

**NATURE RESERVE OF ORANGE COUNTY  
EXOTIC PLANT CONTROL PROGRAM  
2008**

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## EXECUTIVE SUMMARY

To address the threat that exotic, invasive plant species pose to native ecosystems, the Nature Reserve of Orange County (NROC) allocated approximately \$260,600 in 2008 for the control of several exotic plant species of management and monitoring concern in the Orange County coastal subregion NCCP/HCP (The Natural Communities Conservation Plan & Habitat Conservation Plan). Exotic plant species targeted for control include artichoke thistle (*Cynara cardunculus*), garland chrysanthemum (*Chrysanthemum coronarium*), veldt grass (*Ehrharta calycina*), tree tobacco (*Nicotiana glauca*), castor bean (*Ricinus communis*), and pampas grass (*Cortaderia selloana*). Exotic plant management entailed prioritizing areas for treatment and controlling targeted exotic species through herbicide application.

Treatment areas included Laguna Coast Wilderness Park (Emerald Canyon, Willow to Big Bend, north of SR 73 and Laguna Creek), Aliso and Wood Canyons Wilderness Park (AWCWP), Buck Gully, the University of California Irvine Ecological Reserve (UCI), City of Irvine Southern Open Space Preserve (North Laguna Canyon, Shady and Bommer Canyons, Bonita Canyon, Muddy Canyon, No Name Ridge and Quail Hill), El Toro Ecological Reserve, Whiting Ranch, and Crystal Cove State Park (CCSP). Treatment for the program began on March 10, 2008 and ended June 2, 2008. In total, treatment required 50 days, with multiple contractors working simultaneously (Nakae 44 days; Nature's Image 11 days; PRG 21 days), and comprised over 2,345<sup>1</sup> acres of occupied habitat.

Prior to monitoring and treatment, sites with potential nesting habitat were surveyed for two species of concern, the California gnatcatcher (*Polioptila californica californica*) and cactus wren (*Campylorhynchus brunneicapillus*). Sensitive species maps were also consulted to avoid impacting additional native plant and wildlife species of concern.

Veldt grass was treated with the monocot selective, post-emergent herbicide Envoy in solution with Tripleline (an adjuvant enhancing herbicide performance). Artichoke thistle was treated with the post-emergent, broad-leaf selective herbicide Transline (chlorpyrid). Artichoke thistle at the University of California Irvine Ecological Preserve was treated with the non-selective glyphosphate Roundup-Pro. Garland chrysanthemum was treated with Roundup-Pro and Transline (at El Toro). Tree tobacco and castor bean were treated with Garlon 4 with the activator-surfactant Oranj-All (enhances herbicide performance). At all sites, all target species within 100 ft of streams or waterways were treated with Aquamaster. In addition, Telar was mixed with Transline, Roundup-Pro and Aquamaster at all treatment locations, excluding the University of California Irvine Ecological Preserve. Telar (sulfuron) prevents maturation of seed embryos and reduces seed viability when applied during the rosette stage. Lastly, Activator 90, a non-ionic, biodegradable surfactant was applied with Transline.

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<sup>1</sup> County crews treated an additional 272 acres of Italian thistle, black mustard and other exotics at Whiting Ranch in 2008.

## 1.0 INTRODUCTION

The Exotic Plant Control Program of 2008, implemented by the Nature Reserve of Orange County (NROC), continued previous efforts seeking the control of invasive exotic plant species of the Orange County coastal subregion NCCP/HCP (The Natural Communities Conservation Plan & Habitat Conservation Plan). Treatment areas comprised over 2,345 acres of invaded habitat and were prioritized in coordination with NROC and The Nature Conservancy (TNC). Treatment areas included: Laguna Coast Wilderness Park (Emerald Canyon, Willow to Big Bend, Laguna Creek, Boat Canyon and Muddy Canyon), Aliso and Wood Canyons Wilderness Park (AWCWP), Buck Gully, the University of California Irvine Ecological Reserve (UCI), City of Irvine Southern Open Space Preserve (North Laguna Canyon, Shady and Bommer Canyons, Bonita Canyon, Quail Hill), El Toro Ecological Reserve, Whiting Ranch, and Crystal Cove State Park (CCSP).

Consistent with programs of the past 10 years, species targeted for herbicide application included artichoke thistle (*Cynara cardunculus*), veldt grass (*Ehrharta calycina*), tree tobacco (*Nicotiana glauca*), castor bean (*Ricinus communis*), pampas grass (*Cortaderia selloana*) and garland chrysanthemum (*Chrysanthemum coronarium*); Italian thistle (*Carduus pycnocephalus*) was treated periodically in past years but was not a target species in 2008.

Exotic plant control activities at Laguna Coast Wilderness Park, AWCWP, Buck Gully, UCI, El Toro Ecological Reserve, and the City of Irvine Southern Open Space Preserve were directed and monitored by Harmsworth Associates under contract to NROC. Treatment at Whiting Ranch and CCSP was supervised and mapped by park staff. Under the supervision of Harmsworth Associates, Nature's Image was contracted by NROC for veldt grass treatment, Nakae and Associates for treatment of artichoke thistle, and garland chrysanthemum and Pacific Restoration Group (PRG), Inc. for treatment of artichoke thistle, garland chrysanthemum, tree tobacco and castor bean at El Toro. PRG has conducted treatment at El Toro for many years and did not require daily monitoring; Harmsworth Associates biologist checked in periodically with the foreman to monitor treatment activity. Prior to treatment, Harmsworth Associate biologists assessed road conditions and treatment areas, mapped treatment areas, and completed sensitive animal and plant surveys. Treatment of exotic species took place in spring 2008 and Harmsworth Associates met daily with Nature's Image and Nakae and Associates crews to supervise all eradication efforts.

### 1.1 Allocation of Funds

Approximately \$260,600 was allocated by NROC for the Exotic Plant Control Program of 2008<sup>1</sup>. Approximately \$175,009 was used for control of artichoke thistle, \$46,691 for veldt grass, \$34,380 for garland chrysanthemum and \$3,620 for both tree tobacco and

castor bean. Pampas grass was treated in two small areas with a portion of the crew and was not quantified.

Treatment for the program began on March 10, 2008 and ended May 30, 2008. In total, treatment required 50 days, with multiple contractors working simultaneously (Nakae and Associates worked 40 days, Natures Image 11 days and PRG 21 days); contracted crews spent 43 days treating artichoke thistle, 12 days treating veldt grass, 18 days treating garland chrysanthemum and two days treating castor bean and tree tobacco.

## **1.2 Objectives**

The long-term goal of treating exotic species on the NROC is to enhance native habitats and biodiversity by reducing cover and density of exotic plant species.

Objectives for reaching this goal include the following:

1. To control priority exotic plants of management and monitoring concern;
2. To reduce exotic plant species of management concern in the Coastal Subregion from greater than 3,000 acres currently to less than 500 acres with minimal weed maintenance by 2015;
3. To monitor and control new invasions of rapidly spreading exotic species;
4. To monitor populations of targeted exotic plant species over time to assess the effectiveness of treatment methods and inform future control effort.

**Table 1:** Summary of Nature Reserve of Orange County activities for exotic plant control in the coastal reserve in 2008. NROC Artichoke thistle, veldt grass, garland chrysanthemum, pampas grass, castor bean and tree tobacco control in the coastal reserve in 2008.

Order of Operations	Site	Total Acreage	Targeted exotics	Treatment History	Herbicide*	Treatment Dates	# of treatment days	Crew size	Funding organization	Oversight
1	Aliso and Wood Canyons Wilderness Park	492	Artichoke thistle, Pampas grass	2005-2008	Transline, Aquamaster	3/10/08-4/1/08	9	1 x 6 man	NROC	HWA
1	LCWP- South of the 73 (Emerald/Bommer/Moro Ridges)	211	Veldt Grass (206 acres) and Artichoke thistle (5 acres)	1999-2008	Envoy, Round-up (polygon 21,22)	3/18/08-4/8/08, 5/14/08	13	1x 11 man	NROC	HWA
2	Quail Hill and north west portion of North Laguna	218	Artichoke thistle	1997-98, 2000-04, 2006-2008	Transline	3/18/08-3/21/08	4	2 x 6 man	NROC	HWA
3	Bommer Canyon and South-West Ridge	299	Artichoke Thistle	2005-2008	Transline, Aquamaster	3/25/08-4/4/08	5.5	1 x 6 man	NROC	HWA
4	Bommer and Hogback Ridge	114	Artichoke thistle	2005-2008	Transline	4/7/08-4/9/08	2.5	2 x 6 man	NROC	HWA
5	Shady Canyon	80	Artichoke Thistle	2005-2008	Transline	4/10/08-4/11/08	2	2 x 6 man	NROC	HWA
6	N of SR 73 (North Laguna, Laguna Creek)	119	Artichoke thistle, Pampas grass	2006, 2008	Transline, Aquamaster	4/15/08	1	2 x 6 man	NROC	HWA
7	Crystal Cove State Park	442	Artichoke thistle	2005-2008	Transline	4/16/08-5/2/08	10.5	2 x 6 man	NROC	CCSP
8	Buck Gully	30	Artichoke Thistle, Garland Chrysanthemum	2003-2005-2008 Polygons 9-15 2007, 2008	Transline, Roundup- Pro	5/5/08-5/7/08	2.5	2 x 6 man	NROC	HWA
9	UC Irvine	64	Artichoke Thistle	Yes	Roundup-Pro	5/10/2008	1	2 x 6 man	NROC	HWA
10	El Toro	181	Artichoke thistle, Italian thistle, tree tobacco, castor bean	Yes	Transline, Aquamaster, Garlon 4, Roundup-Pro	4/17/08-5/30/08	21	1x3 man	NROC	PRG
11	Whiting Ranch	96	Artichoke Thistle	Yes	Transline, Aquamaster	5/7/08-5/15/08	5	2x6 man	NROC	Jennifer Naegle

NROC = Nature Reserve of Orange County; CCSP = Crystal Cove State Park; HWA = Harmsworth Associates

## **2.0 BACKGROUND**

All of the exotic plant species targeted for removal are characterized by their origins in the Mediterranean and African region and an ability to occupy disturbed areas and reproduce quickly. These traits, along with a lack of natural controls and an abundance of historically disturbed sites, have allowed the targeted exotic species to spread rapidly in southern California and out-compete native plants. Along with reducing biodiversity and impairing ecosystem functions, exotic plant populations displace many wildlife species. The practice of using herbicides on invasive exotic plants has gained recognition as a safe, effective, and low-cost means of treatment. Background information on the targeted exotic species and the herbicides used to treat them follow.

### **2.1 Artichoke Thistle**

Artichoke thistle is a spiny, invasive, perennial weed introduced to California from the Mediterranean region during the mid-1800s. Artichoke thistle is found throughout the Coastal and Central Subregions in both native and non-native grasslands, and in the grassland/coastal sage scrub ecotone. Artichoke thistle out-competes native vegetation for light, water, and nutrients. It is well adapted to the climate of southern California and re-sprouts each year from a taproot that can reach a depth of nearly 8 feet (3m). The deep taproot makes artichoke thistle particularly difficult to control with physical methods, such as plowing, mowing, and digging. Artichoke thistle cannot be controlled with biological methods because the plant is closely related to the cultivated artichoke (*Cynara scolymus*). Chemical control is the most effective way to kill artichoke thistle. Treatment experiments have shown that it is best to use Transline® during the rosette stage of development and use Round Up® when the artichoke is mature and bolting. Yearly monitoring and repeat eradication are needed to combat this thistle's ability to re-sprout after chemical spraying and to build up a seed bank that lasts over 5 years.

### **2.2 Garland Chrysanthemum**

Garland chrysanthemum is an annual forb that reproduces prolifically from seed. It invades disturbed areas, grasslands, and increasingly, coastal sage scrub. Physical control includes hand-pulling plants before the seeding period, but that is labor intensive. Biological controls are not known. Herbicide treatment with Transline and Aquamaster were used to control garland chrysanthemum.

### **2.3 Veldt Grass**

In 1992, the Nature Conservancy (TNC) first documented veldt grass in upper Emerald and Moro Canyons of the Coastal Orange County NCCP Subregion. At this time, it covered approximately three acres. Veldt grass is an exotic, warm season perennial grass, restricted to areas with sandy soils. Veldt grass is native to southern Africa and it was introduced to Australia, where it was eventually brought to California for

experimental research conducted by the University of California at Davis. It was also promoted for forage improvement, slope stabilization, erosion control during the 1950s and 1960s. Veldt grass seeds are dispersed by wind and invasion is exacerbated by disturbance. The invasion of veldt grass into native shrub communities causes a rapid shift toward exotic grassland. The more open the original vegetation, the more rapid the invasion occurs. The species spreads readily into disturbed areas (i.e. roadsides) and from there into openings between shrubs. Once established, veldt grass inhibits or prevents germination and establishment of native species (Bossard *et al.* 2000).

Grass invasions have been shown to alter fire cycles, causing more frequent fires that favor the recovery of grasses over shrubs. Veldt grass creates a dense thatch during summer months, as the plant dries and the stems and leaves lean over. In addition to providing excellent fuel, this thatch may interfere with the germination and establishment of native plants during the fall and winter (Bossard *et al.* 2000).

Physical control is labor intensive and comes with mixed success. Removal by hand probably stimulates germination from the seed bank and manual removal must be repeated as plants emerge from the seed bank. Studies show that prescribed burning increases the invasiveness of this species. There are no biological control efforts for veldt grass. Chemical control is the most effective way to kill veldt grass.

### **3.0 SENSITIVE PLANT AND ANIMAL SURVEYS**

Rare and sensitive plant surveys were conducted at each site prior to treatment efforts. Rare plants and sensitive habitat areas were identified with bright colored flagging and therefore avoided by work crews. Native needlegrass grasslands were avoided when the area contained no other exotics. In addition, crew activity and footpaths were monitored daily to minimize overall disturbance to needlegrass grassland and coastal sage scrub (CSS) communities.

Harmsworth Associates biologist, Brian Karpman, conducted California gnatcatcher (*Polioptila californica californica*) and cactus wren (*Campylorhynchus brunneicapillus*) surveys at all treatment areas where CSS was present. California gnatcatchers were observed at all sites; however, cactus wrens were observed only at the University of California Ecological Reserve. Areas occupied by cactus wren nests were flagged off and avoided to eliminate any impact by weed control activities. Additionally, no California gnatcatcher or cactus wren nests were located within the immediate treatment areas or impacted by treatment events.

## 4.0 METHODS

Under the Exotic Plant Control Program of 2005, treatment areas were organized into numbered polygons that were subsequently utilized for treatment in 2006, 2007 and 2008. Location and size of polygons were determined by topography, the presence of fence lines or roads, and the amount of treatment completed in one day. All polygons were mapped and photographed to monitor treatment efforts. Percent cover of exotics, amount and type of chemical used, total acreage treated, crew size, and total hours were recorded once a day in each polygon under treatment. Percent cover per polygon was recorded within six different cover classes. In total, 2,073 acres of artichoke thistle, 168 acres of garland chrysanthemum, 206 acres of veldt grass, and approximately 30 acres for tree tobacco and castor bean, were treated with appropriate herbicides (Table 2).

**Table 2: Total Treatment Acres in 2008 by Cover Class**

Cover Class	1 (~1%)	2 (2-10%)	3 (10-20%)	4 (20-30%)	5 (30-50%)	6 (>50%)	TOTAL ACRES
<b>AWCWP (AT)</b>	317	100	44	16	8	7	492
<b>Buck Gully (AT)</b>	5	2	1	9	0	0	17
<b>Buck Gully (GC)</b>	12	0.3	0	0	0	0	12.3
<b>LCWP (VG)</b>	113	69	21	5	0	0	206
<b>CIOSP (AT)</b>	412	154	81	29	23	45	744
<b>UCI (AT)</b>	58	6	0	0	0	0	64
<b>Quail Hill (AT)</b>	164	29	12	13	0	0	218
<b>El Toro (GC)</b>							151
<b>El Toro (CB, TT)</b>							30
<b>CCSP (AT)</b>		263		174		5	441
<b>Whiting ranch (AT)</b>				96 <sup>2</sup>			96
<b>Total AT</b>	956	554	138	242	31	57	2,073
<b>Total Veldt Grass</b>	113	69	21	5	0	0	206
<b>Total GC</b>	12	0.3	0	0	0	0	12.3
<b>TOTAL ACRES</b>	1,081	623.3	159	147	31	56.5	2,345

AT=artichoke thistle, GC=garland chrysanthemum, TT= tree tobacco, CB=castor bean

### 4.1 Herbicide Use

A foliar spray application method was used for all herbicides; both the foliage and base of target weeds were sprayed. Easily accessible areas with high percent cover of target weeds were sprayed with a hose directly from a truck. In areas with limited access, the spray crews used individual five-gallon backpack tanks. Backpack tanks were also used in needlegrass grasslands and in areas with low percent cover of exotics.

<sup>2</sup> Percent cover/cover class was not calculated at Whiting Ranch. 20-30% is an estimate of the average % cover.

Favorable weather conditions for maximum uptake and effectiveness of herbicides include the following: high irradiation, low humidity, wind speed less than five mph, and a minimum ambient temperature of 65 F. In general, weather conditions in winter and spring of 2008 met these criteria. Treatment was cancelled when conditions were overcast and the likelihood of precipitation was greater than 50%, or when wind speed exceeded five mph.

Veldt grass was treated with the monocot selective, postemergent herbicide Envoy in solution with Tripleline (an anti-foaming adjuvant enhancing herbicide performance). Envoy was applied at a concentration of one gallon per acre (1%). Envoy was used on a test plot at Big Bend in Laguna Coast Wilderness Park in 2004 and proved to be more effective at killing veldt grass than Fusillade (Weinberg 2004). This was the fourth year Envoy was used on a large scale to control veldt grass in the NCCP coastal subregion. Veldt grass in polygons 31 and 9 (along road) missed treatment in early spring and was treated with glyphosate on May 14 by Nakae and Associates.

Artichoke thistle was treated with Transline. Transline, or clopyrid, is a broadleaf-selective herbicide that does not affect grasses or other monocots. The presence of purple needlegrass (*Nassella pulchra*) and native bulbs in the understory of artichoke thistle in many areas prioritized for treatment raised concern about the use of the non-selective herbicide Round Up at these sites. Comparative treatments of Transline with Telar and Roundup-pro with Telar at a small test site proved Transline more effective in reducing artichoke thistle cover without harming native grasses or bulbs (TNC 2002). Treatment with Transline is most effective when conducted in the early spring when artichoke thistle is still in the rosette stage, before the flower stock bolts. Transline was applied at a concentration of 24 ounces per 100 gallons of water (0.18% solution).

Artichoke thistle at the University of California Irvine Ecological Preserve was treated with the non-selective glyphosphate Round-Pro at a concentration of three gallons per acre (3%). Roundup-Up Pro, or glyphosate, is a non-selective contact herbicide. With Roundup-Pro, in contrast to Transline, artichoke thistle is sprayed when the flower stock is bolting, which is the time of maximum growth for the plant. With the use of Roundup-Pro, it commonly take two to three years to control artichoke thistle in a given area, as plants during the first year of treatment show a 40 to 90% mortality rate.

At El Toro, garland chrysanthemum was mistakenly treated with Transline. These areas were re-treated with Round-up. Artichoke thistle was treated with Transline and tree tobacco and castor bean were treated with Garlon 4.

At Buck Gully and Aliso and Wood Canyons Wilderness Park, all target species within 100 ft of streams or waterways were treated with Aquamaster. In addition, Telar was mixed with Transline, Roundup-Pro and Aquamaster at all treatment locations, excluding the University of California Irvine Ecological Preserve, at a concentration of 3oz per acre (0.025%). Telar, or Sulfuron, reduces seed viability when applied during the rosette bloom stage of a plant's growth. It prevents maturation of seed embryos and can be safely mixed with Transline® or Roundup-Pro®. Lastly, Activator 90, a non-ionic,

biodegradable surfactant was applied with Transline and Oranj-All, a d-Limonene surfactant, was applied with Garlon 4.

## **5.0 TREATMENT LOCATIONS**

Treatment locations for spring 2008 included Laguna Coast Wilderness Park (LCWP), Aliso & Wood Canyons Wilderness Park (AWCWP), Buck Gully, University of California Irvine Ecological Reserve (UCI), the City of Irvine Open Space Preserve including North Laguna Canyon and Quail Hill, Whiting Ranch, El Toro Ecological Reserve and Crystal Cove State Park (CCSP) (Appendices 7.0-7.6).

### **5.1 Laguna Coast Wilderness Park**

In LCWP, 206 acres of veldt grass were treated with a total of 12.5 gallons of Envoy and 0.24 gallons of Round-Up over a period of 12 days (March 18 through April 1 and April 14, 2008). Control of veldt grass in LCWP has taken place for the past 9 years and 2008 was the fourth year utilizing the herbicide Envoy. In an effort to treat veldt grass during peak productivity and prior to output of reproductive structures, treatment was conducted in early spring in 2008. Treatment began on March 18 continuing through April 1 with an additional day on April 14. Veldt grass was treated along roads including: Bommer Ridge, Willow Canyon, Emerald Ridge, Moro Ridge, Moro, Emerald and Laurel Canyons, and Big Bend. Veldt grass treatment also occurred along "BVD" and "Razor" trails (Razor is an illegal trail parallel to the toll road) and below the water tower east of Laguna Canyon Road. Veldt grass along Razor trail and Laurel Canyon road was treated with Round-up. Approximately one half (113 acres) of treatment areas contained less than or equal to one percent overall cover of veldt grass, 69 acres contained 2-10% cover, 21 acres contained 10-20% and approximately five acres had 20-30% cover of veldt grass.

Rainfall was again below average in Laguna Beach during the rainfall season of 2007/2008 (July 1- June 30) with overall precipitation totaling 7.3 inches; following the previous season's record drought of only 5.08 inches compared to the yearly average of 12.71 inches (Western Regional Climate Summary). Although precipitation was meager, much of it was concentrated in January and February leading to good conditions for seedling germination. Percent cover of veldt grass had decreased substantially during last seasons (2006/2007) drought, but the seed bank in previously high density areas persisted. An overall increase in new biomass of veldt grass was observed in 2008. Seedlings were abundant in CSS-grassland ecotone areas with long treatment histories (particularly polygons 1-5). Most of the veldt grass treated in years prior did not resprout; the increase in percent cover in spring 2008, as compared to previous years, was due primarily to seedling recruitment.

Veldt grass along the highly used upper Laurel Canyon Road continued to slowly spread down hill along the roadside. Veldt grass was found in a few scattered locations along illegal Razor Trail. One new population of veldt grass was located and removed by Trish Smith in clay soils along Moro ridge in Spring 2008. No further new recruits were found outside of the previously mapped treatment areas in LCWP.

Observations within TNC veldt grass monitoring plots at LCWP showed an increase in veldt grass biomass from 2007 surveys; all veldt grass individuals observed in 2008 were seedlings. A previously rarely used trail at Big Bend was expanded in 2007 and is now frequently used. The trail head occurs directly in the middle of a small population of veldt grass that was close to complete control in 2007. Percent cover increased at Big Bend in 2008 to 10%. Veldt grass in the Big Bend area was found in the same locations as past years and did not appear to be spreading down the road or trail. New veldt grass invasions are largely found along roads, wildlife trails, and illegal mountain biking/hiking trails in LCWP. To maximize benefits of the Exotic Plant Control Program, additional control efforts to reduce new invasions should be implemented by LCWP. These measures should include closing illegal trails and minimizing disturbance adjacent to all conduits.

#### *Sensitive Plant and Animal Surveys*

Catalina mariposa lilies (*Calochortus catalinae*) were again observed in several previously mapped locations. No veldt grass occurred in the immediate vicinity surrounding these populations.

California Gnatcatchers were observed along the east side of lower Emerald Canyon Ridge Road, Moro Ridge and near the toll road. No nests were detected within the treatment area and no treatment was conducted in the vicinity of the gnatcatchers. Spadefoot toads (*Spea hammondi*) and associated breeding pools were located along Bommer Ridge Road north of Moro Ridge and outside of the treatment area. No treatment was conducted within 100 feet of the breeding pools.

## **5.2 Aliso and Wood Canyons Wilderness Park**

At the request of County Park Rangers, postings with chemical information and treatment dates were placed at all public access points at AWCWP prior to treatment in both 2007 and 2008.

Exotic plant species treated at AWCWP included artichoke thistle and pampas grass. Italian thistle was treated in 2005 and 2006 but was not a priority target species in 2008. No garland chrysanthemum was observed in 2007 or 2008 in areas where it occurred in previous years. Treatment began March 10 and ended April 1, totaling 8.5 days. Due to the early treatment date, many artichoke thistles were small seedlings and difficult to locate in the fast growing annual grasslands. Artichoke thistle was treated with the broad-leaf selective herbicide Transline with Telar, and Aquamaster within 100 ft of waterways.

Several pampas grass clumps (on the east side of Woods Canyon in polygon 24) were treated with Aquamaster.

A total of 37 polygons totaling approximately 492 acres were treated for invasive plant species throughout the park. Most previously treated locations in AWCWP were treated again in 2008. Polygon 30 and the majority of polygon 21 were not treated in 2008; no artichoke thistle was seen in these polygons in 2007 or 2008 (excluding the west/uphill side of polygon 21 which received treated).

Percent cover of Italian thistle remained low in most areas due to treatment in 2005 through 2007. It remains unclear if the treatment application rendered all seeds unviable, or if they were unable to germinate due to drought (Harmsworth Associates 2007). Other invasive plant species at AWCWP include: pampas grass, tocolote (*Centaurea melitensis*), which occupies CSS edges, roadsides, and disturbed areas; black mustard (*Brassica nigra*), which dominates the hillside of non-native grasses south of Meadows Trail; and poison hemlock (*Conium maculatum*), which occupies the riparian corridor through Wood Canyon and is prevalent along the east side of Aliso Creek. Pampas grass was treated with Aquamaster in polygon 24 in 2008.

#### *Sensitive Plant and Animal Surveys*

Nesting California gnatcatchers were observed in several areas throughout AWCWP. No chemical treatment was conducted within 100 ft of California gnatcatcher nests. Catalina mariposa lilies (*Calochortus catalinae*) were prevalent in the large meadow along Meadow's Trail in polygon 18 (approximately 60 individuals), polygon 31 (30 individuals) and in polygon 26 (22 individuals).

### **5.3 Buck Gully**

Artichoke thistle and garland chrysanthemum were treated at Buck Gully with the herbicides Transline and Roundup-Pro with Telar on May 5-7. All previously treated polygons were treated in 2008. Artichoke thistle cover ranged from 1-30%, reduced from 30-90% cover in polygons 8-16. Garland chrysanthemum percent cover remained low in each polygon with no additional recruitment in the reserve. Percent cover of garland chrysanthemum decreased from 90% in 2005 to 40% in 2006 to less than 1% in 2007 (likely a combination of chemical treatment and drought) then increased to 10% in some areas in 2008. A total of 12.3 acres of garland chrysanthemum and 17.2 acres of artichoke thistle were treated at Buck Gully in 2008. Only small portions of the 12 acres treated for garland chrysanthemum required treatment; the acreage remains at 12 because that is the size of the original population and is the designated treatment area. Tocolote (*Centaurea melitensis*) remains a problem weed throughout Buck Gully.

#### *Sensitive Plant and Animal Surveys*

No special status birds or plant species were observed near the treatment areas in Buck Gully. California gnatcatchers could be heard occasionally but were located east of the treatment areas.

#### **5.4 University of California Irvine Ecological Reserve**

Sixty-four acres of CSS with scattered patches of artichoke thistle were treated at UCI on May 10, 2008 with the herbicide Roundup-Pro. No Telar was used per the Reserve Manager's (Dr. Peter Bowler) request. Signs were placed on all entry/exit points one week prior to treatment to notify the public of the treatment dates and provide information on the herbicide Roundup-Pro.

Distribution of artichoke thistle in polygon one remained similar to 2007 with scattered seedlings totaling approximately 1% cover throughout the polygon. Only a few scattered plants remain in the northern half and along the western fence line. Polygon two had several small patches of seedlings concentrated on the western half of the polygon comprising <5% total cover with isolated plants in the eastern half of the polygon; the southwest portion of the polygon contained patches with up to 10% cover (percent cover in 2005, 2006 and 2007 was up to 100%, 75%, and 50%). Percent cover near the TNC monitoring plot in polygon 2 decreased substantially from approximately 30% in 2006 to 1% in 2007 and again 1% in 2008.

##### *Sensitive Plant and Animal Surveys*

Several active cactus wren and California gnatcatcher nests were located within the reserve. A 100 ft buffer zone was established around each nest and the spray crew avoided these areas.

#### **5.5 City Of Irvine Open Space Preserve**

A total of 754 acres in the City of Irvine Open Space Reserve were treated for artichoke thistle in spring of 2008. Areas treated included: Hogback/Bommer Ridge, Serrano Ridge, Bommer Canyon, North Laguna Canyon, Shady Canyon, Bonita Canyon, Sand Canyon and Quail Hill and two new areas (polygons 40 and 41) on the east side of Sand Canyon Road. The new polygons comprised a total of 28.7 additional acres.

##### *Hogback/Bommer Ridge*

Hogback/Bommer Ridge is principally composed of needlegrass grassland bordered by CSS with patches of exotic annual grassland. A total of 114 acres of artichoke thistle were treated along Hogback/Bommer Ridge within the City of Irvine Open Space Preserve on April 7-9, 2008. Hogback Ridge connects to Bommer Ridge on its west end and runs north, perpendicular to the 73-toll road. Hogback/Bommer ridge was treated in 1997-2002 and again from 2005 to 2008 (TNC 2002, 2003, Weinburg 2004, Harmsworth Associates 2005, 2006, 2007). Hogback/Bommer Ridge was not treated in 2003 and 2004 and polygon one was untreated prior to 2005.

Percent cover of artichoke thistle varied along Hobgack/Bommer Ridge in Spring 2008. Artichoke thistle density in polygon 2 was reduced slightly but remained high with patches up to 50% (up to 90% in 2006). Polygon 4 (southern portion of the ridge closer to the toll road) had been treated in previous years and was devoid of artichoke thistle with the exception of scattered seedlings along the northern edge. No artichoke thistle was located in polygons 5, 6 and the southern portion of polygon 4.

Percent cover of artichoke thistle in the lower, northern end of Bommer Ridge (polygons 1 and 2) was reduced and seedlings accounted for new biomass of 30-50% cover (polygon 2). An illegal trail runs east from polygon 3 ending in Shady Canyon, north of the turtle pond. Small isolated patches of artichoke thistle seedlings, mostly in the western and eastern ends of the trail, were treated in stands of cactus scrub and needlegrass grassland (polygons 3 and 10).

Black mustard increased in percent cover and distribution along Hogback Ridge in 2008. Artichoke thistle seedlings were difficult to locate in the dense patches of black mustard which dominated the ridgeline in polygons 2, 3 and 4. The greatest increase of black mustard occurred along the ridge road in polygons 2 and 4.

#### *Sensitive Plant and Animal Surveys*

No special status plant or animal species were observed along Bommer/Hogback Ridge near treatment areas.

### **Bommer Canyon**

Artichoke thistle in Bommer Canyon has been treated annually since 1998 (excluding 2005). The ridge west of Bommer Canyon, north of the 73, has been treated periodically within that time but was not overseen by Harmsworth Associates until 2007 and 2008. Treatment for both areas lasted six days, from March 25 through April 14, 2008. Transline with Telar was used on all artichoke thistle plants in Bommer Canyon. Plants were sprayed from backpack tanks and hoses on a truck.

While percent cover of artichoke thistle remained very low in many areas (polygons 24, 25, north half of 21, and the southern portion of 42), some areas experienced a population increase resulting from prolific seedling germination (upper/southern side of polygon 21, east end of 42 and upper portions of 22 and 23). Most areas had received previous chemical treatments, however treatment history for some invasions was unknown (western portion of polygon 42). No artichoke thistle was found in previously treated needlegrass grassland and annual grassland, on the east side of the reserve in polygons 24, 25, and 26; these areas received no treatment in 2008.

#### *Sensitive Plant and Animal Surveys*

No special status animal species were observed in Bommer Canyon or along the western ridgeline near treatment areas. Many-stemmed dudleya (*Dudleya multicaulis*), a CNPS list 1B.2 special status plant, was located just north of treatment areas in polygon 23 on a sandstone outcrop. Approximately 25 individuals were observed.

### ***North Laguna/Shady Canyon/Serrano Ridge***

Artichoke thistle was treated on April 10-15, 2008 in the North Laguna/Shady Canyon area. Exotic plant eradication efforts have taken place at North Laguna Canyon annually since 2001, except in 2005. Serrano/Shady Spur and Shady Canyon have been treated for six years. At North Laguna, two new polygons (40, 41) were treated totaling an additional 28.7 acres (polygons 40 and 41 were treated March 19-21 totaling 2 days). Plant communities treated varied from needlegrass grassland, annual grassland, and CSS/grassland ecotone. Much of North Laguna continued to have low percent cover of artichoke thistle due to previous herbicide treatments with patches of higher density in scattered pockets.

Most treatment areas had scattered isolated artichoke thistle seedlings and low percent cover (< 1% in polygons 10, 11, 12, 15, 16, 17, 18 19, 20). The highest percent cover of artichoke thistle occurred in the new polygon 41 (20-100% cover) in the northern portion of the reserve just east of Sand Canyon Road. Overall, percent cover decreased or remained the same (due to seedling recruitment) in all polygons.

### ***Sand Canyon/Quail Hill***

Artichoke thistle was treated with Transline and Telar at Quail Hill from March 18-21, 2008. Percent cover in 2008 was greatly reduced in most treatment areas compared to 2007. Dense annual grasses and black mustard made it difficult to locate small seedlings at Quail Hill (the same was true for many treatment locations in early spring when the rosettes were very small). A total of 218 acres were treated at Quail Hill; 75% of the acreage (164 acres) on Quail Hill contained less than one percent cover of artichoke thistle in 2008.

## **5.6 Crystal Cove State Park**

Artichoke thistle was treated with the herbicide Transline at CCSP over a period of 10.5 days (April 16-May 2, 2008) covering 442 acres. Harmsworth Associates did not oversee or monitor weed control activities in CCSP. CCSP resource management staff conducted the weed control monitoring while Nakae and Associates conducted actual weed treatment. Boat Canyon was not treated in 2008.

## **5.7 Whiting Ranch**

Approximately 96 acres of artichoke thistle were treated with the herbicide Transline at Whiting Ranch from May 7-15, 2008 totaling five days of treatment. Harmsworth Associates did not oversee or monitor weed control activities at Whiting Ranch. Whiting Ranch resource management staff conducted the weed control monitoring while Nakae and Associates conducted actual weed treatment. An additional 272 acres of invasive weeds were treated at Whiting Ranch by the county of Orange in 2008; these areas were

not included in this report. Only artichoke thistle treated by NROC and monitored by Jennifer Naegle was included.

### **5.8 El Toro Ecological Reserve**

Artichoke thistle, garland chrysanthemum, tree tobacco and castor bean were treated at El Toro from April 17 through May 30, 2008, totaling 21 days of treatment. Artichoke thistle and garland chrysanthemum were treated with Transline with Telar and Round-up Pro, and tree tobacco and castor bean were treated with Garlon 4. Garland chrysanthemum has been treated in the past with Round-up Pro and crews used Transline instead of round-up for 10 days (PRG was told to use round-up, and always have in the past). Areas with low mortality were re-sprayed with Round-up Pro by the contractor (Pacific Restoration Group-PRG). PRG has been conducting weed treatment at El Toro for many years and received limited oversight by Harmsworth Associates biologist. Approximately 181 acres were treated at El Toro in 2008; 30 acres of castor bean and tree tobacco and approximately 150 acres of garland chrysanthemum (artichoke thistle was scattered and isolated).

## **6.0 CHALLENGES**

Rainfall and seedling growth rate varies from year to year. In 2008, rainfall was average in January and February and seedlings were abundant on the March 10 start date. Treatment of artichoke thistle seedlings growing in annual grasslands was especially difficult in 2008 due to abundant non-native forbs (black mustard) and grasses. An additional and reoccurring challenge rose again in 2008 during veldt grass treatment. It is important to begin treatment early enough to prevent seed maturation, but with early treatment, seedling grasses are missed. In order to effectively control veldt grass, an early and late season treatment would be most effective and would save time (crews would not have to search so hard for seedlings). Eleven days (the budget for Natures Image) was insufficient; some of the budget for artichoke thistle needs to go toward veldt grass in order for treatment to be successful. After Nakae & Associates finished artichoke thistle treatment, they spent one day treating veldt grass that had missed treatment. Because Nakae had no prior experience treating veldt grass, the biologist had to be present for the entire treatment. An increased budget for veldt grass would alleviate this problem.

Posting signs and informing the public at UCI and parks proved effective in providing information to the public and in alleviating public concerns regarding the use of chemicals in these public access areas.

## 7.0 RECOMMENDATIONS

- Utilize and expand volunteer programs to assist in management and eradication of garland chrysanthemum in Buck Gully
- Initiate outreach program in LCWP and CCSP to form veldt grass “watch group” to train park users to identify veldt grass and alert reserve managers of new populations
- Early (February and early March) and late (April-early May) season treatment of veldt grass to control emerging seedlings that were not visible or not yet established early in the season
- Continue to ensure that spray crews apply sufficient herbicide to large, mature artichoke thistle rosettes to increase mortality
- Continue to inform public of spraying activities on park property notice boards and public websites
- Work with LCWP reserve managers to close illegal trails (Razor and Big Bend) that promote the spread of veldt grass
- Increase veldt grass treatment contractor budget to 15 days to ensure sufficient early and late season treatment

## 8.0 REFERENCES

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**9.0 APPENDICES**

**9.1 Appendix A: Exotic plant control summary 2008.**

SITE	TREATMENT		TARGET WEEDS <sup>1</sup> / CHEMICAL	COST PER DAY/ TOTAL COST	SUMMARY AND RECOMMENDATIONS
	DATES	TOTAL DAYS			
Emerald and Bommer Ridges, Big Bend trail and the water tower	March 18 – April 8 and May 14	12	V/Envoy V/Roundup-Pro	\$4,059 \$41,922	Increase in percent cover of veldt grass from 2007. Veldt grass seedlings were abundant in areas with high percent cover histories. Most previously treated veldt grass clumps treated in 2006 and 2007 did not resprout. More days were needed to complete veldt grass treatment. Nakae’s crew spent May 14 treating missed areas with roundup (polygon 21 and Laurel Canyon Road). An increase of 3 to 4 days and an early and late season treatment for veldt grass would improve eradication efforts.
Crystal Cove State Park	April 16 – May 2	10.5	A/Transline with Telar	\$4,091 \$61,361	CCSP rangers conducted treatment oversight.
Bommer Canyon and south-west ridge above residences	April 4	1	A/Transline with Telar Aquamaster	\$4,091 \$24,366	Patches of very high density artichoke occurred on north facing slopes along the south side of upper and middle Bommer Canyon. A heavily infested, previously untreated (treatment history unknown) north facing slope on the west side of polygon 42 contained nearly 100% cover of seedlings. However, many areas had a reduction in artichoke thistle cover including the lower (northern) portions of 22 and 23; polygons 24 and 25 had no artichoke thistle and were not treated in 2008.
Bommer and Hogback Ridge (north of the 73 tollroad)	April 7-9	3	A/Transline with Telar	\$4,091 \$12,273	Overall percent cover was reduced from previous years but still remains high (30-50%) in patches in polygon 2. For reasons unclear, artichoke thistle control along Hogback Ridge is taking longer than in other areas. Black mustard density increased along the entire ridge in 2008 increasing the difficulty in locating and treating artichoke thistle.
Whiting Ranch	May 7-15	5	A/Transline with telar	\$4,091 \$20,455	Whiting Ranch staff Rangers conducted treatment oversight at Whiting Ranch.
Shady Canyon, North Laguna, Laurel Canyon, Serrano Ridge and Bommer Ridge south of 73 tollroad	April 10 - 14	4	A/Transline with Telar	\$4,091 \$16,364	Completed all known invaded areas in Shady Canyon, North Laguna, along Serrano Ridge, (including patches along upper Laurel Canyon), the meadow at the bottom of Emerald Ridge, and patches along Moro and Bommer Ridges. Two new polygons (40, 41) in the northwest section of the reserve, east of Sand Canyon Road, were treated in 2008. Overall percent cover north of the 73 toll road remained low with increases a result of seedling recruitment.

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University of California Irvine Ecological Preserve	May 9	1	A/Ranger-Pro	\$4,091 \$4,091	Percent cover remained low throughout reserve. Higher density in southwest corner. Persistent seedbank from previous years near depletion due to development of adjacent properties
Aliso and Wood Canyons Wilderness Park	March 10 - 28	9	A/Transline with Telar P/Aquamaster	\$4,091 \$36,819	All known patches of artichoke thistle and a few pampas grass invasions were treated with Transline or Aqua Master (100 ft from creek); pampas grass was treated with aquamaster. Treatment began early and artichoke thistle seedlings were small making locating them in dense annual grasses and exotic forbs difficult. Percent cover increased in some polygons because of prolific seedling recruitment (polygons 34 and 35-2008 was the 3rd year of treatment for these polygons). Overall, percent cover decreased or remained the same in polygons which have received regular treatment. No garland chrysanthemum was observed at AWCWP in 2008. Pampas grass was treated with Aquamaster in polygon 24.
Buck Gully	May 5 - 7	2.5	A/G	\$4,091 \$10,228	Garland chrysanthemum and artichoke thistle were treated along truck trails with roundup and Transline respectively. GC percent cover remained low with less than one percent in polygons 1, 3, and most of 2; the bottom portion of polygon 2 had 10% cover.
El Toro	April 17 – May 30	21	A/G/T/C/Transline with Telar Roundup-Pro Garlon 4	\$1,810 \$38,000	Pacific Restoration Group treated garland chrysanthemum, tree tobacco, castor bean and artichoke thistle. Harmsworth Associates conducted minimal oversight. Garland chrysanthemum rebounded in 2008 invading over 150 acres at El Toro. Artichoke thistle was scattered infrequently throughout the reserve and was treated with Transline. Approximately 30 acres of tree tobacco and castor bean were treated with Garlon 4.
Quail Hill	March 18 - 21	3	A/Transline with Telar	\$4,091 \$12,273	Percent cover was reduced from previous years but remained high in some areas (particularly west of the water tower). Tall black mustard and exotic grasses made locating rosettes difficult. Especially above (south of) the water tower. Percent cover in southern and western portions remained low (< or = 1%).

A= artichoke thistle, G= garland chrysanthemum, V= veldt grass, T=tree tobacco, C=castor bean, P=pampas grass

**9.2 Appendix B: Aliso & Woods Canyon Wilderness Park exotic plant treatment 2008. Treatment dates: March 10-April 1, 8<sup>th</sup> Year of Chemical Treatment.**

Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
1	CSS/mulefat scrub; weedy along the roadside. No artichoke thistle or garland chrysanthemum in 2008. Patches of Italian thistle.	14.57	A/ Transline with Telar/ Aquamaster	0%	1	50%	CSS /mulefat scrub	sandy loam	flat to 10% /west facing	Scattered artichoke and Italian thistle in 2007. Only Italian thistle 2008. Very weedy (Hemlock, mustard, tocolote along road).
2	Needlegrass grassland with high density Italian thistle in patches throughout polygon in 2007; reduced in 2008. Some of the most diverse, high quality grassland at AWCWP in upper (southern) portion of polygon. Exotic annual forbs and grasses compose about 20% of grassland.	43.22	A/ Transline	1-50%*	1-6	35%	Needlegrass grassland		2-10% north/ NW	Scattered artichoke thistle in 2008. A few small patches along eastern border of polygon.
	Second year treating Italian Thistle was 2007. Did not treat it in 2008.		I	<1%	1					
3	Upper Mathis trail; nice needlegrass grassland bordered by CSS; abundant wildflowers ( <i>Liliaceae sp.</i> Dominant).	4.54	A/ Transline	<3%	2	85%	CSS/ needlegrass grassland ecotone	sandy loam	0-5% / SE	Slight increase from last year. Seedlings along trail and in grassland. Artichoke 85% in 2005, 10% in 2006, 2% 2007, 2008 up to 5%.
4	Upper Mathis trail	5.4	A/ Transline	5%	2	90%	Needlegrass grassland	sandy loam	1 5%/E	Decreased from first year treatment 20-50% in 2005.
5	On the south side of the Mathis trail; grassland patch in CSS.	2.96	A/ Transline	0%	1, 2	90%	Needlegrass grassland	sandy loam	0-5%	Decrease in artichoke from 75% in 2005 to 0% in 2006. Still at 0% in 2008.

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Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
6	Mid-Mathis on north side of trail	2.57	A/ Transline	40% Branig, 10% artichoke, 1% Italian	2 A 1 I	20%	Needlegrass grassland	sandy loam		In 2005 this was nice needlegrass grassland with wildflowers and Italian thistle. In 2006 dominated by black mustard and Italian thistle with a native understory. 2007 had fewer exotics and fewer natives -poor year for both natives and exotics. 2008 had higher percentage of artichoke and black mustard.
7	Lower Mathis Trail. Only a few scattered Artichoke thistles. Lower portion of polygon reaches small drainage with rushes <i>Juncus</i> sp. and 100% exotic annual grassland.	3.91	A/ Transline & Aquamaster	10%	2	15%	Annual grassland, juncus marsh land, needlegrass grassland	sandy loam	0-10% South	Weedy area. Artichoke present only at west end of polygon. Aquamaster used near drainage and freshwater marsh.
	First year treatment 2006. Did not treat in 2007 or 2008.		I	0%	1			sandy loam		Dead Italian thistle thatch remains from 2006 treatment. Italian thistle cover remains low.
8	Lower Mathis. Native grassland with scattered scrub. Small area with scattered artichoke.	4.07	A/ Transline	1-20%	1-3	50%	Needlegrass grassland/ CSS ecotone			Increase of artichoke thistle seedlings from 2007 in north end of polygon. Weedy annual grasses and black mustard throughout needlegrass grassland/CSS ecotone.
9	Lower Mathis and bottom of Oak grove trail. Exotic annual grassland bordered by riparian habitat along flowing creek. Very large patches and high % cover Italian thistle beneath Oaks and sycamores.	4.59	A/ Transline & Aquamaster	0%	1	low*	riparian/ annual grassland			*Percent natives in grassland is zero but overstory in riparian is 100% native sycamore/coast live oak riparian forest.

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Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
	One year of treatment in 2006.		I	0%	1					Italian thistle thatch remains-no new Italian thistle.
10	Native grassland surrounded by CSS just below ridge road south of water tanks	1.36	A/ Transline	1%	1	80%	Needlegrass grassland	sandy loam	12% / East	A few scattered seedlings in 2008.
11	Ruderal area merges with native and non-native grassland/south of water tanks. Scrub-ecotone.	4.25	A/ Transline	1%	1	60%	Needlegrass grassland	sandy loam	10% SE	Black mustard and tocolote covered approximately 10% of non-CSS areas. Artichoke seedlings scattered throughout the loser portion of polygon along old access road.
12	Upper Rock-it trail. Disturbed area bisected by power lines in CSS.	4.38	A/ Transline	5%	2	50%	disturbed CSS	sandy loam	0-5% East	Disturbed yearly by road grading along power lines. Road occupied by tocolote, black mustard, artichoke, & annual grasses. Top of Rock-it trail is dominated by exotics; seed is carried down hill on the trail by hikers/bikers.
13	Top of Rock-It trail; disturbed areas along road and trail in CSS.	8.81	A/ Transline	<1%	1		CSS	sandy loam	2-15% East	No artichoke thistle in 2008.
14	Native grassland on north-east facing slope. Area difficult to access; high % cover in 2006.	4.65	A/ Transline	1-10%	1, 2	85%	Native Grassland	sandy loam	15% NE	Nice grassland with native wildflowers; many <i>Liliaceae</i> spp.. Scattered patches of concentrated
15	Upper Lynx trail. Needlegrass (~10%) and exotic annual grassland bordered by CSS. Very large area with small patches of artichoke thistle.	9.03	A/ Transline	5-20%	2, 3	40%	Needlegrass grassland-very weedy	sandy loam	10-15% East	10% needlegrass & exotic annual grasses and forbs. Varies between grassland and ecotone. High density of artichoke seedlings in scattered patches throughout polygon. Black mustard dominated grassland in 2006.

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Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
16	Oat/needlegrass grassland bordered by coast live oak riparian forest. South end of this polygon is outside of the reserve boundary.	6.6	A/ Aquamaster	1-30%	1-4	10%	needlegrass grassland/ annual grassland	sandy loam	0-15% Flat to NW	Low cover artichoke in majority of polygon-high only in 1 patch in W portion near riparian.
17	Native and exotic grassland on north-facing hill; east of creek along wood canyon road below water tower (across from cholla trail).	12.96	A/ Aquamaster	2-20%	1-3	varies	grassland/ CSS ecotone	sandy loam	10-20%	
	Italian thistle treatment in 2006.		I	3%	2					Scattered Italian thistle along creek.
18	Mid-Meadows Trail. Needlegrass grassland in some areas; exotics occupy lower and upper portions of trail but the middle is grassland and CSS with low cover of artichoke. Toclote, black mustard, & Italian thistle spreading up trail.	9.26	A/ Transline	<1%	1	85%	Needlegrass grassland/ CSS ecotone	sandy loam	5-15% East	California gnatcatchers observed near meadows trail year round. No nests occurred in the treatment area. Artichoke seedlings scattered along trail and in upper meadow. Patches of seedlings in meadow up to 10% cover. *Approximately 60 Calochortus catalinae individuals in upper meadow in 2008. Black mustard dominated lower slope in polygon south of the trail.
	Italian thistle treatment in 2006		I	1%	1					Italian thistle occurred only along lowest part of polygon along the trail and into P-21.
19	East of Alta Laguna and just north of upper meadows trail.	4.74	A/ Transline	10%	2	50%	Marginal needlegrass grassland/ CSS ecotone	sandy loam	12% East	Substantial decrease in artichoke from 85% in 2005 to 10% in 2007. Approx the same in 2008. Patches of seedlings scattered throughout polygon.

Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
20	Top of Meadows trail. Needlegrass/exotic annual grassland with scattered artichoke.	4.75	A/ Transline	1-20%	1, 2,3	50%	Native and non-native grassland	sandy loam	0-5% ridge top	Decrease in artichoke from 90% in 2005, 10% in 2006 to 2% in 2007 but increased to 15% in eastern portion near meadows trail in 2008.
	Small patches scattered along Woods Canyon Rd and along top of the world in 2005, 2006.		G	0%	1					No garland chrysanthemum in 2008.
21	Polygon meets bottom of P-18. Low cover artichoke. Black mustard occupies upper grassland and borders meadows trail. Veg. types include: needlegrass grassland, exotic annual grassland (large meadow), CSS and ruderal (mustard/Italian thistle fields).	41.09	A/ Transline	patches with up to 90% cover. 1% cover artichoke overall in polygon; patches up to 10% on hill, none in the flats.	1, 2	varies-low in annual grassland, higher in ecotone.	Annual grassland (dominant), CSS ecotone, Native grassland	sandy loam	0-10% flat to East facing	Artichoke only in upper portions (western border) of polygon. TNC Artichoke thistle monitoring plot is in polygon 21. No treatment in lower meadow in 2008.
	Italian thistle treatment in 2006		I	<1%	1					Areas treated in 2005 (Ranger-pro) and 2006 (Transline) remain free of Italian thistle and converting back to black mustard (Overstory of Italian thistle was dominated by black mustard in 2005).
22	Scattered distribution of artichoke thistle on east-facing slope along road.	12.13	A/ Transline	10-15%	3	varies	varies from CSS to ruderal grassland and mixed native/exotic grassland patches	sandy loam	5-15% East/ SE	TNC Artichoke thistle monitoring plot #1 is in polygon 22. Occupied along roadside: tocolote, Italian thistle, hemlock, black mustard, & milk thistle.
23	Small CSS/grassland ecotone area just north of gate. gate leading to water facility.	4.49	A/ Transline	1%	1					No artichoke thistle in 2008.

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Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
	Garland chrysanthemum last found and treated in 2005 just southwest of gate.		G	0%	1					South of gate only. No Garland chrysanthemum in 2006, 2007, 2008.
24	Exotic annual grassland bordering riparian.	14.29	A/ Transline	0%	1	low	exotic annual grassland/riparian	sandy loam	flat	Understory and grassland dominated by exotics. No artichoke thistle in 2008.
	Italian thistle treatment in 2006			1%	1	low				100% kill rate of Italian thistle in 2006 using Transline in all treatment areas.
25	Exotic annual grassland bordered by CSS and riparian.	5.63	A/ Aquamaster	0%	1	low	annual grassland/CSS ecotone	sandy loam	flat	No artichoke thistle in 2007 or 2008.
	High percent cover Italian thistle along road and understory of riparian vegetation prior to treatment in 2006.		I	1%	1	zero in understory	annual/ruderal grassland, riparian		flat	Scattered individuals in riparian understory.
26	Mixed native/non-native grassland w/ low cover artichoke and high cover black mustard.	8.41	A/ Transline	1-5%	1, 2	15%	mixed native/annual grassland		flat to gently sloping/ East facing	*22 Calochortus catalinae. Scattered cyca seedlings throughout grassland and up along edge of CSS.
	Italian thistle treatment in 2006		I	2%	1					Italian thistle scattered in riparian understory.
27	Very occupied, weedy disturbed area: high % cover artichoke, Italian thistle, milk thistle and black mustard on east side of wood canyon road. Highest % cover on hilltop below houses.	62	A/ Transline	1-30%	1, 3, 4	20%	variable: ruderal fields, CSS and riparian.		0-30%/ West, south and SW	No natives on hilltop. CSS along lower slope with patches of needlegrass. Some areas 100% black mustard cover. No artichoke thistle along the road.

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Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
	Italian thistle treatment in 2006		I	1%	1					Scattered Italian thistle and milk thistle along road in oak understory.
28	Needlegrass grassland area at confluence of coyote run and Rock-it Trails.	6.62	A/ Transline	<5%	2	50%	native grassland bordered by riparian forest on east side.	sandy loam		Low percent artichoke cover. Scattered seedlings throughout grassland.
	Italian thistle treatment in 2006		I	1%	1					Scattered Italian thistle in riparian understory and along trail.
29	Variable vegetation types along un-named trail near base of Mathis Trail. Isolated Italian thistle along trail with small isolated artichoke populations.	2	A/ Transline	<5%	2	variable	annual grassland/ CSS ecotone/ Riparian	sandy loam	flat	Needlegrass grassland ecotone on west side of creek at confluence of Coyote Run Trail and Nature Loop Trail. Scattered artichoke thistle up hill along trail.
	Italian thistle treatment in 2006		I	<5%	2	variable				Italian thistle invading CSS ecotone areas with high native cover. Difficult to treat Italian thistle in areas of this polygon because of isolated distribution and high cover of native forbs, grasses and shrubs.
30	Large annual grassland has been treated continuously for artichoke thistle both chemically and manually.	50	A/ Transline	<1%	1	zero in grassland	annual grassland	sandy loam	flat	No treatment in 2008.

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Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
	Italian thistle was treated in 2005/2006.		I	1%	1					Scattered Italian thistle in riparian understory.
31	Grassland at the bottom of Mathis Trail on the south west side of the trail. Not treated in 2005.	40	A/ Transline	10%	2	varies-low in annual grassland (<10%) higher in ecotone 90%.	annual grassland, riparian, native grassland/ecotone		flat - 10%/ East facing	Scattered artichoke thistle seedlings-concentrated in upper portion along CSS and along drainage. Needlegrass grassland patches in scrub; high cover of native wildflowers. *Approx 30 Calochortus catalinae individuals on north side of polygon concentrated near drainage.
	Italian thistle was treated in 2006.		I	0%	1					Patches in riparian understory and along drainage.
32	North side of Aliso Creek Road just outside of Reserve boundary on east side of large meadow.	40	A/ Transline	15%	3	none	annual/ ruderal grassland		flat	Artichoke density remains constant in this small polygon. Despite years of treatment seedling recruitment remains high.
33	Polygon runs along both sides of the road on the East side of Aliso creek. Italian Thistle treatment in 2006 and 2007.	5	I	1%	1	30-90%	varies from riparian, CSS, ruderal annual grassland		flat	High % cover of exotics: tocolote, hemlock, black mustard and scattered Italian thistle.
34	Largest population of artichoke thistle at AWCWP in 2006; 2 <sup>nd</sup> largest in 2008. Needlegrass grassland with 80% cover artichoke in 2006. High kill rate in 2007 treatment.	50	A/ Transline	20-50%	3-5	10%	needlegrass grassland, CSS and CSS/ grassland ecotone		20% West	Dominated by annual grasses in 2008 with artichoke thistle seedlings scattered below dense grasses. Difficult to treat thistle in early spring-hard to see thistle in dense grass. 20-50% in 2008.

Polygon	Polygon Description	Acres	Weed(s) <sup>1</sup> / Chemical <sub>2</sub>	% Exotic Cover/Cover Class	Cover Class	% Native Cover	Vegetation Type	Soils	Slope/ Aspect	Notes
	Italian thistle treatment conducted only in 2006.		I	1%	1					100% Italian thistle at top of hill and bordering CSS on south side of the polygon in 2006. Remained only as thatch in 2007 with no additional recruitment in 2008.
35	Several native grasslands make up this polygon near the top of hill along a ridgeline; each has close proximity to the other separated by CSS ecotone.	5	A/ Transline	20-30%	5	10-40%	needlegrass grassland		20% West	Artichoke thistle seedling recruitment in polygon 35 was very high in 2008 with 20-30% cover throughout. Black mustard has invaded some areas and covered up seedlings making treatment more difficult.
36	Large grassland polygon bordered by CSS, east side of Aliso creek.	50	A/ Transline	1-20%	1,2,3	variable	annual grassland, CSS ecotone, CSS		flat-15% West	Abundant seedlings along edge of CSS. Very low density in lower grassland. Old turtle pond (fenced area) is occupied by exotics: artichoke, tocolote, hemlock, garland chrysanthemum, & black mustard.
	Italian thistle treated in 2006.		I	1%	1					Spreading up into CSS in 2006. Few individuals in 2008.
37	First treated in 2007. Older treatment history unknown. Partially outside of reserve boundary.	14.13	A/ Transline	10-75%	2-6	<5%	Annual grassland surrounded on NW sides by CSS		25% SE	Large population-very high percent cover throughout north west portion. Lower downhill in southeast end.

<sup>1</sup>A= artichoke thistle, I= Italian thistle, G= garland chrysanthemum

<sup>2</sup>Total Chemical Amount: Transline (260 oz), Aquamaster (20 oz)

**9.3 Appendix C: Laguna Coast Wilderness Park and Crystal Cove State Park exotic plant treatment**

SPRING 2008 (Bommer, Moro and Emerald Ridges; March 18-31 and May 15. 9th year of veldt grass treatment.)

POLYGON	ACRES	% COVER VELDT GRASS	COVER CLASS	POLYGON DESCRIPTION/ NOTES
9	11.5	2-10%	2	CSS. Scattered veldt grass individuals (seedlings, established plants and resprouting clumps) growing under scrub and along the roadside. See polygon 22 description.
10	11.59	15-20%	3	CSS on steep east facing slope. Seedlings scattered throughout the entire polygon to bottom of ravine. Difficult to find and treat seedlings in heavy scrub.
11	15.28	1-10%	1, 2	CSS on steep east facing slope. Patchy distribution of veldt grass; some areas have up to 10% cover near the road, mostly scattered, low percent cover.
12	23.69	1-20%	1-3	CSS on steep east-facing slope. BVD Trail begins at the top of P-12 heading SE from Moro Ridge Road. Patchy distribution; most areas have no veldt grass, some areas have up to 20%. Scattered along the trail with several larger populations downslope to the east of BVD trail. Both seedlings and resprouts are responsible for the increase.
13	25.01	1-20%	1-3	CSS along steep to gently sloping, east, and southeast-facing slope. Small patches of veldt grass with high cover; total % cover is lower than in 2006/2007, although seedling distribution is increasing. BVD Trail runs through P-13 and veldt grass seeds seem to spread farther down the slope every year.
14	8.78	<1%-10%	1	Annual grassland & CSS ecotone. Gently sloping south facing area with isolated veldt plants in southeast portion of polygon along Bommer Ridge road and a few scattered along Willow Road. No veldt grass was located anywhere else in polygon 14.
15	0.25	<1%	1	Very small polygon along Laurel Canyon road. Hand cut seed then sprayed with Envoy in 2005-2008. Native grassland becoming occupied by tocolote, black mustard and artichoke thistle (Nakae treated artichoke thistle in this polygon). This tiny population is not increasing or decreasing. Due to the presence of native bulbs and grasses, the veldt grass clumps are treated very carefully; this is probably why they have not died with chemical treatment and continue to resprout despite looking dead.
16	5.1	10%	1	CSS on ridge top. No living veldt grass was observed in polygon 16 in 2007 but the population increased to 10% in 2008. Distribution increased slightly downslope to the south and east.
17	4.14	<1%	1	CSS/Big Bend. The population of veldt grass at Big Bend increased to 10% in 2008. Veldt grass seedlings occupied roadside on both sides of Ridge Road. Distribution of veldt grass at Big Bend does not seem to be increasing.
18	3.4	1%	1	CSS and annual grassland/CSS ecotone below water tower on the east side of Laguna Canyon Road. Low cover overall; veldt grass confined along roadside. Hiked down into drainage on east side to locate isolated individuals-none were observed. Density is very low but has been for the last 4 years.
19	12.93	1%	1	A few scattered individuals in thick CSS along road. Seed heads were cut and bagged prior to treatment.
20	1.14	0%	1	First treated/located in 2006-several scattered individuals in CSS along road. No veldt grass found in 2007 or 2008.

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21	4.2	Meadow: 20% Trail: 1%	Meadow: 3 Trail: 1	*Treated veldt grass with roundup-pro in this polygon on May 14, 2008 with Nakae crew. This area was missed by Natures Image-their budget ran out. Nakae does not stock Envoy so they used roundup. Veldt grass occupying small needlegrass grassland along an illegal trail paralleling the toll road on the south side. Two isolated populations scattered along trail west of the grassland.
22	0.8	3%	2	An extension of polygon 9, polygon 22 is a 10 foot wide swath along each side of the steep road (Laurel canyon Rd). This small polygon has served as an informal experimental area. From 2005 to 2008, all veldt grass along the road was hand pulled and bagged; if the mature veldt grass clumps were too large to hand pull, the stalks were cut to the base and the plant was heavily treated. The percentage of cut and treated plants was about 20% compared to 80% hand pulled. After 4 years of this treatment (2008 being the 4 <sup>th</sup> year), the total % cover has not changed, but the distribution of veldt grass has increased farther down the road. Seedlings emerge each year in the same places and most of the treated clumps resprout. However, since the experiment area is along a steep road, downslope from larger populations, seedling recruitment may depend solely on distribution from upslope populations.

Total Chemical Amount: Envoy (2,112oz), Roundup-Pro (30.7 oz), Tripleline (1,056 oz), Blazon (1,056 oz)

<sup>1</sup>E= Envoy, T= Tripleline, B= Blazon

<sup>2</sup>Total Chemical Amount: Envoy (2,602 oz), Tripleline (54.25 oz), Blazon (860 oz)

**9.4 Appendix D: City Of Irvine Open Space Reserve exotic plant treatment activities**

Spring 2008 March 25- April 15. 7th year of treatment for North Laguna, 8th Year of Treatment for Bommer Canyon

Artichoke thistle herbicide: Transline with Telar

POLY	ACRES	% ARTICHOKE COVER	COVER CLASS	% COVER NATIVE	VEGETATION DESCRIPTION	SLOPE/ ASPECT	POLYGON DESCRIPTION / NOTES
1	7.65	East side=15%; West side= 5% Small Patch on east side= 30%	2-3	80%	Needlegrass grassland surrounded by CSS and CSS/ecotone	5-15% north facing ridgeline	Higher cover artichoke in on east side of polygon; isolated distribution elsewhere. Higher cover in gullies and higher up the ridge closer to P-2. Grassland area with bulbs and wildflowers. Artichoke spreading down into gullies and down steep slopes.
2	19.44	5-50%	2-5	Patchy 10-80%	Needlegrass grassland surrounded by CSS and CSS/ecotone	0-5% on ridge; up to 30 on steep E/NE facing slopes	Native grassland with patches of annual grassland. Higher density artichoke along road and on east side of polygon. Reduced from 25-90% cover in 2006 but still high cover due to high seedling recruitment.
3	27.22	1-10%	1, 2	75%	Needlegrass grassland surrounded by CSS and CSS/ecotone	0-15% flat to E/NE	Illegal trail cuts down through CSS on the NE edge of polygon. Needlegrass/cactus scrub patches scattered along trail. Seedlings abundant in northern portion of polygon; difficult to locate given high cover of black mustard and annual grasses.
4	40.58	0-10%	1, 2	Patchy 0-100%	Annual grassland in southern half of polygon. Extensive needlegrass grassland elsewhere with some CSS/grassland ecotone around the edges.	0-25% Flat to E/NE	Top of ridge and most of south and west sides of polygon have no artichoke occupation. The bottom slope near the CSS boundary has around 10% cover. Black mustard covered around 60% of grassland in 2006; lower in 2007 and high again in 2008 at around 60%.
5	8.36	0%	1	90%	CSS/Needlegrass grassland ecotone	flat ridge top	No artichoke thistle found in polygon.
6	1.51	0%	1	95%	CSS/Needlegrass grassland ecotone	flat ridge top	No artichoke thistle found in polygon.
7	0.87	20%	3	20%	Needlegrass grassland opening in CSS	10-15% N/NE	Seedlings represent the entire population.

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8	3.05	5%	2	85%	Needlegrass grassland opening in CSS	15% N/NE	Scattered individuals in openings in CSS.
9	0.32	1%	1	40%	Needlegrass grassland opening in CSS	<5% West	Tiny patch of native grassland surrounded by scrub on south side of road. Easy to miss. Not treated prior to 2006. A few seedlings around dead individuals from previous treatment.
10	1.31	1%	1	80% native grass and forbs	Needlegrass grassland opening in CSS	flat	Needlegrass patch within CSS along illegal trail from polygon 3 down to Shady Canyon near the turtle pond. Reduced from 75% in 2006. Tocolote found along trail; no other weeds occur here. Not treated prior to 2006. A few scattered seedlings occurred in 2008.
11	56.5	<1%	1	Varies	Annual grassland along shady canyon. Some CSS, CSS ecotone.	flat valley bottom	Occasional scattered artichoke thistle seedlings found along road in annual grassland patches. Patchy areas of needlegrass within these grasslands. Not treated in 2005.
12	4.19	<10%	2	75%	Needlegrass grassland opening in CSS	10-15% NE	Not treated in 2005.
13	12.62	10-30%	2-4	varies	Needlegrass grassland, CSS ecotone	0-20% North, West and NW facing slopes	Various densities throughout polygon. Northern (bottom) section along fence line and hilltop on south west corner remain high-up to 30%, but still markedly lower than in previous years. Isolated plants found in most of polygon with lower cover toward the east and SE sections. Needlegrass grassland and ecotone are dominated by black mustard and summer mustard. Not treated in 2005.
14	5.6	10%	2	50%	Mixed native and annual grassland	10-15% NE	Seedlings scattered along road on both sides and into drainage. Not treated in 2005.
15	22.5	1%	1	40%	Annual grassland/ CSS ecotone	0-5% NW and SE	Extensive annual grassland treated for 6 years. Scattered seedlings were easy to miss in the tall annual grasses.
16, 17, 18	1.38 1.36 2.23	1%	1	80%	Needlegrass grassland openings in CSS	10% flat to SW	Three similar small polygons on east side of Serrano Ridge. Just a few scattered seedlings in each polygon.
19, 20	11.22 13.37	1%	1	50%	Mixed large annual/needlegrass grasslands	15% NE and NW	Scattered seedlings in both polygons. Pampas grass occurred in polygon 19 but was not treated in 2008 (Crew was using broadleaf selective herbicide transline which does not kill pampas grass).

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21	44.92	1-50% 1% in north half 50% in SE corner	1-5 varies through polygon	varies	Needlegrass grassland, CSS ecotone, & annual grassland	10-20% NE	High percent cover at top of hill near homes and uphill in southeast corner in native grassland. % cover decreases to <1% near the canyon bottom.
22	33.52	1% at canyon bottom up to 90% up slope	1-6 varies through polygon	50-80%	Needlegrass grassland, annual grassland & CS S/grassland ecotone	5-15% NE	Lower portion of polygon has less artichoke cover than areas up the slope. Higher up slope artichoke cover increases to 90% then again decreases farther up the slope. A gully separates 22 and 23 near the top of the polygons; artichoke thistle cover remains high near the gully.
23	47.29	50%	6	Variable ~50%	Needlegrass grassland, CSS ecotone	5-20% NE	Very high cover throughout polygon. Cover decreases downslope in northern side of polygon. Very nice Needlegrass grassland throughout. False brome (Bradis) occupied lower grassland.
24, 25, 26	63.75 34.67 2.88	<1%		varies~50 -95%	Needlegrass grassland, annual grassland, and both	Various ridge tops to canyon bottoms. Flat to north-facing slopes.	Not treated in 2008. Very low percent cover the past 4 years.
27	0.96	20%	3	>40%	Needlegrass grassland surrounded by CSS/ CSS ecotone	20% E	2008 was 3 <sup>rd</sup> year of treatment. Scattered seedlings throughout polygon.
28	2.98	15%	3	25%	Disturbed annual grassland/CS S ecotone along power tower and service road	15% NE	2008 was 3 <sup>rd</sup> year of treatment. Scattered seedlings throughout polygon.
29	8.48	20%	3	25%	Non-native annual grassland bordered by riparian vegetation on east side.	15% SE	2008 was 3 <sup>rd</sup> year of treatment. Scattered seedlings throughout polygon.
30	4.47	20%	3	25%	Non-native grassland/CSS-ecotone		2008 was 3 <sup>rd</sup> year of treatment. Scattered seedlings throughout polygon.
31	1.25	10%	2	15%	Disturbed non-native grassland/CS S-ecotone along service road	15% W	2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown. Scattered seedlings throughout polygon.
32	3.0	5%	2	75%	Native needlegrass grassland	10% NE	Highest percent cover in west end. 2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.

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33	2.49	<10%	2	75%	Native needlegrass grassland	10% W	2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.
34	6.93	1-20%	2	75%	Native needlegrass grassland	10% W	Scattered seedlings on east end; 20% in west end. 2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.
35	4.25	10-30%	2-4	varies	Non-native grassland surrounded by CSS	15% NE	Highest density on the north side of polygon. 2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.
36	1.42	20-30%	4	~50%	Mixed native/non-native grasses/ CSS- ecotone	15% W	2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.
37	3.81	10%	3	50%	CSS/Native grassland ecotone	20% NW	Polygon lies just north of toll road and just west of 133. 2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.
38	13.3	5%	2	50%	CSS/non-native grassland ecotone	NE	Scattered patches of seedlings. 2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.
39	7.8	30%	5	50%	Mostly native grassland surrounded by CSS	25% NE	Above (SW) of turtle pond. Dense patches of seedlings. 2008 was the 2nd year of treatment by HWA. Previous year's treatment history unknown.
40 (new Polygon)	1.9	5%	2	60%	Disturbed CSS along trail	N	Small infested area in disturbed CSS along trail between polygons 41 and 13. About a dozen mature artichoke thistles in this small polygon. 2008 was the first treatment year under HWA supervision.
41 (new Polygon)	28	15-99%	3-6	Varies: usually >50%	Needlegrass grassland, CSS ecotone.	NE	Large area with very high density artichoke thistle throughout most of the polygon. A dirt trail goes up the eastern side of the polygon; 2008 was the first year of treatment.
42 (new Polygon)	108	1-99%	1-6	Varies: usually >50%	Needlegrass grassland, CSS ecotone.	Varies: W, NW, N, NE, E	Large polygon has been treated for many years. HWA has treated this polygon for last several years (2006-2008) but did not assign it a polygon number. One area, in a north facing grassland with very high artichoke density, previously untreated by HWA, was found to be occupied and was treated in 2008. This area may have been treated by TNC in the past but the treatment history is unknown.

**9.5 Appendix E: University Of California Irvine Ecological Reserve exotic plant treatment activities**

Spring 2008 (7<sup>th</sup> year of treatment)

POLYGON	DATE	ACREAGE	% ARTICHOKE COVER	POLYGON DESCRIPTION/ NOTES	TREATMENT <sup>1</sup>	CREW
1	May 10	28.23	≤1%	Distribution of artichoke thistle in polygon one remained similar to 2007 with scattered seedlings totaling approximately 1% cover throughout the polygon. Only a few scattered plants remain in the northern half and along the western fence line.		
2	May 10	35.615	25%	Several small patches of seedlings concentrated on the western half of the polygon comprising <5% total cover with isolated plants in the eastern half of the polygon; the southwest portion of the polygon contained patches with up to 10% cover (percent cover in 2005, 2006 and 2007 was up to 100%, 75%, and 50%). Percent cover near the TNC monitoring plot in polygon 2 decreased substantially from approximately 30% in 2006 to 1% in 2007 and again 1% in 2008. Overall, cover was low with isolated distribution.		
<b>Total acreage</b>		<b>63.85<sup>2</sup></b>			Ranger-Pro 1,048 oz 140 oz Turf Trax Dye No Telar No Activator 90	2 crews with 6 guys

**9.6 Appendix F: Buck Gully exotic plant treatment activities**

Spring 2008, Treatment dates: May 5-7, 6<sup>th</sup> year treatment of garland chrysanthemum, 4<sup>th</sup> year treatment of artichoke thistle in polygons 4-7, 2<sup>st</sup> year artichoke thistle treatment in polygons 8-15). Herbicide: Transline and Aquamaster, both with Telar

POLY	ACRES	% ARTICHOKE THISTLE (AT)/ GARLAND CHRYSANTH- EMUM (GC)	COVER CLASS	% NATIVE COVER	VEGETATION DESCRIPTION	SLOPE/ ASPECT	POLYGON DESCRIPTION/ NOTES
1	3.37	<1% GC	1	Varied	Polygons 1, 2, 3 are along service roads. The roads are bounded on both sides by CSS. Roadsides dominated by ruderal weeds.	10% SE	Just a few scattered individuals along road. Treatment in this polygon takes little time-just yearly maintenance. There is more garland chrysanthemum along San Joaquin Road then in the reserve.
2	7.13	<1% GC	1	Varied	Polygons 1, 2, 3 are along service roads. The roads are bounded on both sides by CSS. Roadsides dominated by ruderal weeds.	0-15% S	Just a few scattered individuals along road. Treatment in this polygon takes little time-just yearly maintenance.
3	2.32	GC <1-10% 10% in west end	1, 2	Varied	Polygons 1, 2, 3 are along service roads. The roads are bounded on both sides by CSS. Roadsides dominated by ruderal weeds.	0-10% S	Just a few scattered individuals along road. Higher density at the bottom of the road. Treatment in this polygon takes little time-just yearly maintenance.
4	0.77	1% AT	1	90%	Native needlegrass grassland surrounded by CSS	15% NW	Scattered artichoke thistle seedlings in this polygon totaling around one percent of total vegetation cover.
5	0.734	1% AT	1	90%	Native needlegrass grassland surrounded by CSS	0-5% N	Scattered artichoke thistle seedlings in this polygon totaling around one percent of total vegetation cover.

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6	1.75	1% AT	1	85%	Native needlegrass grassland surrounded by CSS	20% NW	Scattered artichoke thistle seedlings in this polygon totaling around one percent of total vegetation cover.
7	1.89	<1% AT	1	80%	Needlegrass grassland surrounded by CSS	25% N	Scattered artichoke thistle seedlings in this polygon totaling around one percent of total vegetation cover.
8	2.98	25% AT	4	25%	Weedy needlegrass grassland/CSS-ecotone	40% N	Seedlings surrounded dead artichoke thistle stalks. 2008 was 2 <sup>nd</sup> year of treatment.
9	5.63	30% AT	4	10%	Needlegrass grassland/CSS	15% N	Seedlings scattered throughout polygon. 2008 was 2 <sup>nd</sup> year of treatment.
10	0.06	10% AT	2	40%	Needlegrass grassland/CSS	NW	Seedlings scattered throughout polygon. 2008 was 2 <sup>nd</sup> year of treatment.
11	0.11	15% AT	3	30%	Weedy needlegrass grassland/CSS-ecotone	5% E	Small patch of artichoke in gully east of stream crossing. Seedlings scattered throughout polygon. 2008 was 2 <sup>nd</sup> year of treatment.
12	0.1	10% AT	2	20%	Weedy CSS/grassland ecotone at the edge of Riparian zone	5% E	Higher percent cover along trail near west end. 2008 was 2 <sup>nd</sup> year of treatment.
13	0.13	10% AT	2	10%	Ornamental and scattered CSS shrubs	20% SE	Small patch near houses at the top of gully SE facing. Seedlings scattered throughout polygon. 2008 was 2 <sup>nd</sup> year of treatment.

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14	0.52	30% AT	4	10%	Weedy needlegrass grassland /CSS	10% E	Seedlings scattered throughout polygon. Dense patches in some areas. 2008 was 2 <sup>nd</sup> year of treatment.
15	1.22	20% AT	3	15%	Weedy needlegrass grassland /CSS	15% NW	Seedlings scattered throughout polygon. 2008 was 2 <sup>nd</sup> year of treatment.
16	1.2	1% AT	1	40%	Grassland/CSS ecotone	35% E	Just a few seedlings scattered throughout polygon. 2008 was 2 <sup>nd</sup> year of treatment.

**9.7 Appendix G:** El Toro Ecological Reserve exotic plant treatment activities Spring 2008

Date	Acres	GC/AT	TT/C B	Roundup-pro (oz)	Garlon 4 (oz)	Transline	Telar	Dye	Ultra Pro Choice water conditioner	Oranj-All surfactant
4/17/08	6	x				25.35	3.6	38.4		38.4
4/18/08	7	x				37.8	5.4	57.6		57.6
4/21/08	6	x				35.9	5.1	54.4		54.4
4/22/08	6	x				35.9	5.1	54.4		54.4
4/23/08	6	x				42.24	6	64		64
4/24/08	7	x				38.02	5.4	57.6		57.6
4/25/08	8	x				42.24	6	64		64
4/28/08	7	x				35.9	5.1	54.4		54.4
4/29/08	8	x				38.02	5.4	57.6		57.6
4/30/08	10	x				46.46	6.6	70.4		70.4
5/12/08	3	x		194.56				24.32	194.56	24.32
5/14/08	6	x		317.44				39.68	317.44	39.68
5/15/08	6	x		348.16				43.52	128	43.52
5/16/08	6	x		455.68				59.96		59.96
5/19/08	15	x		384				48	326	48
5/21/08	20	x		296.96			3.48	37.12	296.96	37.12
5/22/08	6	x		209.92			2.46	26.24	209.92	26.24
5/27/08	8	x		286.72			3.36	35.84	191.15	35.84
5/28/08	10	x		189.44			2.22	23.68		23.68
5/29/08	10		x	10	84			8		1.25
5/30/08	20		x	10	24			5		1.25
<b>TOTAL</b>	<b>181</b>			<b>2,702.88</b>	<b>108</b>	<b>377.82</b>	<b>65.22</b>	<b>924.16</b>	<b>1,664</b>	<b>913.66</b>
<b>Cost Per Day</b>		<b>\$1,810</b>								
<b>Total Cost</b>		<b>\$38,000</b>								

AT=artichoke thistle, GC=garland chrysanthemum, TT=tree tobacco, CB=castor bean

**9.8 Appendix H: Herbicide usage by treatment location**

NROC Exotic Plant Control Program 2008

HERBICIDE	AMOUNT USED (OZ.)								
	LCWP	BUCK GULLY	AWCWP	UCI	CIOSR	EL TORO	CCSP	WHITING RANCH	TOTAL
Transline		336	260		1,670	377.82	1,152	588	4,384
Telar		14	12		71	65.22	48	24	234
Activator (Activator 90, Oranj-all, First choice Ultra Pro)						2,577			2,577
Aquamaster			20						20
Roundup Pro	30.7	33.5		1,152		2,703			3,919.2
Garlon 4						108			108
Tripleline	1,056								1,056
Envoy	2,112								2,112
Dye	1,056	55	42	165	249	964	170	88	2,789

**9.9 Appendix I: Treatment costs by location and target species**

NROC Exotic Plant Control Program 2008

TREATMENT LOCATION	COST
Laguna Coast Wilderness Park	\$46,691
Aliso and Wood Canyons Wilderness Park	\$36,819
Buck Gully	\$10,228
University of California Irvine Ecological Reserve	\$4,091
City of Irvine Open Space Preserve	\$61,361
Crystal Cove State Park	\$42,955
El Toro	\$38,000
Whiting Ranch	\$20,455
<b>TOTAL COST</b>	<b>\$260,600.00</b>

TARGET WEEDS	AVERAGE COST PER DAY		
	<i>Nakae &amp; Assoc.</i>	<i>Nature's Image</i>	<i>PRG</i>
Artichoke thistle, garland chrysanthemum, tree tobacco, castor bean	\$175,009	NA	\$1,800
Veldt grass	\$4,091	\$4,059	NA
<b>TOTAL</b>	<b>\$180,000</b>	<b>\$42,600</b>	<b>\$38,000</b>

**10.0 SITE PHOTOGRAPHS:**



**Photograph 1:** Bommer Canyon, upper side of polygon 21.



**Photograph 2:** Bommer Canyon, artichoke seedlings along riparian edge.



**Photograph 3:** Hogback Ridge, Polygon 2.



**Photograph 4:** AWCWP, polygon 34, looking south. P-34 had 100% artichoke thistle in 2006.



**Photograph 7:** LCWP veldt grass along illegal razor trail, polygon 21.



**Photograph 8:** El Toro, garland chrysanthemum along road looking west.

# Exotic Plant Treatment Sites 2008

Bommer Ridge  
Bommer Canyon  
Shady Canyon  
North Laguna

Nature Reserve  
of Orange County  
Weeding Program

Bryan G. Speegle, Director  
OC Public Works

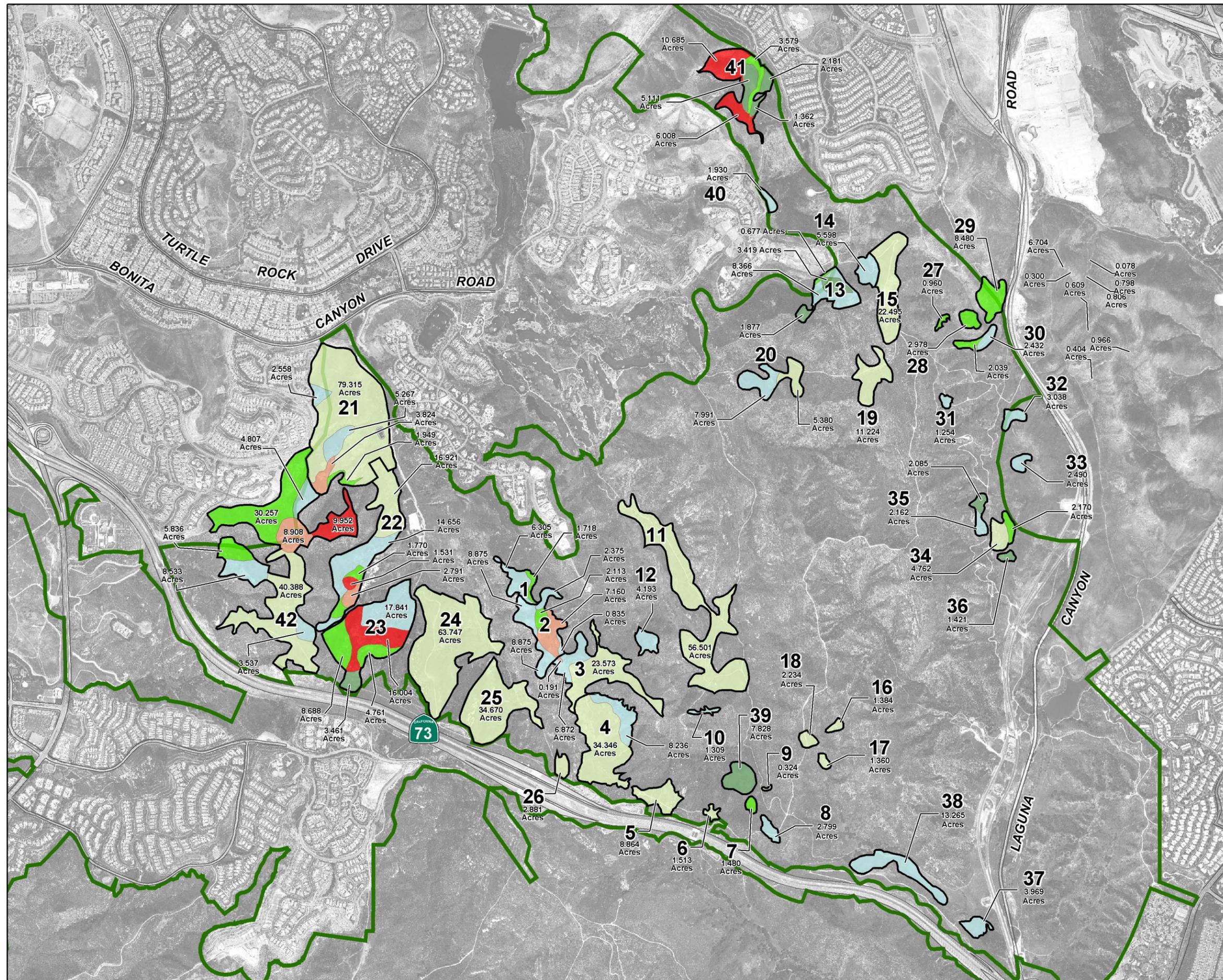
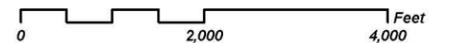
Timothy S. Neely  
OC Planning  
OC Public Works  
Planning GIS Section



NCCP Reserve

Artichoke Thistle Cover

- Less than or equal to 1 Percent (412 Acres)
- 02 - 10 Percent (154 Acres)
- 10 - 20 Percent (81 Acres)
- 20 - 30 Percent (29 Acres)
- 30 - 50 Percent (23 Acres)
- Greater than 50 Percent (45 Acres)



PGS08/Weed0808 (Bommer Ridge) 11x17.mxd

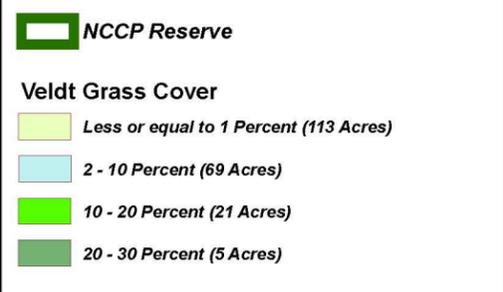
# Exotic Plant Treatment Sites 2008

## South of The 73 Transportation Corridor

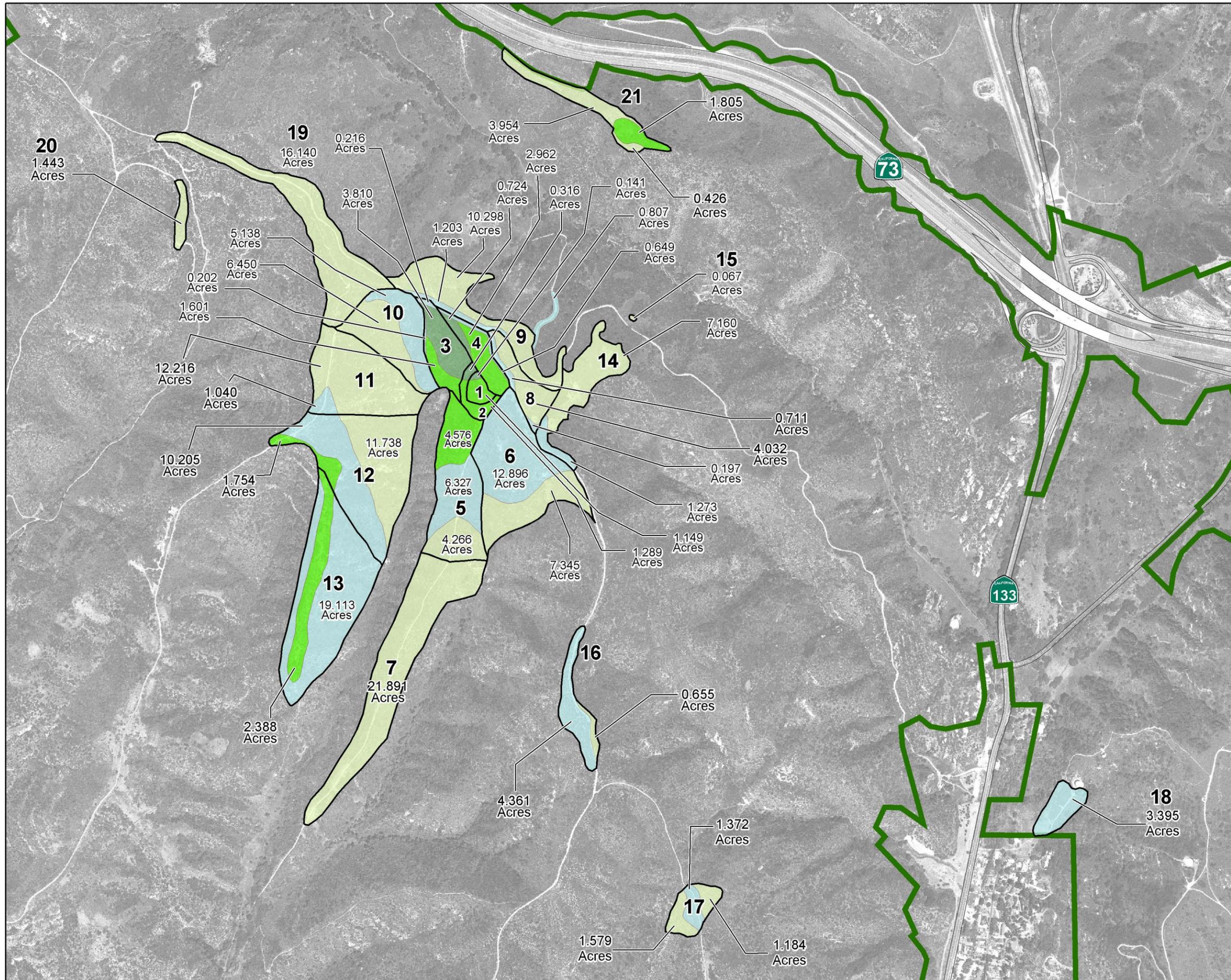
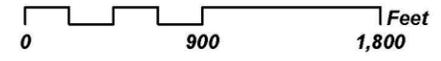
Nature Reserve of Orange County Weeding Program

Bryan G. Speegle, Director  
OC Public Works

Timothy S. Neely  
OC Planning  
OC Public Works  
Planning GIS Section



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# Exotic Plant Treatment Sites 2008

## Quail Hill

Nature Reserve of Orange County Weeding Program

Bryan G. Speegle, Director  
OC Public Works

Timothy S. Neely  
OC Planning  
OC Public Works  
Planning GIS Section



**NCCP Reserve**

**Artichoke Thistle Cover**

- Less or equal to 1 Percent (164 Acres)
- 2 - 10 Percent (29 Acres)
- 10 - 20 Percent (12 Acres)
- 20 - 30 Percent (13 Acres)
- 30 - 50 Percent (N/A Acres)
- Greater Than 50 Percent (N/A Acres)

0 1,000 2,000 Feet

FIG051/Wood/2008 (Quail Hill).indd 11x17.rvt

# Exotic Plant Treatment Sites 2008

## Buck Gully

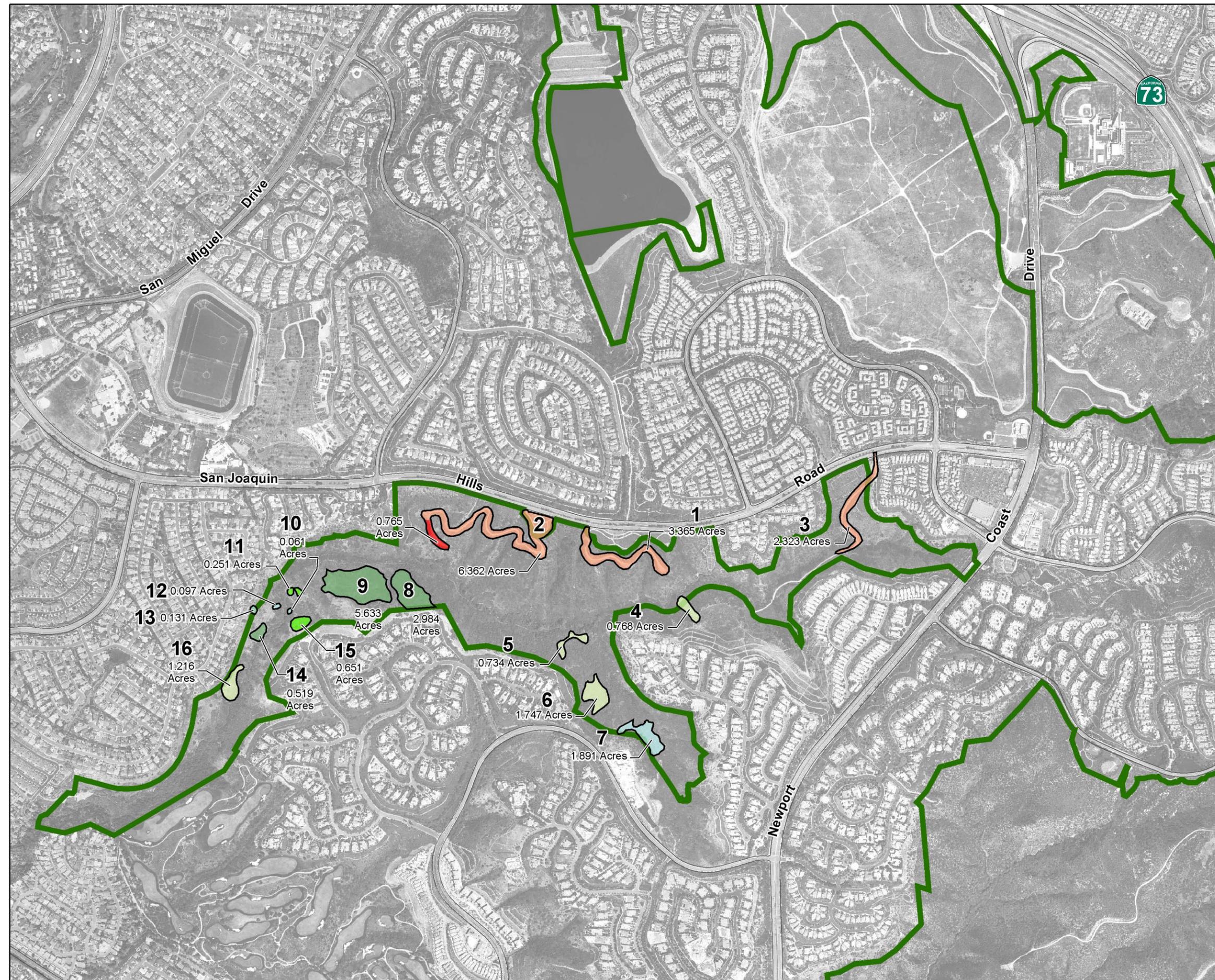
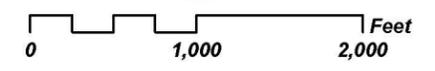
Nature Reserve  
of Orange County  
Weeding Program

Bryan G. Speegle, Director  
OC Public Works

Timothy S. Neely  
OC Planning  
OC Public Works  
Planning GIS Section



PG0808/Weed0808 (Buck Gully).ind 11x17.mxd



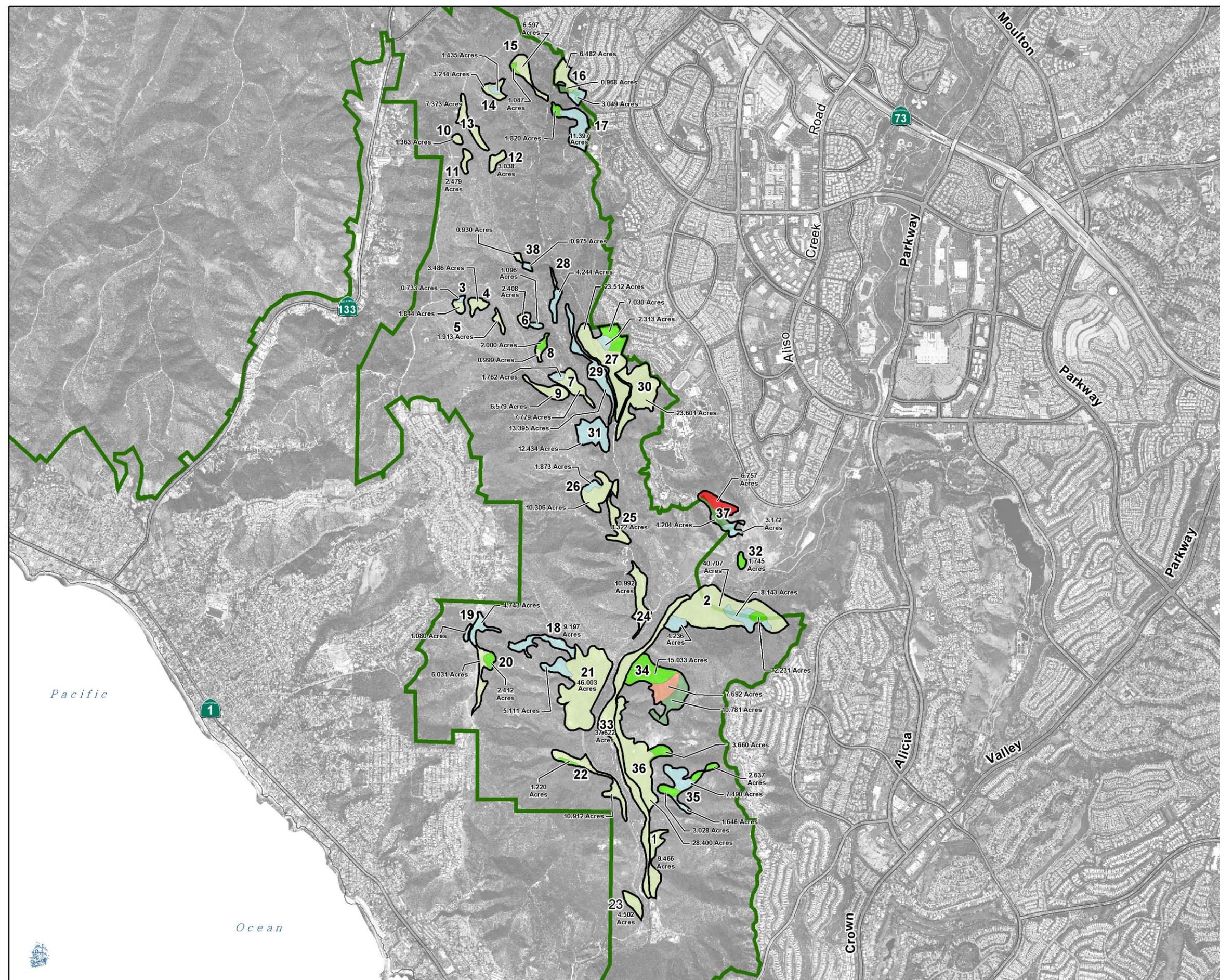
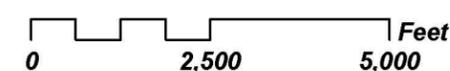
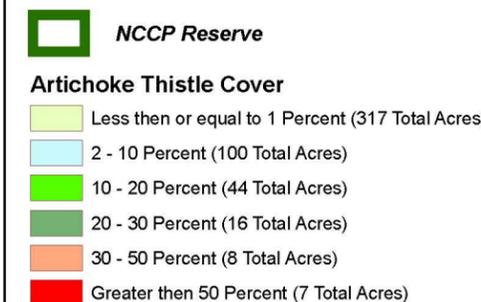
# Exotic Plant Treatment Sites 2008

## Aliso & Wood Canyons

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OC Public Works  
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PC599\Wood2008 (Aliso & Wood)11x17.mxd

**Exotic Plant  
Treatment Sites  
2008**

**UCI**

**Nature Reserve  
of Orange County  
Weeding Program**

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OC Public Works

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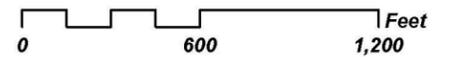
NCCP Reserve

**Artichoke Thistle Cover**

Less or equal to 1 Percent (58 Acres)

2 - 10 Percent (6 Acres)

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# Exotic Plant Treatment Sites 2008

Crystal Cove State Park



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OC Public Works

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OC Planning  
OC Public Works  
Planning GIS Section



Crystal Cove State Park

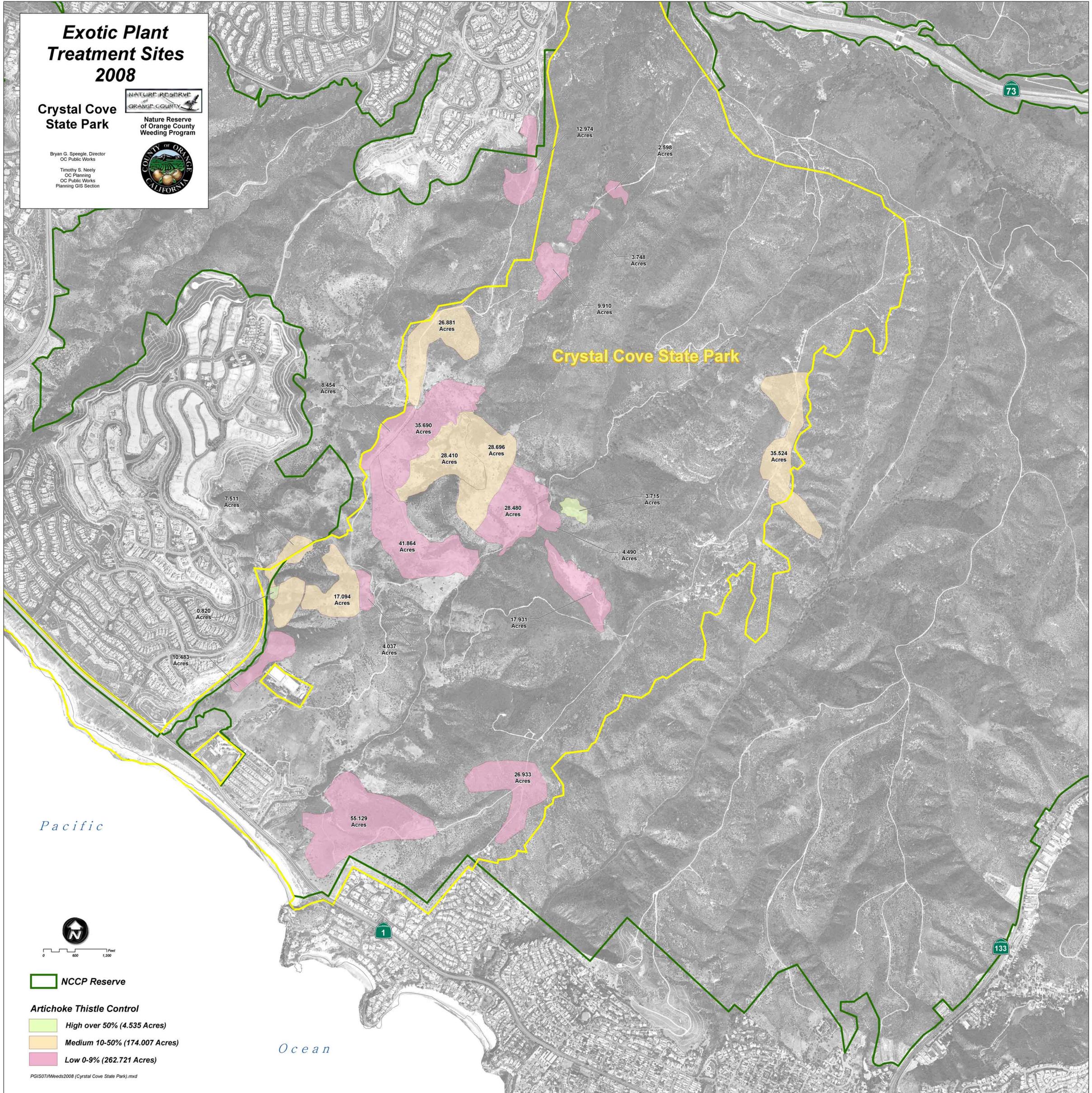
NCCP Reserve

**Artichoke Thistle Control**

High over 50% (4.535 Acres)

Medium 10-50% (174.007 Acres)

Low 0-9% (262.721 Acres)



# Exotic Plant Treatment Sites 2008

Limestone Canyon  
and  
Whiting Ranch  
Wilderness Park



Nature Reserve  
of Orange County  
Weeding Program

Bryan G. Speegle, Director  
OC Public Works

Timothy S. Neely  
OC Planning  
OC Public Works  
Planning GIS Section



0 400 800 1,200 Feet

**NCCP Reserve**

**Non-native plant control**

- Italian & Milk Thistle**  
Primarily in canyon bottoms  
under tree canopy
- Mustard** - Also occurs along  
majority of roads and trails
- Artichoke Thistle**  
Often overlaps mustard
- Additional Non-native  
Species**

PGIS07/Weeds2008 (Limestone Whiting).mxd

