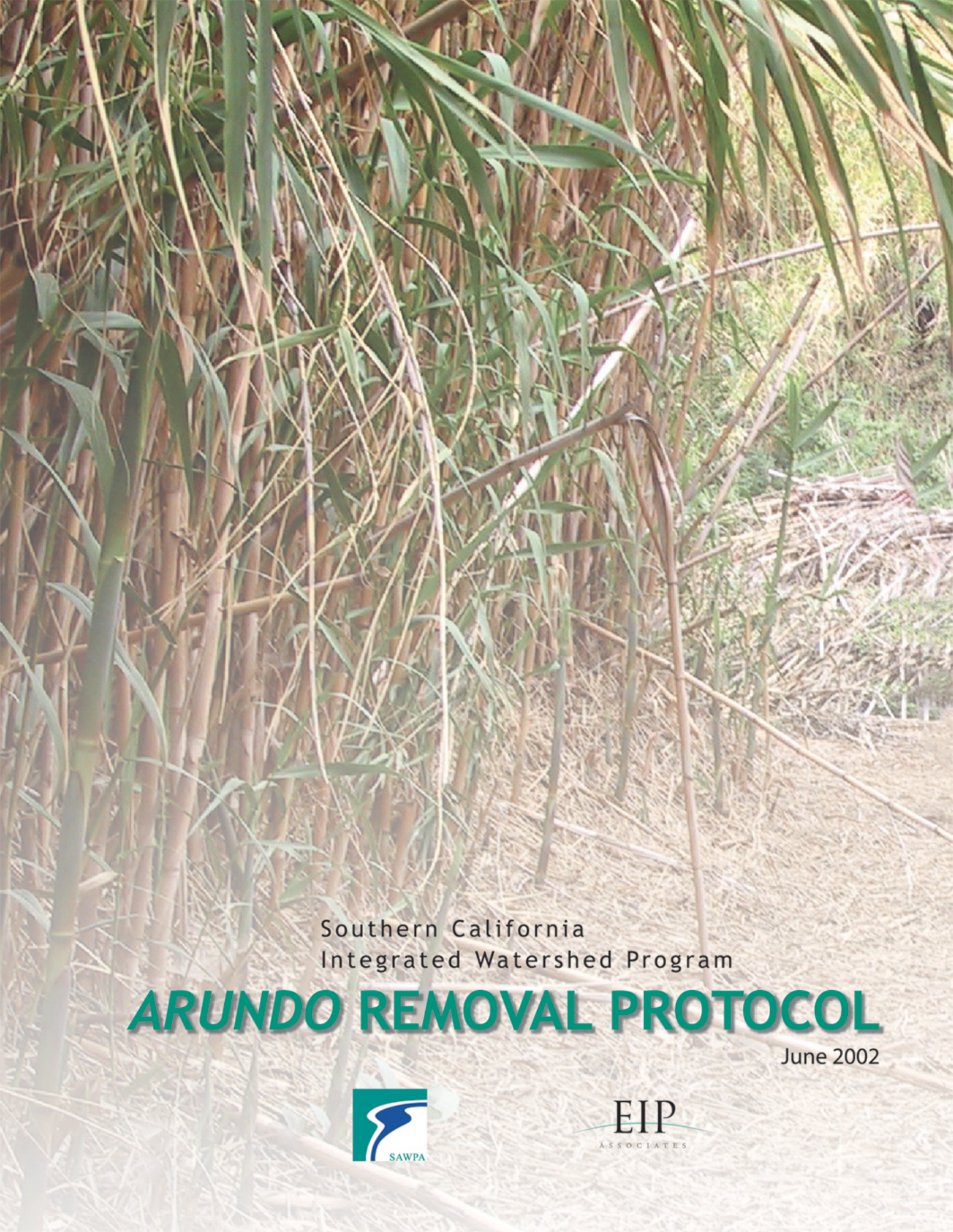
Exhibit 11-G

Arundo Removal Protocol



Southern California
Integrated Watershed Program

ARUNDO REMOVAL PROTOCOL

June 2002

SAWPA

EIP
ASSOCIATES

Southern California Integrated Watershed Program

ARUNDO REMOVAL PROTOCOL

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Kerwin Russell of the Riverside-Corona Resource Conservation District leading a Team Arundo field trip, April 2002
Photo courtesy of EIP Associates

Acknowledgements

Operating within the Santa Ana Watershed, Team *Arundo* is recognized throughout the State of California as a leader in *Arundo* removal efforts. A number of agencies and organizations compose Team *Arundo*, including the Santa Ana Watershed Association of Resource Conservation Districts (SAWA), the Riverside County Parks and Open Space District, the Riverside County Flood Control District, the Orange County Water District, the Orange County Public Facilities and Resources Department, the Monsanto Company, and the Orange County Conservation Corps. Historically, The Nature Conservancy has also been a part of Team *Arundo*. The foresight and leadership of these groups have proven instrumental in elevating the need for *Arundo* removal to an issue of statewide importance. Without the efforts of Team *Arundo* members to secure funding, acquire permits, and develop various methodologies, there would be no need for this *Arundo* Removal Protocol. This protocol, compiled with input from Team *Arundo* members, documents *Arundo* removal as practiced in the Santa Ana Watershed.

In addition, the individuals and groups that directly contributed to the development of this Arundo Removal Protocol deserve recognition and thanks. Seven groups completed Arundo Removal Questionnaires, including Mark Biloki of the Riverside County Flood Control and Water Conservation District, Rick Stroup, Robert Van Geitzen, and George Patino of the Orange County Conservation Corps, Kerwin Russell and Shelli Lamb of the Riverside-Corona Resource Conservation District (representing SAWA), Dennis Washburn, a subcontractor to the Inland Empire West Resource Conservation District, Dan Bogan of the Riverside County Regional Park and Open Space District, Kelly Schmoker and Wanda Smith of the California Regional Water Quality Control Board (Region 8), and Bill Neill of Riparian Repairs (Los Angeles County). Dick Zembal of the Orange County Water District, Gayle Holyoak of the San Jacinto Resource Conservation District, and Ann Croissant of the San Gabriel Mountains Regional Conservancy also provided comment in response to the questionnaires. Kerwin Russell of the Riverside-Corona Resource Conservation District provided valuable input on the final draft of the Protocol. Ron Baxter at the Riverside County Regional Park and Open Space District also reviewed the final draft.

Arundo Removal Program Background

Proposition 13, also known as the Costa-Machado Water Act of 2000, included the Southern California Integrated Watershed Program (SCIWP) (California Water Code Sections 79104.20 through 79104.34), which provided funding for local assistance grants to be administered by the Santa Ana Watershed Project Authority (SAWPA). This funding, which is contingent upon appropriation by the State Legislature to the State Water Resources Control Board (SWRCB), is to be spent on projects to rehabilitate and improve the Santa Ana River Watershed. One component of the SCIWP is the removal of invasive plant species within the Watershed, primarily giant reed or wild cane (*Arundo donax*). The SAWPA Commission has allocated approximately $20 million to several agencies and organizations for an *Arundo* Removal Program within the Watershed. These agencies and organizations, collectively known as "Team *Arundo*," include the Santa Ana Watershed Association of Resource Conservation Districts (SAWA), the Riverside County Parks and Open Space District, the Riverside County Flood Control District, the Orange County Water District, the Orange County Public Facilities and Resources Department, and the Orange County Conservation Corps.

This document outlines the history of the problem of *Arundo* invasion, the current state of the removal efforts within the Watershed, and presents a blueprint for future removal within the Watershed. It details specific procedures used by Team *Arundo*. This document fulfills requirements of the SWRCB, and may be used by other groups removing *Arundo* throughout the State.

Specifically, the *Arundo* Removal Program (ARP) will remove *Arundo* and other invasive species, thereby helping to achieve the following SCIWP goals:

- Remove non-native plants and create new open space and wetlands
- Conserve water, use water efficiently, and capture and manage storm water
- Plan and implement a flood control program to protect agricultural operations and adjacent property and to assist in abating the effects of waste discharges into waters of the State

Riparian channel infested with *Arundo*

Photo courtesy of SAWPA

SECTION ONE

Introduction to the Problem

Biology of Arundo donax

Of the many non-native species that have invaded the riparian forests of Southern California, *Arundo donax* (giant reed) is particularly problematic due to its ability to rapidly invade and colonize new areas and outcompete native species. Spanish settlers originally introduced *Arundo* to Southern California more than 150 years ago to be used for erosion control, as a food source for pigs and goats, and as thatch roofing for homes. *Arundo* is still sold commercially as a bank stabilizing ornamental species throughout the United States. However, the California Department of Food and Agriculture (CDFA) has commenced the regulatory process to add eleven species, including *Arundo*, to the CDFA Noxious Weed List. If CDFA does list *Arundo* as a noxious weed, which is expected by 2003, individual counties may draft ordinances preventing the sale or transfer of *Arundo*. These county ordinances are subject to State approval and are based on several criteria such as the presence of an active removal program. (Barbara Hass, CDFA, 2002, personal communication). The California Exotic Pest Plant Council places *Arundo* on its "List A: Most Invasive Wildland Pest Plants."

Arundo: Monotypic stand of *Arundo donax*
Photo courtesy of SAWPA

Commercial uses of *Arundo* include paper pulp and cellulose for rayon manufacture. Since *Arundo* is difficult to harvest and transport due to its bulk, wood is generally more suitable for paper-making. However, groups within the European Union and other parts of the world are currently studying *Arundo* growth and productivity to determine its suitability for production as a biomass crop for energy, paper pulp, and construction of building materials (Biological Materials for Non-food Products, 2000). In addition, Nile Fiber, a company in California, spent five years on research and development to determine the commercial viability of *Arundo* as an alternative to wood pulp. Although not yet in production, Nile Fiber claims to have produced the first commercial run of bleached *Arundo* pulp. The company is now actively seeking *Arundo* for its operations and may establish *Arundo* plantations throughout the United States (‹http://www.nilefiber.com› 2002). *Arundo donax* culm, or hollow, jointed stalk, has also been used to make reeds for woodwind musical instruments, and historical evidence of this use can be traced back 5,000 years. It is interesting to note that at least some of the frequent references to "reeds" in the Bible allude to *Arundo donax* (Perdue 1958).

Arundo is a genus of tall perennial reed-like grasses (Family: Poaceae) that includes six species native to warmer climates of Europe, Asia, and Africa. Although *Arundo* is thought to have originated in freshwaters of eastern Asia, extensive cultivation has occurred throughout Asia, southern Europe, North Africa, and the Middle East for thousands of years (Bell 1997). *Arundo* is a hydrophilic (water-loving) plant that grows within the riparian zone of lakes, streams, rivers, and in other moist soils. It requires moist soils and large amounts of water to sustain its high growth rates of up to 2 inches per day, using more that 528 gallons of water per year for each meter of standing *Arundo* (Bell 1997). This water uptake rate roughly equates to three times the amount of water used by native southern California riparian vegetation (Zembal and Hoffman 2000).

Arundo is capable of spreading rapidly throughout a watershed once it becomes established. Although *Arundo* may produce a large inflorescence, North American *Arundo* plants are not known to produce viable seeds, as seedlings have not been observed in the field (Dudley 2000) (Jackson 2002, personal communication). Reproduction within North America occurs vegetatively, either by rooting of stem fragments or by underground rhizome extension of a colony. For the most part, stems with no basal material are less likely to root, but under laboratory conditions fresh cut *Arundo* stems will form roots at nodes (Dudley 2000). Since *Arundo* will form roots after cutting, it is important to properly dispose of cut *Arundo* prevent reinfestation after *Arundo* removal. Disposal methods are discussed in Sections IV and V.

Distribution and Removal Efforts of *Arundo donax* in Santa Ana Watershed

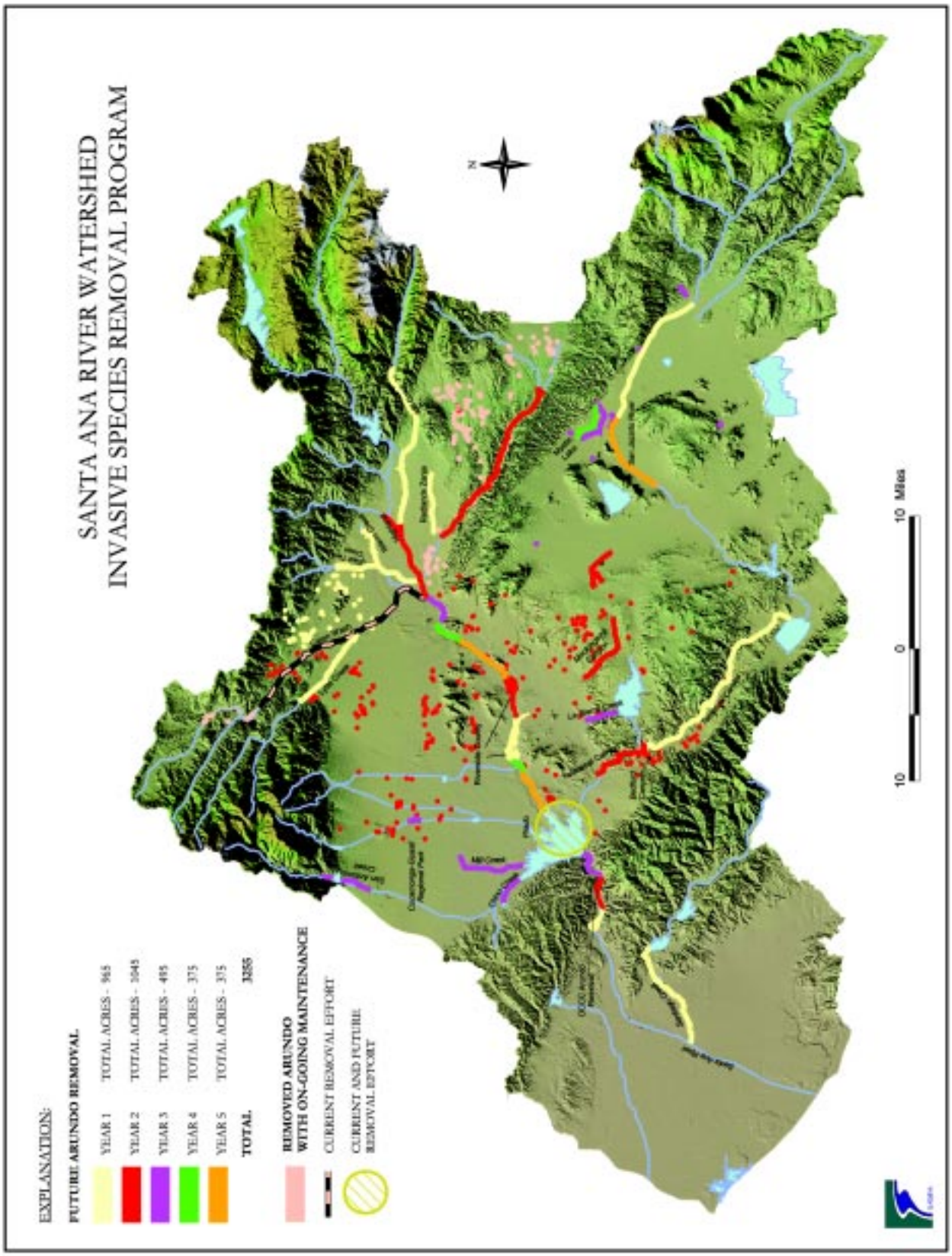
Encompassing approximately 2,650 square miles and flowing over 100 miles from the San Bernardino Mountains to the Pacific Ocean, the Santa Ana River Watershed is the largest coastal stream system in Southern California. The Watershed includes urban, rural, and forested landscapes within large areas of western San Bernardino, Riverside, and Orange Counties, and a small portion of Los Angeles County. *Arundo* infestation within the Watershed is extensive (see Figure 1) and removal efforts began in 1988.

The numerous parties making up Team *Arundo* are clearing *Arundo* from many areas, including the upper tributaries of the Watershed. Table 1 lists *Arundo* distribution and historical specific removal efforts within the Watershed, as described by Neill and Giessow (2001). Appendix A provides further information. By providing necessary funding, the SCIWP *Arundo* Removal Program will greatly accelerate *Arundo* removal efforts within the Watershed.

SCIWP Arundo Removal Program

Although funding for the SCIWP *Arundo* Removal Program (ARP) has been secured for a duration of at least three years, the planning horizon for removing *Arundo* exceeds five years, with the expectation that additional funding will be procured for future work. A preliminary plan for the timing of *Arundo* removal through the ARP has been established, but exact locations and removal agencies are flexible and subject to change.

Through ARP funding the Riverside County Regional Park and Open Space District will remove *Arundo* from the Santa Ana River between the Mission Inn Boulevard Bridge and the Hidden Valley Wildlife Area during the first two years. SAWA will remove *Arundo* from the San Jacinto River, Redlands Zanja, Mill Creek (East Valley), Santa Ana River Phase I area, East Twin Creek, and Warm Creek during the first year. SAWA will remove *Arundo* from Highland, San Timoteo Creek, Juniper Flats, Mockingbird Canyon, Bedford Canyon, and the Santa Ana River Phase II area during the second year. During the third year, SAWA will remove *Arundo* from Mill Creek (Inland Empire West), La Sierra Creek, Mystic Lake, San Antonio Creek, and Cucamonga-Guasti Regional Park. Additionally, SAWA plans to remove further *Arundo* from Mystic Lake and the Santa Ana River during the fourth year and from the San Jacinto River and the Santa Ana River during the fifth year. The Orange County Public Facilities & Resources Department may remove *Arundo* from the Santa Ana River canyon in the Yorba Linda area during the first three years, from Weir Canyon Road to the Orange County line. The Orange County Conservation Corps may remove *Arundo* from Featherly Park in Orange County during the second year of the program. Another agency, likely the Orange County Water District or SAWA, will remove *Arundo* from the upper Watershed and isolated tributaries in San Bernardino and Riverside Counties. In addition, the Riverside County Flood Control District will remove *Arundo* through the ARP (SCIWP Project Authorization Package, EIP Associates 2001).



Future SCIWP *Arundo* removal within the Santa Ana Watershed
Graphic supplied by SAWPA

Table 1: Distribution of *Arundo donax* and Past Removal Efforts Within the Santa Ana Watershed

SOURCE: Neill and Giessow, 2001 and RCRCD, 2002, personal communication

Watershed Zone	Location	*Arundo* Abundance/ Acres Removed	Removal Agency/ Organization	Removal Timeframe
Cajon Wash	Lost Lake and below Highway 38	Abundant to scattered	Inland Empire West Resource Conservation District (RCD)	1999–2000
San Bernardino Area	Downstream areas of Waterman Canyon, Hot Springs Creek, and East Twin Creek	Continuous stands, except along City Creek, where *Arundo* is absent in National Forest to Highland Boulevard, below which scattered clumps are present.	N/A	N/A
San Timoteo Canyon	Near Highway 60 below the City of Beaumont	11 miles of riparian corridor cleared near Alessandro Road, plus most of Live Oak Canyon cleared through Yucaipa	East Valley RCD	1996–2000
Riverside Area	Various	1 mile cleared Near Van Buren Bridge. 7 acres removed at Fairmount Park, 16 acres removed at Alessandro, 10 acres removed at Castle View, 25 acres removed at Woodcrest, 5 acres removed at La Sierra Creek, 16 acres removed at Golden Star Creek	Riverside County Parks and Riverside-Corona RCD	1993–2001
San Jacinto River	San Jancinto Valley below Saboba Reservation	*Arundo* absent from Idyllwild and Nationall Forest land.	San Jacinto Basin RCD and Washburn Grove Management	1998–2001
Temescal Canyon	Downstream from Lake Elsinore and Lake Corona	*Arundo* absent from Walker Canyon. *Arundo* becomes present below Lake Corona and near El Cerrito. Quarter mile reach cleared near El Cerrito	Glenn Lukos and Associates and Canyon Landscaping	1997–1998
Prado Basin	Along River Road Bridge	30 acres removed above River Road Bridge	Riverside-Corona RCD	1993–2002
Santa Ana Canyon	Near Featherly Regional Park	60 acres removed on north side of Featherly Park. *Arundo* remains in central part of flood channel	Orange County staff and Orange County Conservation Corps	1989–2000
Carbon Canyon	Along Carbon Creek	2 acres removed along Carbon Creek. No *Arundo* within Telegraph Canyon in Chino Hills State Park	Chino Hills State Park staff and Chino Fire Dept.	2000
Santiago Creek	Silverado Canyon area	2 miles private property cleared along Silverado Creek. *Arundo* present in Modjeska Canyon	Silverado Canyon residents and County staff	1997–1998
Aliso Creek	Whiting Ranch Park	2 sections of Aliso Creek cleared in Whiting Ranch Park	Orange County employees	Late 1990s
Arroyo Trabuco	Holy Jim Canyon and O'Neill Regional Park	Upper two miles in O'Neill Park cleared. Much *Arundo* in Holy Jim Canyon.	County staff	2000–2001
San Juan Creek	Caspers Regional Park, San Juan Capistrano	Hot Springs area cleared. Area between La Novia Ave. and I-5 cleared but not maintained, and *Arundo* has reinvaded.	Orange County staff and prison crews	1995, 1997–1998

Other Invasive Species

In addition to *Arundo*, team members may remove other invasive species while undertaking *Arundo* removal activities. These species include, but are not limited to, castor bean *(Ricinus communis)*, artichoke thistle (*Cynara cardunculus*), tree or wild tobacco (*Nicotiana glauca*), tamarisk or saltcedar (*Tamarix* sp.), tall whitetop (*Lepidium latifolium*), and tree of heaven (*Ailanthus altissima*). These species disrupt natural ecosystems by competing with native flora for limited resources and generally providing poor quality habitat for native fauna. Removing any exotic species, including *Arundo* and other species, must follow applicable permit conditions.

SECTION TWO

Consequences of *Arundo donax* Invasion

Currently, more than 95% of the historic riparian habitat in the southern part of California has been lost to agriculture, development, flood control, and other human-related impacts (Zembal and Hoffman 2000). However, the greatest threat to the remaining riparian corridors is the invasion of exotic plant species, primarily *Arundo*. As a result of past and present introductions, its ability to colonize new areas relatively easily, and its ability to outcompete native species, *Arundo* has infested nearly every drainage system in the southwestern United States (Brotherson and Field 1987).

Arundo readily invades riparian channels, particularly disturbed areas, is very competitive, is difficult to control, and does not provide significant food or nesting habitat for native animals (Bell 1993). *Arundo* competes with native species, such as willows (*Salix* sp.), mulefat (*Baccharis* sp.), and cottonwoods (*Populus* sp.) that provide nesting habitat for threatened and endangered species such as least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii*), and countless other native species. *Arundo* inhibits seedling recruitment of native riparian species, outcompetes established native species, and uses massive amounts of water that would otherwise be available to native plants and surrounding areas (Frandsen and Jackson 1997).

Ecosystem Dynamics

Disturbance within the river floodplain has favored the fast-growing *Arundo* over native riparian vegetation. This acreage increases each year in response to annual flood events, fires, and other ecological perturbations. *Arundo* readily invades native riparian communities at any stage of succession, not only by invading after floods and fires. Because of these characteristics, once *Arundo* becomes established in a riparian area, it alters the ecosystem by redirecting the succession of the community towards pure stands of *Arundo*.

Riparian channel infested with *Arundo*
Photo courtesy of SAWPA

Landscape near Hidden Valley Wildlife Area: April 2002 fire cleared an estimated 250 acres of *Arundo*
Photo courtesy of Riverside County Park and Open-Space District

Risk of Fire

Arundo is highly combustible, increasing fire frequency and intensity. The pervasion of *Arundo* throughout the Santa Ana Watershed greatly increases the risk of catastrophic fire. Extensive stands of *Arundo* pose a risk to natural resources, homes, and bridges and other infrastructure, forcing public fire agencies to respond to this ever-increasing threat (Zembal and Hoffman 2000). A single fire in April 2002 swept through approximately 250 acres of riverbed near Martha McLean Anza Narrows Park in Riverside County. Although the cause of the fire was unknown, "the flames [were] fed by the riverbed jungle of dry, hollow, *Arundo* cane, which burns quickly and with a loud popping noise that one resident said sounded like a machine gun" (Danelski, 2002). One and half months after the fire, the burned Arundo had resprouted to about 3 feet (Frandsen, 2002, personal communication).

Flooding issues

By virtue of its great biomass, rapid growth, and dense, interconnected root masses, *Arundo* poses a substantial flood management problem. Floodwaters strip portions of the standing crop of *Arundo* and root masses from the substrate and these mats combine with trash and other debris to form substantial debris dams. In contrast, native riparian species tend to bend rather than break during high flows, greatly reducing the amount of vegetative debris washed downstream. Heavy rains wash debris dams of *Arundo* downriver, pushing mats of dense roots and stalks against bridge abutments. These mats can damage the abutments, clog river channels, and re-direct river flows, thereby flooding adjacent lands (Zembal and Hoffman 2000).

For example, Riverside County's River Road Bridge near Norco was damaged twice within 3 years, causing almost $1 million in damage. This bridge is an important transportation corridor for County residents. During a flooding event in March 1995,

Arundo and other debris washed down the Santa Ana River, knocking the bridge off of its supports and leaving it floating in the river. The River Road Bridge was closed for three months, requiring $700,000 in repair work. Further flooding damage occurred in February 1998 when *Arundo*, tree trunks, and sand flowed downstream with the floodwaters, knocking three sections of the bridge off their foundations. This time, damage cost approximately $260,000 to repair. The Riverside County Board of Supervisors subsequently authorized $8 million to construct a new River Road Bridge (McBride 1998). Furthermore, as these large quantities of *Arundo* move downstream, they eventually find their way to the ocean, and subsequently wash up on local beaches. The annual clean up of this debris costs the public millions of dollars each year (Zembal and Hoffman 2000).

Large stands of *Arundo* that line extensive sections of the river can also separate the river from its floodplain. The bank stabilization that results from *Arundo*'s extensive root system alters the natural meandering of the river, reduces the frequency of seasonal wetland inundation, and reduces the interaction of the river with its floodplain (Johnson, et al. 1995). The loss of seasonal flooding significantly alters the size and function of floodplain wetlands, reduces habitat for wetland species, and alters riverine nutrient dynamics (Bayley 1995).

Decreases in Water Quality and Quantity

Arundo absorbs a great deal of water through its roots, effectively removing much water from the available supply. Ideally, native plants that require less water will replace *Arundo*. As previously mentioned, it is estimated that native vegetation uses one-third of the water used by *Arundo*. For example, the removal of every 1,000 acres of *Arundo* and subsequent recovery of native vegetation will yield a water savings of approximately 3,800 acre-feet per year. This is enough to supply almost 20,000 urban residents with water annually (Zembal and Hoffman 2000).

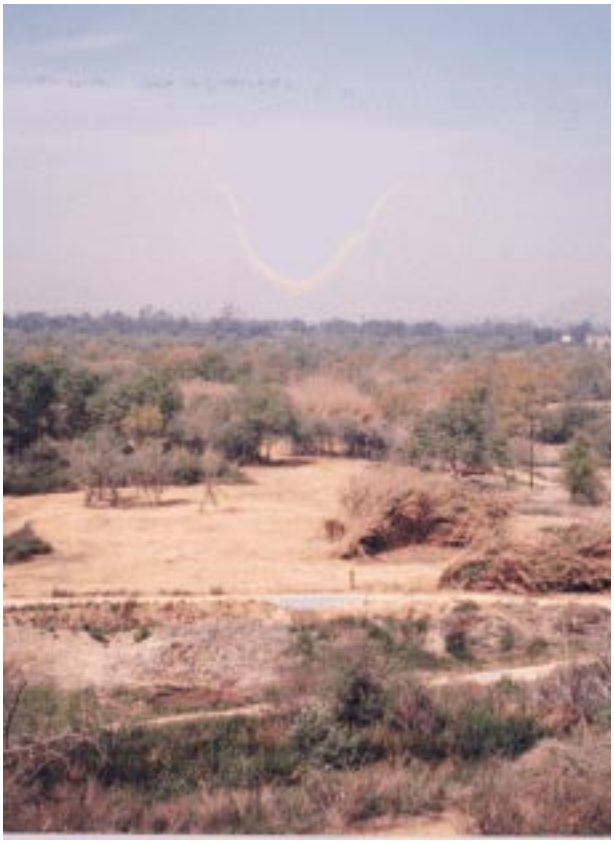
Extensive stands of *Arundo* along rivers lack the dense foliage canopy of native riparian forests. As a result, near-shore stream habitats lack the shade offered by the native vegetation's canopy, and water temperatures are several degrees higher than under natural conditions. Higher water temperatures have a direct negative impact on native stream fishes, such as the Arroyo chub (*Gilia orcutti*) and the threatened Santa Ana sucker (*Catostomus santaanae*). Higher temperatures not only increase algal growth and lower oxygen concentration within the water, they can also lead to increased algal photosynthetic activity that has been found to increase pH levels within the shallower sections of the river. Increases in pH can facilitate the chemical conversion of ammonium (NH_4^+) salts to the toxic non-ionized ammonia form (NH_3), resulting in reduced water quality for both aquatic organisms and downstream users (Bell 1993).

SECTION THREE

Benefits of Removal of *Arundo donax*

Because this exotic plant alters ecosystem dynamics and interrupts and redirects succession, the removal of *Arundo* from the Watershed offers numerous direct and indirect benefits to landowners, land managers, public agencies, and other Watershed residents. These benefits include reduction in risk of flooding and fire, improvements in water quality, increased water conservation, and restoration of habitat for native species, including several threatened and endangered species.

With the elimination of large stands of *Arundo*, intense fires and the associated high risk to life and property will become less frequent and the costs associated with fire fighting will decrease.



Arundo removal site at Hidden Valley Wildlife Area
Photo courtesy of Riverside County Park and Open-Space District

Arundo elimination would further result in a lowered risk of public/personal property damage. Complete control and eradication of *Arundo*, rather than annual maintenance mowing, would result in substantial annual savings to both the residents of the Watershed and the flood management agencies.

Riparian vegetation serves as critical habitat for many state and federally listed threatened and endangered species, such as the least Bell's vireo. Suitable habitat for listed species within the Watershed has been reduced by development by as much as 95% and *Arundo* has replaced over 50% of the remainder. Preventing the spread of *Arundo* will preclude the further deterioration of habitat for many of the sensitive, threatened, and endangered riparian species. As areas of *Arundo* are removed and converted back to native riparian habitat, rare species will be able to expand their populations throughout the Santa Ana River Watershed. Replacing these stands of exotics with native riparian vegetation will, in time, result in sufficient overhanging foliage to provide the necessary cooler water temperatures, bank cover, and improved water quality needed to protect populations of native fish species and other aquatic organisms.

In addition, *Arundo* removal would result in more in-stream water for both residents of the Watershed and the native aquatic organisms. Given that the costs associated with providing imported water to residents will only increase over time, the savings to the water suppliers, and ultimately to the Watershed residents, would be substantial (Zembal and Hoffman 2000).

SECTION FOUR

Arundo Removal Methods

This section generally describes available *Arundo* removal methods, not all of which are used within the Santa Ana Watershed. The next section, "*Arundo* Removal Procedures within the Santa Ana Watershed," details removal methodology of Team *Arundo*.

Available Methods

Removal of *Arundo* can be accomplished by a variety of methods. Each method differs in cost, time, and can be specific to certain areas or types of infested habitat. Removal methods include mechanical removal, chemical control, and biological control, in addition to a comprehensive integrated weed management (IWM) approach. Prevention of further invasion or reinfestation should also be considered in conjunction with removal methods.

Mechanical Removal

Mechanical removal involves two primary methods: either the removal of *Arundo* plants from the substrate or the cutting of *Arundo* plants. The physical removal of *Arundo* plants from the substrate can include hand pulling, hand tools (i.e., pick-axe, shovel), digging, and/or mechanized tools (i.e., mowers, weed eaters, chippers, bulldozers). Removal of the plants from the substrate is effective in killing the plant, however, this method is limited in its use due to the high labor cost and associated slow speed. This method is also disadvantageous due to adverse environmental effects, such as disruption of the substrate, interference with soil fauna and increased potential for erosion. Cutting plants by mechanical methods of removal includes the use of chainsaws, a hydro-axe, shredder, or other heavy machinery. If the entire *Arundo* culm and root are not removed, the plant will resprout. Therefore, mechanical cutting should be performed in conjunction with herbicide application and/or further cutting as described below.

Hydro-Ax: Arundo removal equipment used by Inland Empire West Resource Conservation District (also used to clear fire breaks, as shown in this photo).
Photo courtesy of Inland Empire West Resource Conservation District

Chemical Removal

Chemical removal of *Arundo* is another proven method of clearing areas of infestation. Treatment requires application (either foliar spray or cut-stump) of a broad-spectrum herbicide at specific times during the year to ensure adequate uptake by the plant's root system. However, the types of herbicides that can be used in wetland areas are limited, and currently the only herbicides approved for wetland use by the EPA, CalEPA, and the State Water Resources Control Board are certain glyphosate-based products, such as Aquamaster™[1] and Rodeo®[2] herbicides. Glyphosate is of relatively low toxicity to mammals, birds, and fish; however, the surfactants used in some formulations of glyphosate are toxic to aquatic organisms. Therefore, only some glyphosate formulations containing less toxic surfactants are approved for use in aquatic and wetland ecosystems. Glyphosate experiences limited movement in the environment as it binds readily to soil particles, which minimizes risk of soil leaching and entering nearby water bodies. Current interpretation of a recent circuit court ruling requires that use of herbicides on or within water bodies in California requires a National Pollution Discharge Elimination System (NPDES) permit as well as a water quality monitoring program under the Clean Water Act regulations.

[1]Aquamaster™ is a registered trademark of the Monsanto Company

[2]Rodeo® is a registered trademark of the Dow Chemical Company

When *Arundo* is removed from an area of sufficient distance from the water, other herbicides have been used, such as Roundup Pro®[1] herbicide, which is also glyphosate-based but not registered for aquatic use. Stalker®[2], which is Imazapyr-based and also not registered for aquatic use, has been used by at least one Team *Arundo* member on small-scale eradication of castor-bean, tree tobacco, and saltcedar away from water bodies.

The most effective chemical treatment method involves the foliar application of a glyphosate herbicide during summer and fall (June to November) after the period of most active growth in the spring/early summer, but before the plant goes into dormancy (Jackson 2002). During this period, the plant translocates nutrients through the phloem into its root mass most actively. The herbicide is moved through the phloem to the active growing points throughout the root mass. Since glyphosate cannot penetrate woody material, the herbicide must be applied to the leaves or cut stem of the *Arundo* plants. Specific permit requirements must be followed with respect to herbicide application, and the timeframe for application may require adjustment for certain circumstances. For example, the US Army Corps of Engineers Regional General Permit 41 (See Appendix E), which authorizes the removal of invasive, exotic plants in Southern California, specifically prohibits the application of herbicides in partially infested stands from March 15 to September 15. Cut-stem and foliar application is permitted year-round in fully infested stands. See permit for definitions of fully and partially infested stands, as well as further instructions regarding *Arundo* removal activities.

Several methods of herbicide application have proven effective. For large areas of infestation (greater than 80% canopy cover), aerial spraying is a very quick and cost-effective method of application. Special spray nozzles produce very fine droplets of highly concentrated herbicide that limit the amount of over spray and minimize the amount of herbicide required (Zembal and Hoffman 2000). Aerial spraying is particularly advantageous after a fire. However, no Team *Arundo* members currently practice aerial spraying. Herbicide applicators utilizing aerial application must comply with supplemental herbicide label requirements and Federal Aviation Administration requirements.

Arundo Disposal

Cut *Arundo* may be removed from treatment areas through burning, chipping, or vehicular transportation. The removal of the cut cane is important due to the untreated cane's ability to re-root and colonize new areas either at the site or downstream (if washdown occurs). Although burning is the most cost effective method to dispose of the dead cane, Team *Arundo* members do not burn cane due to environmental considerations and requirements for AQMD permits. Cutting, chopping, and chipping is the most common method of disposal, with Team *Arundo* members using this method to dispose of 80% to 100% of the cut biomass. If chipped and left on site, pieces of cane should be chipped to about ¼ inch to 1 inch to prevent repsrouting. Other uses for *Arundo*, including fiber, may be developed, which would reduce the need for disposal.

Chipping of *Arundo* by Inland Empire West Resource Conservation District
Photo courtesy of Inland Empire West Resource Conservation District

[1]Roundup Pro® is a registered trademark of the Monsanto Company

[2]Stalker® is a registered trademark of the American Cyanimid Company

Biological Control

Currently, there are no known biological agents that have proven effective for *Arundo* control, and consequently this method is not used within the Santa Ana Watershed. However, several insects are known to feed upon *Arundo*, including green bug (*Schizaphiz graminum)*, and two lepidopterans, *Phothedes dulcis* and *Diatraea saccharalis* (Hoshovsky 1986). Unfortunately, little is known about the effects of any of these species on *Arundo* growth or reproduction because, as *Arundo* is grown as a commercial crop in many parts of the world, intentional introduction of pathogens and pests would not be prudent. Also, because of *Arundo*'s agricultural use, little work has been done to identify potential biological control agents. Within southern California, other means of biological control have been considered, including grazing by Angora goats. Used for small-scale control of other exotic weeds in California (Daar 1983), some organizations have considered experimenting to determine if grazing by these goats would be effective at reducing *Arundo* biomass. It should be noted that grazing animals cannot eliminate the roots or rhizomes and therefore can only act as a biomass reduction agent rather than a method of elimination.

Integrated Weed Management

A final, comprehensive strategy, integrated weed management (IWM), combines the above methods to control *Arundo*. IWM is defined in the federal Noxious Weed Act as, "a system for the planning and implementation of a program, using an interdisciplinary approach, to select a method for containing or controlling undesirable plant species or groups of species using all available methods, including education, prevention, physical or mechanical methods, biological control agents, herbicide methods, and general land management practices." IWM uses a multidisciplinary approach to minimize the impact of control actions on the non-target environment and public health while maximizing the effectiveness of practical control methods.

IWM includes "cultural methods" of exotic species invasion prevention, which involve the modification of human behavior both within and around the area of infestation. Recreational, economic, and urban land uses that contribute to the introduction and proliferation of invasive species are discouraged by this method (Duncan and Carrigan 1992). Within the Santa Ana Watershed, behavioral modifications include altered planting practices that encourage the use of native plant species for landscaping, rather than *Arundo* or other exotic species. Other native or less invasive species can be substituted for bank stabilization and aesthetic purposes.

Best Management Practices

With any of these methods, it is critical to apply Best Management Practices (BMPs) and Best Available Technologies (BATs) to all applicable stages of the removal method. In fact, permit conditions require the implementation of BMPs. BMPs are methods that protect environmental quality or reduce environmental impacts from *Arundo* removal activities. BMPs are most often implemented at the time work on an individual activity is conducted in the field; however, they also can be implemented at the time of planning or design. Common BMPs include post-removal bank stabilization, revegetation, and sediment traps when mechanized removal is performed (Caulk, et al. 2000). BATs are new and evolving technologies and/or methods that aid and enhance *Arundo* removal efforts. BATs that have been effectively used in exotic species management include invasive weed databases, Geographical Information Systems (GIS), and Global Positioning Systems (GPS) that help identify, map, and store the locations of *Arundo* within the landscape.

Arundo Removal Procedures within the Santa Ana Watershed

This section details the actual practice of Team *Arundo* for removal activities within the Santa Ana Watershed. SAWPA, through their consultants, EIP Associates, distributed an *Arundo* Removal Questionnaire to Team *Arundo* members. Seven groups, including Riverside County Flood Control and Water Conservation District, Orange County Conservation Corps, Riverside-Corona Resource Conservation District, Inland Empire West Resource Conservation District, Riverside County Regional Park and Open Space District, California Regional Water Quality Control Board (Region 8), and Riparian Repairs (Los Angeles County) each completed questionnaires. Orange County Water District and San Jacinto Resource Conservation District both deferred to the answers supplied by Riverside County Resource Conservation District.

The Integrated Weed Management (IWM) approach most closely describes Team *Arundo*'s methodology, although they have not yet incorporated all aspects of this approach. Team *Arundo* combines mechanical control and chemical control, and strives to incorporate elements from IWM such as landowner and nursery education. Landowner education is important to discourage landowners from planting new *Arundo* in their yard adn to encourage them to eradicate current stands, while nursery education is important because it is still legal to sell *Arundo* within California.

Mechanical Removal on the Santa Ana River

Team *Arundo* utilizes a variety of removal methods, depending on patch size and relative ground cover of *Arundo*. Typically, *Arundo* is removed from larger and fully infested patches using tractor-powered equipment such as hammer-flail, hydro-axe, chipper/shredder, and articulating arm. Chainsaws and hand tools are used for smaller patches, or when sensitive native species are present and intermixed with *Arundo*. Hand tools include loppers, machetes, brush axes, and brush cutters. Rather than completely remove *Arundo* plants (including roots) from the substrate, Team *Arundo* members will cut the stalks. Therefore, herbicide application is necessary because experience has shown that mechanical removal alone is not effective. Within the Santa Ana Watershed, herbicide is applied by hand, either by foliar spraying or using the "cut-stem" (also known as "cut-stump") approach, or a combination of elements from both approaches.

Arundo removal equipment used by Inland Empire West Resource Conservation District
Photo courtesy of Inland Empire West Resource Conservation District

Full Foliar Spraying

Full foliar spraying takes place when the cane is fully grown and up to 30 or 40 feet tall. Spraying is accomplished by using either trucks or all terrain vehicles (ATVs) mounted with 100- to 300- gallon spray tanks, smaller four-wheel drive vehicles equipped with 15- to 50-gallon tanks, or backpack sprayers with 3- to 5-gallon tanks. The pressure sprayers are usually fitted with cone TeeJet® or similar nozzles. When foliar spraying, Team *Arundo* herbicide applicators will dilute the glyphosate-based herbicide to a rate range of 1% to 5% for mature stalks and a rate range of 1% to 8% for immature stalks, as indicated by labeling requirements. All herbicide application is performed according to label specifications; indeed, it should be noted that it is a violation of Federal law to use an herbicide in a manner inconsistent with its labeling. *Arundo* that has been subjected to full foliar spraying is usually left in place.

Cut Stem

The "cut-stem" or "cut-stump" approach involves hand cutting the *Arundo* stalks, and then applying a glyphosate-based herbicide to the cut within 2 to 3 minutes to ensure adequate uptake of the herbicide before the plant seals the cut. Herbicide applicators apply a 50% to 100% solution of a glyphosate-based herbicide, in accordance with labeling requirements for this approach. Herbicide applicators typically use a finger-trigger spray bottle or backpack sprayer for this method. Although this approach requires more time and labor than foliar spraying, it is highly efficacious and significantly reduces both the amount of herbicide used and the potential for over-spray. All herbicide material is delivered to the target areas of each plant, reducing potential environmental problems.

Typically, successful control of *Arundo* requires three to four herbicide applications to re-growth during the first year following initial cutting. Overall, the rate of growth should drop by 30% after each application during the first year, leaving a 10% growth rate by the fourth application. Before the first application, resprout should reach a height of two to four feet. Resprout is monitored either monthly or biweekly, as needed. The site should then be left undisturbed until the second herbicide application, which should occur after new growth has sprouted. Typically, a second cut would be performed. Following the second cut, the area should be monitored for additional resprouting, and third and fourth applications should be performed if needed. Within the second year, the growth rate generally slows such that only 1- 2% of the area requires maintenance..

Combination of Mechanical Removal and Foliar Spraying

As an alternative method, Team *Arundo* members will chip or cut *Arundo* stalks, then return two to four weeks later when the plants are between two and four feet tall to apply a foliar spray solution of a glyphosate-based herbicide. The primary advantages of this method is that the amount of herbicide used on the fresh growth is greatly reduced from that used on the 30 to 40 foot tall *Arundo* stalks (as with full foliar spraying), and that herbicide coverage is better when the stalks are shorter and of a uniform size. One drawback associated with this method is that cutting the stalks induces the plant to re-enter the growth stage, thereby causing it to translocate less of the herbicide to the roots and rhizomes. However, as with previously described methods, supplemental treatments are generally required in *Arundo* removal, and total root kill is almost never achieved with a single application of herbicide when the plants are already established (Zembal and Hoffman 2000).

Arundo Disposal within the Santa Ana Watershed

As previously mentioned, cut *Arundo* may be removed from treatment areas through burning, chipping, or vehicular transportation. The removal of the cut cane is important due to the untreated cane's ability to re-root and colonize new areas either at the site or downstream (if washdown occurs). Cutting, chopping, and chipping is the most common method of disposal, with Team *Arundo* members using this method to dispose of 80% to 100% of the cut biomass. Pieces of cane that are cut or chopped into larger pieces may only be left on-site during the dry season in order to avoid regeneration or washdown and colonization of downstream areas. If chipped small enough, however, chipped cane can be left on-site as mulch. When chipped to pieces between ¼ inch and 1 inch in size, pieces of cane pose little threat of regenerating and/or forming debris dams downstream. Transportation of the cut biomass to areas outside of the channel is an option of last resort. The labor and cost involved is very high and local landfills tend to refuse the cuttings. Team *Arundo* members only transport about 1% to 5% of cut *Arundo* to off-site locations. Within the State of California, disposal of *Arundo* by use in commercial enterprise is still in the experimental stage and is not widely used (Nile Fiber Pulp and Paper 2002, personal communication).

Additives used within the Santa Ana Watershed

Team *Arundo* members will add adjuvants to tank mixtures prior to spraying. Adjuvants are materials that aid in the application of herbicides, and include non-ionic surfactants, dyes, and seed oils. The rate ranges must be in accordance with herbicide label instructions for adjuvant use. These additives include the following:

- **Non-ionic surfactants:** Used to increase the effectiveness of the herbicide, used to provide more uniform coverage by decreasing surface tension of spray solutions, thus aiding in penetration (e.g., LI 700®, Pro-Spreader®).

- **Seed oil:** Spray adjuvant designed to replace non-ionic surfactants, serves similar functions of decreasing surface tension and aiding in penetration (e.g., MSO seed oil®, Can-hance seed oil®).

- **Dyes:** Used to aid in uniform spraying, dyes mark the areas that have been sprayed with herbicide, helping applicators to avoid skipping areas or overlapping spray efforts (e.g., Bulls-eye®).

Chipping of *Arundo* by Inland Empire West Resource Conservation District
Photo courtesy of Inland Empire West Resource Conservation District

SECTION FIVE

Process After Removal

Customarily, treated sites on the Santa Ana River are left to reseed or revegetate naturally with mulefat, willow, cottonwood, and native forbs. Natural regeneration plays the dominant role in the maintenance of native riparian vegetation where natural flood processes still operate. Individual willows cast thousands of wind and water-borne seeds, and the river deposits enough of them in suitable growing sites to keep this dynamic habitat in constant regeneration. This is the natural state in slow driven ecosystems. Furthermore, in most areas where *Arundo* has been removed, it has been intermixed with native trees and shrubs that grow expansively with the reduced competition, eventually filling any voids (Zembal and Hoffman 2000).

Post *Arundo* removal: Successful riparian restoration in San Timoteo Canyon

Photo courtesy of EIP Associates

Generally speaking, revegetation following *Arundo* removal within the Santa Ana Watershed is unnecessary and counter-indicated. Revegetation is expensive, time-consuming, and often unsuccessful. In few cases, it could be desirable to plant cuttings or rooted material; selective planting may help reduce *Arundo* re-infestation by helping native plants establish and outcompete the non-native plants. However, in such a large, dynamic riparian community as the Santa Ana River Watershed, extensive replanting should not be necessary. In fact, revegetation efforts on the Santa Ana River over the past 20 years have been largely problematic and unsuccessful in the long term. The river has removed planted trees and shrubs through scour and sediment deposition, or the planted trees have been replaced by giant reed (Zembal and Hoffman 2000).

Areas should be replanted with native species on a case-by-case basis and only under particular circumstances. Revegetation may be desirable, for example, if *Arundo* removal occurs in an area with very unstable banks that require immediate erosion control or if the *Arundo* removal site is highly visible and aesthetics is an important consideration. Typically, when Team *Arundo* does revegetate, they use willow, mulefat, cottonwood, or elderberry. One Team *Arundo* member recommends waiting to revegetate until fall-spring of the second year after removal. As previously mentioned, proper herbicide application should result in a slowing of *Arundo* growth rate to 1-2% of the area by the second year. This lower treatment area means that remaining *Arundo* will have limited ability to compete with the native species, resulting in a more productive revegetation effort.

SECTION SIX

Permit and Regulatory Compliance for *Arundo* Removal

Applicable permits and regulatory compliance are measures identified in this section. While implementing the *Arundo* Removal Program, specific programs and measures discussed herein must be followed. Obtaining current permits and adhering to the permit requirements are the individual responsibility of each Team *Arundo* member.

See Table 2 for a listing of required permits and regulatory compliance. According to federal law, herbicide applicators must comply with the label requirements and instructions for each herbicide used. Appendix C contains the labels and material safety data sheets (MSDS) for herbicides commonly used for *Arundo* removal within the Santa Ana Watershed. The MSDS provides information to supplement label requirements, such as toxicity and ecological data.

Table 2: Permitting And Regulatory Compliance Required For Arundo Removal Within The State Of California

Law Or Regulation	Regulating Agency	Applicable Document	Type Of Permit Required
Federal Insecticide, Rodenticide, and Fungicide Act (FIFRA)*	US Environmental Protection Agency	Herbicide product label and MSDS sheet	No permit needed; herbicide applicators must comply with herbicide labels
National Pollution Discharge Elimination System NPDES*	State Water Resources Control Board	Water Quality Order No. 2001-12-DWQ: Statewide NPDES Permit for Discharges of Aquatic Pesticides to Surface Waters of the United States	This General Permit applies to entire State of California. However, General Permit users must file a Notice of Intent to Comply with the Terms of the NPDES General Permit
California Food and Agricultural Code *	California Department of Pesticide Regulation	Qualified Applicator's License and/or Qualified Applicator's Certificate	Statewide, a permit is needed only for restricted use materials (glyphosate is not a restricted use material. However, confirm with local County Agricultural Commissioners as local regulations can vary).
California Environmental Quality Act (CEQA)	Governor's Office of Planning and Research, State Clearinghouse	Categorical Exemption	Individual; SCIWP Arundo removal occurs under Categorical Exemption filed by SAWPA
California Fish and Game Code Section 1603	California Department of Fish and Game	Lake or Streambed Alteration Agreement	Individual (agencies removing Arundo must negotiate this permit)
Federal Clean Water Act, Section 401	California Regional Water Quality Control Board	Clean Water Act Section 401 Water Quality Certification	Individual (agencies removing Arundo must negotiate this permit)
Federal Clean Water Act, Section 404	US Army Corps of Engineers	Regional General Permit No. 41 for Removal of Invasive, Exotic Plants	General Permit No. 41 covers Southern California (Los Angeles District)

*Applies only to *Arundo* removal involving herbicide application

Federal Insecticide, Fungicide, and Rodenticide Act

Of three federal laws that regulate pesticide use in the United States, the primary law is the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA requires that all pesticides sold or distributed in the U.S. be registered with the Environmental Protection Agency (EPA). Although EPA oversees pesticide registration, individual states have the enforcement responsibility to regulate pesticide use. Each state must demonstrate that its regulations equal or exceed those of EPA, or risk losing their enforcement authority. The State of California does have strict regulations, requiring that pesticides be registered under the California system before use within this state (Tu, et al. 2001). For Santa Ana Watershed *Arundo* removal efforts, no specific permit is required under this law. However, herbicide users must follow label requirements.
The California Department of Pesticide Regulation (DPR) and the County Agricultural Commissioners (CACs) regulate the sale and use of pesticides in California. However, glyphosate-based herbicides are not restricted use materials and do not require use permits. The DPR's role in the permit process is to conduct scientific evaluations of potential health and environmental impacts and provide commissioners with information in the form of suggested permit conditions. DPR's suggested permit conditions reflect the minimum measures necessary to protect people and the environment. CACs use this information in their evaluation of local conditions to set site-specific limits in permits. Local CACs can require permits for non-restricted use materials.

DPR also issues Qualified Applicator's Licenses and Qualified Applicator's Certificates to individuals that use or supervise the use of State restricted use herbicides within the State (Department of Pesticide Regulation 2001). Although glyphosate is not a State restricted use herbicide, each Team Arundo member agency removing *Arundo* and applying herbicides has individuals with these permits on staff.

National Pollution Discharge Elimination System and Pesticide Permits

On March 12, 2001, the Ninth Circuit Court of Appeals ruled that discharges of pollutants from the use of aquatic pesticides to waters of the United States require coverage under a National Pollution Discharge Elimination System (NPDES) permit (*Headwaters, Inc. v. Talent Irrigation District*). The *Talent* decision was issued just prior to the major season for applying aquatic pesticides (spring/early summer). Because of the serious public health, safety, and economic implications of a delay in such applications, the State Water Resources Control Board (SWRCB) developed a General Permit on an emergency basis in order to provide coverage for broad categories of aquatic pesticide use in California. This permit, which was authorized on July 19, 2001, expires on January 31, 2004 (SWRCB 2001). Agencies applying herbicides under the General Permit must file a Notice of Intent to Comply with the Terms of the Statewide General NPDES Permit for Discharges of Aquatic Pesticides to Surface Waters of the United States.

Coverage under this General Permit is available to public entities for the application of aquatic pesticides for resource or pest management into waters of the United States. This coverage is based on the provisions of the SWRCB's *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (the State Implementation Policy, or SIP), which allows categorical exceptions from meeting priority pollutant criteria/objectives for resource or pest management control measures conducted by public entities. The General Permit is available to all public entities regardless of legal structure, including mutual water companies, public water purveyors, investor-owned utilities, and homeowners' associations (SWRCB 2001).

The General Permit covers the uses of properly registered and applied aquatic pesticides. The General Permit does not cover indirect or non-point source discharges from agricultural or other

applications of pesticides to land that may be conveyed in storm water or irrigation runoff, nor does it cover applications of pesticides that are not registered for use on aquatic sites (SWRCB 2001). The General Permit requires that the dischargers must comply with all pesticide label instructions, DPR and the Department of Health and Safety (DHS) regulations, and any Use Permits issued by the CACs. It also specifies the mandatory steps that must be followed to identify and implement appropriate Best Management Practices (BMP) that are designed to maximize efficacy of control efforts and minimize adverse impacts to the environment. These steps are:

1. *Preliminary Site Evaluations.* The discharger will conduct a site inspection to verify the need for treatment, options to treatment (including non-toxic and less toxic alternatives), and suitability of the site for treatment.
2. *Alternative Control Measures.* The discharger will evaluate other available BMPs and alternative control measures to determine if there are feasible alternatives to the selected aquatic pesticide application project that could reduce potential water quality impacts.
3. *Secondary Site Evaluations and Pre-Treatment Monitoring.* Prior to pesticide application, the discharger will determine the type and intensity of treatment needed on a per site basis. This evaluation will include measurement and analysis of indicators (e.g., slope, vegetation coverage, water level) to provide information on potential efficacy and water quality impacts to the application site as well as downstream locations that may be impacted by movement of the chemical through the watercourse.
4. *Treatment.* Immediately prior to treatment, the discharger will examine a series of indicators and modify treatment plans accordingly. These indicators may include day length, precipitation, recreational activity, sunlight, tidal water exchange, water depth, water flows, water turbidity, and wind. If this examination indicates a potential for reduced control efficacy and/or heightened water quality impacts, the treatment will be rescheduled.
5. *Post-treatment.* The discharger will assess control efficacy and water quality impacts. The results of this assessment will be evaluated by the discharger to refine project operations through an adaptive management process (SWRCB 2001).

Pesticide applications subject to the General Permit must be consistent with the pesticide label instructions (as required by Federal law) and any Use Permits issued by the CACs. The General Permit also requires that the dischargers comply with the Monitoring and Reporting Program (MRP) that is incorporated as Attachment B of the General Permit. Dischargers are required to submit technical and monitoring reports as directed by the appropriate Regional Water Quality Control Board's Executive Officer. The MRP requires that the dischargers develop and implement Monitoring Plan (Plans) to:

1. Document compliance with the requirements of the General Permit;
2. Support the development, implementation, and effectiveness of BMPs; and
3. Demonstrate the full restoration of water quality and protection of beneficial uses of the receiving waters following completion of resource or pest management projects.
4. Identify and characterize aquatic pesticide application projects conducted by the discharger.

5. Assure that projects are monitored that are representative of all pesticides and application methods used by the discharger.

Dischargers must comply with these requirements either individually or by joining with other dischargers to participate in one or more Regional Pesticide Monitoring Program(s) (SWRCB 2001).

The agencies involved in the *Arundo* Removal Program (ARP) within the Santa Ana River are responsible for removing *Arundo* in accordance with the SWRCB's General Permit requirements for *Arundo* removal within the Santa Ana Watershed. They are also responsible for filing a Notice of Intent to Comply with the Terms of the Statewide General NPDES Permit for Discharges of Aquatic Pesticides to Surface Waters of the United States.

Endangered Species Issues

The Endangered Species Act (ESA) regulates a wide range of activities affecting plants and animals designated as endangered or threatened. By definition, an endangered species is any animal or plant listed by regulation as being in danger of extinction throughout all or a significant portion of its geographical range. A threatened species is any animal or plant that is likely to become endangered within the foreseeable future throughout all or a significant portion of its geographical range. Without a special permit, the "take" of any of these federally listed species, or their habitat, is prohibited by federal law. The term "take," as defined by the ESA, means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct. Furthermore, the term "harm" is defined by the USFWS as "an act, which actually kills or injures wildlife. Such act may include significant habitat modifications or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering." (50 CFR §17.3)

Santa Ana Sucker: federally threatened species native to the Santa Ana River
Photo courtesy of SAWPA

Within the Santa Ana River Watershed there are ten federally and/or state listed species that could be affected by activities associated with the ARP. Of these, two are plants, the Santa Ana River woolly star (*Eriastrum densifolium*) and slender-horned spine flower (*Dodecahema leptoceras*); one fish, the Santa Ana sucker (*Catostomus santaanae*); one amphibian, the arroyo toad (*Bufo californicus*); three birds, the least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii*), and bald eagle (*Haliaeetus leucocephalus*); two mammals, the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) and Stephen's kangaroo rat (*Dipodomys panamintinus*), and one insect, the Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*). Because pure stands of *Arundo* do not provide habitat for these native species, the elimination of this low-quality habitat, as proposed by the ARP, would benefit these species through the management and restoration of lands previously occupied by *Arundo*.

While implementing the ARP, species-specific United States Fish and Wildlife Service and/ or California Department of Fish and Game protocols for listed species are employed. Specifically, listed species are avoided during *Arundo* removal activities to avoid adverse impacts and specific permits have not been obtained for each endangered or threatened species.

Additional Permits Needed

Removal of invasive exotic plants in riparian areas requires at least three additional State and federal permits from resource agencies: a Clean Water Act Section 401 water quality certification issued by the California Regional Water Quality Control Board, a Lake or Streambed Alteration Agreement issued by the California Department of Fish and Game, a Clean Water Act Section 404 permit issued by the US Army Corps of Engineers. Appendix B includes copy of each permit, with specific requirements for each permit. These requirements must be followed as part of this *Arundo* Removal Protocol. Removing *Arundo* in accordance with permit requirements is the responsibility of each Team *Arundo* member.

The California Regional Water Quality Control Board, Santa Ana Region issues a Clean Water Act Section 401 water quality certification. The permit covers removal of *Arundo*, tamarisk, castor bean, tobacco, and thistle within Santa Ana River Reaches #3, #4, and #5 (from Prado to Seven Oaks Dam) and tributaries draining to these reaches. This permit requires users to prepare a Stormwater Pollution Prevention Plan including site-specific Best Management Practices. Permit uses are also required to submit an annual monitoring plan to the RWQCB by December 31 of each year, including a summary of the areas of invasive plant removal that year, methods of removal, areas scheduled for plant removal for the next year, and results of the monitoring program.

The California Department of Fish and Game (CDFG) issues Lake or Streambed Alteration Agreements pursuant to Section 1603 of the California Fish and Game Code. CDFG requires notification of any proposed project that may impact a river, stream, or lake, including the removal of vegetation or wood from a stream. Lake or Streambed Alterations are prepared subsequent to noticing and include impact minimization measures. Team *Arundo* members are responsible for adhering to all impact minimization measures.

To fulfill the US Army Corps of Engineers' Clean Water Act Section 404 permit requirements, Team *Arundo* operates under Regional General Permit Number 41, which authorizes the mechanized removal of invasive, exotic plants from waters of the U.S. including wetlands. This permit, which expires on August 17, 2003, applies to Los Angeles, Orange, Riverside, San Diego, Imperial, Ventura, Santa Barbara, Mono, Inyo, and San Luis Obispo counties.

CEQA Compliance

In order to achieve compliance with the California Environmental Quality Act (CEQA), the Santa Ana Watershed Project Authority (SAWPA) filed a Categorical Exemption on July 24, 2001. The exemption was filed with the State of California Governor's Office of Planning and Research, as well as the Clerk-Recorders in Orange, Riverside, and San Bernardino Counties. The exemption was based on CEQA Guidelines Section 15307, Actions by Agencies for Protection of Natural Resources. The *Arundo* Removal Program is exempt from CEQA as an action taken by SAWPA (authorized by the SWRCB as the Program Manager of Proposition 13 funds) to ensure the enhancement of a natural resource, namely, riparian habitat and water resources of the Santa Ana Watershed (*Notice of Exemption: Arundo Removal Program for the Santa Ana River* 2001). No agencies, organizations, or individuals commented upon or challenged the Categorical Exemption. Groups removing Arundo within the Santa Ana Watershed work under this Categorical Exemption; other groups would need to address CEQA compliance on an individual basis.

SECTION SEVEN

Quality Assurance

Team *Arundo* members generally perform their own quality assurance. Typically, each agency or organization's field supervisor, foreman, or project manager is responsible for recording and storing treatment and monitoring documents. Team *Arundo* members provide training and continuing education for field crew and new employees; these programs vary widely for each member. In addition, the SCIWP funding included a small fund for quality assurance, which will be performed by SAWPA and their consultants, EIP Associates. Under SCIWP contracts, once an agency has undertaken *Arundo* removal in an area, it is responsible for keeping the area free of *Arundo* for a period five years. However, individual agencies' requirements are often more strict; some require removal areas to remain *Arundo* free in perpetuity.

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