Final Report Packet
Everest Park, Kirkland WA

Prepared for:
Green Kirkland Partnership

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University of Washington Restoration Ecology Network Capstone 2016-17

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I. Project Summary

A. Overview

This report illustrates the Everest Park Restoration Project implemented in 2016-17 for the city of Kirkland in collaboration with the Green Kirkland Partnership. Five students from the University of Washington Restoration Ecology Network (UW-REN) Capstone course worked from October 2016 to May 2017 to create and implement a restoration plan for Everest Park. They worked with the help of Ina Penberthy who works for the Green Kirkland Partnership which is a coalition created by the City of Kirkland. Everest Park is located just off of Exit 17 on Interstate 405. The restoration site was located just adjacent to the south most baseball field in the park and is south of a restoration site taken on by a previous UW-REN Capstone team.

B. Before and After

Before

After

C. Summary Narrative

The site at Everest Park is about 0.3 acres and is split into four polygons which are categorized by their different features. Everest Park is located off of Exit 17 on i405. The restoration site was located just adjacent to the south most baseball field in the park. There is a path that runs along the north eastern portion of the site which is popular for joggers, walkers, and dog walkers. A stream also runs along this path but bends southward.

Prior to restoration, the site was a deciduous forest mainly consisting of bigleaf maple (*Acer macrophyllum*) and black cottonwood (*Populus trichocarpa*). There were also salmonberry (*Rubus spectabilis*) along the edges of the second and third polygon. The area was also fairly populated with sword fern (*Polystichum munitum*). For ground cover there were quite a few piggyback plants (*Tolmiea menziesii*). Polygon 2 was almost entirely cleared of all plant species on it. Before we were chosen to take on this project, the Green Kirkland Partnership had removed all Himalayan blackberry (*Rubus armeniacus*) and compiled all of the cuttings into piles on cardboard for composting. Our other polygons were filled with English ivy (*Hedera helix*) and English holly (*Ilex aquifolium*).

The main problem of the site was that it was unable to further grow into a coniferous forest. The invasive species were preventing any native fauna from growing and were potentially suffocating the native species that were already established therefore limiting any potential for wildlife habitat.

Project Goals

- Encourage the development of a structurally and biologically diverse forest plant community that supports native fauna
- Improve hydrological functions of the site
- Engage the community in the restoration project for future upkeep of the project site

General Approach

Upon arriving to our site, Polygon 2 was already cleared of the invasive Himalayan blackberry so our priority was invasive suppression and to prepare for planting. For Polygons 3 and 4, the initial priority was to remove the invasive species in those regions. After removing the invasives in these polygons, we mulched Polygon 2 with woodchip mulch. We mulched about 6” to suppress regrowth of Himalayan

blackberry and to retain soil moisture. We didn't feel the need to mulch in Polygons 3 and 4 where there was a much more dense forest due to the large amount of organic matter on the floor. After mulching we had planting events. Grand fir (*Abies grandis*), Pacific madrone (*Arbutus menziesii*), and douglas fir (*Pseudotsuga menziesii*) will help to reduce sunlight infiltration to help shade out invasive species. Planting evergreen species such as Western redcedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) in polygons 3 and 4 will also allow for shading out invasives and for rainwater interception and decrease stormwater runoff. Incorporating evergreen species such as bearberry (*Arctostaphylos uva-ursi*) and Evergreen huckleberry (*Vaccinium ovatum*) will allow for an increase in canopy for various wildlife habitat creation providing food from berries and nuts and providing thickets for shelter. Having a thicker lower canopy provides vertical and horizontal diversity in the forest. The groundcover species planted near the stream will help with improving water quality such as slough sedge (*Carex obnupta*) and lady fern (*Athyrium filix-femina*). These plants also aid in stabilizing the slope to decrease sedimentation.

D. Team Photo

Team members from left to right: Tom Tang (Autumn Quarter), Ahmed Rizvi, Annie Stein, Hao Wang, Zainab Junejo, and Owen Di

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F. Acknowledgements

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G. Organization Logos

GREEN KIRKLAND PARTNERSHIP

CITY OF KIRKLAND WASHINGTON

University of Washington
Restoration Ecology Network
Bothell - Seattle - Tacoma

School of Environmental and Forest Sciences
UNIVERSITY of WASHINGTON
College of the Environment

UNIVERSITY OF WASHINGTON 1861 LVX SIT

II. As-Built Report

A. Background

1. Site Description

The 23.4-acre Everest Park is in the Everest neighborhood of Kirkland (Figure 1). The park consists of 13.4 acres of natural area, tennis courts, baseball diamonds, and a playground surrounded by residential area. There are 2.7 acres of natural area currently being restored, which includes the riparian corridor and the upland forest. Originally known as Dick Everest Park, which was owned by the Federal Government, Everest Park was transferred to Kirkland City to utilize it for park and recreational purposes. During the 1960s, the restrooms, parking lots, and ball fields were constructed after additional land was purchased to make the park the size it is today.

The projected site was initially 7,000 square feet, but has now been extended to 14,000 square feet because volunteers recently helped remove 9,000 square feet of invasive species. This removal process consisted of pulling and removing some of the Himalayan blackberry in the area. This left parts of the land bare, with no remaining vegetation, native or invasive, in some areas of the site. Figure 2 shows the slope in polygon 1, the area that had the *Rubus armeniacus* removed in polygon 2, the portion added to the initial proposed site in polygon 3, and the portion added to the initial proposed site and change in soil type in polygon 4.

The site is mostly flat with a steep slope along the western border. This slope, represented by polygon 1, is a 52-degree upward slope pointing west, which has a width of 1.56 meters (Figure 2). On the eastern side, there is a small stream which flows northwest towards downtown from a ground source, which is further to the southeast. This stream is small, ranging from 0.67 – 1.56 meters in width and goes no more than 0.25 meters deep after heavy rainfall.

The overall canopy consists of deciduous trees including big leaf maple (*Acer macrophyllum)* that are much denser on the northeast side of the site in polygons 3 and 4, and less coverage on the southwestern side of the site in polygons 1 and 2 (Figures 2 and 3). Polygon 2 consists of coverage that goes from 0% to 100% as it gets closer to polygon 3 (Figure 2). There is a large community of black cottonwood (*Populus trichocarpa)* that dominates towards the edges (Figure 3). Sword ferns (*Polystichum munitum)* are also

dominant along the stream and cover about 40% of the ground (Figure 3). The sub canopy is created by salmonberry (*Rubus spectabilis)* and Indian plum (*Oemleria cerasiformis)* (Figure 3). Piggyback plant (*Tolmiea menziesii*) covers about 60% of the ground (Figure 3). The non-native species of *Rubus armeniacus* dominate polygon 3 and polygon 4 (Figure 4). English ivy (*Hedera helix*) and English holly (*Ilex aquifolium*) are scattered within polygons 3 and 4 (Figure 4).

The soil in polygons 1, 2 and 3 consist of Indianola loamy sand while polygon 4 is Alderwoods gravelly sandy loam (Figure 2). Polygon 4 was made into a separate polygon to show the distinct cutoff between the two soil types as well as to show where the stream flows through the site (Figure 2). Overall disturbance in the site is low but along the eastern side of the stream, erosion is clearly visible. The banks of the stream show signs of erosion, most likely due to the rising water levels during rainstorms and plants are lacking along the stream edge.

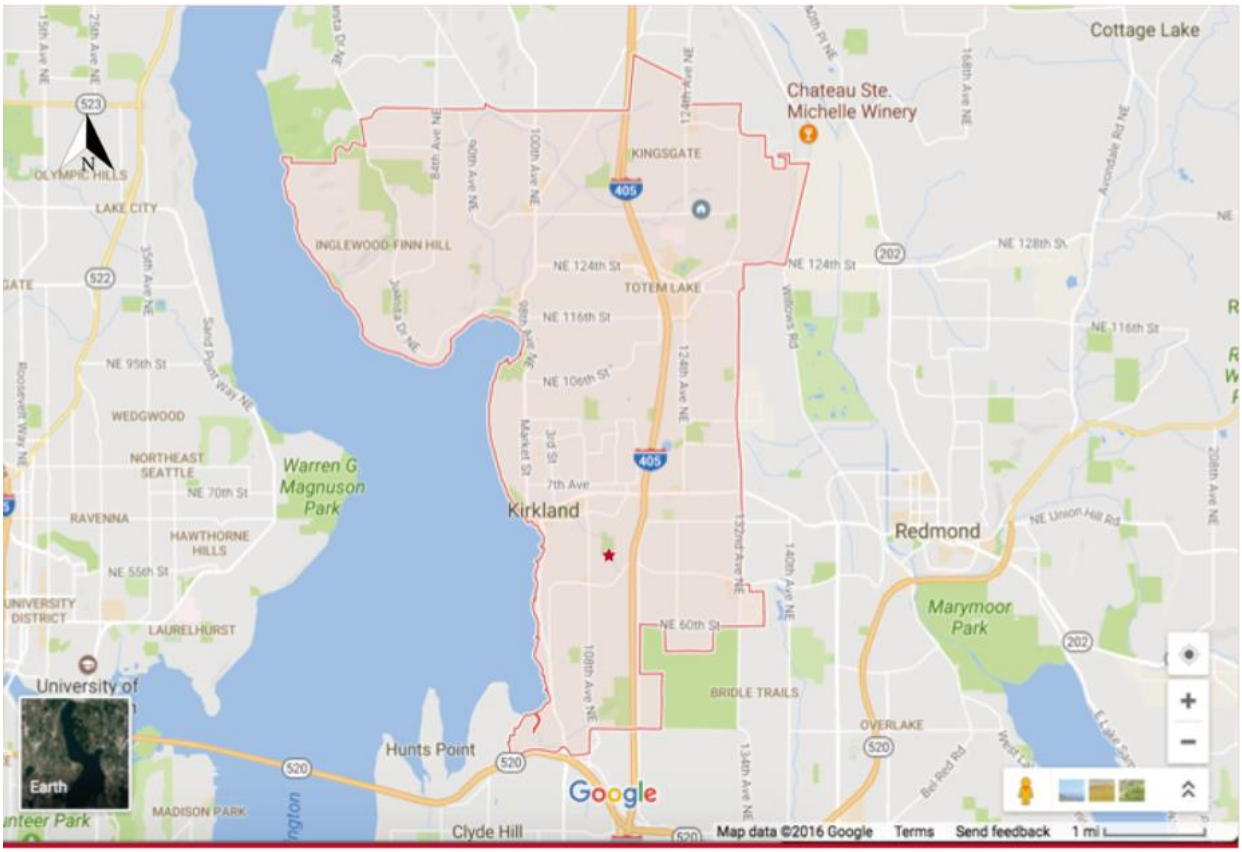

Figure 1. City of Kirkland- The lightly shaded red area represents the city of Kirkland. The red star indicates where Everest Park resides in the City of Kirkland.

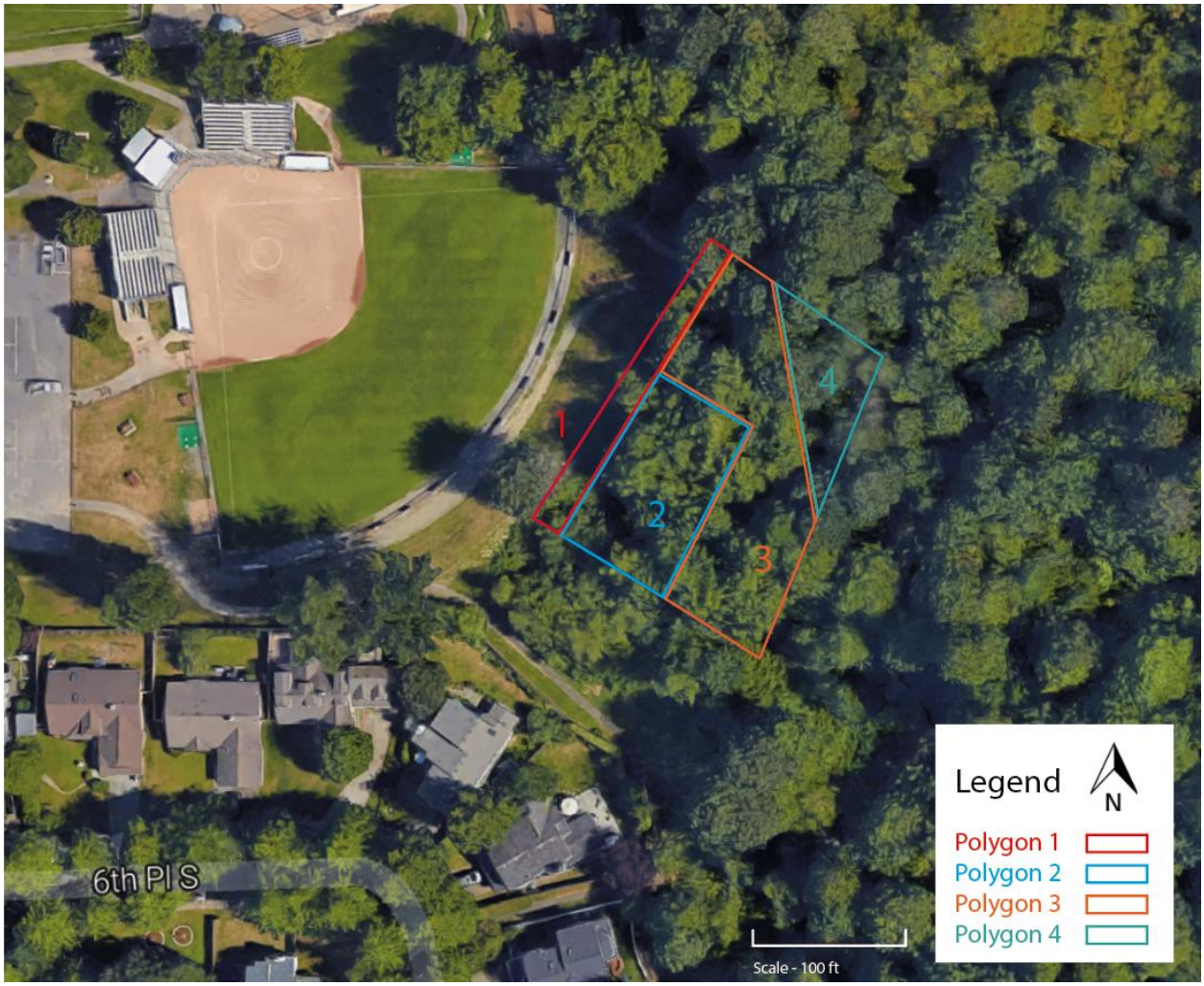

Figure 2. Everest Park project site including polygons.

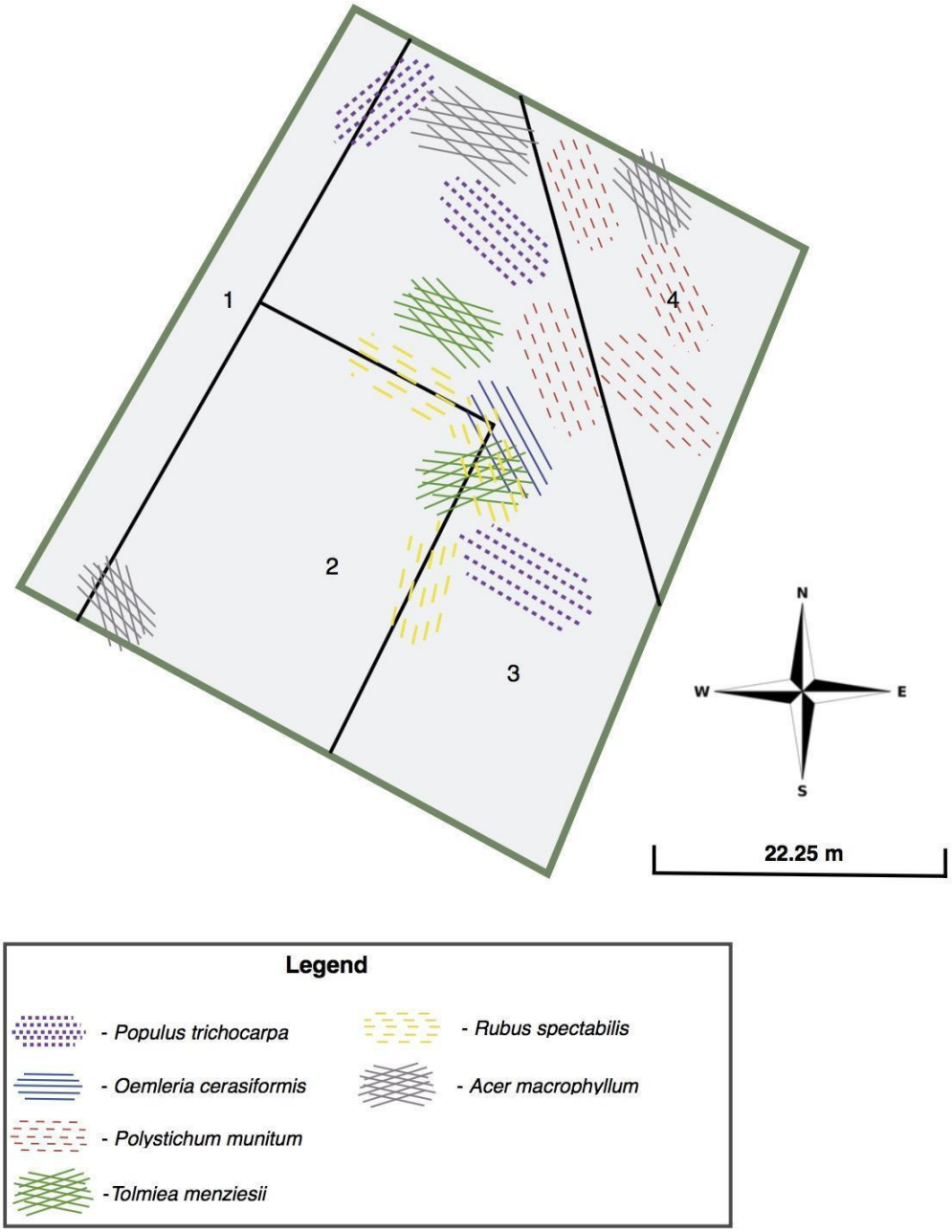

Figure 3. Native species and their locations within polygons.

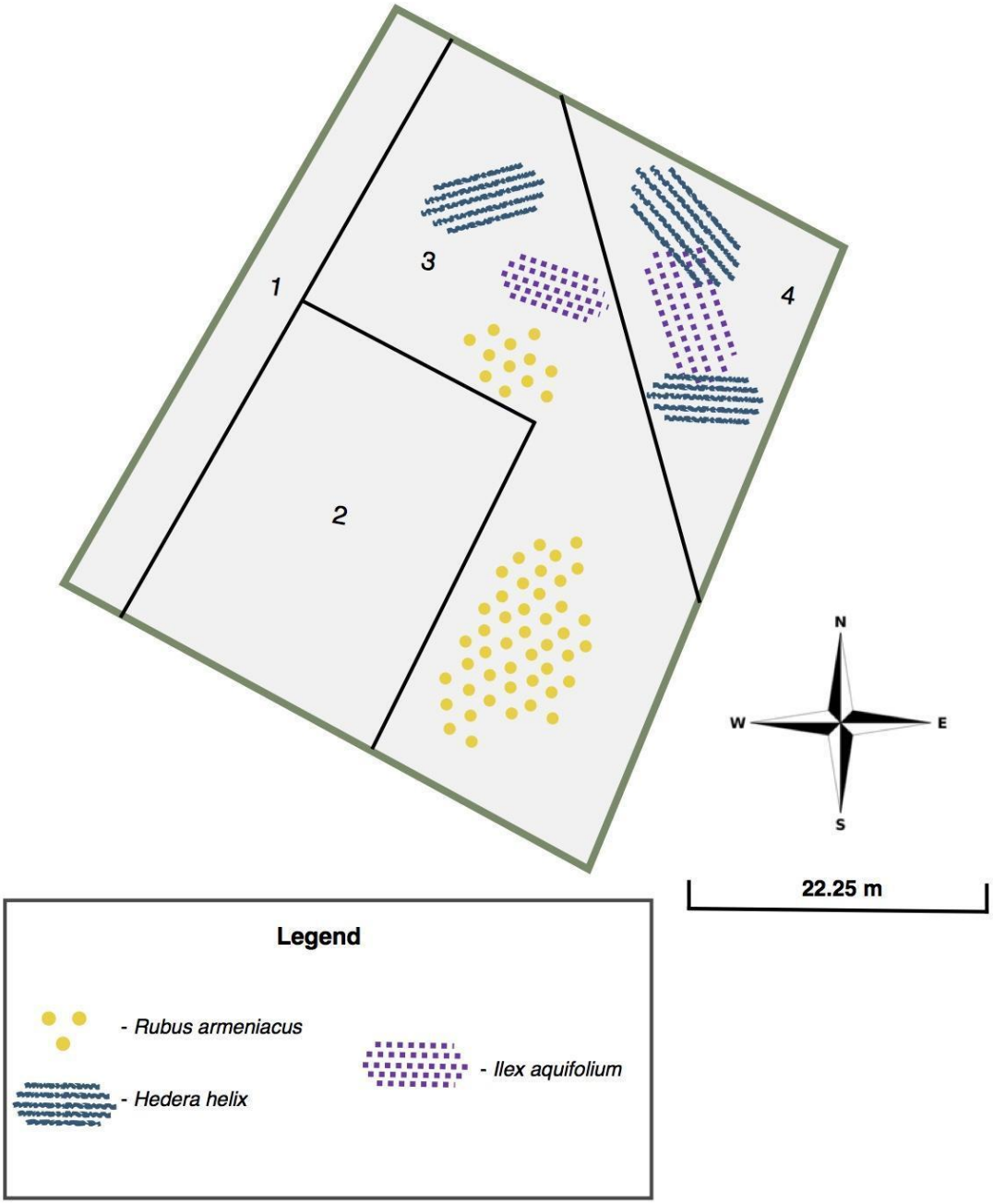

Figure 4. Non-native species and their locations within polygons.

2. Restoration Needs and Opportunities

Ecological restoration is defined as a deliberate action aimed at initiating or accelerating the process of recovering the ecosystem regarding its health, sustainability and the overall integrity (Clewell AF et al. 2016). The task of restoring an ecosystem comprises of many projects, for example, reforestation, soil erosion control, restoring vegetation in disturbed areas, reintroduction of native plants, and removal of non-native plants species, planting of genetically local native species, and improvement of habitats with specific or targeted species of plants.

At the Everest Park project site, one of the tasks is to remove *Rubus armeniacus, Hedera helix,* and *Ilex aquifolium* completely. These species are removed from both above and below the ground. First we must identify the three species of plant and remove them, then cover the soil with mulch to prevent invasive growth and also create a multi-layered canopy to provide a shade which will further help to inhibit the growth of invasive plants. It is also paramount to create a plan for future volunteers to remove re-growing invasive species (Celentano D et al. 2016).

One of the leading causes of the decline in services provided by the ecosystem and extinction of species is a loss of habitat. As such, there is need to reverse, restore, and prevent further loss of habitat. Such an endeavor can be achieved through conservation of any existing habitat as well as restoring of habitat that has previously been degraded.

Ecological restoration presents some possibilities for both human and the ecosystem as a whole. To start with, restoring the ecosystem means the restoration of some naturally occurring capital for humans and other living things; this include provision of drinkable water for all and fresh air. This will also help in mitigating of climatic changes through reduction of carbon dioxide in the atmosphere, and therefore reducing the greenhouse effect (Palmer et al. 2014). Other opportunities presented due to the restoration of the ecosystem that are helping in conserving some endangered species as well as making the surrounding to be visually appealing. As human beings are the cause of degradation of the ecosystem, restoration offers them a right opportunity to fix these problems.

B. Tasks and Approaches

Goal 1: Encourage the development of a structurally and biologically diverse forest plant community that supports native fauna.

Objective 1-1: Remove the invasive species in the area and minimize the threat of regrowth.

Task 1-1a: Remove all *Rubus armeniacus* biomass above and belowground.

Approach: We will use a lopper to cut the stems of the *R. armeniacus* about 8-12 inches from the ground and then use a shovel to dig up the root crown. We will attempt to hand pull stems where applicable.

Approach Justification: Getting rid of the root crowns as well as the canes has been proven to be the most effective (King County no date b). *R. armeniacus* can grow from the root crown and from pieces of roots and canes (Hoshovsky M no date*).*

Task 1-1b: Remove all *Hedera helix* biomass above and belowground.

Approach: Remove all *H. helix* by hand pulling vines and roots from the ground. If necessary, shovels can be used to assist in removing all roots from the soil. For *H. helix* on trees, we will use shears or loppers to cut the vines at shoulder length and the base of the tree.

Approach Justification: Removing *H. helix* with shovels and by cutting vines at waist height on trees has been proven to be the best method to prevent regrowth (Morisawa TL no date).

Task 1-1c: Mark all *Ilex aquifolium* for removal.

Approach: Using tape, we will mark all *I. aquifolium* that are too large to be removed by shovels for a park member to inject the plant with herbicide pellets.

Approach Justification: *I. aquifolium* are best controlled by digging up the entire root crown to prevent regrowth (King County no date a). However, for larger plants it is recommended to apply herbicide directly onto a cut or damaged part of the plant.

Task 1-1d: Cover soil in a layer of mulch to prevent invasive plant growth.

Approach: We will obtain mulch from our CP. Apply the mulch to the entire site at a depth of 4 inches.

Approach Justification: Mulching is best in areas that have been previously infested with invasive species and areas prone to weeds because it creates a barrier between organically rich soil and the ground where weeds can easily germinate (Green Seattle Partnership 2016).

Task 1-1e: Create multilayered canopy to shade out invasive plants.

Approach: We will be planting several conifers such as *Abies grandis* and *Thuja plicata* as well as evergreen shrubs such as *Gaultheria shallon* and *Mahonia aquifolium* to create a thicker canopy and shrub layer.

Approach Justification: Shading out invasive species is important in minimizing any potential for forest edges or gaps for invasive species to repopulate. Depriving sun loving invasive species of sunlight will allow for native shade tolerant species to populate the area.

Task 1-1f: Create plan for volunteer work to remove invasive plants.

Approach: Thoroughly educate and guide volunteers on the proper removal and cleanup of invasive species

Approach Justification: Allowing the local community to participate and gain knowledge in the restoration of a local park is key in increasing their knowledge and community understanding on environmental issues (Caldwell et al. 2016).

Objective 1-2: Install a diverse collection of native flora.

Task 1-2a: Acquire a diverse collection of native flora appropriate for site conditions.

Approach: We will submit our plant order form and use all the salvaged plants that our partner has made available for us.

Approach Justification: It is important that there be high diversity at the site because greater biodiversity will result in more ecosystem services being performed at the site up to a point (Benayas et al. 2009). Increased biodiversity will also make the site more resistant in the face of any future disturbance.

Task 1-2b: Plant native flora on the site.

Approach: We will have a planting work party where volunteers will plant the plants according to the plans we have made. Bare root plants and plants from containers should go into holes that are as deep as the roots and twice as wide with a dome in the middle. The roots should be spread over the dome and the hole filled in so the plant is secure. Plugs should be planted in holes slightly larger than the plugs themselves and packed into the ground.

Approach Justification: Some plants need a hill or cone to grow on to help stabilize the plant and reduce the risk of killing it (Kelly B no date). When trees and shrubs are planted correctly, it increases their chance of survival and it also minimizes the amount of resources needed for them to thrive initially (Powell K 1997).

Objective 1-3: Improve the habitat value for native wildlife.

Task 1-3a: Acquire a collection of native flora that will improve the habitat value.

Approach: We will order plants that are appropriate for the conditions of our site and will increase the habitat value of the area by producing seeds, berries, nectar, and create shelter from the elements and potential predators.

Approach Justification: Habitat values can be improved by introducing sources of food and shelter from predation or exposure to adverse weather as well as areas for breeding and passages to move through the site (Efroymson et al. 2008). Many of the plants that will be added to the site will improve the habitat value by introducing berries and seeds in the spring and summer that could be consumed by birds and small mammals, and nectar that could be used by hummingbirds and insects. More shelter will be introduced in the forms of thick foliage and large woody debris that can be used by birds, mammals, and insects.

Goal 2: Improve hydrologic functions of the site.

Objective 2-1: Improve water quality of the stream on site.

Task 2-1a: Acquire native flora that will control erosion along stream banks.

Approach: We will order plants that can help control for erosion and plant them along the stream banks.

Approach Justification: It is important that appropriate plants be used in riparian areas in order to control for erosion along the stream banks. Grass species can help to increase the soil strength in riparian areas and reduce the amount of erosion and help to stabilize the slopes (Simon A et al. 2002).

Objective 2-2: Reduce stormwater runoff from the site.

Task 2-2a: Create multilayered canopy to slow down and reduce stormwater runoff.

Approach: We will order a variety of trees, shrubs, and groundcover and plant them to create a multilayered canopy.

Approach Justification: Having an urban forest can help to reduce stormwater runoff by increasing the tree canopy cover and thus the amount of water intercepted by plant biomass (Xiao Q et al. 1998).

Stormwater runoff interception increases significantly in areas with forested land (Xiao Q et al. 1998).

Goal 3: Engage the community in the restoration project for future upkeep of the project site.

Objective 3-1: Connect with local community to increase volunteer turnout for restoration events.

Task 3-1a: Work with partner to host restoration events involving the community.

Approach: We will communicate with our partner, who will then recruit volunteers for events, about all work parties that we are planning and fill out all appropriate paperwork. We will explain to the volunteers at events who we are and what our goals are for each work party.

Approach Justification: The success of coordinated events depends on the efficiency and organization of the group holding the event (Caldwell WJ et al. 1999).

Objective 3-2: Educate people in the area on the restoration project and how they can get involved.

Task 3-2a: Talk to people during volunteer events about getting involved in the project.

Approach: We will talk to people at Everest Park while we are volunteering about what our project is and how they can help if they are interested.

Approach Justification: A community member's participation increases the member's knowledge and therefore increases the community's knowledge through sharing of ideas (Caldwell WJ et al. 1999).

Objective 3-3: Create plans for future upkeep of the site once the initial restoration project has been completed.

Task 3-3a: Work with partners to create stewardship plan for long term upkeep of the site.

Approach: We will create a stewardship plan that will be approved by our partner to make plans for future

restoration work at the site and how to keep up with any invasive species.

Approach Justification: For long term projects, it is important that volunteers continue to remove invasive species until the population is reduced to 90% of what it originally was (Wenning B 2015). It is also important for volunteers and people who work at the park to monitor the site to ensure that the invasive species do not become a problem again (Wenning B 2015).

C. Specific Work Plan

1. Site Preparation Plan

a) Current Conditions

Based on the unique features from different part of the site, we divided the site into four polygons.

Polygon 1:

This polygon stands on a 52-degree upward slope pointing west which has a width of 1.56 meters. Polygon 1 currently has no invasive species present due to the work party that was hosted before we were assigned our site. The party had removed any visible invasive and layered the region slightly with mulch. This polygon is on the outer perimeter of the baseball field, and there is a bench present. Therefore, there will be some sort of traffic along the edge.

Polygon 2:

Polygon 2 is a flat open area with significant sunlight exposure. It was once dominated by *R. armeniacus* and with the effort from the Everest Park staff and volunteers, almost of the *R. armeniacus* has been removed. However, there are not any native plants. There are some deciduous trees around the edges of the polygon, however the overall coverage and upper canopy is minimal.

Polygon 3:

There is a small stream runs through polygon 3 towards west and a trail runs along the northern side. Polygon 3 is the main problem for our site. There is an

enormous number of invasive species appearing in the area including *R. armeniacus, H. helix,* and *I. aquifolium*. Polygon 3 has 75-100% canopy coverage due to the *A. macrophyllum* and *P. trichocarpa*. There are several established native species in the area: 60% of the ground is covered by *P. munitum* and *T. menziesii*.

Polygon 4:

Polygon 4 is different from the other polygons due to its unique soil texture. Polygon 4 is Alderwoods gravelly sandy loam while the other three are sandy loamy. Polygon 4 is the smallest polygon, we made this area an individual polygon to distinguish its unique soil. This area has canopy coverage of 100% due to *A. macrophyllum*.

b) Site Preparation Activities:

Polygon 1:

Since Polygon 1 has already been worked on with the previous work party, our main focus is not to remove any invasive species. There is some mulch layered sparsely around the polygon to reduce invasive regrowth. Our goal is to establish a dominant array of native species, which will include ferns and shrubs. This will be done with the help of live stake plants.

Polygon 2:

Polygon 2 was once occupied by *R. armeniacus*, with the effort from the Everest Park staff and volunteers, roughly 98% of the invasives have been removed. The staff and volunteers finished their job by mulching the area with roughly a 2-inch layer of mulch. However, since then the mulch has moved around and has exposed bare soil. Our plan is to evenly distribute the standing mulch first, and then create mulch rings wherever we want to plant as well as sheet mulch the remaining area with roughly 2 inches of mulch.

Polygon 3:

Our first step will be to remove all of the invasive *R. armeniacus, H. helix,* and *I. aquifolium* in the area. Once

done, our next step will be to determine the exact locations for where we want to plant our plants. These locations will be marked with rings of mulch. After establishing our mulch rings, we will mulch off any remainder open spaces with roughly 2 inches of mulch.

Polygon 4:

Polygon 4 has no *R. armeniacus*, so our focus will be on removing all of the *H. helix,* and *I. aquifolium* in the area. Once completed, we will take the same approach on mulching the area with rings like Polygon 3. However, when it comes to spreading the remainder of mulch as a 2-inch layer, we will be focusing on specific regions in Polygon 4 since the area is quite dense with ferns already. The mulch will be there just to facilitate inhibition of regrowth of invasives in the exposed areas.

c) Logistical Considerations:

Human disturbance: There is a social trail that runs along the northern border of our site. Although it does not cut through our site, we have noticed trash along the north end of Polygon 3 and 4, which might be a sign that individuals either enter the perimeter or just throw their garbage into the ferns. Furthermore, due to there being a bench along the eastern border of our site and a baseball field, there is a possibility that people can walk along the border, or baseballs can go flying into our site resulting in people walking through the area.

Accessibility: As shown in Figure 2, there is a parking lot located on the eastern side of our site. You can follow that parking lot to a paved walkway, which runs along the southern site of our site. Just before our site, people can bank north towards it along a smooth hilltop, which brings you to the edge of Polygon 1. Volunteers can use this path, or walk along the flat portion along the perimeter of the baseball field. Just east of Polygon 1, next to the field, is our hub for each work party. There is easy access to it for check-in, materials, mulch, and tools.

2. Planting Plan

Polygon 1:

Polygon 1 is unique due to the topography of the site. Most of the site is very flat, but this polygon is entirely made up of a steep slope. Since the ground is sloped, there is very little water infiltration in this part of the site. It is important to choose plants that will be able to survive in drier soil and that can also help to control for erosion. Although erosion control is not a main goal for the overall site, this will likely help the site in the long term. This polygon is also the most exposed to the rest of the park, so it is important that there be plants here to create a buffer. The idea is that these plants will deter people from coming into the site to help protect the rest of the project site from being disturbed by humans or pets. The fewer people and pets there are walking around in the site, the less likely it is that invasive species will be reintroduced once all the restoration work is done. There will also be less erosion due to people and pets walking through the site.

The plants that were planted in this polygon are *Holodiscus discolor, Rosa gymnocarpa,* and *Polystichum munitum*. The *H. discolor* and *R. gymnocarpa* were planted on 4 foot centers, as is recommended for shrubs so that there will be enough space to avoid root crowding (Arbor Day Foundation no date). The *P. munitum* was planted on 2 foot centers, which will help to reduce competition between the plants and also create a dense layer of groundcover (Rodriguez no date). There were 5 bare root *H. discolor,* 6 *R. gymnocarpa* from 1-gallon containers, and 20 plugs of *P. munitum* planted in this polygon. We want to include a good number of plants in this polygon so that we can create more plant biomass between the edge of the site and the park right next to it.

Although there are only three species of plants that we planted in polygon 1, they will help to achieve our smaller goals for this polygon as well as the larger goals for the overall site. *P. munitum* is good to plant on slopes due to the nature of its root system, so it will help to stabilize the slope (Rodriguez no date). *H. discolor* is often found growing on slopes, so it will be able to survive under these conditions on the site and help to control for erosion (The Wild Garden no date). *R. gymnocarpa* is a thorny species that will deter people from entering the site. Between the selection of plants and the number of plants that will be on the

slope, this will help to create a thicker and thornier shrub and ground layer of biomass that should stop people from coming into the site. If there are fewer people coming into the site, there is a lower threat of invasive species being introduced. These plants will also create shade where there was not any before, which could help shade out any invasives that might threaten this area, helping with Objective 1-1. The *H. discolor* can also help with Objective 1-3 since the foliage can be used as habitat and the flowers will attract pollinators (The Wild Garden no date).

Polygon 2:

Polygon 2 is very open both in terms of space and in light availability. All the invasive plants have been removed from this area and there is not much in the way of native species either. There are very few trees here either, so there is a lot of light available for the plants that will be planted in this polygon. The soil is well drained, so any plants here must be tolerant of those conditions. The main goal for this area is to plant more evergreen trees. We want to create the foundations for a mixed deciduous and coniferous forest, so we will fill it with more evergreen plants. We also hope to minimize the threat of any invasive species that were present in this area coming back and taking over. We would also like to increase the habitat value of this polygon for any wildlife that lives within the park.

The focus in this polygon is on evergreens. We planted three different species of evergreen tree: *Abies grandis*, *Arbutus menziesii*, and *Pseudotsuga menziesii*. These trees were planted on 8 foot centers, which is the minimum spacing recommended for the trees to not crowd each other, but to still create more dense cover (Elefritz et al. 2006). We planted five *A. grandis* from 1-gallon containers and two *A. menziesii* plugs. As for the *P. menziesii*, there will be eight bare roots in the polygon. We will also be planting five *Arctostaphylos uva-ursi*, three *Corylus cornuta,* five *Gaultheria shallon*, five *Holodiscus discolor*, and six *Vaccinium ovatum* in this polygon on 4 foot centers. For groundcover, we will plant 15 *Tolmiea menziesii* on one foot centers from 3.5-inch containers and 13 plugs of *P. munitum* will be planted on 2 foot centers.

These plants will work together to achieve the goal of creating the beginnings of a coniferous forest and they will also

help us to achieve objective 1-2. We chose a variety of native plants that will be able to thrive in the specific environment of this polygon to achieve that goal. There are plants that survive well in drier soils and sunlight, such as *A. menziesii, P. menziesii, A. uva-ursi, G. Shallon,* and *H. discolor*, that were all planted towards the south side of the polygon where there is more light. We have also selected plants that are more shade tolerant to plant closer to polygon 3 where there is not as much light, such as *A. grandis, C. cornuta, G. shallon, V. ovatum, T. menziesii,* and *P. munitum*. These plants will also help with objectives 1-1 and 2-2. They will create a multilayered canopy of trees, shrubs, and groundcover. This canopy will eventually create shade to shade out any invasive species and the many different species in this area will also compete with any invasives that might threaten the site. The canopy will also help to slow down rainwater when it rains on the site, which will then reduce the speed and amount of stormwater runoff. Many of these plants will also help with objective 1-3 by creating thickets that can be used as shelter or producing seeds and berries that can be eaten (Table 3).

Polygon 3:

Polygon 3 has the most diverse conditions out of all the other polygons. Along the edges of polygon 2, the canopy cover is low and light levels are high since it is highly populated by deciduous trees and shrubs. As you go north and deeper into the forest, light levels begin to decrease making this polygon accessible for both shade tolerant and intolerant species. The soils closest to the border of polygon 2 are more drier and well drained sandy soils. As you move northeast and closer to the stream, the soil starts to gain more clay and moisture. At the moment, it is mainly a deciduous forest and the goal is to accelerate succession toward a coniferous forest.

The conifers we planted are *Picea sitchensis, Thuja plicata,* and *Tsuga heterophylla* which were planted with 8 foot centers. This is to give each individual decent space to thrive without too much overlap occurring with other plant species. We planted eight *T. plicata* and *T. heterophylla* each and both will come in bare root form and we are planting two *P. sitchensis* which come in a 2-gallon containers. The evergreen shrubs we planted include four *Gaultheria shallon,* three *Mahonia nervosa,* and four *Corylus*

cornuta. The *M. nervosa* and *G. shallon* both came in 4-inch containers where *C. cornuta* came in 2 gallon containers and all shrubs used four-foot spacing. For groundcover species, we planted 12 *Carex obnupta* on 1.5-foot spacing and 15 *Tolmiea menziesii* on 0.5-foot spacing and these species arrived in plugs and 3.5 inch containers respectively. The final groundcover species is the *Athyrium filix-femina* and we planted seven of them on 2-foot spacing from 4-inch containers.

Polygon 3 has various environmental conditions within it but the goal remains the same throughout which is to make it a coniferous forest and to increase wildlife biodiversity. Species such as *T. plicata* and *T. heterophylla* will assist in transitioning the site from deciduous to a mixed forest which would be achieving Objective 1-2. These tall year-round tree species will also allow for rainwater interception and decrease stormwater runoff which falls under Objective 2-2. They will also assist in shading out shade intolerant invasive species. Evergreen shrubs are beneficial in providing year-round ground cover habitat for wildlife. Objective 1-3 is obtained from *G. shallon* providing thickets that could be used for shelter and *M. nervosa* providing shelter as well as berries for food. Having a thicker lower canopy provides vertical and horizontal diversity in the forest. Groundcover species planted near the stream will help with improving water quality tackling Objective 2-1. And the *T. menziesii* is a native ground species that will help in absorbing excess water to prevent runoff and in outcompeting invasive species. *C. obnupta* is a graminoid that we planted near the stream bank as it prefers more marsh like habitats with wet soils rich in organic matter. Due to its deep root systems, it will help with Objective 2-1 in improving water quality of the stream. It is also known to provide habitat for an array of wildlife species. *A. filix-femina* is a larger ground cover species that we were not able to plant in the exact spots we intended to due to high forest density and considering the safety and comfort of our volunteers so we planted them a little more downstream closer to Polygon 2.

Polygon 4:

Polygon 4 has very dense canopy cover since it is in the interior of the forest. It consists of densely packed shrubs and deciduous trees. Plants that would be planted here would need in general need to be smaller due to spacing issues. In the fall and

winter, light penetration is higher since the leaves of the deciduous plants have fallen and canopy cover is around 60%. In the summer, the canopy cover is likely around 90%. The soil in this polygon is a moist sandy loam as it is near the stream.

We planted one species of coniferous tree which is *Thuja plicata* which come in plugs and we will plant 10 of them. They have 8 foot centers but since we are not planting many more species, they should be able to utilize more space if necessary. We also planted three *Mahonia nervosa* which come in 4 inch containers and will have 4-foot spacing but again, they should be able to access more space as there are not many other species and there should be little overlap.

The goal for polygon 4 is to enhance the already existing forest. At the moment, it is primarily a deciduous forest but we would like to turn it into a mixed coniferous and deciduous forest and eventually a full coniferous forest. Planting 10 *T. plicata* will aid in achieving Objective 1-1 by providing shade to help phase out invasive species. The coniferous trees will also help with Objective 1-2 which is to increase canopy diversity and shift the forest into a coniferous forest. *M. nervosa* is an evergreen shrub which will aid in Objective 1-2 in diversifying the canopy with year-round ground cover. It also contributes to Objective 1-3 because of its berries that can be consumed by various wildlife including bird species.

Table 1: Plant materials in polygons 1 and 2.

	Polygon 1			Polygon 2		
Species	#	Spacing (ft.)	Form	#	Spacing (ft.)	Form
Trees						
Abies grandis				5	8	1-gallon container
Arbutus menziesii				2	8	Plug

Pseudotsuga menziesii				8	8	Bare root
Shrubs						
Arctostaphylos uva-ursi				5	4	4-inch container
Corylus cornuta				3	4	2-gallon container
Gaultheria shallon				5	4	4-inch container
Holodiscus discolor	5	4	Bare root	5	4	Bare root
Rosa gymnocarpa	6	4	1-gallon container			
Vaccinium ovatum				6	4	Plug
Groundcover						
Tolmiea menziesii				15	1	3.5-inch container
Ferns						
Polystichum munitum	20	2	Plug	12	2	Plug

Table 2: Plant materials in polygons 3 and 4.

	Polygon 3	Polygon 4

Species	#	Spacing (ft.)	Form	#	Spacing (ft.)	Form
Trees						
Picea sitchensis	2	8	2-gallon container			
Thuja plicata	8	8	1-gallon container	10	8	Plug
Tsuga heterophylla	8	8	1-gallon container			
Shrubs						
Corylus cornuta	4	4	2-gallon container			
Gaultheria shallon	4	4	4-inch container			
Mahonia nervosa	3	4	4-inch container	3	4	4-inch container
Graminoids						
Carex obnupta	12	1.5	Bare root			
Groundcover						
Tolmiea menziesii	15	1	3.5-inch container			
Ferns						

Athyrium filix-femina	7	2	4-inch container			

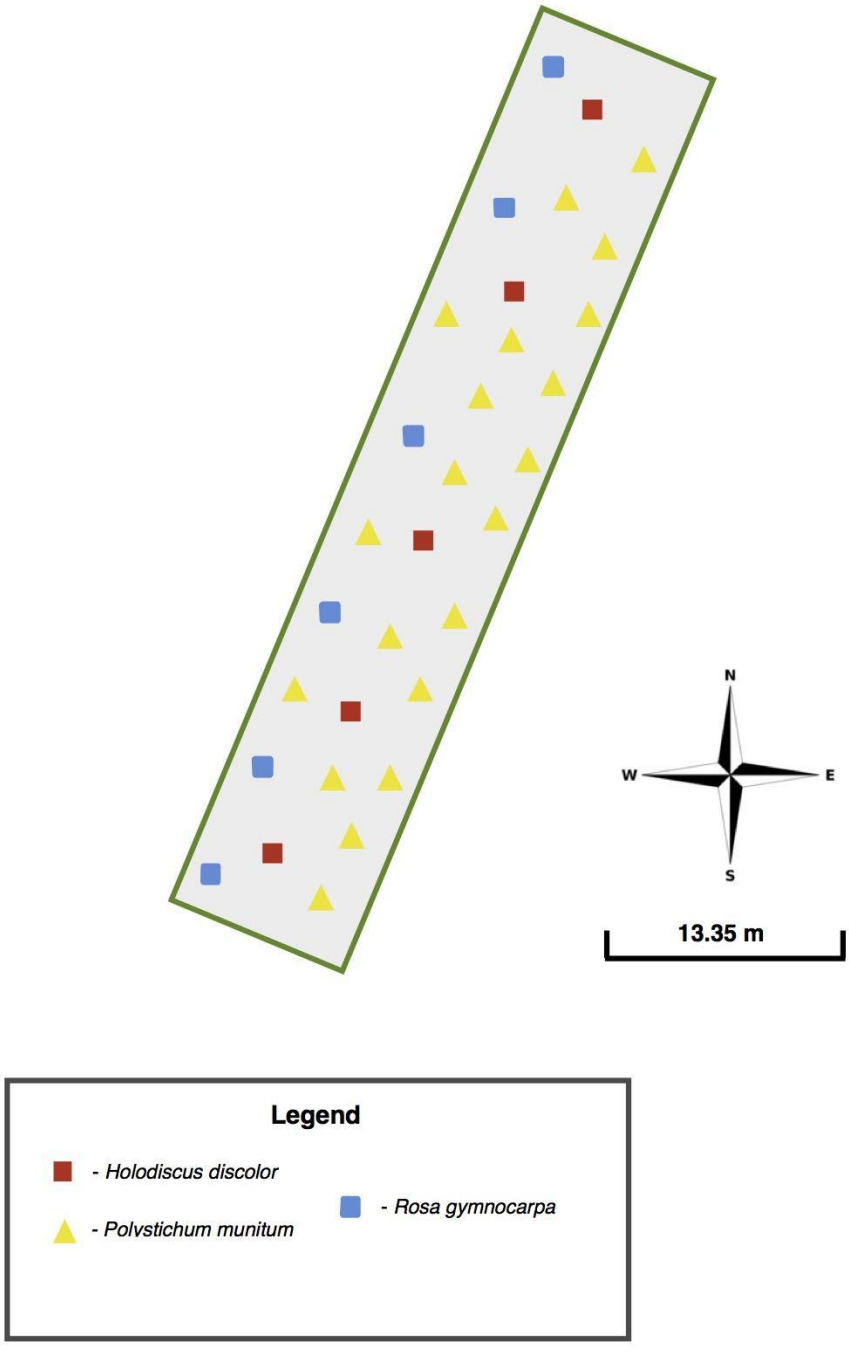

Figure 5: Planting plan for Polygon 1

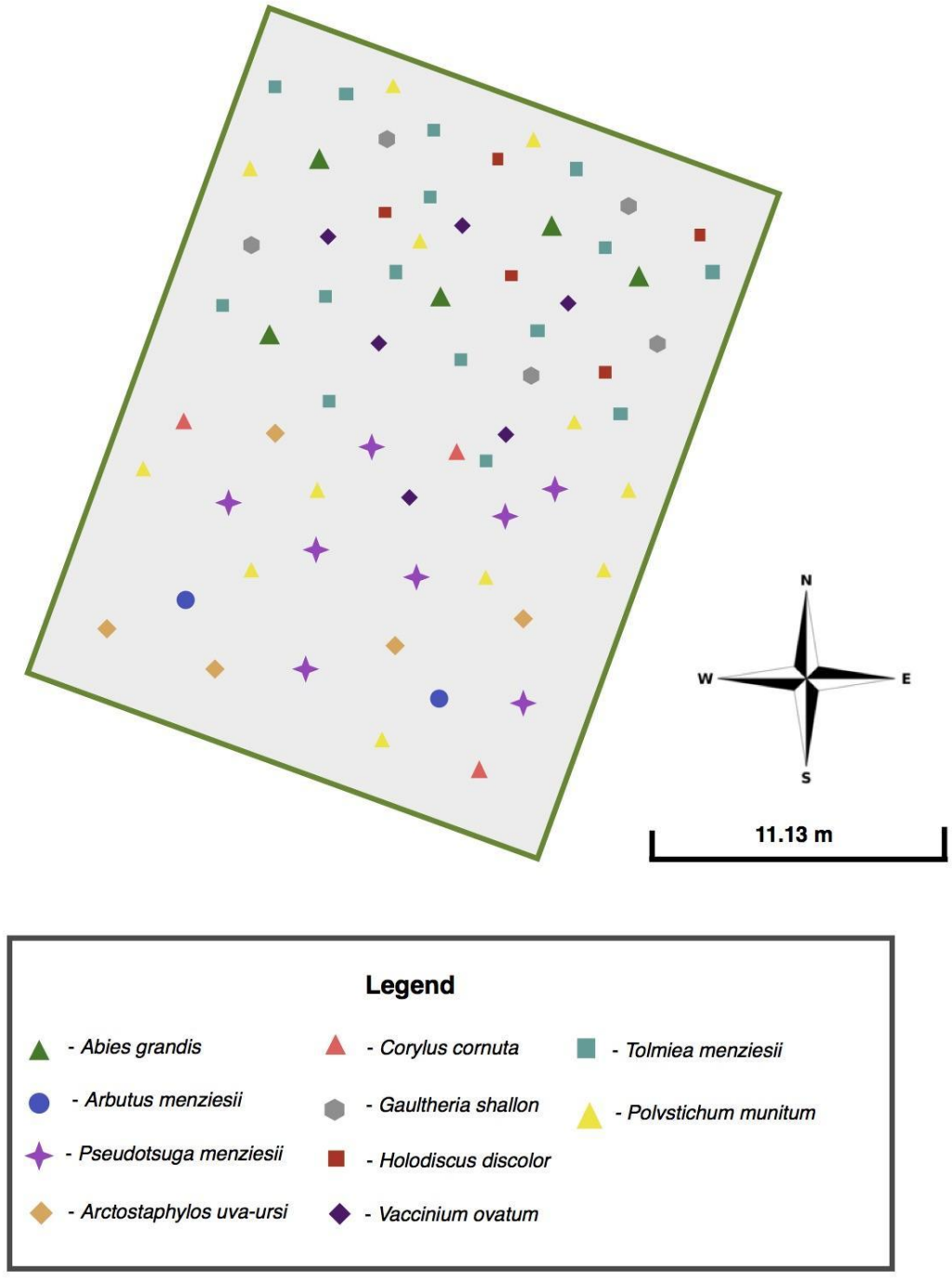

Figure 6: Planting plan for Polygon 2

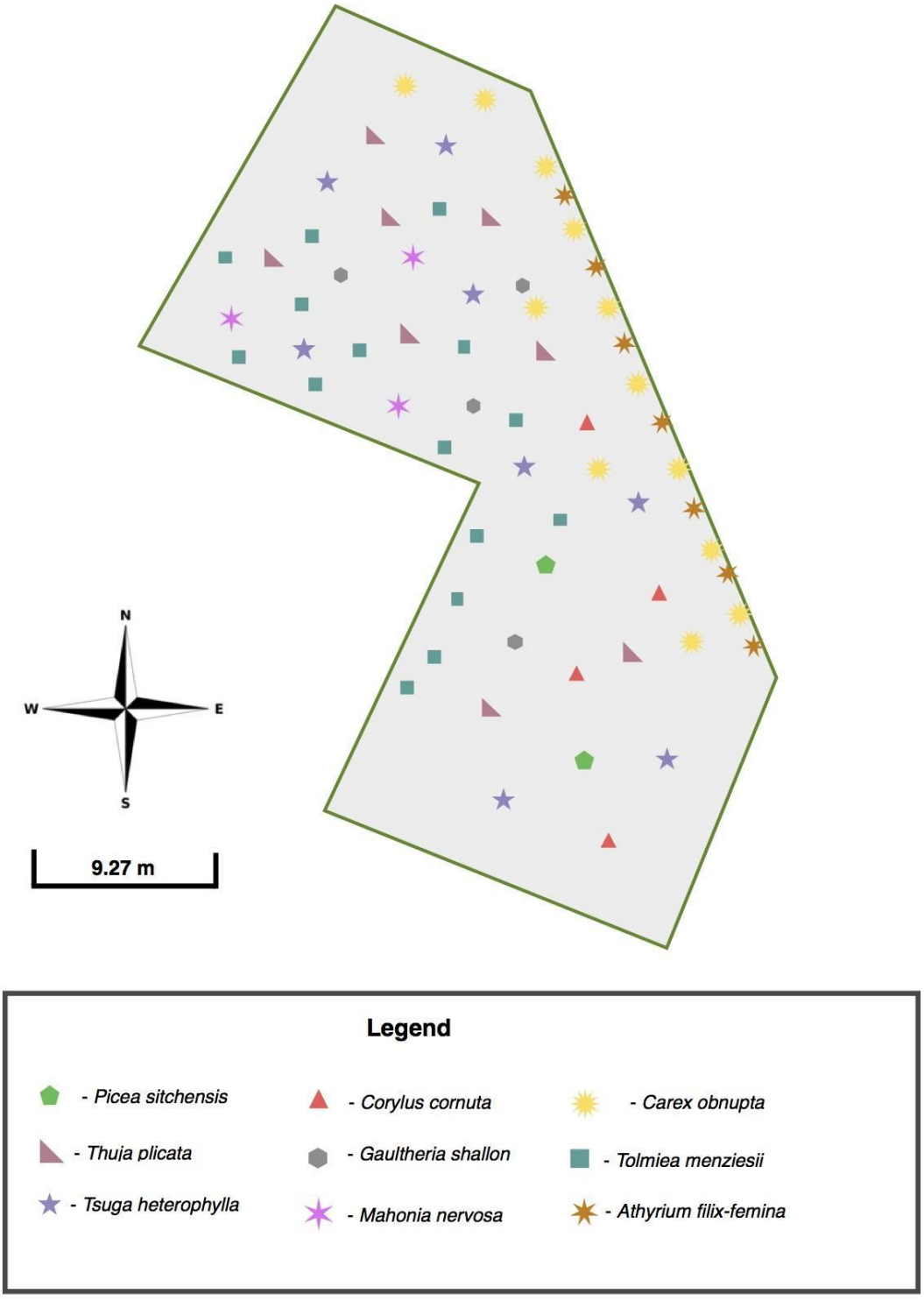

Figure 7: Planting plan for Polygon 3

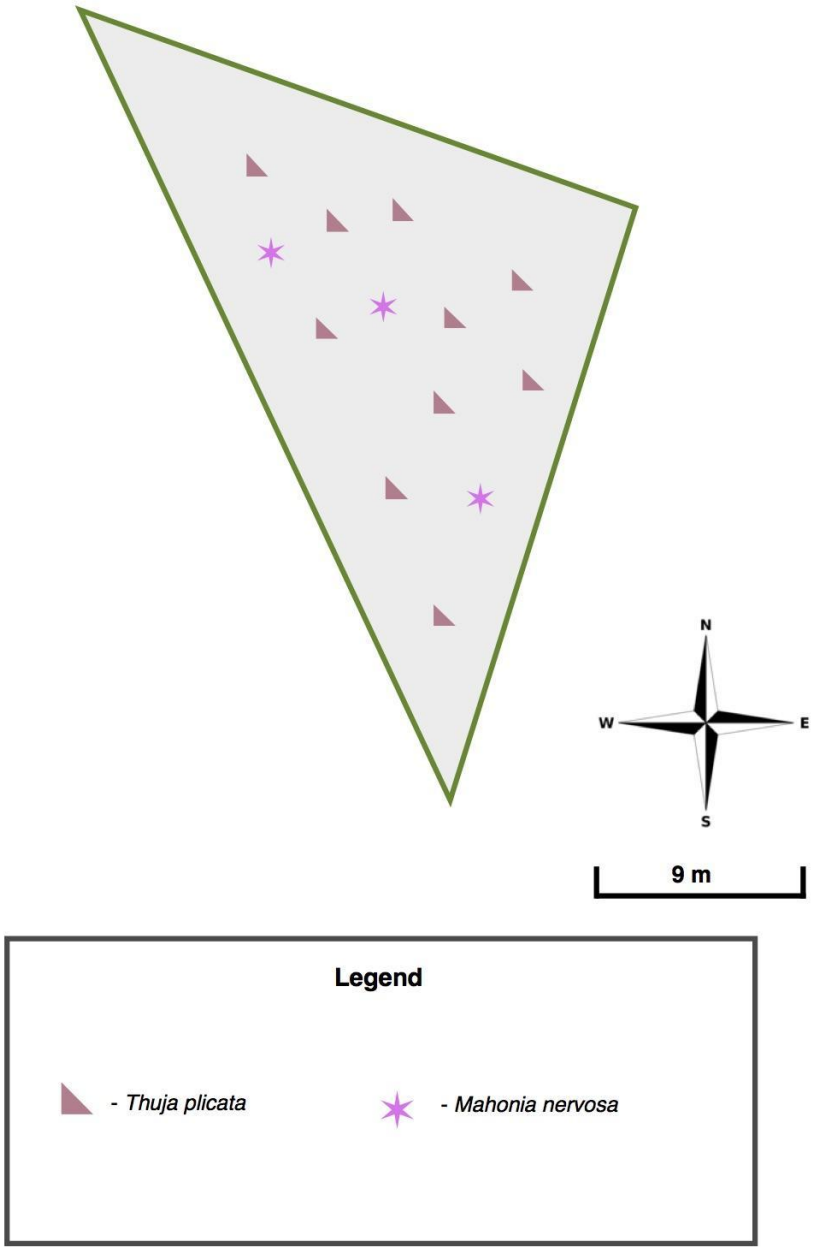

Figure 8: Planting Plan for Polygon 4

Table 3: Plant benefits for wildlife

Species	Benefits to wildlife

Abies grandis	Produces seeds, habitat for insect larvae, creates thickets for shelter
Arbutus menziesii	Produces berries, habitat for insect larvae
Arctostaphylos uva-ursi	Produces berries
Corylus cornuta	Produces seeds, creates thickets for shelter
Gaultheria shallon	Produces berries, habitat for insect larvae, creates thickets for shelter
Holodiscus discolor	Produces nectar, creates thickets for shelter
Mahonia nervosa	Produces berries
Picea sitchensis	Produces seeds, creates thickets for shelter
Pseudotsuga menziesii	Produces seeds, habitat for insect larvae
Rosa gymnocarpa	Produces nectar, creates thickets for shelter
Thuja plicata	Produces seeds, creates thickets for shelter
Vaccinium ovatum	Produces berries and nectar

*All sourced from the Starflower Foundation

3. Budget Plan

Table 4: Labor & Financial Budget Plan

	Project Total Budget						Project To-Date (as of 5/25/2017)					
Expeditures	UW (labor)	UW (cash)	Client	In-Kind (non-labor)	In-Kind (labor)	Total	UW (labor)	UW (cash)	Client	In-Kind (non-labor)	In-Kind (labor)	Total
Prepare Site												
Site Assesment	$ 300.00						$ 300.00					
On site preperation	$ 150.00						$ 150.00					
SUBTOTAL	**$ 450.00**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 450.00**	**$ 450.00**		**$ -**	**$ -**	**$ -**	**$ 450.00**
Invasive Weed Control												
Removal of R. armeniacus and H. helix	$ 625.00				$ 3,375.00		$ 600.00				$ 2,340.00	
Mulch acquisition			$ 50.00						$ 50.00			
Mulching	$ 500.00				$ 1,350.00		$ 750.00				$ 1,080.00	
SUBTOTAL	**$ 1,125.00**	**$ -**	**$ 50.00**		**$ 4,725.00**	**$ 5,900.00**	**$ 1,350.00**		**$ 50.00**	-	**$ 3,420.00**	**$ 4,770.00**
Plant Purchase & Planting												
Ordering plants & outlining	$ 500.00						$ 450.00					
Acquiring plants	$ 150.00	$ 580.00	$ 215.00				$ 150.00	$ 446.11	$ 215.00			
Plant Installation												
Planting plants in all polygons	$ 750.00				$ 1,350.00		$ 450.00				$ 315.00	
SUBTOTAL	**$ 1,400.00**	**$ 580.00**	**$ 215.00**	**$ -**	**$ 1,350.00**	**$ 3,545.00**	**$ 1,050.00**	**$ 446.11**	**$ 215.00**	**$ -**	**$ 315.00**	**$ 2,026.11**
Community Engagment												
Plan and manage work parties	$ 1,800.00						$ 1,350.00					
Reports								$ -				
Develop work plan	$ 3,000.00						$ 2,750.00					
Stewardship Plan	$ 2,250.00						$ 2,250.00					
Final Report	$ 2,250.00						$ 2,000.00					
Design, prepare, print final poster	$ 450.00	$ 20.00						$ 20.00				
	$ 9,750.00	**$ 20.00**	**$ -**	**$ -**	**$ -**	**$ 9,770.00**	**$ 8,350.00**	**$ 20.00**	**$ -**	**$ -**	**$ -**	**$ 8,370.00**
TOTAL EXPENDITURES	**$ 12,725.00**	**$ 600.00**				**$ 13,325.00**	**$ 11,200.00**	**$ 466.11**	**$ 215.00**	**$ -**	**$ 315.00**	**$ 12,196.11**

The Labor and Financial Budget plan has been based off of the amount of work it took for all of the work parties, acquiring plants, and developing all of the paper assignments. Furthermore, out of the $600 budget we were given, we finished off the quarter using only $466.11 of the allotted money. According to our ending total, it looks like we were just under how much we anticipated we would spend this whole year in terms of financially and labor wise. That means we budgeted our whole year appropriately, we just added a bit more than what we predicted.

4. Other Plans

In the work plan, we stated that we wanted to do tool safety training by potentially creating handouts, this was not able to be done due to other deadlines. However we do make sure to give each volunteer proper tool safety training before each volunteer event.

D. Work Timeline

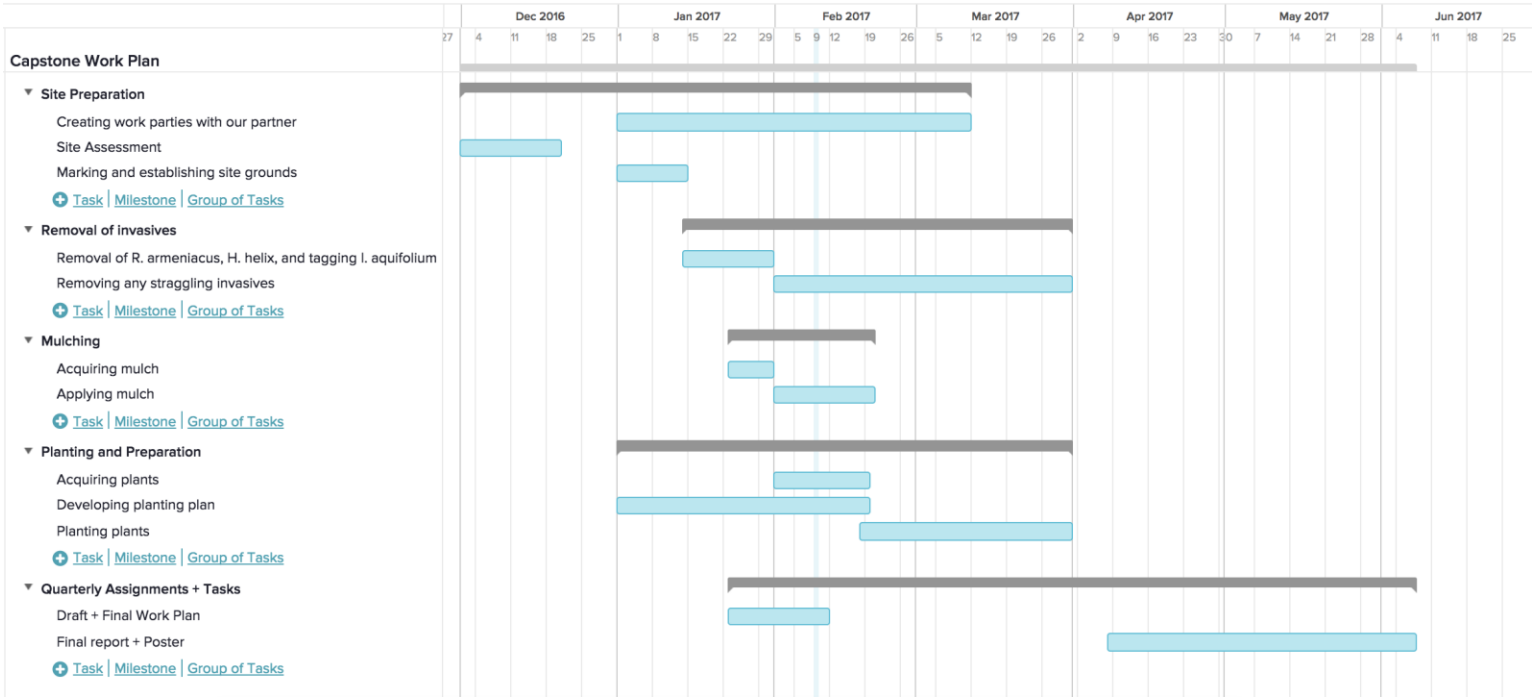

Figure 9: Work timeline for remaining quarters.

E. Design for the Future

1. Stewardship Expectations and Development Plan

The goal for our restoration site is to reintroduce plants such as shrubs, ferns, and coniferous trees to promote the return of a natural mixed canopy coniferous and deciduous forest composed of species associated with the Douglas fir-western hemlock/dwarf Oregon grape-sword fern communities. To accomplish this, we expect stewardship of the restored forest to maintain and monitor the restoration. To have an effective stewardship plan, it is crucial to have community involvement (Goal 3). The Green Kirkland Partnership has existing companies who give back to the community by volunteering at events, but we would like to expand this community support for sustained stewardship of the restoration.

Education and awareness are important tools for our restoration to be successful. Our project location is surrounded by residential communities that most likely are the majority of people who frequent the adjacent recreational park area. The neighboring park also supports sport activities. These park-goers are an ideal volunteer source to expand the Green Kirkland Partnership volunteer base for future stewardship of the restoration project. They would most likely have a greater sense of ownership of the

improvement of the park that they enjoy to utilize for activities, and aesthetic purposes. We plan to tap into this resource by displaying fliers at the Everest Park where human traffic frequents the park, like baseball dugouts, to bring awareness to the park's restoration activities, the need for community volunteer involvement, and upcoming restoration events. The fliers will connect the interested community member to the Green Kirkland Partnership website, and Facebook link, where the user will become educated on the importance of forest restoration, on restoration techniques, and additional information on how to get involved.

Restoration events can be a social event that will connect neighbors together and create a stronger local community network. We hope that this will entice involvement, in addition to a greater sense of ownership of the restoration project. During these events, community volunteers will naturally become educated in the location's restoration process, local ecosystem, and human impact. Furthermore, we hope that these future stewards will reach out to their friends, families, and neighbors to educate and excite about restoration involvement. This will develop the future stewardship that our site will depend on.

2. Project Design and Stewardship

In 50 years from now, we expect that the planted conifers and understory flora will have become established. Additionally, we expect that invasive species will be successfully suppressed as a result. To accomplish our long-term goals, returning the forest site to its natural hydrological and wildlife functions, we depend on continued stewardship of the project.

To meet the long-term vision, our restoration site is designed so that it will promote continued stewardship until the restoration becomes successful and stable. Polygon 1 will be planted with species appropriate for its unique topography that will provide natural habitat functions, and deter human disturbances; also, the new foliage and pollinators give aesthetic features that will draw attention to the restoration, and hopefully to stewardship efforts as well. Since Polygon 2 is the most deteriorated area of the site, and has high exposure to the sun, our design plan has a concentration of coniferous and lower canopy species. This will help the successful future stewardship of the site by assisting in the

suppression of the invasives removed. The remaining polygons were designed accordingly to accomplish the same.

By the end of our project we expect to have established a comprehensive stewardship plan for our partner that will support our project goals. After we finish the planting phase of the project, land stewardship is expected to include monitoring for invasive species regrowth, removal of invasive regrowth, and mulch application as necessary to support restored native understory vegetation and forest canopy establishment success. Responsible stewardship of the site will ensure success in meeting our long-term goals.

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