date)

IV. VEGETATION MANAGEMENT GOALS AND OBJECTIVES

The following five goals define the focus of these Management Guidelines. Objectives for each goal are also provided to help direct and evaluate proposed projects and management activities.

A. Insure the health and longevity of valuable existing vegetation.

- A.1 Conserve and properly maintain valuable existing vegetation.
- A.2 Diversify vegetation with plant additions and continuous replenishment.
- A.3 Select future plants for hardiness and disease-resistance, as well as for native character.

B. Provide landscape continuity along the trail both spatially and over time.

- B.1 Provide plant palettes that will achieve consistency throughout the length of the trail.
- B.2 Retain the essential landscape pattern by balancing view opportunities with canopy enclosure.
- B.3 Maintain and restore native landscape elements wherever possible.
- B.4 Protect the trail's vegetation from detrimental external influences.
- B.5 Allow for variations in landscape character where dictated by existing conditions.

C. Maintain trail vegetation while conserving both labor and resources.

- C.1 Establish management practices which maximize the efficient use of both labor and resources in the maintenance of trail vegetation.

C.2 Insure that maintenance activities provide the best possible care for vegetation, eliminating impacts on plant health and longevity such as mower damage, weed competition and others.

C.3 Insure that appropriate vegetation is selected and located to accommodate existing infrastructure (utilities, paving, etc.) and current management practices.

D. Foster community appreciation and stewardship for trail vegetation.

D.1 Encourage the involvement of citizens in all aspects of trail management.

D.2 Facilitate public understanding of the management and protection of this trail ecosystem.

E. Protect and enhance vegetation for wildlife and, integrating human and wildlife interests.

E.1 Provide vegetation along the trail that will foster desirable native wildlife.

E.2 Enhance connectivity between habitat elements through landscape continuity.

E.3 Reinforce the vegetated edges of habitat areas to prevent or minimize disturbance.

V. EXISTING TRAIL CONDITIONS AND MANAGEMENT PRACTICES

A. Vegetation

Much of the vegetation along the Burke-Gilman Trail established as a direct result of the disturbance that has occurred on this site over the years. Before the turn of the century, the pre-colonial forest was logged. When the railroad was developed, the site was again disturbed and regeneration consisted of vegetation that could easily establish itself in disturbed conditions.

Today, the vegetation inventory consists of an overstory made up of approximately 25 to 30 species, and an understory dominated mainly by exotic invasive species. (Table 1) However, there are a few remaining pockets of almost entirely native plant material. The Inventory Maps (IA -25A) in Appendix F illustrate the vegetation inventory for the trail by vegetation class. The vegetation classes are described in Appendix A. The relative occurrence of each vegetation class, by length of trail and percent of trail length, is found in Appendix B.

Of the species that comprise the overstory, bigleaf maple *(Acer macrophyllum)* is by far the largest component. All other species, with the exception of red alder *(Alnus rubra)*, black cottonwood *(Populus trichocarpa)*, and some willow *(Salix)* spp., occur to a very limited degree. Deciduous canopy cover accounts for approximately 55% of the trail length. If deciduous/evergreen mix and row plantings are considered, the number increases to 73%. The presence of evergreens, including broad-leaf and conifer, is relatively limited. The evergreen canopy component accounts for approximately 2% of the trail length. 17% of the trail is considered to be open, meaning there is no canopy cover.

As mentioned, invasive species dominate much of the understory along the trail. Along a full 60% of the trail the understory is dominated by invasive species, with another 12% of the trail length having only invasive species as a cover. Thus, 72% of the trail length is affected by invasive species in one way or another. Out of the remaining 28% of understory along the trail, approximately 6.5% is entirely dominated by native plants.

a) Table 1 List of Plant Species Along the Burke-Gilman Trail

Botanical Name	**Common Name**
Abies grandis	Grand Fir
Acer circinatum	Vine Maple
Acer macrophyllum	Bigleaf Maple
Acer platanoides	Norway Maple
Acer pseudoplatanus	Sycamore Maple
Acer rubrum	Red Maple
Alnus rubra	Red Alder
Amelanchier alnifolia	Serviceberry
Arbutus menziesii	Pacific Madrone
Betula papyrifera	Paper Birch
Chamaecyparis nootkatensis	Yellow-Cedar
Cornus stolonifera	Red-osier dogwood
Corylus cornuta var. californica	Western Hazelnut
Crataegus douglasii	Black Hawthorn
Crataegus x lavallei	Carriere Hawthorn
Crataegus monogyna	Common Hawthorn
Crataegus phaenopyrum	Washington Hawthorn
Cytisus scoparius	Scotch Broom
Daphne laureola	Spurge Laurel
Equisetum spp.	Horsetail
Fraxinus latifolia	Oregon Ash
Gaultheria shallon	Salal
Gleditsia triacanthos	Honey Locust
Hedera helix	English Ivy
Holodiscus discolor	Oceanspray
Ilex aquifolium	English Holly
Mahonia aquifolium	Tall Oregon-Grape
Mahonia nervosa	Dull Oregon-Grape
Malus spp.	Crab-Apple
Oemleria cerasiformis	Indian-Plum
Photinia spp.	Photinia
Pinus contorts var. contorts	Shore Pine
Pinus contorts var. latifolia	Lodgepole Pine

Pinus monticola	Western White Pine
Polygonum spp.	Knotweed
Polystichum munitum	Sword Fern
Populus nigra 'Italica'	Lombardy Poplar
Populus trichocarpa	Black Cottonwood
Prunus laurocerasus	English Laurel
Prunus spp.	Flowering Plum
Prunus spp.	Flowering Cherry
Pseudotsuga menziesii	Douglas Fir
Pteridium aquilinum	Bracken Fern
Rhododendron spp.	Rhododendron
Rhus typhina	Staghorn Sumac
Robinia pseudoacacia	Black Locust
Rosa gymnocarpa	Baldhip Rose
Rosa nutkana	Nootka Rose
Rubus discolor	Himalayan Blackberry
Rubus laciniatus	Evergreen Blackberry
Rubus parviflorus	Thimbleberry
Rubus spectabilis	Salmonberry
Rubus ursinus	Trailing Blackberry
Salix babylonica	Weeping Willow
Salix scouleriana	Scouler's Willow
Salix sitchensis	Sitka Willow
Sambucus racemosa	Red Elderberry
Sequoia sempervirens	Coast Redwood
Solanum spp.	Nightshade
Sorbus aucuparia	European Mountain-Ash
Spiraea douglasii	Hardhack
Symphoricarpos albus	Snowberry
Thuja plicata	Western Red Cedar
Tsuga heterophylla	Western Hemlock
Vaccinium ovatum	Evergreen Huckleberry

B. Soils and Geology

The Schematic Design Report for the Burke-Gilman Trail (MacLeod 1975) gives a comprehensive description of the soil and geology of the Burke-Gilman Trail:

> The major determinant of the geomorphology and topography of the area has been advancing and retreating glaciers that have inundated the Puget Lowland over the last two to three million years and have left the area basically as a series of north - south running troughs (i.e. Lake Washington, Lake Sammamish, etc.) and ridges (i.e. Capitol Hill, etc.) The soils have developed almost entirely from

unconsolidated materials that were deposited over local rock formations during the glaciations.

The Burke-Gilman Trail is primarily located within two major geological zones, except for a short portion immediately west of 25th Avenue NE, where it crosses post-glacial alluvial deposits laid down by what was once Ravenna Creek. The two major zones are of Vashon Till and a formation designated as Older Clay Till and Gravel.

Vashon Till, which extends from the intersection at 25th Avenue NE to immediately south of NE 70th Street, is a mixture of clay to gravel sizes and is the "hardpan" of common usage. It may contain occasional lenses of sand or gravel; is very difficult to excavate by hand; is of very low permeability; an excellent foundation material; and is stable both seismically and in terms of slide susceptibility.

The Older Clay Till and Gravel has within it large, identifiable lenses of sand and gravel which have properties distinct enough to warrant designation as a separate but related sub-category (relatively stable, well drained material). The larger category occurs in two major areas, from immediately south of NE 70th Street to Thornton Creek, and from approximately NE 110th Street to the end of the trail, and is basically similar to the Vashon Till except that it usually contains water and is highly susceptible to slides where it occurs on steep slopes. Groundwater that has percolated down through the ground until it reaches an impermeable layer, usually clay or clay-silt, has a tendency to saturate and "lubricate" the seam between the layers, which results in the top layer sliding.

The large lenses of sand and gravel mentioned previously (occurring within larger areas of Older Clay Till and Gravel) have essentially the same characteristics as the larger classification with the exception that they are relatively stable on steep slopes and not subject to sliding. This material occurs primarily in a section from Thornton Creek north to approximately NE 110th Street.

C. Habitat

The Burke-Gilman Trail contains five classes of wildlife habitat, even though it is a narrow, disturbed vegetation corridor: immature deciduous forest; mature deciduous forest; shrubland; tree savannah; and palustrine forest wetland. These are described in the Seattle Department of Parks and Recreation **Urban Wildlife and Habitat Management Plan**.

The trail provides habitat for reptiles, birds, and mammals. Three sections of the trail are designated in this plan as **habitat nodes** for the further enhancement of wildlife habitat. These nodes were selected based on their habitat potential, including size, quality of habitat, potential for enhancement and connectivity to other habitat areas. The Management Projects identify these nodes and recommend plant introductions and enhancements to facilitate habitat development. These nodes are located approximately as follows:

- East of 40th Avenue NE (adjacent to Burke-Gilman Park) and west of the equivalent of 52nd Ave NE (contained in Management Units 5 & 6)

- East of the equivalent of 54th Ave NE, between the equivalents of NE 80th and NE 87th Streets (contained in Management Unit 8)

- East of 46th Avenue NE ROW, Between the equivalent of NE 90th and NE 95th Streets (adjacent to Matthews Beach and Sandpoint & 95th Natural Area) (contained in Management Unit 9)

D. Environmentally Critical Areas

The City of Seattle's critical areas inventory identified the following types of environmentally critical areas along the Burke-Gilman Trail (see also Figure 2):

- Slopes of 40% or greater exist along much of the trail, especially in the northern half
- Potential landslide areas are located along the section of the trail north of NE 70th Street to NE 145th Street. The only exception being the section from NE 93rd Street to NE 107th Street
- Riparian corridors cross the trail east of NE 40th Street (Yesler Creek), southeast of NE 92nd Street (Maple Creek) and west of Sandpoint Way (Thornton Creek).
- Liquifaction zones stretch along the sections around the University of Washington, Sandpoint Naval Station, and the south side of Matthews Beach.
- Known slide areas are scattered along the trail (see Figure 3), and are especially concentrated north of 110th Street.

This critical areas inventory does not include all environmentally sensitive areas along the Burke-Gilman Trail. Additional sensitive areas have noted as part of the inventory of the trail vegetation, including wetlands and wildlife habitat areas.

The Department of Parks and Recreation will insure that all vegetation management activities comply with the City of Seattle's Environmentally Critical Areas Interdepartmental Standard Operational Procedure. All activity on-site will meet or exceed standards described in the Department of Construction and Land Use's **Construction Best Management Practices Manual**. Additional precautionary measures will be taken to avoid site impacts. Reforestation recommendations will consider soil, slope stability and habitat characteristics. All proposed projects within areas of known instability will be reviewed by staff engineers before approval.

a) Figure 2: Burke Gilman Trail Vicinity Critical Areas Maps

b) Figure 3: Burke Gilman Trail: Slide Areas

E. Existing Infrastructure and Management Practices

The Burke-Gilman Trail is not only a living landscape. Its stature as a premier recreational and transportation facility is based on a continuous, well-paved asphalt surface. The trail corridor also contains numerous public utilities that are important to the surrounding neighborhoods. Therefore, vegetation planning must accommodate the function of other infrastructure elements.

Because of the scale of the landscape, the Department of Parks and Recreation depends on heavy equipment for vegetation management. This work is complemented by maintenance performed by the Northeast District crews, who perform needed weed eating, pruning, litter pick-up, and site inspection on a regular or as-needed basis.

Three pieces of equipment are currently used along the trail to manage vegetation. They are the Toro 580D turf mower, the Ditch Master and a slope mower. Any design and planting plans must allow the safe operation of these pieces of equipment.

- The Toro 580D is a mowing vehicle used for turf areas along the trail. It has a total extended width of 18', but typically only a 4' outboard deck is used for mowing the shoulders of the trail. Mowing frequency is approximately three times per month during the summer.
- The Ditch Master excavates drainage ditches along the trail. It requires 1 to 1.5 feet of clearance from woody vegetation on the outboard side of the ditch. Overhead clearance must be at least 8 feet.
- The slope mower is a 4' wide flail mower head attached to an articulated hydraulic arm extending from the side of a tractor. This vehicle is used to mow woody vegetation along the margins of the trail's turf landscape approximately twice each summer. It is also used to mow between and behind existing row trees along the trail. This task is time-consuming for the slope-mower operator, but current management practices do not include routine hand-mowing around or behind the row trees.

All trail surfaces should have 3 to 4 feet of clearance to woody vegetation for safety purposes and mower clearance. All drain and sewer lines should have 3 to 4 feet of clearance from any woody vegetation to allow for potential servicing. (see Figure 5 for required trail clearing limits).

Trees along the trail are pruned on an as-needed basis in response to reports of potential hazards or trail user conflicts. The Department of Parks and Recreation also receives requests for pruning permits from adjacent property owners who wish to prune trees to achieve certain objectives. Pruning of all Park trees is subject to DPR policies which regulate the amount and type of pruning that can be done, so as to protect the overall quality of the park landscape. These requests are evaluated on a case-by-case basis, which includes a site inspection by the DPR Senior Urban Forester. Permit fees and deposits are assessed to insure the tree work meets DPR standards.

The inventory of the trail included a review of all pruning permit requests for the last 5-7 years. Those requests that concerned private views are identified in Figure 4.

a) Figure 4: View Concern Areas

VI. VEGETATION MANAGEMENT APPROACHES

The following actions are needed for successful management and restoration of the vegetation along the Burke-Gilman Trail.

A. Native Character

1. Preserve native plant components.

(Objectives A.1, B.3 & E.1)

Because the Burke-Gilman Trail is located on the site of an abandoned railroad right-of-way, the landscape is almost entirely disturbed from its natural state. This has allowed the establishment of many invasive species, limiting the amount of native regeneration. The native plant species that have survived or re-established are limited in their diversity.

All sections of the trail that contain an established native component should have invasive species removed to preserve valuable plant material. These guidelines give priority to the management of areas that still maintain a native component, this priority being reflected in the project section. Habitat nodes are designated areas where native habitat management is highest priority.

2. Plant native species to restore greater diversity.

(Objectives A.2, B.3 & E.1)

The most pervasive canopy tree along the trail is bigleaf maple, with very few other native trees as dominant components. The lack of native species is even more noticeable in the understory, where invasive species dominate along 72% of the trail's length.

Planting additional native species will reduce the dominance of invasive species, creating an environment less likely to invite future establishment of invasive species.

3. Utilize plant species that promote native character.

(Objective A.3, B.1, & E.2)

Where a native habitat does not exist or is not planned, use plant species that still maintain a native character. The mixed planting palettes promote this theme. (Appendix D)

B. Views

1. Select trees that do not interfere with existing public view corridors.

(Objectives B.2, B.5 & C.3)

Planting palettes provided in Appendix D list trees in different height categories. Where views are to be preserved, any new trees planted should be from the small or medium categories.

Taller trees may frame these view corridors. In most cases, small trees should be used in view areas, but if the elevation of the land allows for it, medium-sized trees can also be used.

2. Collaborate with adjacent property owners when planting.

(Objective B.2, B.5, C.3 & D.1)

Future plantings along the trail may accommodate private views by selecting and locating plant material so as to maintain view windows that coincide with recent pruning permits. This accommodation will be made on a case-by-case basis, as long as the result does not compromise the character of the trail landscape as outlined in these guidelines. However, the issuance of a pruning permit does not afford the permit holder any rights or privileges beyond the permission to perform pruning as specified in the permit. All pruning will be done in accordance with the Purpose and Policy of the DRAFT Department of Parks and Recreation Tree Policy.

3. Protect tree health and longevity during all pruning.

(Objectives A.1, B.4 & D.2)

Due to the lack of healthy, mature trees along the trail, existing trees should be preserved. Topping of trees reduces photosynthetic capacity for food production (leaves and needles) and increases susceptibility to disease through large open wounds.

Limit pruning to windowing and top thinning, allowing the removal of no more than 20-30% of the live crown. Neither of these practices should be excessive, as plants could be forced into decline.

All pruning will be done in accordance with the Purpose and Policy of the DRAFT Department of Parks and Recreation Tree Policy.

Refer to ANSI A300 Pruning Standards for correct pruning practices.

C. Plantings

1. Thoroughly assess the site as part of project design

(Objectives B.5 & C.3)

The Burke-Gilman trail contains numerous utility services, including electrical (both above and below ground) cable, telephone, sewer and drainage. Before beginning any project, all utilities must be located. Locations can be approximated from existing City GIS data. However, some private or Parks and Recreation services may not be included. Prior to any digging, call Dial-a-Dig 48 hours before starting any new plantings. Call 1-800-424-5555.

Trees and large shrubs should not be planted within 4 feet of an existing underground utility. Shrubs and herbaceous plant material can be planted over existing utility lines with the understanding that future maintenance activities may require the removal of these plants.

2. Design projects to minimize long-term maintenance

(Objectives C.1, C.3 & D.1)

New projects cannot add to the existing workload of district field staff. Therefore, all projects must be designed to naturalize successfully after the initial three year establishment period. New plantings of large trees near the trail should incorporate root barrier to protect the pavement. Select and place all vegetation to minimize encroachment on established clearing limits (see Figure 5).

3. Provide establishment care as an integral part of any planting project

(Objectives A.2, C.2, & D.1)

All projects should be fully planned for intensive establishment care for the first three years following planting. This would include: weeding, watering, fertilization, plant replacement, etc. If necessary, projects may be required to include irrigation systems, weed mats or other infrastructure to insure successful establishment.

4. Limit the damaging effects of root growth.

(Objective C.1 & C.3)

To help prevent roots lifting trail pavement and entering utility pipes, root barriers should be used when planting trees near the trail. Nylon mesh (Jason Mills Q889 with extra firm finish) or commercial solid barriers work well in limiting the extension of large roots. These should be specified as part of any new planting project within 20’ of the paved trail surface.

5. Establish and maintain a grass-free zone around the base of existing and newly planted formal row trees.

(Objectives A.1, B.4. C.1 & C.2)

Create grass-free zones at the base of existing row trees, and establish this zone on all new row plantings. The zone should be mulched to a depth of 2-3", and should have a diameter of at least 3'. Grasses over the surface root zone of a tree compete directly with those roots for moisture and nutrients, leading to reduced tree vigor and health. Also, a grass-free zone provides protection to the trunk from mower and trimmer damage that can seriously affect the health of a tree.

a) Figure 5: Clearing limits for Upright Woody Vegetation - Schematic Cross Section

6. Stake newly-planted trees only as necessary and remove stakes after initial growing season.

(Objectives C.1 & C.2)

Stake only those trees that are susceptible to windthrow or potential lean problems. Stakes should be placed outside the root-ball, and ties should loosely secure the tree so as to eliminate the occurrence of girdling. Removal of stakes and ties after the initial growing season is important. Failure to do so promptly can lead to trunk girdling, windthrow when stakes and ties are finally removed, and poor development of taper.

D. Invasive Species

1. Aggressively remove invasive species from canopy, tree trunks and understory.

(Objectives A.1. B.3, B.4, D.1, D.2 & E.1*)*

The removal of invasive species from much of the trail will assist in the restoration of native habitats, the diversifying of plant species present along the trail, and the improvement of the health, vigor, and longevity of existing vegetation.

Projects laid out in this plan call for the elimination of invasive species from areas including:

- Native species that are dominant but have minimal invasive component that could spread.
- Existing trees and understory plants that are being seriously affected (health, vigor) by the presence of invasive species.
- Establishment of invasive species on trunk or in canopy of otherwise healthy trees.

There are many other areas along the trail where invasive species are established and could cause future problems for existing vegetation. These areas should be monitored and dealt with on a prioritized basis. The highest priority areas are identified within the guidelines as projects requiring immediate action.

E. Soil Erosion Control

1. Introduce plant species that reduce soil erosion.

(Objectives A.1, B.5 & C.3)

The use of plant species contained in the soil erosion control palettes (Appendix D) will help to reduce soil erosion on steep slopes. Many of these plants have deep rooting systems which bind the soil on slopes. Existing vegetation should not be cleared from steep slopes as it is likely assisting the binding of the soil. Rather, soil erosion control species should be introduced to improve soil stability.

Note: slope instability differs from soil erosion in that erosion occurs due to the movement of water across a surface, whereas instability generally results from sub-surface conditions. When soil becomes saturated, a lubricated seam can occur between the saturated soil and an adjacent impermeable layer. This event can lead to the sliding of the heavy, saturated soil from a slope.

2. Consult with a Geotechnical Engineer in areas of slide potential.

(Objectives A.1 & B.5)

As noted, two major areas of the trail are susceptible to slide activity. Therefore, in areas of high slide potential, a geotechnical engineer should be consulted before any activities take place on any slope. (Figure 3)

F. Hazard Tree Management

1. Annually inspect and evaluate potential hazard trees.

(Objective C.1)

Red alder and bigleaf maple make up much of the native canopy along the trail. In particular, as these two species decline they are prone to break-up and overall failure. Weak attachments of branches often lead to the dropping of large branches, causing potentially hazardous conditions along the trail.

Hazard tree evaluation is based on the likeliness of tree failure, the size of the failure, and the proximity to potential targets. This evaluation should take place annually, using the International Society of Arboriculture's (ISA) " Tree Hazard Evaluation Form" and Matheny and Clark's "A Photographic Guide to the Evaluation Of Hazard Trees in Urban Areas." (ISA, 1994), with a report of "risk" trees being made to the urban forester for further evaluation.

2. Remove all black cottonwoods from trail vicinity.

(Objectives C.1, C.3)

Black cottonwood *(Populus trichocarpa)* has a tendency to drop large branches during the summer, even if the tree appears to be healthy. The condition is called "summer branch drop" and often occurs during or soon after hot, calm summer afternoons. Due to the rapid growth, large size, and proximity to the trail of many cottonwoods, this condition could cause a potentially dangerous situation.

Cottonwood roots also heave pavement where they grow close to the trail. Due to these factors, and to avoid continual monitoring and maintenance, it would be advisable to remove all black cottonwood from within 50 feet of the trail.

VII. MANAGEMENT AND RESTORATION PROJECTS

A. Plant Palettes

The plant palettes in Appendix D are to be used as a guide for the restoration planting projects outlined below. Each palette is designed to serve a unique purpose in the implementation of these guidelines. However, these palettes alone do not represent a usable landscape plan. They are intended to be employed by Department of Parks and Recreation staff or Adopt-a-Park volunteers who are knowledgeable about plant ecology and horticulture. Not every plant in a palette is suitable for every situation where that palette occurs. Furthermore, these palettes do not replace the need for landscape architecture in many situations, especially in close proximity to the trail. All proposed projects should first be submitted as plan drawings for DPR staff to review.

Native Planting Palette - This palette is the primary palette for the trail landscape. It is to be used where native character is to be enhanced or reintroduced. The goal for this palette is to establish and maintain a diverse, multi-layered canopy, consisting of mature trees, regenerating saplings, tall shrubs, low shrubs and herbaceous material. Where no overstory currently exists, the focus of restoration should be primarily on establishing new canopy.

Wet Site Palette - designed to maintain or re-introduce a native vegetation character to areas of the trail considered to be wet sites. The goal is to eliminate invasive species from these wet areas. Emphasis is on providing overstory and a dense, aggressive native shrub layer to compete with invasive species and buffer runoff. Project M7N1 in Management Unit 5 calls for the development of a Wetland Demonstration Project for which this plant palette is directly applicable. All trees/plants listed perform very well on wet sites.

Row Planting Palette - provides a selection of trees that maintain the formal look of a row planting and achieve that goal with minimal maintenance. Understory would typically be turf, but groundcovers and low shrubs can also be selected from the native plant palette. Most trees listed are non-native species, however each tree has characteristics similar to those of PNW native vegetation.

Mixed Planting Palette - this is supplemental to the Native Planting Palette, to be used with natives to provide variety in the structure of the vegetation. Also, these plants assist in diversifying the composition of the vegetation as well. Most areas would be planted with multiple layers using a diversity of species. However, discrete areas could be planted with one or a few selections to achieve a specific height or density of planting. Even though these plants are non-native, they were chosen for their similarities to native vegetation.

Soil Erosion Palette - plants were chosen for their ability to protect soil on steep slopes and limit the effects of soil erosion. The primary goal would be to establish a diversity of tall and low shrub vegetation that would provide a dense and competitive root system. Where possible, overstory establishment should be pursued as well.

B. Project Descriptions

The following is a list of vegetation management and restoration projects that are deemed to be highest priority. These projects directly address the objectives above and are designed to be performed by Adopt-A-Park volunteers with the support and supervision of the Seattle Department of Parks and Recreation. This list is not exhaustive but identifies areas that can be readily restored, contain valuable plant material and wildlife habitat, and are invaded by non-native species which are seriously affecting plant health. Many sections of vegetation along the trail, not noted within these projects, are also dominated by invasive species and should be considered as secondary but necessary projects.

About Project Labeling

These projects are identified on the Projects Maps (1B-25B) in Appendix F. Each project that requires future planting is identified by the Plant Palette Key. The key is found on each map and corresponds to the palettes in Appendix D.

The project numbering system refers to the map and location on each map of the project. For example, Project M1W1 is found on Map 1B and is the first project on the west side of the trail on that map. Therefore, M7-8S2 is on Maps 7B and 8B, and is the 2nd project on the south side of the trail on Map 7A.

The vegetation classes used on the Project Maps and the Inventory Maps are described in Appendix A.

1. Management Unit 1: NE 45th St. to NE 50th St.

This section of trail has a single-family residential area to the west and a multiple-family residential/commercial area to the east.

M1W1

- Remove invasive species from tree canopy and trunks.
- Remove invasive groundcover where tree health is affected.
- Diversify overstory with native conifers.
- Establish understory to limit invasive species, using plants for erosion control.

This area offers good potential for restoration of native vegetation on a hillside.

M1E1

- Join existing row plantings by filling gaps to create one continuous row planting.
- create mowed turf or mixed fescue grass understory.

Due to the amount of off-trail foot traffic in this area, there is little chance of developing any shrub or groundcover understory other than mowed turf or mixed grasses.
Addition of row trees to fill gaps adds to landscape character.

2. Management Unit 2: 25th Ave NE to 30th Ave NE (Map 2B)

This section of trail is surrounded by light industrial and commercial properties.

M2S1

- Remove Himalayan blackberry from along fence.
- Turf entire area where blackberry removed to match understory beneath adjacent row trees.

Removal of blackberry prior to further spread will eliminate future competition problems for existing row trees.

M2S2

- Remove Himalayan blackberry around bigleaf maple and western hazelnut.
- Plant small or medium native conifers and deciduous trees.
- Establish native understory.

Blackberry is seriously affecting plant health. Good potential exists to establish native species.

3. Management Unit 3: 30th Ave NE to 36th Ave NE

The trail here is bordered by single-family residential property to the north and light industrial/commercial properties to the south.

M3N1

- Remove Himalayan blackberry around row Norway maples.
- Eliminate direct competition.

M3S1

- Remove invasive species from understory to limit effect on good native component.
- Diversify overstory and understory with erosion control pallette and native trees.
- Plant to increase native understory.

Presence of a good native understory warrants the elimination of invasive species starting to establish on the site.

M3N2

- Remove invasive species.
- Introduce native overstory and understory to match west side of trail.

Introduction of native species will match vegetation on south side of the trail and give a continuity to this section.

M3N2

- Good native component.
- Remove invasive species and diversify with native replacements.

The addition of native species to this site will insure the maintenance of a native habitat, free of invasive species.

4. Management Unit 4: 36th Ave NE to 40th Ave NE

The trail is surrounded by single-family residences, except on the east side from 37th Ave NE to NE 50th St. which is multiple-family residential/commercial.

M4S1

- Remove invasive species from turf area Replace gaps with turf.

Turfing this section will match the north side of the trail in this section. At present, the turf is being taken over by invasive species and would be more aesthetically pleasing if invasives are removed.

M4W1

- Reduce dominance of Himalayan blackberry.
- Develop mixed overstory and understory using mixed and native planting palettes.
- Remove Japanese knotweed and Scotch broom.

Invasive species are affecting plant health. Pure blackberry section should be retained for picking by trail-users.

M4E1

- Remove invasive species, seriously affecting health of existing trees.
- Diversify overstory and understory with native planting palette.

Plant health is seriously affected by invasive species. Development of a diverse planting will help to reduce future re-establishment of invasives.

M4W2

- Replace existing row planting with small or medium row trees and protect trunks from mower damage.
- Complete row between NE 51st St. and 40th Ave NE.

Good location for row planting, but trunks must be protected from mower damage.
Existing trees all show signs of trunk damage.

M4E2

- Remove English ivy from trunks and canopy.

Invasive species dominating tree canopy.

5. Management Unit 5: 40th Ave NE to Princeton Ave N

The trail is bordered by single-family residential properties to the north and multiple-family residential/commercial properties to the south.

M5N1

- Remove invasive species, seriously affecting health of existing trees.
- Diversify overstory and understory with mixed and native plant palettes.

Plant health seriously affected by invasive species. Good potential to develop overstory and understory on north side to match south side of trail.

M5S1

- Excellent native component in understory.
- Remove minimal invasive species presence to eliminate potential competition with native species.
- Diversify overstory with conifer/broad-leaf evergreen trees.

Excellent potential for wildlife habitat enhancement. Proximity to Yesler Creek and the associated ravine lends to the bridging of habitat corridors.

M5N2

- Develop Wetland Enhancement Demonstration Project - standing water for much of the year.
- Remove invasive and introduced garden species. Diversify native component.

Currently, standing water exists throughout much of the year. Some wetland plant species already exist but the site is seriously dominated by invasive species. Ducks already use this site, so habitat enhancement is a realistic goal.

M5S2

- Remove invasive species to restore native species dominance.
- Introduce native understory on north side of trail.

Good native component present. Match south side of trail by planting native understory on north side.

6. Management Unit 6: Princeton Ave NE to NE 65th St.

The trail has single-family residences on the west side and multiple-family residences/commercial properties on the east side.

M6E1

- Remove black cottonwoods which are limiting Douglas fir growth potential.

Limit invasive species in understory and replace with native species. Black cottonwood seriously limiting growth potential of otherwise healthy Douglas fir.

M6S1

- Remove Himalayan blackberry.
- Plant deciduous and broad-leaved evergreen from mixed plant palette to join separated mixed deciduous sections.

Removal of blackberry and introduction of mixed planting will enhance the continuity of this trail section.

M6E2

- Remove invasive species to reduce negative effect on good overstory diversity.
- Introduce mixed plant understory.

Elimination of invasive species affecting the overstory will allow for development of good plant specimens.

7. Management Unit 7: NE 65th St. to NE 77th St.

The trail is bordered by single-family residences to the west and multiple-family residences to the east.

M7-E1

- Remove invasive species in middle section to improve native species development.
- Remove invasive species from MDi to the north.
- Diversify overstory using medium/small trees and plant native understory in MDi to the north.

Good native plant component being affected by invasive species. Introduction of tree species should be done with the consideration of view concerns in this section.

M7-W1

- Remove only Himalayan blackberry affecting tree performance.
- Remove all Japanese knotweed.

Blackberry in this area are easily accessible for picking by trail users. Japanese knotweed is strongly established and needs to be controlled.

M7

- Protect row planting trees from mower damage.

Signs of decline in tree health due to mower damage.

M7W2

- Reforestation needed due to severe pruning/topping of Bigleaf maples and occurrence of invasive species
- Plant low/medium height mixed trees and soil erosion control plants

Unprofessional pruning practices have led to severely damaged trees. Best approach is to start replanting using low/medium height plants to avoid future view problems.

M7E2

- Remove Hybrid black poplar, in direct competition with Douglas fir

Performance potential of Douglas fir seriously affected.

M7W3

- Reforestation section due to badly pruned Bigleaf maple and invasive species in understory.
- Replant from mixed planting palette using small trees and mixed understory.

Unprofessional pruning. Requires replanting using small trees to avoid future view conflicts.

8. Management Unit 8: NE 77th St. to Inverness Dr. NE (Map 13B to Map 14B)

The trail has single-family and multiple-family residences to the west and Sandpoint Way NE to the east.

M8E1

- Control invasives in the understory.
- Reforest with native conifer and deciduous trees.

This is the widest section of the Burke-Gilman Trail and has the greatest potential for native habitat. Existing bigleaf maples are multi-stem stump sprouts. Diversification with native conifers and snag conversion could increase habitat values considerably.

M8W1

- Thin Sycamore row planting.

A remnant row planting is crowded and likely to lift trail pavement in the future. Gradual thinning and replacement would afford a more continuous native palette.

M8W2

- Remove invasive species to assist with development of existing native component.
- Diversify understory by replanting with native plants where invasive species are removed.

Good potential for wildlife habitat enhancement. Continuation of project M13EW1.

9. Management Unit 9: Inverness Dr. NE to NE 97th St.

The trail is surrounded by single-family residences.

M9S1

- Consult with Geotechnical Engineers prior to implementation.
- Introduce soil erosion control plants without removing existing vegetation.
- Establish native understory so as to add to soil stabilization.

Refer to Soil Erosion Control section for implementation approach.

M9N1

- Remove invasive species, especially Japanese knotweed.
- Diversify section using mixed plant palette.

Some wet site species already exist. Diversifying will help reduce spread of Japanese knotweed.

M9E1

- Potential for development of pure conifer stand.
- Remove invasive species, especially Japanese knotweed.
- Plant understory with consideration that most of section is wet for much of the year.

Development of wet site species in the understory will assist in limiting invasive species. Good conifers warrant protection from invasives.

M9W1

- Remove invasive species, good existing native component.
- Diversify overstory by introducing conifers.

Adjoining land on north side of trail directly east and west of Sand Point Way NE allows for development of good wildlife habitat.

Excellent area for enhancement of wildlife habitat. Two parcels of land directly adjacent to the trail are owned by the DPR and provide a sizable area for habitat development.

M9E2

Strong native component would act as bridge from wildlife habitat in previous section to Matthews Beach Park and Lake Washington.

- Remove minimal amount of invasive species present.

This section serves to bridge a number of wildlife habitats. It also serves to join Project M16-17N2 with Lake Washington, helping to diversify the wildlife of these areas.

M9E3

- Remove planting boxes.
- Expand row planting to incorporate entire open section, using small/medium height trees.
- Complete existing row planting to enhance landscape character.

10. Management Unit 10: NE 97th St. to NE 112th St.

The trail is surrounded by single-family residences.

M10W1

- Replant along ridge of raised turf section on west side of trail
- Use mixed deciduous and evergreen low-growing shrubs to create continuity and for aesthetic purposes
- Create similar design on east side of trail.
- Remove invasive species and unhealthy pines, replant with mixed shrubs and turf.
- Define raised turf section by enhancing existing row of shrubs. Duplicate effect on east side of trail.

M10W2

- Remove Japanese knotweed.
- Leave Himalayan blackberry for berry picking.

Blackberry serves as a recreational resource. Japanese knotweed is highly invasive in this section and should be eradicated.

M10E1

- Pruning Permit recently issued.
- Allow pruning of main stems in decline and limited thinning for view purposes.
- Develop native understory using soil erosion control plants, specifically Sword fern.

M10E2

- Remove invasive species from understory of row planting, seriously affecting plant performance

Removal of invasives around row trees will improve health and performance.

11. Management Unit 11: NE 112th St. to NE 125th St.

The trail is surrounded by single-family residences.

M11E1

- Remove invasive species from understory of row planting, seriously affecting plant performance.

Removal will improve overall plant performance.

M11E2

- Remove invasive species from trunk and canopy of trees to reduce possibility of future failure.

Potential for failure of trees exists due to dominance of invasive species.

M11E3

- Complete continuous stretch of row plantings.
- Design is disjointed by DEnn and Ob sections.

The joining of row plantings will add to the consistency of landscape character in this section of trail.

M11W1

- Consult with Geotechnical Engineers prior to implementation.
- Remove invasive species from canopy.
- Introduce soil erosion control plants without removing existing vegetation.
- Establish native understory so as to add to soil stabilization.

Refer to Soil Erosion Control Section for implementation approach.

12. Management Unit 12: NE 125th St. to NE 145th St.

The trail is surrounded by single-family residences.

M12E1

- Remove invasive species.
- Diversify overstory and understory using mixed planting palette.

Large enough section to act as break in row planting theme. Acts as a natural break in the row plantings that exist in this section of the trail. Removal of invasive species will allow for further development of understory.

M12W1

- Consult with Geotechnical Engineers prior to implementation.
- Increase diversity in understory in order to reduce risk of erosion.
- Good area for use of Red-osier dogwood stakes.

Refer to Soil Erosion Control section for implementation approach.

M12E2

- Remove invasive species to allow for improved performance of native understory.
- Diversify overstory with introduction of conifers on west side of trail, and the addition of erosion control plants and deciduous trees to east side of trail.
- Good potential for wildlife habitat development.

Native component is good throughout this site. The addition of conifers will enhance a potential wildlife habitat.

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IX. APPENDICES

A. Appendix A: Vegetation Classes Present on the Burke-Gilman Trail

DEi Deciduous-Evergreen Mix/Invasive Species
mix of deciduous and evergreen species with understory dominated by invasive species

DEn Deciduous-Evergreen Mix/Natives
mix of deciduous and evergreen species with understory dominated by native species

DEnn Deciduous-Evergreen Mix/Non-Native
mix of deciduous and evergreen species with understory dominated by introduced/garden species

Ei Evergreen/Invasive Species
evergreens dominant with understory dominated by invasive species

Et Evergreen/Turf and Mixed Grasses
evergreens dominant with maintained turf or mixed grasses in the understory

En Evergreen/Natives
evergreens dominant with understory dominated by native species

It Invasive Species/Turf and Mixed Grasses
no significant non-invasive species with maintained turf or mixed grasses beneath or surrounding

MDi Mixed Deciduous/Invasive Species
2+ deciduous species dominant with understory dominated by invasive species

MDt Mixed Deciduous/Turf and Mixed Grasses
2+ deciduous species dominant with maintained turf or mixed grasses in the understory

MDn Mixed Deciduous/Natives
2+ deciduous species dominant with understory dominated by native species

MDb Mixed Deciduous/Bare
2+ deciduous species dominant with bare soil or gravel beneath

MDnn Mixed Deciduous/Non-Native
2+ deciduous species dominant with understory dominated by introduced/garden species

NNi Non-Native/Invasive Species
introduced/garden species dominant with understory dominated by invasive species

NNt Non-Native/Turf and Mixed Grasses

introduced/garden species dominant with maintained turf or mixed grasses in the understory

NNb Non-Native/Bare

introduced/garden species dominant with bare soil or gravel beneath

NNnn Non-Native/Non-Native

introduced/garden species dominant with understory dominated by introduced/garden species

Oi Open/Invasive Species

no overstory with area dominated by invasive understory species

Ot Open/Turf and Mixed Grasses

no overstory and maintained turf or mixed grasses in the understory

Ob Open/Bare

no overstory and bare soil or gravel in the understory

Ri Row Planting/Invasive Species

evenly-spaced planting of single species with invasive species dominant in the understory

Rt Row Planting/Turf and Mixed Grasses

evenly-spaced planting of single species with maintained turf or mixed grasses in the understory

Rb Row Planting/Bare

evenly spaced planting of single species with bare soil or gravel in the understory

SDi Single Deciduous/Invasive Species

single deciduous species dominant with understory dominated by invasive species

SDt Single Deciduous/Turf and Mixed Grasses

single deciduous species dominant with maintained turf or mixed grasses in the understory

SDn Single Deciduous/Natives

single deciduous species dominant with understory dominated by native species

SDnn Single Deciduous/Non-Native

single deciduous species dominant with understory dominated by introduced/garden species

B. Appendix B: Length of the Burke-Gilman Trail Dominated by Specific Vegetation Classes (in feet)

Understory	Overstory Type								
Type	Row	Open	Inv	MxD	SD	Evr	DEv	NN	Totals
Invasive	3575		0	29700	5175	1125	4200	1950	53975
Turf	4700	4425	875	875	1025	225	0	1525	13650
Natives	0	0	0	3225	1100	475	200	0	5000
Bare	625	150	0	125	0	0	0	800	1700
Non-native	0	0	0	500	100	0	125	650	1375
Totals	8900	12825	875	34425	7400	1825	4525	4925	75700

Inv:	Invasive	Evr:	Evergreen
MxD:	Mixed Deciduous	DEv:	Deciduous/Evergreen
SD:	Single Deciduous	NN:	Non-native

C. Appendix C: Percentage of the Length of the Burke-Gilman Trail Dominated by Specific Vegetation Classes

Understory	Overstory Type								
Type	Row	Open	Inv	MxD	SD	Evr	DEv	NN	Totals
Invasive	4.72	10.90	0	39.23	6.84	1.49	5.55	2.58	71.30
Turf	6.21	5.85	1.16	1.16	1.35	.30	0	2.01	18.03
Natives	0	0	0	4.26	1.45	.63	.26	0	6.61
Bare	.83	.20	0	.17	0	0	0	1.06	2.25
Non-native	0	0	0	.66	.13	0	.17	.86	1.82
Totals	11.76	16.94	1.16	45.48	9.78	2.41	5.98	6.51	100.00

Inv:	Invasive	Evr:	Evergreen
MxD:	Mixed Deciduous	DEv:	Deciduous/Evergreen
SD:	Single Deciduous	NN:	Non-native

D. Appendix D: Undesirable Plants for the Burke-Gilman Trail

Many plant species should not be considered for use along the Burke-Gilman Trail. They are not appropriate because they do not perform well or do not fit into the intended landscape character. the list below suggests plants that do not perform well or threaten sustainable landscapes along the trail. These plants should not be planted along the trail, and over time, should be eliminated by attrition.

Botanical Name	**Common Name**	**Reason**
Cornus florida	Eastern dogwood	anthracnose
Hedera helix	English ivy	invasive
Ilex aquifolium	English holly	invasive
Populus trichocarpa	Black Cottonwood	prone to failure
Prunus laurocerasus	English laurel	invasive
Prunus spp.	Cherry	short-lived, brown rot

E. Appendix E: Invasive Species to Control Along the Burke-Gilman Trail

Invasive, non-native species constitute the largest component of the existing understory along the trail. Control of these invasives is the single most important approach to insuring that the goals of these guidelines are achieved.

Botanical Name	**Common Name**
Clematis vitalba	Clematis
Convolvulus sepium	Bindweed
Cytisus scoparius	Scotch Broom
Equistetum spp.	Horsetail
Hedera helix	English Ivy
Ilex aquifolium	English Holly
Phalaris arundinacea	Reed Canarygrass
Polygonum spp.	Knotweed
Prunus laurocerasus	English Laurel
Rubus discolor	Himalayan Blackberry

F. Appendix F: Plant Palettes

1. Wet Site Palette

This palette is designed to maintain or re-introduce a native vegetation character to areas of the trail considered to be wet sites. The goal is to eliminate invasive species from these wet areas. Emphasis is on providing overstory and a dense, aggressive native shrub layer to compete with invasive species and buffer runoff. Project M7N1 in Management Unit 5 calls for the development of a Wetland Demonstration Project for which this plant palette is directly applicable. All trees/plants listed perform very well on wet sites.

RECOMMENDED TREES FOR WET SITES

Botanical Name	Wet	Sm	Med	Lge	Decid	Conif	Br Ev	Common Name
Acer circinatum		X			X			Vine Maple
Acer rubrum			X		X			Red Maple
Alnus rubra	X			X	X			Red Alder
Betula papyrifera				X	X			Paper birch
Fraxinus latifolia	X			X	X			Oregon Ash
Nyssa sylvatica			X		X			Sour Gum
Populus tremuloides	X	X			X			Quaking Aspen
Salix lasiandra	X		X		X			Pacific Willow
Salix scouleriana	X	X			X			Scouler's Willow
Salix sitchensis	X	X			X			Sitka Willow
Salix hookeriana 'Clatsop		X			X			Hooker's Willow
Taxus brevifolia		X				X		Western Yew
Thuja plicata	X			X		X		Western Red Cedar

RECOMMENDED UNDERSTORY PLANTS FOR WET SITES

Botanical Name	Wet	Low	Med	Tall	Decid	Conif	Br Ev	Common Name
Athyrium filix-femina		X					X	Lady fern
Blechnum spicant		X					X	Deer fern
Carex obnupta	X	X					X	Slough Sedge
Cornus canadensis		X					X	Bunchberry
Cornus stolonifera				X		X		Red-osier dogwood
Ledum groenlandica	X	X					X	Labrador Tea
Lystichicum americanum	X	X				X		Skunk cabbage
Myrica gale			X			X		Sweet Gale
Oemlaria cerasiformis				X		X		Indian Plum
Oplopanax horridus	X		X			X		Devil's Club
Physocarpus capitatus				X		X		Ninebark
Ribes bracteosum		X				X		Stink currant
Rubus spectabilis	X		X			X		Salmonberry
Sambucus racemosa				X		X		Red Elderberry

Spirea douglasii	X		X		X		Hardhack
Tolmiea menziesii		X			X		Piggyback Plant
Viburnum edule			X		X		Highbush Cranberry

Sm	Mature height <30’	Low	<3’ tall	Decid	Deciduous
Med	Mature height 30’-50’	Med	3’-6’ tall	Conif	Conifer Evergreen
Lge	Mature height >50’	Tall	>6’ tall	Br Ev	Broadleaf Evergreen

Wet Wetland Restoration

2. Row Planting Palette

This palette provides a selection of trees that maintain the formal look of a row planting and achieve that goal with minimal maintenance. Understory would typically be turf, but groundcovers and low shrubs can also be selected from the native or mixed plant palettes. Most trees listed are non-native species, however each tree has characteristics similar to those of PNW native vegetation.

RECOMMENDED TREES FOR ROW PLANTINGS

Botanical Name	Sm	Med	Lge	Decid	Conif	Br Ev	Common Name
Acer davidii ‘George Forrest’		X		X			George Forrest Maple
Acer ginnala ‘Flame’	X			X			Flame Amur Maple
Acer rubrum ‘Red Sunset’		X		X			Red Sunset Maple
Acer saccharum ‘Legacy’			X	X			Legacy Sugar Maple
Cornus kousa	X			X			Kousa Dogwood
Crataegus x *lavallei*		X		X			Carriere Hawthorne
Crataegus phaenopyrum	X			X			Washington Hawthorn
Fraxinus ornus		X		X			Flowering Ash
Gleditsia triacanthos ‘inermis’		X		X			Honey Locust
Liquidambar styraciflua ‘Rotundiloba’		X		X			Sweetgum
Lithocarpus densiflorus		X				X	Tanbark Oak
Magnolia virginiana		X				X	Sweet Bay
Quercus coccinea			X	X			Scarlet Oak
Quercus ilex						X	Holly Oak
Rhus typhina	X			X			Staghorn Sumac
Sorbus aria	X			X			Whitebeam

Sm	Mature height <30’	Low	<3’ tall	Decid	Deciduous
Med	Mature height 30’-50’	Med	3’-6’ tall	Conif	Conifer Evergreen
Lge	Mature height >50’	Tall	>6’ tall	Br Ev	Broadleaf Evergreen

3. Mixed Planting Palette

This is supplemental to the Native Planting Palette, to be used with natives to provide variety in the structure of the vegetation. Also, these plants assist in diversifying the composition of the vegetation as well. Most areas would be planted with multiple layers using a diversity of species. However, discrete areas could be planted with one or a few selections to achieve a specific height or density of planting. Even though these plants are non-native, they were chosen for their similarities to native vegetation.

RECOMMENDED TREES FOR MIXED PLANTINGS

Botanical Name	Sm	Med	Lge	Decid	Conif	Br Ev	Common Name
Abies koreana		X			X		Korean Fir
Acer campestre		X		X			Hedge Maple
Acer ginnala 'Flame'	X			X			Flame Amur Maple
Acer rubrum		X		X			Red Maple
Amelanchier x grandiflora	X			X			Serviceberry
Arbutus 'marina'	X			X			Madrona hybrid
Calocedrus decurrens			X		X		Incense Cedar
Chamaecyparis obtusa	X				X		Hinoki Cypress (species only)
Cornus kousa	X			X			Kousa Dogwood
Garrya elliptica	X					X	Coast Silk-tassel
Lithocarpus densiflorus		X				X	Tanbark Oak
Maclura pomifera 'Whiteshield'	X			X			Whiteshield Osage Orange
Quercus ilex		X				X	Holly Oak
Rhus typhina	X			X			Staghorn Sumac
Taxus baccata	X				X		English yew (species only)
Tsuga mertensiana	X				X		Mountain Hemlock
Umbellularia californica			X			X	

RECOMMENDED UNDERSTORY PLANTS FOR MIXED PLANTINGS

Botanical Name	Low	Med	Tall	Decid	Conif	Br Ev	Common Name
Berberis darwinii						X	Darwin Barberry
Berberis x *stenophylla*						X	Rosemary Barberry
Cistus spp.		X				X	Rockrose
Myrica pensylvanica	X			X			Bayberry
Osmarea burkwoodii		X				X	
Osmanthus delavayii		X				X	
Quercus vacciniifolia						X	Huckleberry Oak
Rhododendron 'Dora Amateis'	X					X	'Dora Amateis'
Rhododendron 'Cilpinense', 'Rose Elf'		X				X	'Cilpinense', 'Rose Elf'
Rhus glabra				X			Smooth Sumac
Rosa rugosa		X		X			Rugosa Rose
Syringa vulgaris			X				

Sm	Mature height <30’	Low	<3’ tall	Decid	Deciduous
Med	Mature height 30’-50’	Med	3’-6’ tall	Conif	Conifer Evergreen
Lge	Mature height >50’	Tall	>6’ tall	Br Ev	Broadleaf Evergreen

4. Native Planting Palette

This palette is the primary palette for the trail landscape. It is to be used where native character is to be enhanced or reintroduced. The goal for this palette is to establish and maintain a diverse, multi-layered canopy, consisting of mature trees, regenerating saplings, tall shrubs, low shrubs and herbaceous material. Where no overstory currently exists, the focus of restoration should be primarily on establishing new canopy.

RECOMMENDED TREES FOR NATIVE PLANTINGS

Botanical Name	Hab	Sm	Med	Lge	Decid	Conif	Br Ev	Common Name
Acer circinatum		X			X			Vine Maple
Acer macrophyllum				X	X			Big-leaf Maple
Alnus rubra	X			X	X			Red Alder
Arbutus menziesii			X				X	Pacific Madrone
Betula papyrifera	X			X	X			Paper Birch
Chamaecyparis nootkatensis	X			X		X		Yellow Cedar
Crataegus douglasii		X			X			Black Hawthorn
Fraxinus latifolia	X			X	X			Oregon Ash
Malus fusca		X			X			Pacific Crab-apple
Myrica californica		X					X	Pacific Wax Myrtle
Pinus contorta var. contorta		X	X			X		Shore pine
Pinus contorta var. latifolia			X			X		Lodgepole Pine
Pinus monticola			X			X		Western White Pine
Populus tremuloides	X	X			X			Quaking Aspen
Pseudotsuga menziesii	X			X		X		Douglas Fir
Quercus garryana	X			X		X		Garry Oak
Rhamnus purshiana		X			X			Cascara
Taxus brevifolia		X				X		Western Yew
Thuja plicata	X			X		X		Western Red Cedar
Tsuga heterophylla	X			X		X		Western hemlock

RECOMMENDED UNDERSTORY PLANTS FOR NATIVE PLANTINGS

Botanical Name	Low	Med	Tall	Decid	Conif	Br Ev	Common Name
Amelanchier alnifolia			X	X			Serviceberry
Arctostaphyllos columbiana			X			X	Hairy Manzanita
Arctostaphyllos uva-ursi							Kinnikinnik
Asarum caudatum		X				X	Wild Ginger

Athyrium filix-femina	X					X	Lady Fern
Blechnum spicant	X					X	Deer Fern
Ceanothus velutinus			X			X	Buckbrush
Cornus canadensis	X					X	Bunchberry
Cornus stolonifera			X	X			Red-osier Dogwood
Corylus cornuta var. californica			X	X			Hazel
Gaultheria shallon		X				X	Salal
Holodiscus discolor			X	X			Oceanspray
Juniperus communis	X	X			X		Juniper
Lonicera involucrata		X	X	X			Black Twinberry
Mahonia aquifolium		X				X	Tall Oregon-grape
Mahonia nervosa	X					X	Dull Oregon-grape
Maianthemum dilitatum	X			X			False Lilly-of-the-Valley
Myrica gale		X				X	Sweet Gale
Oemlaria cerasiformis			X	X			Indian Plum
Oplopanax horridus		X		X			Devil's Club
Pachistima myrisnites		X				X	Oregon Box
Philadelphus lewisii			X	X			Mock Orange
Physocarpus capitatus			X	X			Ninebark
Polystichum munitum	X					X	Sword Fern
Rhododendron macrophyllum		X				X	Pacific Rhododedron
Ribes sanguineum		X		X			Red Currant
Rosa gymnocarpa		X		X			Bald-hip Rose
Rosa nutkana		X		X			Nootka Rose
Rubus leucodermis	X			X			Blackcap
Rubus parviflorus		X		X			Thimbleberry
Rubus spectabilis		X		X			Salmonberry
Sambucus racemosa			X	X			Red Elderberry
Smilacena racemosa	X			X			False Solomon Seal
Spirea douglasii		X		X			Hardhack
Stachys cooleyi	X			X			Hedge nettle
Symphoricarpos albus	X			X			Snowberry
Tolmiea menziesii	X			X			Piggyback Plant
Vaccinium ovatum		X				X	Evergreen Huckleberry
Vaccinium parvifolium		X		X			Red Huckleberry
Viburnum edule		X			X		Highbush Cranberry

Sm	Mature height <30'	Low	<3' tall	Decid	Deciduous
Med	Mature height 30'-50'	Med	3'-6' tall	Conif	Conifer Evergreen
Lge	Mature height >50'	Tall	>6' tall	Br Ev	Broadleaf Evergreen
Hab	Wildlife Habitat canopy				

5. Soil Erosion Palette

plants were chosen for their ability to protect soil on steep slopes and limit the effects of soil erosion. The primary goal would be to establish a diversity of tall and low shrub vegetation that would provide a dense and competitive root system. Where possible, overstory establishment should be pursued as well.

RECOMMENDED TREES FOR SOIL EROSION CONTROL

Botanical Name	Shl	Med	Deep	Decid	Conif	Br Ev	Common Name
Acer macrophyllum			X	X			Big-leaf Maple
Arbutus menziesii			X			X	Pacific Madrone
Pinus contorta var. contorta			X		X		Shore pine
Pseudotsuga menziesii			X		X		Douglas Fir
Quercus garryana			X		X		Garry Oak
Salix spp.	X	X		X			Willow
Taxus brevifolia		X			X		Western Yew
Thuja plicata		X			X		Western Red Cedar
Tsuga heterophylla	X	X			X		Western hemlock

RECOMMENDED UNDERSTORY PLANTS FOR SOIL EROSION CONTROL

Botanical Name	Shl	Med	Deep	Decid	Conif	Br Ev	Common Name
Acer circinatum		X		X			Vine Maple
Amelanchier alnifolia		X		X			Serviceberry
Arctostaphyllos columbiana		X				X	Hairy Manzanita
Arctostaphyllos uva-ursi	X						Kinnikinnik
Ceanothus velutinus		X				X	Buckbrush
Cornus stolonifera	X	X		X			Red-osier Dogwood
Corylus cornuta var. californica	X	X		X			Hazel
Gaultheria shallon	X					X	Salal
Holodiscus discolor		X		X			Oceanspray
Juniperus communis	X	X			X		Juniper
Lonicera involucrata	X			X			Black Twinberry
Mahonia aquifolium	X	X				X	Tall Oregon-grape
Mahonia nervosa	X					X	Dull Oregon-grape
Oemlaria cerasiformis	X			X			Indian Plum
Pachistima myrisnites	X					X	Oregon Box
Polystichum munitum	X					X	Sword Fern
Ribes sanguineum	X			X			Red Currant
Rosa gymnocarpa	X	X		X			Bald-hip Rose
Rosa nutkana	X	X		X			Nootka Rose
Rubus parviflorus	X			X			Thimbleberry
Rubus spectabilis	X	X		X			Salmonberry
Sambucus racemosa		X		X			Red Elderberry
Spirea douglasii	X			X			Hardhack
Symphoricarpos albus	X			X			Snowberry

Vaccinium ovatum	X		X	Evergreen Huckleberry

Shl	Shallow rooting system	Decid	Deciduous
Med	Medium depth rooting system	Conif	Conifer Evergreen
Deep	Deep rooting system	Br Ev	Broadleaf Evergreen

G. Appendix G: Maps