

Final Vegetation Management Plan

Discovery Park

Prepared for:

Seattle Department of Parks and Recreation
Seattle, Washington

Prepared by:

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Bellevue, Washington

March 5, 2002

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Discovery Park Vegetation Management Plan

1 INTRODUCTION AND APPROACH

1.1 Introduction

The 1972 Master Plan for Discovery Park defined the park as an open space of quiet and tranquility away from the stress and activity of the city. The park will be managed to retain as much of its natural character as possible, balancing the maintenance and restoration of the area's forested predevelopment condition with existing uses of the park.

The Master Plan was revised in 1974 and a vegetation management plan was prepared for the park in 1980. However, population growth in the region has increased usage of the park and put new pressures on its plant communities. In the face of these changing conditions, the Seattle Department of Parks and Recreation (DOPR) decided to prepare a new vegetation management plan.

As an initial step in preparing the new plan, DOPR asked Jones & Stokes in early 2001 to conduct a vegetation inventory of the park. Vegetation data was collected from 169 plots distributed throughout the park, each 0.1 acre in size. The vegetation management plan presented here is based in part on the subsequent inventory of these plots, and on meetings and conversations with DOPR and Discovery Park staff, the Discovery Park Advisory Council, and Friends of Discovery Park. The documents listed below also contributed information to the plan.

- Fort Lawton Park Master Plan (1972)
- Revised Master Plan (1974)
- Discovery Park Final Environmental Impact Statement (1979)
- Discovery Park: The Meadow (1979)
- Discovery Park Vegetation Management Plan (1980)
- Discovery Park Wildlife Plan (1983)
- Fort Lawton Historic District Adaptive Reuse Study (1983)
- Discovery Park Development Plan (1986)
- Revised Interpretive Plan for the Fort Lawton Historic District (1990)
- Discovery Park Habitat Improvements Project (1994 and 1995)

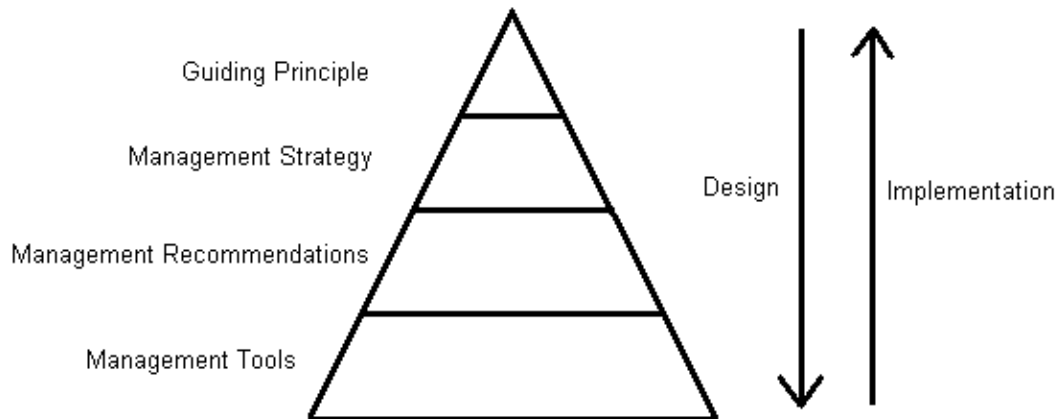
This final vegetation management plan is also based on a meeting held October 9, 2001. At this meeting, members of the public offered comments on the draft plan. The final plan reflects revisions made as a result of these comments.

1.2 Approach

Discovery Park is located at West Point in the Magnolia neighborhood of Seattle. From the late 19th century until the late 1960s, the land on which the park is located was a U.S. Army post, Fort Lawton. Most of the current park was transferred to the City of Seattle in 1972, when the Master Plan was prepared. The intent of this vegetation management plan is to follow the mandates of the 1972 Master Plan and the 1974 Revised Master Plan, and to balance the maintenance and restoration of the area's forested predevelopment condition with existing uses of the park.

To that end, this plan follows a four-tiered approach to developing and implementing management strategies within the park. The four-tiered approach may be envisioned as follows:

Figure 1. Plan Design and Implementation Conceptual Approach.



Design of the vegetation management plan is driven by a fundamental goal or guiding principle that serves as the objective of the management strategies. Management strategies provide a basis for making recommendations on specific issues. The recommendations identify particular actions and/or tools that will be used in implementing the plan.

Implementation of the plan follows the reverse course. Specific management tools are utilized to carry out management recommendations. These recommendations in turn fulfill the objectives of the management strategies. As the management strategies are fulfilled, the fundamental goal of the plan is achieved.

The guiding principle of the vegetation management plan is to restore, to the extent possible, the presettlement character of the Discovery Park vegetation communities. This concept is consistent with the 1972 Master Plan, which states, "The general objective of plant and tree development shall be to support and reinforce native and indigenous growth." Past and existing uses of some park areas, however, attenuate the ability to manage for that goal. As a result, not all areas of Discovery Park can be managed for reforestation and/or reestablishment of fully natural conditions. Nevertheless, the recovery and restoration of native plant communities in Discovery Park is the guiding principle of the vegetation management plan.

The primary management strategy is to use existing conditions to make inferences about the structure of past communities of vegetation and about the potential for enhancement of current plant communities. Analysis of data from the 2001 inventory of the park has been used to provide an understanding of current conditions at the park. This information has been used to formulate a management strategy consistent with enhancing the existing vegetation communities.

To implement the management strategy, specific management recommendations are made in this plan. Included are both general policies and specific action items intended to support the management strategy. Management recommendations are also based in part on the results of the vegetation inventory.

Finally, the vegetation management plan identifies management tools, i.e., methods, procedures, and modes of implementation for carrying out the specified action items.

The 2001 Vegetation Management Plan has been created as a guidebook for addressing the dominant management issues in the park and applying general management techniques to specific situations within it. The management plan is specific to Discovery Park and is intended for use by park managers to help realize the goals defined in the Master Plan and other earlier documents. The lifespan of the document is not strictly defined, but it should remain relevant for at least 20 years. More importantly, the management concepts and objectives in the plan are defined in a way that allows the manager some latitude in their implementation.

The first section of this plan describes the existing plant communities at Discovery Park, and discusses the results of the 2001 vegetation inventory. The second section outlines general recommendations for carrying out management strategies on several key issues. The third section describes each of 21 management zones defined and delineated by DOPR and Discovery Park staff, and gives specific management recommendations. The delineation of the 21 zones was based in part on the distribution of plant communities and in part on use patterns within the park. Finally, three appendices provide the following information and illustrations.

- Appendix A contains diagrams of the 21 management zones.
- Appendix B includes typical drawings and specifications for some of the management techniques recommended in the plan.
- Appendix C summarizes the methods used in the 2001 vegetation inventory.

2 EXISTING CONDITIONS AND RECENT VEGETATION STUDIES

2.1 A Brief Natural History of Discovery Park

Discovery Park is in the Western Hemlock forest zone and the Puget Trough physiographic province of western Washington (Franklin & Dyrness 1973). The Puget Sound area is further recognized as a special type within the Western Hemlock zone. Within this special type, features not common elsewhere can be found, including stands of pine, Oregon white oak groves, prairies, bogs, and remnant populations of unusual species.

Indications of some of these features appear in Discovery Park, including small stands of pine alongside Douglas-fir, with moderately dense salal underneath. Certain portions of the park could potentially support oak groves as well. However, these two conditions are probably not natural anomalies; instead, they likely result from past logging, development, and landscaping.

Prior to nonindigenous settlement of the area, the West Point area was probably cedar-hemlock forest, with spruce in wetter areas and Douglas-fir in drier locations (Institute for Environmental Studies 1974). The park's current forest canopy is largely a result of logging to develop and expand the military base. As a result, conifer diversity and coverage is lower than the likely presettlement conditions. The shrub and herb communities that are commonly associated with cedar-hemlock forests are reduced in size and diversity in the park as well.

2.2 2001 Vegetation Inventory

In accordance with general survey goals and guidelines provided by the DOPR, Jones & Stokes established 169 vegetation inventory plots in Discovery Park. Plot locations were based on an earlier general vegetation community map prepared by the Seattle Urban Nature Project (SUNP). The SUNP map described general locations of plant communities, based on predominant vegetation type (hardwood, coniferous, or mixed forest; grassland; shrubland) and average tree size. The 2001 Jones & Stokes vegetation inventory provided additional details from specific plot locations within most of the SUNP communities. The majority of the plots were installed between February 14, 2001 and March 8, 2001. Additional revisits to certain plots and installation of replacement plots continued until April 22, 2001.

Each plot was circular and encompassed 0.1 acre. Within each plot, Jones & Stokes identified and evaluated individual trees, estimated shrub and herb coverage, and collected additional data on plot features. The data were analyzed to provide the basic community structure information that would be used for preparing management strategies and recommendations. Specifically, this information was used to address management issues, including

- removal of the most aggressive invasive species from the park;
- management of other invasive species, such as Himalayan blackberry;
- identification of the “most natural” components of the park, and management to support these features;
- development of a revegetation plan to enhance native conifer coverage in portions of the park; and
- identification of features and natural assets within the park that would best maintain the wide variety of active and passive recreational uses that the park currently supports.

A complete description of the methods used during inventory can be found in Appendix C, Survey Methods.

2.3 Results of Vegetation Inventory

2.3.1 Definitions

The discussion of results of the vegetation inventory includes several terms that require further definition. These terms below appear in the text and are also used in the tables summarizing community types.

- **Average Percent Cover** - This figure is the sum of the estimated aerial space that a species fills within each plot, divided by the number of plots. For analysis within community types, the cover estimates for each plot are added for a given species, and divided by N, the number of plots in that type. For example, in a community type where N=4, a species with cover estimates of 5, 15, 4 and 0% for the four plots has an average of $5+15+4+0=24/4=6\%$ average cover. For parkwide average cover estimates, the sum of cover estimates for a given species is divided by 169, the number of plots in the park.
- **Constancy** - This measurement is the percent of plots on which a given species has been found. For community type tables, constancy is based on the number of plots in that type (“N”). For example, if a species has a constancy of 66 for a given community type, and the number of plots in that type is 12, then the species has been found on $12 \times 0.66 = 8$ plots. For parkwide calculations, constancy is based on the total number of plots installed, 169. Therefore, a species with a constancy of 42 parkwide has been found on $169 \times 0.42 = 71$ plots.

- Community type – This indicator represents an aggregation of plots with similar species composition and abundance. Species composition and abundance is generally a product of soil, light, and moisture conditions on a plot. Seven community types are identified from the plot data. This analysis has been based on the type of canopy cover and on the soil moisture preferences of the dominant tree species and/or the dominant shrub species.

2.3.2 General results

2.3.2.1 Live Vegetation

A total of 134 plant species were counted in the 2001 Jones & Stokes vegetation inventory. The Latin name, common name, six-letter code, average cover, and constancy for each species are provided in Table 1. Plant Species Parkwide Average Percent Cover and Constancy.

Table 1. Plant Species Park-wide Average Percent Cover and Constancy

Species	Latin binomial	Common name	Avg. % cover where present	Avg. % cover Parkwide	Constancy Parkwide
ABIAMA	<i>Abies amabilis</i>	Pacific silver fir	20	0.1	<1
ABIGRA	<i>Abies grandis</i>	grand fir	15	1.4	9
ACECIR	<i>Acer circinatum</i>	vine maple	9	0.2	2
ACEMAC	<i>Acer macrophyllum</i>	bigleaf maple	39	25.3	65
ACEPLA	<i>Acer platanoides</i>	Norway maple	1	0	<1
ACEPSE	<i>Acer pseudoplatanus</i>	sycamore-leaf maple	10	0.1	<1
ACHMIL	<i>Achillea millifolium</i>	common yarrow	2	0	1
AGRALB	<i>Agrostis alba</i>	creeping bentgrass	46	12	27
AGRREP	<i>Agropyron repens</i>	quackgrass	24	2.6	11
ALNRUB	<i>Alnus rubra</i>	red alder	44	20.3	46
AMEALB	<i>Amelanchier alnifolia</i>	serviceberry	5	0	<1
ANAMAR	<i>Anaphalis margaritacea</i>	pearly everlasting	2	0	<1
ANTODO	<i>Anthoxanthum odoratum</i>	sweet vernal grass	10	0.1	<1
ARBMEN	<i>Arbutus menziesii</i>	madrona	16	1.4	8
ATHFIL	<i>Athyrium filix-femina</i>	lady fern	4	0.3	7
BERAQU	<i>Berberis aquifolium</i>	tall Oregon grape	1	0	4
BERNER	<i>Berberis nervosa</i>	low Oregon grape	10	2	20
BROMUS	<i>Bromus spp</i>	brome grass	2	0	<1
BROSIT	<i>Bromus sitchensis</i>	Alaska brome	14	0.6	4
CARDEW	<i>Carex deweyana</i>	Dewey's sedge	2	0.1	7
CAROCC	<i>Cardamine occidentalis</i>	Western bitter cress	1	0.1	6
CEDDEO	<i>Cedrus deodara</i>	Deodar cedar	25	0.1	<1
CIRARV	<i>Cirsium arvense</i>	creeping thistle	2	0.1	2

Species	Latin binomial	Common name	Avg. % cover where present	Avg. % cover Parkwide	Constancy Parkwide
CLASIB	<i>Claytonia sibirica</i>	candy flower	3	0.3	11
CLEVIT	<i>Clematis vitalba</i>	Virgin's bower	3	0	1
CORCOR	<i>Corylus cornuta</i>	Western beaked hazel	12	1.2	14
CORNUT	<i>Cornus nuttallii</i>	Pacific dogwood	19	0.3	2
CORSER	<i>Cornus sericea</i>	redstem dogwood	11	0.2	2
COT SPP	<i>Cotoneaster spp</i>	Cotoneaster	1	0	1
CRADOU	<i>Crataegus douglasii</i>	black hawthorn	4	0.7	17
CYTSCO	<i>Cytisus scoparius</i>	Scot's broom	14	3.4	27
DACGLO	<i>Dactylis glomerata</i>	orchard grass	5	0.6	12
DAPLAU	<i>Daphne laureola</i>	spurge laurel	0	0	2
DIGPUR	<i>Digitalis purpurea</i>	foxglove	1	0	2
ELYGLA	<i>Elymus glaucus</i>	blue wildrye	27	0.3	1
EPIANG	<i>Epilobium angustifolium</i>	fireweed	2	0	2
EPIWAT	<i>Epilobium watsonii</i>	Watson's willow-herb	1	0	<1
EQUARV	<i>Equisetum arvense</i>	field horsetail	4	0.1	3
EQUTEL	<i>Equisetum telmateia</i>	giant horsetail	9	0.6	6
FESARU	<i>Festuca arundinacea</i>	tall fescue	9	1.2	13
FESRUB	<i>Festuca rubra</i>	red fescue	15	0.4	2
GALIUM SPP	<i>Galium spp</i>	bedstraw	3	0.8	25
GAUSHA	<i>Gaultheria shallon</i>	salal	19	3.1	17
GERROB	<i>Geranium robertianum</i>	stink geranium	3	0.2	8
GEUMAC	<i>Geum macrophyllum</i>	big-leaved avens	1	0.1	5
GLYELA	<i>Glyceria elata</i>	common mannagrass	2	0	<1
GRASS		grass	15	2.6	18
HEDHEL	<i>Hedera helix</i>	English ivy	13	3.6	28
HOLDIS	<i>Holodiscus discolor</i>	ocean spray	12	1.8	16
HOLLAN	<i>Holcus lanatus</i>	velvet grass	0	0	<1
HYDTEN	<i>Hydrophyllum tenuipes</i>	slender waterleaf	22	0.5	2
HYPRAD	<i>Hypochaeris radicata</i>	hairy cat's ear	1	0	5
ILEAQU	<i>Ilex aquifolium</i>	English holly	6	2.4	39
IRIPSE	<i>Iris pseudacorus</i>	yellow iris	2	0	2
JUNEFF	<i>Juncus effusus</i>	soft rush	1	0	<1
JUNIPER SPP.	<i>Juniperus spp</i>	juniper	5	0	<1
LAMPUR	<i>Lamium purpureum</i>	red deadnettle	6	0.2	4
LATLAT	<i>Lathyrus latifolia</i>	everlasting pea	0	0	<1
LONCIL	<i>Lonicera ciliosa</i>	orange honeysuckle	2	0	2
LONHIS	<i>Lonicera hispidula</i>	hairy honeysuckle	2	0	3

Species	Latin binomial	Common name	Avg. % cover where present	Avg. % cover Parkwide	Constancy Parkwide
LUPRIV	<i>Lupinus rivularis</i>	stream lupine	1	0	1
LUZULA SPP	<i>Luzula spp</i>	woodrush	1	0	<1
LYSAME	<i>Lysichiton americanum</i>	skunk cabbage	12	0.3	2
MALFUS	<i>Malus fusca</i>	western crabapple	1	0	<1
MALUS SPP	<i>Malus x domestica</i>	escaped domestic apple	5	0.1	1
MOSS		moss	6	2.5	41
OEMCER	<i>Oemlaria cerasiformis</i>	Indian plum	15	7.4	51
OENSAR	<i>Oenanthe sarmentosa</i>	water parsley	10	0.4	4
OSMCHI	<i>Osmorhiza chilensis</i>	sweet cicely	1	0	<1
PHAARU	<i>Phalaris arundinacea</i>	reed canarygrass	8	0.5	7
PHYCAP	<i>Physocarpus capitatus</i>	Pacific ninebark	11	0.1	1
PINCON	<i>Pinus contorta</i>	shore pine	6	0.2	4
PINPON	<i>Pinus ponderosa</i>	Ponderosa pine	1	0	<1
PINUS SPP	<i>Pinus spp</i>	Pine (non-native)	30	0.2	<1
PLALAN	<i>Plantago lanceolata</i>	English plantain	1	0.1	12
PLAMAJ	<i>Plantago major</i>	common plantain	5	1	<1
POA SPP	<i>Poa spp</i>	bluegrass	25	1.2	5
POLCUS	<i>Polygonum cuspidatum</i>	Japanese knotweed	8	0.1	1
POLGLY	<i>Polypodium glycyrrhiza</i>	licorice fern	1	0	2
POLMUN	<i>Polystichum munitum</i>	sword fern	14	9.4	66
POPBAL	<i>Populus balsamifera ssp. trichocarpa</i>	black cottonwood	45	0.5	1
POPLOM	<i>Populus lombardii</i>	Lombardy poplar	2	0	<1
PRUEMA	<i>Prunus emarginata</i>	bitter cherry	19	3.2	17
PRULAU	<i>Prunus laurocerasus</i>	cherry laurel	4.4	0.8	17
PRULUS	<i>Prunus lusitanica</i>	Portuguese laurel	2	0.1	2
PSEMEN	<i>Pseudotsuga menziesii</i>	Douglas-fir	25	8	31
PTEAQU	<i>Pteridium aquilinum</i>	bracken fern	6	0.5	9
QUEGAR	<i>Quercus garryana</i>	Oregon oak	1	0	<1
RANREP	<i>Ranunculus repens</i>	creeping buttercup	12	0.4	3
RHAPUR	<i>Rhamnus purshiana</i>	cascara	2	0	<1
RIBBRA	<i>Ribes bracteosum</i>	stink currant	1	0	1
RIBLAC	<i>Ribes lacustre</i>	swamp gooseberry	3	0.1	2
RIBSAN	<i>Ribes sanguineum</i>	flowering currant	1	0	2
ROBPSE	<i>Robinia pseudoacacia</i>	black locust	33	0.4	1
ROSA SPP	<i>Rosa spp</i>	rose	5	0.1	2
ROSGYM	<i>Rosa gymnocarpa</i>	baldhip rose	2	0.1	5

Species	Latin binomial	Common name	Avg. % cover where present	Avg. % cover Parkwide	Constancy Parkwide
ROSPIS	<i>Rosa pisocarpa</i>	swamp rose	2	0	<1
RUBARM	<i>Rubus armeniacus</i>	Himalayan blackberry	15	7.8	50
RUBLAC	<i>Rubus laciniatus</i>	evergreen blackberry	25	0.1	<1
RUBLEU	<i>Rubus leucodermis</i>	blackcap raspberry	3	0.3	10
RUBPAR	<i>Rubus parviflorus</i>	thimbleberry	10	0.1	<1
RUBSPE	<i>Rubus spectabilis</i>	salmon berry	27	12.7	46
RUBURS	<i>Rubus ursinus</i>	Pacific blackberry	21	13.8	66
RUMACE	<i>Rumex acetosella</i>	sheep sorrel	0	0	1
RUMCRI	<i>Rumex crispus</i>	curly dock	1	0	<1
SALALB	<i>Salix alba</i>	white willow	20	0.1	<1
SALIX SPP	<i>Salix spp</i>	willow	20	0.2	1
SALLUC	<i>Salix lucida ssp. lasiandra</i>	Pacific willow	15	0.1	<1
SALSCO	<i>Salix scouleriana</i>	Scouler's willow	35	0.6	2
SAMRAC	<i>Sambucus racemosa</i>	red elderberry	7	2.3	33
SCIACU	<i>Scirpus acutus</i>	hard-stem bulrush	2	0	<1
SCILLA SP.	<i>Scilla spp.</i>	scilla	1	0	<1
SCIMIC	<i>Scirpus microcarpus</i>	small-fruited bulrush	60	0.4	<1
SMISTE	<i>Smilacina stellata</i>	starry Solomon's seal	1	0	<1
SORAUC	<i>Sorbus aucuparia</i>	Rowan tree, European mountain ash	6	0.2	3
SPIDOU	<i>Spiraea douglasii</i>	Douglas spirea	3	0	<1
STEMED	<i>Stellaria media</i>	chickweed	4	0.6	15
SYMALB	<i>Symphoricarpos albus</i>	common snowberry	3	0.2	7
TAROFF	<i>Taraxicum officinale</i>	common dandelion	1	0	4
TAXBRE	<i>Taxus brevifolia</i>	Pacific yew	8	0.1	1
TELGRA	<i>Tellima grandiflora</i>	fringe cup	4	0.7	16
THAOCC	<i>Thalictrum occidentale</i>	western meadow rue	1	0	<1
THUOCC	<i>Thuja occidentalis</i>	eastern arborvitae	8	0	<1
THUPLI	<i>Thuja plicata</i>	western redcedar	13	3.4	27
TOLMEN	<i>Tolmeia menziesii</i>	piggyback plant	9	1.1	12
TRIPRA	<i>Trifolium pratense</i>	red clover	1	0	2
TSUHET	<i>Tsuga heterophylla</i>	western hemlock	15	2.7	18
TYPLAT	<i>Typha latifolia</i>	common cattail	10	0.1	<1
URTDIO	<i>Urtica dioica</i>	stinging nettle	14	5.3	38
VACPAR	<i>Vaccinium parvifolium</i>	red huckleberry	2	0.2	9
VERAME	<i>Veronica americana</i>	American speedwell	1	0	1

Species	Latin binomial	Common name	Avg. % cover where present	Avg. % cover Parkwide	Constancy Parkwide
VIBRHY	<i>Viburnum rhytidophyllum</i>	leatherleaf viburnum	5	0	<1
VICAME	<i>Vicia americana</i>	American vetch	1	0.2	14
VIOORB	<i>Viola orbiculata</i>	round-leaf violet	0	0	<1

Of the 169 plots installed, 129 were in forested community types. The vegetation inventory tallied 3,003 individual trees in these 129 forested plots. Of these, numbers of individual trees for common native species appear in Table 2. Individual Numbers of Common Tree Species, below.

Table 2. Individual Numbers of Common Tree Species

Species	Number of Individuals
Bigleaf maple (<i>Acer macrophyllum</i>)	1,138
Red alder (<i>Alnus rubra</i>)	686
Bitter cherry (<i>Prunus emarginata</i>)	552
Douglas-fir (<i>Pseudotsuga menziesii</i>)	248
Western red cedar (<i>Thuja plicata</i>)	61
Western hemlock (<i>Tsuga heterophylla</i>)	41

Parkwide, the most prevalent tree species in Discovery Park is bigleaf maple (*Acer macrophyllum*), followed by red alder (*Alnus rubra*), bitter cherry (*Prunus emarginata*), and Douglas-fir (*Pseudotsuga menziesii*). Bigleaf maple is present on nearly two-thirds of the plots sampled and its coverage parkwide averaged 25.3%. Nearly 1,200 individual bigleaf maples, and over 700 alders, were tallied in the inventory.

The most prevalent native shrub species in the park is Pacific (or creeping) blackberry (*Rubus ursinus*), followed by Indian plum (*Oemleria cerasiformis*), and salmonberry (*Rubus spectabilis*). Pacific blackberry is present on two-thirds of the plots, and its coverage parkwide averaged 13.8%.

The most prevalent species in the herb/fern/moss stratum is sword fern (*Polystichum munitum*). Sword fern is found in two-thirds of the areas sampled, and its coverage parkwide averaged 9.4%. Mosses and stinging nettle (*Urtica dioica*) are also present on at least one-third of the plots.

2.3.2.2 Standing Dead Trees and Down Woody Material

The total count of standing dead trees (snags) was 240. These snags were counted on 73 plots. Among plots where any snags were present, the average number of snags per plot was 3.3. There are 129 forested plots in the park; therefore, the average number of snags per forested plot is 1.9 per plot. From this result, a parkwide estimate of about 19 snags per forested acre may be extrapolated.

Down woody debris (DWD) was tallied by three size classes. These categories included pieces over 3 inches in diameter, pieces 0.5 inch to 3 inches in diameter, and pieces smaller than 0.5 inch in diameter. To be included in the survey, large pieces (>3 inches in diameter) had to be over 3 feet long; pieces in the two smaller classes had to exceed 1 foot in length to be tallied.

In the largest size class, 782 pieces were counted in 116 of the 129 forested plots. The average number of large pieces per forested plot is 6. It is estimated, then, that there are 60 pieces of DWD larger than 3 inches in diameter per forested acre.

In the medium and small size classes, 3,838 and 10,264 pieces were tallied, respectively. Medium and small pieces of DWD were counted on nonforested as well as forested plots. Averages of 28.6 medium and 74.4 small pieces of DWD per plot were calculated.

2.3.2.3 Invasive Species

Invasive species presence at Discovery Park varies among species. Overall, the data support management recommendations to actively remove invasive species and manage for the establishment of native communities.

Nine of the 134 species identified were listed as invasive in the vegetation survey methods. An additional 40 non-native species were identified. Some of these, such as stinky geranium (*Geranium robertianum*) and yellow flag iris (*Iris pseudacorus*), can be aggressive invaders.

One of the more alarming figures to emerge from the data is the constancy of Himalayan blackberry (*Rubus armeniacus*). The species has a parkwide constancy of 50, meaning that it was found at some level in half of the 169 plots. While some areas of the park, such as the areas below the bluffs, were relatively free of invasive species, Himalayan blackberry was found in many of these plots. This invader is a persistent, pervasive species in the park and will likely continue to spread in the absence of aggressive management.

English holly, English ivy, and Scot's broom were the next most prevalent invasive species. Each of these was found in over one-quarter of the plots sampled and holly was present in 39% of the plots. Other invaders, such as reed canary grass and cherry laurel, were present in more manageable densities.

2.3.3 Additional Data Analysis and Previous Results

After data collection was complete, plots were grouped into community types reflecting similarities in the type and abundance of species present. These similarities typically follow moisture conditions on a given plot. Additional consideration is given to soil and light conditions. [Note: As used here, the term "community type" is similar to the term "plant association." However, plant associations are typically derived from and descriptive of potential climax communities in natural or minimally managed settings, and are frequently based on the regenerating species on a given plot. Since Discovery Park is more intensively managed, and since the objective of the vegetation inventory is to evaluate the communities currently present, the term "plant association" has not been used.]

A total of 21 separate community types were originally identified from the data collected at Discovery Park. These community types are described in the May 2001 Discovery Park Vegetation Inventory Summary Report. Community type designations in that report were based on the type of canopy dominance, the dominant tree species, and the dominant shrub species.

Distribution of plots into 21 types proved too cumbersome for development of broad management strategies from the outset of the vegetation management plan. Moreover, the distribution of the plot data into 21 types yielded insufficient grouping of similar communities and sample numbers that did not reliably reflect conditions within a community type.

Plot data has been analyzed further for the final edition of the plan, and the 21 original community types have been further grouped into seven community types. The revised community type designations are based on the

prevailing soil moisture indicator status of the species in a given community. The grouping of the species is discussed in more detail further below. Four of the seven community types are forested. The other three describe grasslands, shrublands, and unique types such as emergent wetlands. Regrouping of the original 21 community types is summarized in Table 3, Final VMP Community Type Designations.

Table 3. Final VMP Community Type Designations

Final VMP Community Type		Former Community Type (May 2001)	
Designation	Name	Designation	Name
A	Wet forested	H/33 M/33	Hardwood/ALNRUB/RUBSPE Mixed/ALNRUB/RUBSPE
B	Wet-mesic forested	C/43 H/23 M/23 M/51	Conifer/PSEMEN-TSUHET/mesic-wet Hardwood/ACEMAC/RUBSPE Mixed ACEMAC/RUBSPE Mixed/THUPLI/mesic
C	Mesic forested	H/22 H/24 H/32 M/22 M/24 M/44	Hardwood/ACEMAC/OEMCER Hardwood/ACEMAC/RUBURS Hardwood/ALNRUB/OEMCER Mixed/ACEMAC/OEMCER Mixed/ACEMAC/RUBURS Mixed/PSEMEN-ACEMAC/RUBURS
D	Dry-mesic forested	C/11 C/41 H/21 M/21 M/41	Coniferous/ABIGRA/dry-mesic Coniferous/PSEMEN-TSUHET/dry-mesic Hardwood/ACEMAC/HOLDIS-BERNER Mixed/ACEMAC/dry-mesic Mixed/PSEMEN-ACEMAC/dry-mesic
E	Shrublands	S/04 S/05	Shrublands/RUBARM-RUBURS Shrublands/CYTSCO
F	Grasslands	G/001	Grasslands
G	Wetlands	O/002	Other/wetlands

2.3.4 Final VMP Community Types

Community types used for characterizing Discovery Park are described below. Summary data on the community types is found in Tables 4 through 10 (following Section 2), and includes species lists, average percentage cover, constancy, and standing dead tree and down woody material density.

These community type designations define a gradient of plant communities corresponding to soil moisture regimes. As a result, there is overlap in the presence and dominance of some species from one type to another. Please note that, while there a “wet” community type is described, no corresponding “dry” category appears at the opposite end of the gradient. There are no true dry-site communities within Discovery Park.

Community Type A – wet communities (20 plots) – The best characterization of these communities is red alder/salmonberry. These two species are present in every Type A inventory plot and normally dominate within their respective strata. Alder accounted for 71% of the individual trees tallied within the 20 Type A plots, and averaged 75% cover. Salmonberry averaged 46% cover. No other shrub species exceeded an average 10% cover. The average cover and constancy of mosses were highest within this community type.

Community Type B – wet-mesic communities (25 plots) – These are communities dominated by bigleaf maple, but with a regular presence of red alder and salmonberry. Bigleaf maple accounted for 59% of the individual trees tallied in these plots. Alder and salmonberry average cover and constancy are lower than in Type A communities; however, these species still share dominance on individual plots. Conifer presence is higher than in wet communities; western red cedar is present in about one-third of the Type B plots, at 10% average cover. The mesic shrub Indian plum is found on one-half the Type B plots, in low (~5%) average cover. Drier-site species such as dwarf Oregon grape and ocean spray begin to appear more regularly, though in small amounts, in this community type. Moss coverage is lower than in wet community types, while sword fern coverage is higher.

Community Type C – mesic communities (56 plots) – This community type is the most prevalent and widespread in the park. Bigleaf maple is the dominant tree species and accounts for 43% of the individual trees tallied in Type C plots. However, the total canopy coverage in these plant communities has a higher number of tree species and more conifers overall than in the wetter community types. The dominant shrubs are Indian plum and trailing blackberry, though shrub diversity is higher than in any other community type. Sword fern is present in nearly all Type C vegetation communities. The mesic type includes communities dominated by bigleaf maple hardwood communities, mixed hardwood-conifer communities, and stands dominated by bitter cherry.

Community Type D – dry/mesic communities (28 plots) – These are vegetation communities dominated by tree and shrub species that tolerate relatively lower soil moisture regimes. Douglas-fir and bigleaf maple are the most common tree species in Type D plots. However, this community type has the highest diversity of tree species in the park. A total of 17 different species are found within the group of plots that describe the community type. Western red cedar and western hemlock are regularly present within this plant community. Grand fir and madrone also appear occasionally. The most prevalent native shrubs are trailing blackberry and salal.

Community Type E – shrublands (17 plots) - These are nonforested plant communities dominated by shrub species. Trees are occasionally present but are never dominant. In Discovery Park, these communities tend to be dominated by non-native invaders, especially Himalayan blackberry and Scot's broom. These two species are present together on all except one of the shrubland plots. Trailing blackberry, a native shrub, is found on 35% of the Type E plots, but its occurrence is notably lower than the invasive species. Creeping bentgrass is the dominant herb on these plots. Standing dead trees and down woody material are both significantly lower than on forested plots. Shrubland communities were most likely not present in Discovery Park prior to nonindigenous settlement of the area. Future management for this community type would be driven primarily by existing recreational uses or a desire to maintain open space.

Community Type F - Grasslands (19 plots) - Grassland communities are open, nonforested plant communities; however, they do not have the same average percent cover or constancy of shrub species that are found in the Type E communities. A mixture of non-native grasses, including creeping bentgrass, orchard grass, tall fescue, and quackgrass dominates this community type. Grassland communities were most likely not present in Discovery Park prior to nonindigenous settlement of the area. Future management for this community type would be driven primarily by existing recreational uses or a desire to maintain open space.

Community Type G - Wetlands (4 plots) - These plots were placed in four emergent wetland communities around the park. Wetland communities, as the name implies, are dominated by plant species that require high soil moisture, including saturated soils for prolonged periods during the growing season.

2.3.5 Indicator Status of Selected Species and Distribution within Community Types

The community types described in the preceding section were primarily derived from the indicator status of the most common native species in Discovery Park. The indicator status of a plant is based on the range of typical habitat conditions in which a species is found. Generally, the indicator status of a plant reflects the species preference for a wetter or drier soil regime and its tolerance for a broad range of conditions.

The designations of community types were determined by placing the most common species along a gradient of preferred moisture regimes. The initial determination of a given species' soil moisture indicator status was based on consultation with recognized manuals of Pacific Northwest flora. These include floras and manuals by Reed (1988), Hitchcock et al (1969), Pojar and McKinnon (1994) and Cooke (1997). Plots that were dominated by species with similar soil moisture preferences were then grouped.

After individual inventory plots had been organized into community types, the distribution of common park species within those types was analyzed for trends that might support the validity of the classification. Figure 2a, Average Percent Cover of Selected Tree Species, Figure 2b, Average Percent Cover of Selected Shrub Species, Figure 3a Constancy of Selected Tree Species and Figure 3b, Constancy of Selected Shrub Species, show the average percent cover and constancy of 14 common native tree and shrub species across the four forested community types. The species were chosen because they are all dominant or co-dominant in some part of the park and because they represent a reasonably full spectrum of soil moisture indicators.

Several trends can be seen in these graphs and in comparing the community type tables. First, the dominance of alder and salmonberry in the wet Type A communities is evident. Both species continue to be found in all four community types and across the moisture gradient. However, their average percent cover drops considerably as site conditions become drier.

At the other end of the spectrum, Douglas-fir, western beaked hazel, and ocean spray all show a tendency to appear in drier site conditions. Douglas-fir average cover and constancy rise steadily as conditions become drier. The two shrub species actually have higher coverage and constancy in the wet-mesic communities; they nevertheless show an overall preference for drier conditions

Third, the graphs highlight the preference of bigleaf maple for mid-level conditions. Bigleaf maple is most often present and dominant in the wet-mesic and mesic community types.

2.4 Existing Vegetation Communities at Discovery Park

2.4.1 General Trends in Vegetation Community Distribution

When the 169 inventory plots are color-coded by community type and mapped onto an aerial photograph of the park, trends in the distribution of community types emerge. Discovery Park is not monotypic in its soil moisture conditions, its topography, or its past disturbances. Community types also are not randomly distributed across the park. Rather, the four forested community types form distinct patterns of dominance. Recognition of these patterns is important in devising a management strategy for enhancing native plant communities, and in making specific recommendations within the various management zones.

Figure 4, Community Type Zone Map shows zones within the park that have been delineated by similarity of community type.

Vegetation community types in Discovery Park are generally distributed along moisture gradients that follow both the north-south and east-west axes of the park. The north end of the park tends to be dominated by wet and wet-mesic communities. To the south, vegetation community types increasingly tend to be relatively drier

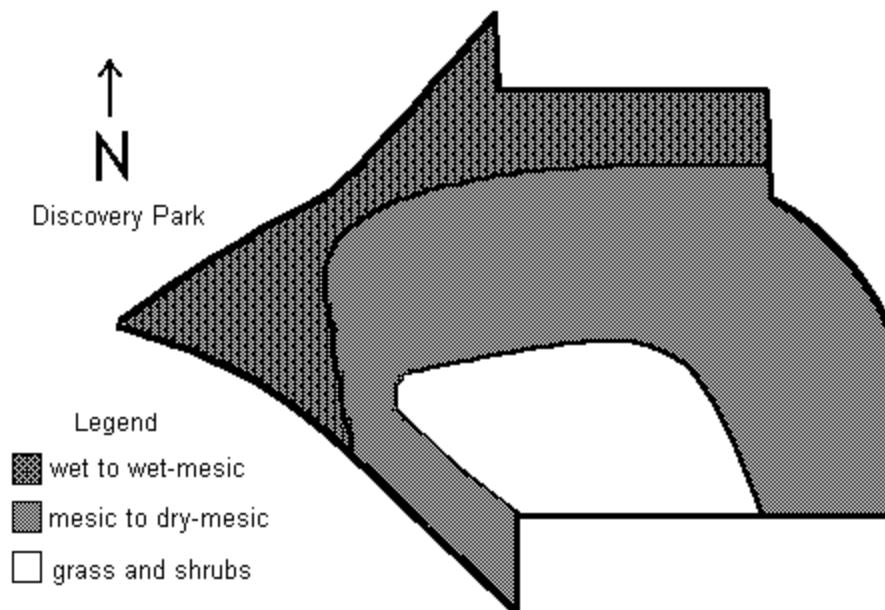
types. Similarly, the areas below the bluff on the west edge of the park tend to be dominated by wet-mesic plant communities. Moving inland (eastward), the dominant plant community types are increasingly drier.

This distribution is a broad tendency and is by no means absolutely regular. Topography and aspect changes allow for variance from the general trend throughout the park. For the purposes of devising a vegetation management strategy, the inventory data support the general trend that wet-dominated to dry/mesic-dominated plant communities follow north-to-south and west-to-east gradients.

The picture of Discovery Park that emerges from this trend is of two broad arcs of vegetation community types, one nested within the other, and both surrounding the park's open grass and shrub areas (see Figure 5 below). The first, a broad band of wet to wet-mesic plant communities, runs across the north end of the park toward Puget Sound, then turns south beneath the park bluffs. The plant community composition within this arc is predominantly hardwood forest, mainly red alder. Nested within this arc, mesic to dry-mesic coniferous and mixed hardwood-conifer communities form a second band of plant communities extending northward from the southeast corner of the park, then turning west toward the bluffs, and continuing beneath the south bluffs. Finally, situated within these two primary bands of vegetation communities are the park's grassland and shrubland communities.

Grassland and shrubland communities in Discovery Park are present as a result of a conscious management decision to maintain open areas for active and passive recreation and for vistas. When identifying community distribution trends along a moisture gradient, the shrubland and grassland communities do not reflect natural conditions and should not be considered as dry-site communities.

Figure 5. General Trends in Community Type Distribution at Discovery Park



Again, this perspective of the park's plant distribution is by no means absolute. Deviations from the trend can be found throughout the area studied. Nevertheless, the trend reported here supports the functional foundation of the vegetation management strategy, which is to identify and enhance plant community types throughout the

park. The observed trend also underlies the specific native community planting recommendations in the vegetation management plan.

2.4.2 Reconciliation with SUNP Mapping

The community type zone map developed by Jones & Stokes provides a broad, “snapshot” view of Discovery Park similar to that found on the SUNP map used as the basis of the inventory plot locations. As in the preparation of the community type zone map, the inventory plot locations (color-coded for community type) were superimposed on the original SUNP map. This approach was intended to determine if plot data analyses led to conclusions similar to the SUNP mapping.

Plot distribution and designation of community types generally supported the delineations of community polygons on the SUNP map. The SUNP map recognizes eight distinct cover types. It delineates 74 separate polygons in the park. Each polygon is given one of the eight cover type designations. Of these 74 polygons, 57 (77%) had only one Jones & Stokes community type designation within the polygon. An additional 12 of 74 (16%) had two different community types within a polygon. No SUNP map polygon had more than three community types within a polygon. This comparison suggests agreement between the SUNP mapping and the Jones & Stokes inventory on the uniformity of distinct plant communities surveyed.

This result is partly an artifact of the plot location process; in many of the SUNP polygons, DOPR requested that only one plot be installed. However, further analysis of the data supports agreement between SUNP conclusions and the vegetation inventory results.

For example, the SUNP map uses eight different cover types. SUNP coniferous cover type polygons show a correlation with dry-mesic community types. Of 10 Jones & Stokes plots located in four SUNP coniferous cover type polygons, 7 (70%) were community type D, dry-mesic, as mapped by Jones & Stokes. Two were mesic, and the remaining plot was wet-mesic. Mixed conifer-deciduous cover types mapped by SUNP also showed a tendency to contain the Jones & Stokes dry-mesic and mesic communities within them. Of the 28 Jones & Stokes plots, 18 (64%) installed in the SUNP mixed conifer-deciduous cover type were mesic or dry-mesic. Only one plot was in a Type A, wet community type. Finally, 18 of 20 Type A, wet community type plots were in the SUNP deciduous forested polygons.

Comparison of the SUNP map and the vegetation inventory underscores the tendency for deciduous stands to be dominated by wet to wet/mesic plant communities, and for coniferous and mixed hardwood-coniferous stands to be dominated by mesic to dry-mesic plant communities.

2.4.3 Discovery Park Compared to Typical Puget Trough Communities

Another picture of Discovery Park that emerges from the inventory plot data is the typical structure and diversity of plant communities within the park compared to other forested areas in the Puget Trough.

Discovery Park is located in the Western Hemlock zone of the Puget Lowlands (Franklin and Dyrness 1973, Kruckeberg 1991). Kruckeberg’s description of typical vegetation in this zone includes dominance by a mixture of conifers, with western hemlock as a climax species. Douglas-fir dominates drier sites, and western red cedar dominates wetter areas. Common understory shrubs are vine maple, salal, red huckleberry, Oregon grape, and Devil’s club. Common herb species are sword fern, deer fern, evergreen violet, foamflower, twinflower, western trillium, false lily-of-the-valley, and wild ginger.

The 2001 vegetation inventory found four of the five shrub species listed above, and two of the eight herb species. [Note: Estimation of herb coverage was low because of the timing of the vegetation inventory. As a result, analysis and discussion of herb coverage will be limited in this section. Recommendations for

enhancement of herb communities will follow later in this report.] Overall, shrub coverage and species diversity compares poorly with high-quality lowland forests in the Puget Sound area. Table 11, Average Cover and Constancy of Common Puget Lowlands Shrub Species in Discovery Park, lists native shrub species of the Western Hemlock zone that Kruckeberg rates as widespread in occurrence and common or frequent in abundance within the Puget Lowlands. The table also provides for each shrub species the Discovery Park average percent cover where present, and the constancy. These two numbers are roughly analogous to abundance and occurrence, respectively.

Table 11. Average Cover and Constancy of Common Puget Lowlands Shrub Species in Discovery Park

Species Name	Common Name	DP avg. % cover	DP constancy
<i>Acer circinatum</i>	Vine maple	9	2
<i>Amelanchier alnifolia</i>	Serviceberry	5	1
<i>Berberis nervosa</i>	Dwarf Oregon grape	10	20
<i>Cornus stolonifera</i>	Red-osier dogwood	11	2
<i>Corylus cornuta</i>	Western beaked hazel	12	14
<i>Gaultheria shallon</i>	Salal	19	17
<i>Holodiscus discolor</i>	Ocean spray	12	16
<i>Linnea borealis</i>	Twinflower	NF	NF
<i>Oemleria cerasiformis</i>	Indian plum	15	51
<i>Oplopanax horridum</i>	Devil's club	NF	NF
<i>Ribes sanguineum</i>	Red-flowering currant	1	2
<i>Rosa gymnocarpa</i>	Baldhip rose	2	5
<i>Rosa nutkana</i>	Nootka rose	NF	NF
<i>Rubus parviflorus</i>	Thimbleberry	10	1
<i>Rubus spectabilis</i>	Salmonberry	27	46
<i>Rubus ursinus</i>	Trailing blackberry	21	66
<i>Salix scouleriana</i>	Scouler's willow	35	2
<i>Sambucus racemosa</i>	Red elderberry	7	33
<i>Spiraea douglasii</i>	Douglas spirea	3	1
<i>Symphoricarpos albus</i>	Snowberry	3	7
<i>Vaccinium alaskense</i>	Alaska huckleberry	NF	NF
<i>Vaccinium ovatum</i>	Evergreen huckleberry	NF	NF
<i>Vaccinium parvifolium</i>	Red huckleberry	2	9

NF = Not Found during inventory

¹per Kruckeberg 1991

The table illustrates the lack of species diversity and abundance in shrub communities at Discovery Park. Thirteen of the twenty-three species listed were found on 5% or fewer (8) of the 169 inventory plots. Five of these were not located at all in Discovery Park. Only four species are present on more than one-third of the 169 plots. In nearly two-thirds of the park, shrub species that are regarded as widespread and common in Puget lowland forests are nearly or completely absent, reflecting a serious lack of diversity and abundance in Discovery Park native shrub communities.

Management recommendations to ameliorate this situation will be described later in this report and include providing park managers with a plant palette of native shrub and herb species to complement specific community types.

Community Type Tables

Table 4. Community Type A – Wet (N=20 plots)

Species Code	Common Name	Avg % cover	Constancy	Individuals tallied (trees only)
ABIGRA	Grand fir	0.1	5	2
ACEMAC	Bigleaf maple	6.9	55	104
ALNRUB	Red alder	75.0	100	317
CRADOU	Black hawthorn	0.2	5	1
PRUEMA	Bitter cherry	0.3	5	1
PSEMEN	Douglas-fir	0.9	10	5
THUPLI	Western red cedar	1.9	30	14
TSUHET	Western Hemlock	1.6	20	2
ACECIR	Vine maple	0.1	5	
BERNER	Dwarf Oregon grape	0.1	5	
CORCOR	Western beaked hazel	0.1	5	
HEDHEL	English ivy	8.4	50	
ILEAQU	English holly	4.4	70	
OEMCER	Indian plum	7.5	60	
PHYCAP	Pacific ninebark	0.1	5	
PRULAU	Cherry laurel	1.1	40	
RIBLAC	Swamp gooseberry	0.3	10	
RUBARM	Himalayan blackberry	6.5	70	
RUBSPE	Salmonberry	46.2	100	
RUBURS	Trailing blackberry	9.4	70	
SAMRAC	Red elderberry	3.6	50	
SPIDOU	Douglas spirea	0.2	5	
SYMALB	Snowberry	0.2	5	
ATHFIL	Lady fern	1.8	30	
CARDEW	Dewey's sedge	0.3	10	
EPIANG	Fireweed	0.1	10	
EQUARV	Field horsetail	0.3	10	
EQUTEL	Giant horsetail	1.0	19	
GALIUM SPP	Bedstraw	1.7	20	
GERROB	Stinky geranium	1.0	5	
GEUMAC	Bigleaf avens	0.1	10	
GLYELA	Common mannagrass	0.1	5	

Species Code	Common Name	Avg % cover	Constancy	Individuals tallied (trees only)
GRASS	grass	4.3	25	
HOLLAN	Velvet grass	0.0	5	
IRIPSE	Yellow flag iris	0.2	10	
JUNEFF	Soft rush	0.0	5	
LUZULA SPP	Woodrush	0.1	5	
LYSAME	Skunk cabbage	1.4	15	
MOSS	Moss	4.2	85	
OENSAR	Water parsley	1.5	20	
PHAARU	Reed canary grass	0.6	15	
POLMUN	Sword fern	8.6	90	
PTEAQU	Bracken fern	2.8	20	
RANREP	Creeping buttercup	0.4	10	
STEMED	Chickweed	0.3	5	
TELGRA	Fringe cup	2.5	15	
TOLMEN	Piggyback plant	3.6	30	
URTDIO	Stinging nettle	2.9	40	
VERAME		0.1	10	
	bare ground	18.6	90	
		avg. count	Constancy	
	standing dead trees	2.0	65	
	DWD >3"	5.6	95	
	DWD 0.5-3"	27.8	100	
	DWD < 0.5"	60.3	90	
	Mtn beaver		10	

Table 5. Community Type B - Wet-Mesic (N=25 plots)

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
ABIAMA	Pacific Silver fir	0.8	4	1
ABIGRA	Grand fir	0.2	12	7
ACEMAC	Bigleaf maple	45.2	96	166
ALNRUB	Red alder	20.4	68	65

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
CRADOU	Black hawthorn	0.1	4	1
PRUEMA	Bitter cherry	0.2	4	1
PSEMEN	Douglas-fir	2.2	16	5
SALLUC	Pacific willow			4
SORAUC	European mountain ash	0.4	12	3
THUPLI	Western red cedar	10.3	44	13
TSUHET	Western hemlock	6.9	32	16
BERNER	Dwarf Oregon grape	5.3	32	
CORCOR	Western beaked hazel	1.5	20	
CRADOU	Black hawthorn	0.1	8	
GAUSHA	Salal	0.1	8	
HEDHEL	English ivy	0.4	16	
HOLDIS	Ocean spray	1.5	36	
ILEAQU	English holly	1.9	36	
OEMCER	Indian plum	5.6	52	
PRULAU	Cherry laurel	0.5	12	
RIBBRA	Stink currant	0.1	12	
RIBLAC	Swamp gooseberry	0.0	4	
RIBSAN	Red-flowering currant	0.0	4	
ROSGYM	Baldhip rose	0.3	16	
RUBARM	Himalayan blackberry	4.6	52	
RUBLEU	Blackcap raspberry	0.4	20	
RUBPAR	Thimbleberry	0.4	4	
RUBSPE	Salmonberry	36.4	96	
RUBURS	Trailing blackberry	12.0	76	
SAMRAC	Red elderberry	1.6	56	
SYMALB	Snowberry	0.1	4	
VACPAR	Red huckleberry	0.4	24	
ATHFIL	Lady fern	0.1	12	
CARDEW	Dewey's sedge	0.1	8	
CLASIB	Candy flower	0.0	4	
EQUDEL	Giant horsetail	0.0	4	
GALIUM SPP	Bedstraw	0.7	36	
GERROB	Stinky geranium	0.3	12	

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
GEUMAC	Bigleaf avens	0.0	4	
GRASS	Grass	0.6	12	
HYDTEN	Slender waterleaf	2.2	12	
MOSS	Moss	2.7	60	
POLGLY	Licorice fern	0.1	8	
POLMUN	Sword fern	17.2	92	
PTEAQU	Bracken fern	0.1	4	
RANREP	Creeping buttercup	1.2	4	
STEMED	Chickweed	0.2	12	
TELGRA	Fringe cup	1.1	28	
TOLMEN	Piggyback plant	3.2	28	
URTDIO	Stinging nettle	11.4	80	
	bare ground	8.1	80	
		avg. count	Constancy	
	standing dead trees	1.5	60	
	DWD >3"	7.6	100	
	DWD 0.5-3"	24.9	100	
	DWD <0.5"	64.2	96	
	Mtn beaver		32	

Table 6. Community Type C – Mesic (N=56 plots)

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
ABIGRA	Grand fir	0.1	5	4
ACEMAC	Bigleaf maple	44.8	89	711
ALNRUB	Red alder	19.9	46	234
ARBMEN	Madrone	2.0	11	15
CEDDEO	Deodar cedar	0.4	2	2
CRADOU	Black hawthorn	1.0	16	26
POPBAL	Black cottonwood	1.1	2	31
PRUEMA	Bitter cherry	6.9	27	483
PSEMEN	Douglas-fir	6.8	29	72

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
ROBPSE	Black locust	1.2	4	32
SALIX SPP	Willow	0.5	2	4
TAXBRE	Pacific yew	0.3	4	5
THUPLI	Western red cedar	2.4	27	22
TSUHET	Western hemlock	1.7	11	11
ACECIR	Vine maple	0.4	2	
AMEALN	Serviceberry	0.1	2	
BERAQU	Tall Oregon grape	0.0	4	
BERNER	Dwarf Oregon grape	1.8	25	
CLEVIT	Virgin's bower	0.0	2	
CORCOR	Western beaked hazel	2.6	16	
CYTSCO	Scot's broom	3.3	30	
DAPLAU	Spurge laurel	0.0	5	
GALIUM SP	Bedstraw	0.0	2	
GAUSHA	Salal	0.5	16	
GRASS	Grass	0.0	2	
HEDHEL	English ivy	4.4	36	
HOLDIS	Ocean spray	1.6	16	
ILEAQU	English holly	2.9	41	
LONCIL	Orange honeysuckle	0.1	2	
LONHIS	Hairy honeysuckle	0.0	2	
OEMCER	Indian plum	15.0	80	
POLCUS	Japanese knotweed	0.3	4	
PRULAU	Cherry laurel	1.2	18	
RIBLAC	Swamp gooseberry	0.1	2	
RIBSAN	Red-flowering currant	0.0	4	
ROSA SPP	Rose	0.2	4	
ROSGYM	Baldhip rose	0.0	2	
RUBARM	Himalayan blackberry	10.9	48	
RUBLEU	Blackcap raspberry	0.3	7	
RUBSPE	Salmonberry	3.4	38	
RUBURS	Trailing blackberry	23.5	82	
SAMRAC	Red elderberry	4.0	34	
SYMALB	Snowberry	0.2	7	
VACPAR	Red huckleberry	0.1	5	

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
VIBRHY	Leatherleaf viburnum	0.1	2	
AGRALB	Creeping bentgrass	1.4	9	
AGRREP	Quack grass	0.8	5	
ANAMAR	Pearly everlasting	0.0	2	
ATHFIL	Lady fern	0.1	4	
BROMUS	Brome	0.0	2	
CARDEW	Dewey's sedge	0.0	4	
CAROCC	Western bitter cress	0.2	13	
CIRARV	Creeping thistle	0.0	2	
CLASIB	Candy flower	0.4	16	
DACGLO	Orchard grass	0.1	5	
ELYGLA	Blue wildrye	0.9	4	
EPIANG	Fireweed	0.0	2	
EQUARV	Field horsetail	0.2	4	
EQUTEL	Giant horsetail	1.0	4	
FESARU	Tall fescue	0.1	4	
GALIUM SPP	Bedstraw	1.2	36	
GERROB	Stinky geranium	0.1	11	
GEUMAC	Bigleaf avens	0.1	5	
GRASS	Grass	2.2	14	
HYDTEN	Slender waterleaf	0.5	2	
HYPRAD	Hairy cat's ear	0.0	2	
LUPRIV	Stream lupine	0.0	2	
MOSS	Moss	2.4	41	
OENSAR	Water parsley	0.0	2	
PHAARU	Reed canary grass	0.1	4	
PLALAN	English plantain	0.0	2	
POLGLY	Licorice fern	0.0	4	
POLMUN	Sword fern	11.9	86	
PTEAQU	Bracken fern	0.3	13	
RUBURS	Trailing blackberry	0.0	2	
SCILLA SP.	Scilla	0.0	2	
STEMED	Chickweed	0.5	11	
TAROFF	Dandelion	0.0	5	
TELGRA	Fringe cup	0.6	25	

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
THAOCC	Western meadow rue	0.0	2	
TOLMEN	Piggyback plant	0.6	7	
URTDIO	Stinging nettle	8.0	48	
VICAME	American speedwell	0.0	2	
VIOORB	Round-leaf violet	0.0	2	
	bare ground	10.6	82	
		avg. count	Constancy	
	standing dead trees	1.6	48	
	DWD >3"	6.0	91	
	DWD 0.5-3"	32.7	98	
	DWD <0.5"	56.2	98	
	Mtn. Beaver		25	

Table 7. Community Type D - Dry-Mesic (N=28 plots)

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
ABIGRA	Grand fir	7.9	29	10
ACEMAC	Bigleaf maple	18.0	75	157
ACEPSE	Sycamore-leaf maple	0.4	4	11
ALNRUB	Red alder	12.9	39	70
ARBMEN	Madrone	3.9	21	60
CORNUT	Pacific dogwood	2.0	11	20
CRADOU	Black hawthorn	0.4	11	5
PINCON	Lodgepole/shore pine	1.1	4	1
PINUS SPP	Pine	1.1	4	1
POPBAL	Black cottonwood	1.1	4	1
PRUEMA	Bitter cherry	5.2	32	67
PSEMEN	Douglas-fir	30.3	71	166

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
RHAPUR	Cascara	0.1	4	2
SALSCO	Scouler's willow	3.8	11	27
SORAUC	European mountain ash	0.7	7	5
THUPLI	Western red cedar	5.2	43	12
TSUHET	Western hemlock	5.8	43	12
				627
ACECIR	Vine maple	0.0	4	
BERAQU	Tall Oregon grape	0.0	7	
BERNER	Dwarf Oregon grape	3.4	36	
CLEVIT	Virgin's bower	0.1	4	
CORCOR	Western beaked hazel	2.6	25	
COT SPP	Cotoneaster	0.1	7	
DAPLAU	Spurge laurel	0.0	4	
GAUSHA	Salal	12.6	50	
HEDHEL	English ivy	6.6	43	
HOLDIS	Ocean spray	6.6	32	
ILEAQU	English holly	3.8	68	
LONCIL	Orange honeysuckle	0.1	7	
LONHIS	Hairy honeysuckle	0.3	14	
OEMCER	Indian plum	3.9	54	
PRULAU	Cherry laurel	0.8	25	
PRULUS	Portuguese laurel	0.3	14	
ROSGYM	Baldhip rose	0.1	11	
RUBARM	Himalayan blackberry	1.7	43	
RUBLAC	Evergreen blackberry	0.9	4	
RUBLEU	Blackcap raspberry	1.0	25	
RUBSPE	Salmonberry	3.9	39	
RUBURS	Trailing blackberry	13.7	79	
SAMRAC	Red elderberry	1.6	36	
SYMALB	Snowberry	0.5	18	
VACPAR	Red huckleberry	0.5	21	
ACHMIL	Common yarrow	0.0	4	
AGRALB	Creeping bentgrass	10.4	21	
AGRREP	Quack grass	1.1	11	
CAROCC	Western bitter cress	0.0	4	
CLASIB	Candy flower	1.0	25	

Species	Common Name	Avg. % cover	Constancy	Individuals tallied (trees only)
DACGLO	Orchard grass	1.1	21	
DIGPUR	Foxglove	0.0	4	
FESARU	Tall fescue	0.4	11	
FESRUB	Red fescue	0.7	4	
GALIUM SPP	bedstraw	1.6	32	
GERROB	Stinky geranium	0.1	11	
GRASS	Grass	4.9	25	
HEDHEL	English ivy	0.0	4	
LAMPUR	Red dead nettle	0.0	7	
MOSS	Moss	2.8	21	
OSMCHI	Sweet cicely	0.0	4	
PLALAN	English plantain	0.1	11	
POA SPP	Bluegrass	0.1	11	
POLMUN	Sword fern	11.5	71	
PTEAQU	Bracken fern	0.2	4	
SMISTE	Starry Solomon's seal	0.0	4	
STEMED	Chickweed	1.4	21	
TAROFF	Dandelion	0.1	7	
TELGRA	Fringe cup	0.1	7	
TOLMEN	Piggyback plant	0.0	7	
URTDIO	Stinging nettle	3.5	32	
VICAME	American speedwell	0.5	21	
	bare ground	9.0	75	
		avg. count	Constancy	
	standing dead trees	2.3	64	
	DWD >3"	4.7	75	
	DWD 0.5-3"	27.5	96	
	DWD <0'5"	52.3	100	
	Mtn. Beaver		21	

Table 8. Community Type E – Shrublands (N=17 plots)

Species	Common Name	Avg. % cover	Constancy
ABIGRA	Grand fir	0.1	6
ACEMAC	Bigleaf maple	0.1	12
ACEPLA	Sycamore-leaf maple	0.1	6
ALNRUB	Red alder	0.8	12
ARBMEN	Madrone	0.5	12
CRADOU	Black hawthorn	1.9	18
JUNIPER SPP.	Juniper	0.3	6
MALUS SPP	Escaped domestic apple	1.5	12
PINCON	Lodgepole/shore pine	0.1	6
POPLOM	Lombardy poplar	0.1	6
PRUEMA	Bitter cherry	0.1	6
PSEMEN	Douglas-fir	0.9	35
QUEGAR	Oregon white oak	0.1	6
SALIX SPP	Willow	0.6	6
THUOCC	Eastern arborvitae	0.5	6
THUPLI	Western red cedar	0.1	6
BERAQU	Tall Oregon grape	0.3	12
BERNER	Dwarf Oregon grape	0.1	12
CORCOR	Western beaked hazel	0.3	6
CORSER	Redstem dogwood	0.1	6
CRADOU	Black hawthorn	0.2	18
CYTSCO	Scot's broom	24.8	94
GAUSHA	Salal	8.5	18
ILEAQU	English holly	0.1	6
OEMCER	Indian plum	0.3	6
PHYCAP	Pacific ninebark	1.2	6
PRULAU	Cherry laurel	0.3	6
RIBSAN	Red-flowering currant	0.1	6
ROSPIS	Swamp rose	0.1	6
RUBARM	Himalayan blackberry	22.1	100
RUBURS	Trailing blackberry	12.1	35
SAMRAC	Red elderberry	0.5	12
AGRALB	Creeping bentgrass	35.0	88

Species	Common Name	Avg. % cover	Constancy
AGRREP	Quack grass	3.0	24
ANTODO	Sweet vernal grass	0.6	6
BROSIT	Sitka brome	0.1	6
CAROCC	Western bitter cress	0.1	6
CIRARV	Creeping thistle	0.4	6
DACGLO	Orchard grass	1.2	18
EPIANG	Fireweed	0.3	6
EQUARV	Field horsetail	0.2	6
FESARU	Tall fescue	4.5	47
FESRUB	Red fescue	2.4	18
GEUMAC	Bigleaf avens	0.0	6
GRASS	Grass	1.3	12
HYPRAD	Hairy cat's ear	0.2	12
LATLAT	Everlasting pea	0.0	6
LUPRIV	River lupine	0.1	6
MOSS	Moss	2.1	29
PHAARU	Reed canary grass	0.1	6
PLALAN	English plantain	0.4	41
POA SPP	Bluegrass	6.8	18
POLMUN	Sword fern	0.1	12
PTEAQU	Bracken fern	0.5	12
STEMED	Chickweed	0.1	12
TRIPRA	Red clover	0.1	6
VICAME	American speedwell	0.5	41
	bare ground	0.6	12
		avg. count	Constancy
	DWD >3"	0.1	12
	DWD 0.5-3"	1.0	18
	DWD <0.5"	5.0	47
	Mtn. Beaver		0

Table 9. Community Type F – Grasslands (N=19 plots)

Species	Common Name	Avg. % cover	Constancy
ACEMAC	Bigleaf maple	0.2	11
ALNRUB	Red alder	0.3	11
ARBMEN	Madrone	0.1	5
CRADOU	Black hawthorn	0.1	11
MALFUS	Western crabapple	0.1	5
PINCON	Lodgepole/shore pine	0.2	21
PINPON	Ponderosa pine	0.1	5
PSEMEN	Douglas-fir	0.3	26
CYTSCO	Scot's broom	0.6	32
ROSA SPP	Rose	0.2	5
RUBARM	Himalayan blackberry	0.1	11
RUBURS	Trailing blackberry	1.7	16
ACHMIL	Common yarrow	0.1	5
AGRALB	Creeping bentgrass	57.3	89
AGRREP	Quack grass	16.2	42
BROSIT	Sitka brome	5.2	32
CAROCC	Western bitter cress	0.1	11
CIRARV	Creeping thistle	0.0	5
DACGLO	Orchard grass	1.8	37
FESARU	Tall fescue	5.3	47
GALIUM SPP	Bedstraw	0.1	11
GRASS	Grass	2.9	16
HYPRAD	Hairy cat's ear	0.1	26
LAMPUR	Red dead nettle	1.8	21
MOSS	Moss	1.3	11
PHAARU	Reed canary grass	1.0	11
PLALAN	English plantain	0.7	47
PLAMAJ	Common plantain	0.3	5
POA SPP	Bluegrass	4.2	21
RUMACE	Sheep sorrel	0.0	5
STEMED	Chickweed	0.6	37
TAROFF	Dandelion	0.3	11
TRIPRA	Red clover	0.1	5
URTDIO	Stinging nettle	0.3	5

Species	Common Name	Avg. % cover	Constancy
VICAME	American speedwell	0.3	47
	bare ground	0.1	11
		avg. count	Constancy
	DWD >3"	0.1	5
	DWD 0.5-3"	0.0	0
	DWD <0.5"	3.1	21
	Mtn beaver		0

Table 10. Community Type G – Wetlands (N=4 plots)

Species	Common Name	Avg. % cover	Constancy
ALNRUB	Red alder	3.3	50
CORSER	Redstem dogwood	8.0	50
RUBARM	Himalayan blackberry	3.8	75
RUBSPE	Salmonberry	2.5	50
SALALB	White willow	5.0	25
AGRALB	Creeping bentgrass	5.8	75
ATHFIL	Lady fern	0.3	25
CIRARV	Creeping thistle	0.3	25
CYTSCO	Scot's broom	0.3	25
DACGLO	Orchard grass	2.5	25
EPIWAT	Watson's willow-herb	0.3	25
EQUDEL	Giant horsetail	0.5	50
GEUMAC	Bigleaf avens	0.5	25
GRASS	Grass	0.3	25
IRIPSE	Yellow flag iris	0.5	25
JUNEFF	Soft rush	0.3	25
LYSAME	Skunk cabbage	5.0	25
MOSS	Moss	0.8	25
OENSAR	Water parsley	7.5	25
PHAARU	Reed canary grass	12.5	75
RANREP	Creeping buttercup	6.3	50
RUMACE	Sheep sorrel	0.0	25
RUMCRI	Curly dock	0.3	25
SCIACU	Hard-stem bulrush	0.5	25
SCIMIC	Small-fruited bulrush	15.0	25
TOLMEN	Piggyback plant	0.3	25
TYPLAT	Common cattail	2.5	25
	bare ground	4.0	50
		avg. count	Constancy
	DWD >3"	1.0	25
	DWD 0.5-3"	6.0	75
	DWD <0.5"	30.0	75
	Mtn beaver		25

3 GENERAL MANAGEMENT ISSUES AND RECOMMENDATIONS

3.1 Native Plant Community Enhancement

3.1.1 Issues

Prior to white European settlement of the Seattle/Puget Sound region, the area on which Discovery Park is now located was dominated by a mixture of coniferous species including Western hemlock, Douglas-fir, Sitka spruce, western red cedar, and Grand fir (Institute for Environmental Studies 1974). Settlement of the area, including logging and development of Fort Lawton, has resulted in the clearing of much of the south end of the park. Another result has been the dominance of alder along the extreme northern and western edges of the park.

Existing plant community conditions are described in the preceding section. The conclusions reached in that section include the recognition of patterns of community types and a general lack of or reduction in native plant communities, relative to higher-quality lowland forests.

Supporting the growth and expansion of native plant communities is a guiding principle of this plan and of the 1972 Master Plan. This principle is especially important in areas where invasive plant species have taken hold and threaten to supplant native communities.

The notion of recognizing a matrix of species that form a native plant community should be fostered at Discovery Park. Park staff can use the information in the vegetation inventory and on the management zone maps to make an assessment of the type of plant community that is present in a given area. They can then consult a plant palette that corresponds to the identified local plant community types and choose species from the palette for additional planting.

The Discovery Park staff should also be encouraged to use small sections of the park for experimentation with different restoration techniques.

3.1.2 Recommendations

The management objectives for most of the south end of the park require maintaining clear, open vistas and do not allow for reforestation. However, in the north end of the park and in the areas along and beneath the bluff, underplanting with coniferous species is recommended. Specifically, in the areas below the bluff, western red cedar and Sitka spruce underplantings are recommended; in the areas above the bluffs, Douglas-fir and Western hemlock underplantings are recommended.

There are six areas within the park where dominance of invasive species has reached a point at which recovery and management of the affected area will require time- and labor-intensive management efforts. Detailed actions for these areas are described within the specific recommendations for the zones. However, the general pattern of recovery and restoration includes

- aggressive removal of invasive species, including contact application of herbicides as necessary;
- mulching the areas with 8 inches to 12 inches of wood chips; and
- planting with mixed alder, maple, and conifers. Specific ratios are weighted toward alder to stimulate natural amendment of the soils. Alder can be culled from these areas later (10 to 15 years). Spacing of the plantings should allow for maintenance mowers to pass, to repress re-emergence of invasive species.

In other areas, selections of plant species for restoration and replanting efforts should be based on plant palettes that correspond to the plant community types identified in the 2001 vegetation inventory. This approach will provide the Discovery Park managers the greatest degree of freedom in designing restorations while keeping them within the larger goal of maintaining the park's original character. Plant palettes corresponding to locally identified community types will also provide park staff and volunteer workers with an easily used tool for choosing appropriate species for native plant community enhancement.

The plant palettes for the four forested communities and a master plant palette are found in Tables 12 through 16 below. The plants selected for the palette are native species and have been selected for the specified plant community types based on their soil moisture indicator status. Plant palettes for shrublands, grasslands, and wetlands have not been provided because in many areas of the park, shrublands are dominated by invasive species. These areas should undergo aggressive removal of invasives, and native tree and shrub species chosen from the appropriate forested community type palette should replace the invaders.

Table 12. Plant Palette - Community Type A - Wet

Scientific Name	Common Name
Trees	
<i>Fraxinus latifolia</i>	Oregon ash
<i>Picea sitchensis</i>	Sitka spruce
<i>Populus trichocarpa</i>	Black cottonwood
<i>Thuja plicata</i>	Western red cedar
Shrubs	
<i>Cornus stolonifera</i>	Red-osier dogwood
<i>Lonicera involucrata</i>	Black twinberry
<i>Malus fusca</i>	Pacific crabapple
<i>Oplopanax horridus</i>	Devil's club
<i>Physocarpus capitatus</i>	Pacific ninebark
<i>Ribes bracteosum</i>	Stink currant
<i>Ribes lacustre</i>	Swamp gooseberry
<i>Salix lucida var. lasiandra</i>	Pacific willow
Herbs	
<i>Boykinia elata</i>	Slender boykinia
<i>Corydalis scoulerii</i>	Scouler's corydalis
<i>Lysichiton americanum</i>	Skunk cabbage
<i>Petasites frigidus var. palmatus</i>	Sweet coltsfoot
Ferns	
<i>Athyrium filix-femina</i>	Lady fern

Table 13. Plant Palette - Community Type B - Wet-Mesic

Scientific Name	Common Name
Trees	
<i>Fraxinus latifolia</i>	Oregon ash
<i>Picea sitchensis</i>	Sitka spruce
<i>Populus trichocarpa</i>	Black cottonwood
<i>Rhamnus purshiana</i>	Cascara
<i>Taxus brevifolia</i>	Pacific yew
<i>Thuja plicata</i>	Western red cedar
<i>Tsuga heterophylla</i>	Western hemlock
Shrubs	
<i>Acer circinatum</i>	Vine maple
<i>Cornus stolonifera</i>	Red-osier dogwood
<i>Crataegus douglasii</i>	Pacific crabapple
<i>Linnaea borealis</i>	Twinflower
<i>Lonicera involucrata</i>	Black twinberry
<i>Malus fusca</i>	Pacific crabapple
<i>Menziesia ferruginea</i>	Fool's huckleberry
<i>Oplopanax horridus</i>	Devil's club
<i>Philadelphus lewisii</i>	Mock-orange
<i>Physocarpus capitatus</i>	Pacific ninebark
<i>Ribes bracteosum</i>	Stink currant
<i>Ribes lacustre</i>	Swamp gooseberry
<i>Ribes sanguineum</i>	Red-flowering currant
<i>Rosa nutkana</i>	Nootka rose
<i>Rubus parviflorus</i>	Thimbleberry
<i>Rubus pedatus</i>	Five-leaf bramble
<i>Salix lucida var. lasiandra</i>	Pacific willow
<i>Salix sitchensis</i>	Sitka willow
<i>Sambucus racemosa</i>	Red elderberry
<i>Vaccinium ovalifolium</i>	Oval-leaf huckleberry
Herbs	
<i>Aquilegia formosa</i>	Columbine
<i>Aruncus dioicus</i>	Goat's beard
<i>Asarum caudatum</i>	Wild ginger
<i>Boykinia elata</i>	Slender boykinia
<i>Corydalis scoulerii</i>	Scouler's corydalis

Scientific Name	Common Name
<i>Dicentra formosa</i>	Bleeding hearts
<i>Disporum hookeri</i>	Hooker's fairy bells
<i>Maianthemum dilatatum</i>	False lily-of-the-valley
<i>Petasites frigidus</i> var. <i>palmatus</i>	Sweet coltsfoot
<i>Smilacina stellata</i>	Starry Solomon's seal
<i>Vancouveria hexandra</i>	Inside-out flower
Ferns	
<i>Adiantum pedatum</i>	Maidenhair fern
<i>Athyrium filix-femina</i>	Lady fern
<i>Blechnum spicant</i>	Deer fern
<i>Gymnocarpium dryopteris</i>	Oak fern

Table 14. Plant Palette - Community Type C - Mesic

Scientific Name	Common Name
Trees	
<i>Abies grandis</i>	Grand fir
<i>Cornus nuttallii</i>	Pacific dogwood
<i>Pseudotsuga menziesii</i>	Douglas-fir
<i>Rhamnus purshiana</i>	Cascara
<i>Taxus brevifolia</i>	Pacific yew
<i>Thuja plicata</i>	Western red cedar
<i>Tsuga heterophylla</i>	Western hemlock
Shrubs	
<i>Acer circinatum</i>	Vine maple
<i>Berberis nervosa</i>	Dwarf Oregon grape
<i>Chimaphila umbellata</i>	Prince's pine
<i>Corylus cornuta</i> var. <i>californica</i>	Western beaked hazel
<i>Crataegus douglasii</i>	Pacific crabapple
<i>Gaultheria shallon</i>	Salal
<i>Holodiscus discolor</i>	Oceanspray
<i>Linnaea borealis</i>	Twinflower
<i>Lonicera ciliosa</i>	Trumpet honeysuckle
<i>Menziesia ferruginea</i>	Fool's huckleberry
<i>Philadelphus lewisii</i>	Mock-orange
<i>Ribes sanguineum</i>	Red-flowering currant

Scientific Name	Common Name
<i>Rosa gymnocarpa</i>	Baldhip rose
<i>Rubus parviflorus</i>	Thimbleberry
<i>Sambucus racemosa</i>	Red elderberry
<i>Symphoricarpus albus</i>	Snowberry
<i>Vaccinium membranaceum</i>	Thinleaf (Big) huckleberry
<i>Vaccinium ovalifolium</i>	Oval-leaf huckleberry
<i>Vaccinium ovatum</i>	Evergreen huckleberry
<i>Vaccinium parvifolium</i>	Red huckleberry
Herbs	
<i>Achlys triphylla</i>	Vanilla leaf
<i>Aquilegia formosa</i>	Columbine
<i>Aruncus dioicus</i>	Goat's beard
<i>Asarum caudatum</i>	Wild ginger
<i>Clintonia uniflora</i>	Queen's cup bead lily
<i>Cornus canadensis</i>	Bunchberry dogwood
<i>Dicentra formosa</i>	Bleeding hearts
<i>Disporum hookeri</i>	Hooker's fairy bells
<i>Osmorhiza chilensis</i>	Sweet cicely
<i>Smilacina racemosa</i>	False Solomon's seal
<i>Smilacina stellata</i>	Starry Solomon's seal
<i>Trientalis latifolia</i>	Western starflower
<i>Vancouveria hexandra</i>	Inside-out flower
Ferns	
<i>Blechnum spicant</i>	Deer fern
<i>Gymnocarpium dryopteris</i>	Oak fern
<i>Polystichum munitum</i>	Sword fern

Table 15. Plant Palette - Community Type D - Dry-Mesic

Scientific Name	Common Name
Trees	
<i>Abies grandis</i>	Grand fir
<i>Arbutus menziesii</i>	Madrone
<i>Cornus nuttallii</i>	Pacific dogwood
<i>Pinus contorta</i>	Shore pine
<i>Pseudotsuga menziesii</i>	Douglas-fir

Scientific Name	Common Name
Shrubs	
<i>Amelanchier alnifolia</i>	Saskatoon
<i>Arctostaphylos uva-ursi</i>	Bearberry
<i>Berberis aquifolium</i>	Tall Oregon grape
<i>Berberis nervosa</i>	Dwarf Oregon grape
<i>Chimaphila umbellata</i>	Prince's pine
<i>Corylus cornuta var californica</i>	Western beaked hazel
<i>Gaultheria shallon</i>	Salal
<i>Holodiscus discolor</i>	Oceanspray
<i>Lonicera ciliosa</i>	Trumpet honeysuckle
<i>Pachistima myrsinites</i>	Oregon boxwood
<i>Rosa gymnocarpa</i>	Baldhip rose
<i>Symphoricarpus albus</i>	Snowberry
<i>Vaccinium parvifolium</i>	Red huckleberry
Herbs	
<i>Trientalis latifolia</i>	Western starflower
Ferns	
<i>Polystichum munitum</i>	Sword fern

Table 16. Master Plant Palette - Discovery Park VMP - Forested Communities

Plant Species		Community Type			
Scientific Name	Common Name	A	B	C	D
Trees					
<i>Abies grandis</i>	Grand fir			x	x
<i>Arbutus menziesii</i>	Madrone				x
<i>Cornus nuttallii</i>	Pacific dogwood			x	x
<i>Fraxinus latifolia</i>	Oregon ash	x	x		
<i>Picea sitchensis</i>	Sitka spruce	x	x		
<i>Pinus contorta</i>	Shore pine				x
<i>Populus trichocarpa</i>	Black cottonwood	x	x		
<i>Pseudotsuga menziesii</i>	Douglas-fir			x	x
<i>Rhamnus purshiana</i>	Cascara		x	x	
<i>Taxus brevifolia</i>	Pacific yew		x	x	
<i>Thuja plicata</i>	Western red cedar	x	x	x	
<i>Tsuga heterophylla</i>	Western hemlock		x	x	

Plant Species		Community Type			
Scientific Name	Common Name	A	B	C	D
Shrubs					
<i>Acer circinatum</i>	Vine maple		x	x	
<i>Amelanchier alnifolia</i>	Saskatoon				x
<i>Arctostaphylos uva-ursi</i>	Bearberry				x
<i>Berberis aquifolium</i>	Tall Oregon grape				x
<i>Berberis nervosa</i>	Dwarf Oregon grape			x	x
<i>Chimaphila umbellata</i>	Prince's pine			x	x
<i>Cornus stolonifera</i>	Red-osier dogwood	x	x		
<i>Corylus cornuta var californica</i>	Western beaked hazel			x	x
<i>Crataegus douglasii</i>	Pacific crabapple		x	x	
<i>Gaultheria shallon</i>	Salal			x	x
<i>Holodiscus discolor</i>	Oceanspray			x	x
<i>Linnaea borealis</i>	Twinflower		x	x	
<i>Lonicera ciliosa</i>	Trumpet honeysuckle			x	x
<i>Lonicera involucrata</i>	Black twinberry	x	x		
<i>Malus fusca</i>	Pacific crabapple	x	x		
<i>Menziesia ferruginea</i>	Fool's huckleberry		x	x	
<i>Oplopanax horridus</i>	Devil's club	x	x		
<i>Pachistima myrsinites</i>	Oregon boxwood				x
<i>Philadelphus lewisii</i>	Mock-orange		x	x	
<i>Physocarpus capitatus</i>	Pacific ninebark	x	x		
<i>Ribes bracteosum</i>	Stink currant	x	x		
<i>Ribes lacustre</i>	Swamp gooseberry	x	x		
<i>Ribes sanguineum</i>	Red-flowering currant		x	x	
<i>Rosa gymnocarpa</i>	Baldhip rose			x	x
<i>Rosa nutkana</i>	Nootka rose		x		
<i>Rubus parviflorus</i>	Thimbleberry		x	x	
<i>Rubus pedatus</i>	Five-leaf bramble		x		
<i>Salix sitchensis</i>	Sitka willow	x	x		
<i>Sambucus racemosa</i>	Red elderberry		x	x	
<i>Symphoricarpos albus</i>	Snowberry			x	x
<i>Vaccinium membranaceum</i>	Thinleaf (Big) huckleberry			x	
<i>Vaccinium ovalifolium</i>	Oval-leaf huckleberry		x	x	
<i>Vaccinium ovatum</i>	Evergreen huckleberry			x	

Plant Species		Community Type			
Scientific Name	Common Name	A	B	C	D
<i>Vaccinium parvifolium</i>	Red huckleberry			x	x
Herbs					
<i>Achlys triphylla</i>	Vanilla leaf			x	
<i>Aquilegia formosa</i>	Columbine		x	x	
<i>Aruncus dioicus</i>	Goat's beard		x	x	
<i>Asarum caudatum</i>	Wild ginger		x	x	
<i>Boykinia elata</i>	Slender boykinia	x	x		
<i>Clintonia uniflora</i>	Queen's cup bead lily			x	
<i>Cornus canadensis</i>	Bunchberry dogwood			x	
<i>Corydalis scoulerii</i>	Scouler's corydalis	x	x		
<i>Dicentra formosa</i>	Bleeding hearts		x	x	
<i>Disporum hookeri</i>	Hooker's fairy bells		x	x	
<i>Lysichiton americanum</i>	Skunk cabbage	x			
<i>Maianthemum dilatatum</i>	False lily-of-the-valley	x	x		
<i>Osmorhiza chilensis</i>	Sweet cicely			x	
<i>Petasites frigidus var. palmatus</i>	Sweet coltsfoot		x		
<i>Smilacina racemosa</i>	False Solomon's seal			x	
<i>Smilacina stellata</i>	Starry Solomon's seal		x	x	
<i>Trientalis latifolia</i>	Western starflower			x	x
<i>Vancouveria hexandra</i>	Inside-out flower		x	x	
Ferns					
<i>Adiantum pedatum</i>	Maidenhair fern		x		
<i>Athyrium filix-femina</i>	Lady fern	x	x		
<i>Blechnum spicant</i>	Deer fern		x	x	
<i>Gymnocarpium dryopteris</i>	Oak fern		x	x	
<i>Polystichum munitum</i>	Sword fern			x	x

Community Types: A – wet B – wet-mesic C – mesic D – dry-mesic

Native plant communities can be further enhanced on a smaller scale in several areas of the park by establishing islands of “legacy trees” with associated shrub and herb plantings. Legacy trees are those large, old individuals that are the focal point of their own small associated communities. They are landmarks and references for park visitors over generations. Discovery Park already has a number of such trees, including a number of magnificent bigleaf maples scattered throughout the park.

An effort should be made to start the next generation of legacy trees. The ideal locations for these tree plantings are in some of the open, grassy triangles of land where paths and/or roads come together. Species selected for planting could vary, but should include additional bigleaf maples, grand fir or Oregon white oak.

Plant palettes for forested communities should be used for selection of shrub and herb species in the legacy tree areas.

In general, encouraging the establishment of several test plots will assist restoration and reforestation efforts. Test plots will be small areas for comparative study of different treatments for reclaiming and reforesting disturbed sites. Sites will be adjacent to each other (or nearly so), and will be monitored for a period of at least 5 years to determine effectiveness.

3.2 Interior Road Removal

3.2.1 Issues

Discovery Park has a number of asphalt roads remaining from the park's use by the military. Only three of these roads are open to automobile traffic; the remainders are closed to motorized vehicles except for use by park staff.

The roads add to the fragmentation of the park and their presence inhibits management of the park toward the goal of reforestation and restoration of presettlement character. The roads also support edge communities that tend to be dominated by nonnative invasive plant species. Removal of some of the roads would increase the area of contiguous forest and would therefore increase the amount of forest interior. The natural character of the park would also be enhanced by the removal of some of the roads.

While there is a clear ecological rationale for removing the roads within the park, there are also social and economic arguments for retaining the roads. Removal of the roads would limit use of the park by bicyclists, people pushing baby strollers, visitors in wheelchairs, and visitors who prefer not to use the park's soft trails because of health or age concerns. The expense of removing and properly disposing of the road materials may also be prohibitive. Nevertheless, the ecological benefit to be realized from removing interior roads exceeds the potential social and economic disadvantages that could result from road removal. Rehabilitation of the roadbeds proposed for removal would make the North Forest whole and complete for the first time in over 100 years. This in itself provides an inarguable social benefit to the park and to the city.

3.2.2 Recommendations

The vegetation management plan recommends that certain roads be removed from the park. The Discovery Park maintenance staff must retain some roads for use in working around the park. Road removal is not likely to occur until later in the implementation of the plan. Moreover, this recommendation may not be fully implemented because of Seattle Department of Parks and Recreation park maintenance obligations. Also, certain roads, including Kansas and Idaho Avenues, are water and/or sewer line corridors. Removal of these roads would require development of a maintenance access plan for those utilities. Roads recommended for removal are shown on Figure 6, Recommended Road Removals.

Full recovery of old roadbeds will be a long-term process. Establishment of the basic components of native forested communities may take as much as 20 years before additional enhancement efforts are initiated. In most cases, the process for road removal and recovery will follow the general procedures described below.

1. Pavement will be broken up and removed using a front-end loader or other suitable heavy equipment. Maintenance staff will arrange for the proper disposal of old pavement.
2. The former pavement base will be decompacted using a bulldozer dragging a heavy plow or other suitable equipment for breaking up the top 12 inches to 18 inches of roadbed.

3. The decompacted roadbed will be covered with 12 inches to 15 inches of wood chip mulch.
4. The area will be seeded with red alder.

Park maintenance staff will monitor the growth of the alder and select suitable periods for thinning and/or underplanting of shrub and conifer species.

3.3 Social Trails and Stairways

3.3.1 Issues

Social trails are unofficial paths within Discovery Park that are not part of the park's design and are not maintained by park staff. Most social trails are shortcuts to popular points within the park or routes used by transients to traverse the park.

Social trails fragment plant communities, increase edge communities within the park, and provide an avenue for infiltration by nonnative species. These trails also provide greater access for garbage and domestic animal feces to the larger plant communities found in the interior portions of the park, as well as increasing human disturbance of wildlife.

Since the presentation of the draft vegetation management plan, the Friends of Discovery Park have undertaken the development of a trails plan for the park. This plan will address the issue of maintained trails, social trails, and methods for closing social trails.

Discovery Park also has a number of old stairways dating from the park's former use as a military base. The stairways are cast concrete, and in many cases are inaccessible or no longer usable. At least eight of these stairways contribute to the fragmentation or disturbance of native plant communities in the park. These structures are marked on Figure 7, Recommended Stairway Removal

3.3.2 Recommendations

An evaluation of the existing trails in Discovery Park will be completed in early 2002 under a separate project funded by a City Department of Neighborhoods grant obtained by Friends of Discovery Park.. The plan will make recommendations for maintaining a trail system within the park and for removing social trails. Implementation of the vegetation management plan should incorporate the recommendations of the trails plan, with the following provisions.

- Trail design should minimize fragmentation of Discovery Park. Fundamental goals of the vegetation management plan include restoring continuity in the forested areas of the park, and increasing the area of unbroken forest stands. The final trail plan should not provide access to all parts of the park, especially those remote areas that may act as refugia for wildlife that are less tolerant of human presence.
- Social trails should be closed based on an evaluation of their redundancy. That is, where social trails parallel official park trails or reach similar destinations within a reasonable walking distance, e.g., 250 feet, they should be closed. Also, where two or more social trails parallel each other or reach similar destinations within a reasonable walking distance, at least one of the trails should be closed.

The trail plan will make recommendations for social trail closures. Again, the implementation of the vegetation management plan should incorporate the recommendations of the trail plan. However, the closure and reclamation of social trails should be based on native plant community enhancement. This practice

includes aggressive removal of non-native species and replanting with species selected from the plant palette(s) corresponding to local community types.

3.4 Wildlife Habitat Enhancement

3.4.1 Issues

Coincident with the desire to maintain or restore the health of plant communities within Discovery Park is the need to enhance habitat for the wildlife that utilizes those communities. The 1972 Master Plan states, “The forests will be managed for a wildlife habitat as well as for recreational walking and nature interpretation. Native wildlife will be protected to the extent possible and enhanced or supplemented.” A Discovery Park Wildlife Plan was prepared for DOPR in 1983 by Robert Mindick. The author described populations of known wildlife species within the park, made recommendations for managing the park to achieve improved wildlife habitat.

3.4.2 Recommendations

The implications of a given management action on the park’s wildlife should be routinely considered during the planning and implementation of management actions in Discovery Park. The methods and timing of management actions should be evaluated to ensure that negative impacts to wildlife habitat and populations are minimized.

Each of the 21 management zones should be evaluated for opportunities to create wildlife habitat structures in existing snags and logs. Rootwads and logs could also be brought in or redistributed within park. Appendix B contains conceptual drawings for creating wildlife habitat features in snags and logs. General recommendations for wildlife habitat enhancement include the following.

- Create habitat trees in snags. Snags should be cut to a height where they pose no hazard of falling. The tops should then be cut with chainsaws or other tools to simulate a shattering break, rather than a clean cut. Hollows and other cavities can also be made in snags.
- Improve the diversity and abundance of food sources within the park by enhancing native plant communities, specifically shrub species. Many of the most common shrub species in the Puget lowlands are not present in Discovery Park, or are present in extremely low coverage. Since most of the region’s native wildlife species rely upon these food sources, it stands to reason that Discovery Park cannot and will not provide suitable wildlife habitat without improved abundance and diversity of native plant species.
- Create habitat spaces in down logs. Cavities can be cut into large down trees and logs to provide shelter for wildlife.
- Retain brush and woody debris in the understory of forested zones. Piles of branches and small logs provide cover and den and nesting material for local wildlife.
- Protect planted trees in areas of heavy mountain beaver use. Consult the vegetation inventory for areas with high mountain beaver use. Young tree protection kits may be needed in certain areas. In areas of extreme mountain beaver presence, it may be necessary to plant larger trees in excavated holes lined with chicken wire that extends above the surface to connect to a cage or other wiring to protect the lower portion of the tree.

If, over the long term, management recommendations that reduce fragmentation of the park are implemented, then wildlife diversity and density can be expected to rise. Recommendations that reduce fragmentation include road removal, social trail closures, and enhancement of native plant communities.

3.5 Herbicide Use

3.5.1 Issues

While Discovery Park is not a designated herbicide free area, the use of herbicides is currently limited in the park. The public has supported this position because of the varied uses of the park, including picnics and berry picking, and because of public and environmental health concerns over herbicides. Birds and small mammals have lower body masses than humans, and as a result have lower tolerances of and safe exposures to herbicides. Potential impacts of herbicides on butterfly, moth, and other insect species have also driven public concern over herbicide use in the park.

In many areas throughout the park non-native invasive plant species are threatening the natural plant communities that once dominated the park. Volunteer efforts to remove invasive species have been moderately successful and should be continued. Nevertheless, in certain areas of the park, and in the control of certain species, the limited, judicious use of herbicides is necessary to slow and eventually reverse the spread of non-native invasive species.

3.5.2 Recommendations

The park should continue the practice of removing undesirable species using mechanical means first and resorting to herbicides only in situations where hand and mechanical methods are deemed ineffective. However, for certain sizes and species of invasive plants, herbicide use may be warranted. This category includes upright woody invasive species such as holly, Lombardy poplar, cherry laurel, Portuguese laurel, and locust. These species often produce sucker shoots rather than dying when standing plants are merely cut or girdled. Areas of dense woody shrubs such as Scot's broom may also be candidates for herbicide use.

The park's maintenance staff should also try using less potentially toxic, more natural alternatives to herbicide use. Examples include citric and acetic acid solutions (e.g., Brush Block) for blackberry control. The maintenance staff should apply these products in areas where effectiveness can be monitored. If these solutions effectively inhibit invasive species growth, then herbicide use may not be warranted for that species in certain densities.

In the event that herbicides are deemed to be the only effective treatment, the herbicides to be used should be glyphosate (N-phosphonomethyl-glycine) products such as Roundup, Rodeo, or Accord. Other types of herbicides may also be used at the discretion of DOPR and Discovery Park. Herbicides should not be broadcast sprayed, but applied by direct contact to a cut surface. This practice will minimize applications to nontarget plant species, and will also reduce human and animal exposure.

Researchers have studied the effects of glyphosates on soil, invertebrates, amphibians, and fish. These studies have found that glyphosate exhibits low toxicity. When glyphosate comes into contact with soil it binds rapidly to soil particles and is deactivated. Field and lab studies have shown that proper use of glyphosate results in little impact to invertebrates or amphibians. Some examples are listed below.

- A field study was conducted to investigate the effects of aerial application on honeybee hives (Burgett and Fisher 1990). Bee hives and blooming vegetation were treated at the rate of 5% roundup in 60 gallons of water. No acute or chronic effects were observed for honeybees or brood production.

- Mites and springtails were unaffected by Roundup applications in a sandy soil up to 96 days after application (Gomez and Sagardoy 1985). No effects were noted for the number of trematodes, mites, or springtails in the top 3 cm of soils 180 days after treatment with Roundup (Preston and Trofymow 1989).
- Absence of any toxic effects to carabid beetles was observed in the lab (Brust 1990).
- Butterfly numbers have been known to increase after glyphosate was used to control trees, shrubs, and blackberries (Bramble et al. 1997).
- The U.S. Environmental Protection Agency tested glyphosate on frogs using the FETAX test or frog embryo teratogenic bioassay –*Xenopus*. The results indicate glyphosate is practically nontoxic to amphibian embryos and normal development of larval frogs. Proper use of these products would result in little to no toxicity to amphibians. Further studies by USEPA demonstrated that glyphosate is no more than slightly toxic to fish.

Finally, if DOPR and Discovery Park management feel that herbicide use is warranted, then one additional step that could be taken would be to set up test areas for application of herbicides and evaluation of their effectiveness.

The general recommendation for herbicide use, then, is to follow a policy of limited, judicious use of glyphosate herbicides in situations where size and density of invasive species populations make hand, mechanical, and alternative means of control ineffective.

The following additional guidelines for herbicide use in Discovery Park are recommended.

- Herbicide use in a given area should proceed only with the approval of the park director, and be made by licensed applicators. Signs alerting the public to local herbicide applications will be posted.
- With the exception of certain areas with concentrations of upright woody invasive species or dense shrub thickets, herbicides should not be used in the North Forest, the Wolf Tree Nature Trail, Bay Terrace, and the North Bluff.
- Herbicide use should be most limited in the Historic District, the North Bluff Forest, the South Bluff Forest Trail, the South Bluff, or the Metro/King Waste Water Treatment area.
- Herbicide applications should be timed to achieve their best effect and to minimize herbicide application during peak use periods. Based on these criteria, September through November would be the best time of year for herbicide applications. Herbicide use should be curtailed or minimized during the summer months when park use is heaviest.
- Upright woody invasive species may be controlled by “frilling.” This practice involves partially girdling the tree, cutting the trunk in such a way that a channel is formed that will hold an application of herbicide. The combination of girdling and direct herbicide application will control these species.

3.6 Himalayan Blackberry Management

3.6.1 Issues

Himalayan blackberry (*Rubus armeniacus*) is a nonnative invasive shrub that competes aggressively with other shrub species in the park. The 2001 Discovery Park Vegetation Inventory found Himalayan blackberry present in over one-half of the inventory plots. Throughout the park, aggressive management of Himalayan blackberry will be vital to maintaining plant communities and supporting species diversity.

Himalayan blackberry produces abundant, delicious berries in late summer at Discovery Park. Many of the park's visitors search out Himalayan blackberry patches to pick berries. At the January 2001 public meeting on vegetation management, the desire to retain areas of Himalayan blackberry for public consumption was clearly expressed. However, despite the appeal of blackberry thickets in Discovery Park to certain sectors of the public, the ecological imperative for controlling Himalayan blackberry should take precedence. At the public meeting held in October 2001 to present the draft vegetation management plan, attendees expressed strong support for aggressive removal of blackberry from the park and especially from the interior portions of the park.

At the same meeting, a proposal for blackberry thicket management areas was presented as part of the draft vegetation management plan. Under this proposal, selected rows would be cut through larger thickets to improve access to berries while holding the thicket area more or less constant. Other blackberry thickets would then be removed. This scheme appeared to provide a balance between the public desire to retain blackberries and the ecological necessity to remove them. However, accommodating and managing the continued presence of Himalayan blackberry in the park is inconsistent with the goal of reducing invasive species coverage and fostering native plant growth.

3.6.2 Recommendations

The continuing spread of Himalayan blackberry in Discovery Park must be reversed in order to meet the 1972 Master Plan goal of supporting the growth and expansion of native plant communities. Despite public desire for blackberries in the park, a program of aggressive eradication of Himalayan blackberry should begin immediately. Methods for removal of Himalayan blackberry include cutting canes and grubbing roots in small to medium patches, and contact herbicide application to cut surfaces of thicker canes in larger thickets.

The proposal for blackberry thicket management areas, described in the draft vegetation management plan, should be dropped or drastically reduced. If any areas of blackberries are to be retained, these areas should be thickets at the periphery of the park, near the edges of the existing parking lots.

Finally, to project a consistent message to the public regarding the potential damage that Himalayan blackberry poses to Discovery Park's native plant communities, the Discovery Park staff should consider discontinuing the annual Blackberry Festival. The festival is a recently conceived event, without an established tradition, and sends the wrong message to the public about the desirability of blackberry in Discovery Park.

3.7 Other Invasive Species Management

3.7.1 Issues

Discovery Park has invasive species problems beyond Himalayan blackberry. Nonnative invasive species with noticeable and growing populations within the park include the following

- Scot's broom (*Cytisus scoparius*),
- Holly (*Ilex aquifolium*),
- English ivy (*Hedera helix*),
- Cherry laurel (*Prunus laurocerasus*),
- European mountain ash (*Sorbus aucuparia*),
- Portuguese laurel (*Prunus lusitanica*),
- Lombardy poplar (*Populus nigra*),
- White poplar (*Populus alba*),
- Japanese knotweed (*Polygonum cuspidatum*),
- Reed canary grass (*Phalaris arundinacea*),
- Wild sweet pea (*Lathyrus latifolia*),
- Cutleaf/evergreen blackberry (*Rubus laciniatus*),
- Gorse (*Ulex europeus*),
- Black mustard (*Brassica nigra*),
- Canada thistle (*Cirsium arvense*),
- Wild clematis (*Clematis vitalba*), and
- Herb Robert (*Geranium robertianum*).

Control of these species is vital to achieving the objective of maintaining and restoring, to the extent possible, the predevelopment forests of Discovery Park.

The invasive species mentioned above are not native to the Pacific Northwest. However, native plants can also be aggressive spreaders, and in that sense can be locally invasive. An example occurs in the South Meadow of the park, where trailing blackberry (*Rubus ursinus*) has spread across much of the open grasslands. Without control, this and other shrub species could eventually supplant much of the grassland in the South Meadow and other meadow areas.

3.7.2 Recommendations

The following general recommendations are made for the management of invasive species.

- Control of non-native invasive species should be accomplished using hand and mechanical removal techniques or with limited herbicide use as described above. In general, English ivy, wild sweet pea and black mustard should be pulled, as should any other herbaceous or small (<0.5" diameter) woody species. All other woody invasive species under 0.5" diameter should be hand-pulled. Woody invasives to 2" diameter should be hand-pulled if possible. If hand-pulling will not remove invasives of this size, then

they should be cut and grubbed out. Contact herbicide application can be with the approval of the park manager, and following the guidelines in Section 3.5.2. Upright woody invasive species over 2" diameter can still be mechanically pulled or cut at the base. Contact herbicide application can also be used on these larger individuals with the approval of the park manager, and following the guidelines in Section 3.5.2.

- Scot's broom may actually be left in certain areas and underplanted with conifer species. The Scot's broom will provide the shade necessary for the conifers to establish themselves. When the trees have grown to a height above the Scot's broom, the shade they provide will cause the Scot's broom to die back.
- In certain topographic conditions, shrubs and tree species can be overplanted to shade out invasive species. Examples include areas along the top of the bluffs where invasive species populations are growing just over the edge. Planting a line of native trees and shrubs at the top of the slope will prevent sun from reaching the invasive species.

As an additional recommendation for controlling invasive species and maintaining the open character of the South Meadow and other grasslands within the park, Discovery Park should undertake a series of experiments with prescribed burns.

Prescribed burns are the most effective and natural method for stopping the intrusion of shrub and tree species into grasslands. Maintenance of grasslands depends on periodic fires to remove dry matter and invading trees and shrubs. Fires were used by Native Americans to maintain prairies and meadows. This strategy minimizes forest encroachment and discourages invasive growth by trees and shrubs (Tveten 1997, Agee 1993).

Prescribed burns should be timed to minimize impacts to wildlife in the area to be burned. Nesting birds and small mammal offspring would be vulnerable in the spring. Scheduling prescribed burns for the autumn would minimize impacts to wildlife, and would also coincide with the driest period of the year, ensuring an effective burn.

The burns need not use traditional prescribed burn techniques or even actual fire. Alternatives for burning small areas include flame-throwers and infrared panels that pass closely over the ground and create a burned effect. The park should look into these techniques and begin experiments with small test areas. These areas should be monitored for 2 to 3 years to gauge the effectiveness of the burn on shrub species and to evaluate the grass and forb species that return. Volunteer groups could be used for the monitoring efforts, and for pulling seedlings of undesirable plants.

4 SPECIFIC AREA MANAGEMENT RECOMMENDATIONS

This section contains management recommendations for specific zones within the park. In many instances, the management recommendations follow techniques and suggested procedures described above under the general recommendations. Vegetation zone maps summarizing management recommendations and pointing out specific areas for management are found in Appendix A. Conceptual drawings are found in Appendix B. The master plant palette is also reprinted in Appendix B.

For all management zones, park management and staff, volunteer workers, or any other parties engaged in management activities in the park should consult the vegetation zone maps before initiating work. The vegetation zone maps contain information on plant community types within the zone. The community types have corresponding plant palettes for selection of species for replanting or community enhancement. The vegetation zone maps also list invasive species "hot spots," and describe specific actions for localized management activities within each zone.

4.1 Visitor Center Area

4.1.1 Special Characteristics

The Visitor Center area serves as the principal gateway to Discovery Park. The Environmental Education Center provides visitors the opportunity to learn about the history of the park and its natural resources and serves as a location for public meetings and environmental education classes. Portions of this zone around the building are designed for active recreation and playground use. The area includes sites for large picnics and community activities.

The Visitor Center zone also serves an entry point to the North Forest and adjacent forested areas, and as access to the Health Path. Plant community types in this zone include both conifer- and hardwood-dominated forest, and open grassy areas that are used as active recreation fields.

Portions of the south end of this zone are in the early stages of restoration of forested communities.

4.1.2 Management Issues

Principal management issues for this zone are invasive plant species control, native plant community enhancement, wildlife enhancement, and social trail closures.

4.1.3 Management Objectives

The management objective for the Visitor Center zone is to maintain or improve the health of the existing forested areas.

4.1.4 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management recommendations are made for the Visitor Center zone.

- Locate and remove concentrations of invasive plant species. Because of the high use of this area by children, herbicide use should be limited within the Visitor Center zone. Pull English ivy by hand from the ground and cut vines climbing trees. Pull seedlings and girdle or cut saplings of sycamore-leaf maple, a non-native maple species that is becoming established along the paved roads at the north and west edges of this zone. Frill Portuguese laurel growing just west of the Visitor Center parking lot, and replace with native conifers and/or bigleaf maple.
- Plant additional conifer and/or hardwood species based on the local matrix of native plants. Increase coverage of native shrubs and sword fern. Suggested shrubs for the area west of the Visitor's Center parking lot include salal, low Oregon grape, red huckleberry, and evergreen huckleberry. See the general recommendations for guidance on native plant community enhancement.
- Conduct reconnaissance for social trails and close. Use logs to block shortcuts south and east from the paved roads down to the forested area west of the parking lot. A short social trail heads straight up the embankment at the north end of the parking lot. Visitors are apparently not discouraged from using this path up to the road. It should be converted into a short trail with one switchback.

- Locate suitable snags and down logs for creation of wildlife habitat structures.

4.2 Health Path

4.2.1 Special Characteristics

The Health Path zone contains forests dominated by bigleaf maple with occasional western red cedar and Douglas-fir. It has well developed trails and a robust native shrub-herb-fern layer. Trails crossing through these forested areas provide passive recreation opportunities.

4.2.2 Management Issues

Principal management issues for this zone are invasive plant species control, native plant community enhancement and wildlife enhancement.

4.2.3 Management Objectives

The management objective for the Health Path zone is to maintain or improve the health of the existing forested areas.

4.2.4 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. Recommendations for the Health Path zone are similar to those offered for the Visitor Center zone. The following management recommendations are made for the Health Path.

- Locate and remove concentrations of invasive plant species. Pull English ivy from the ground by hand and cut vines climbing trees. Pull seedlings and girdle or cut saplings of sycamore-leaf maple. Himalayan blackberry can be removed by cutting and dabbing with herbicide along the south edge of the zone and in the open area just south of the corner of Texas Way and Tennessee Street.
- Plant additional conifer and/or hardwood species based on the local matrix of native plants. Replant the south edge of the zone with madrone and Pacific dogwood and dry-mesic shrub species such as ocean spray and western beaked hazel. Bitter cherry is also locally vigorous. See the general recommendations for native plant community enhancement guidance.
- There are a number of suitable snags and down logs for creation of wildlife habitat structures in the Health Path zone. Many are already well utilized by wildlife. See Appendix B for suggestions on enhancing additional snags and logs for wildlife habitat.

4.3 North Forest

4.3.1 Special Characteristics

The North Forest is the backbone of Discovery Park. It is the truest glimpse of what the West Point area once was. The matrix of hardwood, conifer, and mixed conifer-hardwood forests that comprise the North Forest is the ultimate underlying model for management objectives within the park. The North Forest provides both passive and active recreation opportunities, environmental education, and the “place of quiet contemplation of nature” described in the master plan.

4.3.2 Management Issues

Principal management issues are invasive species control, wildlife enhancement, blackberry management, road removal, and social trail closures.

4.3.3 Management Objectives

The management objective is to maintain the health and diversity of the North Forest, to restore areas where natural plant communities are depleted by natural and human impacts, and to increase wildlife habitat.

4.3.4 Priority Actions

Priority should be given to spot removal of invasive plant species while they are still manageable.

4.3.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following specific management recommendations are made for the North Forest.

- Use the 2001 vegetation inventory and reconnaissance to locate and eradicate pockets of invasive plant species. Small Himalayan blackberry and Scot’s broom should be hand-pulled. Contact herbicides can be used on larger thickets. Occasional pockets of Himalayan blackberry along Texas Way should be removed. Pull English ivy and cut ivy stems on trees. Frill upright woody invasive species.
- In areas cleared of ivy or other dense pockets of invasive species, replant with native shrubs, including red, oval-leaf, thin-leaf, or evergreen huckleberry, and mock orange. The areas of Himalayan blackberry eradication along Texas Way should be replanted with tree species found in adjacent communities.
- There is an open area on the west side of Texas Way near the western end of the North Forest zone. This area is currently dominated by a combination of Scot’s broom and Himalayan blackberry. Himalayan blackberry and other invasive species present should be removed. Scot’s broom should be thinned. Underplant the remaining Scot’s broom with Douglas-fir, grand fir, bigleaf maple, and bitter cherry. Plant edge of open area with thimbleberry and snowberry.

- Create blackberry thicket management areas in two accessible extant blackberry patches. These patches are found at the southwest corner of the recreation field west of the north parking lot, and further west up Kansas Avenue on the west side of the bend in the road (see diagram in Appendix A).
- Conduct reconnaissance for snags and recent down logs to create wildlife habitat. See specifications in Appendix B for examples.
- Conduct reconnaissance for social trails and close as appropriate.
- Plant Douglas-fir and Grand fir in the open grassy areas north of the Horse Patrol and northeast of the Utah Avenue/Illinois Avenue intersection. Both of these areas abut forested communities. The objective is to extend the edges of those forested communities out into the open areas using native conifers.
- If the removal of portions of Kansas and Idaho Avenues is compatible with DOPR park maintenance, these roads should be wholly or partially removed within the forest. See general recommendations for road removal procedures.

4.4 North Bluff Forest

4.4.1 Special Characteristics

The North Bluff Forest contains healthy hardwood forest and mixed hardwood-coniferous forest. Access to beaches is via trails through portions of these forests.

4.4.2 Management Issues

The principal management issues are removal of invasive species, conifer enhancement, wildlife enhancement, and social trail closures.

4.4.3 Management Objectives

The management objectives for the North Bluff Forest are to maintain or improve the health of the existing forest, and to establish coniferous communities that will be in place at the end of the alder's natural lifecycle.

4.4.4 Priority Actions

Priority should be given to spot removal of invasive species while they are still manageable.

4.4.5 Recommendations

The following specific management recommendations are made for the North Bluff Forest.

- Conduct reconnaissance of the areas for Himalayan blackberry and upright woody invasive species. Hand-pull or dig out blackberry. Frill upright woody invasive species except within 100 feet of wetlands; invaders found within that margin should be girdled or cut.

- Underplant western red cedar, western hemlock, Douglas-fir, and Sitka spruce. Plant hemlock seedlings in decaying logs.
- Conduct reconnaissance for snags and logs suitable for wildlife habitat structures. See specifications in Appendix B and general recommendations.
- Close social trails within the zone.

4.5 North Bluff

4.5.1 Special Characteristics

The North Bluff zone provides picnic areas and open grasslands adjacent to bigleaf maple forest at the top of the bluff and Douglas-fir forest to the south. Illinois Way runs along the eastern edge of the zone and provides a path for visitors to a mowed picnic area at the north end of the zone. A viewing platform in the picnic area provides vistas of Shilshole Bay. The picnic area also functions as a trailhead of sorts for northern access to the South Beach loop trail.

4.5.2 Management Issues

The principal management issues for this zone are blackberry management, invasive species control, social trail closure, road removal, and wildlife enhancement.

4.5.3 Management Objectives

The management objective for the North Bluff is to retain a central open grassland within the zone, while encouraging additional mixed hardwood-conifer growth along the southern and eastern edges of the zone. This objective is consistent with the 1972 Master Plan's requirement that "meadow areas will be maintained above the North Bluff. These additional meadow areas will not be quite as vigorously protected for wildlife habitat as the south meadow, but will serve that purpose along with providing usable open space for walking, sitting, picnicking and other informal recreational activities."

4.5.4 Priority Actions

Priority should be given to establishing a blackberry thicket management area in this zone, and to removing the large Himalayan blackberry patch near the north end of the zone.

4.5.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management actions are recommended for the North Bluff zone.

- The west-central portion of this zone needs intensive restoration and management attention. Remove Scot's broom and Himalayan blackberry. Replant with a 10:4:4 ratio of alder, bigleaf maple, and mixed conifers. Douglas-fir, shore pine, and grand fir are suggested conifers. Occasional clumps of western

beaked hazel and madrone should be included in the planting scheme. This work will require time, effort, and patience. The zone should be actively promoted for Adopt-an-Area use.

- Contain Himalayan blackberry in the southwest corner of this zone, just north of Utah Avenue. Mow the wild sweet pea adjacent to the blackberry patch and replant all areas of removed invasive species with alder.
- Remove Himalayan blackberry on the west side of Illinois Avenue at the north end of the zone. Spread wood chips, and seed or replant with alder.
- Monitor western red cedar dieback along Illinois Avenue. Remove the single horse chestnut across from the restrooms.
- Close social trails leading upslope at the northeast corner of the zone.
- Cut Scot's broom and use contact herbicide applications. Do not use herbicides within 100 feet of the wetland along the east edge of the zone.
- Remove asphalt pavement north of the restrooms. Restore the former roadbed with western red cedar and willow, following procedures described in the general recommendations. Consider lowering the former roadbed grade and expanding the wetland westward into the area formerly occupied by the road.
- Conduct reconnaissance for potential wildlife trees and logs. A large western hemlock snag stands near the top of the stairs leading down to the South Beach Trail. Remove the upper half of the tree and create a false shattered top and other hollows and slits in the remainder. See the general recommendations and Appendix B for suggested procedures.

4.6 South Bluff Forest

4.6.1 Special Characteristics

The South Bluff Forest contains healthy hardwood forest. Access to beaches is via trails through portions of this forest.

4.6.2 Management Issues

The principal management issues are removal of invasive species, conifer enhancement, wildlife enhancement, and social trail closures.

4.6.3 Management Objectives

The management objectives for the South Bluff Forest are to maintain or improve the health of the existing forest, and to establish coniferous communities that will be in place at the end of the alder's natural lifecycle.

4.6.4 Priority Actions

Priority should be given to spot removal of invasive species while they are still manageable.

4.6.5 Recommendations

The following specific management recommendations are made for the South Bluff Forest.

- Conduct reconnaissance of the areas for Himalayan blackberry and upright woody invasive species. Hand-pull or dig out blackberry. Frill upright woody invasive species except within 100 feet of wetlands; invaders found within that margin should be girdled or cut.
- Underplant western red cedar, western hemlock, Douglas-fir, and Sitka spruce. Plant hemlock seedlings in decaying logs.
- Conduct reconnaissance for snags and logs suitable for wildlife habitat structures. See specifications in Appendix B and general recommendations.
- Close social trails within the zone.

4.7 South Bluff Forest Trail

4.7.1 Special Characteristics

The South Bluff Forest Trail zone contains bigleaf maple-dominated hardwood forest with madrone and occasional conifer stands. Robust native shrub communities are found on the upper slopes. However, the lower slopes have been invaded by nonnative shrubs, especially Himalayan blackberry. This zone is also experiencing relatively high tree mortality, with very little regeneration emerging underneath.

Access to the south beach is via trails through portions of this forest. Several viewing platforms are located along these trails.

4.7.2 Management Issues

The principal management issues are removal of invasive species, conifer enhancement, wildlife enhancement, and social trail closures.

4.7.3 Management Objectives

The management objectives for the South Bluff Forest Trail zone are to maintain or improve the health of the existing forest, and to establish coniferous communities that will be in place at the end of the alder's natural lifecycle. Seedlings of both coniferous and hardwood species should be planted soon to establish a healthy understory, which is currently lacking in this zone. Limited trimming of vegetation should be completed to restore some of the vistas from the viewing platforms.

4.7.4 Priority Actions

Priority should be given to spot removal of invasive species while they are still manageable and to establishing a mixed hardwood-deciduous understory

4.7.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following specific management recommendations are made for the South Bluff Forest Trail zone.

- Conduct reconnaissance of the area for Himalayan blackberry and upright woody invasive species. Hand-pull or dig out blackberry. Frill upright woody invasive species except within 100 feet of wetlands; invaders found within that margin should be girdled or cut..
- Underplant western hemlock, Douglas-fir, and western red cedar. Plant madrone in more open areas, especially on the upper third of the slopes within the zone.
- Conduct reconnaissance for snags and logs suitable for wildlife habitat structures. Several small to medium snags are present in the zone. See specifications in Appendix B and general recommendations.
- Cut ivy from trees. See vegetation inventory and Appendix A diagram for specific ivy locations.
- Close social trails within the zone.
- Evaluate views from each of the viewing platforms along the trails in this zone. Trim branches and shrubs to the minimum extent required to restore views. Avoid full removal of individual plants.

4.8 Wolf Tree Nature Trail

4.8.1 Special Characteristics

The Wolf Tree Nature Trail area encompasses healthy mixed conifer-hardwood forests, alder forests, and forested wetlands. The trail itself provides environmental education opportunities for park visitors.

4.8.2 Management Issues

Management issues for the Wolf Tree Nature Trail zone include spot removal of invasive species, conifer enhancement, and wildlife enhancement.

4.8.3 Management Objectives

The management objective for this zone is to maintain the health of the existing forest communities while encouraging additional conifer growth.

4.8.4 Priority Actions

The priority action for this zone is the removal of invasive plant species while their coverage is still relatively minor.

4.8.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. In general, the recommendation for this zone is to focus on simple, small-scale efforts to simultaneously control invasive species and replant conifers. Two- or three-person crews can be sent out to pull, girdle, or frill upright woody invasive species. These crews can carry with them small conifer seedlings for replanting on the spot. The following specific management recommendations are made for the Wolf Tree Nature Trail zone.

- Use the vegetation inventory and conduct reconnaissance to locate pockets of invasive plant species and remove. Upright woody invasive species may be hand-pulled or frilled.
- Underplant existing alder stands with western red cedar and Sitka spruce. The alders are approximately halfway through their normal lifespan, and will provide excellent canopy cover for growing young conifers.
- Plant western hemlock seedlings in wedges cut in down logs. See specifications in Appendix B for inserting seedlings in logs.

4.9 Bay Terrace

4.9.1 Special Characteristics

While the Bay Terrace zone has picnic areas that are readily accessible from Bay Terrace Road, these picnic areas are located at some remove from higher-use open areas. This zone also has good-quality wet forested areas and opportunities for upland forest. Five plant community types were identified in this zone by the 2001 vegetation inventory. Situated at the northeast corner of the park, the Bay Terrace zone functions in part as a buffer for the park interior.

4.9.2 Management Issues

Management issues for the Bay Terrace zone include invasive plant species control, native plant community enhancement, and road removal.

4.9.3 Management Objectives

The management objectives include maintenance of the open grassy picnic areas nearest the road and to re-establishment of the mixed conifer-hardwood forest north of the old logging road.

4.9.4 Priority Actions

Removal of gorse from the grassland/shrubland area in the north central section of this zone should be a priority.

4.9.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management recommendations are made for the Bay Terrace zone.

- Continue maintenance of lawns adjacent to Bay Terrace Road.
- Plant small tree and shrub species such as Pacific dogwood and western beaked hazel at the edge of the lawns above the slope break. This practice will reduce the encroachment of Himalayan blackberry growth by producing shade.
- Remove gorse, Himalayan blackberry, Scot's broom and other invasive plant species from the open area north of the cutover road between 42nd Avenue and Lawtonwood Road. Replant this area with an approximately 8:2:2:1:1 matrix of red alder, cottonwood, Oregon ash, Douglas-fir and Grand fir. Cull alder at 5-year intervals.
- Remove Himalayan blackberry and Scot's broom from the slopes between the picnic area and the cutover road between 42nd Avenue and Lawtonwood Road. Replant with approximately 8:1 red alder and Douglas-fir.
- Remove the cutover road between 42nd Avenue and Lawtonwood Road. See general recommendations for the suggested road removal process.
- A dense stand of large Scot's broom grows at the south end of this zone, near the intersection of Lawtonwood Road and 40th Avenue West. The recommendation for this area is to underplant the Scot's broom with native conifer species, especially Douglas-fir and Grand fir. Mature specimens of both of these species can be found nearby. The Scot's broom will provide shade for the young trees until they reach sufficient height to overtop the Scot's broom. Alternatively, the Scot's broom could be removed and contact herbicide applied to the cut stumps. The area would then be mulched with 8 inches to 12 inches of wood chips before planting Douglas-fir, Grand fir, on 6-foot centers, with occasional clumps of western beaked hazel.

4.10 The 500 Area

The management objectives and recommendations for the 500 area are being prepared under a separate project funded by a grant obtained by the Discovery Park Advisory Council. However, the general management issues and recommendations for Discovery Park, as outlined above, still apply within the 500 area.

The 500 area occupies an important landscape position between open grassy areas to the west and mixed coniferous-hardwood forest to the north and east. The management objectives and recommendations for this area could have a strong bearing on the potential expansion of the Discovery Park forest and the control of invasive plant species.

The first section of this report described general patterns of plant communities in Discovery Park. Figure 5. General Trends in Community Type Distribution at Discovery Park, illustrated the pattern of wet to wet-mesic forest along the north and west edge of the park, with a broad curving band of mesic to dry-mesic forest running north from the southeast corner, then turning west toward the bluffs. Reforestation of the 500 area is critical to restoring the continuity and integrity of that band of coniferous and mixed hardwood-conifer forest. Maintaining the 500 area as an open area will stand in direct opposition to the guiding principle of the vegetation management plan and to the mandate of the 1972 Master Plan.

Pending approval of the separate management plan for the 500 area, this plan recommends that this zone be reforested. Specifically, aggressive removal of invasive species is recommended, together with retention of existing mature trees. These recommendations should be coupled with a long-term strategy for soil amendment and establishment of native mixed coniferous-hardwood forest. See the management recommendations for Zone 20 as a more detailed example.

4.11 South Meadow

4.11.1 Special Characteristics

The South Meadow provides open spaces and vistas of the Puget Sound and the Olympic Mountains. It is among the most popular destinations in the park, and was described in the 1972 Master Plan as being the most important part of the park. Western red cedar and Douglas-fir stands line the south edge of the meadow. A small stand of large bigleaf maples with an open understory intrudes northward from the south end of the meadow.

4.11.2 Management Issues

Key management issues for the South Meadow are invasive species control, native plant community enhancement, social trail closures, and blackberry management.

4.11.3 Management Objectives

Consistently with the 1980 Vegetation Management Plan, the objective identified in this plan for the South Meadow is to maintain the open grassland communities and prevent intrusion of shrub and tree species. This objective effectively requires the park staff to slow or halt natural succession of this zone. However, the high use and visibility of the South Meadow warrants this approach.

4.11.4 Priority Actions

Priority should be given to blackberry management, to experimentation with burning of small areas for shrub suppression, and to eradicating small populations of black mustard and poison hemlock while they are still manageable.

4.11.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management recommendations are made for the South Meadow.

- Establish a blackberry thicket management area along the north edge of the zone, south of the existing fence. This area is readily accessible, and the existing blackberries are not likely to be eradicated. Blackberries in this area should be mowed, both for containment purposes, and to improve access to blackberries.

- The bigleaf maple stand in the south end of the zone has an open understory. Additional native shrubs and ferns should be planted in this area. Indian plum is already well established. Suggested additions include creeping snowberry, ocean spray, and western beaked hazel. Sword fern should also be added.
- In the eastern section of this zone, just west of the bigleaf maple stand, is an ideal location for test plots to gauge the effectiveness of burning as a means to control the intrusion of shrub species into the meadow. See the general recommendations on invasive control for guidance. Over the long term, if the test plots indicate successful control of shrub species, then larger portions of the South Meadow should be managed by rotating prescribed burns through various sections of the meadow. Prescribed burns of sections of the South Meadow should not at any one time exceed more than 12% of its area.
- Create wildlife habitat enhancements in the large bigleaf maple log lying perpendicular to the south side of the Loop Trail. See Appendix B for typical drawings of log hollows and bat slits.
- A volunteer could spend 2 days walking the meadow and pulling the black mustard and poison hemlock that are beginning to appear in early spring.
- Monitor success of native plant community enhancements already installed in the south end of the zone.
- A stand of black locust grows in the southeast corner of the zone. This stand should be underplanted with western hemlock. Large pieces of down woody material should be brought in. Over the long term, approximately 10 years from planting of the hemlock, the black locust should be girdled. If individual locusts sprout suckers, they should be cut and contact herbicide should be applied to the recut stump. Girdling of black locust could conceivably occur sooner, perhaps within 5-8 years. Timing of the girdling of the black locust should be determined at the discretion of the Discovery Park manager or the DOPR urban forester. The primary criterion for deciding to girdle the black locust should be the height and vigor of the conifer underplantings. If, in the opinion of the park manager or the urban forester, the conifers would benefit from the additional light that would be provided by the dieback of the black locusts, then the girdling should proceed.
- Remove Lombardy poplars and white poplars that are emerging in the native shrub row along the fence at the east end of the meadow.
- Rebuild the log barrier at the edge of the bluff in those sections where it has fallen, become buried, or is otherwise ineffective.

4.12 Sludge Meadow

4.12.1 Special Characteristics

Sludge Meadow provides open meadow with vistas of Puget Sound and the Historic District of the park.

4.12.2 Management Issues

Principal management issues for the Sludge Meadow zone are invasive plant species control; native plant community enhancement, and social trail closures.

4.12.3 Management Objectives

The management objective for Sludge Meadow is to maintain the character of the zone as an open meadow while encouraging additional trees and shrubs to connect isolated stands of conifers in some areas.

4.12.4 Priority Actions

The priority action for Sludge Meadow is invasive species control, specifically young Scot's broom and thistle removal.

4.12.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management recommendations are made for the Sludge Meadow zone.

- Underplant Scot's broom growing at the north end of the zone with conifers and bigleaf maple. Add occasional madrone and western beaked hazel clumps. Continue planting Douglas-fir and western red cedar in a strip southward to existing, isolated mature cedar and Douglas-fir. The objective is to provide a continuous line of tall native woody vegetation connecting the stands to the west of this zone with the small, isolated stands in the northeast end of the zone. These plantings will further screen the military housing to the north as well.
- Frill Portuguese laurel and remove Himalayan blackberry from the understory of the small Douglas-fir/western red cedar stand in the northeast corner of the zone. Replace with madrone, ocean spray, snowberry, and western beaked hazel.
- Coordinate volunteers or use maintenance staff to locate and remove invasive plant species. Hand-pulling of most species should be adequate. There are now many young stems of Scot's broom emerging in the south-central section of this zone. These stems should be hand-pulled by the next growing season.
- Over the long term, the Sludge Meadow zone is another candidate for using prescribed burns for grassland management. The Seattle DOPR should carefully monitor proposed experiments with this technique and decide whether burning should be expanded to the Sludge Meadow.
- In an effort to enhance wildlife use of the zone and to attract swallows and bluebirds to the area, a series of 10 to 20 bluebird boxes should be erected along the west and north edges of the Sludge Meadow zone.

4.13 Horse Patrol

4.13.1 Special Characteristics

The Horse Patrol is a small area that once held the horse barns and corrals for the City of Seattle Police Department. The police department is leaving the facility. The barns were razed in late 2001. The area is immediately north of the Utah wetlands and includes an emergent wetland that has a subsurface hydrologic connection to the open water wetland to the south.

4.13.2 Management Issues

The principal management issues are the recovery and restoration of the corral site, and control of invasive species that are likely to move into the area once it has been abandoned.

4.13.3 Management Objectives

The management objective for the Horse Patrol zone is to create a vegetation transition zone, with reforestation in the north end of the zone and more open shrubland to the south.

4.13.4 Priority Actions

Once the Police Department abandons the area, the priority for the site will be to stabilize the area and avoid colonization by invasive species.

4.13.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management actions are recommended for the Horse Patrol zone.

- The north, south, and west edges of the emergent wetland in the north end of this zone are well buffered by dense young alder saplings. Himalayan blackberry in the eastern buffer should be removed and replaced with alder. The wetland buffer should be revisited in approximately 10 years for underplanting of western red cedar. Additional native wetland buffer species could also be planted then. Suggested species include Nootka rose, stink currant, Pacific ninebark, Pacific crabapple, and black twinberry.
- The corral area should be seeded with a mixture of native grasses. Alternatively, the area could be heavily mulched and planted with an 8:2:1:1 ratio of red alder, bigleaf maple, Grand fir and Douglas-fir. The alder will establish itself quickly and will provide shade to inhibit invasive species while the other conifer species become established. The ridge to the west supports several tall, mature Grand firs and bigleaf maples. Over the long term, alders can be culled at 5- to 10-year intervals. Additional Grand fir and bigleaf maple should seed in from the ridge above.
- An open area occurs in the southeast corner of this zone, south of the fence separating the zone from the mowed fields associated with the military buildings to the north. This area should be mowed and mulched with 8 inches to 10 inches of wood chips. It should then be replanted with an 8:2:2:2 ratio of red alder, Douglas-fir, grand fir, western hemlock and western red cedar. Note that implementation of this particular recommendation should take place only with clearance from the park manager. The area includes a clay soil cap that has been placed over contaminated soils. Restoration and planting work in this area should be planned to minimize hazards posed by the soil contaminants, and to prevent penetration of the clay cap.
- The open area also has one large and three medium snags that can be used for wildlife enhancement. See Appendix B.
- The massive blackberry thicket at the southern end of this zone should be treated as a blackberry thicket management area for berry picking. See the general recommendations and Appendix B for procedures and a typical drawing.

4.14 Utah Wetlands

4.14.1 Special Characteristics

The Utah wetlands zone contains an open water and emergent wetland surrounded by open grassland.

4.14.2 Management Issues

The principal management issues for the zone are invasive control and native plant community enhancement. Extreme localized weather conditions, including harsh sun and frequent gusting winds, may inhibit the success of management efforts in this area.

4.14.3 Management Objectives

Management objectives for the Utah wetlands include enhancement of the wetland buffer and control of encroaching invasive species into the grassland and wetland buffer.

4.14.4 Priority Actions

Priority should be given to removing the Himalayan blackberry from the zone, particularly from near the edges of the wetland.

4.14.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management actions are recommended for the Utah wetlands zone.

- Remove and grub out Himalayan blackberry from the wetland buffer. Because of the proximity to the wetland, use hand-pulling and/or mechanical methods for removing the thickets. This area could represent an effective test location for Brush Block, a citric and acetic acid solution that provides a more natural alternative to herbicides.
- Plant willow stakes along the lower slope of the buffer where blackberry has been removed. Plant additional western red cedar further upslope, and bigleaf maple at the top of the slope. Plant wetland shrubs along the open water wetland and within the southern edge of the wetland buffer. Suggested shrub species include red-osier dogwood, Pacific crabapple, and Pacific ninebark. Snowberry clumps could be planted in the buffer.
- Remove the southern end of the massive blackberry thicket that extends north out of this zone. Replant with alder, western red cedar, and willow.
- If trials with prescribed burns in small areas are deemed successful over the long term, then the grasslands in this zone should be burned to maintain the openness of the area.

4.15 Historic District

4.15.1 Special Characteristics

The Historic District has open grassy areas that provide magnificent vistas of the Puget Sound, Bainbridge Island, and the Olympic Mountains. It is also the site of a number of historic Fort Lawton structures. The Historic District is a popular area for picnicking, kite flying, and other recreational activities.

4.15.2 Management Issues

The principal management issue in the Historic District is invasive species control.

4.15.3 Management Objectives

The management objective for this zone is to maintain its open character and broad grassy expanses.

4.15.4 Recommendations

The following management actions are recommended for the Historic District zone.

- Continue mowing the old parade grounds and adjacent mowed areas.
- Monitor the zone for intrusion of invasive species. Because of the heavy use of the area by picnicking visitors and their children, no herbicides should be used on the lawns of the Historic District.

4.16 Top of Historic District

4.16.1 Special Characteristics

The Top of Historic District zone extends from Emerson Street to Utah Avenue and wraps around the east edge of the Historic District. It is an area of the park where forested communities shift to open grasslands. This vicinity has been highly disturbed in the past by activities associated with the construction and operation of Fort Lawton. As such, it contains a variety of community types and poses several management challenges.

4.16.2 Management Issues

Management issues in this zone include invasive species control, native plant community enhancement, social trail closures, wildlife habitat enhancement, and road and staircase removal.

4.16.3 Management Objectives

The management objective for this zone is to reintegrate the zone into the forests to the north and east. This objective will involve time- and labor-intensive work, and involves the assumption that the 500 area immediately east of the zone will also be reintegrated into the park's forest community. Management actions required to realize this objective include recovery and restoration of areas within the zone that have become

overgrown with invasive species, continued support for efforts already underway to re-establish native plant communities, and resistance of invasive species that are dominant in zones to the east.

4.16.4 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. Listed below are management actions recommended for the Top of Historic District zone; they are numerous and varied in their scope.

- Use the vegetation inventory and reconnaissance of the zone to locate problem spots for Scot's broom, Himalayan blackberry, and other invasive species. The vegetation inventory shows that holly coverage is relatively high in some portions of the coniferous forest in the northeast end of this zone. Remove with methods that balance effectiveness with lowest potential impact.
- Immediately south of the Nike building in the center of the zone, is a large area of blackberry/Scot's broom. The invasive species should be removed, using contact herbicides as necessary. Mulch the area deeply with wood chips. Plant mixed conifer species, including Douglas-fir, grand fir, western red cedar, and shore pine, with occasional madrone and bigleaf maple on 6-foot centers (or a suitable spacing to accommodate park maintenance mowers). Irrigate for 2 to 3 years. Mow and/or pull re-emerging invasive species.
- Further south the Scot's broom is less dominant and is growing among mature conifers and madrone. In this area, underplant Scot's broom with madrone, western red cedar, Douglas-fir, and shore pine.
- Close the social trail leading from the stairs at the north end of the South parking lot. Effective closure of this trail may require blockage, signage, and covering of the existing trail with woody debris.
- Pull Scot's broom in the south end of the zone while it is still small and has relatively minor coverage.
- Portions of the south end of the zone should be used for testing various restoration methods that might eventually be applied to larger sites. Discussions of the area with Discovery Park and DOPR staff produced an agreement to attempt several different treatments for reforestation of disturbed areas. These treatments included laying down thick wood mulch layers and reseeding with alder and other colonizing tree species, transplanting large (to 25 feet) trees, and tilling and amending of soils prior to planting. Methods would be monitored for effectiveness for a period of up to 10 years.
- Remove the larger/denser stand of Scot's broom and Lombardy poplar on the inside of Washington road south of the chapel. Maintain the lawn outside of the chapel in its current state.
- In the center of the zone, north of the Nike building and adjacent to California Avenue, underplant Scot's broom stands with conifers and madrone. Suggested conifers include shore pine, Douglas-fir, and western hemlock.
- North of Washington Avenue, add additional madrone plantings to extend the existing madrone stand southward.
- Monitor success of ongoing restoration efforts in the north end of the zone.
- Remove Lombardy poplar along Wisconsin Street. Effective removal may require application of herbicides.

- Within the next 5 years, consider thinning the small, dense stand of young Douglas-fir southwest of Wisconsin Street. If the stand is thinned, cut trees should be left on the ground; then underplant with red and evergreen huckleberries and vine maple.
- Sycamore maple is growing densely along Wisconsin Street and Washington Avenue. Underplant the area with western hemlock, then return and frill the maples in 3 to 5 years.
- Conduct reconnaissance throughout the zone for potential placement of wildlife habitat structures. Focus on the forested portions of the zone near the extreme north and south ends.
- Plant madrone, western beaked hazel, and ocean spray, with occasional bigleaf maple, in the strip immediately adjacent to West Emerson Street.
- Remove concrete staircases along Utah Avenue and at the south end of the Nike Building.

4.17 Daybreak Star Pond Area

4.17.1 Special Characteristics

The Daybreak Star Pond area is similar to the Wolf Tree Nature Trail in that it supports wet alder forests and mixed hardwood-coniferous forests. The area features a series of three ponds connected by a narrow north-flowing drainage. The northernmost pond is near the park's north boundary. Management of this area is limited by the lease of this area to the Indian Cultural Center run by the United Indians of All Tribes Foundation.

4.17.2 Management Issues

The principal management issues in this zone are invasive species control, native plant community enhancement, and pavement removal.

4.17.3 Management Objectives

The management objectives for the Daybreak Star Pond Area are to maintain or improve the health of the existing forested communities, to encourage additional conifer coverage, and to improve riparian communities at the central and north ponds.

4.17.4 Priority Actions

Priority actions for the zone are to conduct spot removal of upright woody invasive species while they are still relatively minor, and to establish control of access to the central and north pond edges. Once again, implementation of management recommendations in this area is limited by the terms of the lease to the Indian Cultural Center; nevertheless, invasive control should remain as an important priority for this zone.

4.17.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to

plant communities in the zone. Management activities within this zone should be coordinated with the Daybreak Star Indian Cultural Center. The specific recommendations for the area are as follows.

- Use the vegetation inventory and reconnaissance of the zone to locate pockets of invasive species and remove them. Upright woody invasive species may be hand-pulled or frilled.
- Monitor the spread of Lombardy poplar east of the central pond for the following 3 years. Several large Lombardy poplars are growing in this area. This species tends to spread clonally, but does not appear to be spreading here. If evidence is found that new shoots are emerging in a wider area, remove the new shoots and consider removal of all Lombardy poplars near the central pond.
- Underplant existing alder stands with western red cedar, western hemlock, and Sitka spruce. The alders are approximately halfway through their normal life span and will provide excellent canopy cover for growing young conifers.
- Use a combination of willow stakes and western red cedar plantings along the stream connecting the ponds. Willow will establish quickly and provide a better buffer than the one currently existing. Western red cedar plantings would extend and connect the existing clumps of mature red cedars.
- The banks of the central and northern ponds have become denuded or degraded around most of these ponds by excessive use. To restore these areas, temporary fencing should be installed to focus access on the one or two most-used points at each pond. The fences would be in place for 3 to 5 years and would protect a zone extending 20 feet out from the pond edge. Within the fencing, plant native wetland and riparian shrubs and herbs such as salmonberry, Pacific ninebark, small-fruited bulrush and slough sedge. The objective of these plantings is to emulate the dense, native riparian growth found around 90% of the south pond. [Note: small pockets of Himalayan blackberry should be removed from the northwest edge of the south pond.] Fencing the pond banks during restoration will not be popular with park visitors. Educational signs explaining the restoration and emphasizing the temporary nature of the fences should be developed and installed at each pond. Moreover, fencing should be designed to provide approximately 14"-18" of clearance beneath the fence. This will allow continued access to the ponds by most small animals.
- Remove remnant pieces of pavement east of the central and south ponds. Because these areas are part of an existing path, the pavement removed should be replaced with wood chips.

4.18 Metro King Wastewater Treatment Area

Because of the developed nature of the Metro/King Wastewater Treatment area, no management objectives or specific recommendations have been developed for this zone.

4.19 Bird Alley

4.19.1 Special Characteristics

Bird Alley derives its name from the density and diversity of birds utilizing this zone. A mosaic of plant communities that provide a broad spectrum of heights, textures, densities, and seeds and fruits make Bird Alley attractive to birds. This same mosaic of plant communities makes the area difficult to manage uniformly.

4.19.2 Management Issues

Management issues in Bird Alley include blackberry management, invasive species control, wildlife enhancement, and native plant community enhancement.

4.19.3 Management Objectives

The management objective for Bird Alley is to maintain the diversity of plant communities while reducing the coverage of invasive species present.

4.19.4 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management actions are recommended for the Bird Alley zone.

- A medium-sized open area lies west of the fence surrounding military housing near the north end of the zone (see diagram, Appendix A). This area should become an intensive management area for blackberry eradication and reforestation. Remove blackberry, using herbicides if necessary. Pull Japanese knotweed. Mow the area and mulch with wood chips. Plant an 8:4:2:2 ratio of red alder, bigleaf maple, Douglas-fir, and grand fir on 6-foot centers (or a suitable space to accommodate park maintenance mowers). This approach will expand on the existing effort to establish alders in the northeast corner of the opening.
- Remove Himalayan blackberry along the east edge of the zone, north of the dense stand of cherry. Replant with snowberry and ocean spray. The objective is to form a barrier comprised of native plant species, to the mixed-shrub area located in the depression in the zone's east center.
- The dense stand of Scot's broom in the east-central portion of the zone should be underplanted with western red cedar.
- Close the social trail that begins about 60 feet south of the Loop Trail/South Beach trail junction, and heads east-southeast to the south end of the zone. Blockage at both ends with a root wad or large log should suffice.
- Pull the stand of Japanese knotweed found along the south edge of the social trail described above.
- Limit herbicide use in this zone. Despite the documented low toxicity of glyphosate herbicides, the park should attempt to err on the side of caution and minimize exposure of birds and other animals to herbicides in this zone.
- Over the long term, work on replacing nonnative assemblages with native plant communities. Consult the vegetation zone map and the master plant palette for species selections appropriate to the zone.
- In an effort to improve wildlife use of this area, erect a line of bluebird boxes along the east edge of the bird alley zone. These structures will attract swallows and bluebirds to the area.

4.20 South Parking Area

4.20.1 Special Characteristics

In the 1980 Vegetation Management Plan, this area was described as having “large, grassy areas with play and picnic areas.” It is currently dominated by Scot’s broom and Himalayan blackberry in its north, central, and eastern sections, and is being aggressively invaded by Lombardy poplar in the west. A few mature western red cedar and madrone are present; otherwise, the area’s native plant communities have failed.

4.20.2 Management Issues

Principal management issues are invasive species control, native plant community enhancement, and road removal.

4.20.3 Management Objectives

The objective for this area is to remove the invasive shrub-dominated community and replace it with a native mixed conifer-hardwood forest. The 10-year goal is to establish a plant community that will have a closer affinity to forested communities to the northeast and east. This territory will extend the arc of forested communities that reaches from the bluffs across the north end of the park, then curves southward along the park’s eastern boundary.

4.20.4 Priority Actions

Priority should be given to removing invasive species and stabilizing the area.

4.20.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The time and labor commitments necessary to implement the following recommendations will probably be greater than in any other zone of the park. Listed below are recommendations for the South Parking Lot zone.

- Mow down the Scot’s broom in the north section of the zone and dab cut surfaces with glyphosate herbicide. At DOPR’s discretion, alternative means of eradicating Scot’s broom may be used. The goal is the complete removal of Scot’s broom and other invasive species from the north end.
- Frill holly, Lombardy poplar, and other upright woody invasive species in the remaining sections of the South Parking Lot zone. Remove when dead.
- Lay 12 inches of wood chip mulch over all areas where invasive species have been removed.
- Plant Douglas-fir, Ponderosa pine, shore pine, and bigleaf maple on 6-foot centers (or on a spacing that accommodates park mowers). Plant occasional clumps of western beaked hazel. The planting objective is to emulate native mesic upland forest communities.
- Irrigate replanted areas for 3 years.

- Hand-remove Scot's broom regrowth.
- Plant Pacific dogwood and madrone along the edges of the replanted area.
- Remove all asphalt pavement within this zone with the exception of the South Parking Lot itself. Follow the general recommendations for road removal.

4.21 Loop Trail West

4.21.1 Special Characteristics

The Loop Trail West zone contains mixed hardwood-conifer forest dominated primarily by bigleaf maple. The Loop Trail passes north-south through this zone.

4.21.2 Management Issues

The principal management issues in the Loop Trail West zone are invasive species control, wildlife habitat enhancement, and native plant community enhancement.

4.21.3 Management Objectives

The management objectives for this zone are to maintain or improve the health of the mixed hardwood-conifer forest and to improve wildlife habitat opportunities.

4.21.4 Priority Actions

Priority should be given to removal of English ivy and holly in some of the problem spots within this zone.

4.21.5 Recommendations

See Appendix A for a diagram of this zone, its plant community types, invasive species hot spots, and site-specific recommendations. Please also consult the master plant palette for selecting species appropriate to plant communities in the zone. The following management actions are recommended for the Loop Trail West zone.

- The zone has a small grassy opening in the south end, downslope from Carolina Street and zone 20. Plant this opening with a mixture of western red cedar and bigleaf maple.
- Use the vegetation survey and reconnaissance of the zone to locate and remove concentrations of invasive species, especially English ivy. English ivy may be hand-pulled from the ground or cut from the trunks of trees. Holly and other upright woody invasive species may be frilled.
- Monitor this zone for sycamore-leaf maple. Most of the mature seed-source individuals for this invasive nonnative are growing within or just west of this zone, especially along the east side of Utah Street/Maryland Avenue. Pull sycamore-leaf maple seedlings by hand if possible. Larger individuals can be girdled.

- Select areas within the zone for additional planting of native forest shrub species. Species suggested for this purpose include red, oval-leaf, thin-leaf and evergreen huckleberry, Oregon grape, salal, Oregon boxwood, and mock orange. Consult the appropriate plant palette for final plant species selections.
- Remove the concrete staircase running from near the intersection of Utah Avenue and Maryland Avenue west up the hill to the 500 area. Reforestation is recommended for the 500 area with the intent of improving the continuity between the North Forest and the forest in the southeast corner of the park. The staircase invites establishment of a trail through the area recommended for reforestation.
- Locate suitable snags or logs for wildlife habitat structures. See Appendix B for typical drawings.

5 IMPLEMENTATION OF THE VEGETATION MANAGEMENT PLAN

Full, effective implementation of the 2001 Vegetation Management Plan will require the coordinated efforts of Discovery Park staff, Seattle Parks and Recreation staff, the Discovery Park Advisory Council, the Friends of Discovery Park, volunteers, and the surrounding community.

A complete schedule of implementation for the Vegetation Management Plan, including estimates of costs for materials and labor, and timing of specific management actions, was not included within the scope of the Vegetation Management Plan. The plan is intended to provide concepts and objectives for the Discovery Park manager and staff, and has been written specifically to allow some latitude in the methods and timing of the implementation of the recommended management actions. For this reason, no specific schedule has been set. However, it should be noted that many of the management recommendations specify the timing and duration of restoration and management actions, and are more or less explicit in the types and amounts of materials to be used.

The Discovery Parks staff will conduct the majority of the management work in Discovery Park and will bear the greatest responsibility for realizing the objectives outlined in the vegetation management plan. However, additional assistance for management projects should be actively sought through outside sources, including

- the Adopt-an-Area program,
- volunteer projects,
- Service Learning, and
- grants.

The Adopt-an-Area is already an important and successful program administered through DOPR. Through this program, individual and group volunteers assume responsibility for managing a specific area within the park. As a result of this program, certain areas of the park have received and continue to receive long-term care from volunteers who simultaneously work on and monitor the area.

Volunteer work parties organized by neighborhood groups, workplace groups, clubs, and other social organizations have also performed considerable work. Students completing their required hours of Service Learning can also be utilized for volunteer projects at the park.

In the past, volunteer groups have obtained additional funding for larger and/or longer-term projects through various grant sources. These sources include Neighborhood Matching Small and Simple Grants, Large Project Funds, the Tree Fund, and other sources that focus on supporting activities with a strong volunteer component.

DOPR and Discovery Park should continue and, where possible, increase their efforts to support these sources of volunteer labor and to cooperate with groups seeking grant funds for work within the park.

Implementation of the plan and realization of some of the objectives in the plan will also take time. Some of the recovery and restoration actions proposed in the plan will consume a minimum of 10 years for completion of even the initial stabilization steps. Reversing the effects of over 100 years of disturbance at the Discovery Park site will require patience and recognition of small gains. Gauging the success or failure of the 2001 Vegetation Management Plan for will require a minimum duration of 25 years. Until then, attention must be focused on evaluating whether the trend is toward additional degradation of the park's natural beauty, or toward a return to the open vistas and quiet forests where the people of Seattle can seek "intimate contact with nature."

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Appendix A

Vegetation Management Zone Maps

Appendix B

Conceptual Drawings of Vegetation and Wildlife Enhancements

Appendix C
Survey Methods
