Garry Oak Meadows Management Plan

Fairwinds' The Lakes District
Nanoose Bay, BC

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List of Acronyms

EIA	-	Environmental Impact Assessment
GOBSMG	-	Garry Oak Meadows Baseline Summary and Monitoring Guide
GOERT	-	Garry Oak Ecosystems Recovery Team
GOM	-	Garry oak meadow
GOMMP	-	Garry Oak Meadows Management Plan
LDNP	-	Lakes District Neighbourhood Plan
PDA	-	Phased Development Agreement
PGL	-	Pottinger Gaherty Environmental Consultants Ltd.
RDN	-	Regional District of Nanaimo
ToR	-	Terms of Reference
IPMP	-	Invasive Plant Management Plan
QEP	-	Qualified Environmental Professional

1.0 INTRODUCTION

The Lakes District, located in Nanoose Bay in the Regional District of Nanaimo (RDN), BC, is an undeveloped property situated around Enos Lake. The Lakes District has an area of 287ha (709 acres). As per current RDN land use regulations, Fairwinds Community & Resort (Fairwinds) plan to develop the Lakes District lands into a community of single-family homes, multi-family homes, commercial areas, community parks, and a large regional park (Figure 1).

Within the Lakes District, seven Garry oak meadow (GOM) polygons (the Subject GOMs) have been identified and this is shown in Figure 1. Pottinger Gaherty Environmental Consultants Ltd. (PGL) identified the need for a Garry Oak Meadows Management Plan (GOMMP) in an Environmental Impact Assessment in 2010. This need was recognized in the Lakes District Neighbourhood Plan (LDNP) (adopted in 2011 as part of the Nanoose Bay Official Community Plan).

The purpose of the GOMMP is to guide management and conservation efforts for the Subject GOMs.

The Terms of Reference (ToR) for the GOMMP are set out in Schedule "AA" of the Phased Development Agreement (PDA) between the RDN and Fairwinds Community & Resort (Fairwinds) – the developer of the Lakes District & Schooner Cove Neighbourhoods. The PDA (agreed in 2014) is a companion agreement to RDN's Lakes District Comprehensive Development Zone (CD44) (enacted in 2014 as RDN Land Use Bylaw 500.384), which designates the locations of the Subject GOMs as Regional Park (CD44-PR1).

PGL has prepared the GOMMP on behalf of Fairwinds, to reflect the ToR, baseline data, and standard environmental best management practices. The GOMMP is to be submitted to the RDN as part of Fairwind's obligations under the PDA.

1.1 Background

During the initial planning stages for the LDNP, sensitive ecosystems were identified and defined onsite using existing terrestrial ecosystem mapping (TEM) and updated field observations. A site-specific hierarchy of sensitivities was developed to provide the design team with constraints and opportunities, and help guide the neighbourhood plans. The LDNP designated a significant portion of sensitive ecosystems as a public park, including:

- 100% of the Garry oak meadows;
- 73% of the Garry oak/arbutus ecosystems;
- 90% of the riparian ecosystems; and
- 33% of the Douglas-fir and western red cedar ecosystems.

This land use plan was reflected in subsequent RDN land use approvals, namely the Lakes District Comprehensive Development Zone (CD44), as well as the PDA.

1.2 Plan Objectives and Document Structure

Although all of the Subject GOMs that are proposed for protection are located in lands designated as a public park, the development bordering these meadows will create new interfaces between residential and recreational land use, and these sensitive ecosystems. The primary objective of the GOMMP will be to monitor and manage potential effects on the meadows from the introduction of invasive plant species and disturbances from trail users and adjacent residents.

As set out in the ToR, the GOMMP will:

Objective		GOMMP Section(s)
1	• Establish baseline conditions of the Subject GOMs and describe detailed methodologies for future monitoring.	2
2	• Establish a Decision Framework and Adaptive Management Plan to inform RDN policy relating to public park access, trail usage, and activities of adjacent homeowners; implementation of the Lakes District Parks & Trails Masterplan; and future Construction Environmental Management Plans for adjacent Environmental Development Permit areas.	3 and 4
3	• Identify options for appropriate invasive species management (including removal by community volunteers under the supervision of a Qualified Environmental Professional), if required.	3.3
4	• Implement an ongoing monitoring program to support the Decision Framework.	4.4

To inform the GOMMP, and further to the ToR, PGL completed a baseline survey in summer 2013, and this was reflected in the Garry Oak Meadows Baseline Summary and Monitoring Guide (GOBSMG) (October 2014) (Appendix 1). The baseline survey characterizes existing conditions at the Subject GOMs and establishes guidelines and methodologies for future, ongoing monitoring.

2.0 BASELINE SUMMARY

The baseline survey provided updated conditions for the Subject GOMs particularly focusing on the existence and characteristics of invasive plant populations. The GOBSMG (Appendix 1) summarizes baseline observations and provides monitoring program guidance that details target survey locations and methodologies, including photopoint monitoring stations, transects, and fixed vegetation plots. The report will facilitate easy repetition during subsequent monitoring events, and establish continuity for ongoing assessment of the Subject GOMs. This strategy will help to identify notable changes in the meadow ecosystems, and assess the effectiveness of required management/mitigation measures.

All of the GOMs occurring in the Lakes District exhibited signs of existing physical disturbance to varying degrees (i.e., low to high-use unofficial trails). In addition to this, a number of invasive plant species are established throughout. Some of the invasive species occurring in the study area have been identified by the Garry Oak Ecosystems Recovery Team (GOERT) as having the most significant potential impact on Garry oak ecosystems (e.g., orchard grass and Scotch broom). On the other hand, some of these species are so well established that populations may be considered a low priority for management due to the relatively low chance of success, and excessive control costs. Details of the baseline observations, including maps of invasive plant occurrences, monitoring stations and transects, can be found in Appendix 1.

Construction on the Lakes District development has not yet begun, so the existing invasive plant species occurring in the Subject GOMs were not introduced as a result of the project. There is a risk, however, that project activities during construction and occupation may promote the spread of existing invasive plant populations, as well as introduce additional unwanted species. To avoid this, it will be essential for Fairwinds and the RDN to implement and maintain the monitoring and adaptive management program moving forward.

3.0 DECISION FRAMEWORK

The Decision Framework follows guidance provided in *General Decision Process for Managing Invasive Plant Species in Garry Oak and Associated Ecosystems* (GOERT, 2007). The summer 2013 baseline data (and future monitoring data) is used in the following section to feed into the framework and assess whether any action should be taken prior to development. This Decision Framework process should continue with the future monitoring program until it is apparent that the Subject GOMs can be preserved in a suitable state without management efforts, or through some other mechanism.

The decision-making process outlined by the GOERT (2007) was used as a starting point and was modified to address anticipated project-specific issues, as originally identified through the EIA. The decision-making process includes:

A. ECOSYSTEM CHARACTERISTICS

1. Is the ecosystem a "Garry oak or associated ecosystem"?
2. What are the characteristics of the ecosystem?
3. Are there notable anthropogenic vectors for invasion that could expedite spread (e.g., access to ecosystem, trail usage, adjacent development, etc.)?
4. What invasive plant species are present?
5. What is their degree of invasion?

B. RISK ASSESSMENT

6. What are the risks of action versus no action?

C. DECISION

7. Proceed with management and control?
8. What measures can be taken to reduce the risk of spread and manage anthropogenic invasion vectors?
9. Which invasive plant species are the highest priorities for management? (Tools exist to help answer this question, such as the Invasive Alien Plant Program Species Scoring Algorithm.)
10. Where to take invasive plant management action within the Garry oak ecosystem?
11. What plant management action to take, and when?
12. How to dispose of the dead plant material?
13. How to learn from management and control activities?

The baseline survey data indicates that the Subject GOMs already exhibit effects of physical disturbances to varying degrees (i.e., low to high-use unofficial trails). In addition to this, a number of invasive plant species are established throughout. As such, the Decision Framework outlined above is applied to the 2013 baseline data in the following sections. The framework is used to identify high-risk invasive plant species occurring in the Subject GOMs, and determine if

management actions should be implemented. Management recommendations consider known ecological conditions of the meadow ecosystems, planned development, and potential risks to the ecological state of the Subject GOMs.

3.1 Ecosystem Characteristics

The GOBSMG (Appendix 1) provides an overview description of current ecosystem characteristics of the Subject GOMs in the Lakes District. A number of invasive plant species were identified in varying degrees of invasion. Table A provides a summary of invasive plant species existing in the Subject GOMs, as detailed in the GOBSMG, and representative photographs are provided in Appendix 2. The baseline data will play an important role in the future risk assessments and decision making process for management of the Subject GOMs.

Table A: Summary of Invasive Plant Occurrences Observed in the Lakes District GOMs (Figure 1)

Invasive Plant Species		Garry Oak Meadow					
Scientific Name	**Common Name**	**Polygon A**	**Polygon B/C**	**Polygon D**	**Polygon E**	**Polygon F**	**Polygon G**
Agrostis capillaris	Colonial bentgrass	●	●	●	●	●	●
Arrhenatherum elatius	Tall oatgrass	●	●	●	●	●	●
Cirsium vulgare	Bull thistle					●	
Cynosurus echinatus	Hedgehog dogtail	●	●	●		●	●
Cytisus scoparius	Scotch broom		●	●		●	●
Dactylis glomerata	Orchard grass	●			●	●	●
Digitalis purpurea	Foxglove			●			
Hypochaeris radicata	Hairy cats ear	●	●	●	●	●	●
Leucanthemum vulgare	Oxeye daisy					●	
Lychnis coronaria	Rose campion	●					
Oanicum dichotomiflorum	Smooth witchgrass	●	●				
Poa pratensis	Kentucky bluegrass	●	●		●		
Rumex acetosella	Sheep sorrel	●	●	●	●	●	●
Vulpia myuros	Rattail fescue	●					

3.2 Risk Assessment

Following the Decision Framework, the risks associated with invasive plant management actions versus no action should be considered. The 2007 GOERT document outlines four areas of risk that should be assessed before deciding if invasive plant management action is the best option. The four areas of risk include:

- Threats to species at risk;
- Risk of greater damage if action is taken;
- Risk of conflict with neighbours; and
- Legal risks.

3.2.1 Threats to Species at Risk

One of the reasons that the Subject GOMs have been protected in the LDNP is that these ecosystems provide habitat for various endangered plants and animals that may occur. While detailed surveys to verify the presence and distribution of various potential species at risk have not been completed, it is likely that species at risk do occur in these ecosystems. Depending on the invasive plant species identified for treatment and the control measures prescribed, there is a chance that species at risk could be adversely affected. Specifically, a number of listed invertebrates, birds, reptiles, and plant species at risk may be at risk of disturbance. Without knowing which species and where they are present, a decision to remove invasive plants will need to be carefully considered and directed by a Qualified Environmental Professional to mitigate negative ecological impacts to those species (i.e., removal of food, shelter, etc.).

As generally accepted through the EIA process, careful management of invasive plant species in the Subject GOMs should have a positive impact on the ecosystems. Although some of the control measures may cause temporary disturbance, the removal of invasive plant populations would likely result in the betterment of native species, provided that the control measures are implemented diligently and in collaboration with a long-term monitoring and adaptive management program.

3.2.2 Risk of Greater Damage

In some cases, invasive species may provide a benefit by restricting human and pet access to a sensitive ecosystem. However, in the Subject GOMs, none of the invasive plant species occurrences documented during the baseline survey could be considered as providing a useful management purpose. There were no species that were present in sufficient numbers or of sufficient characteristics (e.g., large size, armed) that would deter access to the meadows. Therefore, we can conclude that management of the current invasive plant species populations would not result in the risk of greater damage to the Subject GOMs than they are already susceptible to.

3.2.3 Risk of Conflict with Neighbours

Feedback and input from regulatory agencies, public consultation, and key stakeholders during the EIA process suggests that management of invasive plant species within the Lakes District Garry oak meadows would be considered a positive initiative. As per Section 3.2.2 above, none of the invasive plant species were present in sufficient numbers or of sufficient characteristics (e.g., size, armed, berry producing) to prevent undesired access, provide a visual buffer, or provide foraging values for the local community (e.g., blackberry). As such, control efforts for invasive plant species in the Subject GOMs would not likely be at risk of causing conflict with neighbours.

3.2.4 Legal Risks

There are no legal requirements to control invasive plants that are applicable to the Subject GOMs. The BC *Weed Control Act* requires all land occupiers to control designated noxious plants. The act lists a variety of plant species that are categorized as noxious throughout all regions of the province, and several that are considered noxious in specific regions of BC. None of the invasive plant species identified during the 2013 baseline surveys of the Subject GOMs during (Table A) are designated as noxious under the provincial *Weed Control Act*.

However, it is acknowledged that managing the ecological integrity of the meadows will include some level of invasive plant management, which should include considerable effort to prevent the spread of existing populations. Prevention strategies and early detection/rapid response management efforts are the best tools for land managers when dealing with invasive plant species. As such, the merit of managing existing invasive plant populations in the Subject GOMs must be carefully considered in order to reduce the risk of spread, minimize the need for future control efforts and maintain or improve the integrity of the GOM ecosystems.

3.3 Recommended Decisions

As per the EIA, the Subject GOMs are of the highest priority for protection given their listed status in BC, their high sensitivities, mature seral stage, and high likelihood of containing individual plant species at risk. EIA management objectives included retaining the GOM ecosystems in this desired ecological state.

The 2013 baseline survey identified existing anthropogenic invasion vectors that could facilitate future spread of existing invasive plant populations or the introduction of new species. Particularly, a number of low to high-use unofficial trails were observed throughout the Subject GOMs. In addition to this, some of the proposed development is located immediately adjacent to, or within close proximity, to the Subject GOMs. All of these features could represent notable anthropogenic pathways facilitating the establishment of new and/or spread of existing invasive plant populations. Using the 2013 baseline data and strategies identified in the EIA, recommended mitigation measures include:

- Limiting park access to key locations that funnel users through designated trails and past educational features;
- Completing a detailed trail system layout in consultation with a Qualified Environmental Professional (QEP) that:
  - Limits impacts on environmentally sensitive areas (e.g., Subject GOMs);
  - Maximizes the use of existing unofficial trails in the Subject GOMs instead of creating new trails;
  - Incorporates permanent fencing or other restrictive vegetation/structures wherever needed/practical to prevent access to humans or pets in the most sensitive areas of the Subject GOMs;
  - Decommissions other unofficial trails not chosen as designated routes through the Subject GOMs; and
  - Implements an effective educational program (e.g., strategic signage, trail entrance kiosks, trail map/information pamphlets, etc.) that provides information on the Subject GOMs, their ecological value, methods of protection, and how to become involved in stewardship activities.
- Developing and implementing the trail management plan that monitors trail usage and informs any post-development restoration and/or further access management;
- Establishing regulations/bylaws that require dogs to be leashed within designated park areas, specifically in and around the Subject GOMs;

- Completing a tree inventory and assessment with the objective to maximize tree retention at the interface between the Subject GOMs and the development footprint; and
- Developing and promoting an Environmental Homeowner's Manual, which includes guidance for ecologically responsible:
  - Landscaping (*Garry Oak Gardener's Handbook* – GOERT, 2011);
  - Water conservation;
  - Recreation (e.g., responsible trail use for humans and pets);
  - Respect for local sensitivities (e.g., the Subject GOMs); and
  - Participation in community-based stewardship.

In addition to the recommended mitigation measures for anthropogenic invasion vectors, recommendations for specific invasive plant management strategies can also be derived from the baseline data. Five of the fifteen most invasive plants on Garry oak ecosystems (GOERT, 2002) were confirmed to occur in the Subject GOMs during the 2013 baseline survey. The five species observed include Orchard grass, Scotch broom, hedgehog dogtail, bull thistle, and rose campion. Two of these species (orchard grass and Scotch broom) are ranked by the GOERT as the top two species with the highest potential impact to Garry oak ecosystems. As such, we can reason that the Subject GOMs would be less threatened by controlling these particular plant species.

Any proposed management efforts for existing invasive plant species occurring in the Subject GOMs will require repeated treatments and monitoring. Given the feedback and input obtained during the EIA process, it is assumed that reaction from the local community to any proposed invasive plant treatment and/or ongoing monitoring program within the Subject GOMs would be positive.

At this stage of the project (i.e., pre-development), management efforts should focus on addressing higher-risk threats to the GOMs. Efforts should be made to prevent the spread of existing populations of high-risk invasive plant species during future construction and occupation phases. It is recommended that management decisions focus on the five species known to occur in the Subject GOMs that are included on the GOERT's list of species that are considered most invasive to Garry oak ecosystems (GOERT, 2002). The five species (orchard grass, scotch broom, hedgehog dogtail, bull thistle, and rose campion) are considered the most invasive plants occurring in the Subject GOMs. Therefore, it can be inferred that these species have the highest likelihood of spreading in future phases of the project (i.e., during construction and occupation). As such, it is recommended that these five species be assessed further through the decision framework.

3.3.1 Orchard Grass

Orchard grass was the most common invasive plant species observed in the Subject GOM Polygons A, E, F, and G. This species, however, was not observed in the meadows occurring on and around the Lookout Summit (Polygons B/C and D). In the *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC* (2002), the GOERT ranks orchard grass as having the highest potential for significant impacts to Garry oak ecosystems. Table B provides a summary of orchard grass occurrences in the Subject GOMs with estimated density and distributions observed during the summer 2013 baseline survey. Distribution and density codes are defined in Appendix 3.

Table B: Summary of Orchard Grass Distribution and Density in the Subject GOM Polygons (Figure 1)

Garry Oak Meadow Polygon	Baseline (2013)[1]	
	Distribution	Density
A	6	4
E	8	3
F	6	4
G	5	3

Note: Distribution and density code definitions are provided in Appendix 3.

Due to its relative threat, orchard grass is a high-priority candidate for management. The fact this species was not observed in the Lookout Summit GOMs (e.g., Polygons B/C and D) provides another reason to consider management options in order to prevent the risk of spreading to uninvaded ecosystems. The proposed development will result in increased recreational use of these areas, which could facilitate these invasions.

The distribution and densities of orchard grass in meadow Polygons A, E, F, and G (Table 2) are relatively high, which suggests this species has been present for several years. The GOM Polygons E, F, and G are relatively small in size, and most of the orchard grass occurrences are characterized by a few to several patches, which will facilitate easier management of this species. Orchard grass in GOM Polygon E was characterized as a more continuous occurrence; however, this is the smallest of all the Subject GOMs occurring in the Lakes District.

Given the relative threat orchard grass represents to the Subject GOMs, the density and distribution characteristics, and the relative size of the target meadows, a Target Species Invasive Plant Management Plan (IPMP) has been developed. The GOERTs *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Orchard Grass (Dactylis glomerata)* (2007) was used to prepare this plan, a copy of which is provided in Appendix 4. The short-term goal of the orchard grass management plan is to contain the invasion and prevent further spread.

In order of priority, the long-term goals of the management plan include:

a) Removal of orchard grass from areas identified as having high conservation values within the meadow (e.g., containing threatened or endangered species); and
b) Removal of orchard grass from the Subject GOMs as a whole.

3.3.2 Scotch Broom

Scotch broom (*Cytisus scoparius*) is the second-highest ranking invasive species with significant potential impact to Garry oak ecosystems (GOERT, 2002). Scotch broom only had minor occurrences in Subject GOM Polygons F and G, and was not observed at all in Polygons A and E. This species was notably more prevalent in meadow Polygons B/C, and D. The majority of the Scotch broom population in the Subject GOMs appeared to be under stress, with many of the populations being in significant decline or dead. Scotch broom is not typically a preferred species for deer; however, observations suggest the poor condition of the Scotch broom populations in the Lakes District is a result of excessive deer browsing. Table C provides a summary of Scotch broom occurrences in the Subject GOMs with estimated density and distributions from the summer 2013 baseline survey.

Table C: Summary of Scotch Broom Distribution and Density in the Subject GOM Polygons (Figure 1)

Garry Oak Meadow Polygon	Baseline (2013)[1]	
	Distribution	Density
B/C	6	2–3
D	6	2–4
F	3	3
G	3	2

Notes: [1] Distribution and density code definitions are provided in Appendix 3.

Similar to orchard grass, Scotch broom poses a significant threat to the Subject GOMs and should be considered a high-priority candidate for management. The decision to manage this species should also consider the fact it was not observed in the Subject GOMs on the Notch Summit. Efforts to prevent the spread of Scotch broom to uninvaded Subject GOMs would be a valuable investment. In addition to this, there is an opportunity to take advantage of the generally poor health of the Scotch broom populations (due to deer browse and stress), which may aid the success of management efforts.

The distribution and densities of Scotch broom in the Subject GOMs is limited to a few patches with generally low densities. This suggests that these populations are relatively new, and an "early detection and rapid response" approach should be applied to this invasion.

Given the relative threat Scotch broom represents to the Subject GOMs, the poor health of existing populations, the generally low density and distribution characteristics, and the applicability of "early detection and rapid response," a Target Species IPMP for Scotch broom has been developed. The GOERT's *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Scotch Broom (Cytisus scoparius)* (2002) was used to prepare this plan, a copy of which is provided in Appendix 4. The goal of the management plan is to contain the invasion, prevent further spread, and remove this species from the Subject GOMs.

3.3.3 Hedgehog Dogtail

Hedgehog dogtail (*Cynosurus echinatus*) is considered to have a relatively moderate significance of potential impact to Garry oak ecosystems (GOERT, 2002). This species was observed in all of the Subject GOM polygons except for Polygon E. The distribution of this species is generally quite high, with most occurrences having a density of greater than 10 plants per square meter. Table D provides a summary of hedgehog dogtail occurrences in the Subject GOMs, with estimated density and distributions based on the summer 2013 baseline survey.

Table D: Summary of Hedgehog Dogtail Distribution and Density in the Subject GOM Polygons (Figure 1)

Garry Oak Meadow Polygon	Baseline (2013)[1]	
	Distribution	Density
B/C	6	2–3
D	6	2–4
F	3	3
G	3	2

Notes: [1] Distribution and density code definitions are provided in Appendix 3.

Hedgehog dogtail poses a moderate threat to the Subject GOMs and should be considered a moderate priority for management. The decision to manage this species should consider the fact it was observed in almost all of the Subject GOMs in relatively high numbers. This suggests that this species is quite advanced in its invasion, eradication is very unlikely, and local control or management may be the only viable option. Control of well-established infestations of hedgehog dogtail is very difficult due to the persistence of the seed bank of this species in surrounding soils (GOERT, 2003).

If future survey efforts identify invaded areas within the Subject GOMs as having relatively higher conservation values (e.g., areas containing plant species at risk), then removal efforts should focus on these habitats, and applicable best practices for management of this species should be applied. Regardless, the recommended management plan for this species is to prevent its spread to the uninvaded Subject GOM (Polygon E). If this species is identified in meadow Polygon E, then "early detection and rapid response" measures should be applied. Other than monitoring for spread, no further management efforts are recommended for hedgehog dogtail.

3.3.4 Bull Thistle

Non-native thistle species, such as bull thistle (*Cirsium vulgare*), have been assigned a lower relative significance rating by the GOERT for impacts to Garry oak ecosystems (2007). This species was only observed in Subject GOM Polygon F, at the north end of Enos Lake. The occurrence was characterized by a few sporadically-occurring individuals throughout the meadow, at densities of roughly two to five plants per square meter.

Although the relative threat bull thistle represents to the Subject GOMs is considered to be low, the low density and distribution characteristics suggests that "early detection and rapid response" principles can be applied for successful management and prevention of spread. Doing so will work to conserve the integrity of this meadow ecosystem, and help to avoid the need for more labour-intensive management efforts in the future. A Target Species IPMP for thistle has been developed and will be implemented in collaboration with the other management plans noted in this report. The thistle Target Species IPMP has been prepared and is provided in Appendix 4. The goal of the management plan is to remove this species from Subject GOM Polygon F, and contain and prevent this species from spreading to other Subject GOMs.

3.3.5 Rose Campion

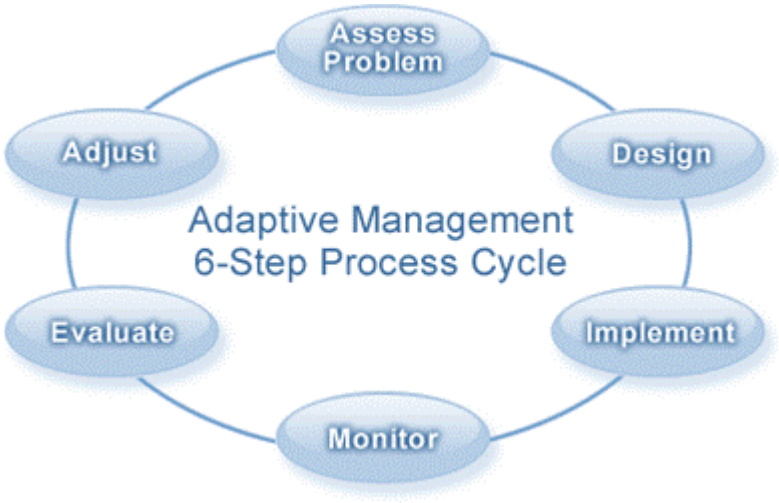
Similar to bull thistle, rose campion (*Lychnis coronaria*) has been assigned a lower relative significance rating by the GOERT for impacts to Garry oak ecosystems (2007). In fact, of the 15 most invasive species listed by the GOERT, rose campion is the lowest species on the list. Rose campion was also only observed in one Subject GOM (Polygon A) on top of Notch Summit. This occurrence was characterized by a relatively minor population during the summer 2013 baseline survey, and was noted as a single patch or clump consisting of six to ten plants in a square meter.

Although this species represents a lower threat to the Subject GOMs, the low density and distribution characteristics suggest that "early detection and rapid response" principles should be applied for successful management. This approach will work to prevent the future spread of rose campion and reduce the need for more intensive management efforts in the future. It is recommended that a Target Species IPMP for rose campion be developed and implemented in collaboration with the other management plans previously mentioned. The rose campion Target Species IPMP has been prepared and is provided in Appendix 4. The goal of the management plan should be to remove this species from Subject GOM Polygon A, and contain and prevent this species from spreading to other meadows.

4.0 ADAPTIVE MANAGEMENT PLAN

Adaptive management is not simply an "on-the-fly" adaptation of management strategies based on trial and error. As described in *Adaptive Management Strategy for the Decision Support Tool to Address Invasive Species In Garry Oak and Associated Ecosystems*, this problem-solving tool "[…] is actually a rigorous approach for learning through deliberately designing and applying management actions as experiments" (Murray, 2002). A simple adaptive management framework includes six primary steps, including assessment, design/planning, implementation, monitoring, evaluation, and adjustment (Murray, 2002) (Figure A).

Figure A: Adaptive Management 6-Step Process Cycle[1]



4.1 Assessment

The EIA represents a major component of the first step in the Adaptive Management Plan. A site-specific hierarchy of sensitivities was developed in the EIA to provide the design team with constraints and opportunities, and help guide the neighbourhood plan. This process designated a significant percentage of sensitive ecosystems as a proposed public park, including the conservation of 100% of the Subject GOMs.

4.2 Design/Planning

The Decision Framework provided in this document (Section 3) and application using the baseline data represents the first part of planning in the Adaptive Management Plan. This report focuses planning efforts, and recommends management plans for particular, high-risk invasive plant species known to be present in the Subject GOMs.

The second part of the planning phase requires development of Target Species IPMPs for the five species discussed in Section 3. Target Species IPMPs for orchard grass, Scotch broom, thistle and rose campion are provided in Appendix 4. Following guidelines provided by the GOERT (2007) and

[1] BC Ministry of Forests and Range, accessed March 24, 2015. https://www.for.gov.bc.ca/hfp/amhome/Admin/index.htm

other relevant resources (e.g., Coastal Invasive Species Committee, Invasive Species Council of British Columbia), the intent of the management plans is to provide clear specifications on:

- Species ecological characteristics;
- Where within the Subject GOMs to take action;
- What action to take (i.e., treatment method) and when (i.e., specific season);
- How to dispose of invasive plants and plant parts; and
- How to learn from the management and control activities.

4.3 Implementation

The implementation of this program is expected to be the start of a multi-year effort dictated by the condition of the Subject GOMs, as well as the ecological characteristics and location of the target invasive species identified within. The overall goal of the program is to maintain, and where considered feasible, improve the health of the Subject GOMs through prevention and management/removal of existing invasive species. To achieve this goal and support effective implementation, it is anticipated that a QEP will provide direction and monitor work done by volunteers. When possible, implementation of volunteer management efforts will be coordinated with regular QEP monitoring events.

It would be beneficial for implementation efforts to begin as soon as possible. Given the aggressive nature of invasive plant species, each and every growing season that passes could result in significant spread of existing populations. Allowing these plants to spread permits their advancement along the typical invasion establishment curve. The more time that passes, the greater the efforts, resources and costs required to manage these occurrences. In addition to this, the more time that is allowed to pass decreases the chances of eradication and shifts management efforts towards containment and prevention objectives.

Care must be taken when implementing the Target Species IPMPs in the Subject GOMs. Meadow ecosystems are extremely fragile and susceptible to disturbances. Best practices must be implemented for all management efforts, with particular attention to seasonal timing to avoid undesired effects. The QEP will provide guidance and direction to management crews and monitor their efforts to ensure best practices are followed.

4.4 Monitoring

Once the recommended Target Species IPMPs have been carefully implemented, a monitoring program will commence, as per the GOBSMG document (Appendix 1). The monitoring program will be used to provide an ongoing assessment of the success of project mitigation, including implementation of the Target Species IPMPs. Monitoring efforts will help to detect any potential harmful effects to the Subject GOMs (unknown or anticipated), and help to evaluate the need for retreatments, adjustments to the Target Species IPMPs, or additional management strategies.

For the duration of construction of each phase of the development located immediately adjacent to a Subject GOM and for the first three years thereafter, it is expected that the monitoring will include two monitoring events annually:

- One spring monitoring event; and
- One mid- to late-summer monitoring event.

Table E below provides a summary of the roles and responsibilities of the proposed monitoring program.

Table E: Monitoring Program Summary

	During Construction	Three Years Post-Development	Four Years Post-Development +
Responsible Party	Fairwinds	Fairwinds	RDN
Work Undertaken By	Fairwinds QEP	Fairwinds QEP	RDN QEP
Summary of Monitoring Scope	• Two annual monitoring visits (spring and summer); • Photo-point monitoring and vegetation sampling; • General observations and assessment of management efforts; and • Preparation of annual monitoring summary report.		
Report Recipients	Fairwinds and RDN	Fairwinds and RDN	RDN

4.5 Evaluation and Adjustment

The success of invasive plant species management efforts will be tracked and evaluated during the two annual monitoring events. This will facilitate early detection of new and/or spreading invasive plant populations. Observations made during the annual monitoring program will promote an effective adaptive management program by feeding back into the Target Species IPMPs. Species treatments will be evaluated to determine their effectiveness and whether any adjustments are needed or a new approach is necessary. The adjustments will be made to the management plans, and implementation and monitoring efforts will be modified to reflect the changes.

All new invasive plant species occurrences in the Subject GOMs after the start of construction will be assessed using the Decision Framework outlined in Section 3. If deemed necessary, new Target Species IPMPs will be prepared and implemented accordingly. The management goals for any new species occurrence will be to minimize efforts wherever possible through the promotion of "early detection and rapid response" principles. The new target species management plans will then be added to the adaptive management process, and will be monitored, evaluated, and adjusted until management objectives have been met.

All data and observations recorded during the monitoring program will be summarized in an annual monitoring report to be prepared by the end of each calendar year. The report will include photo-point monitoring results, as well as a summary of observations recorded during the vegetation sampling efforts. The annual monitoring report should also identify any notable changes to the Subject GOMs, new plant invasions, as well as management successes or challenges, and prevention strategies. The report will evaluate the management efforts and assess the need for adjustment. The report will be provided to Fairwinds and the RDN. It is recommended that the RDN provide copies of the report to appropriate stakeholders.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Careful and diligent application of the Lakes District GOMMP should facilitate adequate stewardship of the Subject GOMs. The GOMMP, together with complimentary mitigation measures, will not only work to conserve the Subject GOMs, but may also achieve improvements in the ecological state of the meadows through management and possible eradication of existing invasive plant populations.

The GOMMP should be considered a living document that is continually updated on an annual basis, reflecting the results of the most current meadow surveys, monitoring data, and adaptive management strategies. As such, the Decision Framework provided in this report was applied to the 2013 baseline data as a starting point. In doing so, we have identified both existing and anticipated anthropogenic invasion vectors, as well as existing high-risk invasive plant species occurring in the meadows, and determined the current need for management actions. A summary of recommendations is provided in Table F.

Table F: Summary of Key Recommendations

Recommendations	Applicable Report Sections
Anthropogenic Vectors	
Limit park access to key locations	3.3
Complete a detailed trail systems layout	3.3
Develop and implement a trail management plan	3.3
Complete a tree inventory and retention assessment along the interface of the development and the Subject GOMs	3.3
Develop and promote an Environmental Homeowner's Manual	3.3
Invasive Plant Management	
Contain and prevent spread of orchard grass populations in the Subject GOMs (short-term)	3.3.1, Appendix 4
Remove orchard grass from the Subject GOMs with initial priority for areas having high conservation values (long-term)	3.3.1, Appendix 4
Contain, prevent further spread, and remove Scotch broom from invaded Subject GOMs	3.3.2, Appendix 4
Monitor spread of hedgehog dogtail to uninvaded Subject GOM (i.e., Polygon E) and apply "early detection rapid response" strategies of occurrence is detected in this Subject GOM	3.3.3
Contain, prevent spread, and remove bull thistle from invaded Subject GOMs	3.3.4, Appendix 4
Contain, prevent spread, and remove rose campion from invaded Subject GOMs	3.3.5, Appendix 4

The baseline survey data suggests that the Subject GOMs currently exhibit effects of physical disturbances to varying degrees (i.e., low to high-use unofficial trails). Based on these existing anthropogenic invasion vectors and anticipated future invasion pathways (i.e., development adjacent to the Subject GOMs), mitigation measures were recommended to reduce the risk of spreading existing or introducing new invasive plant populations.

In addition to this, a number of invasive plant species are established throughout. Five of these species have been identified by GOERT as being some of the most invasive plant species with highly significant potential impacts to Garry oak ecosystems. These species are considered priority species for management and were assessed through the Decision Framework to determine the need for management strategies.

Based on the Decision Framework assessment, it was determined that management efforts for four of the five species should be implemented and Target Species IPMPs were prepared (Appendix 4). Where feasible, the goal of the Target Species IPMPs is to ultimately remove those species from the Subject GOMs. Preventing the spread of these species to other, uninvaded portions of the meadows will also be a primary objective. Given the significant distribution and densities of hedgehog dogtail, recommended management efforts are limited to containment and prevention of further spread of this species.

It is acknowledged that construction on the Lakes District development has not yet begun, and it can be concluded that the presence of invasive plant species observed during the baseline survey were not introduced as a result of the project. There is a risk, however, that project activities during construction and occupation may accelerate the spread of these species. Management efforts implemented now will help to avoid increased management efforts and resources in the future. The Target Species IPMPs provided in Appendix 4 will work to reduce the risk of spreading these species, and mitigate potential impacts to the integrity of the Subject GOMs.

Respectfully submitted,

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KMG/MNH/mtl
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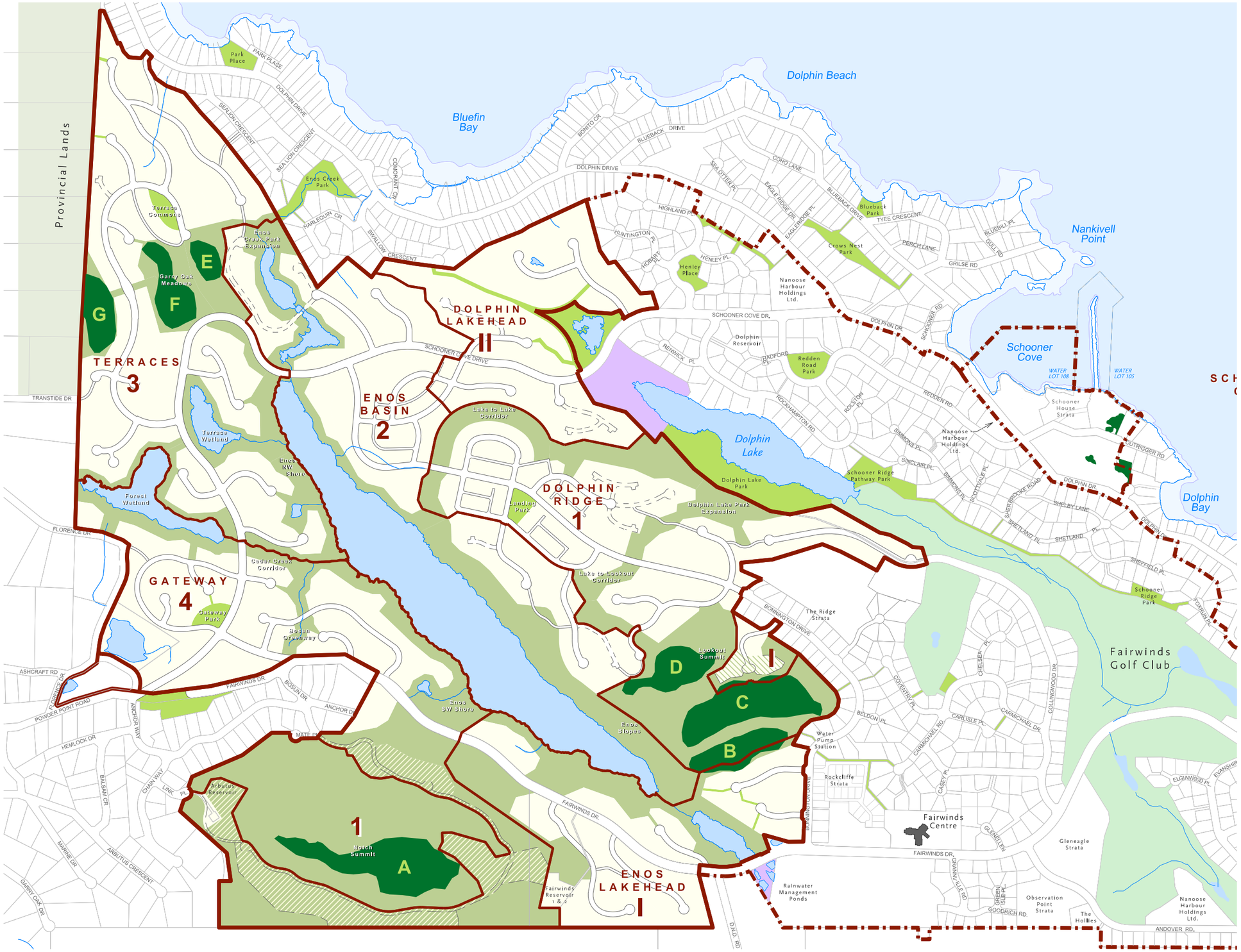
Figure

LAKES DISTRICT GARRY OAK MEADOWS MANAGEMENT PLAN

Figure 1
GARRY OAK MEADOWS POLYGONS & NEIGHBOURHOOD PHASING

APRIL 2014



LEGEND

- OCP Urban Containment Boundary
- The Lakes District Neighbourhood Plan Area
- Garry Oak Meadows Polygons
- Development Areas
- Regional Park
- Community Park
- Notch Park Lands subject to Option to Purchase

GARRY OAK MEADOW POLYGONS

A	PHASE 1	3.87 ha	9.56 ac
B	PHASES 1 + I	1.63 ha	4.03 ac
C	PHASES 1 + I	3.47 ha	8.57 ac
D	PHASE 1	1.63 ha	4.03 ac
E	PHASE 3	0.62 ha	1.53 ac
F	PHASE 3	1.52 ha	3.76 ac
G	PHASE 3	1.35 ha	3.33 ac
		14.09 ha	34.82 ac

Note: The Garry oak Meadows Management Plan applies to the identified Garry oak Meadow polygons. All Garry oak Meadow polygons are located within designated Public Parkland and will be dedicated according to the phased development of the Lakes District Neighbourhood.

Garry oak Meadows ecosystems, together with Woodlands (mixed Arbutus) ecosystems, compose the initial 1:30,000 scale SEI Polygons (2004).

Polygons were ground-truthed in the field by a Registered Professional Biologist, resulting in the expansion of surveyed Garry oak Meadows ecosystem polygons.

Refer to Appendix 1 Section 2: Environmental Review for a detailed inventory within the Lakes District Neighbourhood Plan.

SCALE 1:10000

0 40 120 200 400m

EKISTICS

Appendix 1

Baseline Summary and Monitoring Guide

Garry Oak Meadows Baseline Summary and Monitoring Guide

Fairwinds' The Lakes District
Nanoose Bay, BC

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April 2015

PGL

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1.0 INTRODUCTION

The Lakes District, located in Nanoose Bay in the Regional District of Nanaimo (RDN), BC, is an undeveloped property situated around Enos Lake. The Lakes District has an area of 287ha (709 acres). As per current RDN land use regulations, Fairwinds Community & Resort (Fairwinds) will develop the Lakes District lands into a community of single-family homes, multi-family homes, commercial areas, community parks, and a large regional park (Figure 1).

Within the Lakes District, seven Garry oak meadow (GOM) polygons (the Subject GOMs) have been identified (Figure 1). Pottinger Gaherty Environmental Consultants Ltd. (PGL) identified the need for a Garry Oak Meadows Management Plan (GOMMP) in an Environmental Impact Assessment in 2010. This need was recognized in the Lakes District Neighbourhood Plan (LDNP) (adopted in 2011 as part of the Nanoose Bay Official Community Plan).

The purpose of the GOMMP is to guide management and conservation efforts for the Subject GOMs. The Terms of Reference (ToR) for the GOMMP are set out in Schedule "AA" of the Phased Development Agreement (PDA) between the RDN and Fairwinds Community & Resort (Fairwinds) – the developer of the Lakes District & Schooner Cove Neighbourhoods. The PDA (agreed to in 2014) is a companion agreement to RDN's Lakes District Comprehensive Development Zone (CD44) (enacted in 2014 as RDN Land Use Bylaw 500.384), which designates the locations of the Subject GOMs as Regional Park (CD44-PR1).

1.1 Background

During the initial planning stages for the LDNP, sensitive ecosystems were identified and defined onsite using existing terrestrial ecosystem mapping (TEM) and updated field observations. A site-specific hierarchy of sensitivities was developed to provide the design team with constraints and opportunities, and help guide the neighbourhood plans. The LDNP designated a significant portion of sensitive ecosystems as a public park, including:

- 100% of the Garry oak meadows (Subject GOMs);
- 73% of the Garry oak/arbutus ecosystems;
- 90% of the riparian ecosystems; and
- 33% of the Douglas-fir and western red cedar ecosystems.

This land use plan was reflected in subsequent RDN land use approvals, namely the Lakes District Comprehensive Development Zone (CD44), as well as the PDA.

1.2 Report Objectives

The purpose of this report is to describe baseline conditions in the Subject GOMs, and establish guidance and methodologies for the ongoing monitoring program. The intent is to describe baseline conditions prior to the commencement of construction, which will be used to prepare the GOMMP. The GOMMP will outline a decision framework and adaptive management plan for the Subject GOMs with the objective to retain these ecosystems in the desired ecological state.

Construction was originally anticipated to commence in 2014; however, construction has been delayed through the project-approval process. Current estimates indicate that construction will not begin until 2016–2017. As such, it may be prudent to collect additional baseline data to feed into the GOMMP before construction begins. This will ensure that current conditions of the Subject GOMs are known immediately prior to the start of construction monitoring (see Section 2.1).

1.3 Management Objectives

Although all of the Subject GOMs are proposed for protection in lands designated as a public park, the development bordering these meadows will create new interfaces between the sensitive meadow ecosystems and residential and recreational land uses. The primary objective of the GOMMP will be to monitor and manage potential effects on the Subject GOMs from the introduction of invasive plant species and disturbances from trail users and adjacent residents.

The GOMMP will:

1. Establish baseline conditions of the Subject GOMs and describe detailed methodologies for future monitoring (subject of this report);
2. Establish a decision framework and adaptive management plan to inform RDN policy relating to public park access, trail usage, and activities of adjacent homeowners; implementation of the Lakes District Parks & Trails Masterplan; and future Construction Environmental Management Plans for adjacent Environmental Development Permit areas;
3. Implement an ongoing monitoring program to support the decision framework; and
4. Identify options for appropriate invasive species management actions (including removal by community volunteers under the supervision of a Qualified Environmental Professional) should they be required.

2.0 BASELINE SUMMARY

Fairwinds retained PGL to conduct a baseline survey of the Subject GOMs (Figure 1) and establish a methodology for ongoing monitoring of these sites. This task was completed in September 2013, well before the expected start date for construction.

2.1 Methodology

The baseline survey was conducted by Registered Professional Biologists specializing in vegetation ecology. The inventory implemented an intuitive approach using professional experience and targeting the locations at highest risk for project-related effects (e.g., trails or interfaces with residential lots and/or new land uses). Two monitoring tools were used, including:

- Photopoint monitoring; and
- Vegetation sampling.

Construction on Phase 1 of the Project has not yet started, and is not expected to begin until 2016–2017. The monitoring program outlined in the Project's *Terms of Reference – Garry Oak Meadows Management Plan* (Appendix 1) requires two monitoring events per year in the meadows during construction. These include:

- One spring monitoring event; and
- One mid- to late-summer monitoring event.

For due diligence, it is recommended that an additional baseline survey be completed mid-summer prior to the commencement of construction. This will ensure that current characteristics of the meadows are known and thoroughly assessed.

2.1.1 Photopoint Monitoring

Photopoint monitoring is a standard procedure for taking replicable photos of sites that require long-term management. PGL's biologists established several photo stations during the baseline survey, which were geo-located with a hand-held GPS. Field demarcation was not completed in an effort to reduce disturbance impacts to the ecosystem, as well as minimize visual impacts. The photo stations were positioned to best enable detection of potential changes to meadow conditions (e.g., establishment and/or spread of invasive plant populations, off-trail disturbances) and to provide good visual perspective of the various meadows.

A total of 29 photo stations were established throughout the Subject GOMs. Figures 2–4 spatially locate each of the 29 stations and the directional view of the photographs taken. Several of the monitoring photos were taken using panoramic imaging to provide a broader view of the meadows. The photo-point monitoring photographs are provided in Appendix 2 and location data are provided in Table 1.

During the summer season prior to the start of construction, additional baseline photos will be taken at each of the photo-point monitoring stations identified in Figures 2–4 showing the same orientation/perspective. Once construction has begun, photographs will be taken during both the spring and summer monitoring events. If deemed necessary to depict and/or monitor certain conditions and changes in the meadows, additional photo-point monitoring stations may be established in the future.

2.1.2 Vegetation Sampling

An intuitive approach to vegetation sampling was implemented using both transect and fixed plot methodologies. The 2013 baseline survey targeted potentially vulnerable areas of the Subject GOMs near areas of future development, as well as areas of existing disturbance (e.g., unofficial trails).

Transects through the Subject GOMs were established, particularly focusing on the outer perimeters of the polygons and existing unofficial trails through the meadows (Figures 5–7). Existing individual or patch/clump occurrences of invasive plants observed along transects were recorded and geo-located with a hand-held GPS (approximate average error of ±3m). Occurrence characteristics such as aspect, slope position, and elevation were recorded. Distribution and density characteristics were also recorded using codes listed in Table 2, as defined in the provincial Invasive Alien Plant Program (IAPP) Site & Invasive Plant Survey Record (Appendix 3). Where occurrences were observed consistently throughout the polygon, distribution and density was recorded for the polygon as a whole. These observations, as shown in Figures 8–10, were recorded in addition to observations made within each of the fixed vegetation plots.

Several fixed vegetation monitoring plots measuring 5m by 5m ($25m^2$) were established throughout the Subject GOMs (Figures 5–7). The fixed plots are intended to facilitate ongoing, long-term assessment of ecosystem health in high-risk areas, identify and assess presence/absence of invasive populations, and monitor possible natural succession over time. Two monitoring plots were established in the smallest of the seven Garry oak meadow polygons (Polygon E), three plots were completed in Polygon G, four in Polygons A, D and F, and six plots were established in Polygon B/C (Figures 5–7).

The four cardinal corners of each plot were geo-located using a hand-held GPS (approximate average error ±3m). Invasive plant species occurrences were identified for each fixed vegetation monitoring plot and additional photographs were taken. Invasive plant species characteristics such as distribution, density, slope position, and aspect were recorded for each occurrence within the plot. Distribution and density codes (Table 2) were assigned to each recorded occurrence, as per the provincial IAPP Site & Invasive Plant Survey Record (Appendix 3).

Table 2: Distribution and Density Code Descriptions, as Defined in the IAPP Site & Invasive Plant Survey Record

Code	Distribution Description	Density Description
1	Rare individual, a single occurrence.	≤1 plant/m^2
2	Few sporadically occurring individuals.	2-5 plants/m^2
3	Single patch or clump of species.	6-10 plants/m^2
4	Several sporadically occurring individuals.	>10 plants/m^2
5	A few patches or clumps of species.	N/A
6	Several well-spaced patches or clumps of a species.	N/A
7	Continuous uniform occurrence of well-spaced individuals.	N/A
8	Continuous occurrence of a species with few gaps in the distribution.	N/A
9	Continuous dense occurrence of a species.	N/A

Invasive plant species present throughout a Subject GOM were recorded during the polygon transects. Occurrences within the fixed plots were recorded separately from the general polygon observations and characteristics specific to the occurrence within the plot were noted. This is intended to allow for more specific and quantitative comparisons during future monitoring events.

Invasive plant species observations primarily focused on determining the presence/absence of invasive plants identified in the GOERT-published guide, *Invasive Species in Garry Oak and Associated Ecosystems in British Columbia* (2003). Additional known exotic plant species observed in the Subject GOMs were also noted.

As previously noted, construction of the Lakes District development has not yet begun and the subsequent monitoring program outlined in the Terms of Reference (Appendix 1) has not yet been triggered. As with the photopoint monitoring, it is recommended that an additional baseline survey be completed mid-summer prior to the commencement of construction in order to avoid gaps between the 2013 data and the first monitoring program during construction.

All future surveys (i.e., additional baseline surveys and those associated with the future monitoring program during construction) will repeat the survey methodology outlined in this document. Field biologists will retrace the general transect paths and record invasive plant occurrence characteristics throughout the meadow polygons and within the fixed vegetation plots, as shown in Figures 5–7.

2.1.3 Reporting

All data and observations recorded during the monitoring program will be summarized in an annual monitoring report to be prepared by the end of each calendar year. The report will include photo-point monitoring results, as well as a summary of observations recorded during the vegetation sampling efforts. The annual monitoring report should also identify any notable changes to the Subject GOMs, new plant invasions, as well as management successes or challenges, and prevention strategies. The report will evaluate the management efforts and assess the need for adjustment. The report will be provided to Fairwinds and the RDN. It is recommended that the RDN provide copies of the report to appropriate stakeholders.

2.2 Observations

Existing adverse impacts to the ecology of the Subject GOMs within the Lakes District were evident throughout (see photos provided in Appendix 4). Numerous unofficial trails were observed in all of the meadows with heavier-use trails occurring on the highest points of land (e.g., the Lookout Summit and Notch Summit). Many of the plant communities inhabiting the rocky, poor sites at elevation were in significant decline due to trampling, scuffing and general impacts from human use. Specific examples of anthropogenic, physical disturbances are provided in Photographs 1–5.

General characteristics of the Subject GOMs can be seen in the photopoint monitoring photographs provided in Appendix 2. Station locations and associated photo perspectives are provided in Figures 2–4, as well as Table 1. These photos should be repeated in future baseline surveys and subsequent monitoring years to document significant changes to the overall condition of the meadows and notable invasive plant population changes.

In addition to the physical disturbances, existing populations of invasive plant species were observed throughout, including a number of species identified in *Invasive Species in Garry Oak and Associated Ecosystems in British Columbia* (GOERT, 2003). None of the invasive plant species observed in the Subject GOMs are listed as a noxious weed under the provincial *Weed Control Act. H*owever, most of the species are identified by the GOERT as common invasive threats to Garry oak ecosystems that should be managed to avoid further degradation to ecosystem integrity.

Table 3 provides a summary of invasive plant species observed in the Subject GOMs fixed vegetation monitoring plots (Figures 5–7), which are identified by the GOERT as threats to Garry oak ecosystems. The distribution and density characteristics are also provided for each of the recorded occurrences. All of the fixed vegetation monitoring plots contained at least one invasive plant species.

Figures 8–10 summarize invasive species occurrences observed in each of transect completed through the Subject GOMs during the 2013 field program. A number of species were observed to occur throughout the meadows; distribution and density characteristics for these occurrences are provided in tabular format on each of the corresponding figures. Where species occurrences were less frequent, the occurrences are shown on the figure with corresponding symbols characterizing the species, distribution, and density. Table 4 summarizes the data associated with each of the less-frequent occurrences recorded.

Orchard grass (*Dactylis glomerata*) was the most common invasive plant species observed in Polygons A, E, F, and G. This species, however, was not observed in the meadows occurring on and around the Lookout (Polygons B, C, and D). In the *Towards a Decision Support Tool to Address*

Invasive Species in Garry Oak and Associated Ecosystems in BC (2002), GOERT ranks invasive plant species in terms of significance of impact to Garry oak ecosystems. Orchard grass was ranked the highest significance of potential impact and should be considered as a candidate for management priority within the Subject GOMs.

Other common invasive plant species occurring throughout the Subject GOMs included hedgehog dogtail (*Cynosurus echinatus*), which was observed on all but one of the surveyed meadows, sheep sorrel (*Rumex actosella*), and colonial bentgrass (*Agrostis capillaris*). Tall oatgrass (*Arrhenatherum elatius*) was also fairly common throughout and although this species is not included in the GOERT-published guide, *Invasive Species in Garry Oak and Associated Ecosystems in British Columbia* (2003), it is an exotic species to BC and could pose a potential invasion risk to the Gary oak meadow ecosystems.

Scotch broom (*Cytisus scoparius*), another high-ranking invasive species of significance (GOERT, 2002), only had minor occurrences in Polygons F and G, and was not observed at all in Polygons A and E. Scotch broom, however, was notably more prevalent in Polygons B, C, and D. The Scotch broom occurrences in the Subject GOMs appeared to be under stress with many of the populations being in significant decline or dead (Photograph 6). Scotch broom is not typically a preferred target species for deer; however, observations suggest the poor condition of the Scotch broom populations in the Subject GOMS may be a result of excessive browsing.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The intent of the baseline survey was to update and document existing conditions of the Subject GOMs with a particular focus on characterizing the existence of invasive plant populations. The objective of this document was to summarize baseline observations and provide a monitoring program guidance document that details target survey locations and the methodologies used. Photopoint monitoring stations, transects, and fixed vegetation plots established during the baseline surveys have been recorded to facilitate easy repetition during subsequent monitoring events once construction begins. The continuity will provide an ongoing assessment of the Subject GOMs, identify notable changes, and assess the effectiveness of any required management/mitigation measures.

The existing conditions of the Subject GOMs already exhibit signs of physical disturbance of varying degrees (i.e., low to high-use unofficial trails). In addition to this, a number of invasive plant species are established throughout. Some of the invasive species occurring in the Subject GOMs have been identified by GOERT as being some of the highest significance of potential impact on Garry oak ecosystems (e.g., orchard grass and Scotch broom). In some cases, however, these species are so well-established that their populations may be considered a low priority for management.

Given the fact that construction on the Lakes District development has not begun, we can conclude that the introduction of the invasive plant species observed during the 2013 baseline survey were not introduced as a result of the project. There is a risk, however, that project activities during construction and occupation may promote the spread of existing invasive plant species. It will be essential for Fairwinds to implement the monitoring program, as described in Appendix 1, and for the RDN to maintain this program as required once the responsibility is transferred to them.

3.1 Recommendations

Recommendations for future efforts include:

- Completion of a second baseline study during the summer prior to construction to confirm and build upon 2013 data. This will avoid unnecessary gaps between 2013 data and the initial monitoring period. The nature of invasive species can result in rapid changes to ecosystem conditions. Significant gaps between baseline and monitoring data post-construction may prove challenging in determining the need and responsibility of management efforts;
- Complete a risk-based assessment to identify priority invasive plant species management candidates and establish a decision framework for action. Management objectives would target those species of highest priority to minimize risk of spread during construction and would be clearly defined in Target Species Invasive Plant Management Plans; and
- Prepare Target Species Invasive Plant Management Plans based on the above-noted assessment and focusing on high-risk species. The plans should include a variety of control strategies such as eradication, population suppression, limiting spread, and/or reducing impacts. Control strategies would depend on species ecology, as well as density and distribution of the invasion.

Respectfully submitted,

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Tables

Table 1
Photopoint Monitoring Stations
Fairwinds' The Lakes District, Nanoose Bay, BC
PGL File: 130-12.07

Photopoint Monitoring Station Number	Garry Oak Meadow Polygon	Approximate Photo Direction in Degrees	Easting	Northing
01	G	183	414995	5460119
02	G	167	415030	5460044
03	F	14	415132	5460046
04	F	112	415152	5460081
05	F	351	415199	5460048
06	F	11	415199	5460106
07	F	190	415200	5460121
08	E	181	415253	5460202
09	E	14	415282	5460183
10	E	168	415300	5460188
11	A	85	415533	5458645
12	A	247	415720	5458664
13	A	149	415774	5458599
14	A	176	415931	5458582
15	D	19	416471	5459147
16	D	8	416552	5459155
17	D	153	416557	5459158
18	D	306	416560	5459126
19	B/C	336	416570	5458951
20	B/C	158	416577	5458955
21	B/C	153	416641	5459035
22	B/C	140	416730	5459009
23	B/C	355	416679	5458874
24	B/C	179	416680	5458876
25	B/C	12	416813	5458996
26	B/C	96	416816	5458995
27	B/C	14	416786	5459070
28	B/C	157	416796	5459075
29	B/C	276	416817	5459067

Note: All location recorded in UTM Zone 10

Table 3
Summary of Invasive Plant Species Occurrences in Fixed Vegetation Monitoring Plots
Fairwinds' The Lakes District, Nanoose Bay, BC
PGL File: 130-12.07

Vegetation Monitoring Plot	Garry Oak Meadow Polygon	Invasive species Present		Baseline (2013)	
		Scientific Name	Common Name	Distribution	Density
VMP-A	Polygon E	*Dactylis glomerata*	orchard grass	1	1
		Arrhenatherum elatius	tall oatgrass	5	3
VMP-B	Polygon E	*Dactylis glomerata*	orchard grass	8	4
VMP-C	Polygon F	*Dactylis glomerata*	orchard grass	6	4
		Rumex acetosella	sheep sorrel	3	2
		Arrhenatherum elatius	tall oatgrass	5	3
VMP-D	Polygon F	*Cirsium vulgare*	bull thistle	3	2
		Cynosurus echinatus	hedgehog dogtail	8	4
		Hypochaeris radicata	hairy cats ear	2	2
		Dactylis glomerata	orchard grass	5	4
VMP-E	Polygon F	*Arrhenatherum elatius*	tall oatgrass	4	4
		Agrostis capillaris	colonial bentgrass	4	3
		Rumex acetosella	sheep sorrel	4	2
		Dactylis glomerata	orchard grass	4	3
VMP-F	Polygon F	*Arrhenatherum elatius*	tall oatgrass	6	4
		Dactylis glomerata	orchard grass	3	3
		Rumex acetosella	sheep sorrel	3	4
		Agrostis capillaris	colonial bentgrass	5	4
VMP-G	Polygon G	*Rumex acetosella*	sheep sorrel	5	4
		Arrhenatherum elatius	tall oatgrass	4	3
		Hypochaeris radicata	hairy cats ear	5	3
VMP-H	Polygon G	*Arrhenatherum elatius*	tall oatgrass	7	3
		Agrostis capillaris	colonial bentgrass	3	3
		Rumex acetosella	sheep sorrel	5	4
VMP-I	Polygon G	*Arrhenatherum elatius*	tall oatgrass	8	3
		Rumex acetosella	sheep sorrel	5	2
		Agrostis capillaris	colonial bentgrass	3	3
VMP-J	Polygon D	*Agrostis capillaris*	colonial bentgrass	5	4
		Rumex acetosella	sheep sorrel	6	3
		Hypochaeris radicata	hairy cats ear	2	2

Table 3
Summary of Invasive Plant Species Occurrences in Fixed Vegetation Monitoring Plots
Fairwinds' The Lakes District, Nanoose Bay, BC
PGL File: 130-12.07

Vegetation Monitoring Plot	Garry Oak Meadow Polygon	Invasive species Present		Baseline (2013)	
		Scientific Name	Common Name	Distribution	Density
VMP-K	Polygon D	*Cytisus scoparius*	Scotch broom	4	2
		Hypochaeris radicata	hairy cats ear	4	2
		Agrostis capillaris	colonial bentgrass	3	4
		Rumex acetosella	sheep sorrel	4	2
VMP-L	Polygon D	*Agrostis capillaris*	colonial bentgrass	3	3
		Rumex acetosella	sheep sorrel	2	2
		Hypochaeris radicata	hairy cats ear	2	2
		Arrhenatherum elatius	tall oatgrass	3	4
VMP-M	Polygon D	*Hypochaeris radicata*	hairy cats ear	4	2
		Agrostis capillaris	colonial bentgrass	3	4
		Arrhenatherum elatius	tall oatgrass	3	3
		Rumex acetosella	sheep sorrel	6	3
VMP-N	Polygon C	*Arrhenatherum elatius*	tall oatgrass	5	3
		Agrostis capillaris	colonial bentgrass	3	4
		Hypochaeris radicata	hairy cats ear	2	2
		Cynosurus echinatus	hedgehog dogtail	3	4
VMP-O	Polygon C	*Agrostis capillaris*	colonial bentgrass	5	4
		Hypochaeris radicata	hairy cats ear	2	2
		Arrhenatherum elatius	tall oatgrass	3	3
		Rumex acetosella	sheep sorrel	2	2
		Cynosurus echinatus	hedgehog dogtail	3	4
VMP-P	Polygon C	*Cynosurus echinatus*	hedgehog dogtail	5	3
		Hypochaeris radicata	hairy cats ear	2	2
		Rumex acetosella	sheep sorrel	2	2
		Arrhenatherum elatius	tall oatgrass	3	3
		Agrostis capillaris	colonial bentgrass	5	3
		Poa pratensis	kentucky bluegrass	3	4
VMP-Q	Polygon B	*Agrostis capillaris*	colonial bentgrass	3	4
		Hypochaeris radicata	hairy cats ear	2	2

Table 3
Summary of Invasive Plant Species Occurrences in Fixed Vegetation Monitoring Plots
Fairwinds' The Lakes District, Nanoose Bay, BC
PGL File: 130-12.07

Vegetation Monitoring Plot	Garry Oak Meadow Polygon	Invasive species Present		Baseline (2013)	
		Scientific Name	Common Name	Distribution	Density
VMP-R	Polygon B	*Cynosurus echinatus*	hedgehog dogtail	5	4
		Agrostis capillaris	colonial bentgrass	5	4
		Arrhenatherum elatius	tall oatgrass	5	3
		Hypochaeris radicata	hairy cats ear	2	1
VMP-S	Polygon C	*Agrostis capillaris*	colonial bentgrass	8	4
		Arrhenatherum elatius	tall oatgrass	5	3
		Cynosurus echinatus	hedgehog dogtail	5	3
		Cytisus scoparius	Scotch broom	1	1
		Hypochaeris radicata	hairy cats ear	2	1
		Oanicum dichotomiflorum	smooth witchgrass	3	3
VMP-T	Polygon A	*Dactylis glomerata*	orchard grass	8	4
		Cynosurus echinatus	hedgehog dogtail	5	4
		Agrostis capillaris	colonial bentgrass	3	4
VMP-U	Polygon A	*Agrostis capillaris*	colonial bentgrass	3	4
		Oanicum dichotomiflorum	smooth witchgrass	3	2
		Arrhenatherum elatius	tall oatgrass	5	3
		Hypochaeris radicata	hairy cats ear	4	2
		Cynosurus echinatus	hedgehog dogtail	3	4
		Rumex acetosella	sheep sorrel	2	2
VMP-V	Polygon A	*Cynosurus echinatus*	hedgehog dogtail	7	3
		Rumex acetosella	sheep sorrel	2	2
		Hypochaeris radicata	hairy cats ear	2	2
VMP-W	Polygon A	*Dactylis glomerata*	orchard grass	5	3
		Cynosurus echinatus	hedgehog dogtail	8	4
		Agrostis capillaris	colonial bentgrass	3	4

Table 4
Summary of Invasive Plant Species Occurrences Observed in Transects
Fairwinds' The Lakes District, Nanoose Bay, BC
PGL File: 130-12.07

Waypoint	Garry Oak Meadow Polygon	Invasive Species Observed		Occurrence Characteristic Code	
		Scientific Name	Common Name	Distribution	Density
0130-01	E	*Hypochaeris radicata*	hairy cat's ear	3	3
0130-02	E	*Hypochaeris radicata*	hairy cat's ear	1	1
0130-03	E	*Agrostis capillaris*	colonial bentgrass	3	4
0130-04	E	*Poa pratensis*	Kentucky bluegrass	3	4
0130-05	E	*Rumex acetosella*	sheep sorrel	3	2
0130-07	F	*Cirsium vulgare*	bull thistle	2	2
0130-08	F	*Leucanthemum vulgare*	oxeye daisy	3	4
0130-09	F	*Cirsium vulgare*	bull thistle	1	1
0130-10	F	*Hypochaeris radicata*	hairy cat's ear	1	1
0130-11	F	*Hypochaeris radicata*	hairy cat's ear	2	1
0130-12	F	*Hypochaeris radicata*	hairy cat's ear	1	1
0130-13	F	*Cytisus scoparius*	Scotch broom	3	3
0130-14	F	*Agrostis capillaris*	colonial bentgrass	6	4
0130-15	F	*Rumex acetosella*	sheep sorrel	5	3
0130-16	F	*Rumex acetosella*	sheep sorrel	5	3
0130-17	F	*Hypochaeris radicata*	hairy cat's ear	1	1
0130-18	F	*Cirsium vulgare*	bull thistle	2	2
		Hypochaeris radicata	hairy cat's ear	2	2
0130-19	F	*Hypochaeris radicata*	hairy cat's ear	2	2
0130-20	F	*Hypochaeris radicata*	hairy cat's ear	2	1
0130-21	G	*Hypochaeris radicata*	hairy cat's ear	1	1
0130-22	G	*Hypochaeris radicata*	hairy cat's ear	3	3
0130-23	G	*Hypochaeris radicata*	hairy cat's ear	2	2
0130-24	G	*Cynosurus echinatus*	hedgehog dogtail	3	4
		Agrostis capillaris	colonial bentgrass	3	4
0130-25	G	*Agrostis capillaris*	colonial bentgrass	3	4
		Cytisus scoparius	Scotch broom	4	2
		Hypochaeris radicata	hairy cat's ear	1	1
0130-26	D	*Hypochaeris radicata*	hairy cat's ear	1	1
0130-27	D	*Hypochaeris radicata*	hairy cat's ear	4	2
0130-28	D	*Cytisus scoparius*	Scotch broom	3	3
0130-29	D	*Hypochaeris radicata*	hairy cat's ear	2	2
0130-30	D	*Cytisus scoparius*	Scotch broom	3	2
		Agrostis capillaris	colonial bentgrass	3	4
0130-31	D	*Hypochaeris radicata*	hairy cat's ear	2	2

Table 4
Summary of Invasive Plant Species Occurrences Observed in Transects
Fairwinds' The Lakes District, Nanoose Bay, BC
PGL File: 130-12.07

Waypoint	Garry Oak Meadow Polygon	Invasive Species Observed		Occurrence Characteristic Code	
		Scientific Name	Common Name	Distribution	Density
0130-32	D	*Cytisus scoparius*	Scotch broom	3	2
0130-33	D	*Cytisus scoparius*	Scotch broom	3	3
0130-34	D	*Cytisus scoparius*	Scotch broom	3	3
0130-35	D	*Cytisus scoparius*	Scotch broom	3	4
0130-36	D	*Cytisus scoparius*	Scotch broom	3	2
0130-37	D	*Cynosurus echinatus*	hedgehog dogtail	3	4
0130-38	D	*Cynosurus echinatus*	hedgehog dogtail	3	4
0130-39	D	*Cytisus scoparius*	Scotch broom	4	2
0130-40	D	*Cytisus scoparius*	Scotch broom	3	2
		Digitalis purpurea	foxglove	3	2
0130-41	C	*Cytisus scoparius*	Scotch broom	3	2
0130-42	C	*Cytisus scoparius*	Scotch broom	3	2
0130-43	C	*Cytisus scoparius*	Scotch broom	3	2
0130-44	C	*Cytisus scoparius*	Scotch broom	3	2
0130-45	C	*Cytisus scoparius*	Scotch broom	3	3
0130-46	C	*Cytisus scoparius*	Scotch broom	2	2
0130-47	C	*Cytisus scoparius*	Scotch broom	3	2
0130-48	C	*Cytisus scoparius*	Scotch broom	3	2
0130-49	C	*Cytisus scoparius*	Scotch broom	2	1
0130-50	C	*Cytisus scoparius*	Scotch broom	5	3
0130-51	C	*Cytisus scoparius*	Scotch broom	3	2
0130-53	C	*Poa pratensis*	Kentucky bluegrass	3	4
0130-55	C	*Cytisus scoparius*	Scotch broom	3	3
0130-56	A	*Lychnis coronaria*	rose campion	3	3
0130-60	A	*Poa pratensis*	Kentucky bluegrass	3	4
0130-61	A	*Vulpia myuros*	rattail fescue	5	4
0130-62	A	*Vulpia myuros*	rattail fescue	3	4
0130-63	A	*Vulpia myuros*	rattail fescue	5	4
0130-64	A	*Vulpia myuros*	rattail fescue	5	4
0130-65	A	*Poa pratensis*	Kentucky bluegrass	5	3
		Vulpia myuros	rattail fescue	6	4

Figures

416000

418000

5460500

5459000

N

1

E

F

G

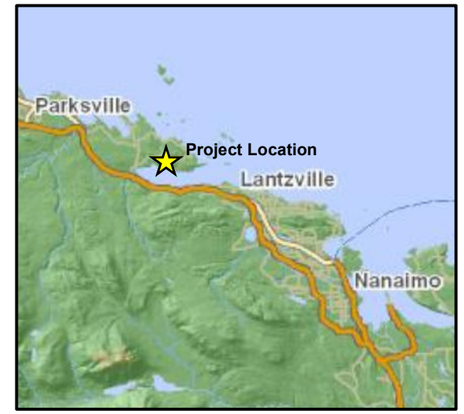
2

A

3

D

B/C



Site Location and Key Figure

Key Area

Garry Oak Meadows

Schooner Cove

The Lakes District

1:12,000

0 350 700

Metres

Coordinate System: NAD 1983 UTM Zone 10N

Pottinger Gaherty Environmental Consultants Ltd.

Figure 1

Map ID: 0130-12.07_001

June 30, 2014

416000

418000

415000

415250

5460250

5460000

N

01

02

03

04

05

06

07

08

09

10

E

F

G

1

2

3

Photo Point Monitoring Locations - Polygons E, F and G

Photopoint View Direction

Photopoint Monitoring Station

Unofficial Trail

Garry Oak Meadows

1:1,500

0 50 100

Metres

Coordinate System: NAD 1983 UTM Zone 10N

Map ID: 0130-12.07_005

June 30, 2014

Pottinger Gaherty Environmental Consultants Ltd.

Figure 2

415500

415750

N

5458750

11

12

A

13

14

5458500

Map ID: 0130-12.07_010

June 30, 2014

415500

415750

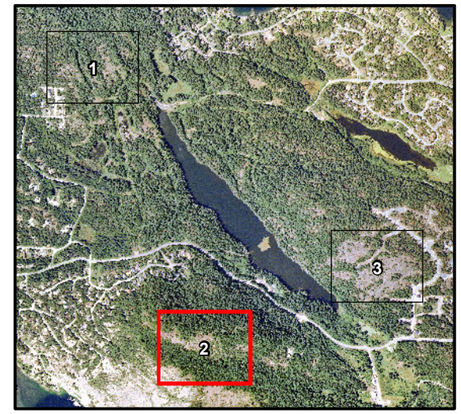


Photo Point Monitoring Locations - Polygon A

Photopoint Monitoring Station

Photopoint View Direction

Unofficial Trail

Garry Oak Meadows

1:1,500

0 50 100

Metres

Coordinate System: NAD 1983 UTM Zone 10N

PGL Pottinger Gaherty Environmental Consultants Ltd.

Figure 3

416500

416750

N

15

16

17

18

D

21

22

27

28

29

25

26

B / C

19

20

24

23

5459000

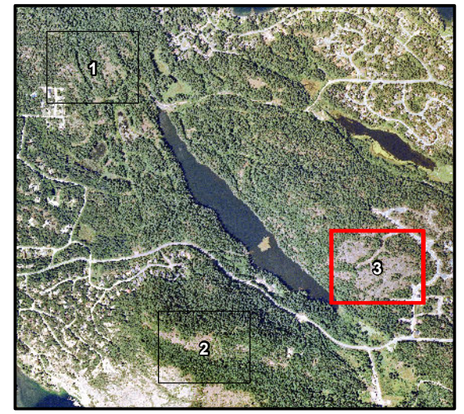


Photo Point Monitoring Locations - Polygons B/C and D

Photopoint Monitoring Station

Photopoint View Direction

Unofficial Trail

Garry Oak Meadows

1:1,500

0 50 100

Metres

Coordinate System: NAD 1983 UTM Zone 10N

Map ID: 0130-12.07_009

June 30, 2014

416500

416750

Pottinger Gaherty Environmental Consultants Ltd.

Figure 4

415000

415250

5460250

5460000

N

VMP-A

VMP-E

VMP-B

E

F

VMP-D

VMP-G

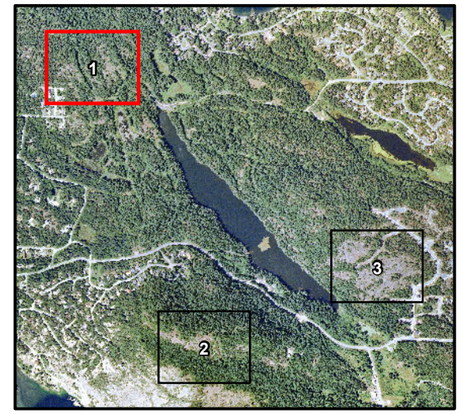
VMP-F

VMP-I

VMP-C

G

VMP-H



Transects and Fixed Vegetation Monitoring Plots - Polygons E, F and G

Fixed Vegetation Monitoring Plot

Unofficial Trail

Transect

Garry Oak Meadows

1:1,500

0 50 100

Metres

Coordinate System: NAD 1983 UTM Zone 10N

Pottinger Gaherty Environmental Consultants Ltd.

Figure 5

Map ID: 0130-12.07_006

June 30, 2014

415000

415250

415500

415750

5458750

5458500

N

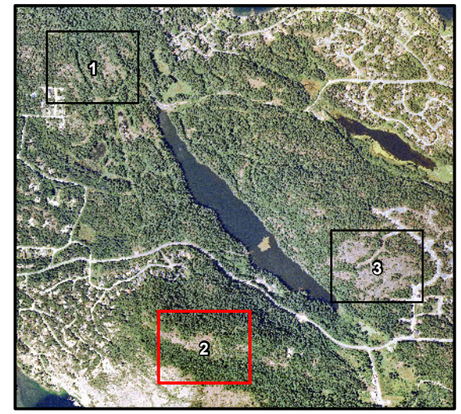
VMP-U

VMP-V

VMP-W

VMP-T

A



Transects and Fixed Vegetation Monitoring Plots - Polygon A

Fixed Vegetation Monitoring Plot

Unofficial Trail

Transect

Garry Oak Meadows

1:1,500

0 50 100

Metres

Coordinate System: NAD 1983 UTM Zone 10N

Map ID: 0130-12.07_007

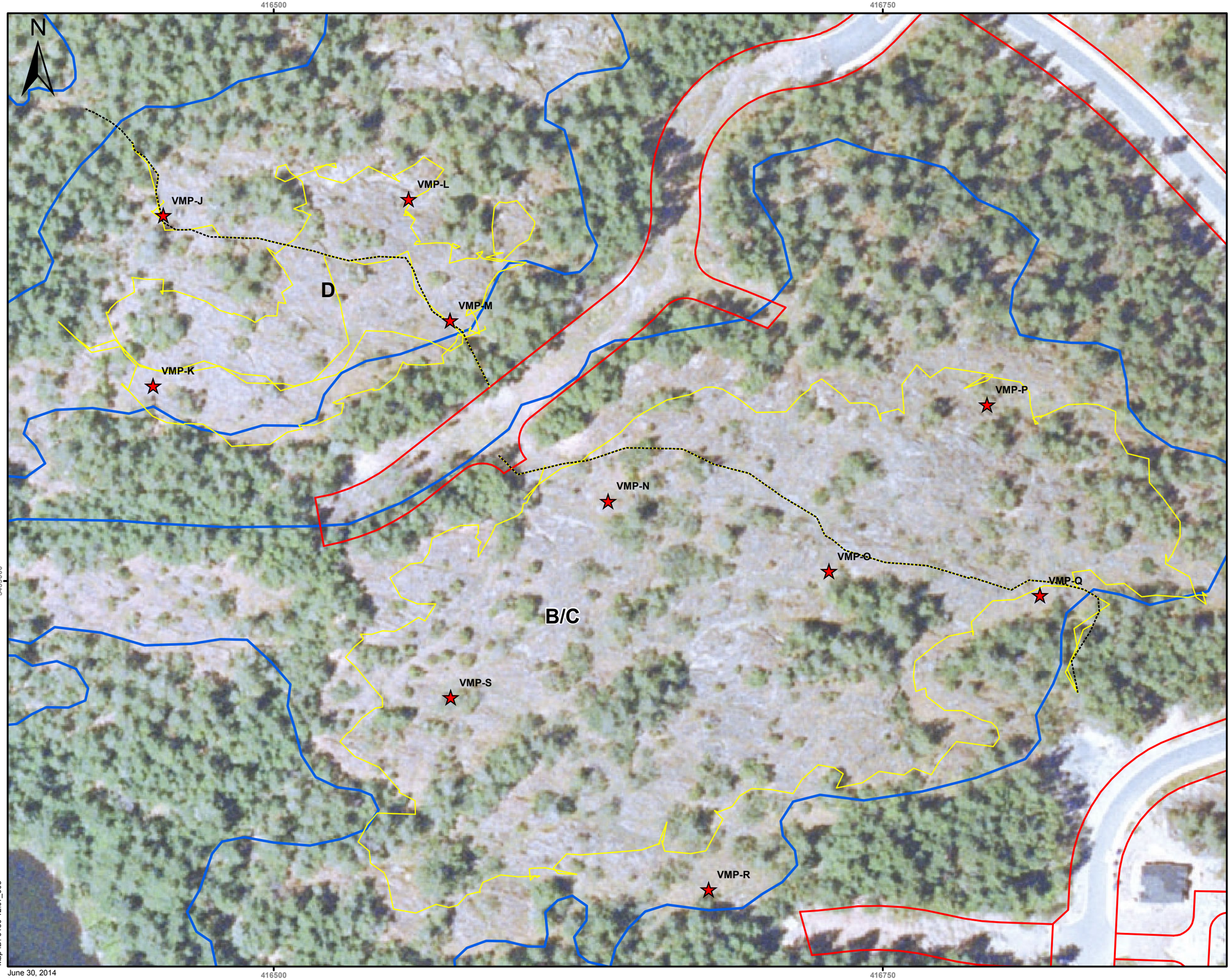
June 30, 2014

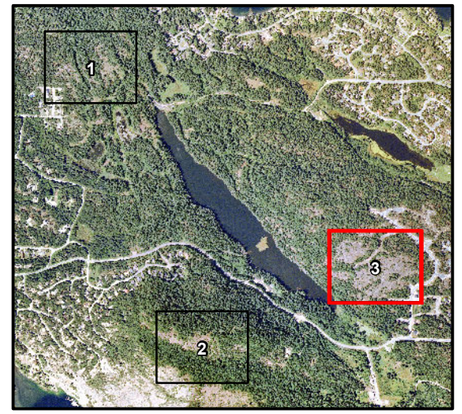
415500

415750

Pottinger Gaherty Environmental Consultants Ltd.

Figure 6





Transects and Fixed Vegetation Monitoring Plots - Polygons B/C and D

- Fixed Vegetation Monitoring Plot
- Trail
- Unofficial Transect
- Road
- Garry Oak Meadows

1:1,500

0 50 100

Metres

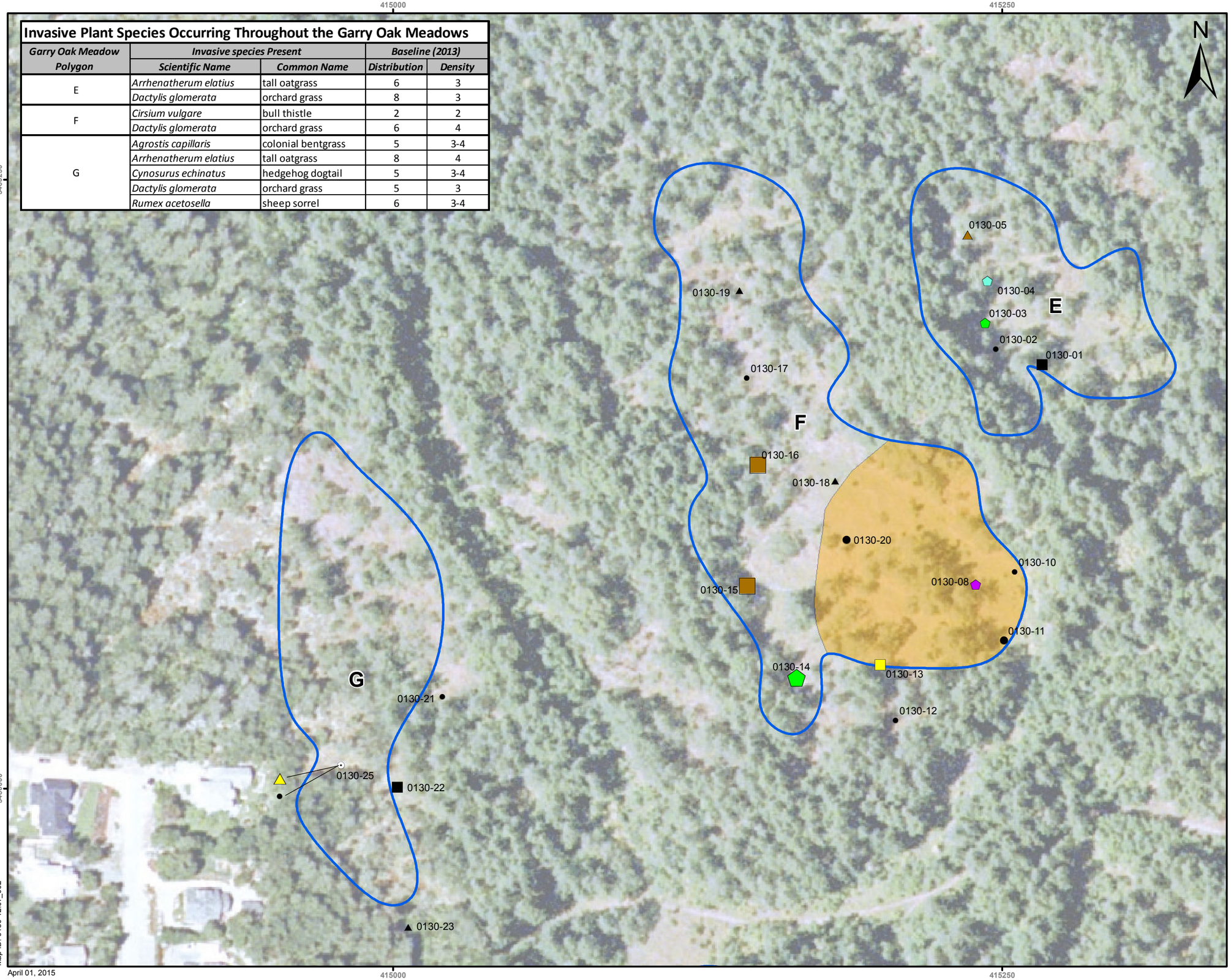
Coordinate System: NAD 1983 UTM Zone 10N

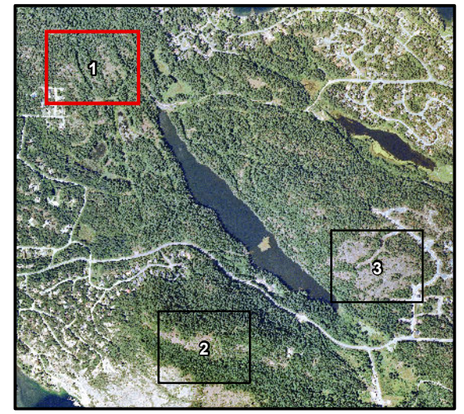
PGL Pottinger Gaherty Environmental Consultants Ltd.

Figure 7

Invasive Plant Species Occurring Throughout the Garry Oak Meadows

Garry Oak Meadow Polygon	Invasive species Present		Baseline (2013)	
	Scientific Name	Common Name	Distribution	Density
E	*Arrhenatherum elatius*	tall oatgrass	6	3
	Dactylis glomerata	orchard grass	8	3
F	*Cirsium vulgare*	bull thistle	2	2
	Dactylis glomerata	orchard grass	6	4
G	*Agrostis capillaris*	colonial bentgrass	5	3-4
	Arrhenatherum elatius	tall oatgrass	8	4
	Cynosurus echinatus	hedgehog dogtail	5	3-4
	Dactylis glomerata	orchard grass	5	3
	Rumex acetosella	sheep sorrel	6	3-4





Invasive Plant Observations - Polygons E, F and G

Species

- *Kentucky bluegrass (Poa pratensis)*
- *Scotch broom (Cytisus scoparius)*
- *bull thistle (Cirsium vulgare)*
- *colonial bentgrass (Agrostis capillaris)*
- *hairy cat's ear (Hypochaeris radicata)*
- *hedgehog dogtail (Cynosurus echinatus)*
- *oxeye daisy (Leucanthemum vulgare)*
- *rattail fescue (Vulpia myuros)*
- *rose campion (Lychnis coronaria)*
- *sheep sorrel (Rumex acetosella)*
- foxglove (*Digitalis purpurea*)

Distribution

- 1 Rare individual, a single occurrence.
- 2 Few sporadically occurring individuals.
- 3 Single patch or clump.
- 4 Several sporadically occurring individuals.
- 5 A few patches or clumps.
- 6 Several well-spaced patches or clumps.

Density

- 1 Low (less than 1 plant/m^2)
- 2 Medium (2-5 plants/m^2)
- 3 High (6-10 plants/m^2)
- 4 Dense (>10 plants/m^2)

Garry Oak Meadows

hedgehog dogtail (*Cynosurus echinatus*)
Distribution: 6;
Density: 4

Note: Please see inset table for summary of invasive plant species occurring throughout the Garry oak meadows.

1:1,500

0 50 100

Metres

Coordinate System: NAD 1983 UTM Zone 10N

PGL Pottinger Gaherty Environmental Consultants Ltd.

Figure 8

Map ID: 0130-12.07_002

April 01, 2015

415500

415750

5458750

5458500

0130-61

0130-62

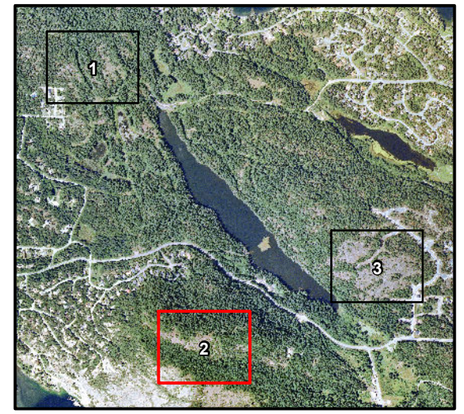
0130-63

0130-64

0130-65

0130-56

A



Invasive Plant Observations - Polygon A

Species

- Kentucky bluegrass (*Poa pratensis*)
- Scotch broom (*Cytisus scoparius*)
- bull thistle (*Cirsium vulgare*)
- colonial bentgrass (*Agrostis capillaris*)
- hairy cat's ear (*Hypochaeris radicata*)
- hedgehog dogtail (*Cynosurus echinatus*)
- oxeye daisy (*Leucanthemum vulgare*)
- rattail fescue (*Vulpia myuros*)
- rose campion (*Lychnis coronaria*)
- sheep sorrel (*Rumex acetosella*)
- foxglove (*Digitalis purpurea*)
- Garry Oak Meadows

Distribution

- 1 Rare individual, a single occurrence.
- 2 Few sporadically occurring individuals.
- 3 Single patch or clump.
- 4 Several sporadically occurring individuals.
- 5 A few patches or clumps.
- 6 Several well-spaced patches or clumps.

Density

- 1 Low (less than 1 plant/m^2)
- 2 Medium (2-5 plants/m^2)
- 3 High (6-10 plants/m^2)
- 4 Dense (>10 plants/m^2)

Note: Please see inset table for summary of invasive plant species occurring throughout the Garry oak meadows.

Invasive Plant Species Occurring Throughout the Garry Oak Meadows

Garry Oak Meadow Polygon	*Invasive species Present*		*Baseline (2013)*	
	Scientific Name	*Common Name*	*Distribution*	*Density*
A	*Agrostis capillaris*	colonial bentgrass	6	4
	Arrhenatherum elatius	tall oatgrass	5	4
	Cynosurus echinatus	hedgehog dogtail	8	4
	Dactylis glomerata	orchard grass	6	4
	Hypochaeris radicata	hairy cats ear	4	2
	Poa pratensis	kentucky bluegrass	5	4
	Rumex acetosella	sheep sorrel	5	2-3

1:1,800

0 50 100

Metres

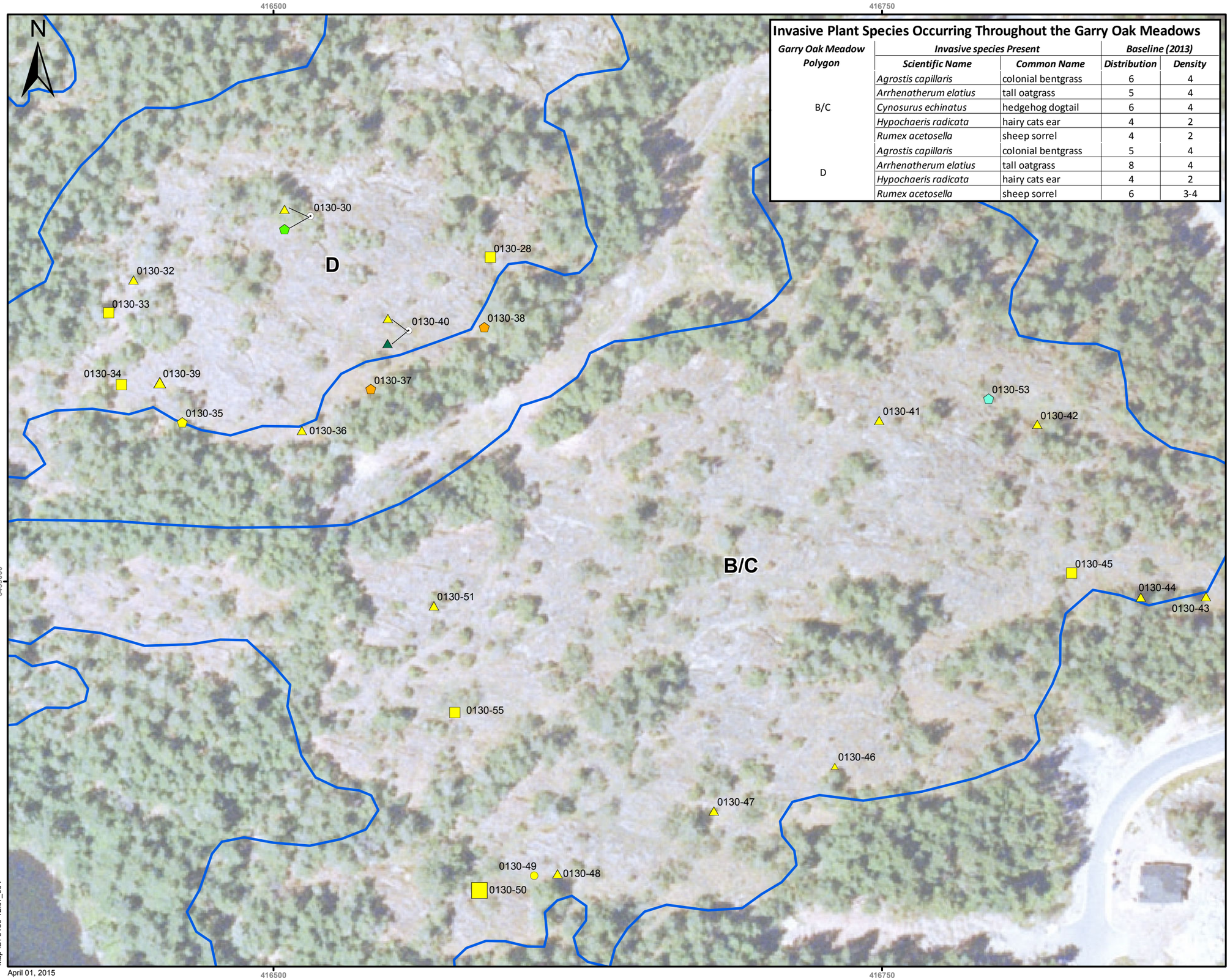
Coordinate System: NAD 1983 UTM Zone 10N

Pottinger Gaherty Environmental Consultants Ltd.

Map ID: 0130-12.07_003

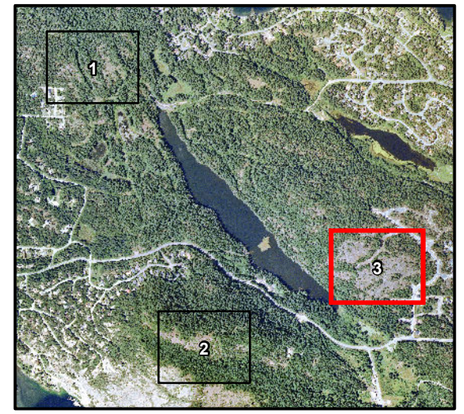
April 01, 2015

Figure 9



Invasive Plant Species Occurring Throughout the Garry Oak Meadows

Garry Oak Meadow Polygon	*Invasive species Present*		*Baseline (2013)*	
	Scientific Name	***Common Name***	***Distribution***	***Density***
B/C	*Agrostis capillaris*	colonial bentgrass	6	4
	Arrhenatherum elatius	tall oatgrass	5	4
	Cynosurus echinatus	hedgehog dogtail	6	4
	Hypochaeris radicata	hairy cats ear	4	2
	Rumex acetosella	sheep sorrel	4	2
D	*Agrostis capillaris*	colonial bentgrass	5	4
	Arrhenatherum elatius	tall oatgrass	8	4
	Hypochaeris radicata	hairy cats ear	4	2
	Rumex acetosella	sheep sorrel	6	3-4



Invasive Plant Observations - Polygons B/C and D

Species

- Kentucky bluegrass (*Poa pratensis*)
- Scotch broom (*Cytisus scoparius*)
- bull thistle (*Cirsium vulgare*)
- colonial bentgrass (*Agrostis capillaris*)
- hairy cat's ear (*Hypochaeris radicata*)
- hedgehog dogtail (*Cynosurus echinatus*)
- oxeye daisy (*Leucanthemum vulgare*)
- rattail fescue (*Vulpia myuros*)
- rose campion (*Lychnis coronaria*)
- sheep sorrel (*Rumex acetosella*)
- foxglove (*Digitalis purpurea*)
- Garry Oak Meadows

Distribution

- 1 Rare individual, a single occurrence.
- 2 Few sporadically occurring individuals.
- 3 Single patch or clump.
- 4 Several sporadically occurring individuals.
- 5 A few patches or clumps.
- 6 Several well-spaced patches or clumps.

Density

- 1 Low (less than 1 plant/m^2)
- 2 Medium (2-5 plants/m^2)
- 3 High (6-10 plants/m^2)
- 4 Dense (>10 plants/m^2)

Note: Please see inset table for summary of invasive plant species occurring throughout the Garry oak meadows.

1:1,500

0 50 100

Metres

Coordinate System: NAD 1983 UTM Zone 10N

Pottinger Gaherty Environmental Consultants Ltd.

Figure 10

Map ID: 0130-12.07_004

April 01, 2015

Appendix 1

Terms of Reference – Garry Oak Meadows Management Plan

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Environmental Consultants Ltd.
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Vancouver, BC Canada V6E 4E6
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Memo

PGL File #: 0130-12.04

DATE: July 17, 2013

Re: Terms of Reference – Garry Oak Meadows Management Plan

April 8, 2014: To reflect amendments to the proposed zoning bylaw for the Lakes District, the following amendments have been made to Figure 1: *The Notch Option to Purchase Lands* has been renamed the *Notch Park Lands Subject to Option to Purchase*, and the colouring of such lands has been changed to a green base (indicating park) with white hatch (indicating subject to option to purchase).

The following document outlines the steps and anticipated methodology to develop the Lakes District Regional Park Garry Oak Meadows Management Plan (GOMMP). The GOMMP is intended to address all seven Garry Oak Meadows phases identified in Figure 1.

BACKGROUND

During the planning stages, sensitive ecosystems were identified and defined onsite using existing terrestrial ecosystem mapping (TEM) and updated field observations. A site-specific hierarchy of sensitivities was developed to provide the design team with constraints and opportunities, and help guide the Lakes District Neighbourhood Plan.

Through the environmental planning process, an approach was taken to balance the protection of ecosystem values onsite. This process designated a significant percentage of sensitive ecosystems as a proposed public park, including:

- 100% of the Garry oak meadows;
- 73% of the Garry oak/arbutus ecosystems;
- 90% of the riparian ecosystems; and
- 33% of the Douglas-fir and western red cedar ecosystems.

The GOMMP will be entirely focused on the areas designated as "Garry Oak Meadows", all of which are located within the planned Regional Park.

Section 3.2.2 of the Lakes District Neighbourhood Plan outlines the policies for the proposed Regional Park, including:

> e. In conjunction with the landowner and according to a schedule outlined within the PDA, prepare a Garry Oak Meadows Management Plan including invasive species management practices and monitoring program that are linked to an adaptive management decision framework.

OBJECTIVES

Although all of the Garry oak meadows that are proposed for protection are located in lands designated as a public park, the development bordering these meadows will create new interfaces between residential and recreational land use and these sensitive ecosystems. The primary objective of the GOMMP will be to monitor and manage potential effects on the meadows from the introduction of invasive plant species and disturbances from trail users and adjacent residents.

The GOMMP will:

1. Establish baseline conditions of all identified Garry oak meadows and describe detailed methodologies for future monitoring;
2. Establish a decision framework and adaptive management plan to inform RDN policy relating to public park access, trail usage, and activities of adjacent homeowners; implementation of the Lakes District Parks & Trails Masterplan; and future Construction Environmental Management Plans for adjacent Environmental Development Permit areas;
3. Implement an ongoing monitoring program to support the decision framework; and
4. Identify options for appropriate invasive species management actions (including removal by community volunteers under the supervision of a Qualified Environmental Professional) should they be required. It is understood that Fairwinds would bear the associated costs.

1.0 BASELINE SURVEY PRIOR TO PHASE 1

Fairwinds will engage qualified biologists (R.P.Bio.) to conduct a baseline survey of the seven Garry oak meadows (Figure 1) and establish the methodology for ongoing monitoring for these sites. This task will be completed prior to construction and will be submitted to the RDN as a component of the Phase 1 subdivision application. It is anticipated that the baseline survey will be completed during summer 2013.

Methodology

The baseline survey will be conducted by Registered Professional Biologists specializing in vegetation ecology and botany, and will be completed before the start of Phase 1 construction. The inventory will implement an intuitive approach using professional experience and target the locations at highest risk for project-related effects (e.g., trails or interfaces with residential lots and/or new land uses). Two monitoring tools will be used, including:

- Photopoint monitoring; and
- Vegetation sampling.

Photopoint monitoring is a standard procedure for taking replicable photos of sites that require long-term management. The biologists will establish the appropriate locations for photo stations during the baseline survey. Photo stations will be geo-located with a GPS and demarcated in the field. They will also be positioned to enable detection of potential changes to meadow conditions (e.g., establishment and/or spread of invasive plant populations, off-trail disturbance).

An intuitive approach to vegetation sampling will also be implemented utilizing both transect and fixed plot methodologies. The baseline survey will target potentially vulnerable areas of the Garry oak meadows near areas of future development and/or disturbance. Existing invasive plant populations will be geo-located with a GPS. Several fixed vegetation plots will also be established in vulnerable areas and include several control plots. The fixed plots will allow for ongoing, long-term assessment of ecosystem health in high-risk areas, and monitoring of natural succession and the presence/absence of invasive plant populations.

The intent of the baseline survey will be to provide an updated general description of the Garry oak meadow conditions and characterize the existing presence of invasive plant populations. Detection of invasive plant populations during the baseline survey may require management efforts (based on a risk assessment) to prevent

the spread of invasive plants into the Garry oak meadows. The baseline results may include advice regarding the benefits of enhancement activities that would aim to reduce the risk of future management efforts.

Upon completion of the baseline survey, a monitoring program guidance document will be prepared that details target survey locations and the methodologies to be used. It is intended that the photo point stations, transects, and fixed vegetation plots established during the baseline surveys will be repeated bi-annually. This continuity will provide an ongoing assessment of the Garry oak meadows, identify notable changes, and assess the effectiveness of any required management/mitigation measures.

2.0 DECISION FRAMEWORK AND ADAPTIVE MANAGEMENT

The decision framework will follow guidance provided in *General Decision Process for Managing Invasive Plant Species in Garry Oak and Associated Ecosystems (GOEs)* (Murray, 2007). Data recorded through the monitoring program, as described above, will feed into the framework and adaptive management program. The decision framework and adaptive management plan should continue until it is apparent that the Garry oak meadows can be preserved in a suitable state without this management method (or through some other mechanism). The Monitoring Program will be managed by Fairwinds and, following the baseline survey, will be undertaken annually beginning with the start of construction until three years after completion of immediately-adjacent development sites. After this period, responsibility will be transitioned to RDN Parks with all appropriate documentation and data.

A breakdown of the decision-making process includes:

Part 1: Things to consider when deciding whether to engage in invasive plant species management in a GOE:

A. ECOSYSTEM CHARACTERISTICS

1. Is the ecosystem a “Garry oak or associated ecosystem”?
2. What are the characteristics of the ecosystem?
3. What invasive plant species are present?
4. What is their degree of invasion?

B. RISK ASSESSMENT

5. What are the risks of action versus no action?

C. DECISION

6. Proceed with management and control?

Part 2: Things to consider when deciding how to undertake invasive plant species management in the GOE:

7. Which invasive plant species are the highest priorities for management? (Tools exist to help answer this question, such as the Invasive Alien Plant Program Species Scoring Algorithm.)
8. Where to take action within the GOE?
9. What action to take, and when?
10. How to dispose of the dead plant material?
11. How to learn from management and control activities?

Another resource – *Adaptive Management Strategy for the Decision Support Tool to Address Invasive Species In Garry Oak and Associated Ecosystems* (Murray, 2002) – provides strategic direction on using an adaptive management approach to manage for invasive species.

3.0 MONITORING PROGRAM

The GOMMP monitoring program will commence one year following the completion of the baseline inventory. It is assumed that environmental monitoring will be employed throughout the construction phase, which will include the ongoing assessment of potential impacts to Garry oak meadows. However, specific monitoring efforts will be required throughout construction and beyond to ensure that potential impacts are identified at an early stage and managed, as needed.

Methodology

The monitoring program will follow the guidance document prepared using the baseline survey data. As established in the baseline surveys, the intuitive monitoring approach will continue and include both photopoint monitoring and vegetation sampling. The effectiveness of the monitoring program will be used to assess the success of project mitigation, detect any potential harmful effects, and identify the need for addition management strategies. Additional implementation monitoring efforts may be required for any needed management/mitigation efforts that are completed.

Frequency and Level of Effort

For the duration of construction and the first three years following construction completion, it is expected that the monitoring should include two monitoring events annually, including:

- One spring monitoring event; and
- One mid- to late-summer monitoring event.

It is anticipated that each monitoring event will require three days for two biologists to complete. The two monitoring events during the active growing season will facilitate early detection of new and/or spreading invasive plant populations. This approach will help promote an effective management program, if required, and minimize management efforts by addressing the issues early.

Upon completion of the third year post-construction monitoring event, the annual monitoring frequency could be decreased to one event (early summer) per year, based on advice from a qualified biologist. Upon completion of the first five years of post-construction monitoring, the RDN may wish to re-assess the need for and frequency of ongoing monitoring.

4.0 INVASIVE SPECIES MANAGEMENT ACTIONS

The Garry Oak Ecosystems Recovery Team (GOERT) has prepared a series of guidance documents for management actions related to the most common invasive plant species, including Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems for:

- Daphne (*Daphne laureola*);
- Orchard-grass (*Dactylis glomerata*);
- English Ivy (*Hedera helix*);
- Evergreen Blackberry (*Rubus laciniatus*) and Himalayan Blackberry (*Rubus armeniacus/discolor/procerus*); and
- Scotch Broom (*Cytisus scoparius*).

Each of these guidance documents cover:

- Deciding where to take action;
- Deciding what action to take, and when;
- Deciding how to dispose of dead plant material; and
- Recognizing uncertainty.

The level of effort, frequency and timing of management efforts will depend on the invasive species occurrence. Upon completion of the monitoring events, targeted invasive plant management plans (IVMPs) will be prepared for implementation during the next appropriate window. Action windows for IVMP implementation are generally dictated by the ecological characteristics of the target species identified. Based on ecological characteristics, IVMPs may require repeated treatments over the course of several years to fully mitigate potential impacts.

MNH/mtl

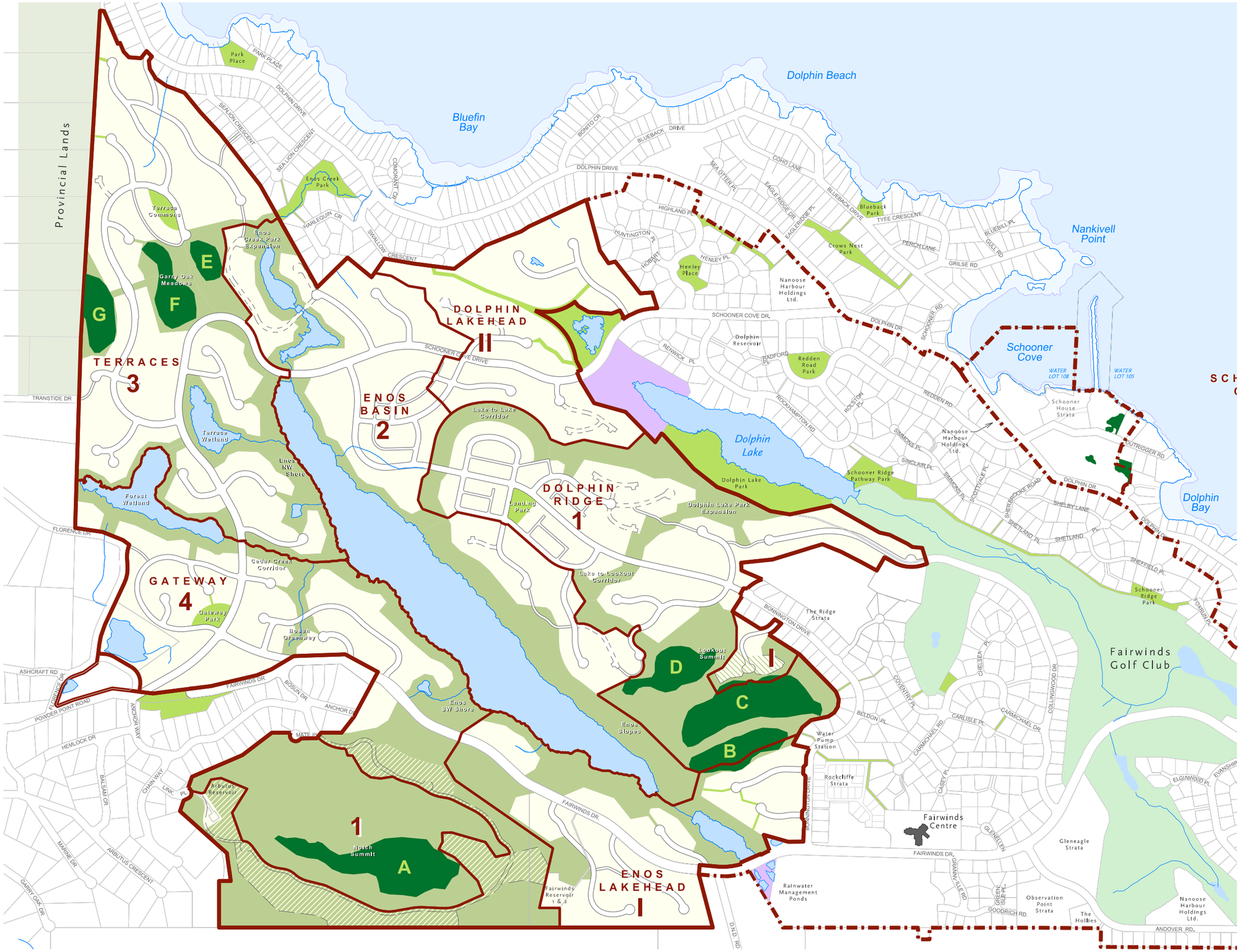
P:\001-199\130\12-04\2 - GoM Management Plan Rev - Apr14\m-0130-12-04-GoM Management Plan-Jul13-Rev2.doc

Attachments: Figure 1 – Garry Oak Meadows Polygons & Neighbourhood Phasing

LAKES DISTRICT GARRY OAK MEADOWS MANAGEMENT PLAN

Figure 1
GARRY OAK MEADOWS POLYGONS & NEIGHBOURHOOD PHASING

APRIL 2014



LEGEND

- OCP Urban Containment Boundary
- The Lakes District Neighbourhood Plan Area
- Garry Oak Meadows Polygons
- Development Areas
- Regional Park
- Community Park
- Notch Park Lands subject to Option to Purchase

GARRY OAK MEADOW POLYGONS

A	PHASE 1	3.87 ha	9.56 ac
B	PHASES 1 + I	1.63 ha	4.03 ac
C	PHASES 1 + I	3.47 ha	8.57 ac
D	PHASE 1	1.63 ha	4.03 ac
E	PHASE 3	0.62 ha	1.53 ac
F	PHASE 3	1.52 ha	3.76 ac
G	PHASE 3	1.35 ha	3.33 ac
		14.09 ha	34.82 ac

Note: The Garry oak Meadows Management Plan applies to the identified Garry oak Meadow polygons. All Garry oak Meadow polygons are located within designated Public Parkland and will be dedicated according to the phased development of the Lakes District Neighbourhood.

Garry oak Meadows ecosystems, together with Woodlands (mixed Arbutus) ecosystems, compose the initial 1:30,000 scale SEI Polygons (2004).

Polygons were ground-truthed in the field by a Registered Professional Biologist, resulting in the expansion of surveyed Garry oak Meadows ecosystem polygons.

Refer to Appendix 1 Section 2: Environmental Review for a detailed inventory within the Lakes District Neighbourhood Plan.

SCALE 1:10000

0 40 120 200 400m

EKISTICS

Appendix 2

Photopoint Monitoring Photos

Photopoint Station 01 - Polygon G (September 2013)

Photopoint Station 02 - Polygon G (September 2013)

Photopoint Station 03 - Polygon F (September 2013)

Photopoint Station 04 - Polygon F (September 2013)

Photopoint Station 05 - Polygon F (September 2013)

Photopoint Station 06 - Polygon F (September 2013)

Photopoint Station 07 - Polygon F (September 2013)

Photopoint Station 08 - Polygon E (September 2013)

Photopoint Station 09 - Polygon E (September 2013)

Photopoint Station 10 - Polygon E (September 2013)

Photopoint Station 11 - Polygon A (September 2013)

Photopoint Station 12 - Polygon A (September 2013)

Photopoint Station 13 - Polygon A (September 2013)

Photopoint Station 14 - Polygon A (September 2013)

Photopoint Station 15 - Polygon D (September 2013)

Photopoint Station 16 - Polygon D (September 2013)

Photopoint Station 17 - Polygon D (September 2013)

Photopoint Station 18 - Polygon D (September 2013)

Photopoint Station 19 - Polygon B-C (September 2013)

Photopoint Station 20 - Polygon B-C (September 2013)

Photopoint Station 21 - Polygon B-C (September 2013)

Photopoint Station 22 - Polygon B-C (September 2013)

Photopoint Station 23 - Polygon B-C (September 2013)

Photopoint Station 24- Polygon B-C (September 2013)

Photopoint Station 25 - Polygon B-C (September 2013)

Photopoint Station 26 - Polygon B-C (September 2013)

Photopoint Station 27 - Polygon B-C (September 2013)

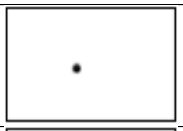
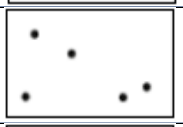
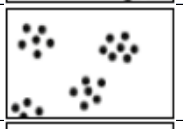
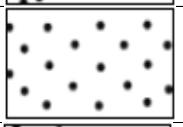
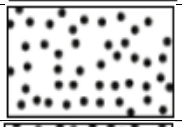
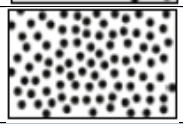
Photopoint Station 28 - Polygon B-C(September 2013)

Photopoint Station 29 - Polygon B-C (September 2013)

Appendix 3

IAPP Commonly Used Distribution and Density Codes

Some commonly used codes in IAPP:

Distribution Code		
Code	Reference	Description
1		Rare individual, a single occurrence
2		Few sporadically occurring individuals
3		Single patch or clump of a species
4		Several sporadically occurring individuals
5		A few patches or clumps of a species
6		Several well-spaced patches or clumps of a species
7		Continuous uniform occurrence of well-spaced individuals
8		Continuous occurrence of a species with a few gaps in the distribution
9		Continuous dense occurrence of a species

Density Code		
Code	Reference	Description
1	Low	≤ 1 plant/m^2
2	Medium	2-5 plants/m^2
3	High	6-10 plants/m^2
4	Dense	> 10 plants/m^2

Jurisdiction Codes	
MFR	Ministry of Forests and Range
AH	Alaska Highway
HYDR	BC Hydro
BCR	BC Rail
BCTC	British Columbia Transmission Corp.
BNSF	Burlington Northern Santa Fe
CNR	CN Rail
CPR	CP Rail
DND	Department of National Defense
GL	Grazing Lease
FN	First Nations Reserves
MN	Mining Companies
MOT	Ministry of Transportation and Infrastructure
MOE	Ministry of Environment - *except Provincial Parks*
MOP	Municipality owned land
PIPE	Oil and Gas Companies
PNG	Pacific Northern Gas
PCAN	Parks Canada
P	Private Land
PP	Provincial Parks
MRD	Regional District owned land
TEL	Telus
TER	Terasen Gas Inc.
TRP	TransCanada Pipelines
WE	Westcoast Energy Inc.

Appendix 4

Photolog

Photograph 1:

Showing heavily used trail in Polygon A.

Photograph 2:

Showing heavily used trail in Polygon A.

Photograph 3:

Showing heavily used trail in Polygon A.

Photograph 4:

Showing heavily used trail in Polygon D.

Photograph 5:

Showing heavily used trail in Polygon D.

Photograph 6:

Showing dead population of Sctoch broom in Polygon B-C.

Appendix 2

Representative Photographs of Invasive Plant Species Known to Occur in the Subject GOMs

Colonial bentgrass
(*Agrostis capillaris*)

Tall oatgrass
(A*rrhenatherum elatius*)

Bull thistle
(*Cirsium vulgare*)

Hedgehog dogtail
(*Cynosurus echinatus*)

Scotch broom
(*Cytisus scoparius*)

Orchard grass
(*Dactylis glomerata*)

Foxglove
(*Digitalis purpurea*)

Hairy cats ear
(*Hypochaeris radicata*)

Oxeye daisy
(*Leucanthemum vulgare*)

Rose campion
(*Lychnis coronaria*)

Smooth witchgrass
(*Oanicum dichotomiflorum*)

Kentucky bluegrass
(*Poa pratensis*)

Sheep sorrel
(*Rumex acetosella*)

Rattail fescue
(*Vulpia myuros*)

Appendix 3

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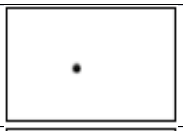
1		Rare individual, a single occurrence
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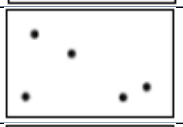
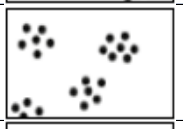
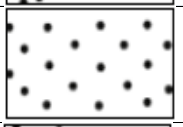
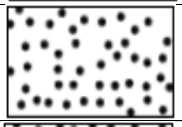
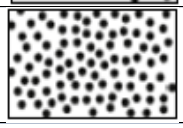
4		Several sporadically occurring individuals
5		A few patches or clumps of a species
6		Several well-spaced patches or clumps of a species
7		Continuous uniform occurrence of well-spaced individuals
8		Continuous occurrence of a species with a few gaps in the distribution
9		Continuous dense occurrence of a species

Density Code		
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CNR	CN Rail
CPR	CP Rail
DND	Department of National Defense
GL	Grazing Lease
FN	First Nations Reserves
MN	Mining Companies
MOT	Ministry of Transportation and Infrastructure
MOE	Ministry of Environment - *except Provincial Parks*
MOP	Municipality owned land
PIPE	Oil and Gas Companies
PNG	Pacific Northern Gas
PCAN	Parks Canada
P	Private Land
PP	Provincial Parks
MRD	Regional District owned land
TEL	Telus
TER	Terasen Gas Inc.
TRP	TransCanada Pipelines
WE	Westcoast Energy Inc.

Appendix 4

Target Species Invasive Plant Management Plan

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www.pggroup.com

Target Species Invasive Plant Management Plan

PGL File #: 0130-12.08

DATE: April 2, 2015

Fairwinds' The Lakes District, Nanoose Bay, BC
Target Species Invasive Plant Management Plan: Bull Thistle (*Cirsium vulgare*)

In *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC* (2002), the Garry Oak Ecosystems Recovery Team (GOERT) ranks non-native thistles, such as bull thistle (*Cirsium vulgare*), as being a potential risk for significant impacts to Garry oak ecosystems, albeit a lower risk than other species listed (i.e., listed as 12 of 15 of the most invasive plants). During the 2013 baseline survey, bull thistle was confirmed to occur in low frequency in the The Lakes District Garry oak meadows (Subject GOMs). Given the relative threat this species represents and its low occurrence, it was recommended that bull thistle be assessed through the Decision Framework portion of the Garry Oak Meadows Management Plan (GOMMP), which was prepared for Fairwinds' The Lakes District project. Through this process, it was determined that a Target Species Invasive Plant Management Plan (Target Species IPMP) be prepared for implementation.

The objective of the bull thistle Target Species IPMP is to capitalize on the species low distribution/density characteristics and apply an "early detection and rapid response" approach. The goal of the management plan will be to:

- Contain the invasion;
- Prevent further spread; and
- Remove bull thistle from the Subject GOMs as a whole.

Site Summary

Bull thistle was only observed in Subject GOM Polygon F, at the north end of Enos Lake. The occurrence was characterized by a few sporadically-occurring individuals throughout the meadow, at densities of roughly two to five plants per square meter.

Although bull thistle represents a relatively low threat to the Subject GOMs (compared to other species listed by the GOERT as the 15 most invasive plants on Garry oak ecosystems), the low density and distribution characteristics suggests that "early detection and rapid response" principles can be applied for successful management and prevention of spread. Doing so will work to conserve the integrity of this meadow ecosystem, and help to avoid the need for more labour-intensive management efforts in the future.

Species Summary

Bull thistle is a biennial, tap-rooted plant originating from Eurasia, growing from to two to five feet in height and reproducing via seed (Polster, 2009). The first year of growth is characterized by a rosette, which elongates and flowers during the second year (King County, 2014). This species of thistle is generally intolerant of shade and typically grows in dry to moist environments that are open or otherwise characterized by some level of disturbance such as roadsides, cultivated fields, pastures, or logged forestland (Weeds BC, 2002). Bull thistle

typically blooms between June and October (Polster, 2009). Most seeds land within close proximity to the plant with some being transported via wind; they are notably viable and usually germinate quickly under suitable conditions (Weeds BC, 202).

Recommended Action Plan

The recommended action plan for bull thistle in the Subject GOMs is based on a number of assumptions:

- Plant populations observed during the 2013 baseline survey have not significantly increased and/ or spread;
- Occurrences are characterized by sporadically-occurring individuals;
- The majority of the Subject GOMs are characterized by thinner soils;
- Resources are available to implement the plan accordingly; and
- Efforts will be coordinated by Qualified Environmental Professionals (QEPs).

Given the above assumptions the recommended action plan for bull thistle management includes:

- Digging up/pulling any rosettes;
- Pulling or cutting maturing plants after they have bolted but before they flower (preferably cutting plant roughly 2–3cm below grade to minimize re-sprouting);
- Minimizing soil disturbance by replacing, re-seeding or adding a layer of mulch, as approved by a QEP; and
- Implementing follow-up monitoring and a manual removal program in subsequent years to identify growth from the seed bank of soil.

Waste material (i.e., removed bull thistle plants and plant parts) must be removed from the site and disposed of at an appropriate facility (e.g., approved waste management facility or high-temperature composting facility). Flowering or seeding plants must be collected, bagged and discarded to an appropriate facility. Waste material must not be dumped in surrounding natural areas.

References

Garry Oak Ecosystem Recovery Team and Nature Conservancy Canada. 2002. *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC.* Victoria, BC.

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Target Species Invasive Plant Management Plan

PGL File #: 0130-12.08

DATE: April 2, 2015

Fairwinds' The Lakes District, Nanoose Bay, BC
Target Species Invasive Plant Management Plan: Orchard Grass (*Dactylis glomerata*)

In *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC* (2002), the Garry Oak Ecosystems Recovery Team (GOERT) ranks orchard grass (*Dactylis glomerata*) as having the highest potential for significant impacts to Garry oak ecosystems. During the 2013 baseline survey, orchard grass was observed to occur in a number of The Lakes District Garry oak meadows (Subject GOMs). Given the relative threat this species represents, it was recommended that orchard grass be assessed through the Decision Framework portion of the Garry Oak Meadows Management Plan (GOMMP), which was prepared for Fairwinds' The Lakes District project. Through this process, it was determined that a Target Species Invasive Plant Management Plan (Target Species IPMP) be prepared for implementation.

The GOERTs *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Orchard Grass (Dactylis glomerata)* (2007) was used to prepare this plan. The short-term goal of the orchard grass Target Species IPMP is to contain the invasion and prevent further spread. Long-term goals of the management plan include, in order of priority:

- Removal of orchard grass from areas identified as having high conservation values within the meadow (e.g., containing threatened or endangered species); and
- Removal of orchard grass from the Subject GOMs as a whole.

Site Summary

Orchard grass was one of the most common invasive plant species observed in the Subject GOM Polygons A, E, F, and G (Polygons are spatially defined in the GOMMP). However, this species was not observed in the meadows occurring on and around the Lookout Summit (Polygons B/C and D). Table A provides a summary of orchard grass occurrences in the Subject GOMs with estimated density and distributions observed during the 2013 baseline survey. Distribution and density codes are defined in the GOMMP.

Table B: Summary of Orchard Grass Distribution and Density in the Subject GOM Polygons

Garry Oak Meadow Polygon	Baseline (2013)[1]	
	Distribution	Density
A	6	4
E	8	3
F	6	4
G	5	3

Note: Distribution and density code definitions are provided in the GOMMP.

Due to its relative threat, orchard grass is a high-priority candidate for management. The fact that this species was not observed in the Lookout Summit GOMs (e.g., Polygons B/C and D) provides additional motivation to manage this species in order to prevent the risk of spreading to uninvaded Subject GOMs.

The distribution and densities of orchard grass in meadow Polygons A, E, F, and G are relatively high, which suggests this species has been present for several years. The Subject GOM Polygons E, F, and G are relatively small in size, and most of the orchard grass occurrences are characterized by a few to several patches, which will facilitate easier management of this species. Orchard grass in Subject GOM Polygon E was characterized as a more continuous occurrence; however, this is the smallest of all the Subject GOMs occurring in the Lakes District.

Species Summary

Orchard grass originates from Eurasia and is typically cultivated for pasture or hay. It is a tufted perennial growing from short rhizomes and is characterized by hollow stems of up to 1.5m in height (Pojar and MacKinnon, 2004). This species of grass can be typically found on disturbed sites at low to middle elevations, and quite frequently occurs along roadsides (Pojar and MacKinnon, 2004). Orchard grass has a dense, non-creeping and deep root system (Polster, 2009). It is known to tolerate some acidic drought soil conditions and/or drought, is very shade tolerant, and is very good at re-growth after cutting (Polster, 2009).

Recommended Action Plan

In the GOERTs *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Orchard Grass (Dactylis glomerata)* (2007) guidelines are provided for determining what method to use for the management of orchard grass, and when to use it. Determination is based on a number of circumstances and influential factors. For the Subject GOMs requiring orchard grass management, we have based our decision on the following assumptions:

- Most occurrences are characterized by patches or clumps;
- The majority of the Subject GOMs are characterized by thinner soils;
- Resources are available to implement the plan accordingly; and
- Efforts will be coordinated by Qualified Environmental Professionals (QEPs).

Given the above assumptions and based on the GOERTs defined best practices (2007), the recommended action plan for orchard grass management includes:

- Cutting the root crown of individual plant occurrences just below ground level using a hook knife or similar tool;
- Implementing the initial treatment during any time of the season;
- Implementing repeat treatments before seed set (late summer); and
- Planting native Garry oak ecosystem grass species (plugs) in the resulting holes (spring or fall season), or seeding using appropriate seed mix (seed stock must be sourced from a reliable supplier with assurance of species content).

Waste material (i.e., removed orchard grass plants and plant parts) must be removed from the site. Orchard grass waste material is suitable for composting where facilities exist, or for other typical offsite disposal locations. Care should be taken to avoid seed dispersal, and leftover plant parts (i.e., thatch) should be raked up and removed.

References

Garry Oak Ecosystem Recovery Team and Nature Conservancy Canada. 2002. *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC.* Victoria, BC.

Garry Oak Ecosystem Recovery Team and Nature Conservancy Canada. 2007. *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Orchard Grass (Dactylis glomerata).* Victoria, BC.

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Target Species Invasive Plant Management Plan

PGL File #: 0130-12.08

DATE: April 2, 2015

Fairwinds' The Lakes District, Nanoose Bay, BC
Target Species Invasive Plant Management Plan: Rose Campion (*Lychnis coronaria*)

In *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC* (2002), the Garry Oak Ecosystems Recovery Team (GOERT) ranks rose campion (*Lychnis coronaria*), as being a potential risk for significant impacts to Garry oak ecosystems. Rose campion is the lowest species of the 15 exotic plants the GOERT lists as the most invasive plants to Garry oak ecosystems. During the 2013 baseline survey, rose campion was confirmed to occur in low frequency in The Lakes District Garry oak meadows (Subject GOMs). Given the relative threat this species represents and its low occurrence, it was recommended that this species be assessed through the Decision Framework portion of the Garry Oak Meadows Management Plan (GOMMP), which was prepared for Fairwinds' The Lakes District project. Through this process, it was determined that a Target Species Invasive Plant Management Plan (Target Species IPMP) be prepared for implementation.

The objective of the rose campion Target Species IPMP is to capitalize on the species low distribution/density characteristics and apply an "early detection and rapid response" approach. The goal of the management plan will be to:

- Contain the invasion;
- Prevent further spread; and
- Remove rose campion from the Subject GOMs as a whole.

Site Summary

Rose campion was only observed in one Subject GOM (Polygon A) on top of Notch Summit. This occurrence was characterized by a relatively minor population during the summer 2013 baseline survey, and was noted as a single patch or clump consisting of six to ten plants in a square meter.

Although this species represents a lower threat to the Subject GOMs, the low density and distribution characteristics suggest that "early detection and rapid response" principles should be applied for successful management. This approach will work to prevent the future spread of rose campion and reduce the need for more intensive management efforts in the future.

Species Summary

Rose campion is a herbaceous perennial plant that grows in basal clumps and produces attractive magenta flowers. The plant flowers from June through July and has characteristic basal leaves arranged in a rosette (Washington State University, 2015). The plant can reach between 40cm and 100cm in height (E-Flora, 2013). Typical habitat range includes mesic to dry roadside and waste places in the lowlands (E-Flora, 2013). Based on gardening resources and plant guides/profiles provided by nurseries, rose campion can tolerate partial shade and self-seeds under suitable growing conditions. According to The Wisconsin Master Gardener Program, the plant is

easiest to propagate from seed, as each plant is capable of producing a significant number of seeds; however, the plant will also grow from basal cuttings if taken in the late spring (University of Wisconsin-Extension, 2013).

Recommended Action Plan

The recommended action plan for rose campion in the Subject GOMs is based on a number of assumptions:

- Plant populations observed during the 2013 baseline survey have not significantly increased and/or spread;
- Occurrences are characterized by sporadically-occurring individuals;
- The majority of the Subject GOMs are characterized by thinner soils;
- Resources are available to implement the plan accordingly; and
- Efforts will be coordinated by Qualified Environmental Professionals (QEPs).

There are no known species-specific best practices for the management of rose campion. However, given the above assumptions and the fact this species propagates best by seed, a recommended action plan has been prepared, including:

- Pulling plants before they flower ensuring the majority of roots are removed;
- Minimizing soil disturbance by replacing or re-seeding or adding a layer of mulch, as approved by a QEP; and
- Implementing follow-up monitoring and a manual removal program in subsequent years to identify growth from seed bank of soil.

Waste material should be removed from the site and disposed of at an appropriate facility (e.g., approved waste management facility or high-temperature composting facility). Flowering or seeding plants should be collected, bagged and discarded to an appropriate facility. Waste material must not be dumped in surrounding natural areas.

References

Garry Oak Ecosystem Recovery Team and Nature Conservancy Canada. 2002. *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC.* Victoria, BC.

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Washington State University. 2015. *WSU Clark County Extension: PNW Plants.* [ONLINE] Available at: http://www.pnwplants.wsu.edu/PlantDisplay.aspx?PlantID=271. [Accessed 31 March 15].

University of Wisconsin - Extension. 2013. *The Wisconsin Master Gardener Program: Rose Campion*. [ONLINE] Available at: http://wimastergardener.org/?q=RoseCampion. [Accessed 31 March 15].

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Target Species Invasive Plant Management Plan

PGL File #: 0130-12.08

DATE: April 2, 2015

Fairwinds' The Lakes District, Nanoose Bay, BC
Target Species Invasive Plant Management Plan: Scotch Broom (*Cytisus scoparius*)

In *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC* (2002), the Garry Oak Ecosystems Recovery Team (GOERT) ranks Scotch broom (*Cytisus scoparius*) as having the second highest potential for significant impacts to Garry oak ecosystems. During the 2013 baseline survey, Scotch broom was confirmed to occur in low densities and distribution in a number of The Lakes District Garry oak meadows (Subject GOMs). Given the relative threat this species represents it was recommended that Scotch broom be assessed through the Decision Framework portion of the Garry Oak Meadows Management Plan (GOMMP), which was prepared for Fairwinds' The Lakes District project. Through this process, it was determined that a Target Species Invasive Plant Management Plan (Target Species IPMP) be prepared for implementation.

The GOERTs *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Scotch Broom (Cytisus scoparius)* (2002) was used to prepare this plan. The objective of the Scotch broom Target Species IPMP is to capitalize on the species low distribution/density characteristics and apply an "early detection and rapid response" approach. The goal of the management plan will be to:

- Contain the invasion;
- Prevent further spread; and
- Remove Scotch broom from the Subject GOMs as a whole.

Site Summary

Scotch broom only had minor occurrences in Subject GOM Polygons F and G, and was not observed at all in Polygons A and E. This species was notably more prevalent in meadow Polygons B/C, and D. The majority of the Scotch broom population in the Subject GOMs appeared to be under stress, with many of the populations being in significant decline or dead. Scotch broom is not typically a preferred species for deer; however, observations suggest the poor condition of the Scotch broom populations in the Lakes District is a result of excessive deer browsing. Table C provides a summary of Scotch broom occurrences in the Subject GOMs with estimated density and distributions from the summer 2013 baseline survey. Distribution and density codes are defined in the GOMMP.

Table A: Summary of Scotch Broom Distribution and Density in the Subject GOM Polygons

Garry Oak Meadow Polygon	Baseline (2013)[1]	
	Distribution	Density
B/C	6	2-3
D	6	2-4
F	3	3
G	3	2

Note: Distribution and density code definitions are provided in the GOMMP.

Scotch broom poses a significant threat to the Subject GOMs and should be considered a high-priority candidate for management. The decision to manage this species should also consider the fact it was not observed in the Subject GOMs on the Notch Summit. Efforts to prevent the spread of Scotch broom to uninvaded Subject GOMs would be a valuable investment. In addition to this, there is an opportunity to take advantage of the generally poor health of the existing populations (due to deer browse and stress), which may aid the success of management efforts.

The distribution and densities of Scotch broom in the Subject GOMs is limited to a few patches with generally low densities. This suggests that these populations are relatively new, and an "early detection and rapid response" approach should be applied to this invasion.

Species Summary

Scotch broom is a perennial shrub originating from central and southern Europe and north Asia (E-Flora, 2013). Broom typically prefers dry, sandy soils with full sun exposure, and can tolerate soil pH of 4.5 to 7.5 (E-Flora, 2013). This species is characterized by erect stems with numerous branches and can reach heights of 1–3m. The plant's usual flowering period extends between May and early June, but has been noted to extend earlier or later into the season in the Vancouver area (E-Flora, 2013).

Propagation of Scotch broom is by seed only, which are ejected from a significant number of seed pods occurring throughout the plant. The seeds can remain dormant in the soil for up to 30 years and can be dispersed a number of ways, including via: watercourses, vehicle traffic, material hauling (soils, gravel, etc.), or by birds and other animals (Polster, 2009).

Recommended Action Plan

In the GOERTs *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Scotch Broom (Cytisus scoparius)* (2002) guidelines are provided for determining what method to use for the management of Scotch broom, and when to use it. Determination is based on a number of circumstances and influential factors. For the Subject GOMs requiring Scotch broom management, we have based our decision on the following assumptions:

- Most occurrences are characterized by patches or clumps;
- Most occurrences are characterized by stems being "bigger than pencil size";
- The majority of the Subject GOMs are characterized by thinner soils;
- Rare plants are in the vicinity of the occurrences (precautionary principle);
- Resources are available to implement the plan accordingly; and
- Efforts will be coordinated by Qualified Environmental Professionals (QEPs).

Given the above assumptions and based on the GOERTs defined best practices (2002), the recommended action plan for Scotch broom management includes:

- Cutting the main stem at or below grade with an appropriate tool (e.g., loppers);
- Implementing the initial treatment after the plants have flowered but before the seed pods ripen; and
- Implementing follow-up monitoring in subsequent years to identify growth from seed bank present in soil.

Waste material (i.e., removed Scotch broom plants and plant parts) must be treated appropriately. Assuming the broom is removed during the timeframe noted above (i.e., plants are without seed), the waste can be left onsite (i.e., scattered, mulched, or deposited under coniferous forest where it will not affect ground vegetation).

References

Garry Oak Ecosystem Recovery Team and Nature Conservancy Canada. 2002. *Towards a Decision Support Tool to Address Invasive Species in Garry Oak and Associated Ecosystems in BC.* Victoria, BC.

Garry Oak Ecosystem Recovery Team and Nature Conservancy Canada. 2002. *Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Scotch Broom (Cytisus scoparius).* Victoria, BC.

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