



## SAN LORENZO VALLEY WATER DISTRICT

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### DRAFT FRENCH BROOM MANAGEMENT AND MONITORING PLAN

This is a DRAFT Document of the French Broom Management & Monitoring Plan open for public review. The French Broom Management & Monitoring Plan will be considered by the Board of Directors at the regularly scheduled meeting on March 5, 2015 at 7:30. We welcome your comments.



# *French Broom Management & Monitoring Plan*

*MANAGEMENT OF GENISTA MONSPESSULANA INFESTATIONS  
ON THE OLYMPIA WATERSHED PROPERTY*

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PREPARED FOR: THE SAN LORENZO VALLEY WATER DISTRICT

## Contents

Introduction .....	2
Existing Data Summary .....	3
Prioritization Zone Justification .....	4
Removal .....	5
Long Term Maintenance .....	7
Adaptive Management .....	8
Monitoring Plan .....	9
Work Crew Options and Analysis.....	10
References .....	15
Appendix A. Sand Specialty Plant Map .....	16
Appendix B. Steep Slope Map.....	17
Appendix C. Monitoring Sheet.....	18
Appendix D. Management Timeline .....	19
Appendix E. Labor Estimate by Priority Zone.....	20

## Introduction

*Genista monspessulana* (French broom) is an invasive perennial legume commonly found in disturbed areas throughout California. Due to its tenacious rate of growth, high seed production, seed longevity, and regenerative abilities, the species has been given a rating of “high” from the California Invasive Species Council (CAL-IPC) <sup>[1]</sup>. In Santa Cruz County, French broom and its relative Portuguese broom (*Cytisus striatus*) have become very common weeds in both urban and wild land settings. In the wild, broom creates homogenous stands in disturbed areas, outcompeting native plant species and reducing biodiversity. Seed can remain viable in the soil for up to 25 years and possibly longer <sup>[2]</sup>; this trait, combined with its high rate of reproduction, makes the species especially challenging to eradicate. Removal of broom from a site is possible when an eradication plan is executed with stringent maintenance and monitoring protocols and consistent management and funding over a long period of time. In areas containing sensitive habitats and endangered plant species, broom can pose an immediate and serious threat to biodiversity and the recovery of listed species.

The Olympia Watershed contains a rare ecotype commonly referred to as “sand hills habitat” due to the presence of soils with a very high sand content. The unique nature of the soils has led to an array of sand hill specific flora and fauna. However, the same soil type attracted a high-value sand quarrying operation. The operation left the site with high levels of soil disturbance, creating an ideal opportunity for invasive species such as French and Portuguese broom to colonize. Since the discovery of a number of rare and endangered plant and animal species within these habitats, many quarrying operations have been closed and the new land managers face the daunting task of reclaiming the lands for native species. The following report suggests a prioritized approach to control and eventually eradicate broom species from the Olympia Watershed (formerly the site of one such closed quarry and currently owned and managed by the San Lorenzo Valley Water District), making way for the re-establishment of the rare native plants and animals that make sand hills habitat so unique.

## Existing Data Summary

The Olympia Watershed property has been the subject of thorough scientific and anecdotal investigation, primarily under the management of the San Lorenzo Valley Water District. Through education and watershed recovery grants, the District has identified both the extent of invasive species on the property and the location and extent of rare and endangered sand hill species. Studies have been conducted by Randall Morgan, Suzanne Schettler, Ken Moore, Jodi McGraw, and Harvey & Stanley Associates, Inc. These studies<sup>[4]</sup> compiled inventories of sand hill specialty species and the various invasive species competing with them within the Olympia Watershed property. Volunteer work spearheaded by Ken Moore has led to the removal of large patches of invasive species within the property limits. Specifically, Moore's volunteers and work crews removed stands of acacia (*Acacia dealbata*), yellow star thistle (*Centaurea solstitialis*), and French and Portuguese broom. The broom removal plan described in this report is built upon the studies performed on the site to date and will follow in the footsteps of previous invasive species management efforts towards the ultimate goal of protecting rare species and habitats on site and returning the Olympia Watershed to a native landscape.

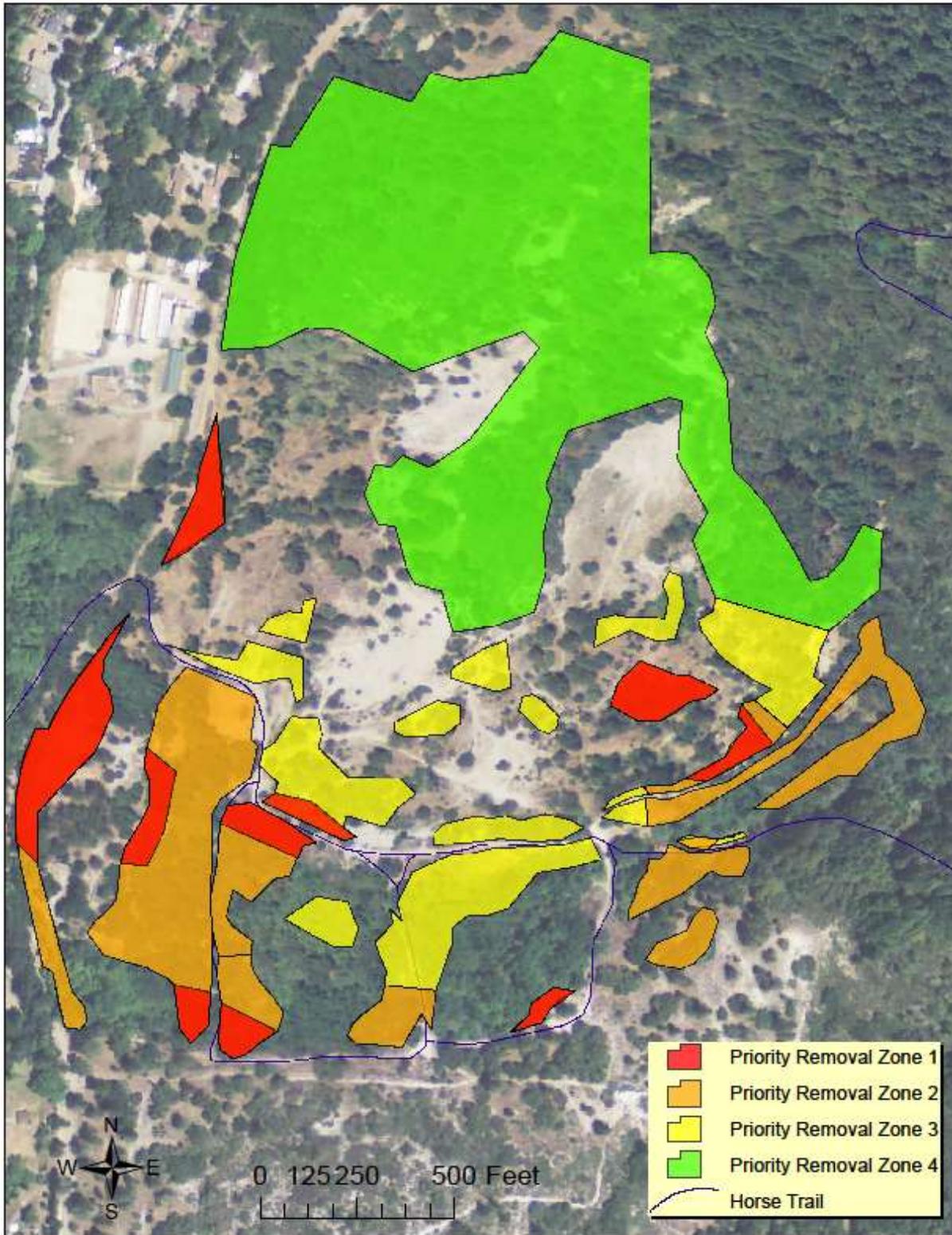
## Prioritization Zone Justification

When approaching removal of highly invasive species it is often necessary to prioritize specific areas for removal in order of importance based on existing conditions, management goals, and resource availability. Existing conditions include considerations such as aspect, sunlight and moisture availability, soil conditions, soil disturbance, past removal efforts, presence/absence of native species (rare and otherwise), presence/absence of other non-target invasive species, etc. Management goals vary from site to site based on the priorities of the land manager. In this case, the San Lorenzo Valley Water District is seeking to protect and enhance habitat for rare and endangered plant species on the property. Resource availability will be determined by the District and can be applied to the plan as deemed necessary. Below is a map of French broom extent within the property as mapped by the District. The broom population has been sectioned into four priority levels. See **Figure 1** for priority map.

These priorities are a reflection of the vicinity of broom to areas with high levels of rare and endangered plant species as mapped by Suzanne Schettler. See **Appendix A** for species map. Secondary considerations for prioritization included ease of access, proximity to high-traffic paths, outlier infestations, and proximity to centralized drainages within the watershed.

Priority 1 areas represent stands of broom that were found to be in close proximity to the greatest diversity and number of sand hill specialty species, greatest potential to spread seed, high public visibility, or potential to create larger satellite populations if untreated. Priority 2, 3, and 4 areas represent stands of broom that pose less of a threat to biodiversity of sand specialty species as inventoried by Schettler. These priorities are meant to guide control efforts. However, if resources exist to engage all areas it is suggested that all zones are treated as described below.

Figure 1



## Removal

### Preparation

Due to the sensitive nature of the Olympia Watershed property, some preparation for removal efforts should be performed before work begins. Pre-project photos should be taken from a recognizable vantage point to sum up pre-project conditions and ensure all treated areas are re-checked in subsequent years. The majority of the rare and listed species on site are annuals, making harming them during winter hand removals a very low risk. However, any perennial rare or listed species within the removal zones should be flagged and shown to work crews for avoidance during the project. Educational information on the listed animals found on the site and their habitat requirements should be prepared and reviewed with work crews prior to removal efforts to lower the potential for take during project activities.

### Initial Removal

Initial removal strategies for this property will be hand removal of all French and Portuguese broom found within Priority Zones in order. Ideal timing for removal will depend on weather conditions and resource availability. If funds are available, broom removal should take place after the first or second storm of the season when the soil has been softened by moisture. This site has the advantage of highly sandy soils however, making removal of plants relatively easy by hand even in dry conditions. While most individual plants will be removable by hand pulling, more mature plants will have had time to send deep tap roots into the soil and can prove difficult to remove. Leverage based specialized tools such as the Weed Wrench (production discontinued) or Pullerbear (available at [www.pullerbear.com](http://www.pullerbear.com)) can be used to remove deep rooted broom with relative ease. A crew should have at least one of these tools on hand at all times to ensure complete removal of mature plants from the site as they have the greatest potential to spread seed. Removing an individual broom plant requires the removal of the trunk and root from the earth. Leaving the root in the ground will lead to re-growth of the plant and a deeper, stronger, taproot. Due to site conditions and brief field test removals, full removal of trunk and root should not prove to be an obstacle once the wet season has arrived. Individual plants showing no sign of seed production can be piled and left on-site, though it should be taken into consideration that piles of dry broom may be highly flammable. Individual plants with seeds present should be bagged and removed from the site to reduce future recruitment of the species and lower long-term management costs.

In the case that individual broom plants prove impossible to remove entirely from the soil a qualified herbicide applicator should be hired to cut and paint the trunks immediately with a glyphosate-based herbicide.

Some populations of broom were noted to be on very steep sandy slopes that should be addressed by skilled, experienced, ecologically minded laborers to minimize damage done to the area by removal. The steep slopes identified in the field are marked in **Appendix B**.

### Safety Protocols

Sites identified for removal present some dangers to work crews and, as such, safety protocols should be implemented to reduce risk. Work crews should receive education on poison oak (*Toxicodendron diversilobum*) and rattle snakes as both have been noted to be present on site. Yellow-jackets, a species of wasp, have been noted to be prevalent on the site and work areas should be scouted immediately prior to work being performed for potential nests. Should a nest be located, it should either be flagged for avoidance or removed entirely to ensure worker safety. Workers should wear personal protective equipment for removal work (i.e. gloves, boots, pants, etc.) to reduce risk of injury.

## Long Term Maintenance

Yearly, long-term, consistent maintenance is essential if initial removal efforts are to result in successful control of the species. A single mature broom can produce up to 20,000 seeds <sup>[3]</sup> and, while it is unlikely that any of the plants found on the property are producing that quantity of seed as individuals, it is likely that hundreds of thousands of seeds have been produced on the property over the years and are present in the soil awaiting the opportunity to sprout. Control and eradication of these seedlings should be achieved through a technique called flaming. Flaming is a simple and efficient technique that allows a small work force (1-3 people) to tackle large quantities of broom seedlings. The largest obstacle to effective flame control of broom seedlings is timing. Flaming should occur during the wet season (December-February), preferably following a storm event when the soil retains moisture to an inch of depth to reduce the likelihood of any fire escape. This limitation can be problematic due to unpredictable rain patterns, contractor availability, and resource availability. Flaming should be performed by well-trained individuals who will be able to properly differentiate between broom seedlings and native plant seedlings. Broom seedlings should be in their cotyledon phase for optimum flaming results. Seedlings generally reach this phase in January-February depending on weather conditions and site disturbance. If field conditions and resources allow, a follow-up flaming may be beneficial two weeks to one month after initial flaming to remove any late germinating seedlings.

This process of hand removal and flaming should be repeated each winter to ensure no new seeds are released on treated sites. Years required for this repeated treatment is entirely dependent upon the seed bank and can be fifteen to twenty years or more. However, if yearly maintenance is diligently performed, the scope of maintenance will be drastically lowered over time and can eventually be reduced to annual monitoring and upkeep.

Safety precautions are a high priority during all flaming activities. Whenever flaming is to occur, a fire extinguisher should be on site to ensure workers have the ability to retard any flames before they extend beyond controllable levels.

## Adaptive Management

In the case that the window of flaming has been missed, adaptive management strategies should be implemented to ensure that previously treated stands do not reach maturity and begin to produce seed. It is unlikely that seedlings will reach reproductive maturity within the first year of life, making it possible to address the seedlings with a follow-up hand removal as conditions allow. However, sites should be monitored at least once in the summer and fall if flaming has been missed to ensure that no broom plants flower and produce seed before the winter hand removal takes place. Any flowering plants should be removed by hand as soon as possible. Due to the low potential for broom to reach this point in the first year, the number of flowering plants should be low enough for a single monitor to pull by hand while walking the sites. In the case that a large number of individuals are found to be flowering before the winter hand removal the District should be immediately informed and a rapid response removal should be implemented to prevent a renewal of the seed bank.

## Monitoring Plan

Monitoring for broom infestations on the property will be an ongoing effort and will be key in attaining successful eradication of the species from the Olympia Watershed. A successful eradication of the existing stand of broom does not mean that the species will not arrive on site through natural processes in the future. Early detection of new infestations and re-occurrences of old infestations will greatly reduce future costs and should be a priority for management of the property. A number of Early Detection & Rapid Response (EDRR) methods have been developed throughout California with a variety of detail. As the property has been the host of a number of invasive species management projects, it would be ideal to dove-tail monitoring of broom removal with the monitoring of other common invasive species known to have occurred on site. Any monitoring efforts aimed at broom occurrences should also take note of the presence of acacia, yellow star-thistle, eucalyptus (*Eucalyptus sp.*), tocalote (*Centaurea melitensis*), and black locust (*Robinia pseudoacacia*). While not the focus of this report, each of these species poses a similar threat to biodiversity and native establishment within the property.

Monitoring of the individual removal sites should take place once a year in the spring by a qualified biologist or citizen scientist. Monitors will take photos from previously marked photo points as well as field notes on presence/absence of invasive species using an aerial map alongside the a table similar to the following example. See **Appendix C** for a blank copy of the monitoring sheet.

Sample ID	Species Code	Common Name	Number of Individuals	Reproductive Evidence	Notes
1	GEMO	French Broom	3	No	At the base of the closed service road
2	CESO	Yellow Star Thistle	2	No	
3	GEMO	French Broom	1	Yes	Pulled flowering plant
4					

### Table properties

Sample ID: To be marked on field map and reported to District's GIS Tech for recording.

Species Code: Four letter code, first two letters of genus and species

Common Name: Common name of species

Number of Individuals: A quick count of individuals within a fifty foot radius.

Reproductive Evidence: Are flowers or seeds present on the species? Yes or No.

Reference Notes: Note any landmarks/aspect/special notes about infestation.

Results of monitoring data should be immediately reported to the District to help inform management needs. Monitoring of previously treated areas should be the priority of all monitoring activities. However, if resources are available to monitor the entire property, a complete walk through should be performed.

## Work Crew Options and Analysis

### American Conservation Experience

333 Soquel Avenue Santa Cruz, California 95062

Primary Contact:

Vasiliki Vassil

Director of ACE California

Phone: (831) 427-1091

v.vassil@usaconservation.org



### Organizational Profile

American Conservation Experience (ACE) is a non-profit conservation program aimed at offering international and domestic young adults a chance to experience America's natural resources through on-the-ground restoration and conservation work. In addition to habitat restoration, ACE performs fuels reduction projects, and constructs and maintains trails. ACE is headquartered in Arizona and has offices in Santa Cruz, California as well as in St. George, Utah. ACE members are typically between the ages of 18 and 30, with most falling into the 18-25 year old range. While many are from the US, a significant number are from abroad. International members generally commit to a minimum of 10 to 12 weeks with ACE; some stay on much longer. Most crews are sized between 10 and 20 people, although larger and smaller crews may be available. Crews are typically housed in ACE residential centers located in Santa Cruz and South Lake Tahoe while off the job, and camp on-site when working. Camping on-site gives the crews a vested interest and deeper understanding of the area they are working in and cuts down on overhead and travel costs for the project owner. Crews are led by a staff supervisor, who reports to senior ACE staff on project activities. The ACE Director of Operations works closely with the project partner to ensure that project goals are clear and that logistical needs are fully coordinated. ACE provides crew food, hand tools, transportation and camping supplies. Chainsaws and other specialized tools also are available. The project partner ensures the presence of potable water and sanitation facilities.

### Cost

For comparison, a ballpark estimate has been provided by ACE. A typical cost for a crew of 10 people (including supervisor) is \$4,960 per week. A crew of 10 that includes 2 trained chainsaw operator costs \$5,120 per week. If additional chainsaw operators are needed, they will be charged at a rate of an additional \$160 per person, per week. Two weeks of pure French broom removal with no sawyers would cost **\$9,920**.

## California Conservation Corps

757 Green Valley Road, Watsonville, California 95076

Primary Contact:

Janet W.

(831) 768-0150

[jwohlgem@ccc.ca.gov](mailto:jwohlgem@ccc.ca.gov)



### Organizational Profile

“Hard work, low pay, miserable conditions...and more!” –CCC motto

The California Conservation Corps (CCC) is a well-known and experienced organization specializing in on-the-ground natural resource work since 1976. The Corps employs young men and women looking to gain real world experience and training. Crew sizes vary depending on size, duration, and type of job and CCC members from neighboring regions can be used on larger scale jobs when needed. Each crew typically works ten hour, four day weeks and are exempt from prevailing wage rates. Crews work in a wide variety of settings doing everything from trail creation to fire breaks to invasive species removals.

### Cost

For comparison, a ballpark estimate has been provided by the CCC. A ten person crew, removing French broom for two weeks would cost **\$15,000**.

## **Ben Lomond Conservation Camp #45**

13575 Empire Grade Road, Santa Cruz CA, 95060  
(831) 426-1610



### Organizational Profile

The Ben Lomond Conservation Camp, sometimes referred to as the Ben Lomond Fire Crews, is part of a statewide program that gives individuals convicted of non-violent crimes an opportunity to work in conservation, earn a stipend while incarcerated, build work ethic and experience. These crews are typically made up of 17-man crews and can be used for a variety of labor projects, French broom removal included. The primary advantage to this organization is the comparably low cost of having them work a particular site. A site must first apply for and pass a Captain's Inspection before a crew will work. The paperwork for the inspection is available by email or fax upon request at the phone number listed above. It should be noted that crews are available on a first come first serve basis and can be pulled from the area indefinitely if a wildfire starts and their assistance is needed.

### Cost

For comparison, a cost estimate has been provided by Camp #45. The camp charges a flat rate of **\$200/day** for a crew sized between 12 and 17. Two weeks of French broom removal at that rate would total to **\$2,000**.

## **Ecological Concerns Incorporated**

Mailing Address: 125 Walk Circle, Santa Cruz, CA 95060  
Yard Location: 336A Golf Club Drive, Santa Cruz, CA 95060  
Primary Contact:  
Jon Laslett  
Project Manager  
(831) 750-0113  
jlaslett@ecologicalconcerns.com



### Organizational Profile

Ecological Concerns Inc (ECI) is a local native habitat restoration contractor that specializes in restoration and mitigation projects. The company has a dedicated work crew capable of performing both detail and broad scale tasks in any habitat. Work crews are familiar with a variety of native and non-native species, allowing them to work in a range of different areas with the ecological insight that is often missing in labor crews. Crews typically range from 2 to 4 man teams, but can be increased as needed on a per-project basis. Many of the members of the ECI work crew team are versed in herbicide, tree falling, and flaming techniques. The company also boasts a number of heavy machines and skilled operators, allowing them to take on larger projects and complete smaller sized projects with greater efficiency. ECI can also provide supervisors specialized in invasive plant management to oversee other crews and provide qualified herbicide application as necessary.

### Cost

For comparison, a cost estimate has been provided by ECI. A three person crew for two weeks of French broom removal would cost **\$12,000**. Supervisory staff for two weeks of removal can be provided for work crews at a rate of **\$4,800** for two weeks.

## **Volunteer Labor**

While not an existing organization, considering the potential for volunteer labor on projects such as this is always important. The most obvious benefit of volunteer labor is the nearly non-existent costs of the labor itself. Overhead costs, however, can be much higher than dealing with an established organization as the recruitment, maintenance, and advertisement to volunteers can be time consuming task and are never a guarantee of an incoming work force. Timing of the removal of French broom is also incredibly important when considering volunteer labor as an option. French broom, particularly in dry years, can be a difficult plant to remove and often a visually and physically daunting task. As group sizes and availability throughout the year can be variable, relying on volunteer labor for large-scale invasive species management could prove problematic, especially when considering the tenacity of French broom's recovery. Follow-up maintenance of broom sprouts could also prove to be an inefficient use of volunteer time as a work crew would be able to flame seedlings with relatively low cost during the wet season in lieu of pulling, a task not typically fit for volunteers due to liability and lack of training.

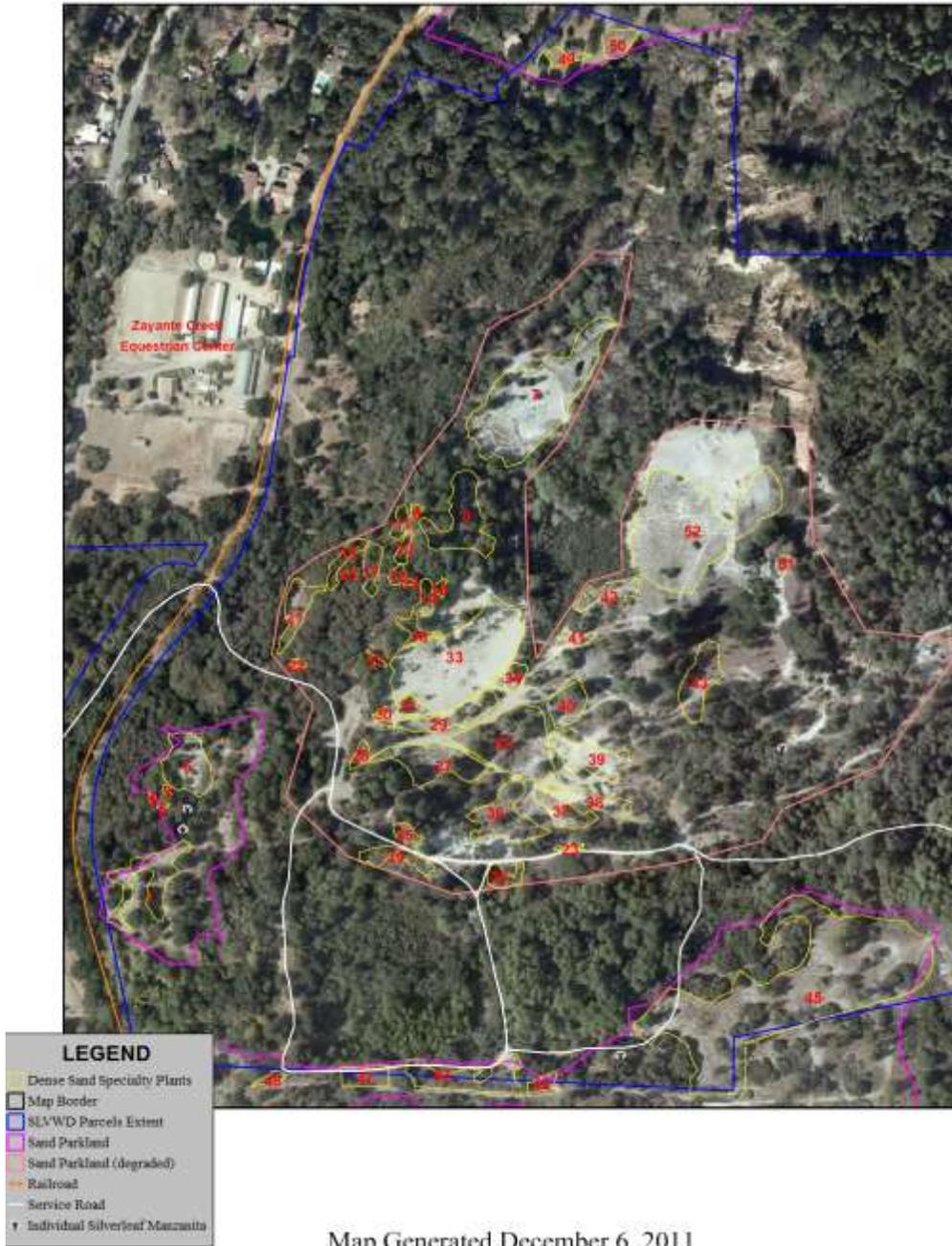
An ideal use for volunteer labor, in the case of the Olympia Watershed Project, could be for monitoring purposes as individuals interested in hiking trails are often interested, on some level, in botany and wild land management. Monitoring for French broom seedlings by volunteers would require minimal training, cut down on cost, engage the community in restoration of important habitat, and create public outreach opportunities. This use of volunteers would require an employee of the District to manage volunteer activities. This inherent overhead cost should be carefully considered before beginning any volunteer outreach.

## References

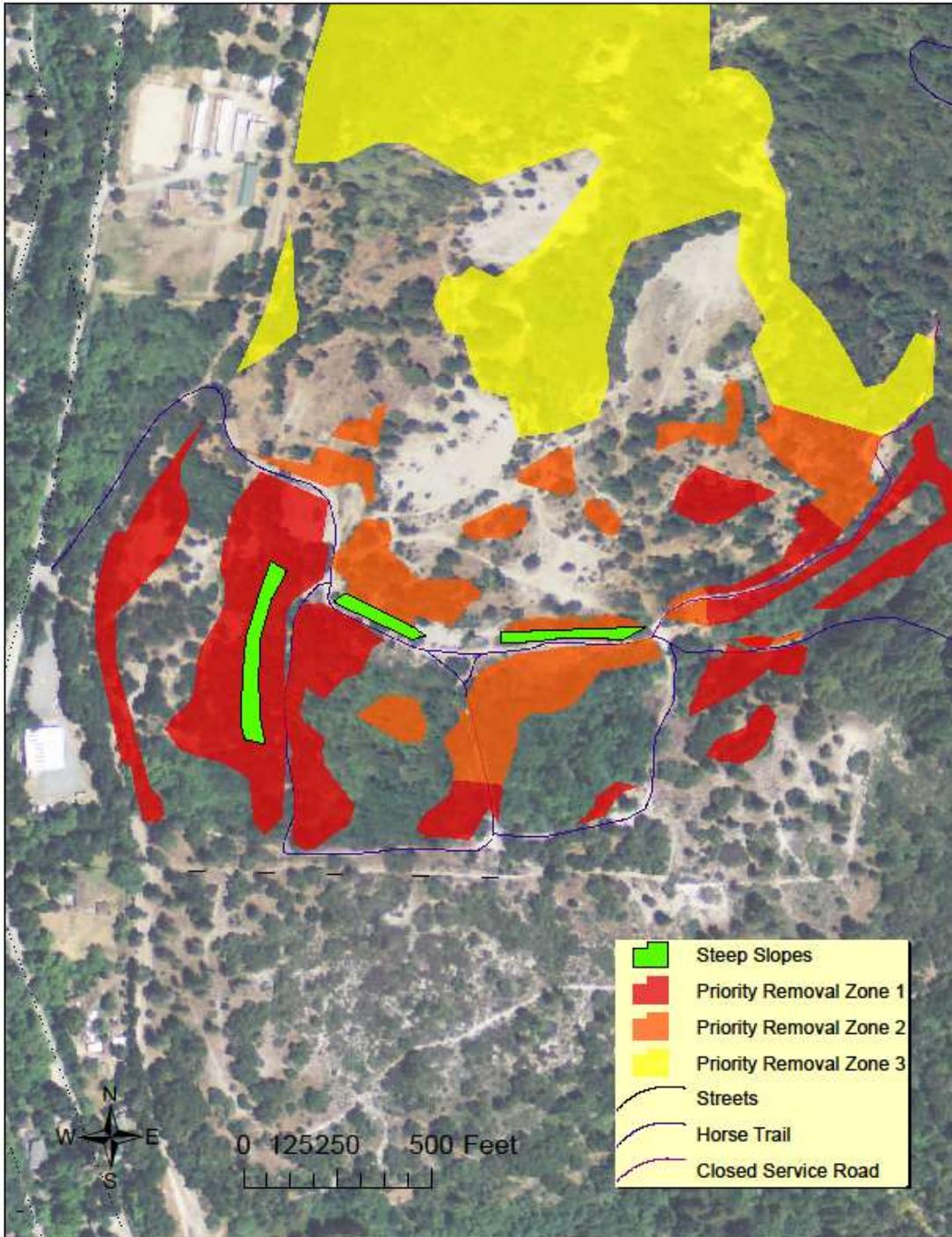
- 1) "Genista monspessulana (French broom)." *Cal-IPC*. California Invasive Plant Council. Web. 11 Nov 2013. <[http://www.cal-ipc.org/ip/management/plant\\_profiles/Genista\\_monspessulana.php](http://www.cal-ipc.org/ip/management/plant_profiles/Genista_monspessulana.php)>.
- 2) Moore, Ken. "Controlling French Broom." *Wildwork*. N.p., n.d. Web. 25 Nov 2013. <[http://www.wildwork.org/webdocs/How\\_to\\_Eliminate\\_French\\_Broom.pdf](http://www.wildwork.org/webdocs/How_to_Eliminate_French_Broom.pdf)>.
- 3) Oneto, S.R. et. al. "How to Manage Pests: Broom." UC IPM Online. UC ANR, n.d. Web. 17 Nov 2013. <<http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74147.html>>.
- 4) Studies:
  - a. Harvey & Stanley Associates, Inc. 1983. Randall Morgan's "Appendices to Analysis of the Loss of Sand Parkland Vegetation at Lone Star Industries' Olympia Quarry, and the Potential for Reestablishing the Sand Parkland Vegetation and Other Options."
  - b. Harvey & Stanley Associates, Inc., 1983; McGraw, 2004; Schettler, 2011 "Identification of Rare and Unique Plant Species"
  - c. Moore, Ken. "Final Project Report" and associated removal projects.
  - d. Schettler, Suzanne. "2012 Sand Specialty Plant Map of the Olympia Watershed"

# Appendix A. Sand Specialty Plant Map

Olympia Wellfield - Preliminary Map: Dense Clusters of Sand Specialty Plants



## Appendix B. Steep Slope Map



**Note:** Steep slope identification was not the primary focus of field investigations. Other slopes may occur on site that require special treatment and should be identified prior to any initiation of removal activities.

## Appendix C. Monitoring Sheet

Sample ID	Species Code	Common Name	Number of Individuals	Reproductive Evidence	Reference Notes
1					
2					
3					
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## Appendix D. Management Timeline

	Preparation	Hand Removal	Flaming Round 1	Flaming Round 2	Photo Monitoring	Removal Site Monitoring	Follow-up Hand Removal
January							
February							
March							
April							
May							
June							
July							
August							
September							
October							
November							
December							
Ideal Management Conditions							
Adaptive Management							

## Appendix E. Labor Estimate by Priority Zone

### **Priority Zone 1**

These areas have the closest proximity to dense sand hills specialty plants, have easy access, and are adjacent to drainage points or roadsides, and should be the highest priority within the property. Combined, they contain roughly 3 acres of land with stand density ranging from medium to high (60-100%). ECI estimates that a well-trained, four man crew, working full eight hour days at removing all French broom from the site would take approximately five days.

### **Priority Zone 2**

Zone 2 contains roughly 8 acres, with 5 to 6 acres of that having medium to high (60-100%) coverage of French broom. Work should focus on proximity to species status species and move outward from those points. ECI estimates that a well-trained, four man crew, working full eight hour days at removing all French broom from the site would take approximately fourteen days.

### **Priority Zone 3**

Zone 3 contains roughly 6 acres, with 2 to 3 of that having low to medium (30-60%) coverage of French broom. ECI estimates that a well-trained, four man crew, working full eight hour days at removing all French broom from the site would take approximately seven days.

### **Priority Zone 4**

Zone 4 contains roughly 20 acres, with a range of coverage throughout. Due to the large size of this zone and the relatively poor access, initial removal of French broom would take an estimated two months to complete.