Everest Park Final Report

University of Washington
Restoration Ecology Network Capstone
2014-2015

Prepared for Katie Cava, Green Kirkland Partnership
and
The City of Kirkland

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Project Summary

Overview

This report presents the restoration work completed by the 2014-2015 University of Washington Restoration Ecology Network (UW-REN) team at Everest Park in Kirkland, Washington. The 2014-2015 UW-REN restoration site is located on the eastern side of the 23.3 acre Everest Park. The park is set within a residential neighborhood which receives many visitors, especially during the spring and summer months. The site is managed by Green Kirkland Partnership (GKP). The GKP was formed by the city of Kirkland and Forterra (Formerly Cascade Land Conservancy). GKP works with the city of Kirkland, non-profit organizations, businesses and the local community to restore over 400 acres of natural areas. There are 2.27 acres of active restoration in Everest Park including the 2014-2015 UW-REN restoration site and there is another 11.23 acres that will be restored in the future. The GKP office has been essential in support for the Everest Park restoration project.

Figure 1. Before and After Restoration in Polygon 2

Pre-site Conditions

The restoration site is approximately 1485 m² and relatively flat with small hills and depressions in areas of the site. A mature deciduous canopy with two small stands of Thuja plicata (Western redcedar) cover most of the site with a few invasive species dominating the understory. Invasive species includes Rubus Armeniacus (Himalayan blackberry), Hedera helix (English ivy) and Ilex aquifolium (English holly). Everest Creek flows west along the southern edge of the site and then north along the western edge of the site. The majority of the soil on the site is characterized as being sandy-loam. Low points in the site collect and retain water after rain events during winter. An established social trail runs through the site, parallel with the creek,

which connects to another trail on the other side of the creek. The trail has led to heavy soil compaction and erosion especially along the southern edge of the site. The northern and southeastern edges have little canopy cover and therefore receive full sun. The interior of the site is shaded by Acer macrophyllum (big-leaf maple), Populus balsamifera ssp. trichocarpa (black cottonwood), and Alnus rubra (red alder) trees during the spring and summer months.

Ecological Concerns

The dominant presence of invasive species *R. armeniacus*, *H. helix*, and *I. aquifolium* was preventing the site from functioning and developing into a healthy forest ecosystem (NWCB). The invasive plant species were outcompeting the native vegetation for water, nutrients, and space, reducing structural and species diversity needed for an ecologically healthy forest. The site also lacked diversity among conifer species as the majority of the trees present are deciduous and few natural seed sources exist nearby. As a result, this inhibits the process of forest succession and limits regeneration of native vegetation (Clewell and Aronson 2013). In addition, the social trail has had a major impact along the creek. The heavy use of the trail has led to soil compaction and has caused extensive erosion along the creek banks, preventing native species from establishing there, and further worsening the erosion.

Project Goals

- Promote succession towards a typical Puget sound lowland mixed coniferous forest
- Improve ecosystem functions
- Establish community interest for further maintenance efforts

General Approach

The first step to begin our restoration efforts includes the removal of invasive species such as *R. armeniacus*, *H. helix*, and *I. aquifolium*. After successfully removing the invasive vegetation, 6-8 inches of mulch is then applied to the exposed area to prevent secondary growth of the invasive plants. The mulch being used is composed of woody, organic material which retains moisture and provides nutrients to the soil over time (Chalker-Scott 2007). The plant selection for the site consisted of a combination of shade and sun tolerant shrubs and groundcovers, as well as conifer trees to increase the structural diversity of the site. In addition, the native species of trees and shrubs selected will grow to establish a dense canopy to promote shade which helps suppress the growth of Himalayan blackberry (Soll 2003). Each polygon will have a different combination of plants based on available sunlight, amount of shade, soil properties, and slope stabilization requirements.

- *Pseudotsuga menziesii (*Douglas-fir), *Tsuga heterophylla (*Western hemlock), and *T. plicata* are the conifer trees which will suppress growth of invasive species and eventually replace the deciduous canopy.
- Fast-growing shrubs such as snowberry (Symphoricarpos albus) and red-osier dogwood (*Cornus sericea*) planted densely along with durable groundcovers such as swordfern (*Polystichum munitum*) to contest with the invasive species in the first few years.

To create structural diversity within the plant community and also provide ecological functions, shade tolerant shrubs and trees were planted throughout the site in ideal locations.

- *P. menziesii, T. heterophylla*, and *T. plicata* will grow tall and provide nesting sites and cover for various bird species (Elman 2009).
- *Rubus parviflorus* (Thimbleberry), *Sambucus racemosa (*red elderberry), *Lonicera involucrata (twinberry*), and *A. symphoricarpos* provide fruits and habitat opportunities for wildlife such as birds, insects, and small mammals.

The heavy use of the social trail has led to soil compaction and extensive erosion along the creek edge. Therefore, the native plants selected were to provide slope and stream bank stabilization.

- *T. plicata*, *P. munitum, A. symphoricarpos,* and *L. involucrata* were planted along the creek edge to help stabilize the bank and reduce compaction.
- *Rubus spectabilis* (Salmonberry) and *Rosa nutkana* (Nootka rose) were planted to deter people from using the social trail and entering the site. A layer of mulch was also added to the trail to reduce human impact on the soil.

Once our restoration project is complete, the site can be used as an example for educational opportunities on forest ecosystems. The local community, from nearby schools to various other clubs or organizations, can appreciate why invasives species are detrimental to the sustainability of natural areas in an urban setting. With further understanding of why native plant species matter, perhaps it will encourage local residents to volunteer more often and learn more about restoration practices. Lastly, the restored site demonstrates what a natural ecosystem may resemble.

Accomplishments

- Removed over 7,500 square feet of invasive species
- Installed over 370 native plants which included trees, shrubs and ground covers
- Spread 28 cubic yards of mulch
- Re-routed social trail away from creek
- Hosted over 200 volunteers, engaging the local community in forest restoration

Team Members

From left to right: Juan Carlos Ballesteros, Ben Saari, Yi Xu, Julie Tran and Rebecca Kuklok

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- To the 200+ volunteers that made our restoration activities possible
- To Nature Consortium for donating pots for salvages.
- We would also like to thank our professors Kern Ewing, Jim Fridley, Warren Gold, Carleen Weebers and the teachers' assistant Elliot Church

As Built Plan

Background

Site Description

The proposed Everest Park restoration site is located in the city of Kirkland, Washington. It is within the Moss Bay Drainage Basin in the central Puget Sound trough. Everest Park consists of 23.3 acres of maintained park with 13.5 acres of natural area (Kirkland Maps, City of Kirkland Everest Park). In the middle of the main part of the natural area, Everest Creek flows northwest towards Lake Washington. The park also includes baseball fields, a tennis court, a playground, and paved walking paths. The south, west, and northeast edges of Everest Park are bordered by residential neighborhoods, including 10th street which ends along the eastern side of the ecological restoration site. The natural areas of Everest Park are divided into units for management by the GKP (Figure 2). The GKP is a collaborative effort between the City of Kirkland and Forterra as well as other local community, business and nonprofit organizations with the goal of restoring and maintaining the natural areas within Kirkland (City of Kirkland 2014). The portion of the park that the UW-REN team will be restoring is approximately 1485 m^2 and is located in the southern half of Unit 3 (Figure 2). The site is mainly a mature deciduous forest with a number of invasive understory species and also contains a social trail that runs through the site. The northern portion of Unit 3 is currently undergoing restoration by the Washington Native Plant Society (WNPS) stewards and directly borders the site. Everest Creek flows along the southern boundary of the site and north along the western boundary. Through a system of pipes, Everest Creek flows beneath Kirkland and eventually drains into Lake Washington (The Watershed Company).The restoration site has been divided into 8 polygons based on canopy, native and invasive species cover, soil conditions, and management purposes (Figure 4). Each polygon has its own set of challenges in invasive removal and physical features. Therefore, every polygon has a specific set of native plants to be installed with regards to the planting plan our team developed.

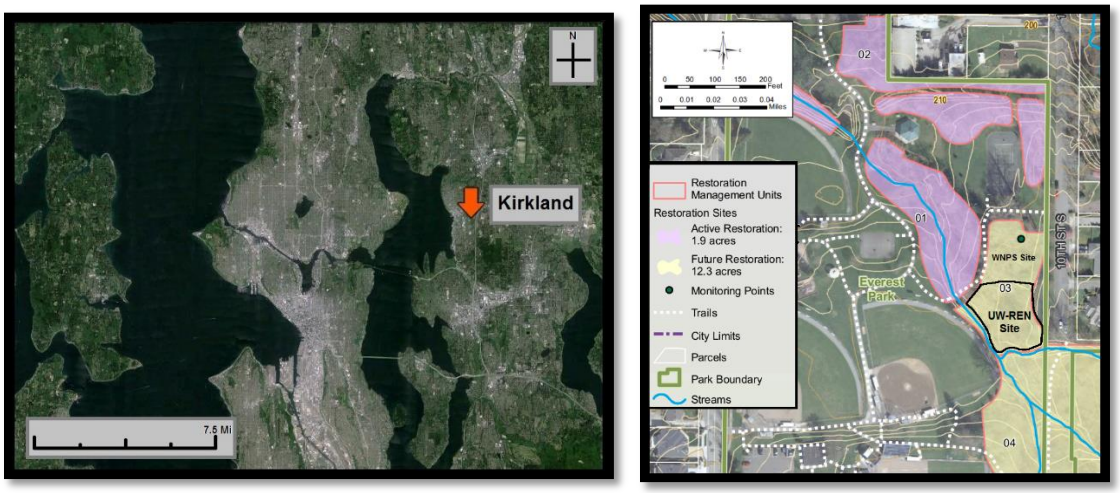

Figure 2. Location of Site in Puget Sound and in Kirkland

I. Physical Features

The site is approximately 68 meters above sea level and is mostly flat with a slight slope of about 2 degrees from east to west. The slope creates a minor depression in the site where water tends to collect during rainy events. Furthermore, there is a 1.5 meter tall berm along the entire western edge of the site, which then slopes steeply down to the stream bed. The soils at the site are fairly consistent throughout and are classified as being a gravelly sandy loam in the Alderwood series (Kirkland Maps, National Cooperative Soil Survey), which are typically well-drained (National Cooperative Soil Survey 2014).

Everest Creek borders the south and west boundaries of the site and the creek ranges from 0.5-1.5 meters wide (K. Cava, personal communication 2014). Since the creek bank is impacted by erosion from the trail, a 3 to 4 feet buffer will be maintained along the edge during volunteer events. This also provides a safeguard for the volunteers during work events.

II. Invasive Species

The site had a number of well-established patches of invasive species (Figure 4). *R. armeniacus* dominates much of the site, particularly in Polygons 2, 4, and 7. *H. helix* is also found throughout the shaded areas of the site with large patches in Polygon 4. *I. aquifolium* is the predominant invasive tree species on the site, with several large individuals and a number of seedlings in Polygon 4 and 5. A few other individual invasive species are present in the site but are not as significant in terms of quantity.

III. Vegetation Structure

Despite the heavy presence of invasive species, there are a large number of native tree and shrub species found in the site but very few visible ground cover species present (Figure 5). Mature deciduous trees such as *A. macrophyllum, A. rubra*, and *P. balsamifera* ssp. *trichocarpa* compose the upper canopy. Two dense stands of *T. plicata*, at approximately 20 meters tall, are present in the subcanopy and cover about 515 m^2 total (Figure 5). The stand in Polygon 6 covers about 271 m^2 and the stand in Polygon 4 covers about 243 m^2. *Corylus cornuta* (beaked hazelnut), *O. cerasiformis* (Indian Plum*)*, and *P. munitum* are found throughout the site. A large stand of *C. sericea* exists on the northern border of Polygon 7. In polygons 8 and 5 there are significant stands of *R. armeniacus*. Furthermore, there are several snags present in the site as well as downed woody debris which consists mostly of large branches. While there has been very little evidence observed by the UW-REN team that there is wildlife using the site, we are confident that at least some are present. There is potential for habitat in snags and downed woody debris and a variety of native food sources for birds, insects and small mammals. An older study described the natural areas around Everest Park as quality wildlife habitat and showed signs of woodpecker habitation (The Watershed Company).

IV. Site Challenges

The location of the site in a city park surrounded by a residential neighborhood pose many challenges and difficulties for a successful restoration project. The main challenge for the site is the use and development of the social trails throughout. These social trails have created heavy soil compaction which will make plant establishment more difficult. Some of the other challenges include:

- Erosion and soil compaction along the creek bank in Polygon 1.
- Many invasive plant species including *R. armeniacus* and *I. aquifolium* border the restoration site and may recolonize the site in the future. The surrounding residential neighborhood gardens and users of the social trail represent other potential sources of invasive species.
- Falling trees and branches can be especially hazardous during windy days at Everest Park and can create working conditions that are not ideal for volunteer events. A mature *P. balsamifera ssp trichocarpa* was leaning severely in Polygon 8 and had to be cut into a habitated snag until work could be done.
- The site sees high traffic due to the social trails and kids frequently playing in the site potentially disturbing plants and debris piles.

AD1. Once the *P. balsamifera ssp trichocarpa* was taken down, the amount of debris and fallen branches that accumulated in Polygons 3 and 8 inhibited the removal of invasive species and planting in those polygons. Spreading the branches around the site opened some space but several large logs that remained in place have blocked complete invasive removal and plant installation.

Restoration Needs and Opportunities

Restoration of this site is needed in order to improve ecosystem functions from current conditions to a healthier and aesthetically pleasing forest. Currently, the *R. armeniacus* provides food and habitat opportunities for wildlife. However, this invasive species needs to be removed to enhance the natural succession of the forest. Additionally, stream quality will be improved with erosion control along the bank and increased filtration with installed native plants. The main challenge is the use and development of social trails throughout the site. The social trails have created soil compaction and erosion which will be addressed through specific objectives for the restoration goals. Ability to absorb more storm water runoff and carbon dioxide will also be improved as this site is restored. The need to restore these ecological functions and aesthetic improvements are beneficial to the surrounding community. GKP also works with community and restoration partners by providing the local community and schools with volunteer and educational opportunities along with fostering the appreciation and interest in maintaining natural areas.

Tasks and Approaches

Goal 1: Promote succession towards a typical Puget Sound lowland mixed conifer forest

Objective 1-1: Remove and control invasive plant species

Task 1-1a: Take out invasive species including *R. armeniacus, H. helix,* and *I. aquifolium*

Approach: The thorny branches of *R. armeniacus* will be cut back to approximately 9-12 inches using loppers. This will help us gain access to the exposed stems of *R. armeniacus.* Shovels will be used at the base of the plant to dig up the root ball. If *R. armeniacus* is small enough, a hand tiller can be used by placing the three pronged side into the soil next to the plant and pulling on the handle in an upward

motion until the root ball can be pulled out. *H. helix* will mostly be removed through the use of hand pulling. The stems will be tugged from the ground and pulled until the roots are exposed from the ground. If necessary, a hand tiller can be used to pull up the root system for *H. helix*. Portions of *H. helix* have grown up the sides of trees and are unreachable. In this case, the plant will be cut at approximately chest height around the trunk of the tree. Smaller individuals of *I. aquifolium* will be removed by having the roots dug out using a shovel, hand pulled or using a weed wrench. The larger *I. aquifolium* trees will be flagged and herbicide will be applied by Green Kirkland Partnership employees when possible.

Approach justification: Removing the root ball of *R. armeniacus* greatly reduces its ability to re-establish in that area (King County 2013). It also helps to minimize the time that it takes for it to grow back. Hand pulling or using a hand tiller has shown to be successful in removing *H. helix*. Cutting the *H. helix* around the tree trunk eliminates the plant from reaching the soil for nutrients and reestablishment (King County 2013). Removing the small individuals of *I. aquifolium* will help reduce its population and spread. Mature *I. aquifolium* trees are too difficult to remove by hand as their root system can be very extensive and can cause soil disturbance (King County 2014). The best method for removing *I. aquifolium* is by applying herbicide through the cut stump or frilling method (King County 2014). The Green Kirkland Partnership will be applying all herbicide to mature *I. aquifolium* trees.

AD2. The removal of all root balls was not accomplished in the initial removal process. This allowed for regrowth of some invasive *R. armeniacus*. An extra work party to do additional removal was necessary to help remove the majority of these.

Task 1-1b: Apply woody, organic mulch

Approach: We will apply 6 to 8 inches of mulch that is provided by Green Kirkland Partnership to the areas where invasive species of *R. armeniacus*, *I. aquifolium*, and *H. Helix* have been removed. This will be done using wheelbarrows or 5 gallon buckets for areas with limited access.

Approach Justification: Applying woody mulch to the areas where invasive species are eradicated will help reduce re-establishment. The mulch will also protect the recently disturbed soil.

AD3. We were not able to request enough mulch to spread 6-8 inches on all portions of the site in areas of removal. Mulch was spread throughout the majority of the site but some portions received only 1-2 inches.

Objective 1-2: Install native plants that are appropriate for a typical Puget Sound lowland mixed conifer forest

Task 1-2a: To gather a diverse amount of plant species that are found in lowland mixed conifer forest.

Approach: We will attend a plant salvage that is being hosted by King County to acquire some of the plants that have been included in the plant list for the site.

We will also use the Green Kirkland Partnership nursery to see if there are any available plants on the plant list for our use. In addition, we will be using the method of live staking for species of *C. sericea* and *R. spectabilis* which are currently on the site. We will also be submitting a plant order request form for local plant nurseries and sales including Tadpole Haven, King County Conservation District, and Snohomish Conservation District.

Approach Justification: The plants obtained from Green Kirkland Partnership and from the plant salvage will help us attain the plants needed for the lowland mixed conifer forest. The live staking method from the *C. sericea* and *R. spectabilis* species from the site will help to establish them on other portions of the site. Using these methods of acquiring plants is more cost-effective for our fixed budget. We will be purchasing the rest of the plants from nurseries and conservation sales in order to complete our plant list.

AD4. We decided to only purchase plants from the King and Snohomish Conservation District sales as it was much more cost effective and allowed us to get far more plants for the site. We chose not to obtain Dryopteris expansa (spreading wood fern), Blechnum spicant (deer fern), or Athryrium filix-femina (lady fern) due to availability and cost restraints. Instead we were able to acquire many more P. munitum as cost effective replacements.

Task 1-2b: To install the plants which have been acquired through different methods

Approach: The potted plants that are received through the nurseries will be carefully taken out of the pots, their roots massaged, loosened and then rinsed in order to remove as much of the soil as possible. If the roots of the potted plants are bonded together in a circular fashion their roots will be cut and straightened. Bare root plants that are received from the plant salvage and nurseries will also be rinsed off to remove the soil. Then the plants will be placed in holes that are dug out using a shovel. The holes will be about twice the diameter of the pot or root system and will be as deep as the plants' root system (Leigh 2013). The holes will be filled back in around the plants with the same soil that was removed. The soil will then be pushed down firmly and watered. The live stakes of *C. sericea* will be installed into the ground at half of the height of the stake. The *R. spectabilis* live stakes with root crowns will be planted at a shallow depth to allow root flare to develop. The live stakes and newly planted vegetation will be flagged using a brightly colored tape.

Approach Justification: Removing growth media and loosening the roots of nursery plants will encourage establishment of a healthy root system and less water loss in the native soil and thus increase the chance of survival for the transplants (Chalker-Scott 2009). Planting the transplants in holes as deep as the root system will prevent rotting of the trunk and allow development of a desired root flare above ground (Chalker-Scott 2009). Staking *C. sericea* at half the height will promote balanced growth of roots and shoot mass for a healthy individual. Retaining the root crown of *R. spectabilis* when staking will help ensure

successful establishment in a new area. Flagging these newly installed plants will also help with identification and organization for the site.

Objective 1-3: Maximize the success of planted vegetation by using aftercare methods for planting

Task 1-3a: Use mulching methods to help plants succeed

Approach: The use of wheelbarrows or 5 gallon buckets will be used to bring in organic woody mulch to areas where new vegetation has been planted. The mulch will then be applied to the ground in a 6-8 inch layer depth around the plants. Mulch will be applied as a survival ring structure around the plant's stem to separate the mulch from direct contact of the plant base.

Approach Justification: Applying mulch around a newly installed vegetation will help to protect the plant during the critical establishment period. Mulch will also retain moisture around the plant which helps moderate the temperature for the plants roots systems (Leigh 2013). In areas where erosion is a concern, mulch can prevent surface erosion (Leigh 2013). Because the mulch we are using is composed of woody, organic material, it will eventually break down and provide nutrients to the soil over time (Leigh 2013).

AD5. There was not enough mulch available to apply 6-8 inches to the entire site. However, a ring of at least 3 inches wide and at least an inch thick was applied around the newly planted vegetation in areas that were not sheet mulched.

Task 1-3b: Provide a stewardship plan for community partner

Approach: Construct an outline and plan for Green Kirkland Partnership. The plan will include descriptions of work that was done on site as well future care methods. It will describe the removal of invasive species, watering of specific plants if necessary and other possible maintenance needs for the site to continue to grow and be a successful lowland mixed conifer forest.

Approach Justification: Aftercare and maintenance is essential for ensuring the long term success of this newly restored site to be able to reach a self-sustaining climax stage of succession.

Goal 2: Improve ecosystem functions of a typical Puget Sound lowland mixed conifer forest

Objective 2-1: Increase species and structural diversity within plant communities

Task 2-1a: Install more native species that are appropriate for the community type and provide structural diversity.

Approach: We will use a combination of plants from the salvage, Green Kirkland Nursery, and purchased plants from the district sales. The tree species include *T. heterophylla, T. plicata,* and *P. menziesii*. There is also a variety of ferns and shrubs which are listed on the plant list below.

Approach Justification: The plants were specifically chosen because they are native species to the region and will do well in the conditions of our site. The structural diversity of the new plants will provide habitat diversity for wildlife such as cover and nesting sites for birds and squirrels.

Objective 2-2: Enhance habitat for existing and future wildlife

Task 2-2a: Create plant list beneficial to wildlife

Approach: Develop a plant list of shrubs and trees that attract birds, insects and small mammals.

Approach Justification: The shrubs chosen are primarily fruit and flower bearing. These plants provide food for many birds and small mammals. The flowers also attract a variety of insects which helps with pollination. The trees selected are to offer habitat opportunities for wildlife such as nesting for birds.

Objective 2-3: Improve water quality in Everest Creek

Task 2-3a: Plant along the creek bank

Approach: *T. plicata* and a variety of shrubs will be planted along the edge of the creek. The plant spacing will be critical so patches of bare soil or mulch will be minimal.

Approach Justification: A variety of species with differing root systems growing along the creek bank is critical to erosion control. The root systems will also provide slope stabilization during high water events. In addition, *R. spectabilis* will planted to deter users from using the social trail, decreasing future erosion and soil compaction, as well as blocking entry into the site from the other side of the stream.

AD6: Two additional tasks 2-3b and 2-3c were added to objective 2-3. The team determined that people would still travel through Polygon 1 until the plants established. This would greatly reduce survival of the installed plants and would consequently not reduce compaction or erosion along the creek. We decided to shift the social trail to keep people out of the planted area and then installed woody debris to form a barrier to make it clear where to walk.

Task 2-3b: Reroute the social trail from the creek in Polygon 1.
Approach: The social trail was shifted 1-2 meters north. Limbs and branches blocking the new trail were cut and the new path was cleared of sticks and rocks.
Approach Justification: Shifting the social trail allowed plants to be installed directly along the creek bank and reduce foot traffic close to the creek edge. This will increase survival of installed plants and will reduce future compaction along the creek edge. While we discouraged use of the social trail throughout the rest of the site, it was necessary to make this section of trail more obvious and usable to reduce trampling.
Task 2-3c: Place woody debris as a barrier between creek bank and social trail in Polygon 1
Approach: Woody debris up to 3 m long was placed between the re-routed social trail and the planted area along the creek bank in Polygon 1.
Approach Justification: The woody debris will further reduce walking inside the planted areas of Polygon 1 and directly along Everest Creek. This will increase survivorship of the plants in Polygon 1, reduce compaction, and reduce erosion.

Goal 3: Establish community interest to foster future maintenance efforts

Objective 3-1: Encourage community involvement

Task 3-1a: Work with community partner to promote site restoration work parties

Approach: Establish dates in which to host volunteer work parties for the restoration site. The dates that are established will be given to our community partner to go onto the Green Kirkland Partnership website. The Green Kirkland Partnership will then advertise on their website for interested volunteers to sign up for each work party event.

Approach Justification: The Green Kirkland Partnership has an established volunteer base as well as the ability to promote the work party events on their website. By giving them the dates for restoration work parties in advance and having volunteers sign up online, we are better able to estimate the amount of volunteers that will be attending. Knowing this ahead of time allows the Green Kirkland Partnership to help us prepare for the work parties by supplying the proper amount of tools and beverages.

Objective 3-2: Educate public about importance of involvement in sustaining the presence and health of natural ecosystems

Task 3-2a: Work with schools and clubs to educate about restoration site

Approach: Work with the community partner to figure out dates in which to work with certain school organizations or clubs that have shown interest in working and learning about restoration activities. We will find out more about the organization and what they are more interested in learning about so we can target those specific learning objectives.

Approach Justification: Working with specific schools and clubs that have shown an interest in the site we will be able to educate them. By targeting the specific learning objective of the schools and clubs we will be able to educate them on certain restoration topics such as invasive removal and native plant installations. Through hands-on learning and experience, we will continue to build community interest and education for the interested schools and groups.

Task 3-2b: Educate volunteers about restoration activities and the benefits

Approach: Display brochures and other informational pamphlets to volunteers detailing what natural areas are supposed to resemble. Also, include ecosystems benefits to the surrounding community, pollinator benefits, and pollution sources for streams.

Approach Justification: During work party events, demonstrate how and why restoration work helps the community.

Objective 3-3: Promote local community interest

Task 3-3a: Develop a plan with community partner to periodically hold work parties

Approach: Introduce a schedule for nearby schools or other organizations to provide community service with collaboration from Green Kirkland Partnership.

Approach Justification: Using social networking sites and community service dates will encourage many volunteers to register to events. Distributing signs along the site boundaries will also inform the residential neighborhood of volunteering opportunities.

Specific Work Plans

Site Preparation Plan

A) Current Condition

Polygon 1

Polygon 1 runs along the southern boundary of the site next to the creek bank. The upper canopy provides partial to mostly shaded cover. The soil is classified as a sandy loam. There is an established social trail along the creek edge which has led to heavy soil compaction and erosion.

Vegetation: The dominant invasive species is *R. armeniacus.* There is about 10-15% cover of *R. armeniacus* sporadically spread across the area. *P. minutum* is the dominant native groundcover with 35% coverage. The upper canopy consists of *A. macrophyllum* and *A. rubra* which provides approximately 80% cover. This creates a heavily shaded area along the creek bank.

Polygon 2

Polygon 2 is situated along the western boundary of the site. This polygon contains the 1.5 meter tall berm bordering Everest Creek. The berm has a slight slope of less than 2 degrees east to west with a gravelly sandy loam soil texture. The base of the berm in Polygon 2 can become more saturated than the portions along the berm. The polygon is predominantly shaded, however, there are portions of partial shade and full sun in the southwestern corner of the polygon.

Vegetation: The dominant invasive species in this polygon is *R. armeniacus. R. armeniacus* has fairly dense patches along the berm with a cover of about 25-30%. The dominant native species consists of *P. minutum* which has about 40% cover.

Polygon 3

Polygon 3 is positioned on the northern boundary of the site that receives partial to full sun. This polygon borders the WNPS site and is situated next to a paved walking path. The soil texture is a gravelly sandy loam and the polygon is relatively flat.

Vegetation: There is an established dense stand of *C. sericea* which is the dominant species. *C. sericea* and has about 60% cover in this area. *R. armeniacus* is the dominant invasive species that grows throughout the *C. sericea* stand and has a cover of about 10-15%.

Polygon 4

Polygon 4 is fully shaded with portions of partial shade along the eastern border. The eastern boundary of Polygon 4 runs along the sidewalk of 10th street. There is a slope of less than 2 degrees that runs west to east. However, most of the polygon is relatively flat. The soil present is medium grained to gravelly sandy loam which tends to be saturated towards the bottom of the slope heading west. The soil on other portions of the polygon tend to be less saturated.

Vegetation: There are three dominant invasive species. This includes *R. armeniacus*, about 10% cover, *I. aquifolium*, about 10-15% cover and *H. helix* about 10-15%cover. The polygon is also

shaded by the dominant native *P. balsamifera ssp. trichocarpa* and *T. plicata* which gives about 40-45% cover.

Polygon 5

Polygon 5 borders the eastern side of the site and runs along the sidewalk of 10th street. It receives full to partial sun and has a slight slope of less than 2 degrees that runs west to east. The soil is a medium grained to gravelly sandy loam that is fairly saturated for most of the polygon.

Vegetation: The western boundary of the polygon can be partially shaded by the dominant canopy of *P. balsamifera ssp. trichocarpa* and *T. plicata.* This area is dominated by native *R. spectabilis* and covers about 45-50%. The dominant invasive species include *R. armeniacus* and *I. aquifolium* with approximately 30-35 % cover.

Polygon 6

Polygon 6 lies in the southeastern portion of the site. The western portion under the T. plicata stand is heavily shaded. The remaining area is partly to fully shaded. The soil is a medium grained to gravelly sandy loam throughout and is saturated during the the winter in the western half of the polygon.

Vegetation: The vegetation in this polygon consists of mostly native species with minor patches of invasive species. A stand of *T. plicata* on the northwestern part of the polygon provides 60% shade to this section. Other native species include *O. cerasiformis*, *C. cornuta* and *P. minutum*. *R. armeniacus* is present in a small groupings with about 5% cover.

Polygon 7

Polygon 7 is the largest polygon and is relatively flat throughout. Polygon 7 resides in the innermost portion of the site. It is mostly shaded in this area due to the established native canopy. The soil throughout tends to be a medium grained to gravelly sandy loam soil. The dominant invasive species consist of *R. armeniacus, I. aquifolium* and *H. helix*.

Vegetation: The dominant native trees consist of *P. balsamifera ssp. trichocarpa, A. macrophyllum* and a few *T. plicata.* The native shrubs consist of *P. munitum, O. cerasiformis, R. spectabilis and C. cornuta.* The polygon is covered in upwards of 70% *R. armeniacus* and has several *I. aquifolium* trees.

Polygon 8

Polygon 8 is in the north border of the site. It is partly shaded by the established canopy in Polygon 7 and is slightly depressional. The soil is a medium to gravelly grained and remains saturated for long periods of time after precipitation has occurred.

Vegetation: The dominant native vegetation for Polygon 8 are shrub species *C. sericea* and *R. spectabilis.* These species cover about 40% of the polygon on the outer boundaries, away from the more saturated center portion. The dominant invasive species is *R. armeniacus* which covers 10-15%.

B) Site Preparation Activities

Polygons 2, 3, 8, and 7 have *P. balsamifera* ssp. *trichocarpa* as the dominant species in the upper canopy. However, it is also the area that receives the most sunlight. On the western boundary of the polygon near the creek, there is a berm which contains the majority of the *R. armeniacus* which is the dominant invasive species located in this section of the site. Removal of *R. armeniacus* is the major adjustment to this space. The only gradual slope in this area is along the berm which runs along the western boundary. We will limit the amount of human use when working on the berm to reduce the impact on the soil. Mulching on and around the berm will be critical to prevent erosion. Planting native shrubs and trees will provide soil stabilization as well as shade to prevent invasive species from re-establishing.

Polygons 4 and 5 have a slope of approximately 4 degrees from east to west at the east boundary edge. The rest of the polygon has less than 2 degrees slope. *R. armeniacus* dominates the southern section of the polygon. Whereas *I. aquifolium* and *H. helix* dictates the shaded portion of the northern section of the polygon. There are a few large *I. aquifolium* in this area which will be tagged and removed by the parks department. The majority of the invasive species will be removed with hand tools. Compost piles will be constructed within the polygon to maintain the organic material and nutrients on the site. They also provide habitat opportunities for wildlife. We will also apply a 6-8 inch layer of mulch after removing invasive species to prevent regrowth. A mixture of shade-tolerant native shrubs and trees will be planted throughout this polygon. This creates the diversity of native vegetation as well as multiple canopy layers to suppress growth of invasive plants.

Polygons 1 and 6 occupy the southern portion of the site. The dense canopy is composed of *A. macrophyllum* and *A. rubra* which leads to the partial to full shade of this area. The social trail runs along the boundary of the polygon where the creek edge resides. This has led to heavy soil compaction and erosion. To improve these issues, we will remove the invasive plants and apply a 6-8 inch layer of mulch. We will also limit the amount of volunteers working in this polygon due to safety and soil compaction concerns. In addition, native plants with thorny stems and branches will also be planted along the creek bank to discourage users from further disturbance. The selected vegetation will also be shade-tolerant and wet-tolerant on account of the soil and canopy conditions. Another solution with regards to the social trail is to redirect it away from creek bank to alleviate human impacts on the soil. This decreases the amount of runoff into the creek.

C) Logistical Considerations

Potential Area Disturbance

The restoration site is located next to established pathways that run through Everest Park along the northern boundary and a residential neighborhood along the eastern boundary. A creek runs along the southern and western boundaries of the site. There is a social trail that runs through our site from the northwest direction and exits out along the southeast boundary. During the volunteer work parties, we will redirect the trail away from the creek bank to minimize the amount of human impact on the soil and for safety purposes as well. Compost piles will be constructed discretely within the site for consideration of the neighboring

community. Tarps will also be used along the eastern boundary of the site where grass is established to collect excess removed plant materials. Green Kirkland will also remove excess debris. Parking will be available for volunteers through Everest Park's northern parking lot. A paved trail and short field of grass leads volunteers from the parking lot to the restoration site.

Mulch

There are two designated points where mulch will be staged during work parties. The first location is at the northern boundary of the site next to a paved trail. The second location is at the end of 10th Street where the road ends. These positions were selected for their accessibility and also serve as an appropriate location for vehicle delivery. Furthermore, the mulch piles are not blocking any pathways for users and they offer short distances throughout the site when ready for use.

Entry Points

There are two main entry points to our site which are in close proximity to the mulch staging areas. We will use the entry and exit of the social trail as the access to the site. These entrance points are located at the northern boundary of Polygon 1 and at the end of 10th Street. Using the trail also minimizes the amount of disturbance to native vegetation. For the sensitive and critical areas around the creek bank, flagging or tape will limit human impacts. Moreover, Polygon 2 offers additional entry points if needed for invasive removal, applying mulch, and transporting plants.

Planting Plan

The goal for Polygon 1 is to improve bank stability, reducing soil erosion, and thus improving water quality (Objective 2-3) and alleviating soil compaction. All plants selected are typical of a Puget Sound lowland mixed conifer forest. Once the trail has been rerouted, a number of different native species will be planted all of which have strong root systems. The only conifer planted will be *T. plicata* and will form the long term canopy of the polygon. *T. plicata* will provide two main benefits, its wide spreading roots will secure the creek bank and as it grows it will provide long term shade over the creek. The shade will reduce water temperatures, improving dissolved oxygen levels, and the decreased erosion will reduce sediments in the stream (Saldi-Caromile 2004). There is some risk of trampling by users of the social trail so *T. plicata* will be placed specifically out of the way and will be clearly marked. Four *R. spectabilis* will be planted in a slightly wetter depression along the polygon in a bunch in order to form a clear blockade of the old trail. This will direct people to the new path and reduce compaction within the polygon. *A. circinatum* and *L. involucrata* both have strong fibrous root systems and will provide further soil binding to creek bank (Saldi-Caromile 2004). *S. albus* is a hardy shrub that will provide insurance for plant failures due to the tough soil conditions in the polygon. *P. minutum* will also provide strong soil binding and increased diversity in the polygon (Objective 2-1). *A. circinatum, L. involucrata*, *S. albus*, and *P. minutum* will be spaced along the bank at about 1.5 meters apart, though this will depend on the existing native species in place. All of these species provide wildlife benefits such as fruits in the case of *L. involucrata* and cover in

the case of *T. plicata* (Table 8). This polygon will also only be planted by team members due to specific placements and safety issues of working along the edge of the creek.

AD7. We planted only three *R. spectabilis* because there was no more were needed to form a blockade to the old trail. We added *G. shallon* and *Mahonia nervosa (short oregon grape)* at the far western corner of the polygon as we had extra individuals, space and appropriate conditions for them. See Figure 7 and Table 2 for more details.

Polygon 2 includes the entire berm and provides a microclimate with drier soils at the top and wetter soils at the base. The southern tip of the polygon is particularly higher and gets partial sun so *Gaultheria shallon* will be planted in clumps in order to create a dense planting. It will be of high wildlife value with its berries and flowers for pollinators (Objective 2-2) (Table 8). A single *P. menziesii* will also be planted to provide diversity. Along the rest of the berm species will be planted on a gradient. *T. heterophylla* will be planted near the top while *T. plicata* will be planted at the base. Both species will eventually form a long-term conifer canopy (Objective 1-2). *S. albus* and *P. minutum* will be planted throughout the berm due to their tolerance of different soil moistures. They will provide wildlife interest and diversity for the polygon (Objective 2-1 and 2-2). *O. cerasiformis* will be planted along the top of the berm due to its ability to survive in drier soils and will provide in early pollinator source (Table 8). *Sambucus racemosa* will be planted throughout the lower part of the berm and will also provide wildlife benefits (Objective 2-2).

AD8. We planted two *P. menziesii* in this polygon as we obtained 7 more than planned. There was space and optimal conditions for P. menziesii so they were added here. We added *M. nervosa* to this polygon as we got extra numbers from the salvage event. See Figure 9 and Table 2 for more details. See Figure 9 and Table 2 for more details.

Polygon 3 gets the most of anywhere on the site and thus provides a chance for increasing diversity on the site (Objective 2-1). *P. menziesii* will be planted widely apart in this polygon in order to retain some of the sun exposure long term. *R. nutkana* and *R. sanguineum* will provide pollinator interest and the addition *R. nutkana* will allow for a smooth transition from the WNPS site (Table 8) (Objective 2-2). *R. parviflorus* will be planted in clumps near the edge of the site to form thickets to prevent people from entering the site. *Rosa nutkana, Ribes sanguineum*, *Rubus parviflorus* will also provide interest to visitors passing along the trail with showy flowers and berries (Table 8).

AD9. We added *P. minutum, V. parviflorum* and *T. grandiflora* to this polygon as we got extra numbers from the salvage event. See Figure 11 and Table 2 for more details.

Due to the dense shade in parts of Polygon 4 and the established *T. plicata* stand many ground covers will be planted in this polygon. *Dicentra Formosa, Blechnum spicant, Dryopteris expansa, Tellima grandiflora, and A. filix-femina* will all be planted in these shadier areas to provide much needed native groundcovers to the site (Objective 2-1). In the areas shaded by *P. balsamifera*

ssp. trichocarpa, *T. heterophylla*, and *T. plicata* will be planted to begin succession towards a conifer canopy as *P. balsamifera ssp. trichocarpa* die (Objective 1-2). A variety of shrubs will be planted in the polygon providing a large variety of wildlife interest (Objective 2-2). *Vaccinium ovatum (evergreen huckleberry)* and *R. parviflorus* are also planted in the adjacent WNPS site and thus will provide a transition into the site.

AD10. We did not plant *B. spicant*, *D. expansa*, and *A. filix-femina* due to budget and availability restraints. We did added *P. minutum, P. menziesii*, and *R. sanguineum* to this polygon to replace the species we could not obtain. See Figure 13 and Table 2 for more details.

The center of Polygon 5 is dominated by *R. spectabilis* thus most of the planting will occur on the edges. *T. plicata* will provide a long term conifer canopy while the selected shrub species will provide increased diversity (Objective 1-2 and 2-1). *Physocarpus capitatus*, *C. sericea*, *S. racemosa*, and *R. parvifolium* all provide wildlife interest and cover.

AD11. We did not plant *C. sericea* to this polygon due to availability of rooted cuttings. We concentrated on installing them in Polygon 8. Polyon 5 had more *R. armeniacus* than expected and the resulting open space allowed for more plants than originally planned. We shifted several *A. circinatum, O. cerasiformis, P. minutum* and *D. formosa* from Polygon 7 to this polygon. See Figure 13 and Table 2 for more details.

Polygon 6 has many native shrubs already in place as well as a stand of *T. plicata* so there will be an emphasis on groundcovers in this polygon. *B. spicant, D. formosa, D. expansa, M. nervosa,* and *T. grandiflora* will add wildlife interest and increased structural diversity in the polygon (Objective 2-1 and 2-2). *T. heterophylla* will be placed in the areas without conifer cover already to eventually overtake the deciduous canopy and form a conifer canopy (Objective 1-2).

AD12. We did not plant *B. spicant or Dryopteris expansa* in this polygon due to availability restraints. We decided to add *A. circinatum* and *S. albus* to this polygon from polygon 1. The plants were installed along the border of polygon 1 and 6 in order to eventually create a consistent border of vegetation north side of the social trail. See Figure 7 and Table 2 for more details.

Polygon 7 is our largest polygon and has two slightly different areas. The northern section is wetter than the southern section and thus the species are planted on a gradient between them. *A. circinatum*, *C. cornuta*, and *V. ovatum* will be planted in the southern portion of the polygon and provide wildlife interest (Objective 2-2). The other shrubs will be planted throughout the polygon except the far southern portion. Groundcovers will only be planted in the eastern corner of the polygon where a more established canopy exists (Objective 2-1).

AD13. We added *T. plicata, T. heterophylla, C. Cornuta, G. shallon, L. involucrata, M. nervosa, O. cerasiformis, P. capitatus, P. minutum, S. racemosa, S. albus, T. grandiflora* to this polygon as

we got extra plants from salvage event and moved some plants from other polygons to this one where appropriate. See Figure 9 and Table 2 for more details.

Polygon 8 is wetter and shadier than most of the polygons and has some native species already present. *T. plicata* will planted around the edges of the polygon to provide a native conifer canopy (Objective 1-2). *P. capitatus* will provide diversity and wildlife interest and *C. sericea* cuttings will help increase the continuity with the large stand of *C. sericea* in Polygon 7 and provide wildlife interest (Objective 2-2).

AD14. Large woody debris was left from the cut P. balsamifera ssp. trichocarpa and blocked planting in most of the site. Due to that planting was not possible in the wetter areas of the polygon. We added *G. shallon, L. involucrata, R. sanguineum* and *S. racemosa* to the drier edge of this polygon where there was space available. See Figure 11 and Table 2 for more details.

Map Revisions and Additions

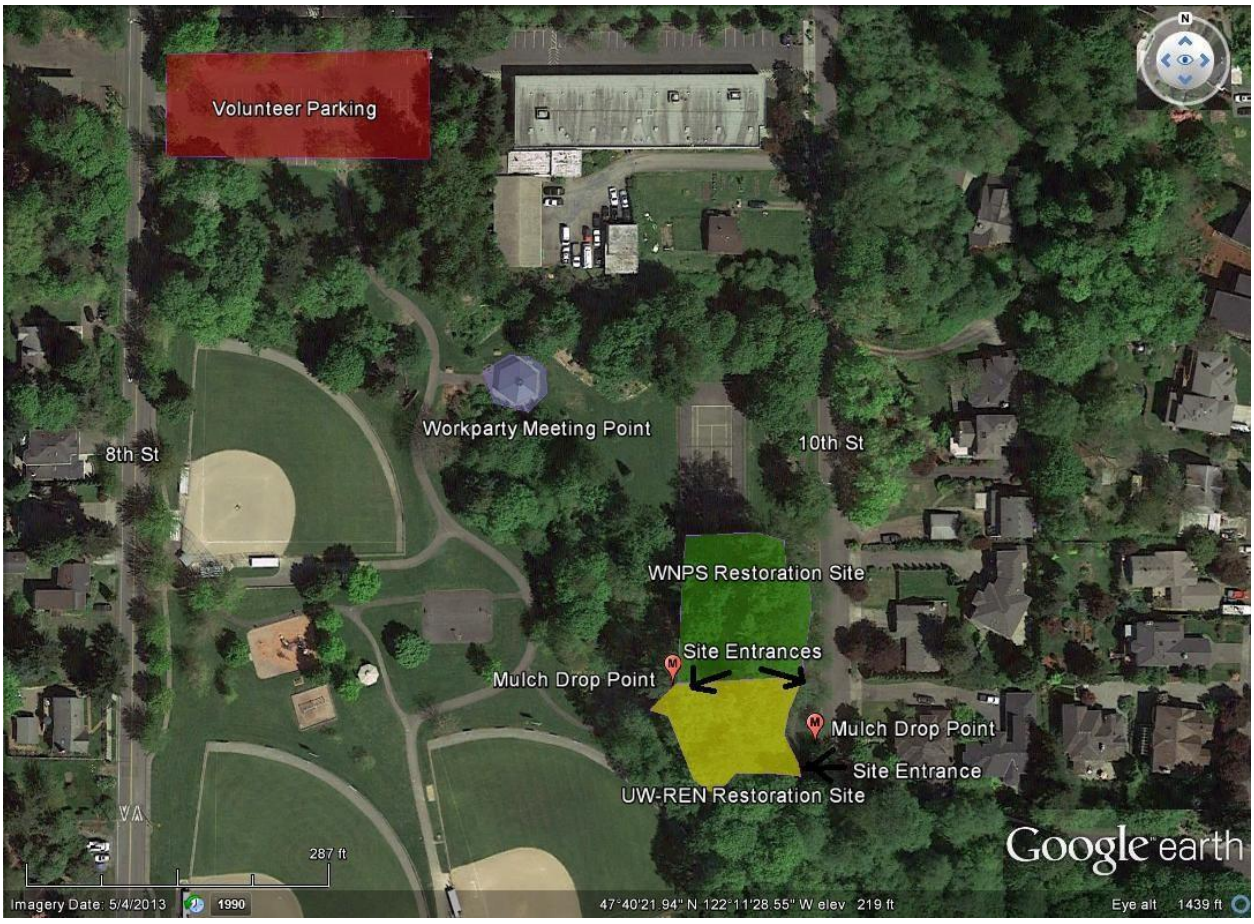

Figure 3. Everest Park and UW-REN Restoration Site Logistics Map

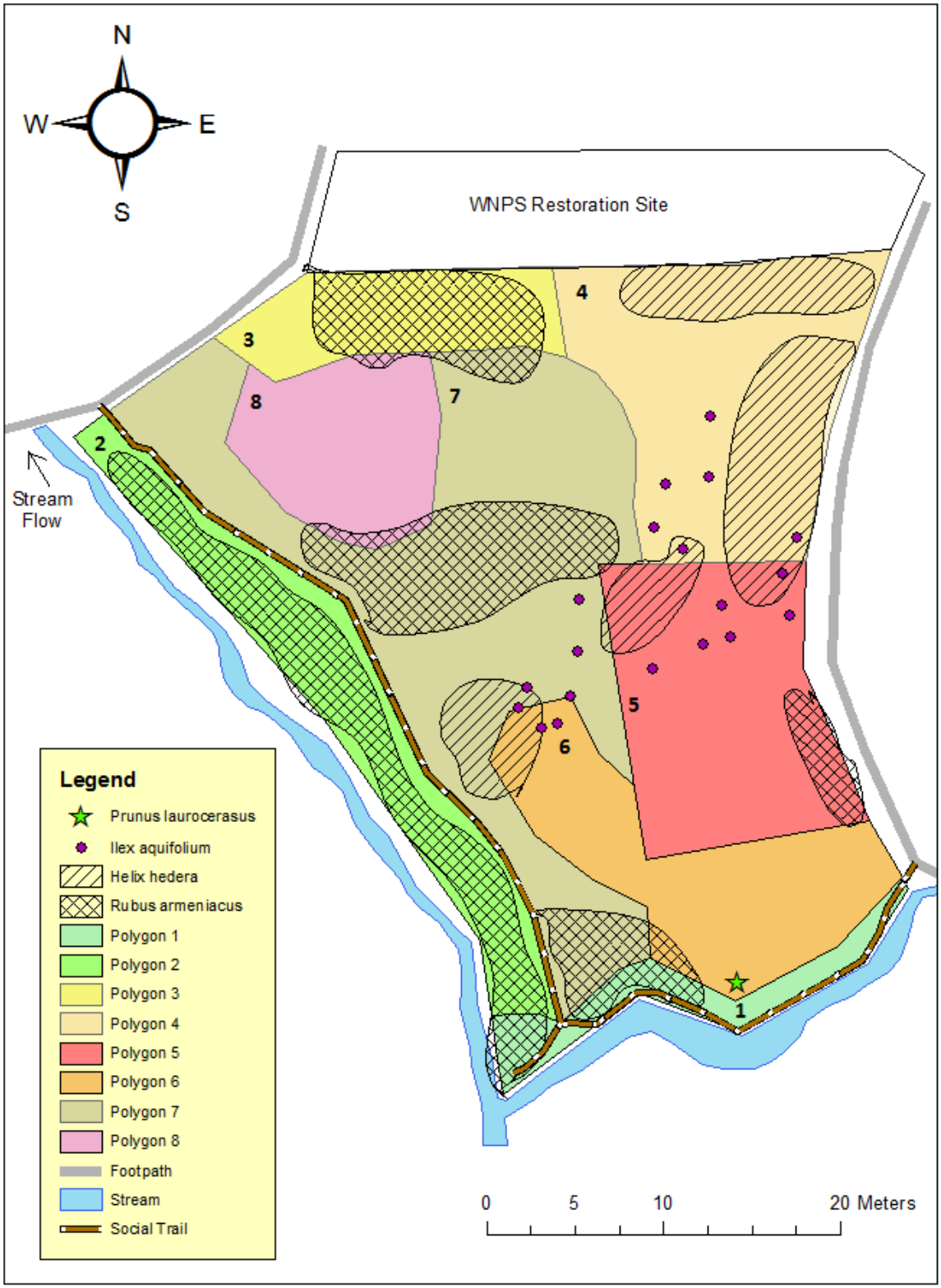

Figure 4. Pre-work Invasive Species Cover and Individuals

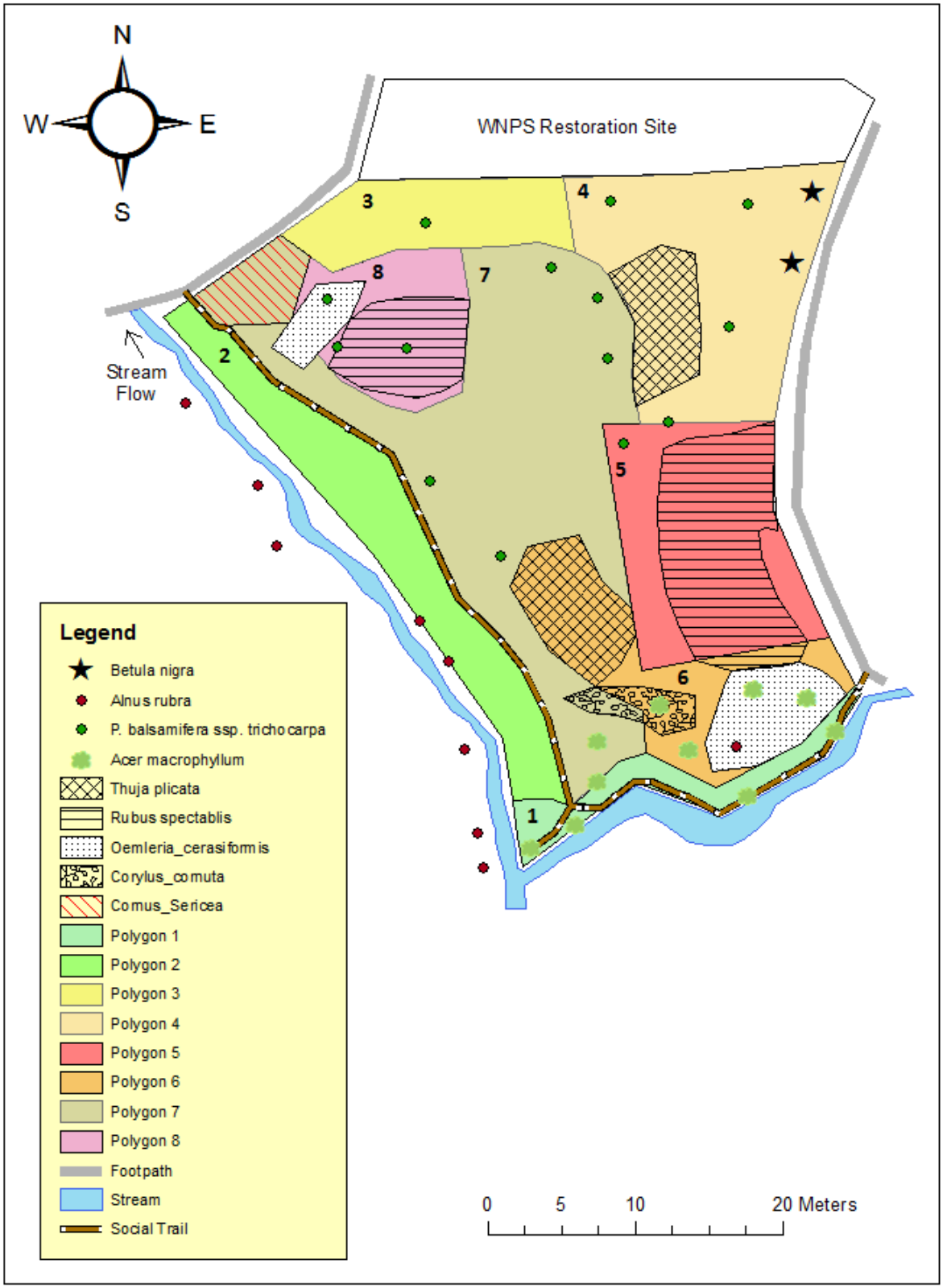

Figure 5. Pre-work Native Species Cover and Individuals

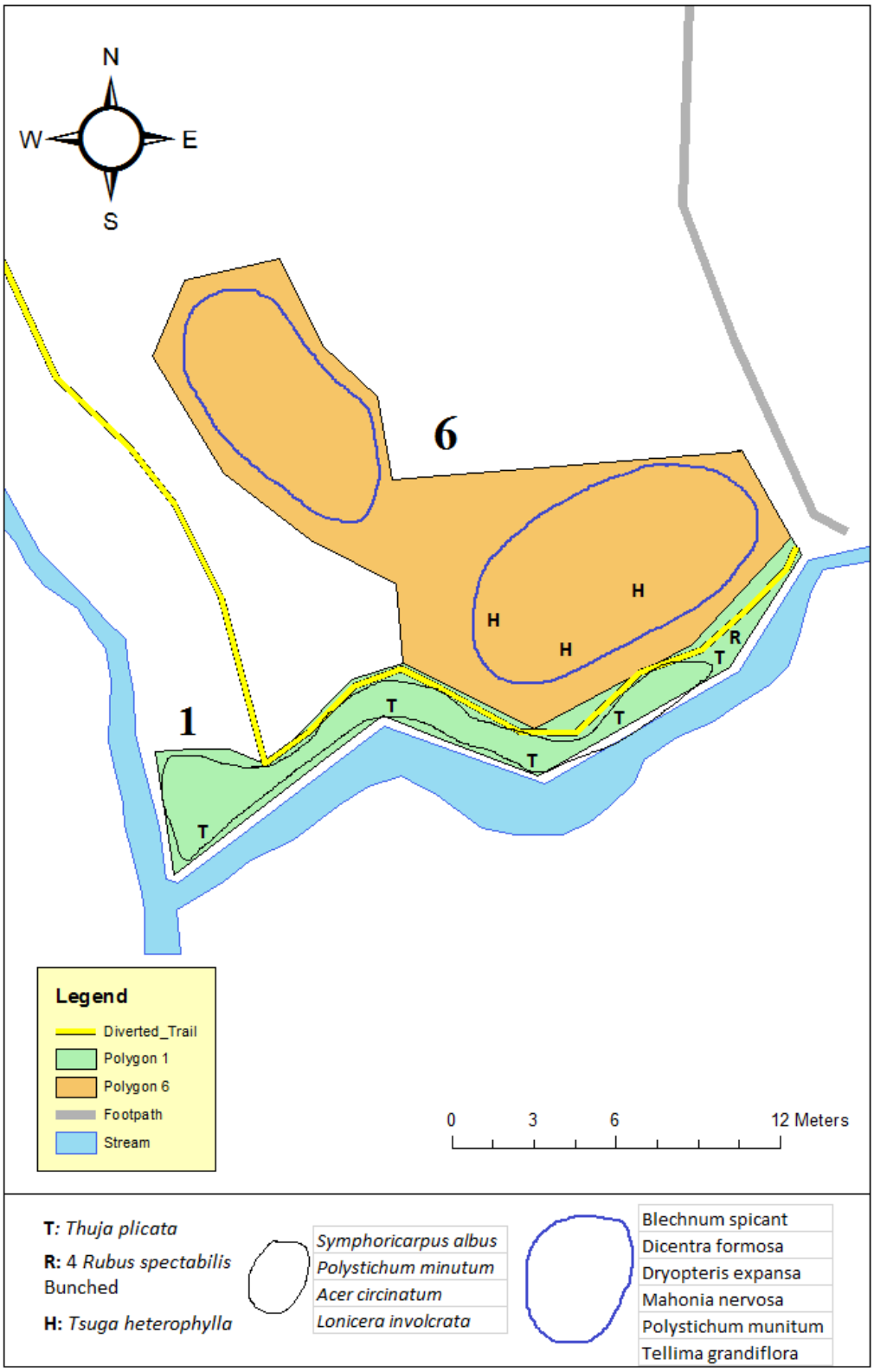

Figure 6. Planting Plan Polygon 1 and 6

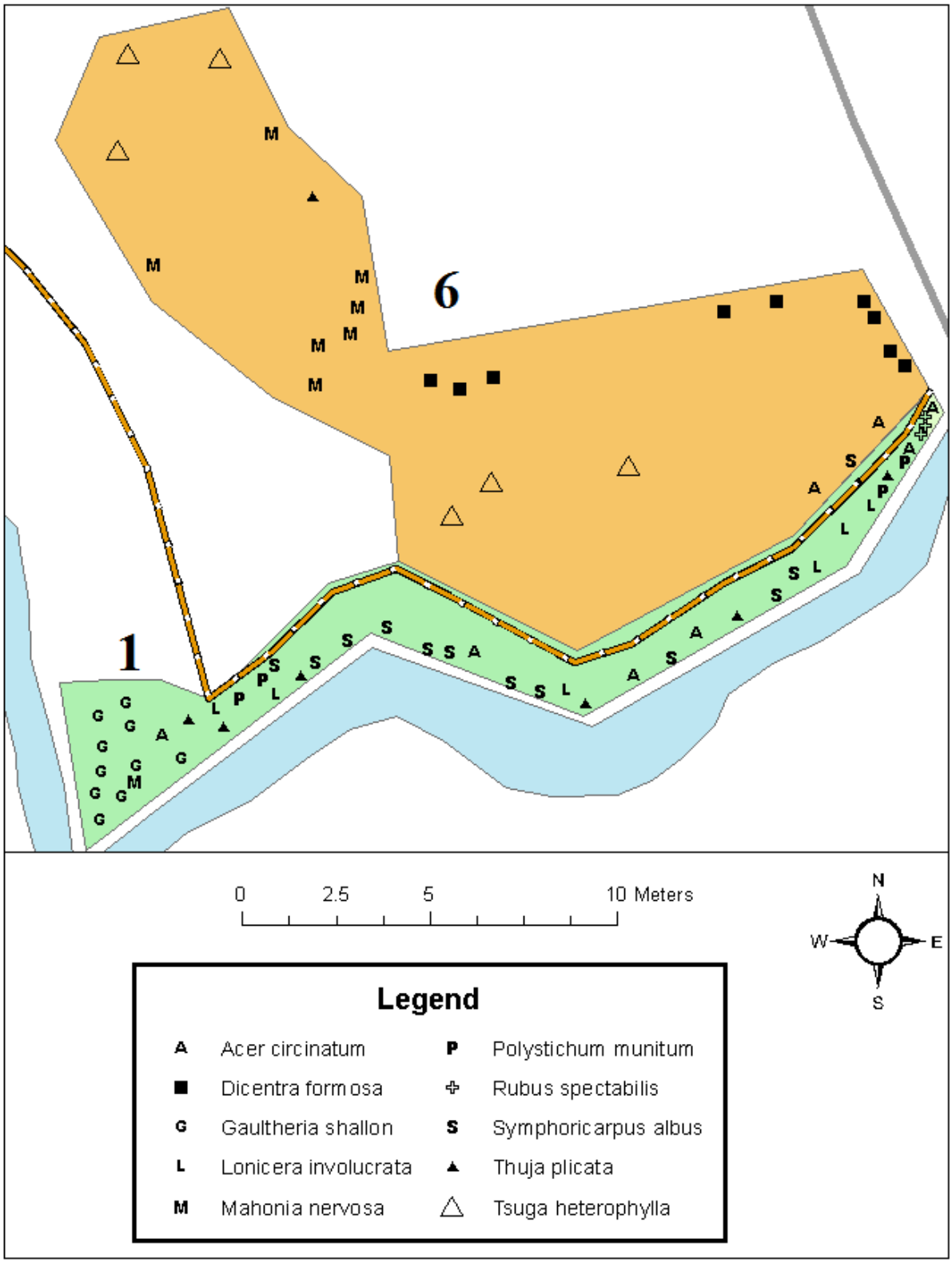

Figure 7. As-Built Plant Installation Polygons 1 and 6

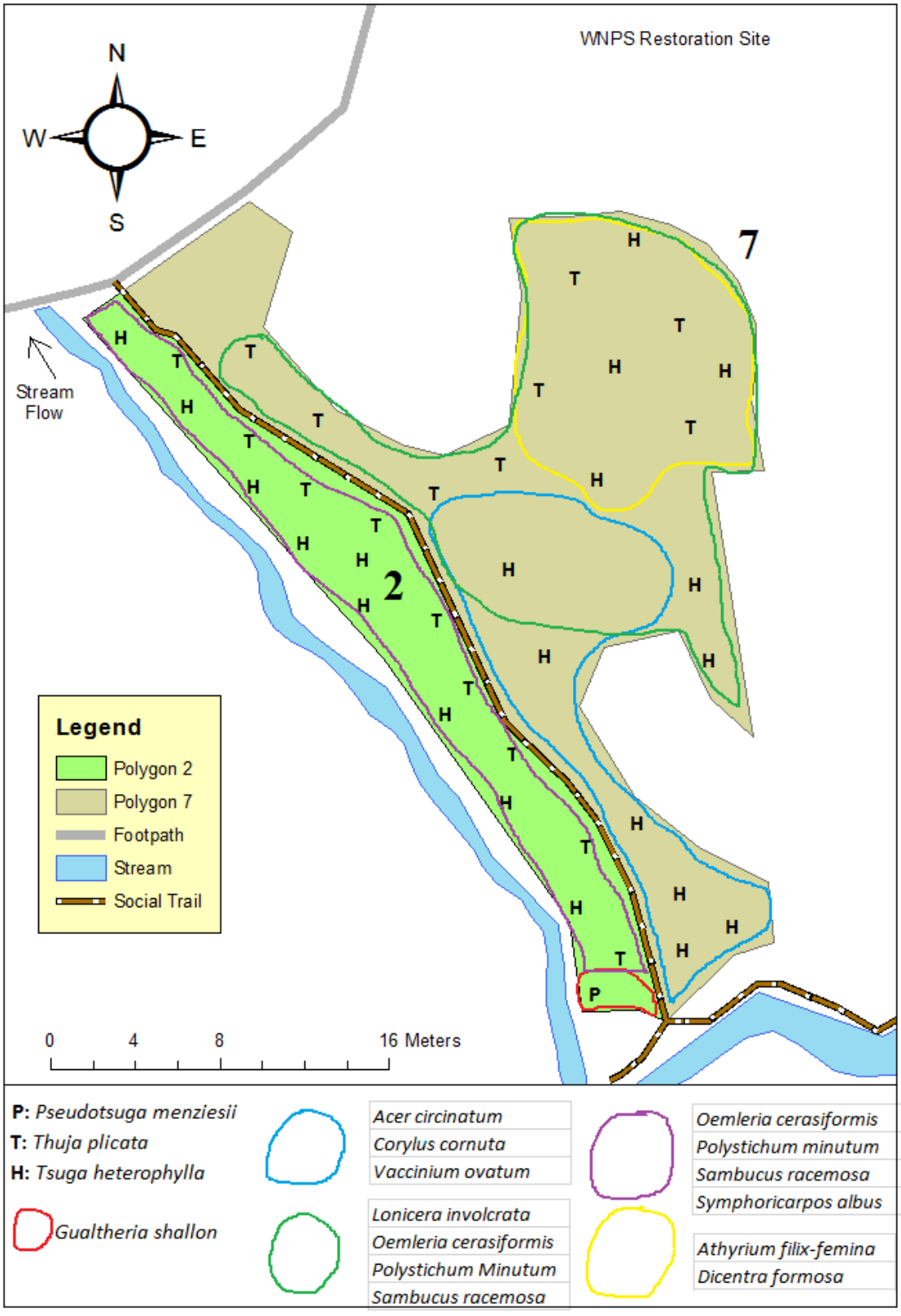

Figure 8. Planting Plan Polygon 2 and 7

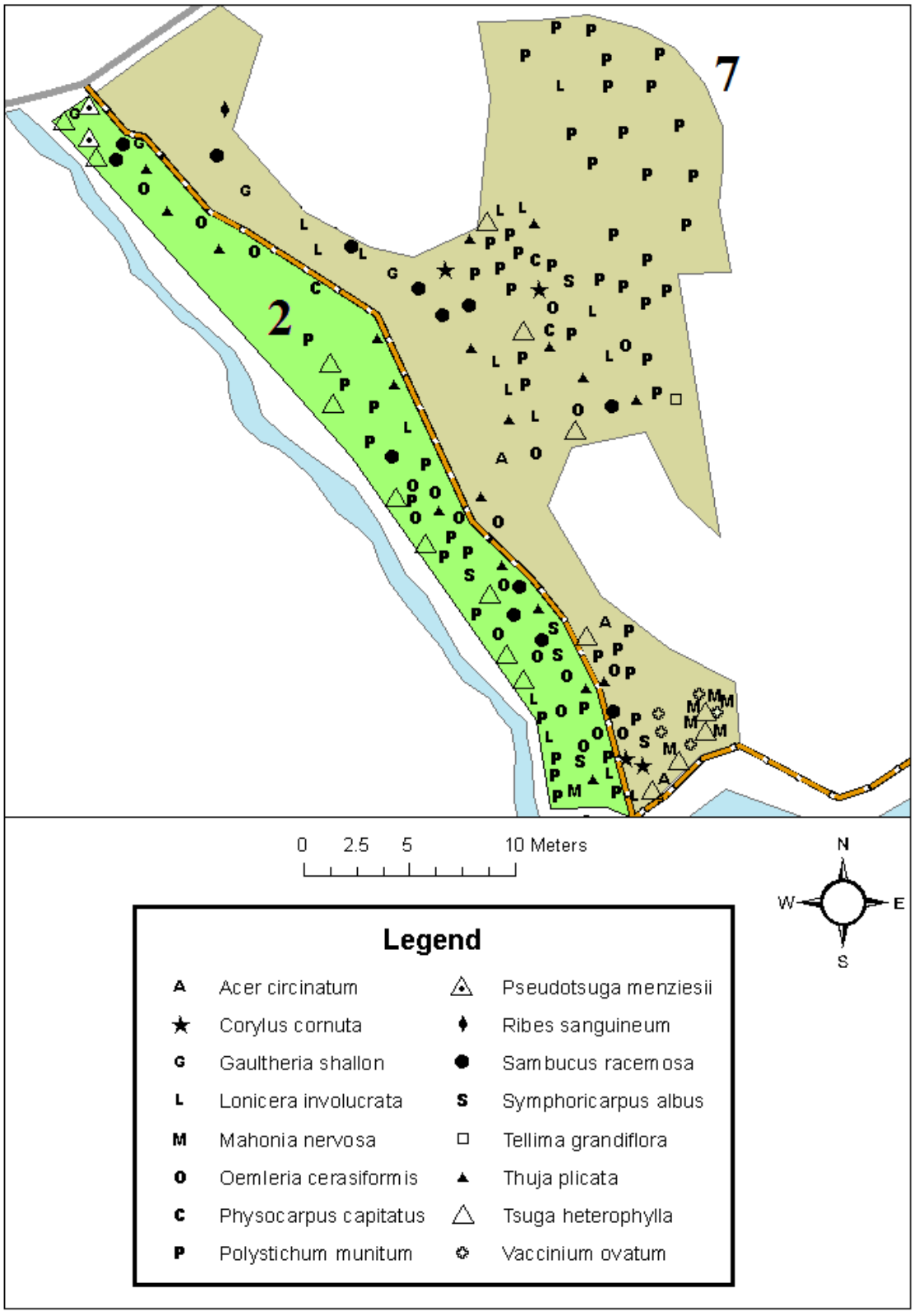

Figure 9. As-Built Plant Installation Polygons 2 and 7

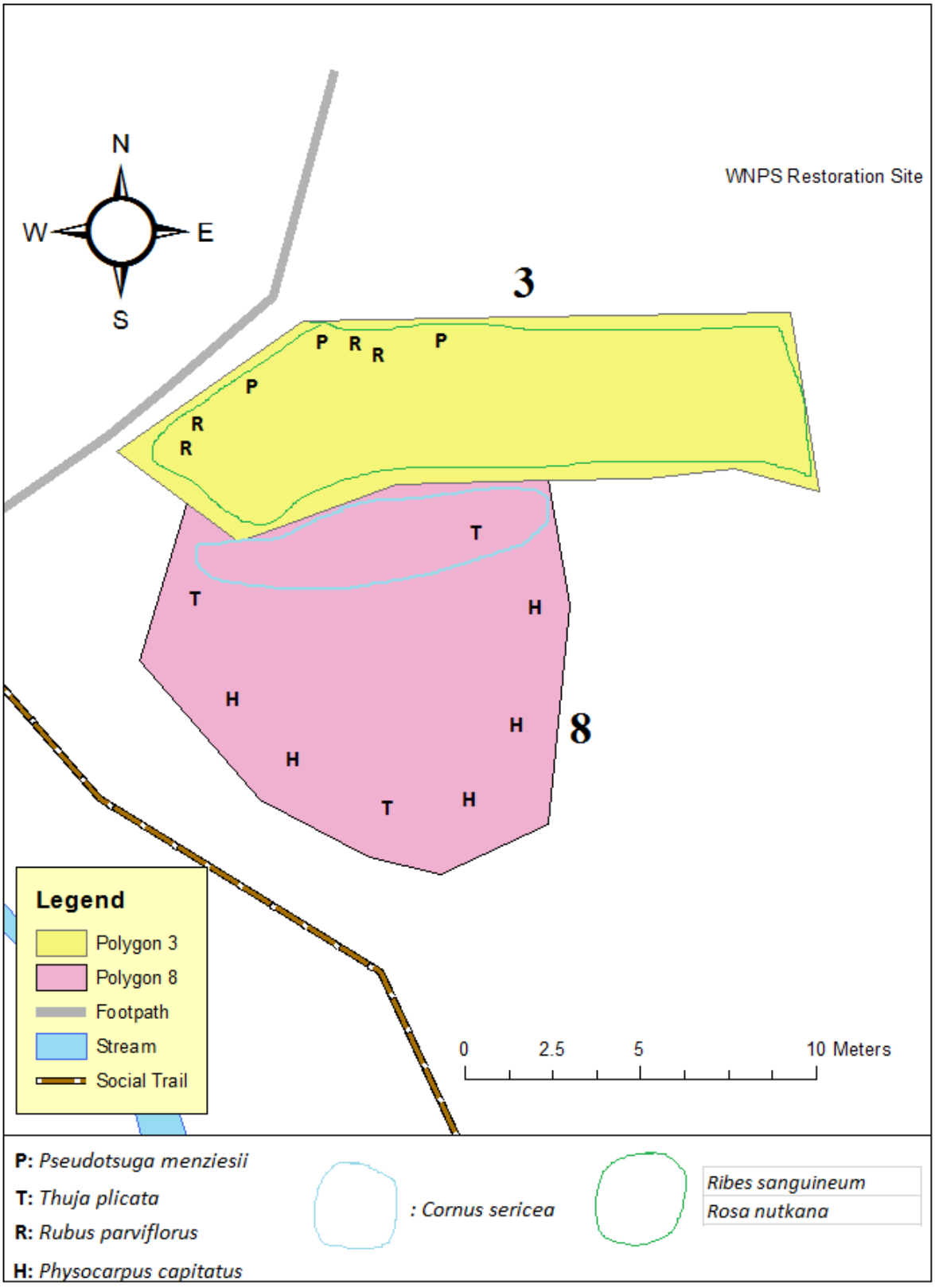

Figure 10. Planting Plan Polygon 3 and 8

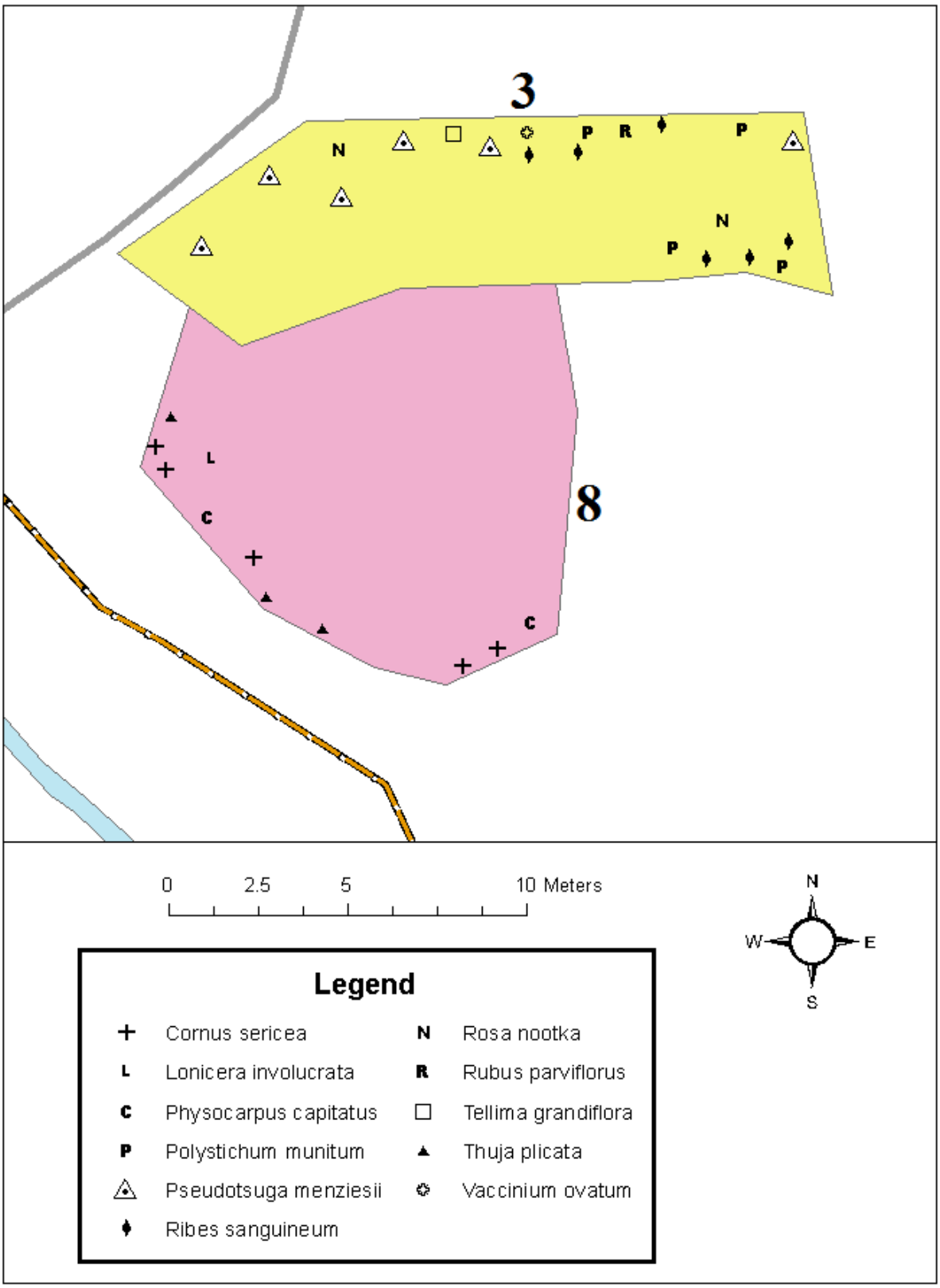

Figure 11. As-Built Plant Installation Polygons 4 and 5

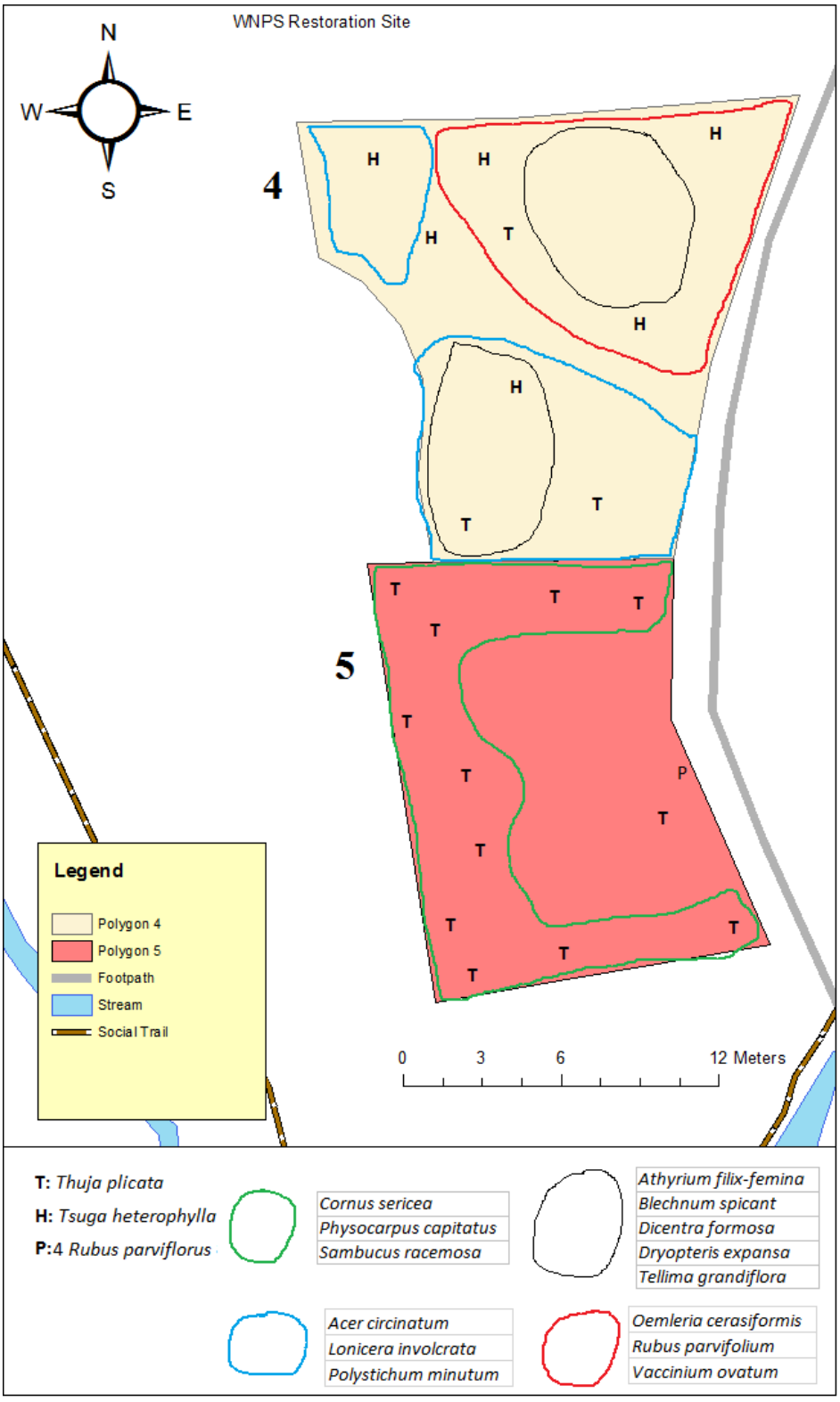

Figure 12. Planting Plan Polygon 4 and 5

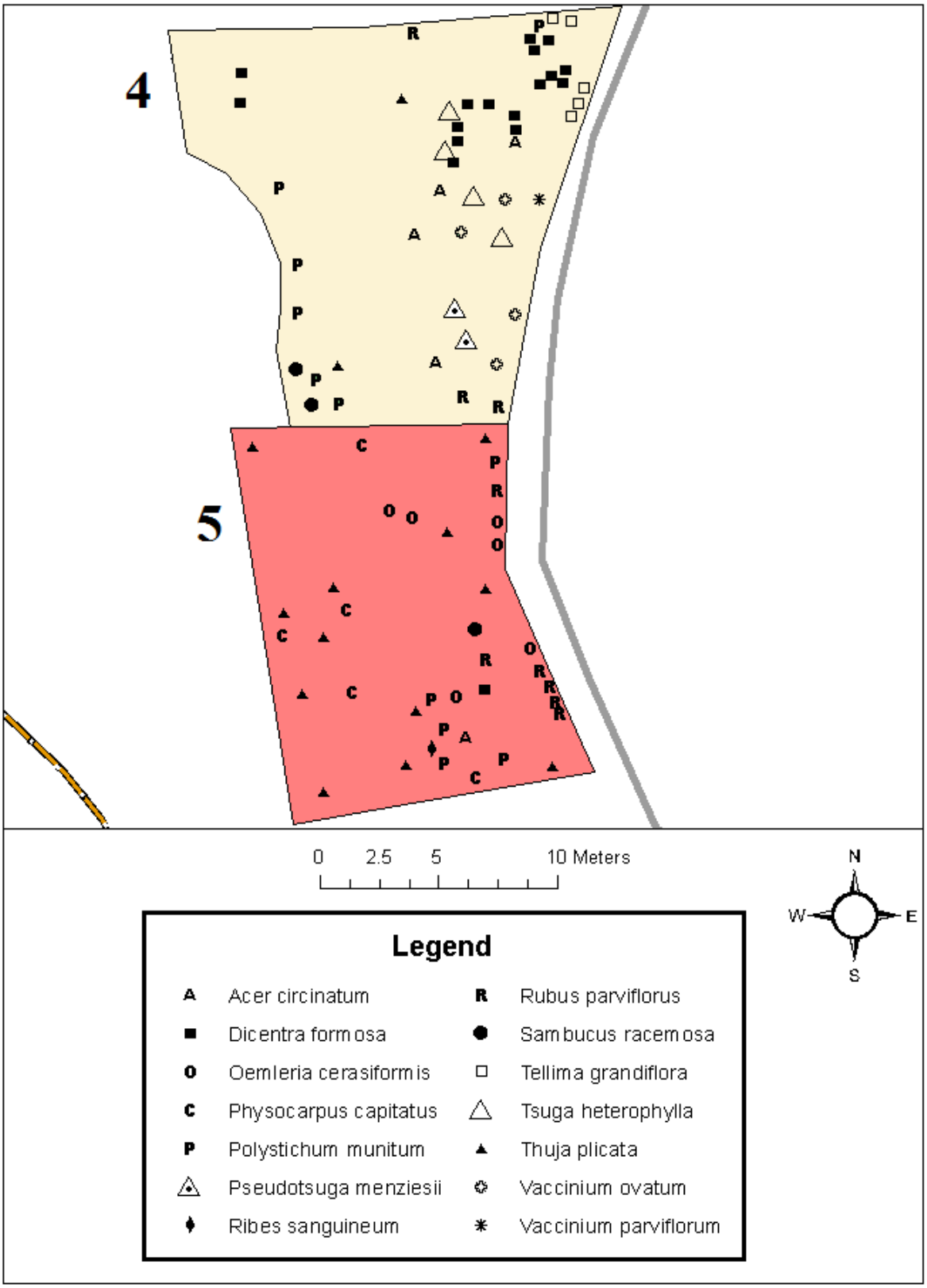

Figure 13 As-Built Plant Installation Polygons 4 and 5

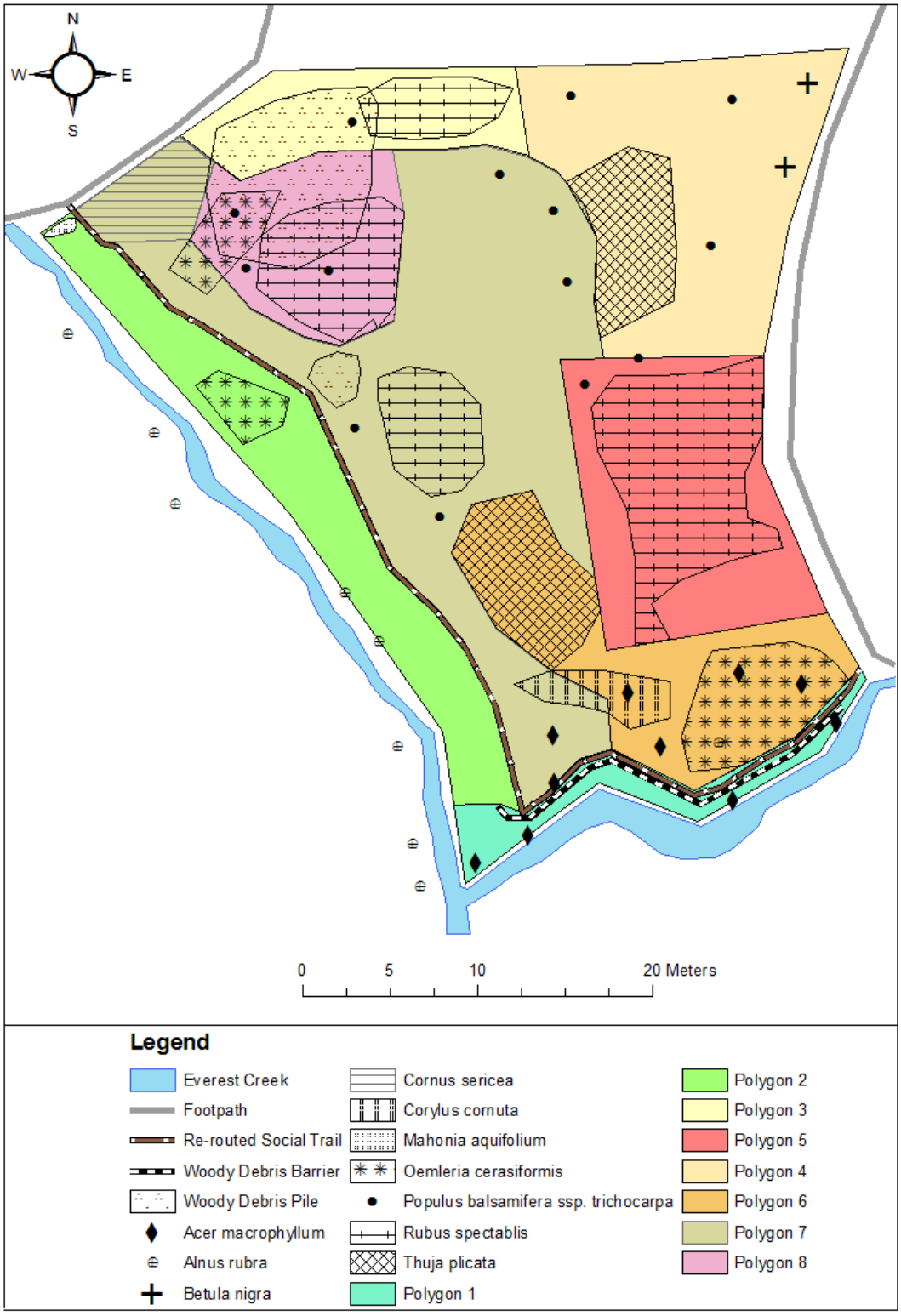

Figure 14. As Built Map with Existing Vegetation

Table Revision

Table 1. General Material Table

Task	Materials	Qty	Source	Tools	Qty	Source
1-1a	Herbicide	5	Parks Department	Loppers	20	CP
				Shovels	15	CP
				Gloves	40	CP
				Hand Tillers	15	CP
				Weed Wrench	2	CP
1-1b	Mulch	$3.8m^3$	CP	Wheelbarrow	2	CP
				Buckets	15	CP
				Shovels	15	CP
1-2a	Plants	363	CP, Plant Salvage, Plant Sale	Shovels	15	CP
				Gloves	40	CP
				Planting pots	30	Nature Consortium
				Burlap	10	Grocery stores
1-2b	Mulch	$3.8m^3$	CP	Gloves	40	CP
	Water		Everest Park	Shovels	15	CP
				Sheers	5	CP
1-3a	Mulch	$3.8m^3$	CP	Wheelbarrow	2	CP
				Shovels	15	CP
				Buckets	15	CP
				Gloves	30	CP
2-1a	Plants	363	CP, Plant	Gloves	30	CP

			Salvage			
Task	**Materials**	**Qty**	**Source**	**Tools**	**Qty**	**Source**
2-1a	Water		Everest Park	Shovels	15	CP
	Mulch	3.8m^3	CP			
2-2a	Plants	363	CP, Plant Salvage, Plant Sales	Gloves	40	CP
				Shovels	15	CP
				Pruning shears	10	CP
2-3a	Plants	363	CP, Plant Salvage, Plant Sales, Live Staking	Gloves	30	CP
				Shovels	15	CP
				Shears	10	CP
3-1a	Plants	363	CP, Plant Salvage, Plant Sales, Live Staking	Gloves	30	CP
	Mulch	3.8m^3	CP	Shovels	15	CP
				Wheelbarrows	2	CP
				Buckets	15	CP
3-2a	Volunteer base		CP, Green Kirkland	Green Kirkland website, other social media		CP
3-2b	Volunteers		CP, Green Kirkland	Green Kirkland website		CP
3-3a	Work party plan		UW-REN Team, CP	E-mail		CP

Table 2. Planting Plan Table

Polygon 1			
Plant ID	#	Form	Spacing(m)
Thuja plicata	~~5~~ 6	12”-18” Bare root	3
Acer circinatum	~~5~~ 4	18-24" Bare root	1.5
Lonicera involucrata	~~5~~ 4	12”-18” Bare root	1.8
Polystichum minutum	~~6~~ 7	3’’-6’’ plug	1.5
Rubus spectabilis	~~4~~ 3	Live stakes	1.5
Symphoricarpos albus	~~5~~ 12	12-18” Bare root	1.5
Gaultheria shallon	11	3-6" plug	3-6" plug
Mahonia nervosa	1	6”Bare root	1.5

Polygon 2			
Plant ID	#	Form	Spacing(m)
Pseudotsuga menziesii	~~1~~ 2	12”-18” Bare root	4.3
Thuja plicata	~~9~~ 10	12”-18” Bare root	3
Tsuga heterophylla	9	9”-12” Bare root	4.3
Gaultheria Shallon	~~10~~ 2	3-6" plug	1.8
Oemleria cerasiformis	~~9~~ 11	12”-18” Bare root	1.8
Polystichum minutum	~~13~~ 16	3’’-6’’ plug	1.8
Sambucus racemosa	~~9~~ 6	12”-18” Bare root	1.8
Symphoricarpos albus	~~5~~ 3	12-18” Bare root	1.8
Mahonia nervosa	1	6” Bare root	1.5

Polygon 3			
Plant ID	#	Form	Spacing (m)
Pseudotsuga menziesii	~~3~~ 7	12”-18” Bare root	4.3
Ribes sanguineum	~~5~~ 6	12”-18” Bare root	1.8
Rosa nutkana	3	12”-18” Bare root	1.8
Rubus parviflorus	~~3~~ 1	12”-18” Bare root	1.8
Polystichum minutum	4	3’’-6’’ plug	1.8
Vaccinium parviflorum	1	Salvaged	1.8
Tellima grandiflora	1	3’’-6’’ plugs	1.5

Polygon 4			
Plant ID	#	Form	Spacing(m)
Thuja plicata	~~3~~ 2	12”-18” Bare root	4.3
Tsuga heterophylla	6	9”-12” Bare root	4.3
Pseudotsuga menziesii	2	12”-18” Bare root	4.3
Acer circinatum	~~2~~ 4	18-24" Bare root	1.8
Polystichum minutum	7	3’’-6’’ plug	1.8
Ribes sanguineum	1	12”-18” Bare root	1.8
Rubus parviflorus	~~3~~ 2	12”-18” Bare root	1.8
Sambucus racemosa	2	12”-18” Bare root	1.8
Vaccinium ovatum	~~5~~ 3	4”-8” Plugs	1.8
Vaccinium parviflorum	1	Salvaged	1.8
~~*Athyrium filix-femina*~~	~~2~~	~~1 gallon container~~	~~1.5~~
~~*Blechnum spicant*~~	~~3~~	~~1’’ 3’’ Plugs~~	~~1.5~~
Dicentra formosa	~~7~~ 15	Small bare root or salvaged	1.5
Tellima grandiflora	5	3’’-6’’ plugs	1.5

Polygon 5			
Plant ID	#	Form	Spacing(m)
Thuja plicata	12	12”-18” Bare root	4.3
Acer circinatum	1	18-24" Bare root	1.8
Oemleria cerasiformis	4	12”-18” Bare root	1.8
Sambucus racemosa	~~9~~ 5	12”-18” Bare root	1.8
Polystichum minutum	7	3’’-6’’ plug	1.8
Rubus parvifolium	~~4~~ 6	Live stakes	1.8
~~*Cornus sericea*~~	~~5~~	~~Live stakes~~	~~1.8~~
Dicentra formosa	1	Bare root	1.5
Physocarpus capitatus	5	12” Bare root	1.8

Polygon 6			
Plant ID	#	Form	Spacing(m)
Tsuga heterophylla	~~3~~ 6	9”-12” Bare root	4.3
Thuja plicata	1	12”-18” Bare root	4.3
Acer circinatum	2	18-24" Bare root	1.8
Symphoricarpos albus	1	12-18” Bare root	1.5
~~*Polystichum munitum*~~	~~6~~	~~3’’-6’’ plug~~	~~1.8~~
~~*Dryopteris expansa*~~	~~5~~	~~1 gallon container~~	~~1.2~~
~~*Blechnum spicant*~~	~~12~~	~~1’’-3’’ plugs~~	~~1.2~~
Dicentra formosa	~~5~~ 9	Bare root	1.2
~~*Tellima grandiflora*~~	~~5~~	~~1 gallon container~~	~~1.2~~
Mahonia nervosa	~~10~~ 8	6” Bare root	1.5

Polygon 7			
Plant ID	~~#~~	Form	Spacing(m)
Thuja plicata	8	12”-18” Bare root	4.3
Tsuga heterophylla	~~12~~ 9	9”-12” Bare root	4.3
Acer circinatum	~~8~~ 3	9”-12” Bare root	1.8
Cornus sericea	2	Live stakes	1.2
Corylus cornuta	~~5~~ 4	6-12” Bare root	1.8
Gaultheria shallon	2	3-6" plug	3-6" plug
Lonicera involcrata	~~15~~ 10	12”-18” Bare root	1.8
Mahonia nervosa	~~10~~ 6	6”Bare root	1.5
Oemleria cerasiformis	~~7~~ 8	12”-18” Bare root	1.8
Physocarpus capitatus	3	12” Bare root	1.8
Polystichum minutum	~~14~~ 38	3’’-6’’ plug	1.8
Sambucus racemosa	~~12~~ 8	12”-18” Bare root	1.8
Symphoricarpos albus	1	12-18” Bare root	1.5
Vaccinium ovatum	~~5~~ 6	4”-8” Plugs	1.8
Tellima grandiflora	1	4”-8” Plugs	1.2
~~Dicentra formosa~~	~~8~~	~~1 gallon container~~	~~1.2~~
~~Athyrium filix-femina~~	~~3~~	~~1 gallon container~~	~~1.2~~

Polygon 8			
Plant ID	~~#~~	Form	Spacing(m)
Thuja plicata	3	12”-18” Bare root	4.3
Physocarpus capitatus	~~5~~ 3	12” Bare root	1.8
Cornus Sericea	~~10~~ 3	Live stakes	1.2
Gaultheria shallon	1	3-6" plug	3-6" plug
Lonicera involucrata	4	12”-18” Bare root	1.8
Ribes sanguineum	1	12”-18” Bare root	1.8
Sambucus racemosa	2	12”-18” Bare root	1.8

Timeline Revision

Table 3. Work Timeline

Winter Quarter													
Task	Total	Jan				Feb				Mar			
		2-8	9-15	16 - 22	23- 29	30 - 5	6- 12	13 - 19	20 - 26	27 - 5	6- 12	13 - 19	20 - 26
Create Planting Plans	40												
Estimated hours	40	20	20										
Actual Hours	30	10	20										
Schedule Percent complete		50%	100%										
Actual percent complete		33%	100%										
Create Work Plan	40												
Estimated hours	40	10	10	10	10								
Actual Hours	40	5	5	5	25								
Schedule Percent complete		25%	50%	75%	100%								
Actual percent complete		12.5%	25%	37.5%	100%								
Select Work Site for Events	0												
Estimated hours	0	0											
Actual Hours	0	0											
Schedule Percent complete		100%											
Actual percent complete		100%											
Establish Photo Points	0												
Estimated hours	0	0											
Actual Hours	0	0											
Schedule Percent complete		100%											
Actual percent complete		100%											
Schedule Tool/Mulch Needs	0												
Estimated hours	0	0											
Actual Hours	0	0											
Schedule Percent complete		100%											
Actual percent complete		100%											
Advertise Events	0												
Estimated hours	0	100%											
Actual Hours	0	100%											
Schedule Percent complete		100%											
Actual percent complete		100%											
Remove Invasive Species	270												
	387.5												
Estimated hours (Team)	120			30	0	0	30	30	30				
Actual Hours (Team)	62.5			30	0	0	0	4.5	10	8	0	0	0
Estimated hours (Volunteer)	150			30	0	0	45	45	30				
Actual Hours (Volunteer)	325			160	0	0	0	36	30	60	0	0	0
Schedule Percent complete				33%	33%	33%	50%	75%	100%				
Actual percent complete				59%	59%	59%	59%	72%	84%	84%	84%	84%	84%
Procure Plants	40												
Estimated hours	40				5	5	10	10	10				
Actual Hours	40				5	25	0	0	10				
Schedule Percent complete					12.5%	25%	50%	75%	100%				
Actual percent complete					12.5%	75%	75%	75%	100%				

Winter Quarter													
Task	Total	Jan				Feb				Mar			
		2-8	9-15	16 - 22	23- 29	30 - 5	6- 12	13 - 19	20 - 26	27 - 5	6- 12	13 - 19	20 - 26
Mulch Cleared Areas	120												
	195.5												
Estimated hours (Team)	30			5	0	5	5	5	5	5			
Actual Hours (Team)	32.5			5	0	0	0	4.5	5	8	0	0	0
Estimated hours (volunteer)	90			15	0	15	15	15	15	15			
Actual Hours (Volunteer)	163			40	0	0	0	24	15	40	0	0	0
Schedule Percent complete				16%	16%	33%	50%	66%	83%	100%			
Actual percent complete				46%	46%	46%	46%	37.6%	47.8%	72.4%	72.4%	72.4%	72.4%
Plant Installation	240												
	157												
Estimated hours (Team)	120					15	15	15	15	15	15	15	15
Actual Hours (Team)	59					0	0	0	5	0	21	15	6
Estimated hours (volunteer)	120					15	15	15	15	15	15	15	15
Actual Hours (Volunteer)	98					0	0	0	15	0	0	12	0
Schedule Percent complete						12.5%	25%	37.5%	50%	62.5%	75%	87.5%	100%
Actual percent complete						0%	0%	0%	19%	19%	31%	42.7%	53.2%
Total Hours													
Team	226	15	25	40	30	25	0	9	30	16	21	15	0
Volunteer	432	0	0	200	0	0	0	60	60	100	0	12	0
Total	658	15	25	240	30	25	0	69	90	116	21	27	0

Spring										
Task	Total	April					May			
		27 - 2	3-9	10-16	17-23	24-30	1-7	8-14	15-21	22-28
Remove Invasive Species	270									
	320.5									
Estimated hours (Team)	120									
Actual Hours (Team)	54.5	0	10							
Estimated hours (Volunteer)	150									
Actual Hours (Volunteer)	265	0	39							
Schedule Percent complete										
Actual percent complete		84%	100%							
Mulch Cleared Areas	120									
	265.5									
Estimated hours (Team)	30									
Actual Hours (Team)	41.5	0	5	0	10	0	0	4		
Estimated hours (volunteer)	90									
Actual Hours (Volunteer)	224	0	18	0	69	0	0	18		
Schedule Percent complete										
Actual percent complete		72.4%	87.8%	87.8%	92%	92%	92%	100%		
Plant Installation	240									
	157									
Estimated hours (Team)	120									
Actual Hours (Team)	59	0	5	0	5	0	0	2		
Estimated hours (volunteer)	120									
Actual Hours (Volunteer)	98	0	30	0	23	0	0	18		
Schedule Percent complete										
Actual percent complete		53.2%	69%	69%	87%	87%	87%	100%		
Begin As-build Report	79									
Estimated hours	79	2	2	2	3	5	5	10	20	30
Actual Hours	78	2	2	2	2	2	2	2	2	60
Schedule Percent complete		2.5%	5.%	7.5%	15%	21.5%	29%	36.7%	62%	100%
Actual percent complete		2.5%	5%	7.5%	10%	12.6%	15%	17.7%	20%	100%
Begin Stewardship Plan	48									
Estimated hours	48	1	0	2	5	10	30			
Actual Hours	50	2	2	2	2	2	40			
Schedule Percent complete		2%	2%	6%	16.7%	37.5%	100%			
Actual percent complete		4%	8%	12%	16%	20%	100%			
Secondary Invasive Removal	42									
	46									
Estimated hours (Team)	12						2	10		
Actual Hours (Team)	10						2	8		
Estimated hours (volunteer)	30						0	30		
Actual Hours (Volunteer)	36						0	36		
Schedule Percent complete							1.2%	100%		
Actual percent complete							0.4%	100%		
Presentation	80									
Estimated hours	80						10	10	10	10
Actual Hours	26						2	2	2	20
Schedule Percent complete							12.5%	25%	37.5%	50%
Actual percent complete							7.6%	9.3%	14%	60.4%
Total Hours										
Team	199	2	22	4	19	4	46	18	4	80
Volunteer	127	0	91	0	0	0	0	36	0	0
Total	326	2	113	4	19	4	46	54	4	80

Lessons Learned

Financial Budget

The importance of following and staying within a given financial budget is a very critical element when planning restoration on a site. Our team came in slightly under budget as was originally planned.

Table 4. Expenditures

Expenditures by major category	**Cost (Dollars $)**
Plants	
Trees	84.00
Shrubs	313.00
Groundcover	97.00
Tax	46.93
Subtotal for Pricing	**540.93**
Mulch	
Subtotal mulch	**0**
Tool Rental	
Subtotal tool rental	**0**
Transportation	
Subtotal for Transportation	**0**
Printing	
Subtotal for Printing	**20.00**
Project Total	**560.93**

There were some takeaways that we learned when dealing with the financial budget. We learned that when working with a limited budget that the diversity and availability of certain plant species may not be possible to attain. We had to adjust and minimize our plant selection in order to fit the needs and size of our site. Some plants were too expensive or unrealistic for us to use given our budget. We had to carefully select plants that we would be the most beneficial for the overall restoration.

Moreover, we learned that the use of plant salvages and live staking from plants on our site not only helped to keep the costs of plants down but also increased the diversity of our site. Even though we were planning to attend a salvage, we needed to order our plants from the Snohomish and King Conservation District before going to the salvage. We did our best to plan out the plants that we would most likely be able to obtain at the salvage and ordered the ones that we knew we would most likely not be able to obtain. While there was no way of ensuring that we would be able to secure those plants at the salvage, planning it out this way allowed us to stay on budget and purchase the greatest number and diversity of plants. We also used live staking of salmonberry and red-osier dogwood that was already present on our site to supplement our plant supply. Live staking them allowed us to plant those species in other areas of the site for free while already knowing they

Lastly, we also learned the great benefit of our community partner's ability to supply us with mulch and tools at no cost. Adding in the price of mulch into our budget would have greatly affected the amount and variety of plants that we would be able to purchase. Not having to worry about purchasing mulch or tools for the site allowed us to focus our efforts towards plants more. We will have to remember to take into account the price of mulch and tools when planning future restoration projects.

Labor Budget

Table 5. Labor Budget Table

Labor by Activity (Expenditure)	**Team**	**Volunteers**	**Total**
Site Preparation			
Site Assessment	30	0	30
Site Proposal	40	0	40
Planting Plan	30	0	30
Work Plan	40	0	40
Subtotal Site Preparation	140	0	140
Invasive Plant Removal			
R. armeniacus Removal	~~46~~ 58	~~80~~ 285	~~126~~ 343
H. helix Removal	~~46~~ 8	~~80~~ 32	~~126~~ 40

I. aquifolium Removal	~~46~~ 6	~~80~~ 40	~~126~~ 46
Subtotal Invasive Plant Removal	~~138~~ 72	~~240~~ 357	~~378~~ 429
Plant Acquisition			
Planting	~~150~~ 59	~~150~~ 98	~~150~~ 157
Nurseries	20	0	20
Salvage	36	0	36
Livestake collection	36	0	36
Subtotal Plant Acquisition	102	0	102

In order for us to restore such a large restoration site, hosting volunteer work events was crucial. Our initial volunteer event turned out to have more volunteers than anticipated. While it was good to have the large amount of labor, it was difficult for a team of 5 to manage so many volunteers. From this experience, we learned that having smaller work parties was ideal in terms of management and the quality of work performed by volunteers. This was especially necessary when dealing with planting. We also learned we underestimated the amount of volunteer work parties that was needed. We required more hours for invasive removal than expected but we were close. By the end of the year, we had a much more realistic idea of how much work could be completed in a single work party.

We also learned that it was crucial to explain planting procedures in detail in order for the volunteers to install the plants correctly to give them the best chance of survival. For instance, after one of our work parties, we found that several plants had not been properly planted. The roots of the plugs had not been loosened and was placed at an incorrect depth with mulch mixed into the soil. From this occurrence, we made sure to explicitly explain proper planting procedures to the volunteers during demonstrations. We also had them work with a partner and the team monitored all the volunteers during the planting session.

In addition to the volunteer labor, the team spent more time outside of volunteer work parties than was expected. Due to the incompletion of the planting and mulching during planned work events, the team spent time outside of them to finish the plant installation and mulch

spreading. The take away that the team learned was the amount of work required to finish restoration tasks takes longer than is sometimes anticipated.

Planting Plan

During our restoration process, a large *P. balsamifera* ssp. *trichocarpa* in Polygon 8 was leaning and posed a safety concern. It was deemed too hazardous for any volunteers including our team to perform restoration work around this area. As a result, the tree was cut down, leaving large logs and branches scattered in this section of the site. We were unable to move the larger debris, so many of the plants that were arranged to be installed in this area had to be relocated into Polygons 3, 5, and 7. We needed to reconsider appropriate placements for each species' needs for these plants in order to not waste any and give them a high chance of survival. From this unforeseen circumstance, we learned to adapt and modify our planting plan so adjustments could be made to complete the plant installation.

During a work party, the northeast portion of Polygon 7 was discovered to be very rocky about 5 inches into the soil and had many tree roots near the surface. Therefore, adjustments were made to accommodate this condition. For example, additional *P. munitum* plugs were planted in this location because as they have very small roots. The plants we planned to have there were moved elsewhere within the polygon, creating denser spacing between plants. From this situation, we learned to adjust our plans according to unexpected site conditions and to the importance of additional soil samples in urban areas.

Design for the Future

Part I. Stewardship Expectations and Development Plan

Aside from holding work parties and educating the volunteers and students who attend, we will develop a stewardship plan with maintenance and monitoring practices for our client to follow after our departure in June. This plan will help carry out our goals for the future vision of our site as a healthy native forest on its way to self-sustainability that not only provides beneficial ecosystem functions but also enhances the aesthetics of the neighborhood and provides an educational tool that can foster continued community interest and restoration efforts. Having a natural forest will encourage more wildlife to use the site for food and shelter, thus possibly attracting birdwatchers or other wildlife enthusiasts to visit the site and care to keep it healthy. Improving the aesthetics will hopefully attract the attention of park visitors to learn more about the restoration efforts and to volunteer in helping to keep their community looking nice. Being located within a public park, local schools may also be able to take field trips to the site to have younger generations help with restoration while also learning about its importance.

Part II. Project Design and Stewardship

By removing invasive species and installing appropriate native vegetation, we will help our site become a healthier and more ecologically functional riparian upland forest community. Planting

closer to the social trail that runs through the site and along the southern edge of the stream bank will foremost prevent any further disturbance of this site by trespassers.

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