TIJUANA RIVER VALLEY
INVASIVE PLANT CONTROL PROGRAM
PHASE 4:
FINAL REPORT

Grant Agreement No.: 5001139
Project Name: Tijuana River Valley Invasive Plant Control Program – Phase 4
Contractor Name: Southwest Wetlands Interpretive Association (SWIA)
Project Director: Mayda Winter
Project type: Invasive species control and habitat enhancement
Funding source: *TransNet* Environmental Mitigation Program FY 2009
Funding amount: $149,437
Start date: January 1, 2009
End date: April 30, 2010

APRIL 30, 2010

Southwest Wetlands Interpretive Association
700 Seacoast Drive #108
Imperial Beach, CA 91932

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1.0 EXECUTIVE SUMMARY

The Tijuana River Valley is in one of the most important biological sites in California, but it is being degraded by non-native invasive plants, particularly Arundo (*Arundo donax*), castor bean (*Ricinus communis*) and tamarisk (*Tamarix* spp.). SWIA started the Tijuana River Valley Invasive Plant Control Program in 2002 with the goal of controlling the worst invasive species in all of the wildlands in the entire valley.

Funding from the *TransNet* Environmental Mitigation Program FY 2009 (this project) allowed for continued expansion of the program and was called Phase 4. The project was undertaken to enhance and restore prime riparian and mule fat habitats within the Tijuana River Valley through the treatment of invasive, non-native plants and the planting of native plant species. The project was on public lands, mostly within the County of San Diego's Tijuana River Valley Regional Park. The overall goals of the project were to improve these valuable sites for visitors, to control the spread of invasive plants, and to restore native habitats.

During this project, SWIA conducted the following activities:

A. Maintained a Technical Advisory Group (TAG)
The TAG included members from the resource agencies and all of the major stakeholders in the valley. The TAG advised and guided the project.

B. Controlled Invasive Plants and Revegetated with Native Plants
The control of invasive plants and revegetation was a success:

- Invasive plants within 87.5 acres were treated (the area treated exceeded the contract requirement of 74 acres); and
- Native riparian plants were planted within a 1.5 acre revegetation site.

C. Conducted Project Monitoring
Monitoring produced detailed information about the progress of the project and allowed for informed discussion between and among the project principles and the TAG.

The monitoring showed that the project was very successful:

- Treatments were thorough and effective;
- Invasive plant cover was substantially reduced providing space for the expansion of native plants;
- Sites were dramatically changed, showing new views of resources previously hidden by invasives; and
- Native cuttings planted into the revegetation site were showing good growth.

In conclusion, SWIA met or exceeded all the goals of this grant and the grant allowed SWIA to complete Phase 4 of a very successful, on-going invasives control program.

2.0 INTRODUCTION

The Tijuana River Valley is in one of the most important biological sites in California (Concur 2000): (1) it includes a county regional park, a state park, and a national wildlife refuge (Figure 1); (2) it contains prime riparian and salt marsh habitats within an urban area; (3) it includes critical habitat for the least Bell's vireo, southwestern willow flycatcher, salt marsh bird's beak, wandering skipper butterfly, light-footed clapper rail, and Belding's savannah sparrow; (4) it is one of the sites designated as a Biological Habitat of Special Significance in the San Diego Basin Plan; (5) it is on the California Coastal Commission's list of California's Critical Coastal Areas; and (6) the estuary is federally designated a National Estuarine Research Reserve by NOAA and is internationally recognized as a Wetland of International Importance by the Ramsar Convention.

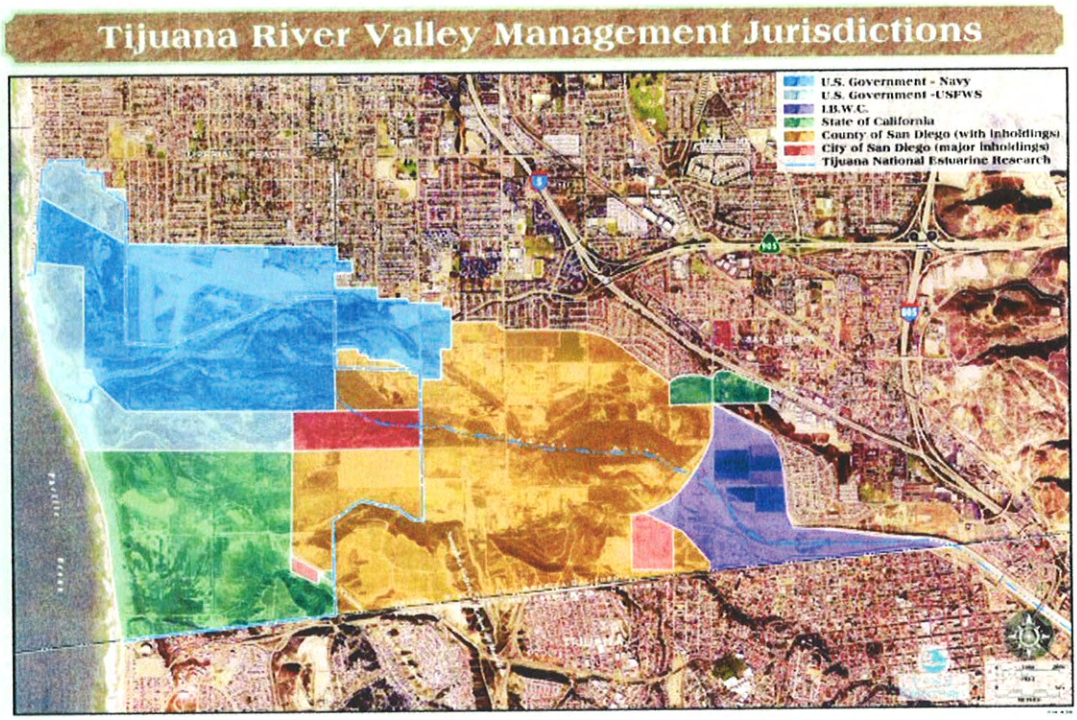

Figure 1. Tijuana River Valley Management Jurisdictions.

But the valley is being degraded by non-native invasive plants, particularly giant reed or Arundo (*Arundo donax*), castor bean (*Ricinus communis*) and tamarisk (*Tamarix* spp.; SWIA 2002). These plants alter vegetation structure, displace native plant species, and degrade habitats for native animal species (Bossard et al., 2000). They also increase fire frequency, alter soil chemistry, reduce surface water availability, and alter rates of sedimentation and erosion.

Tijuana River Valley Invasive Plant Control Program was started by SWIA in 2002. The purpose of the program was to control the spread of the worst invasive plants in the entire 3,600 acre valley. The ambitious program was expected to require several phases and to extend over several years. So far the program has been continuously funded since 2002, has gone through five phases and has already treated invasives within more than 1,600 acres with funding of over $2.6m. Treatments have been conducted within the county regional park, the state park, the national wildlife refuge, and the national estuarine research reserve. The program has enthusiastic support from the various public landowners in the valley and from the resource agencies.

These are the main sources of funding for the phases of the invasives control program:

- Phase I – California State Coastal Conservancy; US Fish and Wildlife Service (2002 – 2008)
- Phase II – State Prop 13, Watershed Protection (2004 – 2007)
- Phase III – State Prop 40, NonPoint Source Pollution (2006 – 2008)
- Phase IV – SANDAG's TransNet Environmental Mitigation Program FY 2009 (2009 – 2010) – this project
- Phase V – U.S. Fish & Wildlife Service (2009 – 2014)

SWIA has submitted an application for additional funding from SANDAG's TransNet Environmental Mitigation Program for FY 2010 which would be for 2010 – 2013.

3.0 PROJECT GOALS

The project was undertaken to enhance and restore prime riparian and mule fat habitats within the Tijuana River Valley through the treatment of invasive, non-native plants and the planting of native plant species. The project was on public lands mostly within the County of San Diego's Tijuana River Valley Regional Park. The overall goals of the project were to improve these valuable sites for visitors, to control the spread of invasive plants, and to restore native habitats.

The main tasks of the project were to:

- **Maintain a Technical Advisory Group (TAG)**
  The TAG would guide and advise the project, and was expected to include members from the resource agencies, Tijuana River Valley land owning agencies, and experts in the field of invasive plant control.

- **Control Invasive Plants and Revegetation**
  The control would involve the treatment of the invasive plants within at least 74 acres and the re-vegetation of at least 1.5 acres with native species. Thus a total of at least 75.5 acres were to be enhanced or restored. This was the most important task and was expected to require the most time, effort and money.

- **Conduct Project Monitoring**
  Monitoring of the invasives treatment sites would provide valuable information on the success and effectiveness of the project.

4.0 LIST OF SUB-CONTRACTORS

SWIA hired the following contractors to conduct the project tasks:

- AECOM (leads = Tito Marchant and Julie Simonsen-Marchant) – to conduct the invasive treatments and restoration activities;
- Boland Ecological Services (Dr. John Boland) – to oversee the field work, to conduct the monitoring, and to run the TAG meetings; and
- Lisa Ordonez to assist with the monitoring.

5.0 PROJECT DESCRIPTION

The numbering in this section follows the contract.

TASK 1. PLANS AND COMPLIANCE REQUIREMENTS

All environmental documentation and landowner right-of-entry agreements for the project had been obtained prior to the start of the project. Copies of the California Environmental Quality Act (CEQA) document, the National Environmental Policy Act (NEPA) document, the Streambed Alteration Agreement and the landowner right-of-entry agreements were provided to the Grant Manager before work began.

TASK 2.1. TECHNICAL ADVISORY GROUP (TAG)

The TAG was maintained throughout the course of this project. The TAG included members from the resource agencies, Tijuana River Valley land owning agencies, and experts in the field of invasive plant control. The current members are listed in Table 1. The TAG attended one annual meeting during the project which was held on September 8, 2009. The meeting was well attended and involved a presentation of past results and a discussion of the planned TransNet work. The TAG's ideas and opinions were incorporated into the work. The meeting was documented; the agenda, meeting minutes and attendance list were provided to the Grant Manager.

Table 1. The TAG list.

Technical Advisory Group (TAG) – List of Members

Don Brubaker	U.S. Fish and Wildlife Service
Brian Collins	U.S. Fish and Wildlife Service

Patrick Gower	U.S. Fish and Wildlife Service
Carolyn Lieberman	U.S. Fish and Wildlife Service
Slader Buck	U.S. Fish and Wildlife Service
Kelly Fisher	California Fish and Game
Christine Fritz	California Fish and Game
Chris Peregrin	California State Parks
Clay Phillips	California State Parks
Kim O'Connor	U.S. Navy
Larry Duke	San Diego County Parks and Recreation
Yidelwo Asbu	San Diego County Parks and Recreation
Jessica Norton	San Diego County Parks and Recreation
Megan Hamilton	San Diego County Parks and Recreation
Lisa Wood	City of San Diego
Wade Caffrey	City of San Diego
Jim Nakagawa	City of Imperial Beach
Bill Winans	San Diego County Dept of Agriculture
Lee McEachern	California Coastal Commission
Karen Bane	California State Coastal Conservancy
Megan Johnson	California State Coastal Conservancy
Steve Smullen	U.S. International Boundary and Water Commission
Joshua Gough	U.S. Border Patrol
Barbara Kus	U.S. Geological Survey
Chris Nordby	Nordby Biological Consulting
Mike McCoy	Southwest Wetlands Interpretive Association
Jeff Crooks	Tijuana River National Estuarine Research Reserve

TASK 2.2. CONTROL OF INVASIVE PLANTS AND REVEGETATION

The invasive-plant treatment sites were in prime mule-fat and riparian habitats mainly in the eastern part of the valley (Figure 2). The sites were chosen because they linked previously treated sites, creating extensive continuous areas of treated sites. We promised to treat within 74 acres and actually treated within 87.5 acres (Table 2).

Table 2. List of TransNet Treatment Sites.

Site #	Site Name	Acres
A	Border Patrol (treatment)	1.5
B	Dairy Mart Ponds (treatment)	86
C	Hollister Bridge (treatment and re-vegetation)	1.5
	TOTAL	**89**

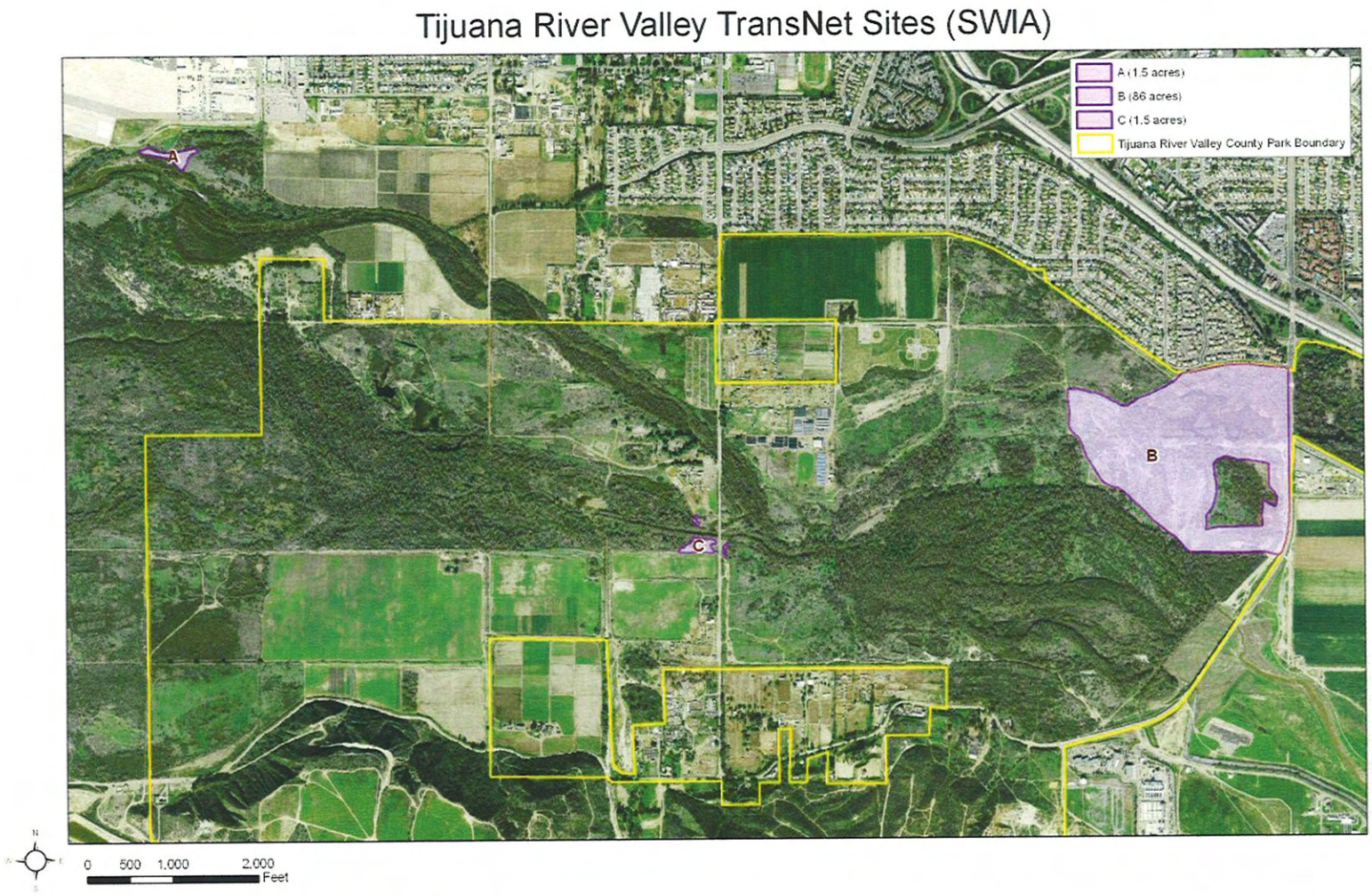

Figure 2. Map showing TransNet sites: invasive species treatment sites (A and B) and the restoration site (C).

Treatment methods were species specific. The cut-stump method was used to treat tamarisk; stems were cut and immediately sprayed with the herbicide imazapyr (75% solution). The foliar-spray-and-leave-in-place method was used to treat Arundo and castor bean. Glyphosate herbicide (7.5% solution) was sprayed onto the foliage of the plants using either a power sprayer with a 250' long hose or a back-pack sprayer (Figure 3). The crew made sure that the herbicide spray did not go onto the surrounding native vegetation by preparing the Arundo beforehand by "trampling" it, i.e., they bent *Arundo* branches into a clump and pulled branches away from willows, etc. The crew made an extra effort to make sure that all of the stems in a stand were well sprayed and used ladders to get into particularly tall or dense stands.

Figure 3. Power-spraying a clump of Arundo.

2.2.3 Re-vegetation

The re-vegetation site was near Hollister Bridge (Site C in Figure 2). We treated and cleared invasive species from the sites and then planted with cuttings of native species. This site is suitable for cuttings because it becomes very wet during the rainy season. The number and species planted were: 600 mule-fat (*Baccharis salicifolia*), 300 arroyo willow (*Salix lasiolepis*), and 300 narrow-leaf willow (*Salix exigua*). These are the dominant riparian plants in the area. The re-vegetation expanded on previous restoration we had conducted at Hollister Bridge.

TASK 2.3. PROJECT MONITORING RESULTS

The monitoring was conducted independently of the treatment and re-vegetation (see Section 4.0). This allowed for unbiased reporting of results. The monitoring addressed several important questions concerning treatment effectiveness and the answers are given below.

Question 1. What was the effectiveness of the herbicide treatment?
Methods: Living invasive plants scattered throughout the treatment area were labeled and photographed prior to the treatments. [Large multi-stemmed Arundo and tamarisk patches were considered a single individual.] Then, during February 2010, the plants were revisited and determined to be (a) treated or not, and (b) alive or not (successfully treated).

Results: All the labeled plants had been treated and most of the plants were completely dead (Table 3). However, some of the Arundo were resprouting (43%). It should be noted that the resprouting Arundo patches were large (>7m diameter), originally consisted of thousands of stems and at the time of surveying had only 1 or 2 new sprouts.

Table 3. Survivorship of treated plants.

Species	number alive	total	% alive	notes
ARUNDO (clumps)	10	23	43%	each live patch had 1 - 2 sprouts
CASTOR BEAN	0	29	0%	
TAMARISK	0	34	0%	

These results show that the initial treatment of these target species was effective but that retreatment – particularly of Arundo patches – is essential.

Question 2. What was the overall appearance of the restored sites and how did that change with time?
Methods: Photos of the sites were taken from 18 photo points scattered throughout the restoration sites. The photos were taken before (September 2009) and after (February 2010) the restoration work to determine changes in appearance.

Results: All of the after photos showed that the invasives project had made dramatic changes at the treatment sites. Three of the before-after pairs are provided here – one from each of the main Sites A, B and C (Figures 4, 5 and 6). Note that the 'before' pictures tend to be green because they were taken in summer, whereas the 'after' pictures tend to be grey because they were taken in winter when the dominant native plants in the area (willows) have lost their leaves.

At Site A, the tamarisk plants in the channel were cut and removed revealing a stunted salt marsh community, consisting of mainly *Salicornia virginica* (Figure 4). The salt marsh plants growing on the channel bottom had been shaded by the tall tamarisk plants but will now receive significantly more sunlight and likely spread across the channel bottom.

At Site B, the tamarisk plants surrounding one of the Dairy Mart Ponds were cut and removed providing a view of the pond (Figure 5). This is the first time in many years that birders have been able to get a view of this pond and we have already been thanked several times by birders for providing a view of the pond and the unusual birds that live there.

Figure 4. Before and after photos of the channel in Site A. Note that the tamarisk plants clogging the channel were cut and removed – providing sunlight to the salt marsh plants (*Salicornia virginica* and others) growing on the channel bottom.

Figure 5. Before and after photos of a Dairy Mart Pond in Site B. Note that the tamarisk surrounding the pond have been cut – providing a view of the pond.

Figure 6. Before and after photos of Site C the revegetation site. Note that the large clumps of Arundo have been removed.

At Site C, the revegetation site, several large clumps of Arundo were sprayed and then cut and chipped in place (Figure 6). The site was later planted with cuttings (described below). The restoration of this site expands on other restoration projects we've conducted in the area in the past and now the view from Hollister Bridge is Arundo-free!

Question 3. How specifically did treated sites change with time?
Methods: Four vegetation transects (30m long) were laid out prior to the work at scattered locations within the restoration sites. The percent cover of the species along the line was measured, using the line-intercept method, before and after the work.

Results: The transects showed that the percent cover of invasive species declined rapidly after treatment, in all cases to 0% cover (Figure 7). The transects also showed that the percent cover of native species stayed the same or showed a modest increase after the treatment of the invasives (Figure 8). Native species are generally slow to establish in treated sites and it will take a year or two to see significant changes.

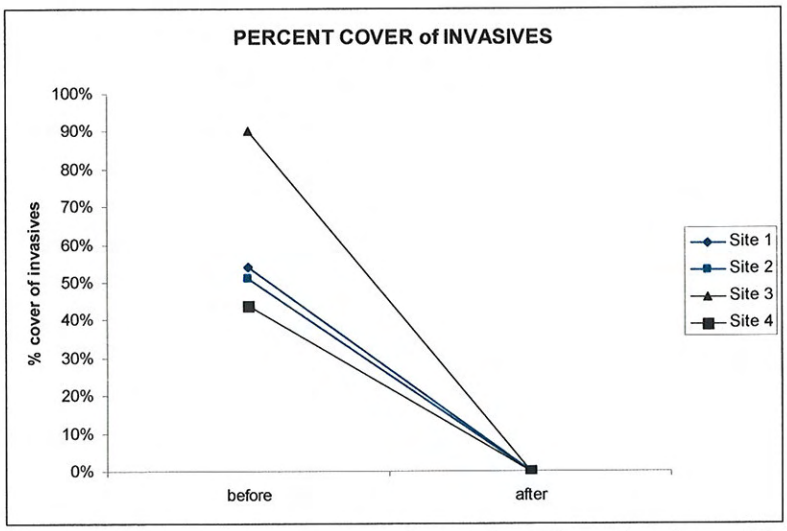

Figure 7. Changes in Percent Cover of Invasive Plant Species at Transects.

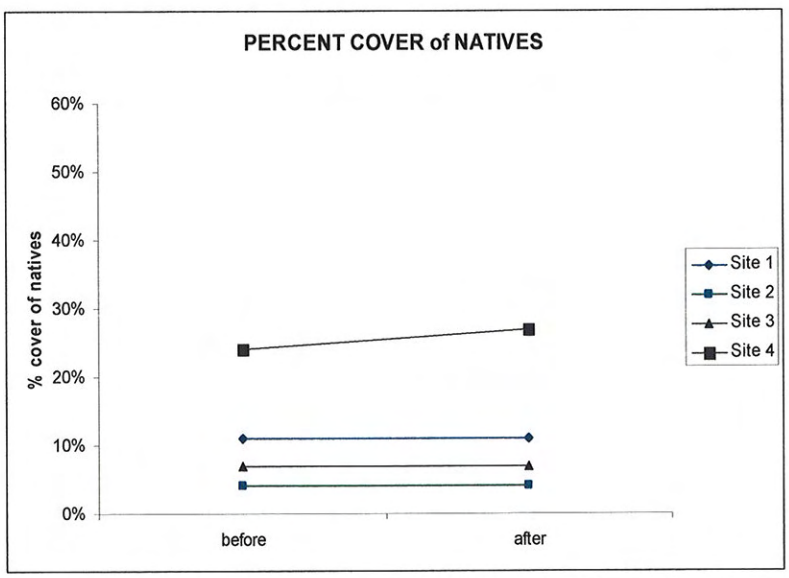

Figure 8. Changes in Percent Cover of Native Plant Species at Transects.

Question 4. What was the survivorship rate of the native plants planted into the re-vegetation sites?

Methods: Cuttings were examined along randomly placed transects through the restoration site in February 2010. Cuttings were determined to be alive if they had new green sprouts or dead if they no green sprouts. [February is a little early in the season to do this determination; it is likely that more of the cuttings will be sprouting in March/April.]

Results: There was good survivorship of the cuttings in the revegetation site (Figure 9). Approximately 50% of the cuttings were sprouting (110 sprouting out of 216 surveyed). This meant that the sprouting plants were between 1.5 and 2.5 meters apart, which will result in good coverage of the entire area.

Figure 9. Cuttings resprouting in the revegetation site.

Conclusions

The monitoring shows that the project was very successful:

- Treatments were thorough and effective;
- Invasive plant cover was substantially reduced providing space for the expansion of native plants;
- Sites were dramatically changed, showing new views of resources previously hidden by invasives; and
- Native cuttings planted into the revegetation site were showing good growth.

6.0 NEXT STEPS

The next steps for the program are to further expand the control activities into new areas in the valley, and to conduct retreatment and revegetation in more of the "old" sites. The program is applying for more funding to conduct this important restoration work.

7.0 REFERENCES

Bossard, C., J. Randall and M. Hoshovsky (eds.) 2000. *Invasive Plants of California's Wildlands.* University of California Press, Berkeley, CA.

CONCUR, Inc. 2000. *Comprehensive Management Plan for Tijuana River National Estuarine Research Reserve and Tijuana Slough National Wildlife Refuge.* Prepared for California Dept. of Parks and Recreation, US Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration.

SWIA. 2002. *Tijuana River Valley Invasive Plant Control Program.* Plan used to support CEQA and NEPA documents. Prepared for SWIA by Tierra Environmental Services. 26 pages plus 41 maps in Appendix.

SWIA

May 7, 2010

Ronald Saenz
SANDAG
401 "B" Street, Suite 800
San Diego, CA 92101-4231

Dear Ron,

Please accept the enclosed document as the ***Final Report: Tijuana River Valley Invasive Plant Control Program, Phase 4.***

We are please to report that our original project has been successfully completed and slightly under budget. We appreciate the flexibility to allow the remaining funds to be reprogrammed to allow us to provide final touch-up work at our restoration site, thus leaving a clean palette against which the new native species can thrive.

We will be submitting an invoice for the final work by May 15, 2010. Please advise us as to the process for requesting reimbursement of the 10% withhold.

We thank you for the opportunity to continue work on this important project and look forward to working with the SANDAG TransNet EMP again.

Sincerely,

Mayda C. Winter

Mayda C. Winter
Grant/Project Administrator

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