

WATERSHED PARK STEWARDSHIP PLAN

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1. INTRODUCTION

1.1 Park Description

Watershed Park is a 75.5-acre undeveloped park owned by the City of Kirkland. The park is located at 4500 110th Avenue NE in the Central Houghton Neighborhood in Kirkland, Washington. Situated on a west-facing slope above Lake Washington, the park features upland forests, a deep ravine containing Cochran Springs Creek, and open shrub land, the site of an abandoned surface mine.

The park is bounded to the east by Interstate 405, and surrounded mostly by low-density residential developments to the west, south, and north. The Cross Kirkland Corridor¹ and 108th Avenue NE both cut through the park, physically separating two small areas in the southwestern corner from the rest of the property. These two isolated sections of parkland are surrounded by areas zoned for commercial and office/multi-family uses (City of Kirkland, 2013a; City of Kirkland, 2014).

1.2 Park Background

William Cochrane, an Irish immigrant, homesteaded the land encompassing the current-day Watershed Park towards the end of the 19th century (Ely, 1975) . In the years since, this area underwent dramatic changes. Trees were logged—a 1936 aerial photograph (King County, 2014) shows that much of the upland area of Watershed Park lacked significant tree cover—and the surrounding areas became increasingly developed.

As the community grew, securing a steady supply of fresh water became increasingly important. Spring flows near the bottom of the ravine in Watershed Park were intercepted and pumped to a reservoir at the top of the slope. Water from this reservoir provided the City of Kirkland with water from 1915 to 1967. Soon after this system was taken out of service, a catastrophic landslide along the slopes of the ravine sent debris flows all the way down to Lake Washington (Ely, 1975; The Watershed Company, 2013).

By this time, work on Interstate 405 was in full swing. The southeastern corner of the park was used as a borrow pit, mined for gravel and sand to provide construction materials for the

¹ The [Cross Kirkland Corridor](#) is a 5.75-mile segment of the Eastside Rail Corridor being developed as a multi-modal transportation corridor.

freeway. No reclamation was done at the mine site when it was abandoned in 1968, leaving behind a barren 10-acre pit, stripped of topsoil, and devoid of native vegetation.²

In the early 1970s, the Kirkland Watershed officially became Watershed Park. Over the years, this park, like many other natural areas in urban locales, has become increasingly overgrown with introduced species such as Himalayan blackberry and English/Atlantic ivy. These invasive plant species suppress native plant regeneration and growth.

In 2005, the City of Kirkland and Forterra (then the Cascade Land Conservancy) joined forces to address the declining health of forests and other natural areas in Kirkland parks. The result was the Green Kirkland Partnership, a program that draws on City of Kirkland resources, volunteers, and partners such as Forterra, to restore City-owned forests and other natural areas according to a [20-Year Forest Restoration Plan](#) (City of Kirkland, 2008). Watershed Park is one of the areas targeted for restoration by the Green Kirkland Partnership. Restoration work at Watershed Park has been ongoing since 2007.

1.3 Plan Purpose

The volunteer Green Kirkland Steward program is a critical component of the 20-Year Forest Restoration Plan. The purpose of this stewardship plan for Watershed Park is to assist park managers and volunteer Green Kirkland Stewards with the ongoing restoration and management of natural areas in Watershed Park. The goal of restoration at the park is to cultivate a resilient forest, resistant to non-native species invasion, which will provide habitat for wildlife and improved ecosystem services, including stormwater retention and reduced flooding, removal of air pollutants, and carbon sequestration. Stewardship objectives include:

- management of invasive plant species
- establishment of native vegetation, including trees, particularly conifers, and understory species
- ongoing monitoring and maintenance of restored areas

² Washington State Legislature does not require reclamation of surface mines where mining activities were completed prior to 1971.

2. SITE ASSESSMENT

2.1 Organization

To help organize stewardship efforts and to provide a spatial reference, Watershed Park has been divided into sixteen restoration management units. These management units were established based on a number of factors including soil characteristics, native vegetation communities, hydrology, disturbance history, and landmark features such as trails.

Hardscape, landscaped and open water areas were excluded, as these areas are not suitable for restoration activities. Figure 1 shows the location, extent, and restoration status of the management units at the park. As of the end of 2013, 14.3 acres of a total of 77.9 acres of park and surrounding right-of-way areas had been enrolled in restoration.

2.2 Social Inventory

2.2.1 Attractions and Facilities

Watershed Park is an undeveloped park, designated for passive recreational uses such as walking, running, and bird watching. The park has no restroom facilities, and limited on-street parking is available. A network of maintained and unmaintained unpaved trails provides access to forested areas, Cochran Springs Creek, and the old borrow pit. Several benches are situated along the trails. Pathways on the floor of the now-defunct concrete reservoir form a peace symbol, adding some curiosity value to the site.

2.2.2 Demographics

Park users are mostly residents of the surrounding neighborhoods. Eastside Preparatory School, a private school near the park, uses the park as an outdoor classroom. There are several other schools in the vicinity, including Northwest University, Kirkland's Seventh Day Adventist School, Emerson High, and the International Community School. Many students use the park trails on their way to and from school, and the "peace reservoir" is a popular party spot, unfortunately resulting in a litter problem.



Figure 1. Restoration management units at Watershed Park.

2.3 Ecological Inventory

2.3.1 Methods

A rapid assessment protocol, developed by EarthCorps and Forterra's Green Cities Program, was used to collect baseline ecological data for each management unit at Watershed Park. This protocol is designed to provide a general overview of site characteristics and vegetative cover. Instead of setting up sampling plots, data is collected by walking through each management unit and assessing general conditions. For each management unit, data was collected on aspect, slope, soil properties, downed and standing dead wood, litter layer, canopy characteristics, understory species, invasive plant species cover, and restoration needs. For more detail on the protocol, see Appendix I.

2.3.2 General Site Characteristics

The general site characteristics are summarized in Table 1.

Topography

Upland areas in the east of the park are situated along the crest of a flat-topped hill, with management units 04 and 13 sloping gently to the east, and 01, 02, 08, 11, and 14, to the west. To the west of these areas, the topography drops more steeply, especially in 10 and parts of 05 and 06, which forms part of a 160-foot deep, forested ravine. This ravine opens up to the west, and contains the headwaters of Cochran Springs Creek (management unit 09 and 10).

The abandoned borrow pit in the southeast corner of the park (management unit 15) is characterized by steep slopes and a relatively flat floor that slopes gently to the southeastern corner. The pit is about 25 feet deep.

Vegetation Overview

With the exception of management units 15 and 16, Watershed Park is characterized as upland and riparian forest (Figure 2). Upland forests consist of a mosaic of conifer, deciduous, madrone-deciduous mixed, and conifer-deciduous mixed forest. Riparian forest occurs adjacent to the stream and seeps, and comprises a mosaic of wetland and drier forest communities.

Non-native invasive plant species are common in the forested areas, with the highest cover occurring along park edges, trails, and areas associated with significant disturbance such as those associated with the old water works, particularly in 09. Vegetative cover in the borrow pit

(management unit 15) consists predominantly of non-native invasive shrubs, with an understory of introduced grasses and herbs, and a few scattered trees. Management unit 16 comprises the old concrete reservoir surrounded by lawn.

Geology & Soils

The surface geology in the upland areas of the park consists predominantly of glacial till (Washington State Department of Natural Resources, 2014). Underlying the till is a thick deposit of glacial outwash sands. In the western part of the park, the layer of till has been eroded away by glacial melt water, leaving highly erodible sandy deposits exposed along the slopes.

The soils that formed in these glacial deposits have been mapped as Alderwood gravelly sandy loam and Indianola loamy fine sand (United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), 2013). These soils are generally moderately well- to well-drained. Minor components of other soil types can also be expected, especially in depressions, where finer grained sediments and organic matter often accumulate. Field observations confirmed that the soils in most management units consist of silt and/or sand (Table 2).

Because of the combination of steep slopes and sandy soils, often perched atop less pervious layers, and because of the history of landslides, large areas in the park have been identified by the City of Kirkland as medium to high risk for landslides and/or erosion (City of Kirkland, 2003). These areas include management units 06, 09, 10, and parts of 05, 07, 08, 16, 11, 14, and 15. Soils in these areas appear stable, but removal of vegetative cover and/or soil disturbance may result in slope instability. Rainwater running along the trail and then down the steep slope, has led to gully erosion at the northern end of management unit 06, further evidence of the highly erodible nature of the soils in this area.

Soils in parts of 09 and 13 are slightly compacted due to informal trails and, in the case of 09, stream access. In large areas of the borrow pit (management unit 15), soils are not compacted at the surface, but highly compacted a few inches below the surface as a result of historical mining activities. In addition, all the topsoil was removed during mining, leaving soils in this area depleted of organic matter, poor in nutrients, and prone to increasing plant drought stress. Much of the surface of management unit 16 is covered in concrete; soils underneath are likely highly compacted.

Table 1: General site characteristics

Management Unit	01	02	03	04
Area (acres)	3.31	9.07	3.14	6.48
Average aspect	west	west	west	east
Average slope	low	low	low	low
Elevation low/high (feet)	406/430	406/426	426/432	380/430
Exposure	partial sun	shade	shade	shade
Habitat type	deciduous forest	conifer-deciduous forest	conifer forest	conifer forest
CWD cover (%)	5-10	0-5	0-5	0-5
Snags	medium	low	low	low
Special features	trail	trail	trail	trail
Features of surrounding areas	park entrance	road, park entrance	road	I-405
Management Unit	05	06	07	08
Area (acres)	5.13	7.09	5.65	0.87
Average aspect	southwest	southwest	west	southwest
Average slope	medium	medium to high	low	low
Elevation low/high (feet)	140/200	156/300	402/226	396/418
Exposure	shade	partial sun	shade	partial sun
Habitat type	conifer-deciduous forest	riparian forest	madrone-deciduous forest	conifer-deciduous forest
CWD cover (%)	5-10	0-5	10-25	0-5
Snags	low	low	medium	low
Special features	trail; stream; power line corridor	trail; stream	trail	trail
Features of surrounding areas	Cross Kirkland Corridor; road	road	park entrance, road	park entrance; road

CWD=Coarse woody debris

Snags: low=1-5/acre; medium=6-20/acre; high=>20/acre

Table 1 continued: General site characteristics

Management Unit	09	10	11	12
Area (acres)	4.07	11.50	1.99	6.58
Average aspect	southwest	northwest to southwest	flat	west
Average slope	low	high	low	low
Elevation low/high (feet)	186/250	184/420	406/420	392/426
Exposure	partial sun	shade	shade	shade
Habitat type	riparian forest	conifer-deciduous forest	conifer-deciduous forest	conifer-deciduous forest
CWD cover (%)	5-10	0-5	5-10	0-5
Snags	low	low	low	low
Special features	seep; stream; trail; pipes & concrete blocks	ravine; trail	trail; hang-out spot	trail, gully
Features of surrounding areas				
Management Unit	13	14	15	16
Area (acres)	3.04	1.48	10.17	0.56
Average aspect	east	west	southeast	southeast
Average slope	medium	low to medium	low to high	low
Elevation low/high (feet)	190/250	336/390	350/418	412/424
Exposure	shade	shade	full sun	full sun
Habitat type	conifer-deciduous forest	conifer forest	shrub land	-
CWD cover (%)	0-5	5-10	0-5	0-5
Snags	low	low	none	none
Special features	encampment		trail; tool box; borrow pit	disused water reservoir
Features of surrounding areas	I-405		I-405	

CWD=Coarse woody debris

Snags: low=1-5/acre; medium=6-20/acre; high=>20/acre



Figure 2. Map of existing habitat at Watershed Park.

Table 2: Soil characteristics

Management Unit	01	02	03	04
Soil moisture	damp	damp	dry	dry
Soil stability	stable	stable	stable	stable
Soil texture	silt to sand	silt to sand	sand	sand
Compaction	none	none	none	none
Cause of compaction	-	-	-	-
Litter depth (inches)	½-1	½-1	½-1	½-1
Bare ground (%)	0-5	0-5	0-5	0-5
Management Unit	05	06	07	08
Soil moisture	damp	dry	dry	dry
Soil stability	stable	stable; gully along trail	stable	stable
Soil texture	silt to sand	sand	silt to sand	silt to sand
Compaction	light	none	none	none
Cause of compaction	trail	-	-	-
Litter Depth (inches)	>1	>1	½-1	<½
Bare ground (%)	0-5	0-5	0-5	0-5
Management Unit	09	10	11	12
Soil moisture	damp	dry	dry	dry
Soil stability	stable	stable	stable	stable
Soil texture	silt & sand	sand	silt to sand	sand
Compaction	light	none	light	none
Cause of compaction	trail and creek access	-	social trail and hang-out spot	-
Litter depth (inches)	>1	<½	<½	½-1
Bare ground (%)	0-5	0-5	5-25	0-5
Management Unit	13	14	15	16
Soil moisture	dry	dry	dry	dry
Soil stability	stable	stable	stable	stable
Soil texture	silt & sand	silt & sand	silt & sand	silt & sand
Compaction	none	none	none to heavy	heavy
Cause of compaction	-	-	trail, mining activities	reservoir
Litter depth (inches)	<½	<½	<½	0
Bare ground (%)	0-5	25-50	0-5	>50

Hydrology

Watershed Park is part of the Yarrow Creek drainage basin in the Lake Washington-Cedar River Watershed. Cochran Springs Creek originates in the ravine within the park, then flows west, entering Lake Washington at the Yarrow Bay Wetlands (The Watershed Company, 1998a; City of Kirkland, 2013b). The stream is fed by both stormwater runoff from the surrounding residential areas, and by small hillside seeps occurring towards the bottom of the ravine. These seeps form when rainwater, percolating downward through the thick layer of glacial outwash sand, reaches an underlying layer of less pervious silt/clay. It then travels laterally along this relatively impervious layer, surfacing along the slopes of the ravine. Small pockets of wetland are associated with the stream and seeps. Soils in the upland areas are generally dry (Table 2).

Wildlife

Watershed Park provides habitat for a variety of terrestrial wildlife, including mammals, birds, amphibians, and reptiles. Because this is a relatively large block of open space, it provides habitat for larger mammals such as deer and coyotes. Park neighbors have also reported bobcat sightings. The park is listed as a Puget Sound birding hotspot by the [Eastside Audubon Society](#) (Eastside Audubon Society, 2014). A list of wildlife species that can be expected in Kirkland parks can be expected in the [Kirkland's Streams, Wetlands and Wildlife Study Final Report](#) (The Watershed Company, 1998a).

Coho salmon and cutthroat trout have been observed in the lower reaches of Cochran Springs Creek, close to the Yarrow Bay Wetlands (The Watershed Company, 1998a). [Recent restoration](#) of the stream channel downstream of Lake Washington Boulevard, has improved conditions for upstream migration of adult fish, but fish passage barriers still exist at several spots, including where the stream crosses NE 38th Place and the Cross Kirkland Corridor (The Watershed Company, 2013).

2.3.3 Native Vegetation Characteristics

Native vegetation characteristics for each management unit are summarized in Table 3. Scientific names of plant species can be found in Appendix III. Note that only the dominant species present are recorded during the rapid assessment.

Management Unit 01 (Deciduous Forest)

The dominant overstory trees in the deciduous forest consist of bigleaf maple and red alder, with subordinate Douglas-fir and western redcedar. Overstory canopy cover is between 25% and 50%, and tree density is low. Regenerating tree density is less than 50 stems/acre, and in the case of conifers, comprises both naturally regenerating trees and trees planted during restoration. Species include western redcedar, western hemlock, Douglas-fir, red alder, and bigleaf maple. Shrub cover is between 50% and 75%. Dominant shrubs include salmonberry, red elderberry, beaked hazelnut, and low Oregon-grape. The herbaceous layer comprises western sword fern, bracken fern, and trailing blackberry, with cover between 25% and 50%.

Management Units 03, 04, and 14 (Conifer Forest)

The dominant trees in the conifer forest are Douglas-fir and western redcedar, with subordinate bigleaf maple, red alder and Pacific madrone. Canopy cover is more than 75%, and conifer tree density is high. Naturally regenerating trees commonly occur and consist mostly of western redcedar, western hemlock, bigleaf maple, and red alder. Native understory cover is variable and consists of salmonberry, red elderberry, salal, beaked hazelnut, low Oregon-grape, Indian plum, western sword fern, trailing blackberry, and stinging nettle.

Management Units 02, 08, 10, 11, 12, and 13 (Conifer-Deciduous Mixed Forest)

The dominant tree species in the conifer-deciduous mixed forest are bigleaf maple, Douglas-fir, western redcedar, red alder, black cottonwood, western hemlock, and Pacific madrone. Overstory canopy cover is generally >50%, and tree density between 50 and 150 stems/acre in most places. Regenerating conifer and deciduous tree densities are variable, and consist mostly of naturally regenerating trees. Species include western redcedar, western hemlock, bigleaf maple, red alder, bitter cherry, and cascara.

Native understory cover is variable, with the lowest values recorded in 08. Dominant shrub species include Indian plum, ocean-spray, salal, salmonberry, red elderberry, red huckleberry, red-flowering currant, thimbleberry, beaked hazelnut, and low Oregon-grape. Herbaceous species consist of western sword fern, bracken fern, large-leaf avens, stinging nettle, licorice fern, and trailing blackberry.

Management Unit 07 (Madrone-Deciduous Mixed Forest)

Management unit 07 consists predominantly of deciduous-madrone mixed forest, transitioning to conifer-deciduous mixed forest at its western extent. The dominant tree species are bigleaf maple and Pacific madrone, with subordinate Douglas-fir, western redcedar, red alder, and black cottonwood. Overstory canopy cover is between 50% and 75%, and tree density is between 50 and 150 stems per acre. Regenerating tree density is low (<50 stems/acre). Regenerating trees consist mostly of naturally regenerating western redcedar, western hemlock, bigleaf maple, and Douglas-fir.

Native understory cover is good, with shrub cover and herbaceous cover both between 50% and 75%. Dominant shrub species include Indian plum, salal, salmonberry, red elderberry, red huckleberry, beaked hazelnut, and low Oregon-grape. Herbaceous cover consists of western sword fern, bracken fern, stinging nettle, fringecup, and trailing blackberry.

Management Unit 05, 06, and 09 (Riparian Forest)

Although the management units classified as riparian forest are dominated by the stream and associated wetland pockets, these areas also include drier forests. The riparian forest in Watershed Park is mostly conifer-deciduous mixed forest. Tree canopy cover is between 50% and 75%; tree density is between 50 and 150 stems/acre, and even higher in places. The dominant overstory tree species are bigleaf maple, red alder, Douglas-fir, black cottonwood, and western redcedar. Regenerating trees are common and consist of western redcedar, western hemlock, Sitka spruce, red alder, and bigleaf maple.

Shrub and herbaceous species include vine maple, salmonberry, beaked hazelnut, salal, red huckleberry, devil's club, low Oregon grape, red elderberry, western sword fern, trailing blackberry, stinging nettle, fringecup, Pacific waterleaf, and lady fern.

Management Unit 15 (Shrubland)

There is very little native vegetation in the borrow pit. Most of the native vegetation is associated with a stand of Douglas-fir trees in the southeastern corner of the management unit. Overstory canopy cover is less than 10% and consists predominantly of Douglas-fir, with subordinate black cottonwood, red alder, Pacific madrone, and bigleaf maple. All of the Pacific madrone trees in this management unit appear to be diseased, unlike those in other parts of

the park. Regenerating trees include installed Douglas-fir, shore pine, and grand fir, as well as a naturally regenerating stand of bitter cherry in the northeastern corner of the pit.

Understory species provide less than 5% cover, are mostly associated with trees, or scattered along the slopes of the pit, and include red elderberry, Indian plum, tall Oregon-grape, western sword fern, trailing blackberry, and common cleavers. A number of shrubs, mostly red-flowering currant, ocean-spray, vine maple, and common snowberry, have been installed as part of restoration activities.

2.3.4 Non-Native Invasive Vegetation

Non-native invasive vegetation characteristics are summarized in Table 4. Scientific names of plant species can be found in Appendix IV.

Invasive overstory and regenerating trees occur throughout Watershed Park and include sweet cherry, sycamore maple, English holly, cherry-laurel, European mountain-ash, Portugal laurel, and common hawthorn. The abundance of regenerating invasive trees in management units 05, 06, and 07 is of particular concern.

The dominant shrub species is Himalayan blackberry, which occurs in varying amounts in all management units. Evergreen blackberry is also present, and, for the purposes of this report, is included with Himalayan blackberry. Scot's broom is a major component of the shrub layer in management unit 15, and also occurs in management unit 16. The only other shrub species is butterfly bush, an isolated occurrence of which is present in management unit 15.

Invasive herbaceous species are present in most management units, and include English/Atlantic ivy, herb Robert, yellow archangel, and creeping buttercup. Additional species found in the more exposed areas of management unit 15 include St. John's wort, Canada thistle, bull thistle, hairy cat's ear, tansy ragwort, and a variety of other introduced grasses and herbs. Plants included in the category of other introduced grasses and herbs include species such as sheep sorrel, common mullein, nipplewort, prickly lettuce, and oxeye daisy.

Table 3: Native vegetation characteristics

Management Unit	01	02	03	04
Overstory tree canopy cover (%)	25-50	50-75	>75	>75
Average overstory tree diameter (inches)	15-20	20-30	20-30	20-30
Overstory conifer tree density	low	medium	high	high
Regenerating conifer tree density	low	low	low	low
Overstory deciduous tree density	high	medium	low	low
Regenerating deciduous tree density	low	low	none	low
Shrub cover (%)	50-75	25-50	50-75	50-75
Herbaceous cover (%)	25-50	5-25	25-50	0-5
Dominant tree species	bigleaf maple, red alder, Douglas-fir, western redcedar	bigleaf maple, red alder, Pacific madrone, Douglas-fir, western redcedar, eastern cottonwood*	Douglas-fir, bigleaf maple, Pacific madrone, red alder	Douglas-fir, western redcedar, red alder, Pacific madrone, bigleaf maple
Dominant regenerating tree species	red alder, bigleaf maple, western redcedar, western hemlock, Douglas-fir	western redcedar, western hemlock, bigleaf maple	western redcedar, western hemlock	western redcedar, red alder
Dominant shrub species	salmonberry, red elderberry, beaked hazelnut, low Oregon-grape	Indian plum, salal, red elderberry, ocean-spray, salmonberry, low Oregon-grape	salmonberry, salal, red elderberry, beaked hazelnut, low Oregon-grape	salal, salmonberry, low Oregon-grape
Dominant herbaceous species	trailing blackberry, western sword fern, bracken fern	western sword fern, trailing blackberry	western sword fern, trailing blackberry	trailing blackberry, sword fern, bracken fern, stinging nettle

Stem density: low=0-50 stems/acre; medium=50-150 stems/acre; high=>150 stems/acre

*Native in the eastern and midwestern USA

Table 3 continued: Native vegetation characteristics

Management Unit	05	06	07	08
Overstory tree canopy cover (%)	50-75	50-75	50-75	50-75
Average overstory tree diameter (inches)	20-30	20-30	15-20	15-20
Overstory conifer tree density	high	low	low	medium
Regenerating conifer tree density	low	low	low	low
Overstory deciduous tree density	medium	high	high	medium
Regenerating deciduous tree density	low	low	medium	Low
Shrub cover (%)	5-25	50-75	50-75	5-25
Herbaceous cover (%)	25-50	25-50	50-75	0-5
Dominant tree species	bigleaf maple, Douglas-fir, western redcedar	bigleaf maple, red alder, western redcedar, Douglas-fir	bigleaf maple, Pacific madrone, black cottonwood, western redcedar, Douglas-fir,	western redcedar, Douglas-fir, red alder, bigleaf maple, Pacific madrone
Dominant regenerating tree species	western redcedar, bigleaf maple	western redcedar, western hemlock, bigleaf maple	western hemlock, bigleaf maple, western redcedar, Douglas-fir	western redcedar, bitter cherry, red alder
Dominant shrub species	vine maple, beaked hazelnut, salal, salmonberry, red huckleberry	devil's club, salal, Indian plum, salmonberry, red elderberry, beaked hazelnut, red huckleberry, low Oregon-grape	salmonberry, red elderberry, salal, red huckleberry, low Oregon-grape, beaked hazelnut, Indian plum	red elderberry, red huckleberry, Indian plum, red-flowering currant
Dominant herbaceous species	western sword fern, trailing blackberry	western sword fern, trailing blackberry, stinging nettle, fringecup	western sword fern, stinging nettle, trailing blackberry, fringecup, bracken fern	western sword fern, bracken fern, trailing blackberry, large-leaf avens

Stem density: low=0-50 stems/acre; medium=50-150 stems/acre; high=>150 stems/acre

Table 3 continued: Native vegetation characteristics

Management Unit	09	10	11	12
Overstory tree canopy cover (%)	50-75	>75	>75	25-50
Average overstory tree diameter (inches)	5-15	20-30	15-20	20-30
Overstory conifer tree density	low	medium	low	high
Regenerating conifer tree density	low	high	low	low
Overstory deciduous tree density	medium	high	high	low
Regenerating deciduous tree density	low	low	low	low
Shrub cover (%)	75-100	50-75	25-50	25-50
Herbaceous cover (%)	50-75	25-50	5-25	50-75
Dominant tree species	western redcedar, bigleaf maple, black cottonwood, red alder	Douglas-fir, western redcedar, bigleaf maple, black cottonwood, Pacific madrone, western hemlock	Douglas-fir, western redcedar, bigleaf maple, red alder	Douglas-fir, western redcedar, red alder, bigleaf maple, Pacific madrone, black cottonwood
Dominant regenerating tree species	western redcedar, Douglas-fir, Sitka spruce, red alder, bigleaf maple	western redcedar, Douglas-fir, bigleaf maple	western redcedar, bigleaf maple	western redcedar, bigleaf maple
Dominant shrub species	salmonberry, Indian plum, vine maple, red elderberry	salal, Indian plum, low Oregon-grape, salmonberry, beaked hazelnut	salal, red elderberry, Salmonberry, Indian plum, low Oregon-grape, red huckleberry	salal, salmonberry, beaked hazelnut, red elderberry, red-flowering currant, thimbleberry
Dominant herbaceous species	western sword fern, lady fern, giant horsetail, trailing blackberry	western sword fern, trailing blackberry, bracken fern	trailing blackberry, western sword fern, bracken fern	western sword fern, trailing blackberry, stinging nettle, licorice fern

Stem density: low=0-50 stems/acre; medium=50-150 stems/acre; high=>150 stems/acre

Table 3 continued: Native vegetation characteristics

Management Unit	13	14	15	16
Overstory tree canopy cover (%)	50-75	>75	0-25	0-25
Average overstory tree diameter (inches)	15-20	5-15	15-20	<5
Overstory conifer tree density	medium	high	low	none
Regenerating conifer tree density	low	high	low	none
Overstory deciduous tree density	low	low	low	none
Regenerating deciduous tree density	low	low	low	low
Shrub cover (%)	50-75	0-5	0-5	0-5
Herbaceous cover (%)	5-25	0-5	0-5	0-5
Dominant tree species	western redcedar, Douglas-fir, red alder, bigleaf maple, Pacific madrone	Douglas-fir, western redcedar, bigleaf maple, Pacific madrone	Douglas-fir, black cottonwood, red alder, bigleaf maple, Pacific madrone	-
Dominant regenerating tree species	western redcedar, bitter cherry, cascara	western redcedar, bigleaf maple	Douglas-fir, black cottonwood, Pacific madrone, shore pine, grand fir, bitter cherry	bigleaf maple
Dominant shrub species	salmonberry, Indian plum, beaked hazelnut	low Oregon-grape, beaked hazelnut, Indian plum	tall Oregon-grape, Indian plum, red elderberry, red-flowering currant, snowberry, ocean-spray	Indian plum
Dominant herbaceous species	trailing blackberry, western sword fern	western sword fern	western sword fern, trailing blackberry, common cleavers	trailing blackberry

Stem density: low=0-50 stems/acre; medium=50-150 stems/acre; high=>150 stems/acre

Table 4: Non-native invasive vegetation characteristics

Management Unit	01	02	03	04
Overstory stem density	low	low	low	none
Regenerating stem density	low	low	low	low
Shrub cover (%)	0-5	5-25	0-5	0-5
Herbaceous cover (%)	25-50	5-25	0-5	0-5
Dominant tree species	sycamore maple, sweet cherry	European mountain-ash, English holly, common hawthorn	English holly	-
Dominant regenerating tree species	sycamore maple, English holly, cherry-laurel	common hawthorn, cherry-laurel, English holly, Portugal laurel	English holly	English holly
Dominant shrub species	Himalayan blackberry	Himalayan blackberry	Himalayan blackberry	Himalayan blackberry
Dominant herbaceous species	yellow archangel, ivy, herb Robert, creeping buttercup	herb Robert, yellow archangel, ivy	yellow archangel, herb Robert	herb Robert, ivy
Management Unit	05	06	07	08
Overstory stem density	low	low	low	none
Regenerating stem density	medium	medium	medium	low
Shrub cover (%)	0-5	0-5	0-5	75-100
Herbaceous cover (%)	0-5	0-5	0-5	0-5
Dominant tree species	English holly	English holly	Portugal laurel, sweet cherry	-
Dominant regenerating tree species	English holly	English holly, common hawthorn	English holly, common hawthorn	English holly
Dominant shrub species	Himalayan blackberry	Himalayan blackberry	Himalayan blackberry	Himalayan blackberry
Dominant herbaceous species	ivy, herb Robert	herb Robert, ivy, yellow archangel	ivy, herb Robert, bluebells	creeping buttercup

Stem density: low=0-50 stems/acre; medium=50-150 stems/acre; high=>150 stems/acre

Table 4 continued: Non-native invasive vegetation characteristics

Management Unit	09	10	11	12
Overstory stem density	none	low	none	low
Regenerating stem density	low	low	low	low
Shrub cover (%)	5-25	0-5	5-25	5-25
Herbaceous cover (%)	5-25	0-5	0-5	0-5
Dominant tree species	-	English holly	-	English holly
Dominant regenerating tree species	Portugal laurel, English holly, European ash	English holly	sweet cherry	English holly
Dominant shrub species	Himalayan blackberry	Himalayan blackberry	Himalayan blackberry	Himalayan blackberry
Dominant herbaceous species	ivy, creeping buttercup	herb Robert	creeping buttercup, herb Robert, ivy	herb Robert, ivy
Management Unit	13	14	15	16
Overstory stem density	none	none	none	none
Regenerating stem density	low	low	medium	none
Shrub cover (%)	25-50	0-5	75-100	0-5
Herbaceous cover (%)	0-5	0-5	0-5	5-25
Dominant tree species	-	-	-	-
Dominant regenerating tree species	English holly, European mountain-ash	English holly, common hawthorn, Portugal laurel	common hawthorn, sweet cherry	-
Dominant shrub species	Himalayan blackberry	Himalayan blackberry	Scot's broom, Himalayan blackberry, butterfly bush	Himalayan blackberry, Scot's broom
Dominant herbaceous species	herb Robert	ivy, herb Robert	herb Robert, St. John's-wort, tansy ragwort, Canada thistle, yellow archangel, introduced grasses & herbs	creeping buttercup, herb Robert

Stem density: low=0-50 stems/acre; medium=50-150 stems/acre; high=>150 stems/acre

3. STEWARDSHIP

The primary management concerns at Watershed Park include:

- the presence of invasive plants which suppresses native plants, and do not provide good habitat for native wildlife
- the scarcity of mature conifer trees and lack of conifer tree regeneration in some areas
- the risk of erosion and/or landslides along steep, sandy slopes, especially in areas requiring large-scale removal of invasive species

The basic restoration approach followed by the Green Kirkland Partnership is invasive plant removal, followed by planting with native species. Planting a variety of native species is recommended, with planting palettes for forested areas including trees, particularly conifers, to regenerate the overstory, and a variety of tall shrubs and ground covers to increase structural and compositional diversity in the understory. Continued maintenance and monitoring will be required for several years to ensure restoration success.

3.1 Best Management Practices

The best management practices for Green Kirkland Steward restoration activities are summarized below. More detailed descriptions of these practices are available in the [Green Kirkland Steward Field Guide](#) (Green Cities Partnerships, 2014). Links to additional resources are included in the discussion below—website addresses for these and other resources are listed in Appendix II.

3.1.1 Invasive Species Removal

For help with the identification of invasive plants, as well as additional resources about removal and disposal methods, see the [King County Noxious Weed website](#) (King County, 2014). Most control methods need to be applied over several growing seasons to be effective. The best time to manually remove plants by digging or hand pulling, is between fall and spring, when the ground is moist and soft. Minimize soil disturbance to avoid germination of seeds of invasive species. Mulch bare ground, and plant cleared areas with native species, to discourage non-native plants from re-colonizing. Volunteers are restricted from using power tools or applying herbicide in City of Kirkland parks. Such treatments can only be applied by Parks staff or contracted crews. Best practices for removal of specific species are as follows:

Canada Thistle

Canada thistle is a perennial herb that reproduces both by seed and vegetatively. Seedlings can be removed by hand pulling or digging. Due to the extensive root system of this plant, removing established plants by digging is not feasible; small root fragments left behind can grow into new plants. Instead, cut plants close to the ground once flower buds have formed. Cut the regrowth each time the buds appear. Over time, this will weaken the roots. Bag and remove cut plants from the site.

Herbicides, applied during the growing season, at or after the bud stage, are also effective, but avoid spraying drought-stressed plants. These two approaches can be combined for maximum effectiveness.

Creeping Buttercup

Creeping buttercup is a low-growing perennial plant species. Use a shovel or hand tool to dig up plants; be sure to remove all roots, runners, and growing points. Buttercup can sprout from nodes along stem and root fragments. Incomplete digging or use of a cultivator or other cutting tools may make the problem worse. Large, very dense patches can be sheet-mulched. Spreading mulch over a layer of cardboard is more effective than spreading mulch alone.

Herb Robert

Herb Robert is a low-growing winter or spring annual that reproduces solely by seed. Pull plants by hand to remove; grasp the plant firmly at the base to remove the roots. Monitor the site throughout the growing season and remove any new plants. Large patches can be covered with sheet mulch.

Plants without seeds or mature flowers can be composted on site. Put flowering plants, and those beginning to set seed, into a trash bag for disposal. If plants are in full seed it may be better to leave them in place until the next season when the risk of seed dispersal is lower.

Suckering Invasive Trees & Shrubs

This category includes Portugal laurel, cherry laurel, sweet cherry, English holly, butterfly bush, and common hawthorn. Cutting down these trees without removing the roots causes it to send up suckers, exacerbating the problem. Small, young plants may be hand pulled or removed using a Weed Wrench™ or similar tool. Note that freshly cut stems or branches of some species can re-root if in direct contact with the soil.

Mature invasive trees requires chemical removal methods, including cut-stump or lance treatment. Cut-stump treatment consists of application of herbicide to the cut portion of the trunk immediately after cutting. Lance treatment is a newer, less labor-intensive method that involves injecting herbicide shells into the base of the tree trunk.

English/Atlantic Ivy

Ivy is an evergreen vine that spreads both by seed and by rooting at nodes along the vine. Physical removal is the most effective way to control ivy. The top priority is to create lifesaver or survival rings around infested trees. Start by cutting ivy vines at shoulder height and at the base of the tree. Remove all ivy from shoulder-height down. Do not attempt to pull down vines from higher up the tree; they will die and decompose in time. Pulling vines down from high branches can be dangerous and possibly damage the tree.

Clear ivy in a radius of at least five feet around trees by grubbing out ivy roots. Remove extensive swathes of ivy on the ground by clipping the edges of a five to ten-foot-wide section. Starting from one edge, continue clipping and digging, while rolling the mat of ivy into a log.

Small patches of ground-growing ivy can be removed by loosening the soil with a shovel and pulling by hand. Ivy can be composted on site but make sure that removed plant material is not in contact with the soil.

Field and False Hedge Bindweed

Hand pull at least three times per year (early growing season, mid-summer, and late summer) for several growing seasons. Avoid digging or tilling the soil around the roots. Smothering plants with mulch, black plastic or plastic-fiber mats (geotextiles) is another option, but the covering has to be kept in place for several years. As an interim measure, clear all the bindweed from the native plants first, or at minimum, clip the bindweed away from the base of plants that are trying to establish.

Himalayan and Evergreen Blackberry

Himalayan and evergreen blackberry are robust, thicket-forming shrubs that spread both by seed and vegetatively from root and stem fragments. Removal of Himalayan and evergreen blackberry consists of a two-step process: cutting the canes, followed by grubbing out the root balls. Blackberry canes are cut about one foot above the ground, using loppers or pruners. Root balls are then dug up completely, using a shovel, to prevent regrowth. Removed plant material

can be composted on site, but avoid contact with damp soil. To minimize soil disturbance along steep slopes, cutting canes and dabbing with herbicide may sometimes be a more appropriate treatment in such areas.

Scot's Broom

Scot's broom is an invasive shrub that is difficult to eradicate, both because of its substantial and long-lived seed bank, and because it changes the chemistry of the soil, creating conditions unfavorable for re-establishment of native plants. Older plants, i.e. those that are no longer green at the base, can be removed by cutting, using loppers or a pruning saw. This is most effective if done during late summer when plants are drought-stressed. Younger plants are likely to resprout and can be pulled up by hand or, in the case of older seedlings, a Weed Wrench™ or similar tool. Removed vegetation can be disposed of on compost piles.

Tansy Ragwort

Tansy ragwort is typically a biennial plant. It reproduces by seed, but can also establish from root fragments. This plant is a prolific seed producer; seeds are wind-dispersed and can remain viable in the soil for many years. Tansy ragwort grows in full sun, but can also tolerate semi-shade.

Landowners are required by state law and by the King County Noxious Weed Control Board to control infestations of tansy ragwort.³ Isolated plants or small populations can be removed by hand pulling or digging up plants. This is a toxic plant—wear gloves and protective clothing when handling. Dispose of plants with flower stalks by bagging and removing. For larger infestations, herbicide control may be necessary.

Yellow Archangel

Yellow archangel is a fast-growing, shade-tolerant, perennial ground cover with a shallow root system. Plants can be removed manually by hand pulling or digging when the soil is moist. Take care to remove all plant fragments as yellow archangel can resprout from small root and stem fragments. Do not compost on site. Herbicide and sheet mulching are alternative approaches.

³ According to the [King County Noxious Weed Control Board](#), control means to prevent the dispersal of all propagating parts capable of forming a new plant. That means not allowing weeds to reproduce, usually by not letting them go to seed.

St. John's Wort

St. John's wort is a perennial herb that spreads both by seed, and by above- and underground stems. Seeds remain viable in the soil for up to 10 years. This is a difficult plant to eradicate because of its extensive root system and long-lived seeds. Repeated pulling, digging, or herbicide application is required for successful control of St. John's weed.

3.1.2 Composting

Composting on site is cost effective, helps to leave organic material and nutrients on site, and provides excellent habitat for wildlife, but may not be appropriate for all plant species and/or sites (Green Cities Partnerships, 2014). Guidelines for composting removed plant material are available in the [Green Kirkland Steward Field Guide](#).

3.1.3 Planting & Mulching

Best Management Practices for planting and mulching are available in the [Green Kirkland Steward Field Guide](#). Plant between late fall and early spring to ensure sufficient soil moisture for plant establishment. It may be necessary to water plants during the dry summer months for the first three years after planting.

Mulching around plants serves several purposes: it helps to conserve soil moisture, moderate soil temperatures, deter weed growth, and prevent soil erosion. Organic mulches, such as wood chips, also add organic matter and some nutrients to the soil.

When it comes to plant selection there are a number of factors to consider: In natural ecosystems, specific assemblages of plant species tend to grow together, typically in areas with similar environmental conditions and disturbance history. When developing a plant palette for a site, consider site conditions, particularly soil texture and moisture, slope aspect and position, and exposure (sun or shade). Bear in mind that environmental conditions can change over short distances. Also take into account surrounding land uses, especially in urban areas. For example, it may be necessary to limit plant selections to low-growing species to preserve view corridors, or to maintain visibility along trails for safety reasons.

Then identify the target plant community you will use as a reference. This target plant community could be based on field observations from a nearby relatively undisturbed site, published information, or a combination. Several resources to help with plant selection are listed in Appendix II.

3.1.4 Special Considerations

Special care should be taken when working in geologically hazardous areas, such as steep slopes, or in sensitive areas such as in wetlands or along streams and lakes, or their buffers:

Slope Management

Removal of vegetation and soil disturbance along slopes may trigger erosion or landslides. The risk of erosion or landslides depends on many factors, including slope angle and length, soil properties, underlying geology, type and amount of vegetative cover, and the presence of water on the slope. Where large areas have been cleared of invasive plants, the slope may need to be stabilized. Consider the following best management practices:

- Select invasive removal techniques that involve the least amount of soil disturbance.
- Where slopes are not too steep, apply wood chip mulch. If the slopes are too steep to retain mulch, commercially available erosion control products can be applied. WoodStraw® works well on slopes with a grade of up to about 50% (~ 27°); on steeper slopes, coir matting is an appropriate choice.
- Place large woody debris across the slope to divert water flowing down the slope.
- Establishing vegetation on slopes offers long-term protection against erosion. Live-staking with species like willows is a way to establish vegetation cover in a relatively short time, provided there is enough soil moisture. Select plant species with fibrous root systems that will help bind the soil. Plant trees at the crest or toe of the slope; avoid installing trees that will grow to a large size along the slope itself. Plant species appropriate for slopes are listed on the State of Washington Department of Ecology [Slope Stabilization and Erosion Control](#) website.

For safety reasons, volunteers are not permitted to work on slopes steeper than 40%. When working in areas with medium to high slopes, stewards should discuss appropriate treatments with Green Kirkland Partnership staff.

Wetlands, Streams, and Lakes

Plants in wetlands and adjacent to streams and lakes perform many functions. Vegetation slows down surface runoff, allowing water to soak into the soil, and intercepts sediments, excess nutrients, and other pollutants. Plant roots also bind the soil, helping to reduce erosion. Trees

contribute woody debris to streams, improving fish habitat and slowing down stream flow, and trees and shrubs create shade, reducing stream water temperatures. Vegetation in these areas also provides food and shelter for wildlife.

Take care to minimize impacts to these sensitive areas during restoration treatments by following these general guidelines:

- Stewards should consult with Green Kirkland staff before conducting first time removal of invasive plants or planting within 10 feet of the stream channel or in particularly wet, muddy, or erodible areas of wetlands. It may be necessary to check with the Public Works and/or Planning Departments before working in these areas.
- Limit the number of volunteers working in these areas to reduce the amount of foot traffic.
- Avoid clearing large areas of vegetation at one time, especially in areas sloping down towards the stream channel.
- Minimize soil disturbance during manual invasive plant removal, and cover exposed areas of soil with a layer of mulch.
- Replant exposed areas by installing native plant species that grow fast and have good soil-binding properties. Live stakes of native willows, red-twig dogwood, black cottonwood, black twinberry, Pacific ninebark, red elderberry, and salmonberry work well in relatively wet areas. Consider including native sedges, grasses, and rushes.
- Limit herbicide use in wet areas. If herbicide use cannot be avoided, check permitting requirements and use herbicides specially formulated for such areas. Remember that such treatments can only be applied by Parks staff or contracted crews.

Power Line Corridors

There are restrictions on the type and height of vegetation in power line corridors, both for safety reasons, and to provide access for maintenance. Electrical utility providers do regular maintenance in power line rights-of-way. This includes removal or pruning of trees under or next to power lines. When working in power line corridors, please follow the following general guidelines:

- To allow maintenance and repair crews access to power line poles, do not plant trees, shrubs, or vines directly adjacent to or on poles. Keep vegetation at least 10 feet away from poles (Puget Sound Energy, 2012; Seattle City Light, 2013).

- Trees or shrubs planted directly under or within 20 feet of power lines should have a mature height of less than 25 feet. Trees with a mature height of 40 feet or less can be planted between 20 and 50 feet from power lines. Plant trees with a mature height of greater than 40 feet, at least 50 feet away from power lines (Puget Sound Energy, 2012; Seattle City Light, 2013).

Stewards should consult with Green Kirkland staff before working along power line corridors to coordinate vegetation management in these areas with maintenance activities by utility providers. For more information on vegetation management in power lines rights-of-way, refer to the [Puget Sound Energy](#) and/or [Seattle City Light](#) vegetation management web pages.

3.2 Recommendations

Restoration status and considerations, as well as recommendations for each management unit, are summarized in Tables 5 and 6, respectively. Approximately 18% of the total area targeted in Watershed Park have already been enrolled in restoration.

Management Unit 01

Due to the lack of existing evergreen trees, and because it borders on developed areas on two sides, management unit 01 will require more intensive management than most other restoration sites in Watershed Park. About 86% of this management unit has already been enrolled in restoration.

The target habitat for this management unit is conifer-deciduous mixed forest. The main concerns are the paucity of conifer trees and extensive cover of non-native groundcover plants, particularly yellow archangel. Recommendations for this management unit include the following:

- Remove of invasive non-native tree species.
- Keep removing invasive understory species, particularly yellow archangel and ivy.
- Install native conifers, particularly Douglas-fir and grand fir, in more exposed areas, and western hemlock and western redcedar in shadier spots.
- Plant additional forest understory species. Appropriate species for planting will be determined by local site exposure and soil conditions. Native plant species already growing in less-disturbed areas of the forest are well-adapted to site conditions and are good first choices for restoration plantings (see Table 3).

- Ring-mulch installed plants. Consider the application of sheet mulch in more exposed areas.
- Water installed plants during the first 3 summers after installation, if necessary.

Management Units 03, 04, and 14

The target habitat for these management units is conifer forest. None of these areas has been enrolled in restoration, and all are easily accessible to volunteers. The forest in these areas is generally in good condition. Recommendations include mainly:

- removal of invasive tree species
- spot treatment of invasive understory species, particularly Himalayan blackberry, yellow archangel, and ivy

Management units 02, 08, 11, 12, and 13

The target habitat for these areas is conifer-deciduous mixed forest. Apart from small portions of 02 and 08, most of these areas have yet to be enrolled in restoration. All of these areas are accessible to volunteers. The presence of invasive plant species, especially Himalayan blackberry, is a significant problem, particularly in management units 08 and 13. Management recommendations include:

- removal of invasive tree species
- control of invasive understory species, particularly Himalayan blackberry, and to a lesser extent, yellow archangel and ivy
- planting of native conifers, especially western hemlock and western redcedar
- large scale planting of forest understory species where extensive clearing of invasive plants species have occurred
- mulching of installed plants
- summer watering of plants for the first 3 years after installation may be necessary

Management unit 10

The target habitat for management unit 10 is conifer-deciduous mixed forest. Most of this management unit has not yet been enrolled in restoration. Because of the steep slopes and the history of landslides, this area is not accessible to volunteers. Invasive species cover in this area is relatively low. Management recommendations are limited to:

- removal of invasive tree species

- spot removal of Himalayan blackberry and herb Robert
- erosion control where necessary

Management unit 07

The target habitat for this management unit is madrone-conifer mixed forest. All of management unit 07 has been enrolled in restoration. Invasive plant cover is low, but because of this unit's location at the edge of the park, and along one of the main trails into the park, ongoing maintenance will always be necessary. Management recommendations include:

- removal of invasive tree species
- spot treatment of invasive understory species, particularly Himalayan blackberry and ivy
- installation of additional conifers where necessary

Management units 05, 06, and 09

Management units 05, 06, and 09 consist of riparian forest. These areas are characterized by large variations in environmental conditions, particularly in terms of soil moisture. For the most part the target habitat is conifer-deciduous mixed forest, but plant palettes should be tailored to local environmental conditions, especially where wetter soil conditions occur in the vicinity of the stream or along hillside seeps.

Apart from a few small areas, mostly along the trails, management units 05, 06, and 09 have not yet been enrolled in restoration. Parts of the forest in these areas, particularly in management unit 09, as well as sections of 05 and 06 close to roads and corridors, is highly degraded. Less disturbed parts of 05 and 06 are in good condition.

Parts of these management units are accessible to volunteers, but work along steep slopes in the northern to northeastern part of 06 should be left to contracted crews or City of Kirkland staff. Stewards should also consult with Green Kirkland staff before working along the stream corridor, especially in wetter areas and along the power line corridor. Management recommendations include:

- removal of invasive tree species
- control of invasive understory species, particularly Himalayan blackberry and ivy, and to a lesser extent, yellow archangel
- planting of native conifers, especially western hemlock and western redcedar, in 09

- large-scale planting of forest understory species where extensive clearing of invasive plants species have occurred
- mulching of installed plants

Management unit 15

Attempts to restore the borrow pit site to forested conditions have met with limited success. The combination of nutrient-poor, droughty soil conditions, and pressure from established invasive plant species, have resulted in poor survival of native tree species, especially Douglas-fir, western hemlock, and western redcedar. Drought-tolerant shrubs such as snowberry, oceanspray, red-flowering currant, and vine maple have fared slightly better—survival of these species are around 50%. Amending the soil with biosolids compost resulted in slightly improved early survival rates, but also increased competition from non-native plant species, both due to tilling of the soil and higher soil nutrient levels (Henry, 2012).

More recent attempts have focused on areas where there is some established canopy cover, mostly in the southeastern corner of the pit, combined with the selection of native tree species more tolerant of drought and nutrient-poor soils, particularly shore pine, Garry oak, and Ponderosa pine. As these shrubs and trees become established, they will ameliorate site conditions by creating canopy cover and adding organic matter to the soil (Penberthy, 2013).

The target habitat for this management unit is conifer-deciduous mixed forest, plant palettes should include mostly species typical of drier forests and woodlands in the Puget lowlands (refer to the description of Westside Oak and Dry Douglas-fir Forest and Woodlands on the [Northwest Habitat Institute website](#) (Northwest Habitat Institute, 2011)

Management recommendations include:

- clearing invasive species, especially those of large stature such as Scot's broom and Himalayan blackberry, from around existing native vegetation
- prioritizing management of difficult- to-control invasive species which are present in relatively small amounts, particularly Canada thistle
- management of tansy ragwort; control of this species is required by King County
- installation of native plants in cleared areas, focusing on drought-tolerant species
- renewing efforts to provide supplemental water to installed plants until they are established
- mulching around installed plants

Soil disturbance should be minimized as far as possible during invasive removal and plant installation, both to avoid stimulating germination of seeds of predominantly non-native species in the seed bank, and to avoid erosion along the exposed, fairly steep slopes of the pit. Manual removal of thickets of blackberry from along pit slopes will result in large areas of exposed soil. Due to the steepness of these slopes and poor soil structure, these areas will be prone to erosion, necessitating the use of erosion control treatments in some areas.

Soil compaction limits root penetration and causes poor drainage resulting in poorly aerated, waterlogged surface soils in the winter, and very dry soils in the summer. To allow successful plant establishment it may be necessary to manually loosen the soil by digging or tilling (Batey, 2009) where soil is highly compacted. Apply a thick layer of wood chip mulch to suppress germination of weed seeds in these areas.

Management Unit 16

No final decision has been made as to whether this management unit will be restored to forested conditions. If plans to restore this area do go ahead, the target habitat will be conifer-deciduous forest. Restoration of this area will require removal of concrete, tilling the soil to alleviate compaction, and filling of the reservoir with soil before planting. Most of these tasks will not involve volunteers.

Table 5: Restoration status and accessibility.

Management Unit	01	02	03	04
Target habitat	conifer-deciduous mixed forest	conifer-deciduous mixed forest	conifer forest	conifer forest
Area in restoration (%)	86	8	0	0
Accessibility	volunteers	volunteers	volunteers	volunteers
Special considerations	-	-	-	-
Management Unit	05	06	07	08
Target habitat	riparian forest	riparian forest	madrone-conifer mixed forest	conifer-deciduous mixed forest
Area in restoration (%)	0	6	100	12
Accessibility	volunteers	volunteers/crew/staff	volunteers	volunteers
Special considerations	stream; power line corridor	steep slopes; stream		
Management Unit	09	10	11	12
Target habitat	riparian forest	conifer-deciduous mixed forest	conifer-deciduous mixed forest	conifer-deciduous mixed forest
Area in restoration (%)	1	2	0	0
Accessibility	volunteers/crew/staff	crew/staff	volunteers	volunteers
Special considerations	streams; seeps & wetlands; landslide scar	steep slopes; landslide scar	-	-
Management Unit	13	14	15	16
Target habitat	conifer-deciduous mixed forest	conifer forest	conifer-deciduous mixed forest	conifer-deciduous mixed forest
Area in restoration (%)	0	0	42	0
Accessibility	volunteers	volunteers	volunteers	volunteers/crew/staff
Special considerations	-	-	-	concrete reservoir

Table 6: Management recommendations for each management unit.

Management Unit	Control of invasive plants by manual removal	Ivy lifesaver rings	Invasive tree removal		Slope stabilization	Plant installation
			Manual removal	Herbicide treatment		
01	large scale	x	x	x		x
02	large scale	x	x	x		x
03	spot treatment		x	x		
04	spot treatment		x	x		
05	spot treatment	x	x	x		x
06	spot treatment		x	x	x	x
07	spot treatment	x	x	x		
08	large scale	x	x	x		x
09	large scale	x	x	x		x
10	spot treatment		x	x	x	
11	large scale	x	x	x		x
12	large scale	x	x	x		x
13	large scale		x	x		x
14	spot treatment	x	x	x		
15	large scale		x	x	x	x
16	to be determined					



Figure 3. Map of target habitat at Watershed Park.

3.3 Materials

To request materials for restoration activities, fill out a [Tools, Materials & Event Request Form](#) (click on the Steward Resources link on the [GreenKirkland.org](#) webpage) at least three weeks in advance of the event, and email to greenkirkland@kirklandwa.gov.

Tools

There are two lock boxes with tools at Watershed Park, one in management unit 08 and one in 15. For larger volunteer events, the Green Kirkland tool trailer can be requested. An inventory of tools and equipment in the trailer is available at [GreenKirkland.org](#) under [Steward Resources](#).

Mulch

For help on calculating the amount of wood chip mulch to order, consult the [Green Kirkland Steward Field Guide](#). Other types of mulch commonly used include burlap sacks and cardboard, usually in combination with wood chip mulch.

Plant material

Guidelines for calculating the number of plants needed, as well as tools for selecting appropriate plant species, are available in the [Green Kirkland Steward Field Guide](#). A handy calculator for estimating the quantity of plants needed is available on the [Sound Native Plants Nursery website](#).

3.4 Volunteers

Students and staff from Eastside Preparatory School have been restoring the borrow pit area (management unit 15) since 2008. The first volunteer Green Kirkland Steward at Watershed Park was enrolled in 2012, and has been leading smaller restoration events in the rest of the park. Volunteers at restoration events include park neighbors and community members, youth groups, faith-based groups, and students filling community service hours. Larger events, attracting between 50 and 150 volunteers, are generally held on an annual basis. Volunteers for these larger events are usually recruited and managed by contracted environmental organizations or professionals.

3.5 Monitoring

Monitoring is an essential step in restoration, particularly in urban areas surrounded by development. Such areas experience ongoing disturbance and are prone to invasion by non-native, invasive plant species. Monitoring can take different forms, including photo documentation, visual inspection, and scientific monitoring.

Visual inspection

The most basic form of monitoring is simply to walk through a site and do a visual inspection. Factors to assess include plant mortality, invasive plant cover, or anything else that may affect restoration success. Target performance standards are site and species dependent, but for most invasive plant species, cover of more than approximately 5-10% will trigger maintenance actions. The benchmark for survival of installed trees and shrubs is ~85%. High mortality should lead to a reevaluation of restoration methods and corrective actions such as supplemental watering or replanting with species better able tolerate site conditions. In addition to regular site visits by Green Kirkland Stewards, City managers and/or staff visit sites at least once a year as part of developing annual work plans.

Photo documentation

Photo documentation is a good method of tracking development of restoration sites. This entails establishing photo points and taking repeated photos of the same area over time. The goal for Green Kirkland sites is to establish at least one photo point per management unit. When establishing photo points and taking photos consider the following:

- Along with photos, provide walking directions to the photo point location and a detailed description of the surrounding area. Include information about landmarks that will make it easier to relocate the site. Also, record the direction of shooting, the park name, management unit number, the date, and the name of the photographer.
- Repeat photos should be taken at the same time of year to allow for meaningful comparisons. Include notes on significant developments or activities at the site that occurred since the previous photo was taken.
- Try to take repeat photos at the same time of day. If possible, take the photo facing south, with the sun behind you and the sunlight shining on the landscape facing you. This helps prevent glare and avoid direct sunlight in the shot. Taking photos on a cloudy but bright day can help avoid strong shadows.

- To ensure consistency when taking repeat photos, take along a copy of photos from previous years and use it to compare with the field of view.
- Submit photos and recorded information to Green Kirkland Partnership staff for archiving.

Scientific monitoring

Scientific monitoring involves setting up permanent plots and collecting quantitative data over time. This method is more labor intensive and rigorous than visual inspection or photo documentation, but does allow for in-depth evaluation of site conditions and the effectiveness of management techniques. The Green Cities program has developed a set of [Standardized Monitoring Protocols](#) (Green Cities Partnerships, 2012). Trained volunteers, staff, or contractors collect data on plant survival, vegetative cover, tree density, coarse woody debris, and soil conditions. A permanent restoration plot was installed at Watershed Park by EarthCorps and trained volunteers in management unit 01 during summer 2012, and a second plot 02 during 2013 (see Figure 1 for locations). Monitoring reports are available from Green Kirkland staff upon request.

3.6 Timeline

Restoration at Watershed Park has been ongoing since 2007. Large areas targeted for restoration have yet to be enrolled. Due to the park's location in an urban environment, and continued pressure from invasive plant species, areas already in restoration will require many years of ongoing maintenance and monitoring.

The timeline for restoration will depend largely on the availability of resources. Maintenance of areas already in restoration should take precedence over enrolling new areas in restoration. When enrolling new areas in restoration, priority should be given to sites contiguous with areas already in restoration. Restoration efforts in the foreseeable future will likely be concentrated in management units 07, 01, 02, 08 and 15. An annual work plan, created towards the beginning of each calendar year by Stewards, Green Kirkland Partnership, and other City of Kirkland staff, and contracted crews, lays out what work is planned for each management unit for the following year.

4. REFERENCES

- Batey, T. (2009). Soil compaction and soil management – a review. *Soil Use and Management*, 25, 335–345.
- City of Kirkland. (2003). *Natural Resource Management: Landslide and Seismic Hazard Areas Map*. Retrieved March 06, 2014, from City of Kirkland: http://www.kirklandwa.gov/depart/Planning/Code_Updates/Natural_Resources_Management.htm?
- City of Kirkland. (2008). *Green Kirkland Partnership: 20-Year Forest Restoration Plan*. Retrieved March 6, 2014, from City of Kirkland: <http://www.kirklandwa.gov/Assets/Parks/Green+Kirkland+Partnership+PDFs/Green+Kirkland+Partnership+20+year+plan.pdf>
- City of Kirkland. (2013a). *City of Kirkland Zoning Map*. Retrieved March 06, 2014, from [kirklandwa.gov](http://www.kirklandwa.gov), Information Technology Department, GIS Maps: <http://www.kirklandwa.gov/Assets/IT/GIS/Kirkland+Zoning+Map.pdf>
- City of Kirkland. (2013b). *Standard Maps: Sensitive Areas Map*. Retrieved March 06, 2014, from [kirklandwa.gov](http://www.kirklandwa.gov), Information Technology Department, GIS Maps: <http://www.kirklandwa.gov/Assets/IT/GIS/Kirkland+Zoning+Map.pdf>
- City of Kirkland. (2014). *Standard Maps: City Neighborhood Map*. Retrieved March 05, 2014, from [kirklandwa.gov](http://www.kirklandwa.gov), Information Technology Department, GIS Maps: <http://www.kirklandwa.gov/Assets/IT/GIS/Kirkland+Neighborhood+Area+Map.pdf>
- Eastside Audubon Society. (2014). *Puget Sound Hot Spots*. Retrieved April 30, 2014, from Eastside Audubon Society: <http://eastsideaudubon.org/birding/puget-sound-hot-spots/hotspots/watershed-park>
- Ely, A. (1975). *Our Foundering Fathers*. Retrieved March 29, 2014, from Kirkland Heritage Society: <http://kirklandheritage.org/Foundering-Fathers-4-5-3.pdf>
- Green Cities Partnerships. (2012). *Monitoring: Data Collection methods*. Retrieved April 09, 2014, from Forterra: http://www.forterra.org/files/Monitoring_Field_Guide_2013.pdf
- Green Cities Partnerships. (2014). *Steward Field Guide*. Retrieved March 26, 2014, from Green Kirkland Partnership, Steward Resources Page:

[http://www.kirklandwa.gov/Assets/Parks/Green+Kirkland+Partnership+PDFs/GKP+Fores
t+Steward+Field+Guide.pdf](http://www.kirklandwa.gov/Assets/Parks/Green+Kirkland+Partnership+PDFs/GKP+Fores
t+Steward+Field+Guide.pdf)

Henry, C. (2012). *History of Watershed Park Restoration Project*.

King County. (2014). Retrieved March 26, 2014, from King County iMap: Interactive Mapping Tool: <http://www.kingcounty.gov/operations/GIS/Maps/iMAP.aspx>

King County. (2014). *Noxious Weeds in King County, Washington*. Retrieved March 26, 2014, from King County Noxious Weeds: <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds.aspx>

Northwest Habitat Institute. (2011). *Wildlife-Habitat Types*. Retrieved May 06, 2014, from Northwest Habitat Institute: <http://www.nwhi.org/index/habdescriptions>

Penberthy, C. (2013). *Watershed Park Borrow Pit Stewardship Plan*. Submitted in partial fulfillment of the requirements for the degree of Masters in Environmental Horticulture, University of Washinton, Seattle WA.

Puget Sound Energy. (2012). *Vegetation Management*. Retrieved April 30, 2014, from Puget Sound Energy: http://www.pse.com/safety/Tree-Trimming/Documents/1224_VegetationManagement.pdf

Seattle City Light. (2013). *Seattle City Light*. Retrieved April 30, 2014, from Vegetation Management: <http://www.seattle.gov/light/vegmgmt/>

The Watershed Company. (1998a). *Kirkland's Streams, Wetlands and Wildlife Study (Part 1)*. Retrieved March 26, 2014, from City of Kirkland, Planning & Community Development: <http://www.kirklandwa.gov/Assets/Planning/Planning+PDFs/Watershed+Report+July+1998+Part+1.pdf>

The Watershed Company. (2013, March 2013). *Currents: Environments, Landscapes, Interpretation. How many times have you tried solving a problem that takes 34 years to solve?* Retrieved March 26, 2014, from The Watershed Company: <http://www.watershedco.com/blog/how-many-times-have-you-tried-solving-a-problem-that-tak/>

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). (2013). *Web Soil Survey*. Retrieved March 06, 2014, from Web Soil Survey: <http://websoilsurvey.nrcs.usda.gov/app/>

Washington State Department of Natural Resources. (2014). *GIS Data: Surface Geology*. Retrieved March 06, 2014, from Washington State Department of Natural Resources: http://www.dnr.wa.gov/ResearchScience/Topics/GeosciencesData/Pages/gis_data.aspx

APPENDIX I. RAPID ECOLOGICAL ASSESSMENT PROTOCOLS

These rapid assessment protocols were designed to provide a general overview of the conditions present in each management unit within a park. For each management unit, data collection includes a Site Characteristics Inventory and a Vegetation Inventory.

Site Characteristics Inventory

This inventory assesses attributes such as slope, aspect, soil type, and other features of the management unit that can aid in creating a restoration plan.

Aspect

Aspect refers to the direction in which water flows off the site. Options include N, NE, E, SE, S, SW, W, NW, or Flat. A compass is used to determine the predominant direction of slope on the site.

Slope

This is a measurement of slope angle. It is measured using an electronic or mechanical clinometer, or it can be visually estimated. Use the following categories:

- low, which is equivalent to 0-8% or 0-5°
- medium, which is equivalent to 8-25% or 5-14°
- steep, which is equivalent to >25% or >14°

Soil Moisture

Soil moisture refers to the general moisture conditions of the soil as they appear at the time of measurement, or are most likely to appear on any given summer day. Options include standing water, saturated soil, damp soil, or dry soil.

Soil Type

Soil type refers to the dominant size of mineral particles in the sample (sand, silt, clay, or gravel). A small sample of soil is taken from several areas and examined. Sandy soils feel gritty. Clay soils feel sticky. Silty soils feel smooth or slippery. Muck is a special category of soil that consists mostly of decomposed organic matter. Muck is usually black and found in wetlands.

Soil Compaction

Soil compaction occurs when the mineral particles in the soil are compressed, often as a result of foot traffic, or vehicles and heavy equipment moving over the soil. During the site assessment, the presence of areas compacted as a result of human activity, such as trails, is

recorded. The general degree of compaction in each management unit is estimated using the following categories: none, light, moderate, or heavy.

Soil Stability

The assessment of soil stability consists of looking for evidence of soil movement in the management unit. Categories include none, erosion, slumping, or slides.

Litter Depth

A pencil or small ruler is used to probe the depth of the litter layer on top of the soil. The depth of the litter layer is recorded in one of the following categories: <1/2", 1/2-1", 1-2", 2-5", or >5".

Bare Ground

Percent bare ground, or mulch without plants, is recorded in one of the following categories: 0-5%, 5-10%, 10-25%, 25-50%, or >50%.

Coarse Woody Debris (CWD)

The percent cover of coarse woody debris (diameter must be greater than 5 inches) on the ground is visually estimated. Record as 0-5%, 5-10%, 10-25%, 25-50%, or >50% cover.

Snag Density

The number of standing dead trees with a DBH (diameter at breast height) of greater than 5 inches is estimated. Record as none, low (1-5 stems per acre), medium (5-20 stems per acre), or high (>20 stems per acre).

Overstory Tree Diameter

The average diameter at breast height (DBH) of overstory trees, i.e. trees with a DBH larger than 5", in the management unit is recorded in one of the following categories: 5-15", 15-20", 20-30", or >30".

Habitat Type

Habitat type is classified as follows:

- Forests are characterized by more than 25% tree canopy cover. To determine forest habitat type, there must be 30% or greater overstory cover of that type of tree present.

The characteristics of different forest types are as follows:

- Conifer forest—overstory dominated by conifer trees
- Conifer-deciduous mixed forest—conifer and deciduous trees each comprise more than 30% of the overstory

- Deciduous forest—overstory dominated by deciduous trees
- Madrone forest—more than 30% of the overstory dominated by Pacific madrone trees
- Madrone-conifer mixed forest—madrone and conifer trees each make up more than 30% of the overstory
- Madrone-deciduous mixed forest—madrone and deciduous trees each make up more than 30% of the overstory
- Forested wetland—more than 30% of trees growing in standing water or saturated soils, or more than 30% of area has small wetlands present entirely beneath overhanging forest canopy
 - Riparian forest—forest dominated by the presence of a stream or lake
- Savannah—10-25% tree canopy with unmaintained grass, shrubs, or both
- Oak savannah—10-25% tree canopy dominated by oak trees with unmaintained grass, shrubs, or both
- Shrubland—less than 10% overstory canopy and dominated by shrubs or regenerating trees
- Riparian shrubland— shrubland adjacent to a stream or a lake, with less than 10% overstory canopy, and dominated by shrubs or regenerating trees
- Scrub-shrub wetland—less than 10% overstory canopy, and dominated by shrubs or regenerating trees growing in standing water or saturated soils
- Emergent wetland—herbaceous plants growing in standing water or saturated soils
- Grassland/Meadow—less than 10% tree canopy with unmaintained grass

Special features

Special features such as wetlands, streams, dumps, encampments, power lines, roads, etc. found on, or adjacent to, the site are listed.

Vegetation Inventory

Overstory Canopy Cover

The percentage overstory tree (DBH>5") canopy cover present in the management unit is estimated visually. The following categories are used: 0%, 0-25%, 25-50%, 50-75%, >75%.

Tree Density

The relative densities of overstory (>5 inches DBH) and regenerating trees (<5 inches DBH) are estimated. The approximate stems per acre and spacing are used to determine tree density according to the rubric below. Tree density is recorded as none, low, medium, or high.

Stem density	none	low	medium	high
Number of stems/acre	0	0-50	50-150	>150
Spacing (feet on center)	-	43-30	30-17	<17

Shrub Cover

The area covered by native and invasive shrub species is visually estimated and expressed as a percentage of the total area and recorded in the following categories: 0-25%, 25-50%, 50-75%, or >75%. Low-growing woody shrubs, such as low Oregon-grape, are included in this category.

Herbaceous Cover

For the purpose of this assessment, the herbaceous layer includes herbaceous plants, graminoids (grasses, rushes, and sedges), trailing and liana species, and ferns. The percentage cover of native and invasive species in the herbaceous layer is visually estimated and recorded as 0-25%, 25-50%, 50-75%, or >75%.

Dominance

Dominance refers to the species of greatest prevalence/biomass and which has the most influence on the plant community. Indicate dominance by assigning a number between 1 and 3 to each species noted above, with 1 being most dominant. Species sharing a value of 1 are co-dominant. A value of 2 refers to a prevalent but not dominant species, and a 3 is considered least prevalent. Up to four species of trees, shrubs, or herbaceous plants can be listed for each category.

Restoration

The general scale and type of restoration that is required in the management unit is noted.

Relevant information includes:

- the percentage of the management unit in active restoration
- the scale of restoration needed, i.e. spot or large-scale
- type of invasive removal needed, i.e. manual removal, invasive tree treatment, herbicide treatment, or survival rings

- other actions needed, such as additional planting, erosion control, existing site maintenance
- accessibility, i.e. volunteer, contractor, steep slopes, etc.

APPENDIX II. ADDITIONAL RESOURCES

City of Kirkland

City of Kirkland Comprehensive Plan, Central Houghton Neighborhood:

<http://www.codepublishing.com/wa/kirkland/?html/KirklandCPNT.html>

City of Kirkland, GIS Maps:

http://www.kirklandwa.gov/depart/Information_Technology/GIS/GIS_Maps.htm

Cross Kirkland Corridor:

http://www.kirklandwa.gov/Community/Cross_Kirkland_Corridor/About.htm

Our Foundering Fathers by A. Ely (1975), Available from the Kirkland Heritage Society website:

<http://kirklandheritage.org/our-foundering-fathers/>

King County iMap (Interactive Mapping Tool) Property Information:

<http://www.kingcounty.gov/operations/GIS/Maps/iMAP.aspx>

Green Kirkland Partnership

20-Year Forest Restoration Plan:

<http://www.kirklandwa.gov/Assets/Parks/Green+Kirkland+Partnership+PDFs/Green+Kirkland+Partnership+20+year+plan.pdf>

Restoration Resources

Restoration Tools

Green Kirkland Steward Field Guide:

<http://www.kirklandwa.gov/Assets/Parks/Green+Kirkland+Partnership+PDFs/GKP+Forest+Steward+Field+Guide.pdf>

Green Cities Toolbox:

http://www.forterra.org/what_we_do/build_community/green_cities/green_cities_toolbox

Monitoring

Green Cities Standardized Monitoring Protocol:

http://www.forterra.org/files/Monitoring_Field_Guide_2013.pdf

Photo Point Monitoring, USDA Forest Service:

http://www.fs.fed.us/eng/rsac/invasivespecies/documents/Photopoint_monitoring.pdf

Invasive Plant Species

California Invasive Plant Council: <http://www.cal-ipc.org/ip/management/wwh/pdf/19632.pdf>

King County Noxious Weed Control Board:

<http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-control-board.aspx>

Washington State Noxious Weed Control Board: <http://www.nwcb.wa.gov/>

Plant Selection

Green Cities Native Plant Guide:

http://www.forterra.org/files/pdfs/GreenCities_Steward_Plant_Guide.pdf

Sound Native Plants: <http://www.soundnativeplants.com/species-selection-guide>

Washington Native Plant Society: <http://www.wnps.org/landscaping/herbarium/index.html>

Plant Associations in Washington's Puget Trough Ecoregion, Washington State Department of Natural Resources: <http://www1.dnr.wa.gov/nhp/refdesk/communities/index.html>

Preliminary Classification of Freshwater Wetland Vegetation in Western Washington, Washington State Department of Natural Resources:

http://www.dnr.wa.gov/Publications/amp_nh_wetland_class.pdf

Habitat Descriptions, Northwest Habitat Institute: <http://www.nwhi.org/index/habdescriptions>

Ecosystems, Washington Native Plant Society:

http://www.wnps.org/ecosystems/eco_system_home.htm

Erosion, Landslides & Slope Stabilization

Greenbelt Consulting:

http://www.soundnativeplants.com/sites/default/files/uploads/PDF/Unstable_slopes.pdf

Slope Stabilization and Erosion Control, Washington State Department of Ecology:

<http://www.ecy.wa.gov/programs/sea/pubs/93-30/index.html>

Wood Strand Erosion Control Mulch, forestconcepts™: <http://www.woodstraw.com/>

Vegetation Management in Power Line Rights-of-Way

Puget Sound Energy Vegetation Management: http://www.pse.com/safety/Tree-Trimming/Documents/1224_VegetationManagement.pdf

Seattle City Light Vegetation Management: <http://www.seattle.gov/light/vegmgmt/>

Hydrology, Geology & Soil

Kirkland's Streams, Wetlands and Wildlife Study, The Watershed Company:

<http://www.kirklandwa.gov/Assets/Planning/Planning+PDFs/Watershed+Report+July+1998+Part+1.pdf>

<http://www.kirklandwa.gov/Assets/Planning/Planning+PDFs/Watershed+report+July+1998+Part+2.pdf>

<http://www.kirklandwa.gov/Assets/Planning/Planning+PDFs/Watershed+report+July+1998+appendices.pdf>

Surface Geology GIS data, Washington State Department of Natural Resources:

http://www.dnr.wa.gov/ResearchScience/Topics/GeosciencesData/Pages/gis_data.aspx

Web Soil Survey, United States Department of Agriculture—Natural Resources Conservation Service (USDA-NRCS): <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>

Fish and Wildlife Habitat

Kirkland's Streams, Wetlands and Wildlife Study, The Watershed Company:

<http://www.kirklandwa.gov/Assets/Planning/Planning+PDFs/Watershed+Report+July+1998+Part+1.pdf>

<http://www.kirklandwa.gov/Assets/Planning/Planning+PDFs/Watershed+report+July+1998+Part+2.pdf>

<http://www.kirklandwa.gov/Assets/Planning/Planning+PDFs/Watershed+report+July+1998+appendices.pdf>

APPENDIX III. NATIVE PLANT SPECIES

The table below lists native plant species recorded in natural areas of parks in Kirkland during this project. Non-native plants not considered invasive are also included.

Broadleaf trees	
Scientific Name	Common Name
<i>Acer macrophyllum</i>	bigleaf maple
<i>Acer rubra</i> *	red maple
<i>Alnus rubra</i>	red alder
<i>Arbutus menziesii</i>	Pacific madrone
<i>Betula papyrifera</i>	paper birch
<i>Frangula purshiana</i>	cascara
<i>Fraxinus latifolia</i>	Oregon ash
<i>Fraxinus excelsior</i> *	European ash
<i>Populus deltoides</i> *	eastern cottonwood*
<i>Populus trichocarpa/balsamifera</i>	black cottonwood
<i>Prunus emarginata</i>	bitter cherry
<i>Quercus garryana</i>	Garry oak/ Oregon white oak
<i>Quercus palustris</i>	pin oak
<i>Salix</i> spp.	willow tree
<i>Salix matsudana Tortuosa</i> *	corkscrew willow*
<i>Ulmus americana</i> *	American elm*
Conifer trees	
Scientific Name	Common Name
<i>Picea abies</i> *	Norway spruce*
<i>Picea pungens</i> *	Colorado blue spruce*
<i>Picea sitchensis</i>	Sitka spruce
<i>Pinus contorta</i> var. <i>contorta</i>	shore pine
<i>Pseudotsuga menziesii</i>	Douglas-fir
<i>Thuja plicata</i>	western redcedar
<i>Tsuga heterophylla</i>	western hemlock
Shrubs	
Scientific Name	Common Name
<i>Acer circinatum</i>	vine maple
<i>Amelanchier alnifolia</i>	western serviceberry
<i>Arctostaphylos uva-ursi</i>	kinnikinnick/red bearberry
<i>Berberis/Mahonia aquifolium</i>	tall Oregon-grape
<i>Berberis /Mahonia nervosa</i>	low/dull Oregon-grape
<i>Cornus sericea</i>	red twig/red-osier dogwood
<i>Corylus cornuta</i>	beaked hazelnut

*Not native; introduced in the Pacific Northwest

Shrubs	
Scientific Name	Common Name
<i>Holodiscus discolor</i>	ocean-spray/creambush
<i>Lonicera involucrata</i>	twinberry/black twinberry
<i>Myrica californica</i>	Pacific wax myrtle/bayberry
<i>Myrica gale</i>	sweet gale
<i>Oemleria cerasiformis</i>	Indian plum
<i>Oplopanax horridus</i>	devil's club
<i>Philadelphus lewisii</i>	Lewis' mock orange
<i>Ribes lacustre</i>	swamp currant/swamp gooseberry
<i>Ribes sanguineum</i>	red-flowering currant
<i>Rosa gymnocarpa</i>	baldhip/wood rose
<i>Rosa nutkana</i>	Nootka rose
<i>Rosa pisocarpa</i>	cluster/swamp/peafruit rose
<i>Rosa woodsii</i> **	Wood's/pearhip rose**
<i>Rubus leucodermis</i>	black cap raspberry
<i>Rubus parviflorus</i>	thimbleberry
<i>Rubus spectabilis</i>	salmonberry
<i>Salix</i> spp.	willow
<i>Sambucus racemosa</i>	red elderberry
<i>Spiraea douglasii</i>	Douglas' spiraea/western hardhack
<i>Symphoricarpos albus</i>	snowberry
<i>Vaccinium ovatum</i>	evergreen huckleberry
<i>Vaccinium parvifolium</i>	red huckleberry
<i>Viburnum edule</i>	squashberry/high-bush cranberry
<i>Viburnum opulus</i> var. <i>americanum</i>	cranberry tree/American cranberry bush
Ferns	
Scientific Name	Common Name
<i>Blechnum spicant</i>	deer fern
<i>Dryopteris expansa</i>	northern wood fern
<i>Polypodium glycyrrhiza</i>	licorice fern
<i>Polystichum munitum</i>	western sword fern
<i>Pteridium aquilinum</i>	bracken fern
Herbs & Vines	
Scientific Name	Common Name
<i>Anaphalis margaritacea</i>	western pearly everlasting
<i>Aquilegia formosa</i>	western columbine
<i>Armeria maritima</i>	sea-thrift
<i>Aruncus dioicus</i>	goatsbeard
<i>Chamerion angustifolium</i>	fireweed

** Native east of the Cascade Mountains

Herbs & Vines	
Scientific Name	Common Name
<i>Circaea alpina</i>	enchanter's nightshade
<i>Dicentra formosa</i>	Pacific bleeding heart
<i>Epilobium</i> sp.	willowherb
<i>Fragaria chiloensis</i>	beach strawberry
<i>Equisetum arvense</i>	common/field horsetail
<i>Equisetum telmateia</i>	giant horsetail
<i>Fragaria vesca</i>	woodland strawberry
<i>Geum macrophyllum</i>	largeleaved/bigleaf avens
<i>Galium</i> spp.	bedstraw
<i>Hydrophyllum tenuipes</i>	Pacific waterleaf
<i>Lysichiton americanus</i>	skunk cabbage
<i>Oenanthe sarmentosa</i>	American water-parsley
<i>Penstemon rupicola</i> ***	rock penstemon/cliff beardtongue***
<i>Petasites frigidus</i>	western coltsfoot
<i>Rubus ursinus</i>	trailing blackberry
<i>Sisyrinchium californicum</i>	golden-eyed grass
<i>Solidago lepida</i>	western Canada goldenrod
<i>Stachys cooleyae</i>	Cooley's hedge- nettle
<i>Symphotrichum subspicatum</i>	Douglas' aster
<i>Tellima grandiflora</i>	fringecup
<i>Tiarella trifoliata</i>	foamflower
<i>Tolmiea menziesii</i>	piggyback plant
<i>Trientalis latifolia</i>	western/broad-leaved starflower
<i>Typha latifolia</i>	common/broad-leaf cattail
<i>Urtica dioica</i>	stinging nettle
Graminoids (Grasses, sedges & rushes)	
Scientific Name	Common Name
<i>Carex obnupta</i>	slough sedge
<i>Carex deweyana</i>	Dewey's sedge
<i>Eleocharis palustris</i>	common spikerush
<i>Glyceria elata</i>	tall mannagrass
<i>Juncus effusus</i>	common/soft rush
<i>Schoenoplectus tabernaemontani</i>	soft-stem/great bulrush
<i>Scirpus microcarpus</i>	small-fruited/panicked bulrush

***Typically occurs in the Cascade Mountains at mid- to high elevations

APPENDIX IV. NON-NATIVE INVASIVE PLANT SPECIES

The table below lists the common and scientific names of non-native, invasive plant species recorded in Kirkland parks during rapid site assessments. Note that landowners are required to control certain noxious weed species. These plants are indicated in the list by an asterisk. Noxious weeds are non-native plants that are difficult to control once established, and that may be injurious to agricultural and/or horticultural crops, natural habitats and/or ecosystems, and/or humans or livestock. More information is available from the [Washington State Noxious Weed Control Board](#) and the [King County Noxious Weed Control Program](#).

Trees	
Scientific name	Common name
<i>Acer platanoides</i>	Norway maple
<i>Acer pseudoplatanus</i>	sycamore maple
<i>Aesculus hippocastanum</i>	horse-chestnut
<i>Crataegus monogyna</i>	common/English/one-seed hawthorn
<i>Ilex aquifolium</i>	English holly
<i>Laburnum anagyroides</i>	golden chain-tree
<i>Prunus avium</i>	sweet/bird cherry
<i>Prunus cerasifera</i>	cherry plum
<i>Prunus laurocerasus</i>	cherry laurel/English laurel
<i>Prunus lusitanica</i>	Portugal laurel
<i>Robinia pseudoacacia</i>	black locust
<i>Sorbus aucuparia</i>	European mountain-ash
Shrubs	
<i>Buddleja davidii</i>	butterfly bush
<i>Cytisus scoparius</i>	Scot's/Scotch broom
<i>Daphne laureola</i>	spurge-laurel
<i>Rubus armeniacus</i>	Himalayan blackberry
<i>Rubus laciniatus</i>	evergreen/cutleaf blackberry
Herbs & Vines	
<i>Conium maculatum</i>	poison hemlock
<i>Cichorium intybus</i>	chicory/ wild succory
<i>Cirsium arvense</i>	Canada thistle
<i>Cirsium vulgare</i>	bull thistle
<i>Convolvulus/Calystegia arvensis</i>	field bindweed
<i>Convolvulus/Calystegia sepium</i>	hedge false bindweed
<i>Geranium robertianum</i>	herb Robert
<i>Hedera helix</i>	English ivy
<i>Hedera hibernica</i>	Atlantic ivy

Herbs & Vines	
Scientific name	Common name
<i>Hyacinthoides</i> spp.	bluebells
<i>Hypericum perforatum</i>	St. John's wort
<i>Hypochaeris radicata</i>	hairy cat's ear
<i>Impatiens glandulifera</i> *	policeman's helmet*
<i>Impatiens capensis</i>	spotted jewelweed
<i>Iris pseudacorus</i>	yellow iris
<i>Lactuca serriola</i>	prickly lettuce
<i>Lamiastrum galeobdolon</i>	yellow archangel
<i>Lapsana communis</i>	nipplewort
<i>Leucanthemum vulgare</i>	oxeye daisy
<i>Lotus corniculatus</i>	bird's foot trefoil/birdfoot deervetch
<i>Lythrum salicaria</i> *	purple loosestrife*
<i>Polygonum x bohemicum</i>	Bohemian knotweed
<i>Polygonum cuspidatum</i>	Japanese knotweed
<i>Polygonum polystachyum</i>	Himalayan knotweed
<i>Polygonum sachalinense</i>	giant knotweed
<i>Ranunculus repens</i>	creeping buttercup
<i>Rumex acetosella</i>	sheep/ red sorrel
<i>Senecio jacobaea</i> *	tansy ragwort*
<i>Solanum dulcamara</i>	bittersweet nightshade
<i>Typha angustifolia</i>	narrow-leaf cattail
<i>Verbascum thapsus</i>	common/great mullein
<i>Veronica serpyllifolia</i>	thyme-leaved speedwell
<i>Vinca major</i>	bigleaf/greater periwinkle
<i>Vinca minor</i>	common/lesser periwinkle
Graminoids	
<i>Phalaris arundinacea</i>	reed canary grass

*Control required by King County and/or Washington Noxious Weed Control Board (King County, 2014).