Warren G. Magnuson Park
Final Packet
University of Washington Restoration Ecology Network Capstone
2016-2017

Community Partner Tom Kelly

In Affiliation with Magnuson Environmental Stewardship Alliance
and the Green Seattle Partnership

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Project Summary

This report describes the Warren G. Magnuson Park Restoration Project implemented by a team of six students in the University of Washington Restoration Ecology Network (UW-REN) Capstone course in 2016-17. Magnuson Park is located at 7400 Sand Point Way NE, King County, Seattle. The physical site is located on the southwest slope of what is knows as Sand Point Head and is about 300 feet south of the North Cross Park Trail, and about 200 feet east of the tennis courts. The Magnuson Park project is an ongoing extension of UW-REN restoration projects that have occurred since 2012, this year's site is bordered on its western side by last year's restoration.
By June 2017, six restoration projects will have taken place at Magnuson Park, all pushing forward the goal of increasing overall size of contiguous restored area to form what will be one of the largest forested areas in the park. The primary contact and community partner for this project is Tom Kelly, who represents Magnuson Environmental Stewardship Alliance and the Green Seattle Partnership. Tom has worked with previous UW-REN groups and has been actively involved within the restoration. His insight and experience contributed heavily to the success of our project.

Figure 1 and 2: Before and After Photos of the Site

Pre-Restoration Description

The site is approximately one fifth of an acre, or about 8,712 square feet and is situated on a moderate hill with a southwest facing slope, from top to bottom is -17 degrees. The area at the foot of the hill and slope is low quality seasonal wetland. Adjacent to the western and southern boundary of our site is a social trail that is used by many park

users. At a first glance, the sites understory was completely dominated by *Rubus armeniacus*, with only a few native species in sight. The site is divided into three polygons mostly based on vegetation differences. Polygon 1 is located farthest up the hill and is the most steep amongst the three. Although it is the smallest polygon it contains the largest tree species-- an *Arbutus menziesii* and two *Salix scouleriana,* as well as a few *Polystichum munitum*. Polygon 2 is the middle area and also has a slight incline, but not as steep as Polygon 1. Polygon 2 contains a few *Cytisus scoparius*, but it was primarily dominated by *Rubus armeniacus*. Polygon 3 is at the foot of the hill and is the largest, most diverse section of the site. The slope here is almost flat and is low quality seasonal wetland. The vegetation in this section was mostly dominated by *Rubus armeniacus*, but it also contained a mix of *Cytisus scoparius*, *Popularis spp*., *Phalaris arundinacea*, *Polystichum munitum*, and *Cirsium vulgare.*

Ecological Concerns:

- *R. armeniacus* dominated the majority of the site, a species that is known to be difficult to remove.
- The southern portion of the site is seasonal wetland. In the winter months, when rainfall is frequent, volunteers will have to work in muddy conditions. Volunteer morale or willingness to participate might suffer as a result. Plant choices must be tolerant of condition changes.
- The western and southern edges of the site are bordered by trails. Off leash dogs are more likely to trample or dig up newly planted vegetation and hinder efforts toward restoration.
- The site's northern edge remains untreated. This could open up the possibility for invasives such as *R. armeniacus* to be reintroduced to the site, especially when there is little competition from newly planted vegetation.

Project Goals:

- Promote the establishment of native Pacific Northwest vegetation and create a self-sustaining forest habitat
- Improve ecosystem services, ecosystem function, and habitat quality
- Improve overall recreational and aesthetic value of Magnuson Park
- Engage community members and create a network of enthusiastic volunteers

General Approach:

The initial goal of the site restoration was to remove the well established and highly invasive Himalayan Blackberry that was overwhelming the majority of the site. After the invasives were removed, we installed live stakes throughout the site with the majority of them located in polygon 3. Next, we hosted a work party to plant the remainder of our species, followed closely by a series of mulches in order to achieve a thick layer that will help to suppress the reintroduction of invasives and allow for the native species to become established without risk of competition.

Major accomplishments:

- Restored 609 square meters of forested land
- Planted a total of 136 plants, which includes 26 trees species, 64 shrub species, and 46 ferns
- Over the course of six work parties we hosted a total of 130 community members resulting in 415 hours of volunteer work on the site.
- In a single work party, removed approximately 465 square meters of Himalayan Blackberry, 20 of which were part of an adjacent area outside of our site

Team Members:

Figure 3: From top left to bottom right: Justine Mantz, Andres Morales, Emily Newell, James Yan, Franklin Rosas, and Khang Nguyen.

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Acknowledgements:

We would like to thank everyone who helped and contributed with this project:

- Tom Kelly, our community leader and primary contact from Magnuson Environmental Stewardship Alliance and the Green Seattle Partnership, who helped with every step of the project, providing tools and materials, organizing work parties, and offering advice.
- UW-REN professors, Kern Ewing, Jim Fridley, Warren Gold, and TA Shannon Ingebright, who guided and supported the team throughout the year.
- UW Center for Urban Horticulture who offered their nursery to hold our plants.
- Seattle Preparatory School, who provided a great group of 24 high school students that helped us spread the majority of the mulch on our site.
- Starbucks, who generously donated coffee for a few work parties.
- Every volunteer that put time and effort at one of our work parties and helped us restore our site back to a healthy, native forest by removing invasive species, applying mulch, and reintroducing native species.

Figure 4: Acknowledgements

As-Built Report

Background

Location

Magnuson Park is a 350-acre former naval base located in the northeast Seattle neighborhood known as Sand Point (Figure 1). It is part of the Lake Washington/Cedar River Watershed. Part of a peninsula, Magnuson park is bordered on the east by Lake Washington and on the west by residential neighborhoods. The park provides many amenities to residents nearby, including numerous grassy playing fields, boat ramps, a sailing club, a community garden, indoor and outdoor sports complexes, a dog park, swimming beaches, and natural areas featuring wetlands, grasslands, and woody cover. (Aguirre, 2016).

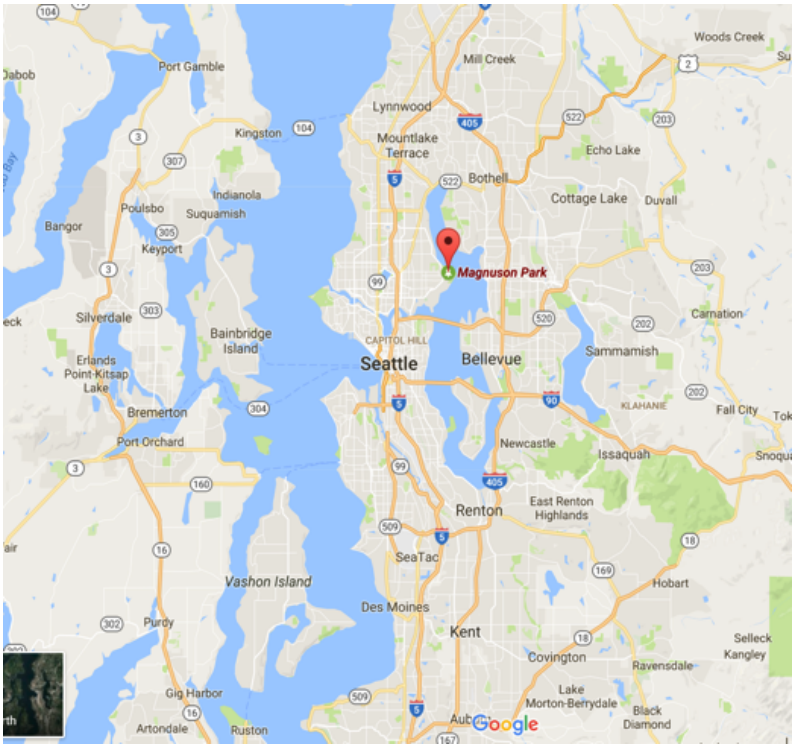

Figure 5: Location of Magnuson Park within Puget Sound region

Site Selection

Magnuson Park has been a location of ongoing restoration projects for student groups from the University of Washington's Restoration Ecology Network (UW-REN) since 2012. Our group has been coordinating with a community partner from the Magnuson Environmental Stewardship Alliance since October, and with his advice, chose a site adjacent to the UW-REN 2015-2016 site. The UW-REN 2016-2017 site is directly to the east of the 2015-2016 site (Figure 2). It was selected because the adjacent restored site could provide valuable insight into what our project goals could be, as well as act as an example for volunteers so that they could witness what needed to be done, such as how to set up brush piles when we cut and removed himalayan blackberry (*Rubus armeniacus*) during our MLK work party. In addition, working on a site adjacent to previously worked on locations reduces the risk of invasives becoming reintroduced to our site post restoration.

Figure 6: Map of Magnuson Park with location of UW-REN 2016-17 site

Site Description

The Sand Point UW-REN 2016-2017 site is a 607 m^2 trapezoidal plot (Figure 3). It is located in T25N, R04, section 2, is approximately 160 ft. north of the Cross Park Trail NE, 200 ft. east of the tennis courts, and 500 ft. northwest of the swim beach parking lot. The western and southern edges run adjacent to small 1 meter wide trails, with the northern and eastern edges alongside untended natural areas. The site has a southeastern downward slope of 31%, becoming the most flat on the southern edge. A wetland borders the south side of the site and during the spring months that portion of the site may be subject to flooding.

The subcanopy is mainly comprised of the highly invasive and pervasive *R. armeniacus*. Other invasives on the site include scotch broom (*Cytisus scoparius*), which which are present in the form of large downed branches, and reed canarygrass (*Phalaris arundinacea*), a common invasive on wetlands, however these species are not nearly as prevalent as *R. armeniacus*. Native plants on our site include the main canopy species present, Pacific madrone (*Arbutus menziesii*), Scouler's willow (*Salix scouleriana*), and western sword fern (*Polystichum munitum*).

Figure 7: The red outline shows the exact location of our site within the boundaries of Magnuson Park, on the southwest slope of Sand Point Head

Restoration Needs and Opportunities

The extremely high presence of invasive plants in our site, specifically *R. armeniacus*, is currently posing significant threats to the forest's ability to mature into a mature conifer forest, instead limiting it to a forest with very sparse canopy. The lack of a strong canopy allows for *R. armeniacus* to thrive, as it requires constant sunlight to grow. In addition, because the *R. armeniacus* is so dense, regeneration of coniferous trees is very difficult. With the removal of *R. armeniacus*, coniferous trees will be able to become well established and eventually develop into a late successional coniferous forest with a strong and dense canopy. The presence of a closed canopy would provide consistent shade that would hinder the further regeneration of *R. armeniacus*, allowing for a subcanopy consisting of native species such as *P. munitum* and evergreen huckleberry (*Vaccinium ovatum*). Another invasive species detrimental to the health of our site is *P. arundinacea*, which, in comparison to native wetland vegetation, provide little value to wildlife, as very few species eat it and it grows too densely to provide adequate cover. Restoration to this site is extremely important in order to allow for it to

mature into native vegetation with an adequate canopy, as well as provide valuable sources of food and shelter for wildlife.

Tasks & Approaches

Goal 1- Promote the establishment of native Pacific Northwest vegetation and create a self-sustaining forest habitat

-Objective 1.1: Decrease or eliminate invasive plant species

-Task 1.1a: Remove all invasive *Rubus armeniacus* biomass
-Task 1.1b: Remove all invasive *Cytisus scoparius* biomass

Approach: An effective way to remove invasive *R. armeniacus* is to first remove the thick and unmanageable aboveground biomass (Soll, 2004). Removing as much of the root crown as possible will then be more doable. Excavating as much of the root crown and root biomass is essential, otherwise it is likely that *R. armeniacus* will sprout more canes (Soll, 2004). Tools required to remove *R. armeniacus* include shovels or pick mattocks. Removal of *C. scoparius* will be done in a similar fashion, however a weed wrench will be required.

-Objective 1.2: Decrease likelihood of invasive re-establishment and need for future maintenance

-Task 1.2a: Monitor site and remove invasives as they appear
-Task 1.2b: Cover soil with thick layer of mulch
-Task 1.2c: Quality control--remove all invasives that reappear post-removal

Approach: Despite best efforts, it is likely that *R. armeniacus* will reappear after initial removal. A watchful eye will be kept on the site post-removal, and difficult or stubborn individuals will be removed as they reappear. The removal process of *C. Scoparius* creates ideal conditions for the species to re-establish in greater number

and in the same location (Hultin, 2008), and these locations will be of top priority. Mulch will also be used to suppress invasive species. An 8 inch layer of mulch will be spread over the soil to suppress *R. armeniacus* and to protect the soil from stray, invasive seeds (Chalker-Scott, 2007).

-Objective 1.3: Increase number of native species present, especially conifers and evergreen species, and plant strategically to shade out *R. armeniacus* and *Phalaris arundinacea.*

-Task 1.3a: Select native species appropriate to local environment of restoration site
-Task 1.3b: Locate and purchase/salvage selected vegetation
-Task 1.3c: Consider current vegetation and shade conditions of site and plant species appropriate for conditions
-Task 1.3d: refer to Planting Plan for species specific location

Approach: First, a list of appropriate species will be assembled. Only the species which are suitable for the conditions of the site will be considered. Quantities are then determined by accounting for the space each individual will occupy, and how much space is available in the site. The list will be submitted to local nurseries and plant sales around the Seattle area. Species not included on the list will potentially be salvaged. Salvaging plants is a great way to be conscious of the budget. Prior to planting begins, the Planting Plan will be referred to. This is because conditions in Polygon 1 are not the same as in Polygon 3. Shade tolerance, soil moisture content, and other characteristics need to be considered to guarantee plant establishment and survival. As plants grow and mature they will shade and outcompete *R. armeniacus* which need direct sunlight for survival (Hultin, 2008).

AD1: No plants were salvaged for this project. It was more convenient to purchase all plants because no salvages overlapped with the planting schedule.

Goal 2- Improve ecosystem services, ecosystem function, and habitat quality

-Objective 2.1: Amplify carbon sequestration

-Task 2.1a: Increase vegetative cover of the restoration site

Approach: To accomplish Objective 2.1, more native plant species will be planted in the site. The result of planting more plant species, specifically perennials and evergreen species, will be increased carbon sequestration. Photosynthesis uses carbon from the atmosphere and stores it in plant tissues in the form of carbohydrates. An increase in vegetation results in an increase carbon sequestration.

-Objective 2.2: Promote surface water infiltration and control stormwater runoff and erosion

-Task 2.2a: Refer to and follow plans developed in the Planting Plan
-Task 2.2b: Spread layer of mulch over soil

Approach: Extensive removal of *R. armeniacus*, frequent precipitation, and the gradual slope of the site will increase rates of erosion. To combat erosion, native plant species which are known for slope stabilization and erosion control will be planted (as detailed in the Planting Plan). In general, increasing vegetative cover will reduce erosion (Bressette, 2014). Specifically, species such as *Rubus spectabilis* and *Pseudotsuga menziesii* will be installed for erosion control. Adding organic material to the soil will slow erosion as well (Chalker-Scott, 2007). To accomplish this a layer of mulch will be spread over the soil.

-Objective 2.3: Select for diverse, native plant species to provide nesting, cover, and foraging habitat

-Task 2.3a: Consider species that potentially inhabit the area and select plants accordingly
-Task 2.3b: Plant selected species according to the Planting Plan in Section III

Approach: In order to improve existing habitat, or replace habitat lost due to removing large quantities of *R. armeniacus*, planting a significant quantity of native trees, shrubs, and ferns is necessary. Species such as *Rubus spectabilis,* among others, can provide berries as food to native bird species (Peterson). Other species included in the plan are *Vaccinium ovatum, Polystichum munitum, Alnus rubra,* and *Pseudotsuga menziesii*. More information on the reasoning, justification, and location of other species is provided in the "Planting Plan" in Section III.

Goal 3- Improve overall recreational and aesthetic value of Magnuson Park

-Objective 3.1: Plant species strategically to allow for varied levels and gaps improving trail user visibility and experience

-Task 3.1a: Refer to and follow the structure of the Planting Plan

Approach: The Planting Plan was devised with current site characteristics and proposed site characteristics in mind. Spacing, shade tolerance, and soil moisture content were all considerations that were made when developing the Planting Plan. Simply following the Planting Plan and monitoring the status of installed native ferns, shrubs, and coniferous trees will guarantee the site's success as a natural Pacific Northwest ecosystem.

Goal 4- Engage community members and create a network of enthusiastic volunteers

-Objective 4.1: Create a fun and inviting learning atmosphere to spark volunteer interest

-Task 4.1a: Provide opportunities for volunteers to learn basic concepts of restoration ecology
-Task 4.1b: Provide snacks and beverages to volunteers
-Task 4.1c: Make personal connections with individual volunteers

Approach: Volunteering should be enjoyable and rewarding. An important component of work parties is informing volunteers. Basic restoration ecology principles will be taught to volunteers at work parties. Volunteers will feel more invested and satisfied if they have a basic understanding of restoration work. Snacks and beverages are another great way to make volunteers feel welcomed, appreciated, and comfortable. Furthermore, socializing with volunteers is another way to show them that their time is valued, and overall makes the experience more enjoyable.

-Objective 4.2: Build continuity between projects in the past and projects in the future to promote maintenance longevity

-Task 4.2a: Reach out to local schools/neighborhoods and invite students and volunteers to work parties
-Task 4.2b: Present lesson plan to students/volunteers
-Task 4.2c: Present status of past projects and current projects

Approach: Student volunteers from local schools have proven to be effective at Magnuson Park in the recent past. The result of developing educational material, showing students successes of past projects and giving students hands on experience participating in restoration work will increase awareness, increase personal investment in restoration projects, and increase stewardship for Magnuson Park restoration in the future. Educational material will include brief park history, effects of disturbances and invasive species on habitat, and the benefits of ecosystem services on native species and the community.

AD2: We did not reach out to local schools. Luckily, our community partner already has a relationship with schools in the area that were able to provide us with productive groups of volunteers.

-Objective 4.3: Raise awareness for restoration projects in Magnuson Park

-Task 4.3a: Design, create, and distribute brochures throughout the Sandpoint community

Approach: Brochures are an easy and inexpensive way to raise awareness about the volunteer opportunities available in Magnuson Park. A bi-fold design, targeted at an audience of about a 6th grade reading level will be developed and distributed to the surrounding community. Door-to-door distribution (the neighborhoods to the west of the park is the targeted community), distribution at local schools, and display at the park's community center will increase awareness of restoration work in Magnuson Park.

AD3: Brochures were not distributed to schools. When reaching out to local schools was no longer part of the plan, distributing brochures to schools was no longer necessary.

Specific Work Plans

Current Conditions

We divided our site into three polygons along horizontal perimeters, based mostly on vegetation differences (Figure 4).

Site Polygons

Polygon 1 is along the northern edge and is a topographically raised area with the greatest amount of canopy cover among all three polygons, due to the existence of old and established tree species. It is at the highest elevation of our site and is the most dry, although our site is overall a moist location.

Polygon 2 is located in the center of the plot and is the largest of the three. The slope is most pronounced in this polygon. There is some canopy cover, however not as much as in polygon 1.

Polygon 3 makes up the southern portion of our site. The slope lessens in this polygon and begins to lead into a topographical depression. Polygon 3 borders the potential

wetland just south of our site and as such is the most moist of the three and is subject to flooding during the winter and fall months.

Site Vegetation

	Polygon One	**Polygon Two**	**Polygon Three**
Area (m^2)	150	203	254
Slope	28%	33%	27%
Aspect	South facing	South facing	South facing
Soil Texture	Loam	Sandy Loam	Silty Loam
Soil Moisture	Moist	Moist	Moist
Light Availability	90% Canopy Cover, Deciduous, Dappled	30% Canopy Cover, Deciduous, Dappled	No Canopy Cover
Present Vegetation	2 *Salix scouleriana,* 1 *Arbutus menziesii,* 3 *Polystichum munitum,* and some *Rubus Armeniacus*	Several *Cytisus scoparius*, but otherwise only *Rubus armeniacus*	Much *Rubus armeniacus, Cytisus scoparius,* several *Popularis sp.*, encroaching *Phalaris arundinacea*, a few *Polystichum munitum,* and *Cirsium vulgare*
Human Impacts	Invasive species	Invasive species	Invasive species

Other Considerations	Sloped	Sloped	Sloped
	Bordered by public trail	Bordered by public trail	May be part of seasonal wetland

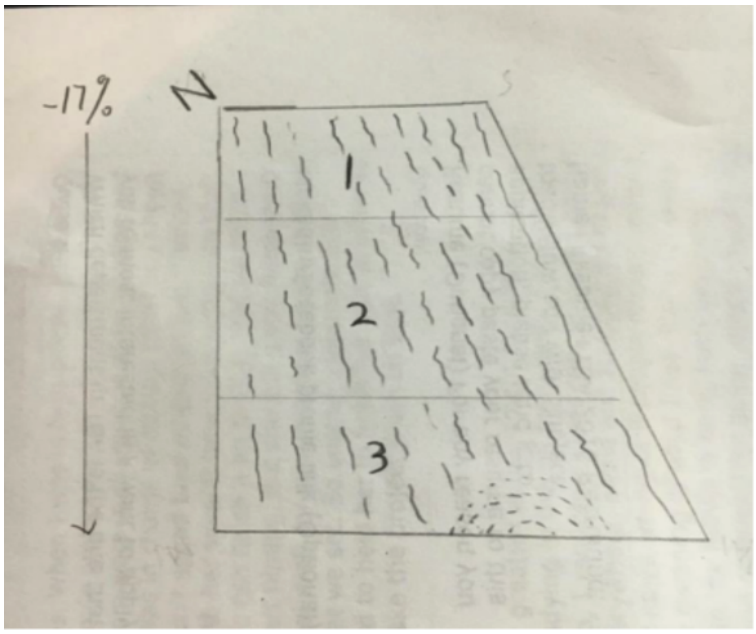

Figure 8: Site Description and Polygon Division

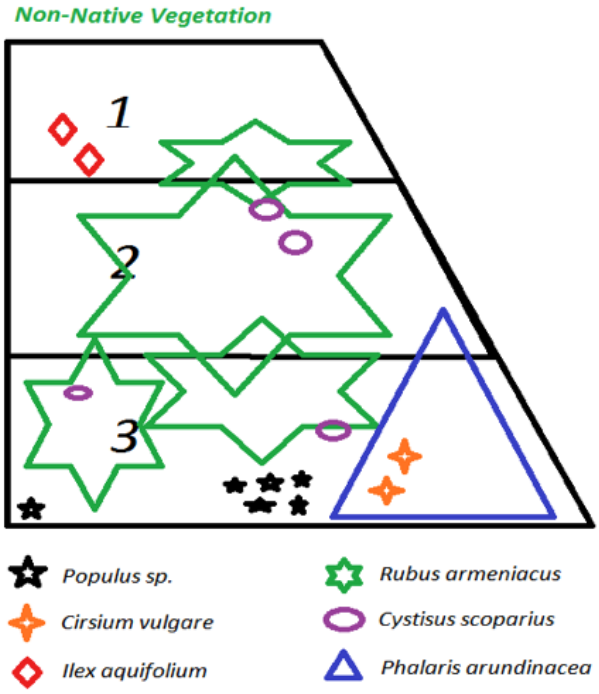

Figure 9: Beginning Non-native Vegetation

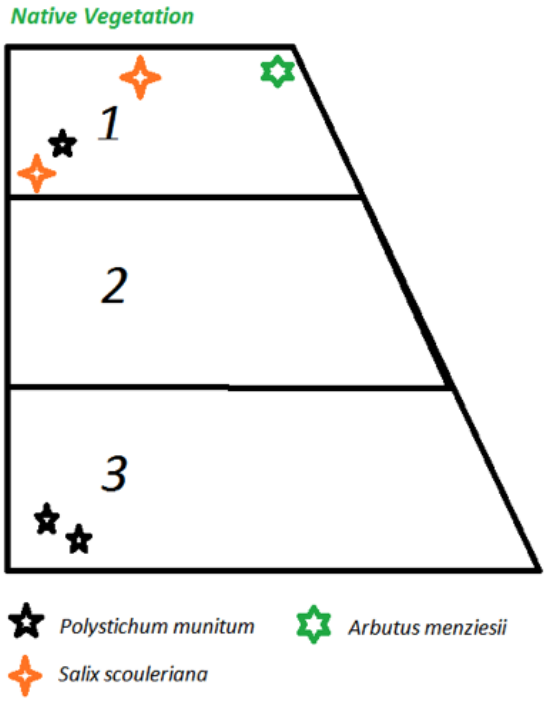

Figure 10: Beginning Native Vegetation

Site Preparation Activities

Polygon One is a moderately sloped section of the site that already has a few native species present. The current native species will need to be considered when planting new native species, but first the invasive species will need to be removed. Thickets of *R. armeniacus* will be cut down to about twelve inches above the soil. Then, the root crowns will be removed from the soil and placed in compost piles to prevent invasive reestablishment. Using a weed wrench, the *C. scoparius* will be excavated from the soil. The following modification will be the introduction of plant species native to the Pacific Northwest. Considering the canopy that is already established, species that can tolerate shaded environments will be installed. The final modification in Polygon One is the spreading of mulch over the soil.

Polygon Two, which is slightly more sloped than Polygon One, has less canopy cover than Polygon One. This decrease in canopy cover and increase in slope will require extra consideration of erosion control. After all *R. armeniacus* and *C. scoparius* has been removed, erosion will occur more easily. After invasive removal, plant species that are not associated with shaded environments will be planted. The Planting Plan takes into consideration which species are best suited for slope stabilization, erosion control, and which species are capable of tolerating more sunlight. Native plants in this polygon are also selected for their benefits to local wildlife for food and cover. Mulching is the next step after native plant installation.

Polygon Three is significantly different from the other two polygons. There is no canopy cover and the soil becomes highly saturated in the Fall and Winter months. Invasive species in this polygon are not as big of an issue; however, the encroachment of *Phalaris arundinacea* will need to be controlled. After control of invasives is completed, native species will be planted. Because of the high moisture content in the polygon, species that are tolerant of wet conditions will be planted. The planting plan takes this into consideration. Mulching will also need to be done in Polygon Three.

Logistical Considerations

Fortunately for our team, our site is easily accessible and travel to the site does not pose any serious threats for disturbance in the surrounding area. It is surrounded by

two previously established trails so we are not required to encroach on any natural areas other than those within our site. In addition, Magnuson Park has a parking lot very close by that ourselves and volunteers can use for parking that doesn't affect wildlife or vegetation in any way.

Staging points for materials (in our case, just mulch) are located to the north of the site along a dirt road, and also previously established, once again allowing us to preserve untouched natural areas without causing heavy disturbance.

Planting Plan

Polygon 1

In Polygon 1 there is already an established canopy. However they are older deciduous trees nearing the end of their lifespan. For this reason, shade tolerant *Tsuga heterophylla* that can eventually take the place of these established trees will primarily be planted in this polygon. Three will be planted from 1 gallon containers, on 6m centers(Figure 11). Otherwise, in Polygon 1, our main focus will be on establishing shrubs and ferns. Species in this category include *Polystichum munitum,Vaccinium ovatum, Symphoricarpos albus, Lonicera involucrata, Mahonia nervosa, and Rubus spectabilis* all of which are species that can tolerate shaded environments and are recommended for slope stabilization (Plant selection guide).

Other than the three trees already present, which are two *Salix scouleriana* and one *Arbutus menziesii*, there are currently only a few *Polystichum munitum* in Polygon 1. *P. munitum* has proven that it can do well in this polygon already, so five more will be planted here, from salvage, on 0.5m centers(Figure 11). These can also provide good habitat for amphibians in their decaying fronds(Native plant guide). Two additional *S. scouleriana* will be planted on 2' centers from cuttings to provide additional shade (Figure 11).Shade tolerant *V. ovatum*'s berries can provide good forage for wildlife (Objective 2.3) and its bushiness can take up some ground space preventing the reestablishment of *R. armeniacus(*Objective 1.3*).* Six will be planted throughout Polygon 1, from 1 gallon containers, on 3' centers(Figure 11). Four *R. spectabilis* will be planted on the edges of Polygon 1 with the hope that their similar structure to *R. armeniacus* will

help them fend off encroachment of it from the neighbouring areas and help replace bird habitat and food that was lost from removal of the *R. armeniacus* (Objective 2.3)(Figure 11). It will also eventually discourage trail users from leaving the trail. This species will be planted in bare root form.

Symphoricarpos albus, Lonicera involucrata, and *Mahonia nervosa* will also be planted to add diversity and to provide berries for wildlife. Two of each will be planted in this polygon from 1 gallon containers on 2' centers(Objective 2.3)(Figure 11).

Polygon 2

In Polygon 2, the canopy is more open than in Polygon 1. More sunlight will reach the forest floor, and therefore species commonly associated with shaded environments will not be considered in the polygon. Keeping the increased sunlight availability in mind in Polygon 2, Three shade intolerant *Pseudotsuga menziesii* will be planted in bare root form, on 8m centers. Eventually these trees will help Polygon 1 and 2 become connected to evergreen forest in surrounding parts of the park (Objective 4.2). One *Alnus rubra* will also be planted near the border of Polygon 3(Figure 11). This is to lead into several other *A. rubra* in that Polygon. This species has a relatively short lifespan, but its limbs fall and provide habitat for wildlife and food for birds (Plant selection guide). Four *Tsuga heterophylla* will also be planted, from 1 gallon containers, near the existing *Salix scouleriana* in Polygon 1(Figure 11). It will provide enough shade for *T. heterophylla* to get established. Shrubs and ferns will also be planted in Polygon 2 including *Polystichum munitum, Symphoricarpos albus, Lonicera involucrata,* and *Mahonia nervosa, Rosa nutkana, Rubus spectabilis,* and *Salix scouleriana.*

P. munitum prefers at least partial shade, but enough is provided by the existing nearby *Salix scouleriana* in Polygon 1 to justify planting seven in this polygon anyway(Figure 11). This conclusion is further justified by the fact that a few of this species are already established here. *S. scouleriana* is readily available and and will help cover some of the immediately unshaded ground by live-staking six on 2' centers(Objective 1.3)(Figure 11). *Rubus spectabilis* and *Rosa nutkana* will be planted, three of each in live-stake form on 3' centers(Figure 11). These two species serve mostly the same purpose, in the hope that their similar structure to *R. armeniacus* will help them fend off encroachment of it from the neighbouring areas and help replace bird habitat and food that was lost from removal of the *R. armeniacus* (Objective 2.3). It will also eventually discourage trail users from leaving the trail. *R. nutkana* will provide aesthetic value from the trail view it

will border (Objective 3.1). These two species are also recommended for slope stabilization (Plant selection guide) (Objective 2.2).

Symphoricarpos albus, Lonicera involucrata, and *Mahonia nervosa* will also be planted to add diversity and to provide berries for wildlife. Two of *S. albus*, and five each of *L. involucrata* and *M. nervosa* will be planted from 1 gallon containers on 2' centers(Objective 2.3)(Figure 11).

Polygon 3

Polygon 3 has no canopy cover. It is also very moist in the Fall and Winter. Another concern in this polygon is the encroachment of invasive *Phalaris arundinacea.* To combat this, establishing quick coverage will be important. *Picea sitchensis* should do well in the conditions of Polygon 3. Three will be planted in the moistest corner on 12m centers from 1 gallon containers. This long lived species will eventually lead to a significant canopy and vertical spatial diversity (Objective 3.1). We will also attempt to combat it by planting *Festuca idahoensis*, a native grass, 20 plugs on 2" centers in the corner of the polygon closest to the oncoming invasive grasses.. There is concern about lack of shade and moisture for these saplings in the dry season, but this should be helped by the *Rubus spectabilis* and *Rosa nutkana* that will also be planted in this polygon that will provide some shade. Three *Alnus Rubra* will also be planted in this polygon on 10m centers in bare root form(Figure 11). This species has a relatively short lifespan, but its limbs fall and provide habitat for wildlife and food for birds (Objective 2.3) (Plant selection guide). *Rubus spectabilis* and *Rosa nutkana* will be planted, Three *R. spectabilis* and nine *R. nutkana* in live stake form on 3' centers(Figure 11). These two species serve mostly the same purpose, in the hope that their similar structure to *R. armeniacus* will help them fend off encroachment of it from the neighbouring areas and help replace bird habitat and food that was lost from removal of the *R. armeniacus* (Objective 2.3). It will also eventually discourage trail users from leaving the trail. *R. nutkana* will provide aesthetic value from the trail view it will border (Objective 3.1). These two species are also recommended for slope stabilization (Plant selection guide) (Objective 2.2). *S.scouleriana* is readily available and and will help cover some of the immediately unshaded ground by live-staking twelve on 2' centers(Objective 1.3). *Symphoricarpos albus, Lonicera involucrata,* and *Mahonia nervosa* will also be planted to add diversity and to provide berries for wildlife. Two of *S. albus*, and five each of *L. involucrata* and *M. nervosa* will be planted from 1 gallon containers on 2' centers(Objective 2.3)(Figure 11). Lastly, *Physocarpus capitatus* is also tolerant of moist

areas and will provide aesthetic value for trail users (Objective 3.1). Five will be planted in bare root form on 4’ centers(Figure 11).

AD4: We had to plant the Festuca idahoensis in the NW corner of Polygon 3 due to too much water still accumulated in the South corner. We hope it will grow well there and form a groundcover that will spread throughout much of the polygon.

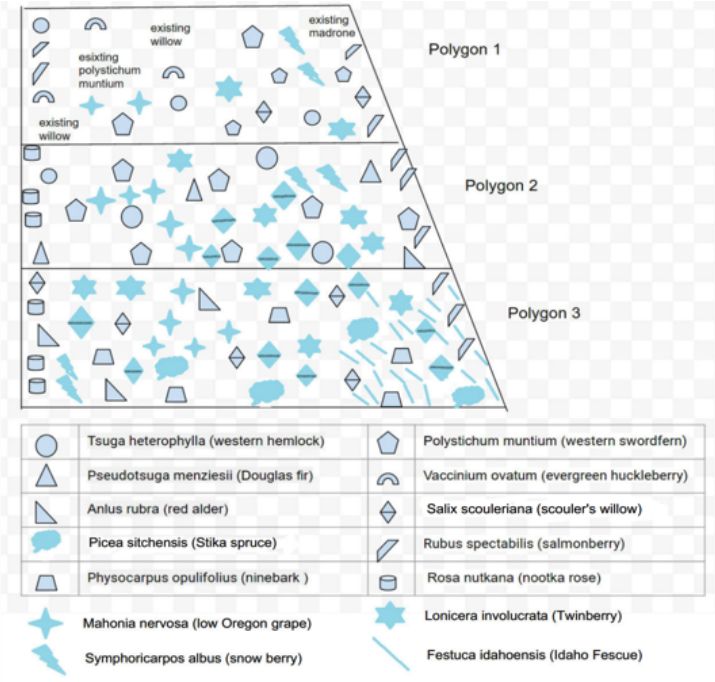

Figure 11: Planting Plan for Polygon 1-3

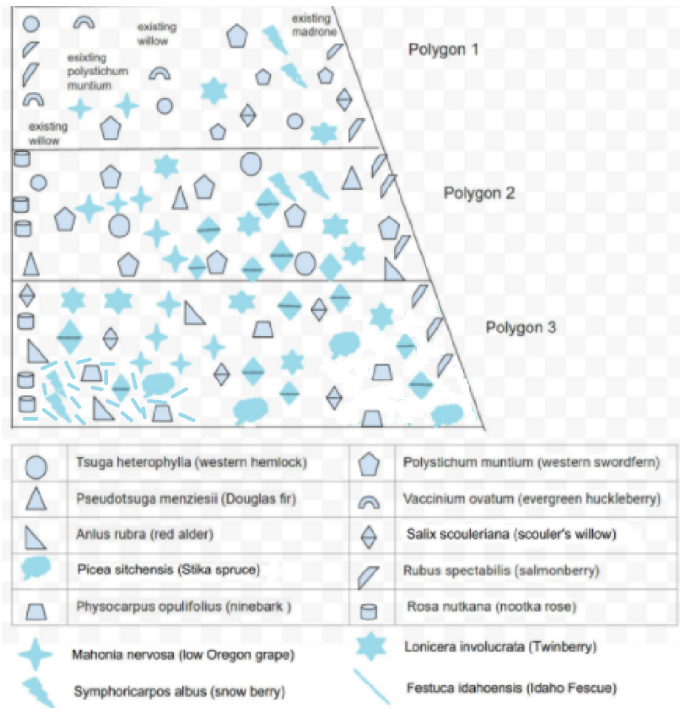

Figure 12: As-Built Map

Table Revisions

Table 1:General Materials List

Tasks	Materials	Qty	Source	Tools	Qty	Source
				Shovels	**15**	**CP**
				Pick Mattocks	**10**	**CP**
				Weed Wrench	**5**	**CP**
	Mulch	**Unknown**	**CP**	**Shovels**	**15**	**CP**
				Wheelbarrow	**5**	**CP**

Task 1-3a Task 1-3b Task 1-3c	**Native plant species**	**Unknown**	**Unknown**			
	Salvaged Plants	**Unknow**	**Unknown**	**Loppers**	**15**	**CP**

Table 2: Plant List

	Polygon One			**Polygon Two**			**Polygon Three**		
Species	#	Spacing	Form	#	Spacing	Form	#	Spacing	Form
trees									
Pseudostuga menziesii	0	NA	NA	3	8 m	Douglas Fir-4”	0	NA	NA
Alnus rubra	0	0	NA	1	10m	1 gallon	3	10m	1 gallon
PIcea Sitchensis	0	NA	NA	0	NA	NA	4	6m	1 gallon
Tsuga heterophylla	3	6m	gallon	4	6m	1 gallon	0	NA	NA
shrubs									
Physocarpus capitatus	0	NA	NA	0	NA	NA	5	4’	Bare root
Lonicera involucrata	2	2’	gallon	5	2’	1 gallon	5	2’	1 gallon

Symphoricarpos albus	2	2’	gallon	2	2’	1 gallon	2	2’	1 gallon
Mahonia nervosa	2	2’	gallon	5	2’	1 gallon	5	2’	1 gallon
Rosa nutkana	0	NA	NA	3	3’	1 gallon	9	3’	1 gallon
Rubus spectabilis	4	4’	gallon	3	3’	Live stake	3	3’	1 gallon
Salix scouleriana	2	NA	NA	6	2’	cuttings	8	2’	cuttings
Vaccinium ovatum	6	3’	1 plug	0	NA	NA	0	N/A	N/A
ferns									
Polystichum munitum	5	0.5m	Sword fern-4”	7	0.5 m	Sword Fern-4”	0	NA	NA
forbs									
Festuca idahoensis	0	NA	NA	0	NA	NA	20	1’	½ gallon

No revisions were made to the plant list table.

Table 2: General Materials

Tasks	Materials	Qty	Source	Tools	Qty	Source
				Shovels	15	CP
				Pick Mattocks	10	CP
				Weed Wrench	5	CP

	Mulch	Unknown	CP	Shovels	15	CP
				Wheelbarrow	5	CP
Task 1-3a Task 1-3b Task 1-3c	Native plant species	Unknown	Unknown			
	Salvaged Plants	Unknow	Unknown	Loppers	15	CP

Timeline Revisions

Table 3: Timeline

Planned	Jan		Feb		Mar			Apr		May	
Actual											
Tasks	1-14	15-28	29-11	12-25	26-10	11-24	25-31	1-14	15-28	29-12	13-26
1.1a: Remove all invasive *Rubus armeniacus* biomass											
1.1b: remove all invasive *Cytisus scoparius* biomass											
1.2a: use pesticide in difficult location or on stubborn invasives											
1.2b: cover soil with thick layer of mulch											
1.2c: quality control—remove or treat with herbicide all invasives that reappear post-removal											
1.3a: select native species appropriate to local environment of restoration site											
1.3b: locate and purchase/salvage selected vegetation											
1.3c: consider current vegetation and shade conditions of site and plant species appropriate for conditions											
1.3d: Refer to planting plan for species specific location											
2.1a: increase vegetative cover of the restoration site											
2.2a: Refer to and follow plans developed in the Planting Plan											
2.2b: Spread layer of mulch over soil											
2.3a: consider species that potentially inhabit the area and select plants accordingly											
2.3b: plant selected species according to the Planting Plan in Section III											
3.1a: Refer to and follow the structure of the Planting Plan											
4.1a: Provide opportunities for volunteers to learn basic concepts of restoration ecology											
4.1b: Provide snacks and beverages for volunteers											
4.1c: Make personal connections with individual volunteers											
4.2a: Reach out to local schools or neighborhoods and invite students and volunteers to work parties											
4.2b: Present lesson plan to student/volunteers											
4.2c: Present status of past projects and current projects											
4.3a: Design, create, and distribute fliers throughout the Sandpoint community											

Lessons Learned

Financial Budget

Table 4: Financial Expenditures

Expenditures by Major Category	**Expected Cost**	**Actual Cost**
Plants		
Subtotal Plants + Tax	324	348.7
Mulch	0	0
Subtotal Mulch	0	0
Total Rental	0	0
Subtotal Rental	0	0
Transportation		
Subtotal Transportation	0	12.23
Subtotal Printing	40	20
Project Total	**364**	**380.93**

Table 5: Revenue Sources

Revenue by Fund Source	
Course Fee Allotment	~~364~~ 380.93
Cash Donations	0
Project Total	**380.93**
Total Revenue	**219.07**

We were well under the original budget we developed in the work plan. We expected to spend around $600, but only spent $380.93 as the total expenditure for our restoration project. As a result, a total of $219.07 was saved.

Most of the money that we saved during this project can be attributed to our community partner, Tom Kelly, who is affiliated with the Magnuson Stewardship Alliance and the Green Seattle Partnership. He was able to provide us with gloves, tools, and more than enough mulch to complete our project. Therefore, it was not necessary to spend any money to acquire the mentioned materials.

We also learned the importance of live staking. We were able to clip limbs from live plants around the park and stake them around the site. As a result we were able to purchase less plants, thus reducing total expenditures.

Another important lesson we learned is to order the proper plants for the conditions on the site. Before we fully considered the conditions of the site we planned to purchase *Festuca idahoensis*, a small grassy plant, and install them in Polygon 3. When the time for planting came around we realized that the location we planned to plant the *F. idahoensis* collected large amounts of water. This is not ideal conditions for grassy species. Although we were under budget, it would be better to have spent our money more wisely and to have purchased plants that were better suited to the conditions of the site.

Table 6: Labor Budget

	Team Hours	**Volunteer Hours**	**Total**
Site Preparation			
Expected	18	0	18
Actual	18	0	18
Rubus armeniacus Removal			
Expected	36	288	324
Actual	30	235	265
Planning			
Expected	25	0	25

Actual	30	0	30
Salvages			
Expected	35	0	35
Actual	20	0	20
Live Stake Acquisition			
Expected	35	0	35
Actual	10	0	10
Planting			
Expected	120	115	235
Actual	55	24	79
Mulching			
Expected	84	75	159
Actual	45	156	201
Plan and Manage Work			
Expected	16	0	16
Actual	12	0	12
Report Preparation			
Expected	42	0	42
Actual	162	0	162
Total Working Hours			
Expected	411	478	889
Actual	382	415	797

We spent less hours for both team hours and volunteer hours than what was anticipated. We greatly overestimated the time needed for planting and underestimated the time needed for mulching and report preparation. When we estimated the time necessary for planting, we did not realize that we would be planting so few plants. If we

were to do the project again, it would be better to know how many plants need to be planted before estimating the time needed for planting.

We underestimated the mulching hours because we did not anticipate the large volunteer groups that would be available for the mulching work parties. We were able to completely mulch the site in two separate days, and the hours added up because we had 30 or more volunteers on both of the days. When volunteer parties get this large, work can be chaotic because the volunteers are usually not familiar with restoration work, the physical site, or the restoration team's vision for the site. Over the course of the mulching work parties, we learned how to effectively split the volunteers by task (loading, transporting, or spreading mulch) to maximize efficiency. By developing a streamlined process for mulching, foot traffic on the site was minimized and very few of our plants were trampled by wheelbarrows. Better markers on plants would have been decreased trampling.

Planting Plan Lessons

In our original planting plan we intended to plant *F. idahoensis* in the South corner of Polygon 3. This was to help dissuade the invasive Reed Canary grass that was encroaching on that corner and that we knew would only encroach faster after we removed the Himalayan blackberry bushes. Unfortunately we misjudged how long the seasonal wetland in Polygon 3 remains wet and this prevented us from establishing the Idaho fescue. We instead planted the 20 plugs in the Northwest corner of the polygon. This area was less wet but also had Reed Canary grass encroaching, so hopefully planting the grass there will serve the same purpose. We hope that the grass will spread throughout the summer and form eventually a bit of a ground cover for Polygon 3 that can last during the wet season and perhaps even spread up the hill into Polygons 2 and 1.
As for the rest of the planting plan, it was followed as written. There are most likely misjudgements in our plan that unfortunately we will not be present to witness, but our hope is that our stewardship plan will be strong enough to account for whatever mistakes these may be.

Other Plans

We reached out to Lakeside Middle School, which is a local school in the area that our site coordinator Thomas Kelly has worked with in the past the last three years.

According to Tom, the 7th graders have shown to be very useful and productive during work parties, so they accompanied us for a work party. We also planned on designing and creating fliers to distribute throughout the local Sandpoint community in order to raise awareness for our restoration project. This will let locals know how and where they could learn to make a difference within their community. The fliers will be a great way to reach out to schools and neighborhoods for potential volunteers. Lesson plans are going to be developed with a status of our restoration site, native plants guide, common invasives to look out for, and how to properly remove them as well. It's extremely important to get the younger generation involved so that they're aware at a young age and could possibly help with future maintenance at Magnuson Park.

Design for the Future

Our goal for the future of the site is to improve and increase value of native forest and natural area around Sand Point Head to form what will eventually be of one of the largest patches of contiguous forest in Magnuson Park. Our site improvements will include increasing value of area as wildlife habitat, increasing diversity of native trees and vegetation, and enhancing the area as a source of value for passive park users. Our restoration design is aimed to shift the area to a state in which more desirable plant cover will keep future maintenance needs within a sustainable level. During the follow up years, while the young planted trees are still growing, the site will require frequent maintenance, but as the mixed deciduous-conifer forested area becomes mature it will require less maintenance and become more self-sustaining. Our goals, objectives, and basic approach are designed to aid in the long-term success of the restoration process. The mulch applied will help control stormwater runoff and also prevent invasives from growing. The increased canopy cover will help prevent the re-establishment of invasives and allow native species to thrive and dominate. The diverse understory community will be a valuable food source and it will provide valuable shelter. Promoting structural diversity with grasses, shrubs, and trees will result in diverse habitats for a variety of wildlife, small mammals to birds. Our efforts are just the beginning to the long-term success of the site, but we will still need future maintenance to continue the success of our restoration project.

Our site will receive summer watering to help plant establishment via park underground irrigation system. Beyond this, our goal is to find continuous involvement from the local community. Our site is going to require frequent volunteer work to remove any prevailing invasives, mediate damage from trail users, and also to re-apply mulch in the future once it starts to decompose. We plan to recruit help from local schools and the community through the help of our CP and his involvement with the Green Seattle

Partnership Website. We understand that having an involved community is pivotal to our sites long-term success and our overall vision for our restoration project. We will develop a long-term development and monitoring plan for our CP that will address the kind of maintenance we anticipate and how often the maintenance should occur after our project is over.

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