Aquatic Pesticide Application Plan

for the

Treatment of Invasive Non-Native Plant Species

on the

Sweetwater River, San Diego National Wildlife Refuge

Tijuana River, Tijuana Slough National Wildlife Refuge

Submitted by:

U.S. Fish and Wildlife Service

San Diego National Wildlife Refuge Complex

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SECTION 1: DESCRIPTION OF WATER SYSTEM

<u>San Diego National Wildlife Refuge</u>. An approximately 3.0-mile (4.8-kilometer) portion of the Sweetwater River extends through the Otay-Sweetwater Unit of the San Diego National Wildlife Refuge (NWR). This segment of the river, which is unarmored and generally located within its historical floodway, extends through the Refuge from just north of the Sweetwater Reservoir to the southern boundary of an abandoned golf course located near the intersection of Willow Glen Drive and Jamacha Road. The river and its associated riparian vegetation occupies approximately 242 acres of the Refuge (Figure 1).

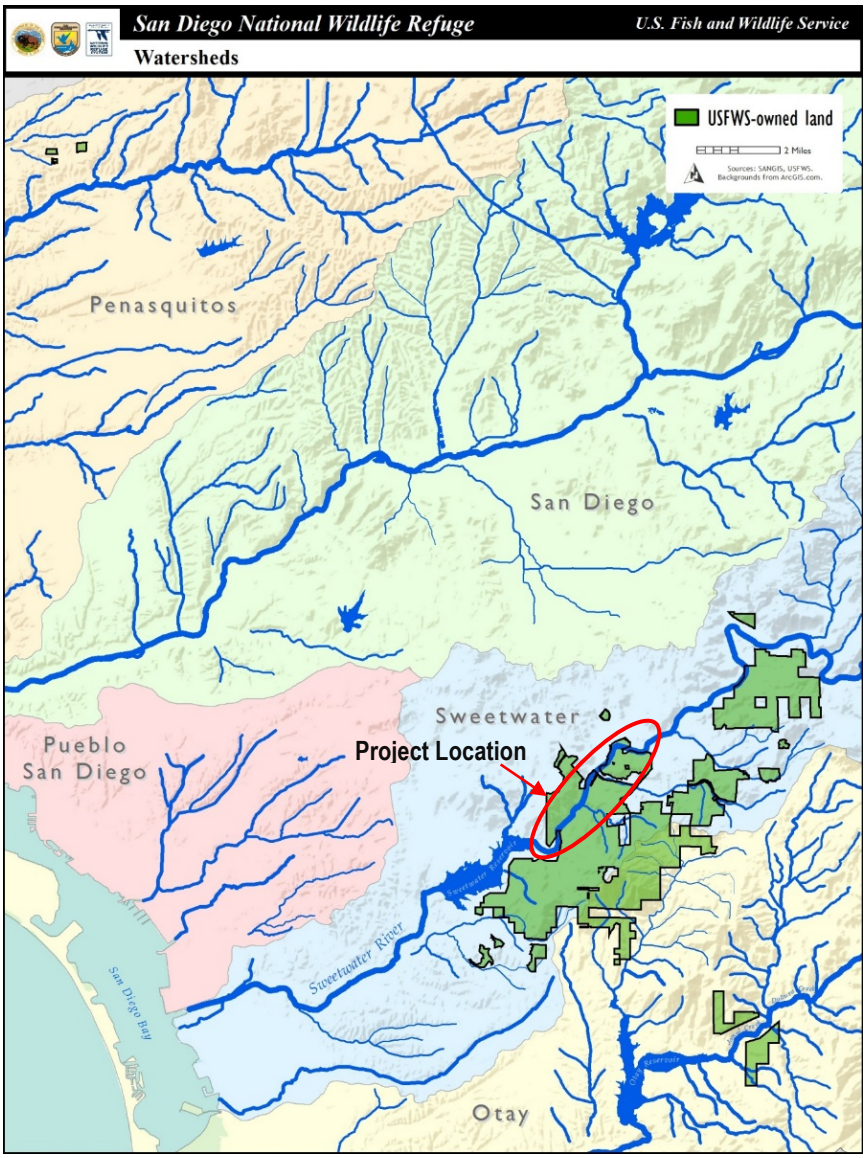

Figure 1. Relationship of the Project to the Sweetwater Watershed

The Sweetwater River is the primary tributary within the Sweetwater River watershed, which encompasses about 230 square miles and extends from the Laguna Mountains to San Diego Bay. The Refuge is situated between the Loveland Reservoir to the north, which controls about 98 square miles of the drainage basin, and the Sweetwater Reservoir to the south, which controls approximately 84 square miles of the basin. Both reservoirs are owned and operated by the Sweetwater Authority, which provides water service to a population of approximately 186,000 within the western and central portions of the City of Chula Vista, all of the City of National City, and portions of unincorporated San Diego County (Bonita).

<u>Tijuana Slough National Wildlife Refuge</u>. The Tijuana River extends generally east/west through the Tijuana Slough NWR (Figure 2). Within the Refuge, the Tijuana River is unarmored with intermittent flows. The river, which extends through the City of Tijuana, Mexico, before entering the Tijuana River Valley, has frequently changed course during the past 40 years (Boland and Woodward 2019) and its riparian corridor, consisting of channels and intermittent streams, has a nearly 3,000-foot-wide riparian corridor. Water quality in the river is influence by upstream activities and the release of untreated sewage, which enters the watershed in Mexico.

Figure 2. General location of the Tijuana River within the Refuge

SECTION 2: TREATMENT AREAS

Two treatment areas are proposed within the San Diego NWR Complex, including the portion of the Sweetwater River located within the San Diego NWR and a portion of the Tijuana River that extends through the Tijuana Slough NWR. The details are provided below.

<u>San Diego NWR</u>. The area within the San Diego NWR targeted for invasive plant control includes approximately 242 acres of riparian habitat located within and along the Sweetwater River floodway (Figure 3) in San Diego County, California. The site includes two units:

- Unit 1 consists of approximately 124 acres and includes the portion of the Sweetwater River and its associated riparian habitat generally located to the north of State Route (SR) 94 (Campo Road), east of SR 54 (Jamacha Road), and south of Willow Glen Drive; and

- Unit 2 consists of approximately 118 acres and is generally located to the south of SR 94 (Campo Road) along the entire length of the riparian corridor located within the Refuge boundary, as well as the western terminuses of two tributary streams to the river.

Within the Sweetwater River floodplain, the riparian vegetation ranges from riparian scrub, characterized by willows (*Salix* sp.) and mule fat (*Baccharis salicifolia*), to well-developed riparian woodland. This riparian woodland is dominated by arroyo willow (*Salix lasiolepis*) and black willow (*Salix gooddingii*), with scattered individuals of western sycamore (*Platanus racemosa*), coast live oak (*Quercus agrifolia*), velvet ash (*Fraxinus velutina*), and California black walnut (*Juglans californica*).

Throughout the length of the riparian corridor, there are small to relatively large infestations of non-native vegetation, including, but not limited to, giant reed (*Arundo donax*), salt cedar (*Tamarix* spp.), pampasgrass (*Cortaderia selloana*), Mexican fan palm (*Washingtonia robusta*), Peruvian peppertree (*Schinus molle*), and various other non-native species. These invasive plants adversely affect habitat quality within the riparian corridor, which is identified as critical habitat for two federally endangered birds, the least Bell's vireo (*Vireo pusillus belli*) and southwestern willow flycatcher (*Empidonax trailii extimus*).

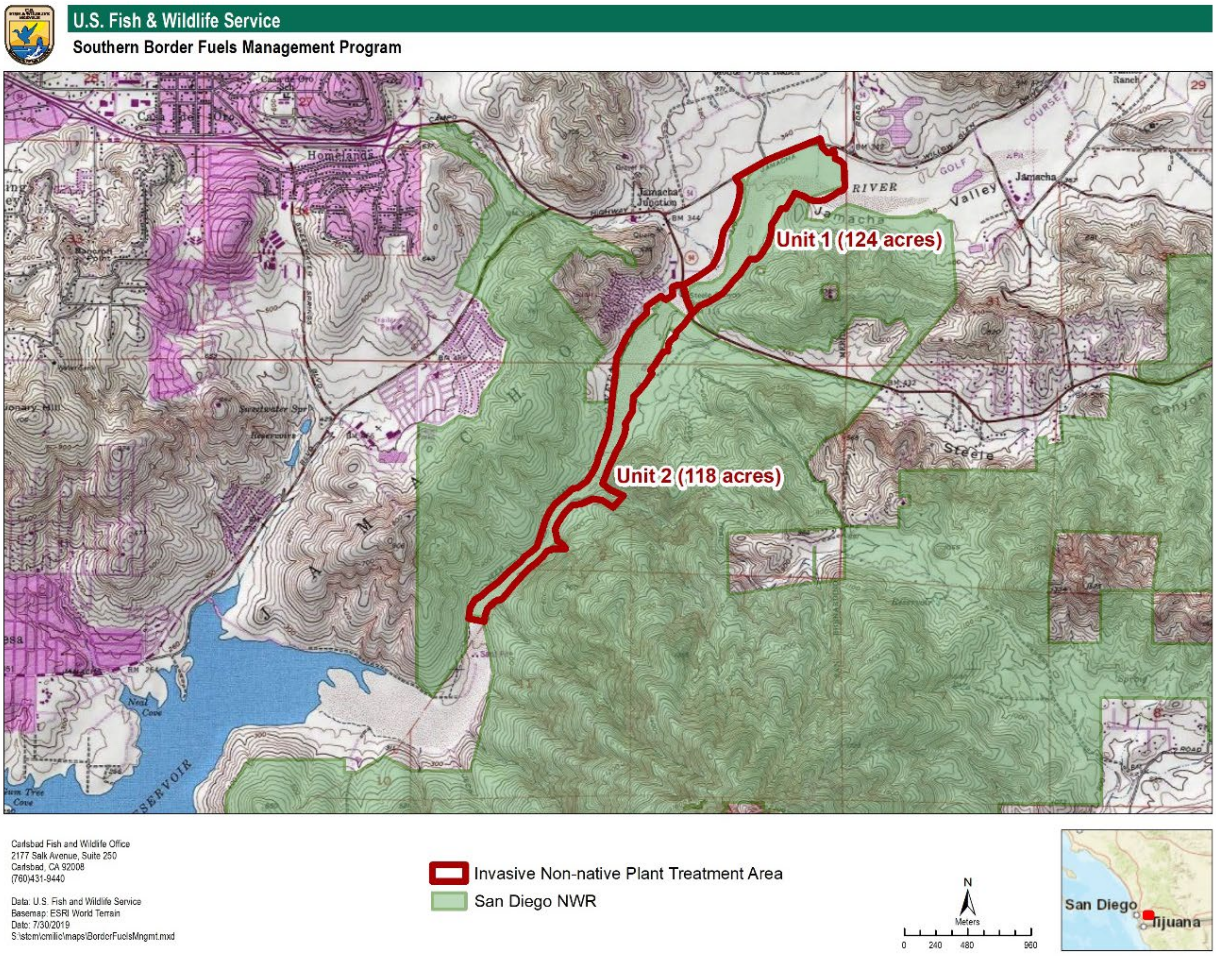

Figure 3. Treatment area within the San Diego NWR

Tijuana Slough NWR. The area within the Tijuana Slough NWR targeted for invasive plant control includes approximately 250 acres, of which about 205 acres would be treated. The project site is located within and along the Tijuana River channel and associated tributaries, including some adjacent upland areas (Figure 4). The project site is located at the southeastern end of the Refuge and to the south of Naval Outlying Field Imperial Beach in San Diego County, California.

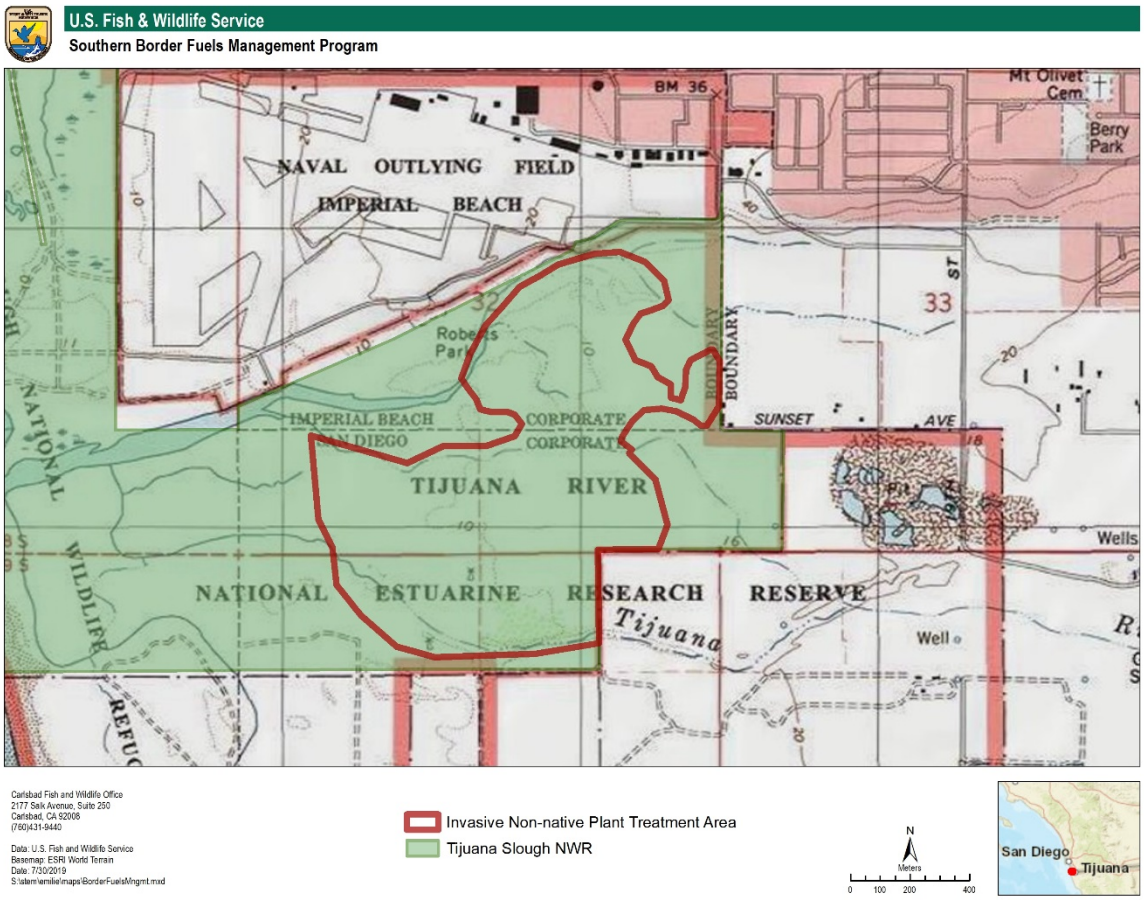

Figure 4. Treatment area within the Tijuana Slough NWR

The project area includes a mosaic of stands of trees and large native shrubs of different ages located at various distances from the current river flows (Boland and Woodward 2019). The dominant native trees include arroyo and black willows. Other vegetation types include southern willow scrub and mule fat scrub. Adjacent uplands include disturbed non-native grasslands and disturbed and undisturbed coastal sage scrub.

The Kuroshio shot hole borer (*Euwallacea kuroshio*), which recently invaded southern California, is responsible for the loss of approximately 30% of the native willows (*Salix* spp.), or 120,000 trees, in the Tijuana River Valley (Boland and Woodward 2019). As a result of the loss of these trees, as well as other disturbances, areas within the project site are now dominated by non-native invasive species including, but not limited to, salt cedar, giant reed, Mexican fan

palm, and castor bean (*Ricinus communis*). Within a few areas of the project site, large monocultures of tamarisk and castor bean are present, while in other locations, invasive plants are intermixed with the native vegetation. The presence of invasive plants degrade the habitats they invade by displacing native vegetation, lowering insect food supply for birds, reducing groundwater, and increasing flood and fire hazards.

SECTION 3: TARGET WEED SPECIES AND NEED FOR CONTROL

A. **Giant Reed (*Arundo donax*)** - *Arundo donax* (Arundo) is a large non-native grass found in many coastal watersheds in southern California, including the Tijuana River and Sweetwater River watersheds. When present, infestation is often extensive, resulting in impacts to both the ecosystem and human infrastructure. The results of studies conducted by California Invasive Plant Council (CIPC) indicate that Arundo uses considerably more water that most other plants in the riparian zone. According to the (CIPC), "*Arundo donax* is threatening California's riparian ecosystems by outcompeting native species, such as willows, for water."

   Stands of Arundo often consist of large masses of above and below ground vegetation that impact geomorphic and fluvial processes within rivers and associated tributaries. Localized changes to fluvial processes have the potential for system wide ramifications. According to CIPC, large stands of Arundo have been found to functionally increase bed elevations by five feet and increase the roughness coefficient for flows, resulting in significant reductions in flow capacity and changes from braided unstable channels to stable single channels. These impacts to riverine fluvial processes change vegetation succession following flow events. Arundo stands also increase fire risk in riparian areas because the tall, well-ventilated fuel structure contains dry fuels throughout the year.

   Studies indicate that avian species are among the most impacted by Arundo. According to CIPC (Arundo_Distribution_Impact_Report_Cal-IPC_March-2011_small.pdf), "The two most severely impacted species were least Bell's vireo and the arroyo toad, followed by the southwestern willow flycatcher, southern steelhead, and tidewater goby. Both the Tijuana River and Sweetwater River support the endangered least Bell's vireo, and the portion of the Sweetwater River within the San Diego NWR is designated as critical habitat for both the least Bell's vireo southwestern willow flycatcher.

B. **Salt Cedar, Tamarisk (*Tamarix* sp.)** - According to CIPC, *Tamarix ramosissima* (salt cedar) is associated with dramatic changes in geomorphology, groundwater availability, soil chemistry, fire frequency, plant community composition, and native wildlife diversity. Salt cedar grows rapidly from a seedling to a mature, flowering plant with an extensive root system in one summer season. The taproot can extend ten feet deep to reach the water table and secondary roots at the soil surface readily soak up rainfall. According to the University of California WEED Research & Information Center (https://wric.ucdavis.edu/PDFs/saltcedar%20WRIC%20leaftlet%2002-2.pdf), salt cedar

can displace cottonwoods and willows growing along rivers and streams. Additionally, once salt cedar has invaded an area, native grasses, forbs, and shrubs are eliminated due to increases in the salinity of the soil surrounding salt cedar, the result of the accumulation of salt exuded from its leaves.

Additionally, wildfires are more frequent and of higher intensity in salt cedar thickets, potentially killing native shrubs while salt cedar often survives. Dense infestations of salt cedar along rivers and streams also decrease flow channel width, which results in increased soil erosion during floods as floodwater is rerouted beyond the stream bank on to adjacent areas of the floodplain. Salt cedar, which provides little support for native birds and other wildlife species in terms of food or shelter, removes foraging and nesting opportunities as it displaces other productive native vegetation.

C. **Tree tobacco (*Nicotiana glauca*)** - According to CIPC, tree tobacco, which grows rapidly into dense stands, can displace native vegetation that supports birds and other wildlife, as well as contribute bank erosion and flooding.

D. **Fennel (*Foeniculum vulgare*)** - When fennel invades native riparian habitat, it alters the composition and structure of the habitat, displacing native vegetation and reducing habitat quality for foraging and nesting birds and other wildlife.

E. **Date/fan palms (*Washingtonia robusta*), (*Phoenix* sp.), (*Syagrus* sp.)** - Fan palms and other palms invade riparian areas, often growing in among native riparian vegetation. Palm provide limited habitat value for wildlife, and represent a significant fire hazard, particularly when located near development. In an interview with the Los Angeles Times in January 1999, Orange County Fire Authority Capt. Scott Brown stated, "palms--and other trees--become a serious fire hazard when they are not well trimmed. The danger is especially great when the leaves and fronds dry out and Santa Ana winds blow." Their high susceptibility to fire represents a significant threat to native riparian plant species.

F. **Castor bean (*Ricinus communis*)** - Castor bean is considered a noxious weed in southern California. The plant contains ricin, an extremely toxic chemical. Within the two project sites, large castor bean plants have displaced native vegetation, reducing habitat quality for the endangered least Bell's vireo and other wildlife.

G. **Peppertree [Peruvian (*Schinus molle*), Brazilian (*Schinus terebinthifolius*)]** - Both California and Brazilian peppertrees are considered invasive plants in California. They displace native plants and degrade habitat quality for native birds and other wildlife. Brazilian peppertrees also produce allelopathic chemicals in the soil, which prevent other plants from growing.

H. **Pampasgrass/Jubatagrass (*Cortaderia selloana*/*Cortaderia jubata*) -** Mature plants of both species are highly competitive with native vegetation. Their presence degrades habitat quality for nesting birds and other wildlife, and the sharp leaf blades of pampasgrass can cause physical harm to animals and humans. The presence of either species in native habitat also represent a significant fire hazard because of the buildup of dry leaves and flowering stalks in mature plants.

I. **Various Ornamental Trees [Chinese elm (*Ulmus parvifolia*), *Eucalyptus* sp., Palo Verde (*Parkinsonia* sp.)]** - As a result of past uses within or adjacent to the Sweetwater and Tijuana river corridors, each project site include specimens of one or more ornamental trees. Although not all are invasive, these trees displace native species and habitat, and potentially disrupt flood flows through the riparian corridor. As a result, these trees will also be subject to removal and possible treatment to prevent resprouting.

SECTION 4: AQUATIC HERBICIDES AND APPLICATION METHODS

4.1 Pesticides Proposed for Use

Provided below is a list of potential herbicide products to be used at both the Sweetwater River and Tijuana River project sites, their active ingredient, and permitted uses.

Round Up Custom EPA # 524-343 - For Aquatic and Terrestrial Use
Active Ingredient: Isopropylamine salt of N-(phosphonomethyl) glycine; (Isoproplylamine salt of glyphosate)

Polaris EPA # 228-534 - Liquid Post-Emergent Herbicide for Vegetation Management and Aquatic Applications
Active Ingredient: Isoproplylamine salt of Imazapyr (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid)

Pathfinder II EPA # 62719-176 - Ready to use product for control of woody plants through basal bark and cut stump application. Do not apply to water.
Active Ingredient: triclopyr (3,5,6-trichloro-2-pyridinyloxyacetic acid, butoxyethyl ester) (referred here as triclopyr BEE)

Garlon 4 Ultra EPA # 62719-527 - Specialty herbicide recommended for the control of woody plants and vines, and herbaceous broadleaf weeds. Permissible on seasonally dry wetlands; do not apply to open water.
Active Ingredient: triclopyr 2-[(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid, butoxyethyl ester) (triclopyr BEE)

4.2 Pesticide Properties

Two things may happen to pesticides when they are released into the environment. They may be broken down, or degraded, by the action of sunlight, water or other chemicals, or microorganisms, such as bacteria. Generally, pesticides have four properties that determine the tendency of pesticides to move off-target. The most important of these properties are persistence, soil adsorption, and vapor pressure. Solubility also is involved, but to a lesser extent than the others. Appendices A-C include, chemical profiles developed by the USFWS for our proposed active ingredients glyphosate, imazapyr, and triclopyr. Summarized below are the pesticides properties found within the Appendices.

Fish LC_{50}: For test freshwater or marine species listed in the scientific literature, U.S. Fish and Wildlife Service (Service) personnel record an LC_{50} in ppm or mg/L. Most common test species available in the scientific literature are the bluegill, rainbow trout, and fathead minnow. Test results for many game species may also be available.

The lowest 96-hour (96-hr) LC_{50} value found for a freshwater fish species is used as a toxicological endpoint for RQ calculations to assess acute risk. Acute toxicity ratings were the following: super toxic < 0.01, extremely toxic 0.01-0.1, highly toxic 0.1-1, moderately toxic 1-10, slightly toxic 10-100, practically non-toxic 100-1000, and relatively harmless > 1000 (USFWS 1984). The lowest 96-hr LC_{50} values found in the Chemical Profiles (see Appendices A-C) are listed below:

- Imazapyr: rainbow trout, 96-hr LC50 = 6.7 ppm; moderately toxic
- Glyphosate: bluegill, 96-hr LC50 > 24 ppm; slightly toxic
- Triclopyr BEE: rainbow trout, 96-hr LC_{50} = 2.7 ppm; moderately toxic

Water Solubility: Service personnel record values for water solubility (S_W), which describes the amount of pesticide that dissolves in a known quantity of water. S_W is expressed as mg/L (ppm). Pesticide S_W values are categorized as one of the following: insoluble <0.1 ppm, moderately soluble = 100 to 1000 ppm, highly soluble >10,000 ppm (USGS 2000). As pesticide S_W increases, there is greater potential to degrade water quality through runoff and leaching. The highest water solubility values found in the Chemical Profiles (see Appendix A-C) are listed below:

- Imazapyr: 6,500,000 ppm; highly soluble
- Glyphosate: 900,000 ppm; highly soluble
- Triclopyr BEE: not water soluble

Soil Mobility: Service personnel record available values for soil adsorption coefficient (K_{oc} [mL/g]). This value provides a measure of a chemical's mobility and leaching potential in soil. K_{oc} values are directly proportional to organic content, clay content, and surface area of the soil.

K_{oc} data for a pesticide may be available for a variety of soil types (e.g., clay, loam, sand). K_{oc} values are used in evaluating the potential to degrade groundwater by leaching. A higher K_{oc} means a lower potential for mobility. The potential for mobility is classified as highest (K_{oc} 0-50), high (K_{oc} 50-150), medium (K_{oc} 150-500), low (K_{oc} 2,000-5,000) and immobile (K_{oc} >5,000). The lowest soil mobility values found in the Chemical Profile (see Appendix A-C) are listed below:

- Imazapyr: K_{oc} 15 in loamy sand; very highly mobile
- Glyphosate: K_{oc} 3,100 in sandy loam; slightly mobile
- Triclopyr BEE: K_{oc} 27 - 68; very highly mobile

Soil Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, soil t½ describes the rate for degradation only. As for t½, units of dissipation time are usually expressed in days. Field dissipation times are the preferred data for use to estimate pesticide concentrations in the environment because they are based upon field studies, compared to soil t½, which is derived in a laboratory. However, soil t½ are the most common persistence data available in the published literature. If field dissipation data are not available, soil half-life data are used in a Chemical Profile. The average or representative half-life value of the most important degradation mechanism is selected for quantitative analysis for both terrestrial and aquatic environments. Based upon the DT_{50} value, environmental persistence in the soil is categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996). The highest soil DT_{50} values found in the Chemical Profile (see Appendix A-C) are listed below:

- Imazapyr: 180 days; persistent
- Glyphosate: 13.9 days; non-persistent
- Triclopyr BEE: 46 days; moderately persistent

4.3 Application Methods

All pesticide use will follow the pesticide label and all relevant state and federal laws and application rates will be in accordance with the product label for each specific target species. Most applications will involve the cut-stump method followed up with foliar spot treatments. Work will be conducted between August 2 and March 19 of each year (although year one will likely start in late October). Table 1 provides an overview of proposed mechanical and chemical control methods for various species.

Table 1 - Control Methods for Targeted Species		
Targeted Species	**Mechanical Treatment and Disposal Methods**	**Chemical Application Methods**
Giant reed (*Arundo donax*)	Prior to chemical treatment, plants will be cut to ground level and the debris removed and disposed of off-site. No mechanical treatment required for seedlings/resprouts.	Cut stems will be treated immediately with an appropriate herbicide using a dauber or paintbrush. Treatment will be targeted for early fall, when net transport of materials in plants is from canopy to roots. Targeted spot treatment of seedlings/resprouts using a directed low volume foliar spray application will generally be limited to use in subsequent years.
Salt cedar, tamarisk (*Tamarix* sp.)	Mature plants will be cut to ground level. Debris will be moved to disturbed areas outside the floodway to be chipped and spread as directed by the Refuge Manager. No mechanical treatment required for seedlings/resprouts.	Injection and/or cut-stump application using with appropriate herbicide or mix of herbicides. Targeted spot treatment of seedlings/resprouts using a directed low volume foliar spray application will generally be limited to use in subsequent years.
Tree tobacco (*Nicotiana glauca*) Fennel (*Foeniculum vulgare*)	Plants will be cut to ground level. Debris will be moved to disturbed areas outside the floodway to be chipped and spread or to be transported off site to an appropriate disposal site. No mechanical treatment required for seedlings/resprouts.	Cut-stump application on mature cut stems with an appropriate herbicide immediately after cutting. Treatment of tree tobacco should not occur when the soil is saturated. Fennel is best treated before it flowers. Targeted spot treatment of seedlings/resprouts using a directed low volume foliar spray application will generally be limited to use in subsequent years.
Date/fan palms *Washingtonia robusta*, *Phoenix* sp., *Syagrus* sp.	Mature plants will be cut to ground level. Debris will be removed and disposed of off-site or may be cut and taken outside the active channel and left on site to deteriorate. No mechanical treatment required for seedlings.	Cut-stump application or injection into mature stems with an appropriate herbicide. Directed low volume foliar spray application to the centers of smaller palm plants could occur using triclopyr or other appropriate herbicide.
Castor bean *Ricinus communis*	Mature plants will be cut to ground level. Debris will be removed and disposed of off-site or may be cut, chipped, and scattered outside the active channel. No mechanical treatment required for seedlings/resprouts.	Immediately after cutting, apply an appropriate herbicide to mature stems. Targeted spot treatment of seedlings/ resprouts using a directed low volume foliar spray application, if needed, would generally be limited to use in subsequent years.
Peruvian peppertree, Brazilian peppertree *Schinus molle, Schinus terebinthifolia*	Mature plants will be cut as close to the ground as possible. Debris will be removed and disposed of off-site or may be cut, chipped, and scattered outside the active channel. No mechanical treatment required for seedlings/resprouts.	Cut-stump application with an appropriate herbicide on mature stems. Apply herbicide to the cambium within 5 minutes. Treat before the plants begin to fruit. Targeted spot treatment of seedlings/resprouts using a directed low volume foliar spray application, if needed, would generally be limited to use in subsequent years.

Table 1 - Control Methods for Targeted Species		
Targeted Species	**Mechanical Treatment and Disposal Methods**	**Chemical Application Methods**
Pampasgrass/ Jubatagrass (*Cortaderia selloana*/*Cortaderia jubata*)	Mature plants will be cut to ground level. Debris will be removed and disposed of off-site or may be cut, chipped, and scattered outside the active channel. No mechanical treatment required for resprouts.	Targeted treatment of cut stems, and/or spot treatment of resprouts, using a directed low volume foliar spray application.
Various ornamental trees (e.g., Chinese elm [*Ulmus parvifolia*], Palo Verde [*Parkinsonia* spp.], *Eucalyptus* spp.)	Mature plants will be cut to ground level. Debris will be removed and disposed of off-site or may be cut, chipped, and scattered outside the active channel. No mechanical treatment required for seedlings/resprouts.	Cut-stump application of an appropriate herbicide on mature stems. Targeted spot treatment of seedlings/resprouts using a directed low volume foliar spray application will generally be limited to use in subsequent years.

As indicated in Table 1, the primary method of control for perennial invasive plants present within the two project sites will involve a combination of mechanical control methods (e.g., stump cutting) with the use of herbicides. Specifically, perennial plants will be cut close to the ground, immediately followed by treating the cut stump with an appropriate systemic herbicide. This method often improves the efficacy of the herbicide compared to herbicide treatment only. Ground based foliar spraying of mature invasive plants is not anticipated, but if implemented, it would be limited and only used on arundo. Ground based foliar spot treatment of resprouts in the first one or two years following initial control is also proposed, and ground based foliar spot treatment of the centers of young palms could occur during first year or subsequent year treatments.

4.4 Adjuvants and Surfactants

Only adjuvants that are considered practically non-toxic to both aquatic invertebrates and fish will be used in aquatic environments. Toxicity data will be derived from the adjuvant's Safety Data Sheets (SDSs). Only two products listed below are being consider for use on the project sites.

Quest CA Reg # 5905-50076 (Water Conditioning Agent and AMS Replacement)

Agri-dex CA Reg # 5905-50094 (Oil Concentrate)

SECTION 5: FACTORS INFLUENCING CHOICE TO USE HERBICIDE

An evaluation of alternative control methods is presented in Section 10. Combining mechanical and chemical methods, as we are proposing for invasive plant control along the Sweetwater and Tijuana rivers, is considered the most feasible method for controlling the targeted invasive

plants presented in Table 1. Relying only on mechanical extraction would be more costly, more time consuming, and substantially more damaging to the overall quality of the existing riparian habitats. The herbicides selected for use on the project sites are considered the most effective for controlling the targeted species, while minimizing impacts to water quality and surrounding native habitat.

SECTION 6: GATES AND CONTROL STRUCTURES

There are no gates or water control structures within either project site.

SECTION 7: SHORT TERM OR SEASONAL EXCEPTIONS

Not applicable to this permit application.

SECTION 8: MONITORING AND REPORTING REQUIREMENTS

This MRP establishes monitoring and reporting requirements, which implement federal and California State laws and regulations. All monitoring of the effects of aquatic herbicide applications to control target invasive plants along the Sweetwater River in the San Diego NWR and along the Tijuana River in the Tijuana Slough NWR will be conducted by the Service or its designated contractor in accordance with the Monitoring Reporting Program (MRP) requirements presented in Water Quality Order No. 2013-0002-DWQ. Samples will be collected and analyzed per MRP guidelines (Table 2). To prevent sample contamination, sample collection will be conducted in accordance with the protocol outlined in Section 9.

8.1 Herbicide Application Reporting

The Service or its designated contractor will maintain a log for each aquatic herbicide application event equivalent to the form found in Appendix D (Pesticide Application Log). The application log shall contain the following information: date of application; name of applicator; type and amount of aquatic herbicide used; application details (e.g., flow and level of water body, time of application started and stopped, herbicide application rate and concentration, relevant information regarding any use of surfactants); visual monitoring assessment; and certification that applicator followed the APAP.

8.2 Monitoring Locations and Frequency

The process of selecting monitoring locations will consider the basic geographic and hydrologic features of the area, application practices and timing of use (which incorporate BMPs to minimize effects), knowledge of transport, fates, and effects of the herbicides to be used, and the designated beneficial uses in each water body.

Table 2. Monitoring Requirements per NPDES General Permit

Sample Type	Constituent/Parameter	Units	Sample Method	Minimum Sampling Frequency	Sample Type Required	Required Analytical Test Method
Visual	1. Monitoring area description (pond, lake, open waterway, channel, etc.)	Not applicable	Visual Observation	1	Background, Event and Post-event monitoring	Not applicable
	2. Appearance of waterway (sheen, color, clarity, etc.)					
	3. Weather conditions (fog, rain, wind, etc.)					
Physical	1. Temperature[2]	°F	Grab[4]	5	Background, Event and Post-event monitoring	6
	2. pH[3]	Number				
	3. Turbidity[3]	NTU				
	4. Electric Conductivity[3] @ 25 °C	µmhos/cm				
Chemical	1. Active Ingredient[7]	µg/L	Grab[4]	5	Background, Event and Post-event monitoring	6
	2. Nonylphenol[8]	µg/L				
	3. Hardness (if copper is monitored, freshwater only)	mg/L				
	4. Dissolved Oxygen[2]	mg/L				

1. All applications at all sites.
2. Field testing.
3. Field or laboratory testing.
4. Samples shall be collected at three feet below the surface of the water body or at mid water column depth if the depth is less than three feet.
5. Collect samples from a minimum of six application events for each active ingredient per year, per refuge (San Diego and Tijuana Slough NWRs). If there are less than six application events in a year, we will collect samples immediately after each application event for each active ingredient and nonylphenol, if applicable. If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation/trigger for an active ingredient, sampling shall be reduced to one application event per year for that active ingredient. If the yearly sampling event shows exceedance of the receiving water limitation/trigger for an active ingredient in an environmental setting, then sampling shall return to six application events for that active ingredient. For glyphosate, collect samples from one application event from each environmental setting per year.
6. Pollutants shall be analyzed using the analytical methods described in 40 C.F.R. part 136.
7. Glyphosate, Imazapyr, Triclopyr.
8. Required only when a surfactant is used.

The intent of the monitoring is to answer the following key questions:

Question No. 1: Does the residual algaecides and aquatic herbicides discharge cause an exceedance of receiving water limitations?

Question No. 2: Does the discharge of residual algaecides and aquatic herbicides, including active ingredients, inert ingredients, and degradation byproducts, in any combination cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective?

For the Sweetwater River, the primary beneficial use is municipal and domestic water supply. For the western segment of the Tijuana River, beneficial uses include habitat for aquatic life; rare, threatened and endangered species; estuarine habitat; and marine habitat.

Background Monitoring: When treatment areas are within standing water or when treatment other than the cut/stump application process using aquatic-labeled glyphosate, triclopyr, or Habitat (imazapyr for aquatic habitats) would occur less than 25-feet from standing water, background monitoring samples shall be collected in or immediately adjacent to the application area just prior to the application event, or up to 24 hours in advance of the application event. Adjacency should be determined based on the probability of drift or overspray. All sampling will be conducted within the adjacent area potentially affected. If standing water is not present within or adjacent to a treatment area at the time of application, or treatment is limited to the cut/stump application process, no samples will be collected.

Event Monitoring: When samples are required to be collected, event monitoring samples shall be collected immediately downstream of the treatment area in flowing waters or immediately outside of the treatment area in non-flowing waters. If standing water is not present outside the treatment area at the time of application, no sample will be collected. When standing water is present downwind of a treatment location where aerial spray application that can result in drift or overspray will be conducted, an event sample will be collected within the area potentially affected by drift or overspray. Samples will be collected immediately after the application event, but after sufficient time has elapsed such that treated water/spray drift would have exited the treatment area (about 5 to 15 minutes).

Post-event Monitoring: The post-event samples shall be taken within 7 days after an application, when background and event monitoring is required. Post-event monitoring samples shall be collected from the treatment area whenever standing water is present; otherwise, the sample shall be taken from the same location as the initial Background Sample. When applicable, one full set of three samples (Background, Event and Post-Event) will be collected during each treatment event scheduled for chemical application.

8.3 Sample Collection

Samples shall be collected using a sampling rod or Van Dorn device at 3 feet below the surface of the water or at mid-water column depth if the water depth is less than 4 feet. Sample collection will be conducted according to the protocol outlined in Section 9 to prevent sample contamination. Environmental parameters to be recorded during sampling include visual appearance of application site, water temperature, dissolved oxygen, pH, turbidity, and electrical conductivity. Field measurements will be recorded on the field data sheet form (Table 3).

Table 3

NPDES Monitoring Data Sheet

Site Name:	Collector:	Target Veg:	Herbicide/Surfactant:

Background Monitoring : Upstream at time of the application event or in application area just prior to (up to 24 hours in advance of) the application event.

Date:	GPS/Waypt:		H_2O Spd (ft/sec)	%Veg	Photo
Time:	Altitude:				☐
OBSERVATIONS – Circle and provide description, if applicable					
Weather: Clear / Partly Cloudy / Cloudy / Overcast / Other:				Wind:	
Water Clarity: Clear / Cloudy / Milky / Muddy / Other:					
Water Color: Clear / Brown / Red/ Green / Other:					
Visible: Films / Sheens / Coatings	Bottom Deposits: Yes / No		Fungi / Slimes / Objectionable Growth:		
Floating/ Suspended Material (algae, trash, etc.):					
Aquatic Life: Yes / No					
Potential Nuisance Conditions: Yes / No					
WATER TESTING					
Temp(°C):	**DO(mg/L):**	**EC(µs/cm):**	**Sal (ppt):**	**pH:**	

Event Monitoring: Immediately downstream of treatment area in flowing waters or immediately outside of treatment area in non-flowing waters.

Date:	GPS/Waypt:		H_2O Spd (ft/sec)	%Veg	Photo
Time:	Altitude:				☐
OBSERVATIONS – Circle and provide description, if applicable					
Weather: Clear / Partly Cloudy / Cloudy / Overcast / Other:				Wind:	
Water Clarity: Clear / Cloudy / Milky / Muddy / Other:					
Water Color: Clear / Brown / Red/ Green / Other:					
Visible: Films / Sheens / Coatings	Bottom Deposits: Yes / No		Fungi / Slimes / Objectionable Growth:		
Floating/ Suspended Material (algae, trash, etc.):					
Aquatic Life: Yes / No					
Potential Nuisance Conditions: Yes / No					
WATER TESTING					
Temp(°C):	**DO(mg/L):**	**EC(µs/cm):**	**Sal (ppt):**	**pH:**	

Post-Event Monitoring : Within the treatment area within one week after application

Date:	GPS/Waypt:		H_2O Spd (ft/sec)	%Veg	Photo
Time:	Altitude:				☐
OBSERVATIONS – Circle and provide description, if applicable					
Weather: Clear / Partly Cloudy / Cloudy / Overcast / Other:				Wind:	
Water Clarity: Clear / Cloudy / Milky / Muddy / Other:					
Water Color: Clear / Brown / Red/ Green / Other:					
Visible: Films / Sheens / Coatings	Bottom Deposits: Yes / No		Fungi / Slimes / Objectionable Growth:		
Floating/ Suspended Material (algae, trash, etc.):					
Aquatic Life: Yes / No					
Potential Nuisance Conditions: Yes / No					
WATER TESTING					
Temp(°C):	**DO(mg/L):**	**EC(µs/cm):**	**Sal (ppt):**	**pH:**	

Water samples for laboratory analyses and other environmental parameters will be collected by staff or a qualified contractor. Laboratory analysis will be conducted by Contaminants Program staff at the Carlsbad Fish and Wildlife Office and/or by a private analytical laboratory, certified for such analysis by the California Department of Health Services. All laboratory analyses will be conducted according to U.S. EPA Guidelines. An annual report summarizing treatments and monitoring will be submitted to the Water Board by March 1 of the year following treatment.

SECTION 9: PROCEDURES USED TO PREVENT SAMPLE CONTAMINATION

Water quality sampling will be performed by trained staff and/or a qualified contractor. Lab provided sample bottles will be used for all water samples collected. Nitrile gloves and safety glasses will be worn when collecting and handling sample bottles. Water samples will be tightly sealed at the point of collection and placed upright with ice packs within an ice chest solely for sample transport. When sampling is completed in a given location, the equipment will be cleaned with a non-phosphate cleaner and triple-rinsed with distilled water. The meter used to collect data from the water on site will be rinsed with distilled water following sampling at each location. Gloves will be changed between collection sites.

SECTION 10: BEST MANAGEMENT PRACTICES

10.1 Product Specific Best Management Practices

Adherence with the following product specific Best Management Practices (BMPs) is required when the following products are used within the San Diego NWR or Tijuana Slough NWR:

Imazapyr products (reduced risk herbicide active ingredient that may be used in upland, riparian, and aquatic habitats): Habitat may be applied within 25 feet of surface water resources, while Stalker may only be applied to upland sites greater than 25 feet from surface water resources.

Glyphosate products (herbicide active ingredient for effective non-selective annual, biannual, and perennial broadleaf and grass weed control): Aquatic-labeled glyphosate formulations will be applied to aquatic habitats, and surfactant free glyphosate formulations will be applied to riparian habitats within 25 feet of surface water resources. Glyphosate may be tank-mixed w/ surfactants classified as slight acute toxicity (>10 ppm) to aquatic organisms, including AgriDex, LI-700, Activate Plus, Big Sur 90, Sil Energy, Dyne-Amic, Freeway, Cygnet Plus, Sun-Wet, Hasten Modified Vegetable Oil, Kinetic or Class Act Next Generation.

Triclopyr products (herbicide active ingredient for control of woody plants including salt cedar): A 25-foot treatment buffer zone from surface water resources will be maintained at all times, except for cut stump treatments of target woody pest species.

10.2 Handling and Application Best Management Practices

Presented here are the Best Management Practices (BMPs) that will be implemented during the mixing, handling, and application of pesticides associated with the control of invasive plants within the two project areas. BMPs may vary, as appropriate, based upon target- and site-specific factors and time-specific environmental conditions.

Pesticide Handling and Mixing

- As a precaution against spilling, spray tanks will not be left unattended during filling.
- All pesticide spray equipment will be properly cleaned. Where possible, rinsate will be used as part of the makeup water in the sprayer tank and applied to treatment areas.
- All pesticide containers will be triple rinsed, and the rinsate will be used as water in the sprayer tank and applied to treatment areas.
- All unused pesticides will be properly discarded at a local "safe send" collection.
- Pesticides and pesticide containers will be lawfully stored, handled, and disposed of in accordance with the label and in a manner that will safeguard human, fish, and wildlife health and that will prevent soil and water contamination.
- Applicators will consider the water quality parameters (e.g., pH, hardness) that are important to ensure the greatest efficacy when specified on the pesticide label.
- All pesticide spills will be addressed immediately and reporting requirements will be implemented as follows: consistent with the California Hazardous Materials Spill/Release Notification Guidance (California Offices of Emergency Services 2014), should a significant release of herbicide occur in association with work being conducted by or for the Refuge, the California Office of Emergency Service (OES) and National Response Center (NRC) shall be notified immediately by telephone with a written Follow-Up Report required within seven days if the release equals or exceeds the Federal Reportable Quantities; if the spill occurs within the Sweetwater River watershed, the Sweetwater Authority shall be contacted immediately following OES and NRC notification.

Applying Pesticides

- Pesticide treatments will only be conducted by or under the supervision of Service personnel and non-Service applicators with the appropriate State or Bureau of Land Management (BLM) certification to safely and effectively conduct these activities on Refuge lands and waters.
- All applicators will be required to have received training on safety and herbicide application regulations to ensure compliance with all Federal, State, and local pesticide use laws and regulations, as well as Department of Interior, Service, and National Wildlife Refuge System pesticide-related policies.
- Before each treatment season and prior to mixing or applying any product for the first time each season, all applicators will review the product label, Material Safety Data Sheet (MSDS), and PUP for each pesticide, determining the target pest, appropriate mix rate(s), personal protective equipment (PPE), and other requirements listed on the pesticide label.

- Refuge staff will use low impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., larger tank wand applications), where practical.
- Applicators will use low volume rather than high volume foliar applications when the low impact methods described above are not feasible or practical to maximize herbicide effectiveness and ensure correct and uniform application rates.
- Applicators will use and adjust spray equipment, including low-drift nozzles where possible, to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift.
- Spraying will occur during low (average less than 7 mph; preferably 3-5 mph) and consistent direction wind conditions with moderate temperatures (less than 85 ^{o}F).
- Applicators will avoid spraying during inversion conditions (often associated with calm or very low wind conditions) that can cause large-scale herbicide drift to non-target areas.
- Equipment will be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications will be made at the lowest height for uniform coverage of target pests to minimize or eliminate potential drift.
- If windy conditions frequently occur during afternoons, spraying will typically be conducted during early morning hours.
- Spray applications will not be conducted on days with greater than 30% forecast for rain within 6 hours, except for pesticides that are rapidly rainfast (e.g., glyphosate in 1 hour).
- Applicators will use drift retardant adjuvants during spray applications, especially adjacent to sensitive areas.
- Applicators will use a non-toxic dye to aid in identifying treated target areas and any areas of overspray or drift. A dye can also aid in detecting equipment leaks. If a leak is discovered, application will stop until repairs are made to the sprayer.
- Refuge staff will consider the timing of a pesticide application to ensure that native plants are protected (e.g., senescence) while effectively treating invasive plants.
- Application equipment (e.g., backpack sprayer, transport vehicles) will be thoroughly cleaned and PPEs removed and properly disposed of after treatments.

Water Agency Coordination

- The San Diego NWR has contacted the Sweetwater Authority regarding this proposal, as well as provided an application schedule for the control invasive plants along the Sweetwater River, a list of herbicides to be used, and a description of the proposed monitoring plan.

10.3 Adverse Incident (Spill) Response Procedures

Pesticide applicators are required to conduct spot checks in the area in and around where pesticides are applied for possible and observable adverse impacts caused by an application of pesticides. Adverse impacts may include, but are not limited to, the unanticipated death or

distress of non-target organisms, disruption of fish or wildlife habitat and disruption of recreational or municipal water use. Visual assessments will occur: 1) during the application when considerations for safety and feasibility allow, and 2) during any post-application surveillance or efficacy check that is conducted. The applicator(s) are responsible for monitoring, and will monitoring will supplemented by other refuge staff.

Operators/applicators must be familiar with the California Office of Emergency Service's California Hazardous Materials Spill/Release Notification Guidance. The operator/applicator should contact California Office of Emergency Services (800) 852-7550, National Response Center (800) 424-8802, and the appropriate refuge staff, if the operator/applicator observes or is otherwise made aware of an adverse incident that may have resulted from a discharge from the pesticide application. Reporting of the incident must occur no later than 24 hours after the operator becomes aware of the adverse incident.

The following information will be included on an incident notification:

1) name and telephone number,
2) location and description of affected area,
3) operator name and contact information,
4) NPDES File #,
5) name of contact person,
6) date and time incident was discovered,
7) description of adverse species and name of affected species,
8) EPA registration # of product,
9) description of steps taken to mitigate adverse effects, and
10) reason why notification was made 24 hours later, if applicable.

Operator is not required to report an adverse incident if it was not related to toxic effects or expose from pesticide application.

SECTION 11: EXAMINATION OF POSSIBLE ALTERNATIVES

Three alternatives were considered: The proposed action (implement mechanical and chemical control of invasive species), mechanical control only, and the no action alternative.

No Action Alternative

Under the no action alternative, no control of invasive non-native plants species would occur. The presence of invasive plants in these watersheds would persist and likely expand into other currently uninfested areas of the riparian habitat. The presence of invasive plants within these riparian systems has and would continue to adversely affect habitat quality and function. Studies indicate that stands of salt cedar alter the hydrology and sediment rates within rivers and streams and have the potential to lower the water table (Brotherson and Field 1987), which further affects the system's native plants. The displacement of native trees and shrubs with non-native species also alters the canopy height and other attributes of

architecture within the riparian zone (Zedler and Kercher 2004). These changes alter nesting conditions for riparian bird species, including the federally endangered least Bell's vireo, and also effect habitat quality for wildlife.

In addition to the effects invasive plants have on habitat structure and function, species such as giant reed and salt cedar are highly flammable (Lambert et al. 2010), therefore their presence in these riparian systems increases the potential for fire. Higher fire risk is a concern for the remaining native riparian areas, as well as adjacent native upland habitat and surrounding developed areas.

The project goals of reducing the risk of wildfire; improving habitat quality for riparian nesting bird species, including the federally endangered least Bell's vireo, and improving access and visibility for Border Patrol operations would not be achieved under the no action alternative.

Mechanical Treatment Only Alternative

Under the mechanical treatment only alternative, invasive plants would have to be removed by chopping, cutting, and/or mowing the above ground vegetation, as well as the below ground roots. These methods can be less selective than just cutting the above ground vegetation and applying an herbicide to kill the below ground root system. The disturbance associated with below ground removal can result in damage to adjacent native species and/or could open areas up to other invasive plant species. In the case of arundo, considerable below ground disturbance is required to remove the entire rhizome root mass. If any rhizome root remains, the plant will resprout requiring further soil disturbance (DiTomaso et al. 2013).

Mechanical removal methods for salt cedar may include mowing, burning, chopping, chaining, and disking. However, according to DiTomaso et al. 2013, "these methods usually only suppress salt cedar temporarily and will not eradicate infestations. Salt cedar is also able to resprout vigorously from the root crown following mechanical control methods."

Implementation of the mechanical treatment only alternative would not include the use of herbicides, but would require substantial alteration of the soil. The result would be changes to the site topography within the two riparian zones and exposure of disturb soils to further invasion by opportunistic non-native species. Exposed soils could also impact downstream habitat if loosened sediment is able to travel downstream to other sensitive habitat areas.

The effects to the environment associated with disturbance and the potential for increased siltation and turbidity levels downstream of treatment activities would be greater under the mechanical treatment only alternative. Further, it is unlikely that implementation of this alternative would meet the current project goals within the time frame and funding allocations provided in the current agreement.

Current Proposal

The approach of using a combination of mechanical and chemical treatments to remove invasive plants from portions of the Tijuana River and Sweetwater River has been selected for implementation over the no action and mechanical treatment only alternatives because implementation of the proposed action will more efficiently and effectively achieve the project goals of reducing the risk of wildfire, improving habitat for riparian nesting bird species, including listed species, and improving access and visibility for Border Patrol operations.

LITERATURE CITED

Boland, J. M. and D. L. Woodward. "Impacts of the invasive shot hole borer (*Euwallacea kuroshio*) are linked to sewage pollution in southern California: the Enriched Tree Hypothesis." *PeerJ* vol. 7 e6812. 1 May. 2019, doi:10.7717/peerj.6812.

Brotherson, J. and D. Field. 1987. *Tamarix*: Impacts of a successful weed. Rangelands 9:100-112.

California Office of Emergency Services. 2014. California Hazardous Materials Spill/Release Notification Guidance.

DiTomaso, J.M., G. B. Kyser, S. R. Oneto, R. G. Wilson, S. B. Orloff, L. W. Anderson, S. D. Wright, J. A. Roncoroni, T. L. Miller, T. S. Prather, C. Ransom, K. G. Beck, C. Duncan, K. A. Wilson, Mann, J. J. 2013. Weed control in natural areas in the Western United States. Weed Research and Information Center, University of California, 544 pp.

Kerle, E.A., J.J. Jenkins, P.A. Vogue. 1996. Understanding pesticide persistence and mobility for groundwater and surface water protection. EM 8561. Oregon State University Extension Service. 8 pages.

Lambert, A.M., C.M. D'Antonio, T.L. Dudley. 2010. Invasive Species and Fire in California Ecosystems. 2010. Fremontia 38:2/38:3 pp.29-36.

U.S. Fish and Wildlife Service. 1984. Research Bulletin. No. 84-78.

U.S. Geological Survey. 2000. Pesticides in stream sediment and aquatic biota – current understanding of distribution and major influences. USGS Fact Sheet 092-00, U.S. Geological Survey, Sacramento, California. 4 pages.

Zedler, J.B. and S. Kercher. 2004. Causes and Consequences of Invasive Plants in Wetlands: Opportunities, Opportunists, and Outcomes. Critical Reviews in Plant Sciences 23(5):431–452 (2004).

APPENDICES

Attachment A – Chemical Profile Imazapyr

Attachment B – Chemical Profile Glyphosate

Attachment C – Chemical Profile Triclopyr

Attachment D - Pesticide Application Log

Appendix D - Pesticide Application Log

Application Information	Weather Information
Date:	Wind Speed:
City, County:	Cloud Cover %:
Location:	Air Temp. (°C):
Applicators:	Water Temp. (°C):
Method of Application:	DO (mg/L):
Vessel Used:	Start Time:
Sample Code, if applicable	End Time:

Type and Amount of Product Used

Sub Location (w/ GPS data)	Estimated Acreage Controlled	Distance from Water	Plant Species Controlled	Product Used	Quantity Used

Other Monitoring Notes

Treatment Notes

I certify that I have reviewed the contents of and have complied with the APAP for this project.

Signature: _____ Name: _____