Reynolds Secondary School

Green Spaces Project

http://joecarr.ca/photogallery/SummitPark/Images/20004468a.jpg

Garry Oak Ecosystem Restoration

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"Treat the earth well: it was not given to you by your parents, it was loaned to you by your children. We do not inherit the Earth from our Ancestors, we borrow it from our Children."

- Ancient Native American Proverb

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1.0 Executive Summary

In this proposal is an outline of plant species suggested for the rocky knoll along the entranceway to Reynolds Secondary School located on Borden Street. The Reynolds Green Spaces Project, Green Group, and Environment & Sustainability class have asked the University of Victoria's Environmental Studies Department for aid in creating an effective, efficient, and engaging planting guide for the rocky knoll restoration. This plan is the result, and takes into consideration the desires of the Reynolds' students as well as advice on the most successful activities for the particular site.

This proposal divides the Reynolds Garry oak restoration site up into five regions based on physical characteristics, shade cover, and view from sidewalks or classrooms: dry site hedgerow, Garry oak meadow, butterfly garden, woodland, and rocky outcrops. Each region is distinct, but there is a high degree of interconnection between all microecosystems. This project encompasses many different varieties of dry site Garry oak ecosystems once found in the region, with the hope of displaying the high biodiversity and variation within unmodified Garry oak ecosystems.

The dry site hedgerow not only provides a physical barrier between the sidewalk and more fragile meadow plants, but as food and habitat for native bird and insect species. Many of the shrubs have beautiful blooms, such as the honeysuckle, but also provide berries and nuts for human consumption.

The meadow is located within a flat, sunny spot in a prominent region of the site. Many flowering plants will be used with overlapping bloom times to create a stunning spring and summer floral display. The meadow will contain

many keystone species, as well as culturally important plants to First Nations of the region such as the common camas.

The butterfly garden is located on the eastern slope of the site, facing the school classroom windows. The high level of flowering plants to be placed in this region will be not only visually pleasing the inside of the school, but will also attract butterflies to the site to encourage pollination and support of native butterfly species.

The woodland is the contained in the northernmost region of the enclosed site. Due to the less visible, and more protected nature of this part of the site, a woodland thicket has been advised. Comprising mostly of shrubs, this region will provide the thicket habitat many bird species like to reside in. While not often considered in Garry oak ecosystem restorations, the woodland component of these ecosystems is just as valid for restoration purposes.

Finally is the rocky outcrops section. For the purpose of this proposal, two distinct rocky sections were chosen to be in focus; however, the site itself is very rocky with many outcrops found in all regions described above. Future work can include the continued planting of the rocky shallow sites, but were beyond the scope of this project. The large rock cluster to the west of the seating area was termed “Meadow Rock” as it is incorporated within the meadow section. The other region was termed the “Entrance Pathway Bank” as it is right on the edge of the pathway leading to the front entrance of the school. Each region of rock has features that call for differing planting techniques, which can be applied in the future to similar rocky features found throughout the site.

This proposal calculates the estimated cost for all plants used in this restoration, as well as a timeline for planting and care strategies. Other tools such as the specific planting outlines, species information, and photo points have been included to encourage a successful restoration.

Through this proposal we hope that the Garry oak ecosystem located on the Reynolds Secondary School property will return to a historical trajectory. We hope that our planting guide enables the students and faculty of Reynolds Green Spaces Project to establish and maintain a functioning Garry oak ecosystem with a high biodiversity of native species and keep exotic invasive species suppressed. We hope that this guide enables a successful restoration, and that it inspires other schools, businesses, and homeowners of the region to initiate their own restoration activities. Finally, we wish for this restoration to result in a visually pleasing garden area for the entrance of Reynolds Secondary to enhance the street appeal of the school, as well as promote the ecological image the school strives for.

2.0 Introduction

Garry oak ecosystems are an iconographic component of Vancouver Island ecology, however these fragile systems are at a serious risk of extinction. Current global Garry oak ecosystem distribution is limited to an extensive north-south range from southwestern British Columbia to southern California (Fuchs, 2001, p. 3). Within British Columbia the majority of the current ecosystems are found within the rain shadow of the Olympic and Vancouver Island mountain

ranges. A Mediterranean-like climate emerges to enable mild, wet winters and warm, dry summers, favouring Garry oak ecosystems (Fuchs, 2001, p. 3).

Garry oak ecosystems found within Canada form "mosaics of maritime meadows, coastal bluffs, vernal pools, grasslands, rock outcrops, and transitional forests" (Fuchs, 2001, p. 3). Victoria is located directly in the middle of the Canadian Garry oak range; however, Lea (2006, p. 34) estimates that less than 10% of pre-European colonization populations still exist, and fewer than 5% that are unmodified. Today, Victoria contains some of the few surviving Garry oak ecosystems; most are severely fragmented and degraded.

The current climate change and temperature models predict that southern British Columbia will increase in temperature by two to three degrees Celsius by about 2050 (Hebda, 1998, p. 207). Garry oak ecosystems are a vital component to this region's landscape because they are able to adapt to these climate changes, although many uncertainties exist such as moisture regimes (Fuchs, 2001, p. 3). The importance of Garry oak ecosystems in the region has the potential to expand greatly in the coming decades as Douglas-fir forests shift northward to stay within preferred climactic norms.

While Garry oak ecosystems are extremely diverse with over 694 plant species alone, there are currently "more than 100 Garry oak-associated plant and animal species being placed on the BC Species at Risk List" (Lea, 2006, p. 38). The regions best suited to Garry oak meadows and woodlands are also experiencing high human population pressures. Intensive development along the eastern Coast of Vancouver Island and the Gulf Islands has led to fragmentation, degradation, and total loss of the Garry oak ecosystems present (Ward et al.,

1993-1997, p. 1). With continued degradation of functional Garry oak ecosystems, it is important to encourage public awareness of this declining ecosystem, and enact changes that would provide opportunities for population rebound.

2.1 Reynolds Green Spaces Project

Reynolds Secondary School is currently working on a Green Spaces initiative that involves a project aimed to restore a Garry oak ecosystem on the knoll in front of the school entrance. The initiative seeks to "preserve existing natural systems and create aesthetic, self-sustainable natural settings" (Reynolds Green Spaces Project, 2008). In addition to this, the project will encourage the implementation of environment and sustainability curriculum, and provide a reference guide for restoration to encourage other schools to start restoration activities on school grounds.

Students of Reynolds Secondary School are actively involved in "green" projects led by Heather Coey, who plays many prominent roles in the community. She is an instructor at the school, coordinator of Reynolds Green Spaces Project, a member of the Green Group, and initiator of the Environment & Sustainability course. A blueprint, as well as a written plan, was developed to guide the students in revitalizing the inner courtyard and front streetscape of the school ground as specific "green" projects.

This proposal has been made specifically for the front grounds of the school entrance on Borden Street. The Green Group has identified a remnant Garry oak ecosystem that they wish to see restored. Through plantings of native species, the school wishes to set a positive example for the community by showing concern for their environment, and to enhance the schools presence on

the street. Critical to this project's success is that the restored Garry oak ecosystem be both ecologically and socially functional. The students sought out the University of Victoria's Environmental Studies Department to create a restoration guide, which will enable them to effectively restore the site. The Ecological Restoration class's group project was assigned the task of creating this proposal, and below are our results.

3.0 The Site

3.1 Location

Reynolds Secondary School is located on Borden Street, between Mackenzie Avenue and Reynolds Street, in Victoria, BC. Beside the main entrance to the school is a strand of well-established Garry oak trees and a small rocky hill. This site is highly visible to both students and the general public, thus the restoration of the site will make the entrance more noticeable, functional, and attractive to the community.

3.2 Site Description

The restoration site has been measured to be approximately 18 by 28 metres, and is located on the west side of the school. The site primarily consists of rock and shallow soil, with a gradual two-meter high slope leading to a rocky knoll. Around the knoll are eight Garry oak trees (*Quercus garryana),* most likely remnants of the larger Garry oak meadows and woodlands that once thrived in the region.

The site is seasonally moist in the winter and becomes significantly drier in the summer. The area is generally sunny from afternoon until sunset, and

shady areas will be found under the canopy of all Garry oak trees. Currently, the knoll consists of exotic grasses, a few ornamental shrubs, and one exotic Deodora (*Cedrus deodara*). The Green Spaces Project desires a seating area on top of the knoll, and a split cedar stack fence around the perimeter and seating area.

3.3 Ecosystem Attributes

In British Columbia, Garry oak ecosystems are highly variable ranging "from savannah to parkland, to open and closed woodland, and also include forests with mixed canopies comprised of various proportions of Garry oak, arbutus, Douglas-fir, and other trees" (Fuchs, 2001, p. 1). Determining these various patterns are moisture regimes, soil depth, and fire disturbance patterns. Throughout these ecosystems the Garry oak tree has become emblematic for the associated plants, animals, and invertebrates found within, as the presence of these trees is what supports the succession of the entire ecosystem. Garry oak ecosystems are known to support 104 varieties of birds, seven varieties of amphibians, seven varieties of reptiles, and 33 varieties of mammals (GOERT, 2005) in addition to the 694 plant taxa that have been identified (Fuchs, 2001, p. 1).

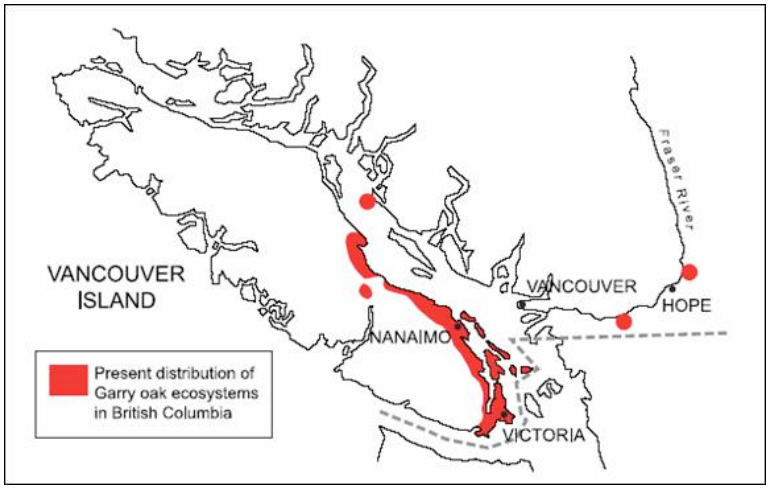


Figure 1.0: Current Garry oak ecosystem distribution of British Columbia http://www.crd.bc.ca/watersheds/ecosystems/garryoakmeadows.htmhttp://www.wildernesscommittee.org/campaigns/publiclands/parks/reports/Vol26No06/article4/images/04_garry_oak.jpg

Over the last 150 years, these ecosystems have become increasingly scarce due to many compounding factors. There are three major contributors to Garry oak ecosystem destruction and degradation: land development, suppression of burning regimes, invasion of exotic species. After European settlement in 1843, agricultural, residential, and industrial development have vastly reduced the extent of Garry oak ecosystems (Fuchs, 2001, p. 5). First Nations regularly burned camas beds, which not only supported the maintenance of this staple food, but also helped to remove competing shrubs and tress that were not fire resistant like Garry oaks. Without regular burning, forest succession leads to the expansion of Douglas-fir trees and associated species into Garry oak ecosystems (Fuchs, 2001, p. 83). The third major threat to Garry oak ecosystems is the colonization of invasive exotic species. Introduced species such as orchard grass, vernal grass, scotch broom, and English ivy out compete many native species (Lea, 2006, p. 47).

3.4 Culture and History

Historically, Garry oak ecosystems provided Indigenous peoples of Vancouver Island with food, medicine, and other basic materials used daily. The common camas was an extremely important cultivated crop within these cultural groups as it provided a rich source of complex carbohydrates (Fuchs, 2001, p. 4). Other plant species associated with Garry oak ecosystems such as the nodding onion, wild strawberry, native blackberry, and the native raspberry acted as essential contributors to First Nations' diets. Garry oak ecosystems were prominent providers of Indigenous ways of life, therefore were carefully monitored, cultivated, and controlled to ensure the success of desired species.

When Europeans colonized the region in the mid 1800's, Garry oak ecosystems were quickly invaded, due to the ideal terrain of meadowlands for pasturing livestock and urban development. The beauty of Garry oak meadows attracted people to these regions to establish homes. Consequently, this led to further destruction and degradation as people spread further into the fragile systems (Lea, 2006, p. 2).

3.5 Problem Identification

There are numerous challenges that this site presents: the presence of turf, the fragmented nature of the area, and the extreme terrain of the landscape. Turf is highly invasive which leads to complications in the reintroduction of native plants. There is currently a layer of mulch that has been laid down on top of the turf, but there may not be a sufficient amount to eradicate it. Additionally, this type of site preparation has been shown to not necessarily be the most effective method in the suppression of invasive species. Secondly, such a small fragmented area is less resilient when faced with disturbance. The amount of surrounding pavement affects the soil's ability to retain moisture. Our site is made up of varying heights and many rocky outcrops. These slopes are extreme in nature and present a challenge in both soil preparation and planting methods.

In addition to these physical obstacles, this site is located in a very high traffic area, making it vulnerable to unpredictable disturbances. Even with the planned establishment of a cedar split stake fence around the perimeter, it is still susceptible to anthropogenic disturbance. Furthermore there has been an over abundance of conflicting ideas regarding the site, possibly causing some frustration for those involved.

There are several stakeholders involved with the Reynolds Garry oak restoration site including the students themselves, Heather Coey, the district of Saanich, and vested individuals among the restoration community. Since the site is a part of Saanich District property, as well as a school ground, this creates policy restrictions and guidelines that must be considered in order for this project to succeed. For instance, CUPE (Canadian Union of Public Employees) must be involved in all paid labour activities on the school ground. Furthermore, the emotional investment of students and faculty members of Reynolds Secondary in the restoration is quite high. Respect of their wishes is important, especially when incorporating the advice given by experts in the field of restoration. A halfway point must be achieved between ideal restoration and what is possible by the students.

Over the progression of the restoration, more obstacles may emerge. This plan is designed to be open and dynamic and therefore plant substitutions, movements, and additions are encouraged for the restoration to be a success. Many unforeseen challenges are likely to arise, but we feel this plan is adaptable and a good starting point to work though any obstacle.

4.0 Goals and Objectives

4.1 Qualify and Quantify

Goals	Objectives
To establish a fully functioning Garry oak ecosystem	✓ The observation of butterfly populations upon the arrival of blooms ✓ The successful establishment of at least 75% of the planted species by the second year ✓ An increase in observable levels of animal biodiversity the most probable species being birds
To create an aesthetically pleasing area	✓ A minimum of five blooming species observable during each month of the flowering season (early spring to mid fall) ✓ All five microecosystems visible from the central seating area ✓ A noticeable increase in plant life upon observation of the designated photo points
To provide an environment that will serve as an educational tool for students, faculty and the general public	✓ The presence of a sign providing information about the restored Garry oak ecosystem ✓ The participation of the student body and faculty in the establishment of the ecosystem ✓ The continued use of the space as a learning mechanism by all teaching departments ✓ The sharing of gained knowledge with surrounding schools and members of the community

Table 1.0: Goals and Objectives

4.2 Reference Site

Every restoration project requires a reference site to offer guidance and a mode of comparison (The SER International Primer, 2004) The site that we visited as our reference is Camas Park. This fragmented Garry oak ecosystem is located on Cumberland and Mackenzie. Historically, Camas Park and the Reynolds' Secondary School landscape existed as a unified ecosystem. This site is a beneficial reference as it shares similar characteristics that can be noted: shallow soil, rocky outcrops, and seasonal wet and dry climate. Current activities at Camas Park attempt to "restore [the site] to a Garry oak/ rocky outcrop ecosystem, focusing on the removal and control of broom in the area" (GORP, 2009). This reference site has influenced the goals that we have established for our Reynolds' restoration project.

4.3 Description

As indicated in the SER Primer (2004, p. 10), "goals are ideals, and the objectives are concrete measures taken to attain these goals." It is fundamental to establish a set of goals, and in turn, a set of objectives to reach prior to the initiation of a restoration. We have chosen a set of three goals to be reached.

1. To establish a fully functioning Garry oak ecosystem

A fully functioning Garry oak ecosystem is often defined as having a high level of biodiversity, as well as the presence of ecological processes necessary for self-sustainability. In order to reach this goal we have established a series of observable and quantifiably objectives. The existence of wildlife within the restored ecosystem is a positive indicator that the restoration is on a desirable trajectory. Therefore, two of our objectives involve the observation of an increase

in insect and animal populations, especially butterfly and bird populations. Since Garry oak ecosystems are renown for plant biodiversity, we hope to see the successful establishment of at least 75% of the varieties of vegetation planted. Furthermore, this restoration will truly persist if the plants designated to be located within the site are not only able to out-compete the exotic grasses, but to flourish and spread.

2. To create an aesthetically pleasing area

The Reynolds Green Spaces desires the Garry oak restoration enhance the schools presence on the street. Keeping this in mind, we have considered the blooming times of plant species to ensure that flowers will be present throughout the spring and summer months. Plant height was also taken into account to ensure that the view into the site is not restricted from the sidewalks. Lastly, the visibility of all five microecosystem from the seating area will provide an increased visual intrigue for visitors and students.

3. To provide an environment that will serve as an educational tool for students, faculty and the general public.

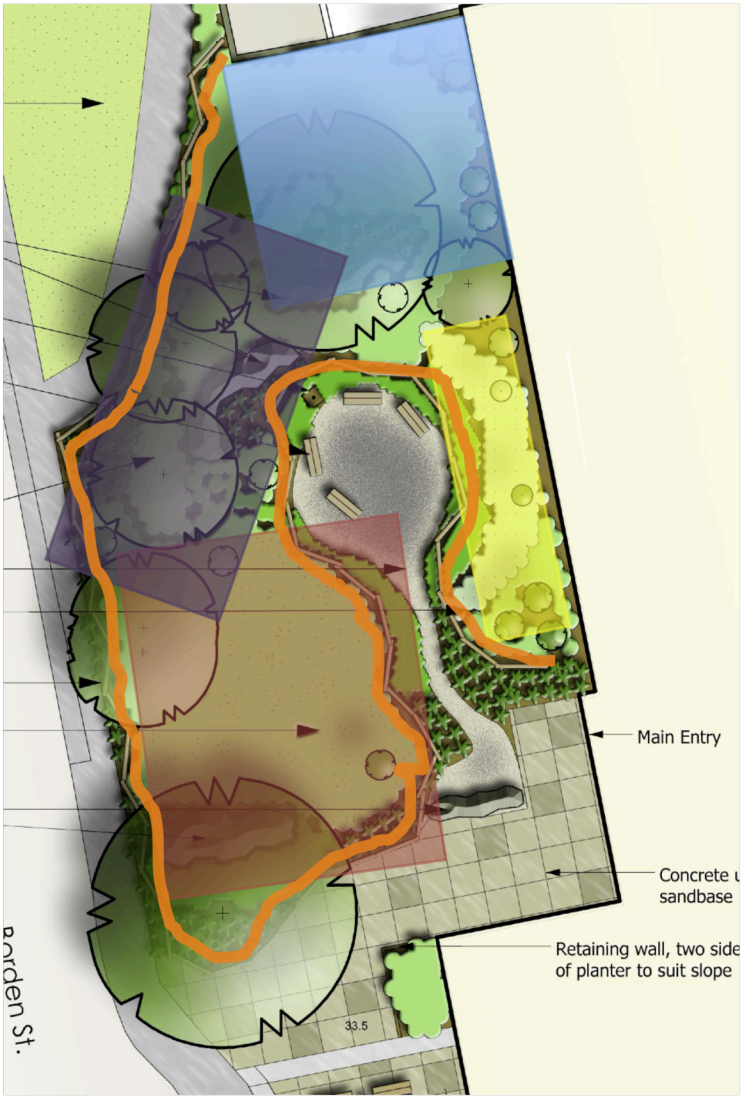
This site's unique location on school grounds offers exciting new ways to involve the public in ecological restoration. The highly visible location on the front lawn will enable the site to serve as a convenient educational tool for current and future students. An informative sign located within the site will be able to educate and explain the restored landscape to students, family members, visitors to the school, and general public.

This project enables students to become involved in the planning and execution of a restoration. By becoming personally involved with the site,

students will develop a greater sense of responsibility and awareness for the ecological community they are a part off. The Green Group has created many learning opportunities in propagating, planting, and caring for native species, and this restoration will broaden the scope of ecological activities to include general students and community members.

5.0 Restoration

5.1 Location of Microecosystems



Meadow – Woodland -

Rocky Outcrops – Butterfly Garden –

Hedgerows -

Figure 2.0: Microecosystem Locations

5.2 Zones

Garry oak ecosystems consists of several subsections that each have their own distinct attributes. When these individual microecosystems are integrated they create a remarkably bio-diverse environment. Biodiversity in any ecosystem provides a state of resilience for unpredicted change and disturbance. "Garry oak ecosystems are home to more plant species than any other terrestrial ecosystem in coastal British Columbia" (Fuchs, 2001, p. 8). Building upon the characteristics of the Reynolds' landscape, five appropriate regions are to be implemented: dry site hedgerow, Garry oak meadow, butterfly garden, woodland, and rocky outcrops.

5.2.1 Dry Site Hedgerow

A dry site hedgerow has been designed to provide aesthetic appeal along the proposed split board cedar fence as well as berries for harvest. The overall length of the fence is estimated to be around 89 metres. The design involves 21 species, 15 of which are shrubs. It has been taken into consideration that the outer hedgerow by the parking lot may be prone to increased human disturbance. With this in mind, many of the larger shrubs and hedgerow species have been placed here to create a natural wall. As a focal point, vine maple shrubs have been placed at the entranceway to the seating area for aesthetic purposes. In the areas receiving the most shade there will be ferns and shady woodland species. In areas below the Garry oak canopy, wild rosebushes have been placed because they thrive under tree cover. Wild roses also tend to be slightly invasive, but the trees and trails should do an accurate job of containing the species. The perimeter of the entranceway path has been designed using

shorter shrubs and flowers in the hopes to provide visual access into the surrounding microecosystems. This area also contains wild strawberries for hungry students and teachers. Plants in this section include:

- Baldhip Rose
- Black Twinberry
- Chocolate Lily
- Common Juniper
- Dull Oregon Grape
- Foamflower
- Hairy Manzanita
- Licorice Fern
- Native Blackberry
- Oceanspray
- Red Columbine
- Red Elderberry
- Red-flowering Current
- Saskatoon Berry
- Tall Oregon Grape
- Thrift
- Vine Maple
- Western Honeysuckle
- White Fawn Lily
- Wild Strawberry

5.2.2 Garry Oak Meadow

Garry oak meadows are culturally significant and are often what is called to mind when picturing a Garry oak ecosystem. The meadow will become one of the main focal points of the site, as it is located on the highest point of the landscape. The methodology behind the plant selection for this particular meadow is based on the shallow soil depth and summer drought followed by damper winter, which is the standard climate for this geographical region. The meadow is a mosaic of numerous forbs species, the most notably of these being common camas. We have incorporated plants that vary in flowering times, to maintain a continuous colour palette. In order to break up the visual plain, two

groupings containing a single common juniper and two red flowering currents, have been positioned within the meadow.

Natural Garry oak meadows are in no way uniform in their growth patterns. In order to mimic this natural state, we have come up with a randomized method of planting. This will be explained in further detail in section 4.3.3 "Garry Oak Meadow Planting Strategy." Plants in this section include:

- Blue Wild Rye
- Broad Leaved Shooting-star
- California Oatgrass
- Canadian Goldenrod
- Common Camas
- Common Juniper
- Lance-leaved Stonecrop
- Menzies' Larkspur
- Nodding Onion
- Pearly Everlasting
- Red-flowering Current
- Satin Flower
- White Fawn Lily
- Woolly Sunflower

5.2.3 Butterfly Garden

Along the border of the school wall, specific plants have been selected that will attract butterflies to the area. The existing valley between the slope of the land and the school wall is an ideal location for the butterfly garden because it provides protection from human traffic and wind. Due to the near-sightedness of butterflies, clumping of plant species makes the area more visible to them. In addition, "some butterflies need water and minerals which they get from probing mud on the edge of puddles, an activity known as 'puddling'" (GOERT 2005, p. 31). Because this area does not naturally provide this source of water,

one will have to be artificially created. This 'puddling' area will be located on the top of the knoll, close to the seating area, so that this butterfly activity can be observed. The plants chosen for the garden provide for the many needs of the insects. Shrubs and larger species provide shade and a place of protection from predators. Fragrant forbs act as a source of nectar, and also attract hummingbirds. Plants in this section include:

- Blue Wild Rye
- California Oatgrass
- Canadian Goldenrod
- Hooker's Onion
- Mock Orange
- Oceanspray
- Pearly Everlasting
- Western Columbine
- Woolly Sunflower
- Yarrow

5.2.4 Woodland

The woodland area is both shady and moist. Therefore the plant species selected are able to thrive in these varying conditions. The species stature was also taken into consideration. These chosen plants have been arranged so that the tallest species reside against the wall and decrease in height as they move outwards towards the knoll. Once again, the blooming periods have been staggered to ensure continuous flowering from April to October. Three Garry oak trees can be found in this area of the site, and this is what differentiates the woodland from the meadow. The woodland understory "expects an annual deposit of fallen leaves that provide a blanket during the winter and decompose to supplement the soil with fresh nutrients" (GOERT, 2005, p. 23). Thus, it is necessary to not disturb the leaf litter. Dead wood provides nutrients and shelter

for invertebrates such as woodlice and wood-boring beetles, which are the foundation for many food chains (GOERT, 2005, p. 23). It should be noted that the leaf litter must also be left undisturbed in the butterfly garden ecosystem, as the larvae over-winter in the dead matter. Plants in this section include:

- Chocolate Lily
- Fools Onion
- Fringe Cup
- Great Camas
- Hairy Manzanita
- Lady Fern
- Nootka Rose
- Oceanspray
- Oregon Oxalis
- Red-flowering Current
- Satin Flower
- Small Flowered Alumroot
- Spring Gold
- Star-flowered Solomens Seal
- Tall Oregon Grape
- Western Bleeding Heart
- Western Buttercup
- White Fawn Lily
- Woodland Strawberry
- Yellow Wood Violet

5.2.5 Rocky Outcrops

Within a Garry oak landscape, rocky outcrops tend to be extremely dry with shallow soil (Fuchs, 2001, p. 1). This dry shallow nature creates different exploitation strategies for plants found in these microecosystems. Garry oak meadows and woodlands are also comprised of rocky sections, as rock is predominant in many Garry oak locations. However, there are plants found only on bare rock or extremely shallow soil areas. These rocky plants are specialized to deal with the lack of moisture or extreme sun exposure (Klinkenberg, 2008).

The Reynolds' Secondary School restoration site contains many large rocky features. Two regions have been particularly addressed in this proposal, as they are the most prominent outcrops of the site: The Entrance Pathway Bank, and Meadow Rock. The Meadow Rock is a grouping of several large rocks under the shade of several surrounding Garry oaks. These rocks have many pockets of deeper soils enabling plants that require some root structure to flourish if planted here. The rocks also have smaller surfaces in which plants such as Oregon and Lance-leaved stonecrops. The meadow plants that surround these large rocks will benefit from their heat-bank and moisture retaining qualities. It can be quite challenging to predict the planting designs for rocky areas such as this, thus a specific guide was not provided for the rocky plants such as stonecrop. It is advised that during the actual planting, soil depth be ascertained and place plants on the rocky features accordingly.

The Entrance Bank is very prominent as it is a highly visible location right next to the front entrance. This region receives direct sunlight for a large portion of the day and will enable sun-loving plants such as Thrift and Wooly Sunflower. This region will best be shown off with some of the most eye-catching flowering plants of a Gary Oak ecosystem. Plants in this section include:

Meadow Rock

- Baldhip Rose
- Great Camas
- Lance-leaved Stonecrop
- Licorice Fern
- Miner's Lettuce
- Oregon Stonecrop
- Satin Flower

Entrance Bank

- Blue Eyed Grass

- Chocolate Lily
- Field Chickweed
- Hairy Manzanita
- Thrift
- Tiger Lily
- Vine Maple
- White Fawn Lily
- Woolly Sunflower

5.3 Soil and Site Preparation

5.3.1 Removal of Non-Native Species

All non-native species that are currently on that site, excluding the Deodara cedar, need to be removed. to ensure easier establishment of native species. There are two non-native ornamental shrubs and a non-native juniper located in the northwest corner of the site. While the Deodora is non-native, it is well established and the removal may be difficult or even kill the tree. Future work on the site may be to remove the Deodora, but for the purpose of this restoration we are leaving it in the plan.

5.3.2 Modified Sheet Mulching

Exotic grasses are notoriously difficult to control, especially when trying to establish more fragile native grasses and forbs. The mulch currently on site is around five or six centimetres thick. Unfortunately, this is unlikely to have an adequate effect on the extermination of the turf. While sheet mulching would be ideal for a site such as this, due to time and material constraints, an alternative mulching technique can be employed.

First, the chosen native plant should be placed directly into the soil, under the current mulch conditions. Then cardboard is to be layered in an overlapping circular pattern around the new plant, around four to six layers thick. If it is a

seed or a bulb the cardboard should be placed directly over the new planting. When dealing with an already germinating species the cardboard should be placed tightly around the base leaving room for the plant to continue growing.

5.3.3 Garry Oak Meadow Planting Strategy

Step 1: A restoration participant will toss a one-metre diameter circle over their shoulder; we suggest the use of a hula hoop

Step 2: Once randomly placed, planting will occur within the circle (Follow block #1 and block #2 plant lists located in appendix III. Use each block five times).

- Place five forbs species surrounded by native grass
- Cluster several plants of same species together

Step 3: Repeat steps one and two ten times.

5.3.4 Butterfly Garden Planting Strategy

Butterfly Water source:

Step 1: Dig shallow hole in the ground and place the dish inside.

Step 2: Cover the dish with a layer of soil approximately three centimetres thick.

Step 3: Cover this with a thin layer of sand.

Step 4: Add several flat stones for perching.

Step 5: Add water, leaving the tops of stones slightly uncovered.

5.3.5 Rocky Outcrop Planting Strategy

The rocky outcrops create a challenge due to the shallow soil. We have not made many recommendations for precise locations of plants on the rock sections due the high variability of rocky crevices. To enable personal initiative, we suggest pushing a ruler into the soil found on and around rocks to test the soil. Each plant recommended has certain requirements. The lilies will require slightly deeper soils due to the presence of bulbs, but species such as the stonecrops will do very well on extremely shallow, crevice like locations.

5.3.6 Relocation of Preexisting Plantings

The previous University of Victoria Environmental Studies class involved in this project planted a cluster of several different shrubs on the top of the knoll. These should be relocated into the appropriate microecosystem areas. The snowberry is a very invasive species that we do not recommend be used in this particular site because of its tendency to spread rapidly. Instead, it could be placed within the courtyard where it can be adequately contained. The Red Osier Dogwood and Scouler's Willow are not currently listed on any of our suggested planting designs, however, they could be used as substitutions for several of the shrubs we have recommended such as the Common Juniper or Tall Oregon Grape. See Table 2.0 for the list of pre-existing plants.

Shrubs on Knoll to be moved	Number of Plants
Red Dogwood	3
Red Elderberry	2
Nootka Rose	1
Mock Orange	3
Willow	1
Ocean Spray	2
Snowberry	2

Table 2.0: Preexisting Native Plants