



Suisun Resource Conservation District

2019 Annual Report

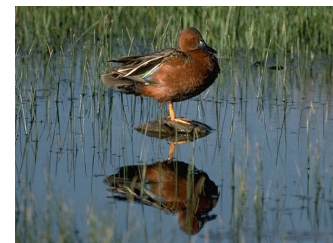


Introduction

As a result of the collapse of agriculture and the Great Dust Bowl in 1938, the California Legislature passed laws authorizing the creation of California's soil conservation districts. In 1971, all of California's 113 soil conservation districts that help manage and protect public land became Resource Conservation Districts. California's Resource Conservation Districts are governed under Division 9 of the Public Resource Code and are empowered to coordinate resource management efforts for purposes of watershed restoration and enhancement, runoff control, soil erosion prevention, water quality protection, distribution of water, improve land capabilities, and the facilitation of resource management efforts for watershed restoration and enhancement.

The Suisun Soil Conservation District was created in 1963 which later became the Suisun Resource Conservation District (SRCD). In 1974, the Nejedly-Bagley-Z'berg Suisun Marsh Preservation Act was passed defining SRCD boundaries and requiring the formal establishment of policies, regulations, and local protection programs for the Suisun Marsh.

The California Legislature enacted the Suisun Marsh Preservation Act in 1977 which established new land use protections under the 1976 Suisun Marsh Protection Plan and empowered SRCD with the "...primary local responsibility for regulating and improving water management practices on privately owned lands within the primary management area of the Suisun Marsh". Additionally, SRCD was given the authority to issue regulations requiring compliance with any water management plan or program for privately owned lands within the primary management area of the marsh.



Vision and Mission

Our Vision

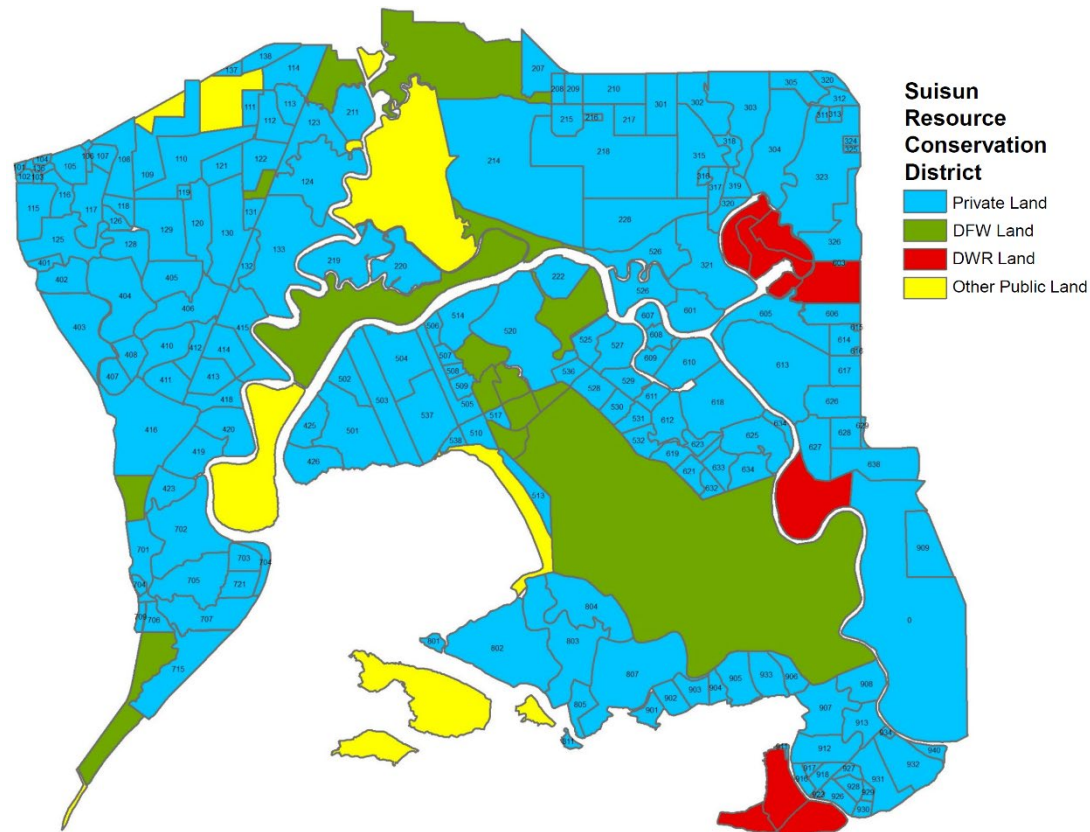
Improve programs and services to provide the Suisun Marsh landowners technical assistance in environmental permitting, habitat management, water control, and funding to ensure the wetland and wildlife values of the Suisun Marsh are sustained and enhanced.

Our Mission

The Suisun Resource Conservation District works collaboratively with private landowners, local, State, and Federal agencies and conservation organizations to meet the environmental and conservation needs of the Suisun Marsh, Solano County, and the San Francisco Bay-Delta of California for future generations. SRCD's historic goal has been to achieve a water supply of sufficient quality so that preferred wetland habitat conditions and wildlife values can be retained through appropriate management practices. SRCD seeks to implement existing programs and develop new efforts aimed at protecting and enhancing the Suisun Marsh wetland and wildlife resources, and support waterfowl hunting heritage.

Scope and Responsibilities

Today, SRCD provides the landowners with technical assistance in environmental permitting, water control, habitat management, invasive species control, competitive grants, and cost share grant programs to ensure the wetland and wildlife values of the Suisun Marsh are sustained and enhanced. SRCD also coordinates with numerous government agencies and conservation partners to represent landowner interests and concerns in the preservation of the Suisun Marsh wetland and wildlife resources.



SRCD Contact information:

Suisun Resource Conservation District
2544 Grizzly Island Road
Suisun City, CA, 94585-9539
Tel: (707) 425-9302; Email: srcd@suisunrcd.org
Website: www.suisunrcd.org

Staff Contacts and Organization Chart

SRCD Main Office:

Steven Chappell	Executive Director	Ext. 4	(707) 425-9302 (707) 631-8634 - cell
John Takekawa	Operations Manager	Ext. 2	(707) 631-1402 - cell
Kelli Perez	Office Supervisor	Ext. 6	N/A
Jesirae Collins	Biologist		(707) 631-4078 - cell
Mark Mouton	Caretaker, Lower Joice Island		(707) 631-1857 - cell

Water Manager's Office:

Phelan McKinney	Biologist/Water Manager	Ext. 300	(707) 426-2431 (707) 631-0819 - cell
Jeff Taylor	Biologist/Water Manager	Ext. 301	(707) 639-6690 - cell
Tim Edmunds	Biologist/Water Manager	Ext. 302	(707) 639-6689 - cell

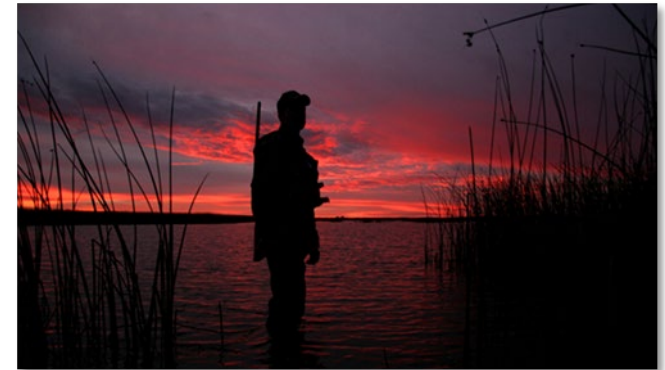


Board of Directors and Associate Directors

The Board of Directors is the governing body of SRCD and is comprised of five unpaid members appointed to 4-year terms. SRCD's Board of Directors meetings are open to the public. They are held at 2 PM on the second Wednesday of each month at the Solano County Supervisors Chambers - 675 Texas Street Fairfield, CA 94533.

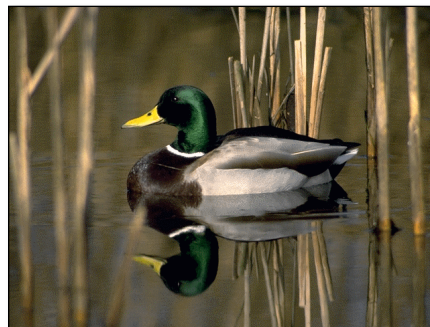
SRCD Board of Directors

Tony Vaccarella	President	(650) 365-1642
Terry Connolly	Finance Committee	(707) 864-1105
Arnold Lenk	Agency Relations Committee	(925) 284-3100
Jim Waters	Legal Committee	(510) 409-3864
Mike Lewis	Personnel Committee	(707) 224-3824



SRCD Associate Directors

Dennis Becker
Kurt Black
H. Kent Hansen
J. Lalo Kwiat
Steve Roerden



SRCD Directors Emeritus (*deceased)

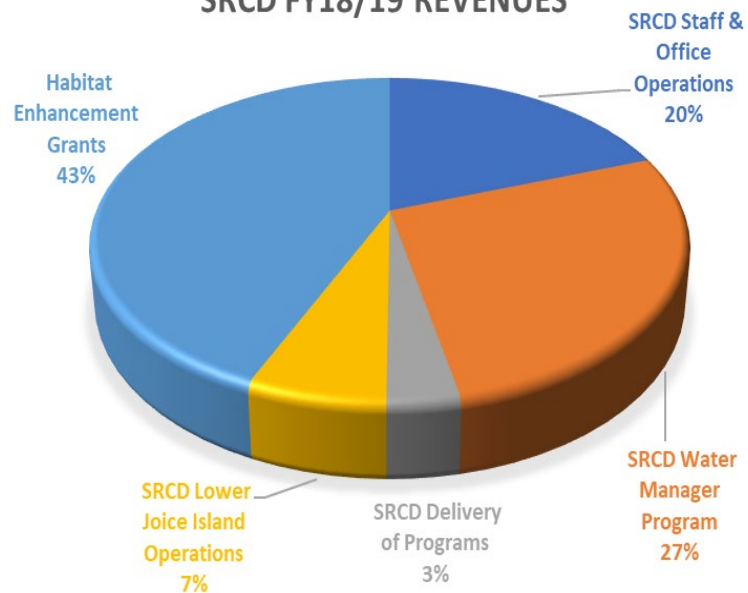
James Bancroft*
Paul Crapuchettes*
Ray Lewis*
Dr. William Coon*
Greg Palamountain*
Timothy Egan*
Leland Lehman*

Financial Summary

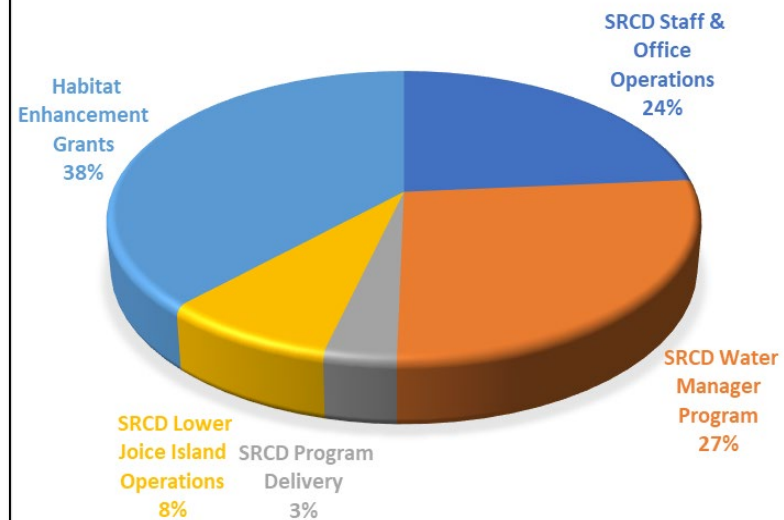
SRCD is supported by a diversity of funding sources that enables SRCD to fulfill our mission and provide services to the Suisun Marsh landowners. Each year, SRCD secures local, state, and federal funds through contracts, agreements, and grant awards to support the delivery of SRCD Programs to the landowners. SRCD's fiscal year is July 1st to June 30th.

Latest Audited SRCD Financials - Fiscal Year 2018/2019

SRCD FY18/19 REVENUES

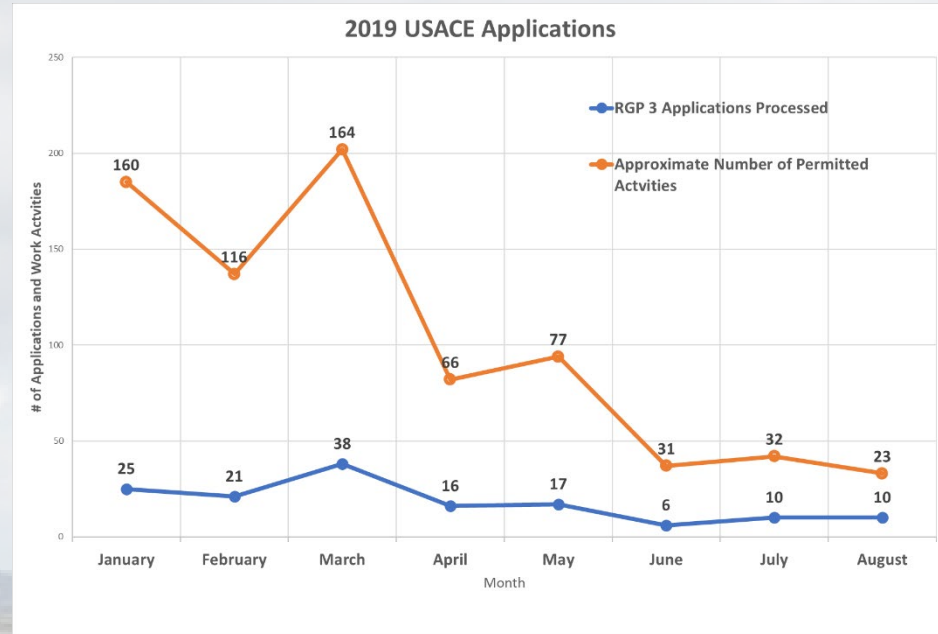


SRCD FY 18/19 EXPENSES



Environmental Permitting

The wetland and wildlife resources of the Suisun Marsh are protected and regulated by a myriad of local, state and federal laws, policies, and regulations. SRCD has held and administered the U. S. Army Corps of Engineer (USACE) Regional General Permit 3 (RGP 3) since 1977 to support the Suisun Marsh landowners' continued operations, maintenance, and enhancement of the managed wetlands. The RGP 3 provides a streamlined permitting procedure for Suisun Marsh landowners, allowing ongoing operations and maintenance of managed wetland infrastructure, water conveyance and control facilities, and levee systems. Under the RGP 3, SRCD is responsible for providing required reports to agencies and guidance to landowners. The landowners are responsible for ensuring all work that they (or their contractors undertake) is in accordance with the terms and conditions of the RGP 3 and companion environmental documents.



In 2014, SRCD obtained the USACE Letter of Permission (LOP) Dredging Permit for Suisun Marsh Exterior Levee Maintenance Activities. The LOP is a 10-year permit allowing $\leq 100,000$ cubic yards/year of dredging for Suisun Marsh exterior levee maintenance.

In 2014, the 30-year Suisun Marsh Habitat Management, Preservation, and Restoration Plan (SMP) and companion Environmental Impact Report/Environmental Impact Statement (EIR/EIS) was completed. SRCD was pivotal in the completion of this 13-year process generating a stable regulatory environment and permitting process for the next 30 years in the Suisun Marsh.

The SMP provides an environmental approval of ongoing managed wetland activities under the RGP 3, in addition to the following:

- Allows issuance of the LOP levee maintenance dredging permit
- Streamlines environmental permitting for managed wetland enhancement projects
- Supports SRCD's assistance and technical support for the management of water and wetlands
- Provides a programmatic review permitting process of future tidal wetland restoration projects

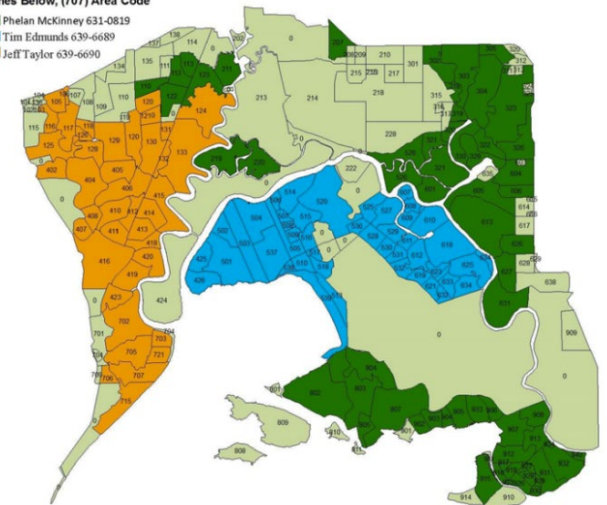
Habitat Management and Technical Assistance

A. Water Manager Program

The Water Manager Program provides full-time support for three SRCD biologists and half-time support for a supervisor to coordinate and improve water management practices on privately owned lands in the Suisun Marsh. This program is funded by a contractual agreement with the Department of Water Resources (DWR) and the U. S. Bureau of Reclamation (USBR) through the 2015 Suisun Marsh Preservation Agreement (SMPA) to improve wildlife habitats on Suisun Marsh managed wetland and also mitigate adverse effects on Suisun Marsh of the Central Valley Project (CVP), State Water Project (SWP), and a portion of other upstream diversions. It provides for the following activities:

- *Assist landowners in implementing and updating individual duck club management plans*
- *Promote and encourage wetland management activities to produce desired wildlife habitats*
- *Provide technical support and new scientific information to landowners on beneficial habitat management, water management, protection of sensitive species, and implementation of best management practices*
- *Supervise and coordinate the SRCD Portable Pump Program*
- *Assist landowners in planning yearly maintenance and enhancement projects*
- *Assist landowners in U. S. Army Corps Permit RGP 3 and LOP Applications*
- *Promote effective use of applied channel water to managed wetlands*
- *Monitor operation of fish screen facilities and assist in routine maintenance*
- *Assist landowners in avoiding mosquito production*
- *Assist landowners in annual Diversion Reporting Requirements*

Suisun Marsh Water Manager Zones
Office Phone: (707) 426-2431
Cell Phones Below, (707) Area Code
■ Phelan McKinney 631-0819
■ Tim Edmunds 639-6689
■ Jeff Taylor 639-6690



B. Portable Pump Program

SRCD has 8 high capacity portable diesel pumps available to Suisun Marsh landowners to perform spring leach cycles and aid in the effective management and enhancement of marsh habitats. The pumps are rented to Suisun Marsh landowners at a subsidized hourly rate. The SRCD Water Managers oversee the requested pump distribution, installation, operation, fueling, and maintenance of the requested pumps.



8" Trash Pump by Pioneer

2019 Rental Rate: \$3/hour plus fuel

Pumps ~2,500-3,000 gpm

10-15 acre-feet per 24 hrs

Consumes ~1.9 gal./hr. of fuel**

*(**Fuel consumption varies depending on site conditions and RPM rates)*



12" Tow pump by Pumpmaster

2019 Rental Rate: \$3/hour plus fuel

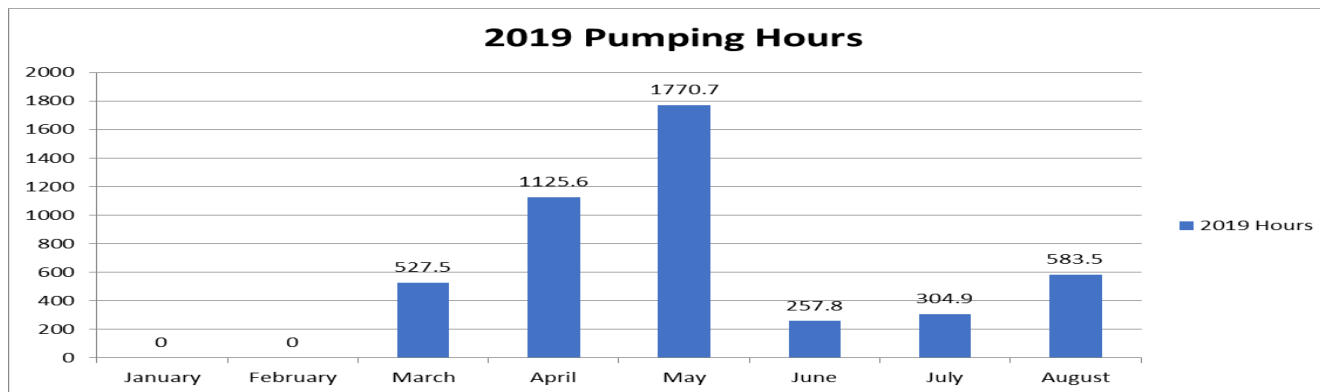
Pumps ~2,500-3,000 gpm

10-15 acre-feet per 24 hrs

Consumes ~1.2 gal./hr. of fuel**

2019 Monthly Pump Use (All Pumps)

Month	2019 Hours
January	0
February	0
March	527.5
April	1125.6
May	1770.7
June	257.8
July	304.9
August	583.5
September	9.2
Total:	4579.2



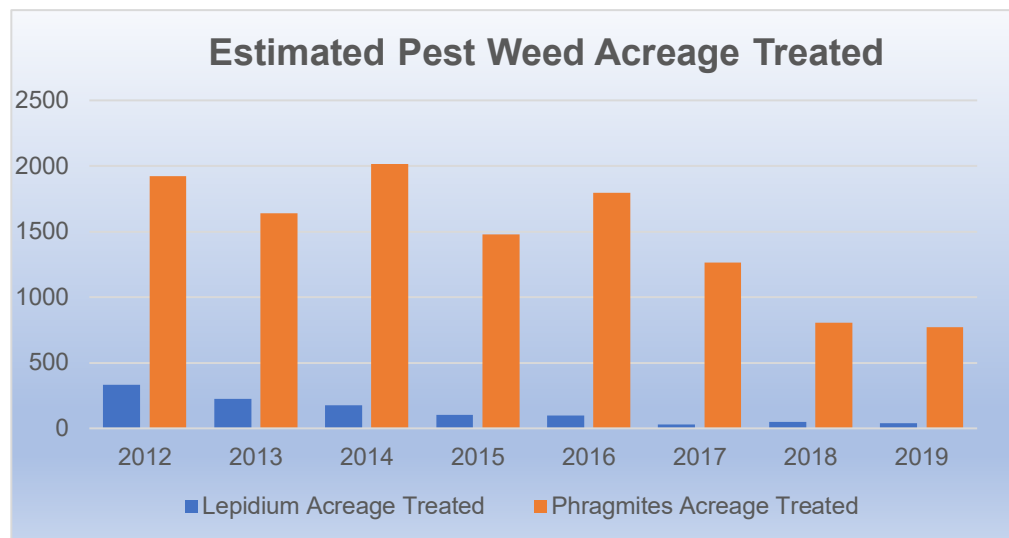
C. Invasive Weed Control Program

The Suisun Marsh wetlands and uplands have been altered by highly invasive non-native plants that threaten the diversity of natural plant communities in the Suisun Marsh. These non-native invasive plant species can form dense monospecific stands in a wide variety of wetland and upland habitats. Non-native plants eventually out-compete native vegetation causing degradation and modification of existing Suisun Marsh habitats. The main goal of SRCD Pest Weed Control Program is to assist landowners in the control and removal of invasive weeds in the Suisun Marsh. SRCD offers technical assistance and advice on control methods, best management practices options, and post treatment habitat restoration. Recent tests have included control application with a spray-drone.



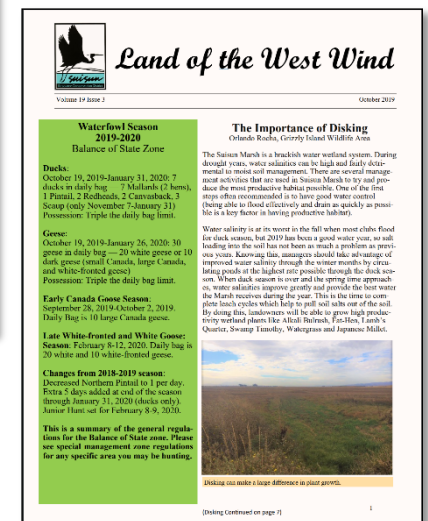
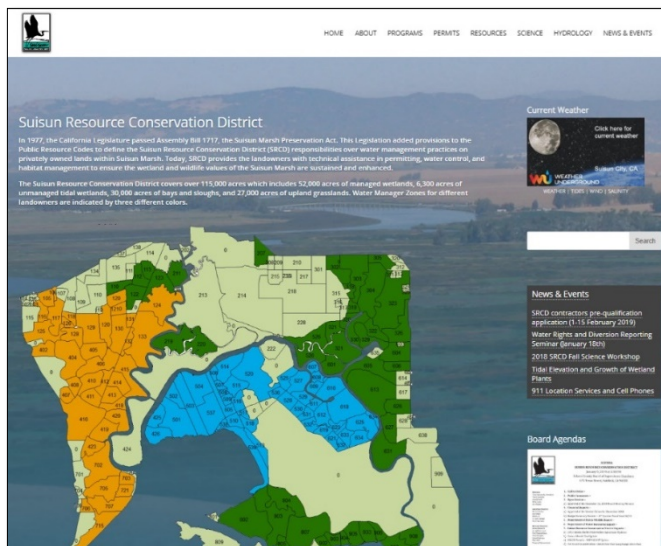
Two species of particular concern in the Suisun Marsh are listed below, although there are other plants of emerging concern:

- Perennial Pepperweed (*Lepidium latifolium*): grows in large concentrations along levee edges and areas within the Suisun Marsh that are not flooded year around. The plant changes the soil composition which can eliminate other plants from emerging once it has established. Best time to spray is before plant sets seed and while its flowering (mid-April to May).
- Common Reed or Phragmites (*Phragmites australis*): grows in dense tall patches in semi-flooded and flooded areas. If unmanaged, stands can fill entire ponds and eliminate native and beneficial plants. Best time to spray is before seed set (mid-June to July).
- Emerging concern: species to watch include as Russian thistle (*Salsola australis*), alligatorweed (*Alternanthera philoxeroides*), water hyacinth (*Eichhornia crassipes*), and water primrose (*Ludwigia hexapetala*).



D. Landowner Outreach and Education

In January 2018, SRCD updated its website (www.suisunrcd.org) including new information on resources, science, hydrology, and scientific news. We produced and shared our triennial newsletter – “Land of the West Wind”. We hosted our Annual Spring Landowner Workshop, special meetings, and a Fall Landowner Science Workshop. SRCD Staff and Water Managers conducted on-site meetings for habitat assessment and management advice. SRCD also performed routine mailing of permits, notifications, and programs to landowners in Suisun Marsh.



E. Dean Witter-Harvey Sorensen Marshlands Project at Lower Joice Island

On September 13th, 2000, SRCD became the owner of the historic 1,330-acre Lower Joice Island Hunting Club located between Suisun and Montezuma Sloughs on the southwest side of the Suisun Marsh. SRCD has continued the long history of waterfowl hunting heritage on this property; it has been managed continuously as a duck club since before 1906. SRCD designated the property as the Dean Witter-Harvey Sorensen Marshlands Project, as part of the generous donation of the island and the establishment of a dedicated endowment to fund management and operations of the island into the future. The endowment provides funding to SRCD for island operating expenses and as a result, SRCD does not incur any costs for island operations. Today, the Marshlands Project supports SRCD's Vision and Mission of protecting and enhancing the Suisun Marsh wetland and wildlife resources by providing 239 acres dedicated as a conservation area in the Suisun Marsh for ongoing permitting needs. Lower Joice Island also provides SRCD staff a location to obtain practicable experience in assessing alternative management strategies for wetland management, operations, maintenance, invasive species control and an area for SRCD to conduct innovative scientific research and monitoring.

Highlights:

- A marsh management burn was successfully completed in April 2019
- Use of a spray-drone was tested to surgically remove invasive plants
- U.S. Geological Survey conducted waterfowl banding studies



Managed Wetland Enhancement and Cost Share Support

SRCD worked with conservation partners including the Department of Water Resources (DWR), California Waterfowl Association (CWA), Ducks Unlimited (DU), Department of Fish and Wildlife (DFW), UC Davis (UCD), United States Geological Survey (USGS), and SF Bay Conservation and Development Commission (BCDC) to pursue grants to promote the protection and enhancement of Suisun Marsh managed wetland values and wildlife resources. Grant applications for enhancement of managed wetland habitats in 2019 included partnership proposals for the following projects:

A. Completed 31 infrastructure improvements under the 2019 Preservation Agreement Implementation Cost-share Program

SRCD implements the SMPA and the Preservation Agreement Implementation (PAI) Fund which provides support from DWR and USBR for managed wetland infrastructure improvements. The SMPA objective is to improve wildlife habitats on Suisun Marsh managed wetland and also mitigates adverse effects on Suisun Marsh of the Central Valley Project (CVP), State Water Project (SWP), and a portion of other upstream diversions. The PAI program provides 75:25 cost-share funding for drainage infrastructure improvements on individual parcels, 50:50 for interior structures and drainage, and 75:25 for joint use facilities benefiting two or more properties.

In 2019, the interagency PAI review committee led by SRCD completed formal assessments of 37 proposed projects from landowners including 8 projects carried over from 2018 and 29 new projects proposed in 2019. DWR and USBR funding support was provided for 13 PAI 75:25 cost-share projects, 7 PAI 50:50 projects, and 5 joint-use 75:25 projects for wetland enhancement. Six approved projects were not completed but will be carried over with the 2020 applications.



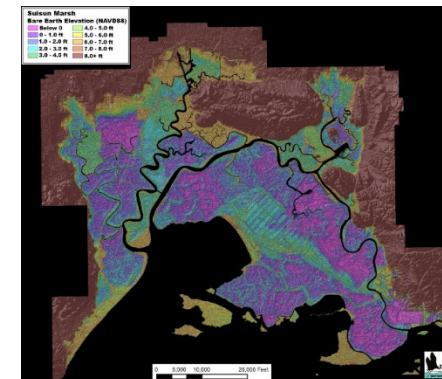
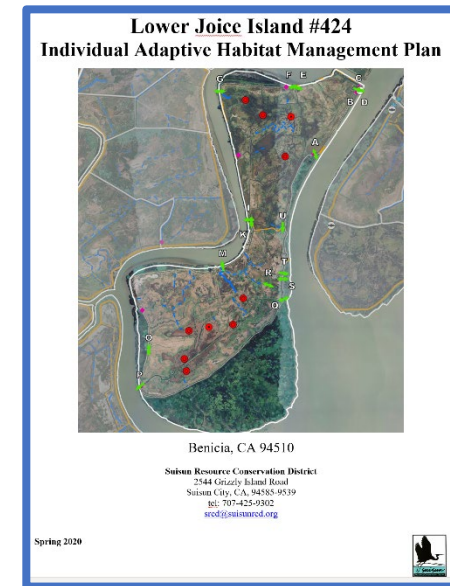
B. Individual Adaptive Habitat Management Plan Updates

The goals of the Individual Adaptive Habitat Management Plans (IMPs) are to provide managed wetland landowners with an overview of background information describing existing conditions and operations on managed wetlands in the Suisun Marsh. They provide wetland management guidance to support diverse waterfowl and wildlife habitat. The plans satisfy regulatory needs for San Francisco Bay Conservation and Development Commission (BCDC) permits for routine maintenance on existing exterior and interior water control structures, existing exterior and interior levees, existing bulkheads, construction of new interior ditches, grading of pond bottoms, installation of new interior water control structures, replacement of previously existing riprap on interior levees, and facility maintenance.

The existing physical, regulatory, and biological conditions in the Suisun Marsh affect wetland management strategies and determines the resulting habitat quality, and ultimately the species that will use the habitat. Wetland habitat managers must continuously adaptively manage their properties in order to achieve desired management objectives. However, the initial IMPs were written in the 1970s and 1980s and have not been updated since that time. In this update, we have developed a new template to incorporate the existing state of knowledge.

C. New Suisun Marsh Digital Elevation Map

In 2018, an airborne light detection and ranging (LiDAR) survey was completed to collect elevation data across Suisun Marsh. However, dense vegetation may obscure the ability to measure the bare earth elevation. In this LiDAR-derived elevation map, we corrected for vegetation height. We used multispectral airborne imagery and field surveys to improve elevation accuracy from 40% to 75% in a high-resolution image (1m pixels). The new coverage is available at the USGS Science Base website link ([LEAN-Corrected DEM for Suisun Marsh](https://doi.org/10.5066/P97R4ES3)) with a citation of (Buffington, K.J., K. M. Thorne, J. Y. Takekawa, S. Chappell, T. Swift, C. Feldheim, A. Squellati, and D. K. Mardock. 2019. LEAN-Corrected DEM for Suisun Marsh: U.S. Geological Survey data release, <https://doi.org/10.5066/P97R4ES3>).



D. Submitted Suisun Marsh Essential Fish Screen competitive grant proposal for \$454K dollars

In December 2019, SRCD submitted a competitive proposal for \$454K to the San Francisco Bay Restoration Authority (Measure AA) entitled “Wetlands without Water? Rehabilitating the Essential Fish Screens of Suisun Marsh for Habitat Resiliency.” The Restoration Authority was established in 2008 and funded in 2016 under Measure AA to apply a parcel tax in Bay Area counties providing funds to protect, restore, or enhance San Francisco Bay and its habitats. This project proposal identified a critical need for renovating the essential fish screens (EFS) of Suisun Marsh that allows diversion of water for wetland management along Montezuma Slough while protecting endangered fish from entrainment. In the spring of 2020, the staff recommended the proposal for approval and funding by the Authority Board. SRCD, in partnership with Ducks Unlimited, will complete a plan for renovating the 14 EFS installed in the 1990s that have outlived their useful life and are in various states of disrepair. The project will include upgrading antiquated solar systems currently powering 6 fish screens, improving EFS maintenance capacity, repairing the Worthington EFS (#634) to test the best renovation methods, and developing a comprehensive blueprint plan with detailed cost estimates required to fix the other 13 EFS systems before they fail. A follow-up proposal will be submitted to request the funds to undertake the other 13 EFS renovation projects in the next cycle of Restoration Authority funding.



E. Submitted competitive grant proposal “Optimizing wetland habitats for native wildlife and improving water quality in Suisun Marsh through resilient infrastructure” for \$1.49M dollars

In November 2019, SRCD submitted a competitive proposal for \$1.49M to the Department of Fish and Wildlife under the Watershed and Delta Ecosystem Restoration Program. The SRCD proposed implementation project would be the largest resilient infrastructure project conducted in Suisun Marsh and affecting 4,448 acres of wetland habitats (nearly 10% of brackish wetlands). It would be led by a unique private-public partnership of SRCD, 11 landowners contributing ~\$170,000 in cost-share funds, the California Waterfowl Association (CWA) donating foundation support, and hydrologic engineering experts (RMA) who developed a unique prioritization model to identify best areas for infrastructure improvements. The goal under the 30-year Suisun Marsh Habitat Management, Preservation, and Restoration Plan EIS/EIR (2014) also is to enhance 50,000 acres of brackish wetlands. The project would benefit native resident

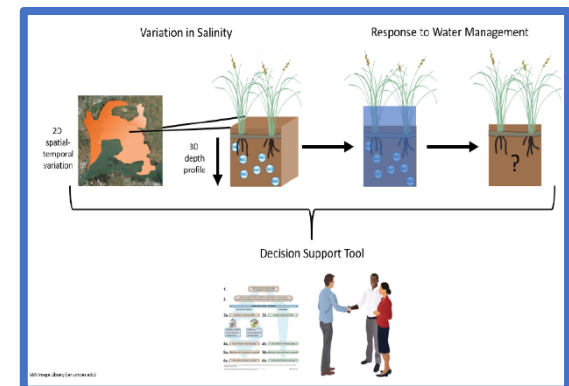


and migratory species including special status species (Salt Marsh Harvest Mouse, Delta Smelt) by providing opportunity for increased adaptive management efforts.

Moist soil management is dependent on periods of "bone dry" desiccation when plants germinate, nutrients cycle, and fieldwork can be completed. Over the next 2 decades, resilient infrastructure would help to ensure the health of brackish wetlands despite extensive freshwater diversions and salinization resulting from climate change effects in our freshwater-starved estuary. We would use before- and after- project data to parameterize the model and assess results of adding the resilient infrastructure to benefit the ecosystem and water quality by offsetting the dual climate change threats of sea-level rise and increasing salinities. This study would inform management decisions and address uncertainties about effects of prolonged droughts highlighted in the Delta Science Plan and 2017-2021 Science Action Agenda.

F. Submitted competitive grant proposal “Managing salinity and water quality to optimize wetland ecosystems for wildlife in Suisun Marsh and the Lower Sacramento-San Joaquin Delta” for \$616K dollars

SRCD developed a competitive proposal for \$616K to examine salinity as a stressor of habitats in managed brackish wetlands with an expert team including the USGS Western Ecological Research Center, UC Davis, Ducks Unlimited, and Department of Water Resources. Managing salinity is fundamental to enhancing 50,000 acres of brackish water wetlands, a coequal goal with restoring tidal wetlands under the 30-year Suisun Marsh Habitat Management, Preservation, and Restoration Plan EIS/EIR (2014). Improving our understanding of processes affecting salinity in brackish wetlands is essential to mitigate for increasing salinity caused by freshwater diversions of the Central Valley Project and State Water Projects and by estuary salinization resulting from climate change effects.

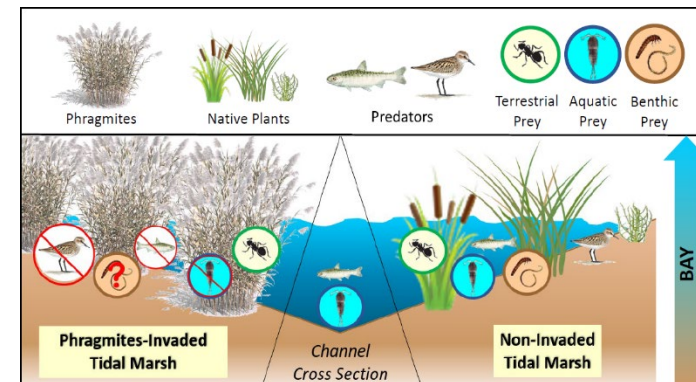


Protecting the health of our freshwater-starved estuary ecosystems requires increasingly careful management of salinity. The proposed study will support Proposition 1 priorities to improve habitats and water quality in the Delta including Suisun Marsh. It will inform management decisions and address uncertainties about salinity and effects of prolonged dry periods noted in the Delta Science Plan and 2017-2021 Science Action Agenda. The resulting decision tool will synthesize science findings and promote use of data in adaptive management. It will provide cost-effective methods for adaptively managing salinity in a decision support tool for landowners. The study will synthesize information on soil salinity and effects on brackish wetland habitats, and it will improve

understanding of salinity as the key stressor to management of plant communities for managed species. It will use cutting-edge measurement tools to develop salinity monitoring datasets and resulting process models.

G. Supported Delta Stewardship Council Science Fellowship \$230k dollar grant application

Operations Manager Dr. John Takekawa agreed to serve as the SRCD community mentor for Dr. Richelle Tanner, an applicant to the Delta Stewardship Council (DSC) competitive science fellowship. The request for \$230K over 2 years was submitted in late December 2019. It proposed a study to examine the early development of the Tule Red Tidal Restoration, the first tidal restoration completed in October 2019 under the Suisun Marsh Habitat Management, Restoration, and Preservation Plan EIS/EIR. However, invasion and expansion of Eurasian *Phragmites australis* in Suisun Marsh threatens to undermine the ecological benefits of tidal restoration efforts. *Phragmites* grows rapidly in disturbed areas and creates dense stands of vegetation impenetrable to fish and wildlife. In this project, we will measure colonization of *Phragmites* in a new restoration site; determine its effect on aquatic, benthic, and terrestrial invertebrate prey items; and examine the possible consequences to fish and wildlife predators. We will examine the new restoration site as well as different reference sites in Suisun Marsh. Dr. Tanner will conduct her postdoctoral work through UC Davis (Dr. Anne Todgham) with an advising team including SRCD, Utah State University (Dr. Karin Kettenring), the USGS Western Ecological Research Center (Dr. Susan De La Cruz), and Manomet (Ms. Monica Iglecia).



H. Led \$160K competitive grant proposal to examine the future persistence of the Salt Marsh Harvest Mouse

On behalf of the research team, SRCD submitted and was awarded a \$160K competitive grant proposal to the National Fish and Wildlife Foundation (NFWF) San Francisco Bay Fund for a project on "Future of the Salt Marsh Harvest Mouse and other native wetland species in the San Francisco estuary: tracking an inevitable decline or guiding a resilient response?" This project will address the lack of comprehensive recovery information for the endangered salt marsh harvest mouse (SMHM) and other small mammals through a unified assessment and survey approach. A comprehensive



SMHM survey in a single season has never been conducted in 50 years, but recent studies demonstrate that SMHM inhabit managed wetlands as well as tidal wetlands. There is a critical need to fill this information gap in light of future land use and climate threats, and the project goal will be to coordinate a team of experts to conduct the first single-season, estuary-wide survey to determine which areas are most resilient.

The findings will be summarized in population color intensity “heat” maps that will identify key areas to help us understand how and where we should focus recovery actions. Instead of tracking an inevitable decline, we propose this study to proactively guide a resilient response. Findings from this study will support the ultimate goal of identifying priority areas to increase future wetland resilience. The project will be undertaken in two phases. Phase 1 will include compilation of existing information, development of the approach, and a pilot test of coordinated surveys and methods including collection of genetic samples. Phase 2 will implement the coordinated survey, and the resulting data will be used to create heat maps of populations summarizing their likely resiliency. Coordinators will include the California Department of Fish and Wildlife, U. S. Fish and Wildlife Services (Ecological Services and Refuges), USGS Western Ecological Research Center, and WRA, Inc.

I. Participated in National Science Foundation Project on Avian Influenza

SRCD Operations Manager Dr. John Takekawa was requested to participate as a subject expert on wild migratory birds in a joint, multi-million-dollar USA-China National Science Foundation (NSF) study on the global threat of avian influenza. The goal of the NSF project, entitled “US-China Collab: Harnessing Big Data to understand and predict diversity and transmission of human- and animal-infected avian influenza viruses in China” is to better understand the role of wild waterfowl in spread of this disease and provide solutions to reduce transmission. Prior to the novel coronavirus pandemic of 2019, avian influenza viruses were feared to be the next large pandemic. During the past 20 years, highly pathogenic avian influenza viruses have infected poultry across the world resulting in losses of billions of dollars. A subset of viruses has caused the death of thousands of people since 2013, and as these viruses persist, economic losses and health concerns to the agricultural, wild, and human communities remain.

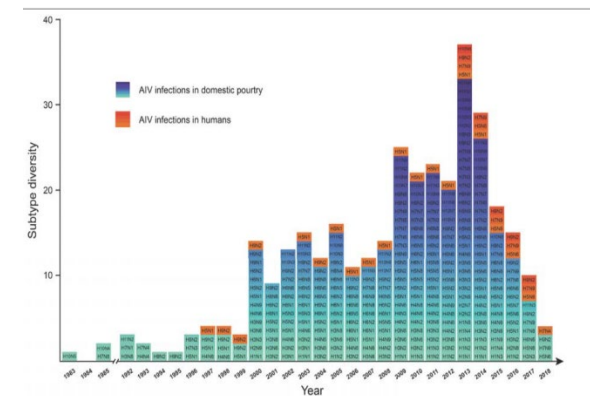


Fig. A.1. Avian Influenza (AI) viruses isolated from poultry and humans in China over the period of 1983-2018. Blue color – AI viruses isolated from poultry, and red color – AI viruses isolated from infected humans.

Knowledge from epicenters such as China remain limited which substantially hinders development of prediction and forecasting models. The investigators will study diversity and transmission dynamics to advance the research in ecology and evolution of influenza viruses and strengthen surveillance and pandemic preparedness. The U. S. research team is led by the University of Oklahoma (Dr. Xiangming Xiao) with partners USGS Patuxent Research Center (Dr. Diann Prosser), and St. Jude Research Hospital (Dr. Richard Webby) and three institutions in China (China CDC, China Agricultural University, and Sun Yat-sen University). The project will provide offsetting salary costs and travel support from 2020-2024 for Dr. Takekawa's participation.

J. Continued Study Support -- Duck Diets and Food during the Winter

USGS and UC Davis students are conducting field studies to determine the diet and availability of dabbling and diving ducks in Suisun Marsh. Their studies look at consumption or use of different seeds and invertebrates, as well as the availability of those food items. SRCD has been assisting the research efforts through coordination of access with landowners and outreach through landowner workshops and regular communications.



K. Continued Study Support-- Nesting Ducks and their Predators

Suisun Marsh provides habitat for breeding mallards, gadwall, northern pintail, and cinnamon teal in the spring and summer. Raccoons and striped skunks consume duck eggs during the breeding season. This predation decreases the success (survival to hatching) of waterfowl nests. USGS has been leading studies on nesting waterfowl and their mammalian and avian predators to examine the most common predators of duck eggs. Through use of GPS transmitters and miniature cameras, the studies aim to better understand habitat use by the predators and the effects of their predation. SRCD supports these studies to provide guidance for landowners to manage their lands for the greatest productivity.



L. Continuing Study Support -- Tracking Waterfowl Marked with Satellite Transmitters

USGS has been capturing and marking waterfowl in Suisun Marsh and other areas in the flyway to examine their movements during the non-breeding season, migration, and breeding season. Waterfowl are marked with cell-GPS transmitters that provide high frequency location data through cellular tower systems. SRCD provides support for administering funding for the work as well as support for coordination with landowners. Work continued through 2019 with the tracking of more ducks and geese and a presentation of initial results at Suisun Marsh Landowner Workshops.



M. Partnering in Enhancing Public Use and Restoring Habitats at Belden's Landing

Belden's Landing is the primary boat launch in the heart of the Suisun Marsh. This project is supported by a \$93K competitive grant over two years from the National Fish and Wildlife Foundation (NFWF) San Francisco Bay Conservation Fund. It will restore the degraded marsh removing invasive species and planting native flora, develop a site vision and boardwalk plan with the community, and improve existing facilities. A non-motorized launch will be added to reduce user conflicts as a Bay Area Water Trail trailhead. In 2019, fishing facilities were installed, invasive plants were removed, and native flora were planted. Work on the improvements will continue in 2020. The project is a unique partnership of the Solano County Parks, SRCD, and DFW.



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