IRVINE RANCH WATER DISTRICT
INTEGRATED PEST MANAGEMENT PLAN
2019 ANNUAL REPORT

IPM PLAN IMPLEMENTATION

IRVINE, CALIFORNIA

LSA

June 2020

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EXECUTIVE SUMMARY

LSA has prepared this annual report for the implementation of the Irvine Ranch Water District (IRWD) Integrated Pest Management (IPM) Plan. IPM is defined as managing pests in a way that protects human health and the surrounding environment in an economically responsible way through the most effective, least-risk option. IRWD's IPM Plan was designed to guide the use of environmentally sensitive pest management strategies and least-toxic control methods at facilities maintained and managed by IRWD, and it focuses on long-term prevention or suppression of pests while protecting human health, the environment, and nontarget organisms. IPM Plan strategies were executed beginning in September 2019. This report encompasses the first 4 months of the program, from September through December 2019. Future reports will cover 1 calendar year.

IRWD facilities described in this report include Rattlesnake Reservoir, San Joaquin Reservoir, Sand Canyon Reservoir, Syphon Reservoir, San Joaquin Marsh, and 33 Natural Treatment System (NTS) basins. LSA biologists surveyed the San Joaquin Marsh and IRWD's NTS basins monthly to map locations of invasive plant species using ArcGIS Collector software and to provide treatment recommendations accordingly. Treatment methods focused primarily on nonchemical removal methods, including manual removal, weed trimming, mowing, mulching, and soil solarization. Removal methods were escalated to chemical treatment methods only for persistent invasive species that could not be eradicated using nonchemical treatment methods. Data collected from the San Joaquin Marsh and NTS basins were used to analyze the number of invasive species and treatment methods recommended for each basin, as well as to extrapolate approximate percent cover by invasive species. An overlap analysis was also conducted to visualize areas that have recurring invasive plant cover over time. Rattlesnake Reservoir, San Joaquin Reservoir, Sand Canyon Reservoir, and Syphon Reservoir were not surveyed by LSA personnel; these facilities are managed by IRWD's Facilities/Fleet Manager. There are also 147 other facilities managed by IRWD's Facilities/Fleet Manager that were not individually described in this report but have been included in acreage and pesticide usage totals.

As treatment of invasive plants focused on testing nonchemical removal methods for infestations during the early stages of IPM Plan implementation, very small quantities of chemical pesticides were applied throughout these first 4 months. Chemical pesticide usage in 2018 totaled 78.34 gallons (gal) for the NTS basins and the San Joaquin Marsh, which are managed by the NTS department. Over the same period, chemical pesticide usage for other IRWD facilities managed by the Facilities/Fleet Manager totaled 84 gal. From January through June 2019, 60.53 gal of glyphosate were applied in the NTS basins and the San Joaquin Marsh. From September through December 2019, following IPM Plan implementation, 0.05 gal of glyphosate and 1.20 gal of organic pesticides were applied in the NTS basins and the San Joaquin Marsh, and 0.72 gal of glyphosate was applied to other IRWD facilities, a significant reduction in the amount of pesticides used throughout all IRWD facilities. Pesticides were applied at the San Joaquin Reservoir, the San Joaquin Marsh, and the Lower Eastfoot NTS basin.

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LIST OF ABBREVIATIONS AND ACRONYMS

ac	acre(s)
af	acre-foot/acre-feet
Cal-IPC	California Invasive Plant Council
ft	foot/feet
gal	gallon(s)
I-5	Interstate 5
I-405	Interstate 405
IPM	Integrated Pest Management
IRWD	Irvine Ranch Water District
NTS	Natural Treatment System
oz	ounce(s)
SR-133	State Route 133
SR-261	State Route 261

IRVINE RANCH WATER DISTRICT INTEGRATED PEST MANAGEMENT PLAN 2019 ANNUAL REPORT

INTRODUCTION

The Irvine Ranch Water District (IRWD) Integrated Pest Management (IPM) Plan was designed to guide the use of environmentally sensitive pest management strategies and least-toxic control methods at facilities maintained and managed by IRWD. IPM is a process used to solve pest problems through cost-effective means while minimizing risks to people and the environment. It is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as cultural control and mechanical control. Chemical pesticides are used only when necessary and are applied in a manner that minimizes their possible harm to people, nontarget organisms, and the environment (e.g., soil and water quality).

This annual report describes IPM activities conducted from September through December 2019. This report only encompasses the first 4 months of the program, based on the contract cycle; future reports will cover 1 calendar year.

Guiding Principles

Following the lead of other public entities such as the City of Irvine and Irvine Unified School District, IRWD is implementing this IPM Plan, which focuses on long-term prevention or suppression of pests while protecting human health, the environment, and nontarget organisms. IRWD—steward of numerous facilities, wetlands, and habitat, much of which is maintained in a native, natural state—adopts this organic-first policy for landscaping and pest control, with specific limitations on the use of pesticides and chemicals.

Integrated Pest Management Plan Components

The IPM Plan includes several components:

- A framework for implementing IPM practices at IRWD facilities and properties
- Consistency with other Orange County–area agencies' IPM approaches
- Training of staff to encourage a mindset of progressive pest management principles
- Sharing the IPM program with the public for transparency
- Monitoring and reporting of actions associated with implementation of the IPM Plan

The focus of this IPM Plan is on the pesticides (rodenticides, insecticides, and herbicides) used to control pests and noxious-weed infestations at IRWD facilities. The purpose of this plan is to guide the use of environmentally sensitive pest management strategies and least-toxic control methods at facilities maintained and managed by IRWD. IPM is defined as managing pests (plants, fungi, insects, and animals) in a way that protects human health and the surrounding environment in an economically responsible way through the most effective, least-risk option. Core elements of IPM include the following:

- Pest prevention to avoid the use of pesticides or other pest control methods
- Nonchemical methods as the first choice for pest control
- Use of organic or least-toxic chemical pesticides
- Use of chemicals and pesticides only in target locations and for targeted species
- Prohibition of dangerous pesticides at parks, playgrounds, or other areas where the public congregates
- Routine inspection and monitoring
- Transparent and proactive communication

When pest prevention is unsuccessful or when noxious weeds are already established, the approach to eliminate these species from an area should follow a systematic decision-making process. Use of nonchemical control methods should first be exercised. When physical control methods are not an option, organic control methods may be needed. High-potential-hazard pesticide applications may only be considered in emergency situations that present a public health or environmental threat.

METHODS

The San Joaquin Marsh and IRWD's Natural Treatment System (NTS) basins were surveyed monthly, on foot, to map locations of invasive plant species. Figure 1 (all figures are in Appendix A) shows the locations in the San Joaquin Marsh and the NTS basins surveyed by LSA personnel. Locations of infestations were recorded as points or polygons using ArcGIS Collector software. Only species that posed a threat to native habitat were recorded. Other species that were determined not to be particularly disruptive to the overall environment were omitted. Omitted species were typically low-growing, noninvasive plant species such as matted sandmat (*Euphorbia serpens*) and spotted spurge (*Chamaesyce maculata*). Species that are listed on the California Invasive Plant Council (Cal-IPC) Inventory were specifically targeted, although there are many other nonnative species targeted for IPM activities that have not yet been listed on the Cal-IPC Inventory. Treatment methods were recommended for each data point or polygon, focusing primarily on nonchemical removal methods. Nonchemical treatment methods consist of manual removal, weed trimming, mowing, discing, mulching, and soil solarization. Seeding is another method that may be implemented in areas that necessitate higher percent cover by native species to prevent invasive nonnatives from establishing. Chemical treatment methods include organic-chemical control and prioritized chemical-pesticide control. Chemical treatment was prescribed for persistent invasive species that could not be eradicated using nonchemical treatment methods.[1] See Appendix B for memorandums addressing the decision-making process justifying chemical-pesticide usage for the edible fig (*Ficus carica*) and giant reed (*Arundo donax*). Data collected through ArcGIS Collector were used to analyze the

[1] While LSA personnel recommended certain treatment methods, some methods may not have been implemented by landscape contractor staff. Chemical pesticides were not used unless recommended.

number of invasive species identified within each basin between September and December 2019, as well as which treatment methods were recommended for each basin. Polygon data were used to extrapolate an approximate percent cover by invasive species throughout each NTS basin. An overlap analysis, provided on Figure 4, was conducted to visualize areas within the NTS basins and San Joaquin Marsh that have recurring invasive-plant cover over time.

Rattlesnake Reservoir, San Joaquin Reservoir, Sand Canyon Reservoir, and Syphon Reservoir were not visited by LSA personnel during monthly surveys. These reservoirs are managed by IRWD's Facilities/Fleet Manager.

INTEGRATED PEST MANAGEMENT PROJECTS

Rattlesnake Reservoir

Rattlesnake Reservoir is a recycled-water storage reservoir owned and operated by IRWD. It formerly was used to supply water for agricultural irrigation. The reservoir retains most dry- and wet-weather flows. No chemical pesticides were utilized at Rattlesnake Reservoir.

San Joaquin Reservoir

San Joaquin Reservoir was built in 1966 and was originally used as a drinking-water reservoir by seven cities and water districts. The reservoir is currently used to store recycled water. It provides 3,080 acre-feet (af) (about 1 billion gallons [gal]) of seasonal storage. Operation of the reservoir maximizes storage during the winter months when irrigation demands are lower. Water is then withdrawn in the summer months to provide landscape irrigation water for Irvine, Newport Coast, and portions of Newport Beach.

Subsequent to the adoption of the IPM Plan, chemical pesticides were applied to vegetation on the dam face of San Joaquin Reservoir. Due to safety hazards associated with physically reaching plants growing on the dam face, it was determined that spraying chemical pesticides was the only viable option for treating vegetation.

Sand Canyon Reservoir

Sand Canyon Reservoir is adjacent to the Strawberry Farms Golf Club near the San Diego (Interstate 405 [I-405]) Freeway. The reservoir has a surface area of 42 acres (ac), a storage capacity of 768 af (250 million gal), and an average depth of 18 feet (ft). The watershed area is approximately 6.7 square miles (4,288 ac). The reservoir is used for both seasonal and operational storage. No chemical pesticides were utilized at Sand Canyon Reservoir.

Syphon Reservoir

Syphon Reservoir, in northern Irvine, began operations in 1949 and historically was used to store irrigation water. It has been integrated into the IRWD recycled-water system as a seasonal storage facility, with a capacity of 535 af (174 million gal). No chemical pesticides were utilized at Syphon Reservoir.

San Joaquin Marsh

The San Joaquin Marsh and Wildlife Sanctuary encompasses 281.58 ac of coastal freshwater wetlands, half of which have been restored to a natural state. San Joaquin Marsh is a vital component of the overall NTS, as water from San Diego Creek is cycled through wetlands and naturally treated before it reaches the environmentally sensitive Upper Newport Bay and the ocean.

IPM activities in San Joaquin Marsh focused on mechanical removal of invasive plants. Chemical pesticides were necessary to remove plants that were resistant to nonchemical removal methods, such as edible fig and giant reed. A total of 39 nonnative plant species were identified in San Joaquin Marsh between September and December 2019. San Joaquin Marsh is divided into four zones for landscape maintenance purposes (Figure 2). Refer to Table A for the number of invasive species identified, an approximate percent cover by invasive species, and treatment methods recommended within each zone. San Joaquin Marsh Zone 3 exhibited the highest percent cover by invasive species, at 21.9 percent, due to the presence of herb-of-grace (*Bacopa monnieri*) within several ponds. Herb-of-grace was not treated, as IRWD drains those ponds once a year, which desiccates the obligate wetland plant.

Natural Treatment Systems

IRWD's NTS is a cost-effective, environmentally sound method for treating dry-weather runoff. The NTS basins throughout IRWD's wider territory are modeled after the successful system of natural treatment ponds that remove nitrogen, phosphorus, and bacteria from surface water entering San Joaquin Marsh. The NTS basins work much like San Joaquin Marsh, only using smaller man-made wetlands placed strategically throughout the San Diego Creek Watershed (Figure 1). Low-flow natural and urban runoff, as well as smaller storm flows, is diverted into these man-made wetlands, where contaminants are removed and prevented from reaching Upper Newport Bay. Thirty-three NTS basins were incorporated into IPM activities from September through December 2019, which are described below. Refer to Table A for a summary of the number of invasive species identified, an approximate percent cover by invasive species, and methods recommended for treatment per basin. Representative photos of the basins are provided in Figure 3.

Quail Springs

Quail Springs is a 10.86 ac basin located adjacent to Shady Canyon Drive in central Irvine. This basin consists of several ponds and channels. Mulching with black plastic was tested in one portion of the basin that had a nearly homogenous stand of Spanish sunflower (*Pulicaria paludosa*). This basin also suffered from an infestation of black mustard (*Brassica nigra*) on the northern slopes. Dead black mustard brush was removed; however, the plants had already set seed, and the infestation is expected to return in the next growing season.

Quail Meadow

Quail Meadow is a 1.40 ac NTS basin located north of Quail Hill Shopping Center in Irvine. This basin consists of a small sediment catchment pond at the inlet, after which water percolates into the ground. The slopes of this basin are relatively bare, but the basin bottom supports a good diversity of native riparian plants.

Table A: Summary of Invasive Plants and Treatment Methods in NTS Basins

Basin ID	Basin Name	Number of Invasive Species	Approximate Percent Cover by Invasive Plants	Treatment Methods Recommended
1	San Joaquin Marsh—Zone 1	14	0.1%	Manual Removal, Chemical Pesticides
	San Joaquin Marsh—Zone 2	15	1.6%	Manual Removal, Chemical Pesticides
	San Joaquin Marsh—Zone 3	23	21.9%	Manual Removal, No Treatment, Chemical Pesticides
	San Joaquin Marsh—Zone 4	17	1.9%	Manual Removal, Chemical Pesticides
2	Quail Springs	12	14.1%	Manual Removal, Soil Solarization
3	Quail Meadow	5	5.4%	Manual Removal
4	Old Laguna	10	5.4%	Manual Removal
5	Turtle Ridge	6	0.6%	Manual Removal
6	Forge Meadow	9	8.8%	Manual Removal
7	Port Culver	13	20.6%	Manual Removal
8	Orchard Meadow	10	11.2%	Manual Removal, No Treatment
9	Lower Eastfoot	5	0.4%	Manual Removal
10	El Modena	10	7.2%	Manual Removal
11	Trabuco	12	2.7%	Manual Removal, Mowing
12	Marshburn	17	13.5%	Manual Removal, Chemical Pesticides
13	Los Olivos Meadow	4	42.6%	Manual Removal, Soil Solarization
14	Laguna Altura North	10	6.0%	Manual Removal
15	Laguna Altura South	3	13.7%	Manual Removal
16	Cypress Meadow A	6	7.4%	Manual Removal
17	Cypress Meadow B	6	8.7%	Manual Removal
18	Cypress Meadow C	10	10.4%	Manual Removal, No Treatment
19	Cypress Meadow D	20	7.5%	Manual Removal
20	Portola Springs Meadow	5	3.2%	Manual Removal
21	Eastwood Meadow	7	5.8%	Manual Removal
22	Middle Eastfoot	11	52.1%	Manual Removal, Soil Solarization
23	Eastfoot Retarding Basin	7	6.8%	Manual Removal, Mowing
24	Upper Eastfoot	9	16.8%	Manual Removal
25	Hidden Canyon	15	44.0%	Manual Removal, Weed Trimmer
26	Ridge Valley A	7	15.3%	Manual Removal, Chemical Pesticides
27	Ridge Valley B	7	13.1%	Manual Removal, Soil Solarization
28	Ridge Valley C	12	14.7%	Manual Removal, Chemical Pesticides
29	Floral View	10	9.0%	Manual Removal
30	Parasol Park	6	25.9%	Manual Removal, No Treatment
31	Twisted Oak	6	76.7%	Manual Removal
32	Iluna Springs	10	11.6%	Chemical Pesticides, Manual Removal
33	Aquila Springs	11	25.6%	Manual Removal
34	Sports Park	14	18.6%	Manual Removal, Chemical Pesticides

[1] Refer to Figure 1 in Appendix A for a map of basin locations.
[2] The approximate percent cover was extrapolated using polygon data. Point data was not utilized in the extrapolation.
NTS = Natural Treatment System

Old Laguna

Old Laguna is a 2.81 ac basin located west of Laguna Canyon Road and south of I-405. This basin consists of two small channels flowing into one large pond. A significant amount of yellow waterweed (*Ludwigia peploides*), an invasive plant with a High Cal-IPC rating, was observed growing along the margins of the channels and pond and was manually removed.

Turtle Ridge

Turtle Ridge is a 1.97 ac basin located north of Shady Canyon Drive in south Irvine. This basin consists of a single large pond. Surveys at this location were conducted from September through November. In December, the basin was dredged and the basin was mostly bare, so surveys for invasive plants were not conducted.

Forge Meadow

Forge Meadow is a 2.38 ac NTS basin located adjacent to Portola Parkway in north Irvine. This basin consists of two ponds connected by a long channel. Beginning in December, a majority of the vegetation in Forge Meadow was removed in preparation for a restoration event. As the basin was mostly bare, data was not collected in the month of December.

Port Culver

Port Culver is a 1.74 ac basin located north of Portola Parkway and adjacent to a large agricultural area in north Irvine. This basin consists primarily of a pilot channel, but water often overflows from the channel and spreads throughout the bottom of the basin. IRWD began implementing a grow–kill cycle on the basin's upland slopes in preparation for a restoration effort.

Orchard Meadow

Orchard Meadow is a 2.30 ac basin located at the intersection of Portola Parkway and Orchard Hills in north Irvine. This basin consists of a channel with a small pond at the center. IRWD personnel recently conducted habitat restoration on the upland slopes of the basin.

Lower Eastfoot

Lower Eastfoot is a 2.13 ac NTS basin located adjacent to Portola Parkway and State Route 261 (SR-261). This basin consists of a channel with a small pond at the center. In December, IRWD personnel began to execute a grow–kill cycle in preparation for restoration of the basin's upland slopes. Several organic chemical pesticides were applied on test plots on the slopes of this basin, detailed below.

El Modena

El Modena is a 1.61 ac NTS basin located within a park adjacent to South Hewes Street in Orange. This basin consists of one large pond with a narrow strip of riparian vegetation lining the water. As the basin is isolated in a park and adjacent to residential areas, nonnative ornamental species are often present.

Trabuco

Trabuco is an 18.07 ac basin located east of Jeffrey Road and north of Trabuco Road in Irvine. This basin serves as a flood retention basin and is managed in a different way than the typical NTS basins. IPM activities are conducted adjacent to any riparian areas. The slopes and fields not immediately adjacent to the channels and ponds containing dry-weather runoff are mowed every quarter and were not included in IPM monthly surveys. This basin suffers from an infestation of Spanish sunflower.

Marshburn

Marshburn is a 14.04 ac basin located at the intersection of Irvine Boulevard and Ridge Valley in Irvine. This basin also serves as a flood retention basin and is managed in the same way as Trabuco, detailed above. It consists of two inlet channels flowing into one large pond. This basin supports a relatively high diversity of native riparian plant species.

Los Olivos Meadow

Los Olivos Meadow is a 3.19 ac NTS basin located adjacent to the Los Olivos housing development and east of the San Diego Creek. This basin has two inlet channels flowing into one pond. Mulching with black plastic was tested in one area with a homogenous stand of Spanish sunflower. The slopes of Los Olivos Meadow have good diversity and cover by desirable native species; however, much of the basin bottom is bare.

Laguna Altura North

Laguna Altura North is a 0.86 ac basin located north of the Laguna Altura housing development and south of I-405. This basin exhibits high percent cover and good diversity of native-plant components on both the slopes and the basin bottom.

Laguna Altura South

Laguna Altura South is a 0.75 ac basin located west of the Laguna Altura housing development and east of State Route 133 (SR-133). This basin exhibits high percent cover by native plant species on the slopes, but the basin bottom is relatively bare.

Cypress Meadow A

Cypress Meadow A is a 6.04 ac basin located next to several apartment complexes as well as Interstate 5 (I-5) and Jeffrey Road in central Irvine. This NTS basin has three inlet channels converging at one pond. Cypress Meadow A had low percent cover by invasive species from September through December 2019.

Cypress Meadow B

Cypress Meadow B is a 2.07 ac NTS basin located adjacent to multiple apartment complexes and north of I-5. It is also neighboring another NTS basin, Cypress Meadow C. This basin consists of two small ponds connected by a channel. While the slopes of this basin exhibit good cover by native plants, the basin bottoms are relatively bare.

Cypress Meadow C

Cypress Meadow C is a 2.63 ac basin located between Cypress Meadow B and Cypress Meadow D, adjacent to I-5. This basin consists of two small ponds connected by a long channel. The basin bottom of Cypress Meadow C has many bare areas.

Cypress Meadow D

Cypress Meadow D is a 3.18 ac basin located immediately adjacent to Cypress Meadow C and bordered to the east by Sand Canyon Avenue. This NTS basin typically does not receive enough flow for water to reach the outlet structure. The slopes of Cypress Meadow D exhibit good cover by native grass species.

Portola Springs Meadow

Portola Springs Meadow is a 0.89 ac NTS basin located north of Irvine Boulevard and east of SR-133. This basin consists of two inlets. Invasive cover is generally low in this basin, as native vegetation cover is high.

Eastwood Meadow

Eastwood Meadow is a 1.89 ac basin located north of Irvine Boulevard in north Irvine. This basin consists of two small ponds connected by one channel. The bottom of the basin is almost entirely dominated by slender aster (*Symphyotrichum subulatum*)—while native, it has outcompeted most other native plant species on the basin bottom.

Middle Eastfoot

Middle Eastfoot is a 3.17 ac NTS basin located west of Woody Knoll and east of SR-261. This basin consists of a long channel with a small pond at the center. Mulching with black plastic was tested at this basin for a stand of Spanish sunflower. Much of the basin bottom is bare or dominated by nonnative plant species.

Eastfoot Retarding Basin

Eastfoot Retarding Basin is a 9.97 ac flood retention basin located east of Leafy Pass in north Irvine. This basin consists of a series of ponds and is managed in the same manner as Trabuco and Marshburn, detailed above. In the fall, this basin was drained to facilitate removal of bulrush (*Schoenoplectus* spp.) to improve water quality treatment functions.

Upper Eastfoot

Upper Eastfoot is a 1.35 ac basin located east of SR-261 and south of English Saddle in north Irvine. This basin consists of one large pond—water often does not flow into the outlet. This basin exhibits high percent cover by Spanish sunflower.

Hidden Canyon

Hidden Canyon is a 3.31 ac NTS basin located adjacent to the Hidden Canyon residential development and south of Lake Forest Drive. It consists of two inlets flowing into one pond. This

basin exhibits high percent cover by nonnative species on both the basin bottom and the south-facing slopes.

Ridge Valley A

Ridge Valley A is a 6.44 ac basin located east of SR-133. It consists of two inlets flowing into one pond. Most of the basin bottom is dominated by slender aster, which has outcompeted most other plant species on the basin bottom.

Ridge Valley B

Ridge Valley B is a 1.65 ac basin located east of SR-133 and adjacent to Ridge Valley A. It consists of a channel that flows into Ridge Valley A. The slopes of Ridge Valley B exhibit relatively good cover by native-plant components.

Ridge Valley C

Ridge Valley C is a 4.68 ac NTS basin located east of SR-133 and adjacent to Ridge Valley B. It consists of one long channel with a pond in the center. While the slopes of the basin exhibit good cover by native plants, the bottom of the basin has relatively more invasive species.

Floral View

Floral View is a 2.98 ac basin located east of SR-133 and west of Floral View. It consists of one channel leading to a circular pond. This basin exhibits good cover by native-plant species on both the slopes and basin bottom.

Parasol Park

Parasol Park, is a 2.69 ac NTS basin located east of SR-133 and north of Great Park Boulevard. It consists of two inlet channels that converge at the NTS basin's outlet structure. While the upland slopes of Parasol Park exhibit good diversity and cover by native-plant components, the basin bottom suffers from infestations by sow-thistles (*Sonchus* spp.).

Twisted Oak

Twisted Oak, is a 0.33 ac NTS basin located northeast of Northwood High School. It consists of one circular pond. This basin exhibits very high percent cover by nonnatives, particularly English plantain (*Plantago lanceolata*). The basin is nearly devoid of native vegetation.

Iluna Springs

Iluna Springs is a 2.68 ac basin located in the Altair Community development north of Irvine Boulevard in the northeastern corner of Irvine. This basin consists of two inlet channels. Iluna Springs exhibits relatively low cover by nonnative species, as the basin is dominated by beardless wild-rye (*Elymus triticoides*) and marsh fleabane (*Pluchea odorata*).

Aquila Springs

Aquila Springs is a 1.17 ac basin located in the Altair Community development east of Irvine Boulevard, consisting of one channel. This basin exhibits good diversity by native vegetation on slopes; however, portions of the basin bottom are bare or dominated by invasive plants.

Sports Park

Sports Park is a 1.95 ac NTS basin located adjacent to the Orange County Great Park north of Marine Way. It consists of a channel with a small central pond. While the slopes of the basin exhibit high diversity and cover by desirable native plants, the basin bottom has relatively more invasive species.

Summary of IPM Usages

As IPM activities commenced in September 2019 and treatment of invasive plants focused on testing nonchemical removal methods for infestations, very small quantities of chemical pesticides were applied throughout these first 4 months. Table B provides a comparison of pesticide usage before and after implementation of the IPM Plan. The San Joaquin Marsh and NTS basins, managed by the NTS department, total 409.52 ac. Other IRWD facilities, which include Rattlesnake Reservoir, San Joaquin Reservoir, Sand Canyon Reservoir, Syphon Reservoir, and 147 other sites, are managed by the Fleet/Facilities Manager and total 279.99 ac.

Table B: Pesticide Usage Comparison

	2018		Jan–Jun 2019		Sep–Dec 2019	
	San Joaquin Marsh/NTS Basins	Other IRWD Facilities	San Joaquin Marsh/NTS Basins	Other IRWD Facilities	San Joaquin Marsh/NTS Basins	Other IRWD Facilities
Glyphosate (gal)	78.34	84.00	60.53	N/A	0.05	0.72
Organic Pesticides (gal)	–	–	–	N/A	1.20	–
Total	**162.34**		**60.53**		**1.97**	

gal = gallon(s)
IRWD = Irvine Ranch Water District
N/A = Not available
NTS = Natural Treatment System

A summary of organic pesticides and prioritized chemical pesticides used in IRWD facilities is provided below. See Appendix C for pesticide application field-monitoring forms documenting the date of application and type and amount of pesticide used. Corresponding figures depicting the locations of pesticide application are also included in Appendix C.

San Joaquin Reservoir

Approximately 0.72 gal of Roundup Pro Max (active ingredient: glyphosate) was mixed with water to create 8 gal of 9 percent solution. The 8 gal of diluted solution was applied selectively using a backpack sprayer with a narrow-cone applicator nozzle to reduce drift on the downstream dam face of San Joaquin Reservoir between August 27, 2019, and December 31, 2019, to remove coyote brush (*Baccharis pilularis*), wild rye (*Elymus* sp.), and laurel sumac (*Malosma laurina*) across 0.25 ac.

San Joaquin Marsh

Roundup Custom Aquatic Herbicide (active ingredient: glyphosate) was spot-sprayed using a backpack sprayer to remove edible fig and giant reed in San Joaquin Marsh. Six ounces of Roundup mixed with 1 gal of water were applied to remove these two invasive species on November 14, 2019.

Natural Treatment Systems

Organic pesticides were utilized in one NTS basin, Lower Eastfoot, on December 12, 2019. Several organic chemical pesticides were used on test plots in Lower Eastfoot during the grow–kill cycle for noxious weeds, such as red brome (*Bromus madritensis* ssp. *rubens*), redstem filaree (*Erodium cicutarium*), and common burclover (*Medicago polymorpha*), on the basin's upland slopes. The following concentrations of organic pesticides were applied using a backpack sprayer: 64 ounces (oz) of Avenger (active ingredient: d-limonene) mixed with 2 gal of water, 10 oz of Fiesta (active ingredient: iron HEDTA) mixed with 2 gal of water, 41 oz of Finalsan (active ingredient: ammoniated soap of fatty acids) mixed with 2 gal of water, and 39 oz of Mirimichi Green (active ingredient: ammonium nonanoate) mixed with 2 gal of water.

Following application of the above organic pesticides, staff noted that there were no visible results of phytotoxicity and that the results were poor, with no control or dieback.

DISCUSSION AND RECOMMENDATIONS

IPM activities over the first 4 months of implementation focused on attempting nonchemical removal methods for invasive species. There was very little chemical pesticide usage throughout IRWD's facilities and NTS basins, as LSA personnel spent the first few months observing the success of utilizing nonchemical treatment methods. Chemical-pesticide usage may increase in the following years as staff observe and identify infestations that are not reduced through nonchemical methods. Nevertheless, chemical-pesticide usage has been greatly reduced from years prior to IPM implementation.

Following the first 4 months of IPM implementation, several recommendations are suggested to streamline IPM implementation activities:

- Currently available organic pesticides are not a cost-effective option for treating invasive-plant infestations within NTS basins; therefore, they should not be listed as a preferred method in the IPM Plan. The cost of organic pesticides is higher than that of glyphosate: higher per application and more applications per year, resulting in higher labor expenses (Smith-Fiola and Gill 2017; Barker and Prostak 2008). Organic pesticides are less effective than conventional pesticides at controlling weed growth (Ferguson 2004; Snell 2016). Because organic pesticides are best suited for newly emerged weeds and treat mainly above-ground biomass, many of the invasive species identified in the NTS Basins would not be successfully killed. Due to the necessity of repeated applications of organic pesticides that require physical contact with all portions of the plant, there may be higher environmental impacts on nontarget invertebrates, soil, and water quality. Many organic pesticides are exempt from United States Environmental Protection Agency (EPA) pesticide registration; as a result, there are little ecotoxicity or worker exposure data available

(Smith-Fiola and Gill 2017). Since the NTS basins support aquatic habitat and are utilized by wildlife, spot-spraying small amounts of prioritized chemical pesticides rather than repeated, concentrated applications of organic pesticides is recommended should mechanical removal methods fail.

- Flaming should not be considered as a treatment method for invasive-plant infestations within NTS basins in future years. It is ineffective for many of the perennial plant species that occur within IRWD's facilities. Flaming in Southern California also poses dangers associated with wildfires. As many of the NTS basins are located adjacent to sensitive areas, flaming is not recommended.

- The field-monitoring forms should be amended to better quantify the amounts of organic and chemical pesticides used. The current form does not include fields to record concentrations and amounts of organic pesticides. LSA also recommends updating the fields for chemical pesticides to incorporate an estimate of the amount of chemical pesticide used, rather than the application rate for the total area. Chemical pesticides are usually spot-sprayed on individual plants rather than broadcasted, so quantifying by total area applied is not practical.

IPM Plan implementation processes are expected to improve in efficiency and effectiveness in the following years.

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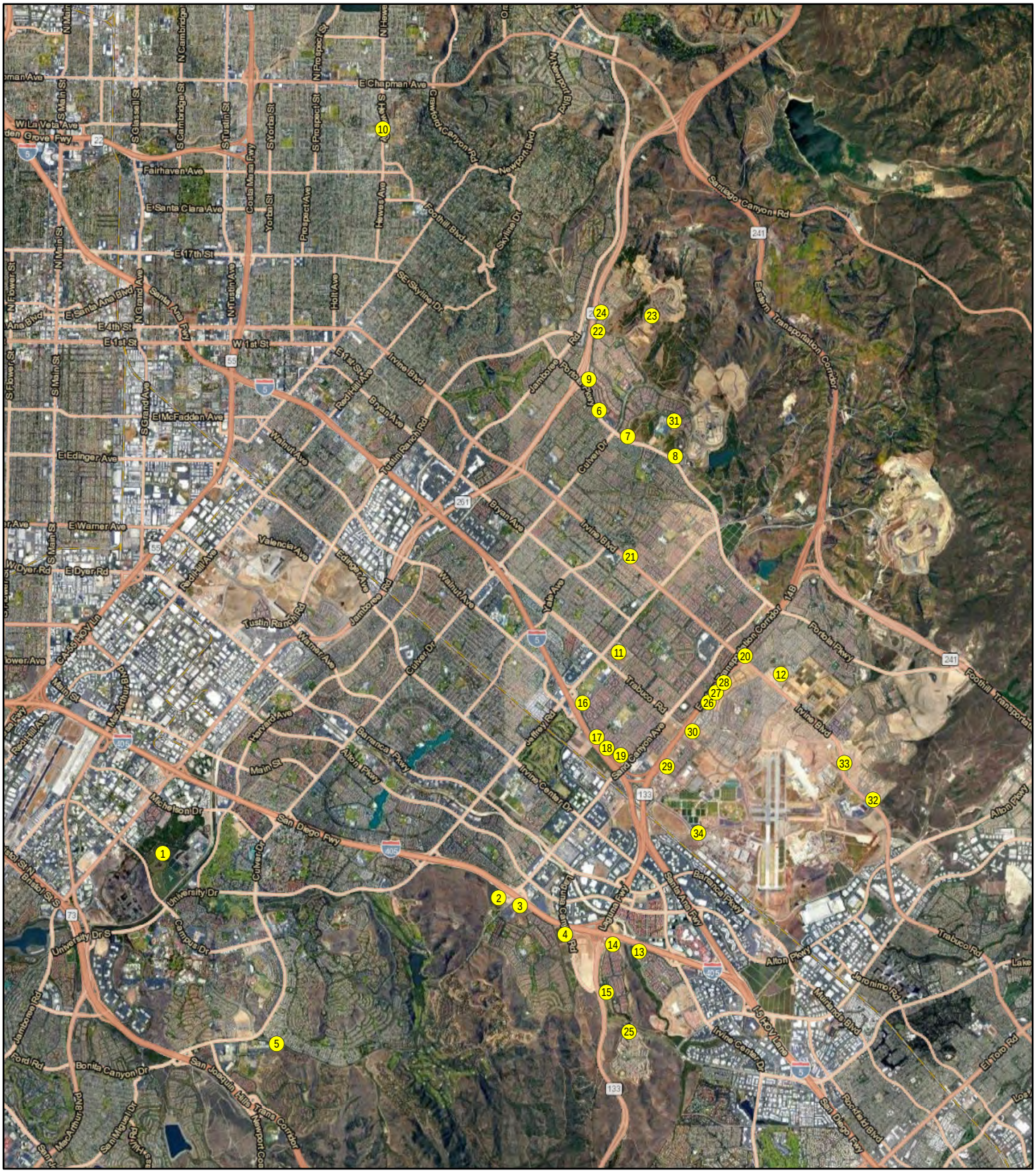
APPENDIX A

FIGURES 1 THROUGH 4



LSA

LEGEND

Site Location

FIGURE 1

N

0 0.75 1.5

MILES

IRWD NTS Maintenance Sites

Project Site Overview

SOURCE: Google Maps (2019); IRWD (7/2019)

I:\IRW1901\GIS\MXD\2019 Annual Report\ProjectSiteOverview.mxd (3/6/2020)

LSA

LEGEND

San Joaquin Marsh

- Zone 1
- Zone 2
- Zone 3
- Zone 4

N

0 375 750

FEET

FIGURE 2

IRWD NTS Maintenance Sites

San Joaquin Marsh Zones 1 - 4

SOURCE: Google Maps (2019); IRWD (9/2019)

I:\IRW1901\GIS\MXD\2019 Annual Report\SanJoaquinMarshSites.mxd (2/24/2020)

View of Quail Springs, looking north.

View of Los Olivos looking north. Much of the basin bottom is overtaken by invasive species.

View of Trabuco, looking south. Spanish false fleabane is prevalent throughout the site.

View of Parasol Park looking east. The slopes exhibit good native diversity and cover, however sow-thistles are prevalent throughout the basin bottom.

View of Twisted Oak, looking north. This site lacks native vegetation.

View of Eastfoot Retarding Basin, looking west. IPM activities occur primarily around the edges of the ponds and channels – the rest of the basin is mowed yearly.

View of Eastwood Meadow, looking west.

View of Orchard Meadow, looking east. Restoration was recently conducted on the slopes of this site.

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 150 300

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

San Joaquin Marsh (Zones 1)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 120 240

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

San Joaquin Marsh (Zones 2)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 150 300

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

San Joaquin Marsh (Zones 3)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 150 300

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

San Joaquin Marsh (Zones 4)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 50 100

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Quail Springs

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 37.5 75

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Quail Meadow

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

I:\IRW1901\GIS\Analysis\Analysis_Sept-Dec2019_20200224\Spaghetti_and_Meatballs.mxd (3/6/2020)

IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Old Laguna

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

N

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Turtle Ridge

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Forge Meadow

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Port Culver

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

I:\IRW1901\GIS\Analysis\Analysis_Sept-Dec2019_20200224\Spaghetti_and_Meatballs.mxd (3/6/2020)

IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Orchard Meadow

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Lower Eastfoot

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

I:\IRW1901\GIS\Analysis\Analysis_Sept-Dec2019_20200224\Spaghetti_and_Meatballs.mxd (3/6/2020)

IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

El Modena

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 100 200

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Trabuco

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

N

0 75 150

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Marshburn

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Los Olivos Meadow

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

N

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Laguna Altura North

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

N

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Laguna Altura South

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 37.5 75

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Cypress Meadow A

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Cypress Meadow B

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Cypress Meadow C

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Cypress Meadow D

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Portola Springs Meadow

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Eastwood Meadow

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Middle Eastfoot

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 50 100

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Eastfoot Retarding Basin

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Upper Eastfoot

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Hidden Canyon

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 50 100

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Ridge Valley A

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Ridge Valley B

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 37.5 75

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Ridge Valley C

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Floral View

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Trabuco East (Parasol Park)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

N

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Orchard Hills Meadow (Twisted Oak)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

District 7 Basin (Iluna Springs)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

N

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

I:\IRW1901\GIS\Analysis\Analysis_Sept-Dec2019_20200224\Spaghetti_and_Meatballs.mxd (3/6/2020)

IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

District 7 Basin 2 (Aquila Springs)

LSA

LEGEND

Site Boundary

Overlap of Weed Areas

- 6 - Overlapped by 6 different polygons
- 5
- 4
- 3
- 2
- 1 - No overlapping polygons

N

0 30 60

FEET

SOURCE: Google Maps (2019); IRWD (9/2019); LSA (9/2019 to 12/2019)

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IRWD NTS Maintenance Sites

4-month Review - September, 2019 to December, 2019

Bee Canyon/Sports Park

APPENDIX B

CHEMICAL-PESTICIDE MEMORANDUMS

CARLSBAD
FRESNO
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

MEMORANDUM

DATE: February 7, 2020

TO: Ian Swift, Natural Resources Manager, Irvine Ranch Water District

FROM: Jessica Lieuw, Assistant Biologist, LSA

SUBJECT: Chemical Pesticide Treatment Justification for Giant Reed

This memorandum documents the results of treatment methods for giant reed (*Arundo donax*) within the Irvine Ranch Water District (IRWD) natural treatment system (NTS) sites. Giant reed is a species of perennial grass in the Poaceae family that has been introduced in California. This species often invades wetlands, riparian habitats, and disturbed areas. Giant reed can reach thirty feet tall, and grows in many-stemmed, cane-like clumps. Giant reed mostly reproduces through a rhizomatous root system or from plant fragments that become rooted. Populations easily spread along waterways, and once established, this plant is persistent and difficult to control. Giant reed displaces native plants due to the massive stands that it forms. It can also alter hydrological regimes and reduce groundwater availability. Moving forward, LSA recommends the use of prioritized chemical pesticides to facilitate removal of giant reed in order to maintain native riparian habitat within the NTS sites and prevent accumulation of the seed bank.

RECOMMENDATIONS

In November 2019, LSA biologists identified a large stand of giant reed growing in the San Joaquin Marsh, which is surveyed as part of the IRWD Integrative Pest Management Plan Implementation Project (project). As the stand was over fifteen-feet high and the species is known to be extremely invasive, LSA biologists prescribed chemical pesticides as a treatment method for the species. Manual removal and other mechanical removal methods were determined to be ineffective in treating the stand of giant reed due to the size of the plants, location of the infestation, and the rhizomatous root system.

Giant reed is listed by the California Invasive Plant Council as an invasive species, with a High rating. LSA recommends spot treatment with prioritized chemical pesticides as a management strategy for giant reed. Literature reviews indicate that it is difficult to control large infestations of giant reed by cutting or pulling individual plants due to the root system. Mowing, mulching, soil solarization, and flaming are not effective treatment strategies due to the species' root system and presence of neighboring native species. LSA has also determined that organic chemical control methods would not be effective for common fig, as this has an extensive root system. Organic control methods are best suited for newly emerged weeds and treat mainly above-ground biomass, which would not affect roots of this species, thus allowing the plant to regenerate. Moreover, recent studies have revealed that organic pesticides can have a higher environmental impact than conventional pesticides, especially on invertebrates. Due to the invasive nature of giant reed, it is imperative to

manage invasions before they overtake native riparian habitat. Applying chemical pesticides to the stump is the most effective method to control infestations. Application of prioritized chemical pesticides should be conducted in a manner that avoids disturbance to installed and recruited native species to the fullest extent practicable.

Please contact Eric Krieg or Jessica Lieuw at (949) 553-0666 if you have any questions regarding these recommendations.

CARLSBAD
FRESNO
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

MEMORANDUM

DATE: February 7, 2020

TO: Ian Swift, Natural Resources Manager, Irvine Ranch Water District

FROM: Jessica Lieuw, Assistant Biologist, LSA

SUBJECT: Chemical Pesticide Treatment Justification for Edible Fig

This memorandum documents the results of treatment methods for edible fig (*Ficus carica*) within the Irvine Ranch Water District (IRWD) natural treatment system (NTS) sites. Edible fig is a species of flowering plant in the Moraceae family that is native to the Middle East and western Asia and has been introduced in California, where it is an escaped cultivar. This species is a tree that often invades and dominates riparian forests, streamside habitats, levees, and canal banks. Edible fig trees produce fruits that are eaten by birds and mammals, thus spreading seeds. These trees grow quickly and can spread through root sprouts. Limbs that are cut or broken and fall to the ground can take root. Populations easily spread along waterways, and once established, this plant is persistent and difficult to control. Moving forward, LSA recommends the use of prioritized chemical pesticides to facilitate removal of edible fig in order to maintain native riparian habitat within the NTS sites and prevent accumulation of the seed bank.

NONCHEMICAL REMOVAL

Beginning in September 2019, LSA biologists identified edible fig trees growing in the San Joaquin Marsh, which is surveyed as part of the IRWD Integrative Pest Management Plan Implementation Project (project). LSA biologists initially prescribed manual removal for the species. Manual removal of edible fig involved cutting or pulling individual plants with the help of a weed wrench. Other mechanical removal methods, such as tillage or mowing, were not prescribed because the habitats were not amenable to these methods. Edible fig trees were observed regenerating from stumps or portions of the root left in the soil.

RECOMMENDATIONS

Edible fig is listed by the California Invasive Plant Council as an invasive species, with a Moderate rating. As the infestations are not responding to mechanical removal methods, LSA recommends spot treatment with prioritized chemical pesticides as a management strategy for edible fig. Literature reviews indicate that it is difficult to control edible fig by cutting or pulling individual plants, as they often root-sprout. What looks like one small sapling may be one of many sprouts from a large network of roots. Mowing, mulching, and soil solarization are not effective treatment strategies due to the species' root system and presence of neighboring native species. Flaming is also ineffective due to the root system. LSA has also determined that organic chemical control methods would not be effective for edible fig, as this species is a tree and has an extensive root

system. Organic control methods are best suited for newly emerged weeds and treat mainly above-ground biomass, which would not affect roots of this species, thus allowing the plant to regenerate. Moreover, recent studies have revealed that organic pesticides can have a higher environmental impact than conventional pesticides, especially on invertebrates. Due to the invasive nature of edible fig, it is imperative to manage small invasions before they become established. Cutting individual trees and applying chemical pesticides to the stump is the most effective method to control infestations. Application of prioritized chemical pesticides should be conducted in a manner that avoids disturbance to installed and recruited native species to the fullest extent practicable. Maintenance before individual plants fruit will be the most effective way to reduce cover and prevent accumulation of the seed bank.

Please contact Eric Krieg or Jessica Lieuw at (949) 553-0666 if you have any questions regarding these recommendations.

APPENDIX C

PESTICIDE APPLICATION FORMS AND APPLICATION LOCATIONS

IRWD – Integrated Pest Management Field Monitoring Form

Date: 8/27/2019 – 12/31/2019

Time: Various

Personnel: Contracted Landscape Staff

Application Equipment Used: Backpack Sprayer

Location of Pesticide Application:

San Joaquin Marsh	Rattlesnake Reservoir	San Joaquin Reservoir	Sand Canyon Reservoir	Syphon Reservoir	Natural Treatment Systems
		X			
Other:					

Target Pests:

Noxious Weed	Aquatic Plants	Algae	Invertebrates	Rodent	Fungi	Other
Coyote Bush						
Wild Rye						
Malosma Laurina						

Non-Chemical Control Methods:

Manual Removal *(e.g., hand pulling, shovel, hoe)*	Mechanical Removal *(e.g., mowing, string trimmer)*	Mulch	Beneficial Insects	Trapping	Other

Organic Chemical Control Methods:

Natural Acid Herbicides *(e.g., acetic acid, d-limonene)*	Iron-based Herbicides	Phytotoxic Oils	Other

Non-Organic Chemical Control Methods:

Type *(e.g., herbicide, fungicide, pesticide)*	Trade Name *(e.g., Roundup, Garlon 4, Diuron 4L)*	Active Ingredient *(e.g., Glyphosate, Triclopyr, Dichlorophenyl)*	Application Rate *(e.g., 6 oz/300 sq.ft.)*	Total Area Applied
Herbicide	Roundup Pro Max	Glyphosate	See Below	.25 Acre

Summary of Results:

The product is used to control the weeds listed above on the downstream face of the dam forming the San Joaquin Reservoir in Newport Coast. The dam face is rock and not safe to traverse by foot. The dam face is crossed by roads at four different elevations. The applications are made using a backpack sprayer from the roads.

The product is diluted with water to a 9% solution and applied selectively using a backpack sprayer using a very narrow cone applicator nozzle to reduce/eliminate drift. Eight gallons of the diluted solution was used at this location.

Complete control of the target weeds was achieved.

LSA

LEGEND

[Chemical Pesticides] Coyote brush, wild rye, laurel sumac

FIGURE 5

N

0 125 250

FEET

IRWD Facilities Maintenance Sites

San Joaquin Reservoir Pesticide Application Location

SOURCE: Google Maps (2019); IRWD (9/2019)

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11-14

IRWD – Integrated Pest Management Field Monitoring Form

Date: 11-14-19

Time: 10:30 AM

Personnel: Javier

Application Equipment Used:
Spot spray | Back spray

Location of Pesticide Application:

San Joaquin Marsh	Rattlesnake Reservoir	San Joaquin Reservoir	Sand Canyon Reservoir	Syphon Reservoir	Natural Treatment Systems
X					
Other:					

Target Pests:

Noxious Weed	Aquatic Plants	Algae	Invertebrates	Rodent	Fungi	Other
						Common Fig
						Giant Reed

Non-Chemical Control Methods:

Manual Removal *(e.g., hand pulling, shovel, hoe)*	Mechanical Removal *(e.g., mowing, string trimmer)*	Mulch	Beneficial Insects	Trapping	Other

Organic Chemical Control Methods:

Natural Acid Herbicides *(e.g., acetic acid, d-limonene)*	Iron-based Herbicides	Phytotoxic Oils	Other

Non-Organic Chemical Control Methods:

Type *(e.g., herbicide, fungicide, pesticide)*	Trade Name *(e.g., Roundup, Garlon 4, Diuron 4L)*	Active Ingredient *(e.g., Glyphosate, Triclopyr, Dichlorophenyl)*	Application Rate *(e.g., 6 oz/300 sq.ft.)*	Total Area Applied
herbicide	Round-Up	Glyphosate	6oz. per 1 gal.	Spot spray
	Custom aquatic			

Summary of Results:

LSA IPM polygon 412 suggest Chemical Pesticides
" " " 601 " " "

LSA

LEGEND

San Joaquin Marsh
Zone 1
Zone 2
Zone 3
Zone 4

[Chemical Pesticides] Common fig
[Chemical Pesticides] Giant reed

N

0 200 400
FEET

FIGURE 6

IRWD NTS Maintenance Sites

San Joaquin Marsh Pesticide Application Locations

SOURCE: Google Maps (2019); IRWD (9/2019)

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IRWD – Integrated Pest Management Field Monitoring Form

Date: 12-12-2019

Time: 9:00 AM

Personnel: ZACARIAS

Application Equipment Used: BACK PACK SPRAYER

Location of Pesticide Application:

San Joaquin Marsh	Rattlesnake Reservoir	San Joaquin Reservoir	Sand Canyon Reservoir	Syphon Reservoir	Natural Treatment Systems
					X
Other: LOWER EASTFOOT					

Target Pests:

Noxious Weed	Aquatic Plants	Algae	Invertebrates	Rodent	Fungi	Other
X						

Non-Chemical Control Methods:

Manual Removal *(e.g., hand pulling, shovel, hoe)*	Mechanical Removal *(e.g., mowing, string trimmer)*	Mulch	Beneficial Insects	Trapping	Other

Organic Chemical Control Methods: TEST PLOTS

Natural Acid Herbicides *(e.g., acetic acid, d-limonene)*	Iron-based Herbicides	Phytotoxic Oils	Other
AVENGER 64 02./ 2 GAL	FIESTA 10 02 / 2 GAL (IRON HEDTA)		FINALSAN 41 02/2 GAL (~~AMMONIATED SOAP OF~~ FATTY ACIDS)
			MIRIMICHI GREEN. 39 02/2 GAL AMMONIUM NONANOATE

IRWD – Integrated Pest Management Field Monitoring Form

Non-Organic Chemical Control Methods:

Type *(e.g., herbicide, fungicide, pesticide)*	Trade Name *(e.g., Roundup, Garlon 4, Diuron 4L)*	Active Ingredient *(e.g., Glyphosate, Triclopyr, Dichlorophenyl)*	Application Rate *(e.g., 6 oz/300 sq.ft.)*	Total Area Applied

Summary of Results:

NO VISIBLE RESULTS OF PHYTO TOXICITY
RESULTS WERE ~~VERY~~ POOR WITH NO CONTROL
OR DIE BACK

LSA

LEGEND

Lower Eastfoot

[Organic Chemical Control] Red brome, redstem filaree, common burclover

FIGURE 7

N

0 62.5 125

FEET

IRWD NTS Maintenance Sites

Lower Eastfoot Pesticide Application Location

SOURCE: Google Maps (2019); IRWD (9/2019)

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