

# Final Report

## Dry Creek Watershed Red Sesbania Control Program



(June 05)



(June 06)

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## 1.0 INTRODUCTION

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### 1.1 Project Overview

The Sacramento Area Flood Control Agency (SAFCA) conducted an invasive plant control program for red sesbania (*Sesbania punicea*) in the Dry Creek watershed from 2004 to 2006. The project is known as the Dry Creek Watershed Red Sesbania Control Project, Phase I (DCWRSCP). The DCWRSCP was funded by a California Department of Water Resources Flood Protection Corridor Program grant administered by SAFCA.

This document presents the results of work conducted under the grant-funded program.

### 1.2 Background Information

#### 1.2.1 Project Description

SAFCA, in partnership with Sacramento County, Placer County, the City of Sacramento, and the City of Roseville, initiated a multiple year program to remove the invasive riparian weed red sesbania (*Sesbania punicea*) from Dry Creek and its tributaries in Placer and Sacramento Counties. This 3-year project was intended to remove mature (fruiting/flowering) red sesbania plants in 2004 and early 2005, and retreat areas (i.e. remove seedlings and re-sprouts) in 2005 and 2006.

This grant funded program was successfully completed on schedule and within budget in October 2006.

#### 1.2.2 Project Location

The Dry Creek Watershed Red Sesbania Control Project encompasses over 80 linear miles of shoreline, 40 linear miles of waterways, and approximately 101 acres of land within the Dry Creek Watershed and its tributaries (i.e., Magpie Creek and Robla Creek, in Sacramento County, and Antelope Creek, Linda Creek, Miner's Ravine, Strap Ravine, Secret Ravine, and Cirby Creek in Placer County). Refer to Figure 1 for the general location of red sesbania infestations in the Dry Creek watershed.

The headwaters of Dry Creek are located in the upper portions of the Loomis Basin, above Newcastle, in unincorporated Placer County, in the area of Granite Bay near Folsom Lake, and in Orangevale in Sacramento County. Areas draining into Antelope Creek and Clover Valley Creek form the northwest boundary of the watershed, and Secret Ravine and Miner's Ravine comprise the northeast portion of the watershed. The numerous small tributaries of Dry Creek merge and form Dry Creek in Roseville. The main stem flows through cities and unincorporated areas north of the City of Sacramento. The creek eventually links up with the Natomas East Main Drain, renamed Steelhead Creek, which flows into the Sacramento River, and, during high flows, into the American River.

The project area was defined as anywhere within the 101-square mile watershed where red sesbania can be found and access obtained for its eradication. The treatment area encompassed all lands within 25 feet of Dry Creek and its tributaries, on private land where access could be obtained from the landowners, on public lands, and on lands where an access or maintenance easements existed.

With the exception of three private parcels where access was denied by the land owner, red sesbania was removed from the entire treatment area.

The distribution of red sesbania in the vicinity of the project area is depicted in Figure 3. The complete extent of the known occurrence of the species extends from the Central Valley to the Sacramento-San Joaquin Delta, and along waterways to the north, west, and south of the infestation depicted in Figure 3. For current information regarding red sesbania occurrence, contact the Department of Fish and Game Bay-Delta invasive plant coordinator, Dan Burmeister at [dburmeister@dfg.ca.gov](mailto:dburmeister@dfg.ca.gov).

### **1.2.3 Management Objectives**

The objective of the Dry Creek Watershed Red Sesbania Control Program was removal of 99.9% of all mature red sesbania from the project area, and re-treatment of seedlings and re-sprouts such that, by the end of the program in summer 2006, there was at least 99.9% removal of all red sesbania plants from the Dry Creek watershed.

This program was intended to:

- Improve floodwater conveyance (especially in areas downstream of the City of Roseville) by removing red sesbania vegetation biomass from the low flow creek channel;
- Aid the restoration of natural riparian and riverine processes;
- Significantly contribute to regional elimination efforts of this invasive plant; and
- Provide technical information about invasiveness and effective control of this plant to other land managers, and weed control technicians, local nurseries, and landowners.

## **2.0 OVERVIEW OF PROGRAM ELEMENTS**

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### **2.1 Management and Technical Advisory Committee**

A Management Advisory Team (MAT) was developed to guide and oversee the project. For this project, the MAT consisted of representatives from Sacramento and Placer County, City of Sacramento and City of Roseville, SAFCA, Placer County Agricultural Commissioner, California Department of Fish and Game, U.S. Fish and Wildlife Service, and NOAA Fisheries.

### **2.2 Reporting Requirements**

The grant reporting requirements include submittal of quarterly progress reports and a final report to the California Department of Water Resources.

*The reports that were prepared during the course of this project are presented below in Section 4.0, “Results”.*

### **2.3 Permits and Agreements**

The Dry Creek Watershed Red Sesbania Control Project was required to obtain the following environmental permits and agency consultation recommendations:

- California Environmental Quality Act (CEQA) review, resulting in issuance of a Categorical Exemption;
- State of California Reclamation Board permit;
- California Department of Fish and Game (CDFG) Section 1601 Streambed Alteration Agreement;
- A County of Sacramento Department of Regional Parks, Recreation, and Open Space Encroachment Permit;
- City of Roseville and Placer County Access Agreements; and
- Informal consultation for work in and near salmonid streams from the National Oceanic and Atmospheric Administration (NOAA).

*The permits that were obtained for the project are summarized below in Section 4.0, “Results”.*

### **2.4 Initial Mature Non-Native Plant Removal**

Several treatment methods were investigated prior to selecting the preferred treatment method for this project. Knowledgeable individuals and organizations were contacted for advice on treatment

effectiveness, and sensitivity to biological resources. Individuals and organizations that were contacted for this project included the California Invasive Plant Council (CAL-IPC) (Joe DiTomaso, pers. comm.); CDFG Invasive Plant Coordinator (Dan Burmeister, pers. comm.); and The Nature Conservancy (John Randall, Invasive Plant Coordinator pers. comm.). In addition, a literature search was conducted.

Documents that were used as references during development of the initial and ongoing invasive species control program for this project included:

- Research presented online by New Zealand's Manaaki Whenua Landcare Research Institute (available online at <http://www.landcareresearch.co.nz/index.asp>):
- Prospects for Biological Control of Weedy Sesbanias (Fabaceae) in the Southeastern United States of America. (Cuda et. al. 1996).
- The Hunt for Red Sesbania: Biology, Spread, and Prospects for Control. (J.C. Hunter and G. A. J. Platenkamp, 2003). Available online at: <http://groups.ucanr.org/ceppc/documents/newsletter310.htm>
- Ecological and Hydraulic Effects of Red Sesbania (*Sesbania Punicea*) Invasion of Riparian Areas in California. (Platenkamp, G. A. J. and J.C. Hunter and, 2003).
- Aquatic and Riparian Weeds of the West. (DiTomaso, J.M., and E. H. Healy. 2003).
- The Invasive Weed *Sesbania punicea* in South Africa and Prospects for its Biological Control. (Hoffman, J.C., Moran V.C. 1988).
- Weed Alert! *Sesbania punicea*. The Nature Conservancy. (The Nature Conservancy, no date specified). Available online at: <http://tncweeds.ucdavis.edu/alert/alrtsesb.html>. Accessed. 1/28/05
- *Sesbania* in Agriculture. (Evans, D.O., and P. P. Rotar, date unknown.)
- Australian/New Zealand Weed Risk Assessment, adapted for Hawai'i. (C. Daehler, 2003). Available online at: [http://www.hear.org/Pier/wra/pacific/sesbania\\_punicea\\_htmlwra.htm](http://www.hear.org/Pier/wra/pacific/sesbania_punicea_htmlwra.htm)
- Cooperative Research Center (CRC) for Australian Weed management, information on red sesbania. Available online at [http://www.weeds.crc.org.au/index\\_flash.html](http://www.weeds.crc.org.au/index_flash.html)

Based on available research, and on input received from knowledgeable individuals and organizations, several preliminary treatment options were developed. These preliminary treatment options were then reviewed in coordination with the U.S. Environmental Protection Agency (Emily Alejandrino pers. comm.), the U.S. Fish and Wildlife Service (Adam Zerrigner, Elizabeth Warne, and Lia McLaughlin pers. comm.), NOAA (John Baker, pers. comm.), and the California Department of Pesticide Regulation (Kathy Brunetti, pers. comm.) as well as the MAT to determine the most effective treatments that had the least potential to effect sensitive biological resources (i.e. elderberries and salmonid habitat).

The resulting invasive plant control Best Management Practices BMP's were then incorporated into the project description for the CEQA document and environmental permits and agreements. A

combination of hand removal and 'cut and paint' herbicide application was selected for the initial treatment of this species. Best Management Practices (BMP's) include the following:

1. Herbicides will only be sprayed in compliance with guidance from the U.S. Environmental Protection Agency (USEPA) as provided by NOAA and the state of California Environmental Protection Agency (CalEPA) for Best Management Practices relating to anadromous fish. Application of herbicide will be restricted to uses and distances from waterways as defined by the label and approved by the EPA and the California Department of Pesticide Regulation (CADPR).
2. Application will be restricted to the period least likely to affect anadromous fish species. During periods of sensitive fish movement (as defined during consultation with NOAA), herbicide application will be prohibited. During other timeframes, herbicide application may include the following techniques defined below.
3. Herbicides used within the stream channel area will be formulations approved by the U.S. Environmental Protection Agency for aquatic use, and will be mixed with a non-toxic indicator dye to allow monitoring of coverage.
4. Herbicides will be applied by low pressure hand sprayers with large droplet size applicator nozzles to minimize aerial drift of herbicide.
5. Only surfactants that have been approved for use in bodies of water by the EPA and the CADPR will be used in and near Dry Creek and its tributaries.
6. Herbicides will not be used during wind speeds greater than 10 miles per hour (or lower if so indicated by the herbicide label).
7. Herbicides will not be used if rain is likely within 24 hours (or longer if indicated by the herbicide label).
8. All removal contractors and their employees will go through worker awareness training to facilitate recognition of elderberry shrubs the host plant of the VELB.
9. Any elderberry plants near contractor work areas will be flagged.
10. A qualified biologist will monitor sesbania removal activities and will stop or relocate work crews if any project activity is determined to be harmful to elderberry shrubs, nesting birds and wildlife resources. The monitor will notify the appropriate regulatory agencies (e.g., USFWS, CDFG) of any such occurrences. Work may be resumed after the biologist determines that doing so will not harm the subject species.
11. Herbicides will be mixed, staged and stored in upland locations and over 25 feet away from elderberry bushes. The licensed Herbicide Applicator will be required to prevent soil and water contamination from these chemicals and report any spills to SAFCA and the appropriate regulatory agencies.
12. Work crews will be informed of the need to limit removal efforts to red sesbania only and will be instructed in the proper identification of the target species, red sesbania. Removal of other species, including other non-natives, will be outside the scope of work of this project.

13. Within 20 feet of elderberry (*Sambucus mexicanus*) stems, red sesbania will be removed using hand removal methods. No herbicides will be applied within 20 feet of the plant or its stems. Herbicides outside of the 20-foot area will be applied using best management practices to ensure that no herbicides affect the nearby plant (e.g., cut and paint application, spraying away and downwind from the elderberry).
14. The contractor will be required to stop work and report if an elderberry is inadvertently damaged. If inadvertent impacts occurred, USFWS will be contacted to determine an appropriate course of action.
15. Vehicles will not be driven in the active bed of Dry Creek or its tributaries. All vehicles will be restricted to existing roads, maintenance and access points, and upland areas.
16. Best Management Practices will be used to avoid erosion and sedimentation if any large areas are left barren of vegetation during the rainy season. Any unavoidable soil erosion will be corrected by restoring the site to original contours; installing erosion control (e.g., erosion control fabric, seed-free straw, straw wattles); and seeding or planting as necessary to stabilize the soils.

***The results of the initial red sesbania control program are summarized below in Section 4.0 - "Results".***

## **2.5 Ongoing Non-Native Invasive Plant Control**

Since most of the ongoing treatment of red sesbania was focused on removal of seedlings and re-sprouts, hand removal and spot treatment with herbicides was selected as the preferred method for ongoing non-native invasive plant control. The timing of re-treatments corresponded to maximum seedling detection periods, in late summer. Ongoing treatment followed BMP's developed for the project (described above).

***The results of the ongoing non-native invasive plant control program is summarized below in Section 4.0- "Results".***

## **2.6 Development of Long-Term Maintenance Program**

A long term site maintenance program was intended to follow the grant-funded initial and ongoing red sesbania treatments. In support of the future maintenance program, a long-term maintenance program plan document was developed as part of this program. This plan included necessary actions, treatment methods, a schedule of activities, roles and responsibilities, a program budget, and a list of prospective project partners.

***The resulting Long Term Maintenance Plan is summarized below in Section 4.0- "Results".***

## **2.7 Site Mapping, Photodocumentation, and Database Management**

The following mapping, photodocumentation, and database products were developed for the Dry Creek Watershed Red Sesbania Control Project:



- **Baseline Mapping Of Red Sesbania Infestations within the Project Boundary.** This mapping included extensive field surveys to determine the extent of the infestation; to map high, moderate, and low density red sesbania; and to establish upper limits of the infestation zone. A GIS database was set up for the project, and is included as a project deliverable.
- Updated red sesbania mapping following each year of treatment to identify trouble areas (targeted for re-treatment), and to modify the upper limits of the infestation as plants were successfully eradicated.
- A map of areas requiring ongoing maintenance in future years.
- An Access database of all treatments conducted under the project.
- Establishment of Permanent photodocumentation sites, and preparation of baseline photo set, and annual photomonitoring photos for subsequent treatment years to document site progress towards stated goals.

*Program deliverables, including the GIS database (electronic format); site mapping, photodocumentation comparison photos; Access Database, and map of areas requiring ongoing treatment are all included in the Section 4.0- “Results” and in Appendices presented below.*

## **3.0 SUCCESS CRITERIA AND MONITORING OBJECTIVES**

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### **3.1 Success Criteria**

The following overall success criteria were established for the weed removal contract:

- 99.9% removal of mature red sesbania in all areas mapped as “sparse” infestations;
- 99.9% removal of all mature red sesbania in all areas mapped as “moderate” or “dense” red sesbania; and
- 99.9% removal of red sesbania seedlings and re-sprouts by the end of the project.

In the first year of the program (2004), the selected Contractor was required to complete removal of all mature plants to help prevent future flowering and seed set and to delimit the seed bank. Contractor was also required to complete removal prior to salmonid movement periods (i.e. before October 31<sup>st</sup>).

For ongoing site re-treatments in Years 2 (2005) and 3 (2006) of the program, the Contractor was required to removal all seedlings and re-sprouts during the most effective treatment period (summer and fall), and to complete work prior to salmonid movement periods (i.e. before October 31<sup>st</sup>).

### **3.2 Performance Monitoring Methods**

Following Contractor’s completion of red sesbania treatments, the biological monitor performed one complete walking survey of the entire creek system in all areas within 25 feet of the water’s edge to visually inspect the treatment area. Visual inspections were conducted within 14 days of the completion of Contractor’s work to help ensure accuracy of detection of untreated red sesbania (Note: detection excluded any new seedlings or sprouts that may have come up within 14 days of the last treatment, after contractor had completed their annual work).

Areas where any red sesbania over 4 inches high were detected were mapped during the site evaluation, and the condition and extent of the remaining red sesbania infestation noted. Problem areas were recorded using a GPS unit, marked in the field with flagging tape, and the location mapped to facilitate relocation by the Contractor. The resulting “punch list” of problem areas was provided to the Contractor to remediate, and a follow-up inspection completed, until the site successfully met performance criteria.

In addition to annual visual inspections, “spot checks” were performed throughout the treatment period to detect issues and problems, photo-document site work, and facilitate problem resolution before the end of each treatment season.

## 4.0 RESULTS

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Section 4.0 provides details of the results of the program activities presented in Section 2.0 above. A brief overview of program activities is provided below in chronological order:

### 2004 Activities:

- Formation of the Management and Technical Advisory Committee (MAT) made up of representatives from the California Department of Fish and Game, California Department of Water Resources, City of Roseville, City of Sacramento, Dry Creek Conservancy, NOAA Fisheries, USFWS, Placer County Agricultural Commission/Weed Management Area, Sacramento County Parks, Recreation, and Open Space Department, Sacramento County Agricultural Commission/Weed Management Area, Sacramento Weed Warriors, SAFCA and the US Fish and Wildlife Service.
- Prepared baseline red sesbania mapping - July 2004 (Appendix A).
- Secured project permits - July 2004 (Appendix D).
- Prepared Contractor bid specifications and awarded contract to Restoration Resources - August 2004 (Appendix C).
- Completed Removal of 80% of all Mature Red Sesbania Plants near open water by October 15, 2004 and in upland sites by November 2004 (photos- Appendix B).

### 2005 Activities:

- Completed removal of remaining 20% of all mature red sesbania Plants by July 2005 (photos- Appendix B).
- Conducted nursery outreach to raise awareness of invasive plant species entering wildlands from backyard gardens (Appendix E).
- Conducted first full re-treatment of red sesbania seedlings and re-sprouts in July 2005, and second full re-treatment in October 2005.
- Conducted outreach to local nurseries and prepared and distributed a “Dear Nursery” letter and “Don’t Plant a Pest” information (January, 2005).
- Conducted outreach to watershed groups and other land managers throughout 2005 (e.g., Dry Creek Watershed Council, Placer County Water Agency, El Dorado Irrigation District, other water agencies, landowners, and land managers) to raise awareness of, and land managers) red sesbania and other invasive plant species entering wildlands from storm drain systems and backyard gardens. from storm drain.
- Presentation to the Dry Creek Watershed Council in May 2005 with an update in fall 2005.
- Presentation to the California Invasive Plant Council, Cal-IPC conference - October 2005.

## **2006 Activities:**

- Conducted third full re-treatment in 2006, beginning on June 6, 2006 and completed by October 15, 2006.
- Prepared Long-Term Maintenance Program plan document in August 2006 (Appendix C).
- Conducted outreach to potential project partners regarding support of the long-term maintenance program into the future from August to October 2006.
- Conducted final walk-thru with Contractor and written sign-off of Contractor's work in November 2006.

Additional details about these activities are provided below.

## **4.1 Reports and Documents Prepared Under the Program**

The following reports, documents, brochures, and handouts were prepared under this project:

- Monthly cost and accounting records;
- Quarterly progress reports (provided to grantor);
- Request for Qualifications document (Appendix C);
- Long Term Maintenance Program Plan; Appendix C);
- Final Report (this report);
- Informational brochure – Dry Creek Red Sesbania Control Project (Appendix E);
- Dear Creekside Resident letters, July 2004, March 2005, and March 2006 (Appendix E);
- Dear Nursery letter and informational brochure about red sesbania January 2005 (Appendix E);

## **4.2 Permits and Agreements Secured Under the Program**

The Dry Creek Watershed Red Sesbania Control Project successfully obtained and complied with the following environmental permits and agency consultation recommendations:

- CEQA review, resulting in issuance of a Categorical Exemption, Section 15304, Minor Alterations to Land, prepared by SAFCA , dated 7/7/2004.
- Reclamation Board Permit issued by the State of California, The Resources Agency, Reclamation Board on July 9, 2004
- California Department of Fish and Game (CDFG) Section 1601 Notification of Streambed Alteration (SAA Notification NO. 1066-2004-0332-R2 dated July 22, 2004).
- A County of Sacramento Department of Regional Parks, Recreation, and Open Space Encroachment Permit NO 04-19 dated 6/3/04 and Permit NO 04-19 dated 6/29/06.
- City of Roseville and Placer County Access Agreements dated 6/29/04 and 6/28/04 respectively.

Copies of all permits issued for the project are included in Appendix D.

In addition to formal permitting, informal consultation was conducted for work in and near salmonid streams with the National Oceanic and Atmospheric Administration (John Baker, pers. comm.) for steelhead and with the United States Fish & Wildlife Service (Adam Zerrigner, Elizabeth Warne, and Lia McLaughlin pers. comm.) for Valley Elderberry Longhorn Beetles (VELB). Informal consultation included telephone conversations and emails that were intended to inform the agencies about the project, and to support the agency's approval of BMP's described herein, and to support the agency's informal finding of no effect on endangered species when using approved BMP's.

### **4.3 Mature Invasive Plant Removal (2004 to 2005)**

Following receipt of project permits, outreach efforts were undertaken to develop a list of potentially qualified contractors who might be interested in bidding on the proposed project. Based on telephone contacts with professional landscape contracting firms in the region, a search of professional organizations such as the California Invasive Plant Council (Cal-IPC) and the Society for Ecological restoration (Ser-Cal), and input from knowledgeable individuals and agencies who had undertaken similar work weed removal work in wildland settings (i.e. the City of Sacramento, the City of Roseville, The Nature Conservancy, and the National Park Service), a list of potentially qualified Contractors was developed.

Concurrent with Contractor outreach efforts, a Request for Qualifications was developed. The Request for Qualifications was circulated to a list of eight prospective Contractors on July 27, 2004. The Request for Qualifications is included in Appendix C.

A Pre-Bid site inspection and walk- thru was conducted on July 29, 2004. Written questions from prospective bidders were accepted until August 3, 2004. Written proposals from Contractors were accepted until August 6, 2004. Written proposals were evaluated by the MAT using the selection criteria that was outlined in the RFQ.

The successful bidding Contractor, Restoration Resources, was selected on August 9, 2004. Contractor mobilization began the week of August 17, 2004. Work performed included both hand and machine removal of red sesbania, and herbicide application. Control methods used for this project are described as follows:

- The preferred method for control of small plants up to 3 inches in diameter was to hand pull the entire plant, root and all, and dispose of the vegetation biomass in an upland location outside the floodplain (designated disposal site or small brush piles placed outside the floodplain).
- Larger plants greater than 3 inches in diameter were cut a few inches above the soil surface. The resulting vegetation biomass was collected and transported to an upland location outside the floodplain (designated disposal site or small brush piles placed outside the floodplain).
- The remaining cut stump was painted immediately with herbicides (i.e. "Cut and Paint" method). Herbicide applications were conducted under the direction of a licensed pesticide applicator. Herbicide applicators treated the cut stumps with Aquamaster™ (5%) (or Round-up™ in locations greater than 25 feet from water).
- Larger infestation such as seedling flushes and re-sprouting cut stumps along sand bars were treated with a foliar application of Aquamaster™ (5%).

- Following herbicide treatment, any remaining cut stumps were either pulled or re-cut flush to the ground surface because stumps are much easier to remove following the herbicide treatment regime.

Due to the high water conditions in Dry Creek in 2004, access to the creek channel was limited, resulting in delays in site access and treatment. As a result, initial removal was only 80% complete by the work cut off date of October 15<sup>th</sup>, 2004. The Contractor continued hand work from October-November 2004, and, as approved by SAFCA, scheduled the remaining removal (i.e. remaining 20% of mature vegetation mostly in the southern end of the project area) for 2005.

Example work performed example photographs are provided below. Refer to the Photodocumentation Photo Log for locations of permanent photopoints, and for photographs taken at every site including baseline, 2004 (immediately after treatment), 2005, and 2006 progress photos.



Red Sesbania Removal Using Hand Tools – Machete (2004)



Red Sesbania Removal with Power Tools - Chainsaws (2004)





Collecting and Removing Red Sesbania Vegetation Biomass (2004)



Removing Red Sesbania Vegetation Biomass using a Cable and Winch (2004)



Herbicide Application (2004)



Vegetation biomass collection (2004)



Transport and Disposal of Cut Red Sesbania in Designated Disposal Sites (2004)



Designated Disposal Site (2004)





Chipping cut biomass to facilitate solarization and breakdown of woody debris (2004)



2004 Comparison Photos- Before (Left) and Immediately After Treatment (Right), Upper Watershed



2004 Comparison Photos – Before (Left) and Immediately After Treatment (Right), Lower Watershed

#### 4.4 Implementation of Ongoing Follow-Up Invasive Plant Control (2005 and 2006)

From summer 2005 to October 2006, the Contractor performed repeated treatments of red sesbania seedlings and re-sprouts within the project area. Several complete treatment sweeps of the project area were performed each year in both 2005 and 2006, as well as spot-treatments at problem sites that were not responding to routine treatment sweeps. Based on the literature research and on direct observations of species reaction to herbicide application at the nearby American River Parkway (Rusmore, pers. comm.), optimal re-treatment timing was identified as during maximum seedling detection periods, (i.e. from late June to October in 2005 and 2006). Ongoing treatment followed BMP's developed for the project (described above in Chapter 2).

Follow-up treatment focused on removal of seedlings. In 2005, there were a few re-sprouts (estimated at 10-15% of all vegetation treated), but the vast majority of red sesbania treated was new seedlings that had sprouted after the 2004 treatment ended in November. By 2006, treatment focused almost exclusively on seedlings.

One important note is that the original research conducted for this project in July 2004 regarding red sesbania life cycle, physiology, and treatment options indicated that this species set flowers and seed approximately 1 to 1.5 years after sprouting. However, during the first year of re-treatment in 2005, seedlings that had sprouted after the final November 2004 treatment were observed flowering in early summer 2005, and some had even set seed by the time the initial 2005 treatment was conducted, a timeframe of from 6 to 11 months.

Unfortunately, since the project schedule was based on the assumption that the species had a 1 to 1.5 year life cycle, and because seasonal restrictions from both salmonid movement periods and high flow periods precluded work during a significant portion of each year, the original work schedule could not be substantially modified during 2005 or 2006 to adjust to earlier or later treatments to treat all flowering/fruitlet plants.

The following photographs illustrate work conducted in 2005 and 2006. Refer to the Photodocumentation Photo Log for locations of permanent photopoints, and for photographs taken at every site including baseline, 2004 (immediately after treatment), 2005, and 2006 progress photos.



Close up of newly-pulled sesbania seedling (August 2006). Plant estimated to be 2 weeks old.





Gravel bar showing dense re-growth of native Fremont's cottonwood and willows following mature red sesbania removal (2006)



Overview of Project Area (lower watershed) 2006. Note presence of native riparian plants.



Red sesbania seedling 4 days after herbicide application  
(Note green dye depicting location of herbicide application, yellowing leaves indicating plant die-off)(2006)



Baseline site conditions, lower watershed (2004)



Site conditions, lower watershed (2006)



Baseline site conditions, upper watershed (2004)



Site conditions, upper watershed (2006)

Following two complete years of re-treatment, the Contractor successfully achieved removal of 99.9% of all red sesbania plants by the end of the project in October 2006. A walk-thru was conducted by the biological monitors, and by SAFCA staff in November 2005, and a sign-off letter and release of contractual conditions was prepared by SAFCA and sent to the Contractor in December 2006.

## **4.5 Development of the Long-Term Maintenance Program**

Despite the significant progress made under the 3 year grant-funded project, red sesbania seedlings will likely continue to germinate following project completion. Without ongoing site maintenance, the area is likely to become re-infested with red sesbania, over time reverting to a level of infestation similar to, or worse than when the control program was initiated in 2004.

To address this issues, SAFCA and its project partners approved development of a long-term maintenance program for the Dry Creek Watershed. The long term maintenance program includes red sesbania treatment in the watershed 1 to 2 times per year for the first 3 years, then regularly, as necessary afterwards until the species is eradicated from the watershed. Because the project area encompasses many agency jurisdiction, and because the success of the program is important to everyone who manages the watershed, the long-term maintenance program is intended to be funded and implemented by several project partners. The complete document is included in Appendix C. The long term maintenance program should be considered a “living document” that will change over time as the various implementing agencies, contractors, and individuals continue to change their roles, funding, and responsibilities to the program over time. General elements of the program are described below.

### **4.5.1 Overview of the Long-Term Maintenance Program**

The Placer County Resource Conservation District (Placer RCD), with assistance from its project partners, intends to implement the Dry Creek Red Sesbania Long-Term Maintenance Program (Maintenance Program). The Placer RCD will enter into Cooperative Agreements with project partners, who will provide technical and financial assistance during the Maintenance Program.

The goal of the Maintenance Program is the eradication of red sesbania from the Dry Creek watershed. At least 3 years, and possibly 5-10 years of active maintenance is expected to be required to achieve full eradication of red sesbania from the Dry Creek Watershed. Eradication of this invasive species will:

- Aid the restoration of natural riparian and riverine processes;
- Maintain the improved floodwater conveyance that was achieved during the SAFCA red sesbania control program (especially in areas downstream of the City of Roseville);
- Significantly contribute to regional elimination efforts of this invasive plant; and
- Provide technical information about effective control of this plant to other land managers and land owners.

The primary objective of the Maintenance Program is to continue control of red sesbania seedlings until the seed bank is exhausted, and the plant is entirely eradicated from the Dry Creek watershed. A secondary objective of the program is outreach and education, particularly to upstream and tributary land owners and land managers. The third objective is to share technical information with others.

## Potential Project Partners

The Placer County RCD, with oversight from SAFCA shall have management authority over the project. The Dry Creek watershed encompasses land in both Sacramento and Placer counties, and passes through several city, water agency, and flood control jurisdictions, including:

- The County of Sacramento;
- The County of Placer;
- the City of Sacramento;
- the City of Roseville;
- the City of Rocklin;
- the Placer County Water Agency;
- the Placer County Flood Control and Water Conservation District; and
- the Sacramento Area Flood Control Agency.

This area is also within the jurisdiction of several other agencies and organizations involved with water conservation, floodplain management and restoration, and weed management, including:

- the Dry Creek Conservancy;
- the Placer County Agricultural Commissioner's office;
- the Sacramento County Agricultural Commissioner's office; and
- the Placer County Resource Conservation District (RCD).

All of these agencies and organizations are considered potential project partners, and are anticipated to provide project support, including funding, staff support, and other resources necessary to accomplish eradication of the species. The counties of Sacramento and Placer, together with the cities of Sacramento, Roseville, and Rocklin will assist the Placer County RCD with securing property access. All project partners will assist with outreach and education activities. The Placer County RCD and its project partners have established a fund for continued, long term management and maintenance of red sesbania in the Dry Creek watershed.

### 4.5.2 Invasive Plant Removal Activities

The Placer RCD will select and retain a Contractor(s) to conduct necessary weed control. The recommended treatment regime is as follows.

- At least two full treatments will be completed per year for the first three years, the first in August, and the second in late September to early October (Note: treatment in areas within 25 feet of flowing water must be completed by October 15<sup>th</sup> of each year to prevent effects on fish migrations as per EPA and NMFS project guidelines).
- The recommended method for control of widely-scattered individual red sesbania is hand-pulling seedlings up to 3 inches in diameter. This is most applicable to individual plants and sparse infestation areas in most of the upper watershed area.
- For seedlings larger than 3 inches in diameter, and at larger infestation sites, a cut and paint application of herbicides, or a foliar spray herbicide application using a small nozzle, small area/low volume herbicide application setting should be used to carefully apply herbicide to localized areas (e.g. individual plants and small clusters). Because most of the red sesbania seedlings will be within 25 feet of flowing water, an application of 5% Aquamaster™ mixed with a dye to facilitate identification of treated plants is recommended. Application, signage, and notification procedures



must be conducted under direct supervision by a licensed Herbicide Applicator, and must follow labeling instructions and federal and state requirements.

## **4.6 Site Mapping and Database Management**

Under this Task, May & Associates, Inc. developed both a GIS and a Microsoft Access database, and updated and maintained this information over the life of the project from 2004 to the end of the project in October 2006. The GIS and Access databases are structured to produce maps and tables, run queries (e.g. comparisons of site conditions between years), and produce detailed notes on the treatment areas and invasive plant infestations within the Dry Creek Watershed.

The intent of these project deliverables is to allow the long term maintenance program to use mapping and treatment data during long-term site maintenance, updating the information as necessary to keep database in a useful condition.

The GIS Database was developed in 2004 and updated annually. The baseline layers were created by combining an aerial photograph base layer for the project area by 'stitching' together GIS layers provided by the Placer County and Sacramento County Planning Departments. Additional information on lands within Roseville was provided by the City of Roseville GIS department. The air photographic base layer, once created, was overlain with the topographic base map layer; infrastructure layer; roads layer; and parcel and ownership information layer.

The work area boundary; work units layer; and red sesbania mapping layer were then created based on preliminary project planning and the results of field mapping of the red sesbania infestation. Various maps and mapping products were created over life of project, including annual updates of red sesbania treatments to assess progress; mapping of problem areas and 'hot spots' that Contractors were advised to revisit/assess, or retreat, and mapping of new red sesbania infestations, both in and near the project area. The new red sesbania infestation information was shared with the Department of Fish and Game in order to increase the knowledge base about regional species distribution and infestation rates.

Contractor work records were incorporated into an Access database. The purpose of the Access database is to provide a user-friendly format for tracking work performed in the watershed over time; providing a means to query the database (e.g., work dates by site; treatment methods; treatment results; acres treated per dates) that could be used into the future during the project maintenance phase.

Electronic Copies of both the GIS database and the Access Database were provided to SAFCA as separate program deliverables.

## 5.0 DISCUSSION

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Overall, the DCWRSCP is considered a successful project. All of the various program elements and grant requirements were completed on time, and the project was completed within its allocated budget. All mature red sesbania was removed from the project area, and all seedlings and re-sprouts were treated for 2 consecutive years, resulting in 99.9% removal of red sesbania from the watershed at the end of the contract period in October 2006. These successes are a result of the hard work of a conscientious and diligent Contractor and the oversight of an experienced, problem-solving program management team.

As with every project, there is however, room for improvement. This section is intended to describe 'lessons learned' on this project so that future red sesbania efforts can build on and improve on weed control efforts undertaken during the DCWRSCP. Lessons learned are presented below, in no particular order.

1. **Plan for a Minimum Twice Yearly Treatment Cycle.** One of the most important lessons learned was that the reported life cycle for the target species in the literature was incorrect. Although the literature reported a life cycle of 1 to 1.5 year, we observed red sesbania sprouting, establishing, flowering, and setting seed in as little as 9 months. Given our experiences, we would recommend switching from an annual treatment calendar (as was established in the beginning for this program) to a multiple treatment per-year regime, with a minimum of 2 treatments per year, preferably 3 treatments for established infestation sites.
2. **Adjust Treatment Schedule Every Year based on Observed Site Conditions.** During the course of the project, there were unusually heavy storm events in both 2004 and 2005, and also later-than-typical storm events in 2005 and 2006, all resulting in late season, high water levels in Dry Creek and its tributaries. As a result, the Contractor had limited access to the treatment area in late spring (the planned primary herbicide treatment period). In addition, the unusually high water levels left low-lying sandbars (considered prime germination areas for red sesbania) under water until much later in the season than anticipated (i.e. until September or early October).

Also, during the course of this project, we observed multiple 'waves' of red sesbania peak germination, with higher and drier areas experiencing highest seedling germination rates in late June, while sand bars and other wet low elevational areas with peak germination rates in late summer, as late as the end of October (well past the allowed herbicide treatment period). The lesson learned is to allow for a more flexible treatment schedule that is established annually based on field observations.

We recommend a site assessment in early June to establish the treatment schedule for the year. Further, we recommend a minimum of 2 to 3 treatments per year, starting when seedlings are easily identifiable but before plants flower (typically late June or early July). Although it may seem counter-intuitive at first, we recommend that the majority staffing and funding be allocated to the last treatment cycle (in September or early October), focusing on sandbars and other low-lying areas immediately adjacent to the water's edge.

3. **Plan for a Longer Treatment Timeframe To Achieve Eradication.** For this project, treatment was funded for 3 years. However, due to the relatively well-developed seed bank present in the Dry Creek watershed and the longevity of red sesbania seeds, it was not possible to completely eradicate the species within the 3 year timeframe of the project. We recommend a follow-up maintenance period of at least 3 years, with a possible extension to



allow for an additional 5 to 10 years of treatment to achieve full eradication. In the absence of continued treatment leading to full eradication, the project site will likely revert back to its original infestation levels or worse over time. We recommend that other projects plan for a 3-year primary treatment period, followed by a maintenance period during which half of the original effort is provided for up to 3 years following the primary treatment period, and approximately  $\frac{1}{4}$  of the effort is provided for years 4 and 5, and possibly up to 10 years following completion of the project.

- 4. Investigate Alternative Treatment Options for Wet Areas such as Sand Bars.** We found herbicide treatment was least effective on wet sandbars, perhaps due to lack of adhesion of the herbicide onto the plant's surface. We recommend alternative treatment specifically for wet sandbar type areas that are found not to be responding to typical treatments after the first full year of weed control activities. Because sand bars and other low-lying wet areas are considered prime habitat for seedling germination, alternative treatments should be investigated. Possible alternative treatments include hand pulling young seedlings (Note: will require multiple treatments per year to be effective); addition of a non-toxic tackifier to the herbicide such as vegetable oil based tackifier (Note: the use of any herbicides other than those specifically approved for use near water will need to be approved by the U.S. Fish and Wildlife Service and NOAA Fisheries prior to use. Herbicide application must follow EPA labeling guidelines for herbicides); and/or use of controlled flaming. A pilot flaming program was undertaken for this project with generally positive results. Flaming has been very successful with other emerging woody shrub species, and involves passing a flame over the seedlings during the wet season immediately after sprouting. This treatment effectively boils the young plants, and does not result in a flame or fire.
- 5. Expand Program to Treat Additional Invasive Plant Species.** In addition to red sesbania, several other invasive riparian plants were detected in the Dry Creek Watershed. Invasive species that were observed in Dry Creek and its tributaries included giant reed (*Arundo donax*), pampas grass (*Cortaderia selloana*), Chinese tallow tree (*Sapium sebiferum*), catalpa (*Catalpa* sp.), and fennel (*Foeniculum vulgare*). The additional cost of treating additional invasives concurrent with red sesbania is minimal in comparison with conducting separate treatment for each species.
- 6. Investigate Potential to Use Volunteers for Follow-Up Weed Control, Invasive Plant Detection.** For this project, it was not appropriate to use volunteers for follow-up weed control because the majority of the project area was on private lands. However, for projects conducted on public lands, a volunteer stewardship component should be considered for the maintenance phase of the project. Maintenance activities would likely include invasive plant detection, follow-up weed treatments, and possibly active restoration plantings (as necessary). Development of a stewardship program would have additional benefits, including building community goodwill and support for the project, improving the project area, and reducing long-term maintenance costs.
- 7. Include Outreach and Education as a Critical Element of Program Success.** We strongly suspect that the source population for red sesbania in the Dry Creek Watershed was one or more backyard garden escape landscape specimens, possibly entering the watershed through garden waste disposal, active planting, or through seeds washing downstream via the storm water drain system. Therefore outreach to both local residents and local plant nurseries was considered a key aspect of the program. "Don't Plant a Pest" and similar brochures are readily available from the USDA and Sacramento and Placer County's Weed Management Area offices.

8. **Investigate Use of More Effective Herbicides.** As with other aspects of restoration science, newer and more effective herbicides with less toxicity are being developed every year. For example, Transline™ (clopyralid), is an herbicide that is particularly effective on members of the legume family (Fabaceae), and could therefore be an important tool in controlling red sesbania. Since Transline™ is more selective than broad-spectrum herbicides such as Aquamaster™ or Round-up™ it may reduce incidental damage associated with current application methods. Because red sesbania is a legume, and no native legume species occur in this particular riparian habitat, Transline™ (clopyralid) may hold great promise for red sesbania control. (Note: the use of any herbicides other than those specifically approved for use near water will need to be approved by the U.S. Fish and Wildlife Service and NOAA Fisheries prior to use. Herbicide application must follow EPA labeling guidelines for herbicides).

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Baker, John. Biologist, Fisheries Division, National Oceanic and Atmospheric Administration.  
Various emails regarding informal consultation and no effect on salmonids. July 2004.

Brunetti, Kathy. Coordinator, California Department of Pesticide Regulation. Sacramento, CA.  
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Warne, Elisabeth. Regulator, Endangered Species Branch, U.S. Fish and Wildlife Service, Sacramento, CA. Various emails in July 2004 regarding informal consultation for work on Hansen Ranch. [Elizabeth\\_warne@fws.gov](mailto:Elizabeth_warne@fws.gov)

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## Appendix A. Tables and Figures

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**Figure 1. Known Red Sesbania Infestations in the Dry Creek Watershed**

**Figure 2. Extent of Original (Treated) Red Sesbania Infestation**

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**Figure 3. Red Sesbania, Regional Distribution Near Dry Creek**

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**Figure 4. Potential Problem Areas in the Dry Creek Watershed**

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## Appendix B. Photodocumentation

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## Appendix C. Reports

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## Appendix D Permits and Agreements

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## Appendix E Brochures, Handouts, and Other Materials

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