

2021 ANNUAL REPORT

SACRAMENTO-YOLO MOSQUITO & VECTOR CONTROL



Sacramento-Yolo
MOSQUITO & VECTOR
CONTROL DISTRICT

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Dear Residents, Colleagues & Friends

It is with great pleasure that we present to you the 2021 Annual Report for the Sacramento-Yolo Mosquito and Vector Control District. Once again, the District had a successful year serving the residents of Sacramento and Yolo counties protecting community members against mosquitoes, West Nile virus (WNV), invasive mosquitoes and other related threats. This report outlines the work conducted by the District to accomplish the primary goal and mission of protecting public health.

After the introduction of Covid-19, the District continued adapting its practices and 2021 proved to be another difficult year. Fortunately, mosquito control agencies were deemed essential and the District continued to offer all of its services while making necessary adjustments and abiding by health and safety mandates set forth by local health departments and the California Department of Public Health. 2021 brought constant changes and ongoing challenges to ensure the safety of our employees while at the same time offering mosquito control services to all of our residents, but we always kept pushing forward.

In 2021 ongoing surveillance efforts continued to detect the invasive mosquito *Aedes aegypti* in various new areas within District boundaries. The first detection of invasive mosquitoes came in April in the city of Winters in Yolo County. While this was a known infestation site from the previous year, we were surprised to detect these mosquitoes so early. *Aedes aegypti* were also discovered in May in the Arden-Arcade area, another known infestation site from the previous year. However, as the season progressed the extent of the infestation became larger and widespread as mosquitoes were found in more homes. In addition, in 2021 there were many new detection sites including two different locations in Elk Grove, Orangevale/Carmichael and multiple areas within the city of Sacramento. After each new detection the District launched a variety of public outreach efforts with the goal of educating residents about invasive mosquitoes. Field technicians conducted intense door-to-door inspections canvassing the neighborhoods within detection areas looking for larval sources and adult mosquitoes. Also, in response to the extensive finding of both immature and adult mosquitoes, the District conducted treatments directly in the backyards of residents, as well as extensive larviciding and adulticiding treatments throughout the different areas where invasive mosquitoes were found. After an intense season with invasive mosquitoes, as temperatures cooled, mosquito populations declined and the last time *Aedes aegypti* mosquitoes were detected was in November.

Despite invasive mosquitoes, West Nile virus continues to be a top priority and the District's largest public health concern. Within our District area, WNV activity was relatively mild in 2021 as compared to previous years, however other parts of the state registered an active season. Since we know WNV is endemic to the area and residents need to do their part to protect themselves, we had ongoing public information and outreach campaigns promoting mosquito prevention messages encouraging public participation in reporting dead birds and other common mosquito breeding sources. The laboratory closely monitored all mosquito activity by trapping, sorting and collecting mosquito samples to determine WNV activity and where it was concentrated. When the disease reached levels that posed a threat for increased virus transmission to the public, control operations responded by conducting ground spraying to quickly and effectively decrease the abundance of mosquitoes. Field technicians also spent time looking for and treating routine mosquito breeding sources, inspecting thousands of catch basins throughout our two counties and responding to service requests from the public. Mosquitofish were utilized in various urban, rural and agricultural areas as a natural method of controlling mosquitoes and our ecological management department worked closely with various entities and residents to reduce mosquito populations.

As we continue to plan for the future and search for ways to improve our programs, our commitment and dedication to offer the best mosquito control program to all the residents of Sacramento and Yolo counties stands firm. We look forward to serving you!

If you have any questions please visit our website at www.FIGHTtheBITE.net or call us at 1-800-429-1022.

Sincerely,



Gary Goodman
District Manager

Sincerely,



Craig Burnett
2021 President, Board of Trustees

History



In 1915, the California Legislature adopted the “Mosquito Abatement Act” (now incorporated into the California Health and Safety Code, Division 3) which formed the basis for the creation, function and governing powers of Mosquito Abatement Districts.

On June 18, 1946, the Sacramento County-Yolo County Mosquito Abatement District was formed by joint resolution of the Board of Supervisors for Sacramento and Yolo counties. The driving force behind the formation of the District was the public’s need for protection against mosquito-borne diseases and relief from serious pest nuisance.

In July of 1990, the District Board voted by resolution to change the name of the District to the Sacramento-Yolo Mosquito and Vector Control District to better reflect the expanded services and responsibilities the District assumed regarding ticks, yellow jackets and other vectors.

The District is governed by a Board of Trustees, each appointed by one of the incorporated cities or one of the counties within the District’s boundaries. Board meetings are held at 10:00 am on the third Tuesday of each month in Elk Grove.

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Administrative Office, Public Information, Control Operations, Fisheries and Laboratory Sacramento County

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Personnel

Manager: Gary Goodman
Assistant Manager: Samer Elkashef
Administrative Managers:
Janna McLeod and Shelley Eckler
Program Coordinator: Steve Ramos
Senior Administrative Assistant:
Raj Badhan
Administrative Assistant:
Kellee Brinkman

Laboratory

Laboratory Director: Marcia Reed
Biologist: Sarah Wheeler
Vector Ecologist: Debbie Dritz
Microbiologist: Kara Kelley
Laboratory Technicians: Courtney Chagolla, Whitney Clack, Joy Drake, Paula Matney, Karin Jenkins, Stanley Roberts, Katrina Stokes, Marilou Thomas, Marti Towery, Nicholas Tremblay, Haley Unmacht

Fisheries

Fisheries Supervisor: Tony Hedley
Field Technicians: Vincent Luu, Kiara Day, Grant White

Public Information & Education

Public Information Officer:
Luz Maria Robles

Ecological Management

Ecological Management Supervisor:
Marty Scholl
Ecological Management Technicians:
Robert Fowler, Guy Kachadorian

Mapping & Information Technology

Mapping/Systems Coordinator:
Ruben Rosas
**Information Technology
Administrator:** Dan Fisher

Shop

Supervisor: Tom Price
Mechanics: Ben Weisenberg,
Don Henson

Mosquito Control Operations North Sacramento County

Supervisor: Kevin Combo
Field Technicians: Nick Ascarrunz,
Ken Harris, Ron Burkhouse, Tyler Carlson,
John Snell, Timothy Guimont, Katie
Kirkham, David Smith, Timothy Yuen

Mosquito Control Operations South Sacramento County

Supervisor: Demetri Dokos
Field Technicians: Jeff Anderson, Jonas
Leuluaialii, Brian McGee, Phillip Merritt,
Jacob Pascual, Nate Pascual, Richard
Speakman, Kevin Valone

Mosquito Control Operations North Yolo County

Supervisor: Brett Day and Michael Fike
Field Technicians: Garrett Bell, Jason
Lloyd, Zeb Middleton, Mark Pipkin,
Jake Vigna

Mosquito Control Operations South Yolo County

Supervisor: Will Hayes and Garth Ehrke
Field Technicians: Dan Bickel, Frank
Mendez, Soda Sanouvang, Kylie
Letamendi, George Santiago

Mosquito Control Operations Catch Basin Crew

Supervisor: Ryan Wagner
Field Technicians: Shan Badhan,
Douglas Camero, Jay Geigle, Eric
Guimont, Garrett Koch

Integrated Pest Management



Mosquito and vector control are based on scientifically planned management tactics and control strategies that reduce the abundance of target pests in a timely manner. This method is commonly referred to as “Integrated Pest Management” (IPM). This comprehensive program incorporates five basic methods: public information and education, mosquito and vector surveillance, biological control, physical control, and microbial and chemical control.

Public Information & Education

The District’s outreach program educates and informs the public about mosquito and West Nile virus prevention methods through an extensive advertising and media campaign. District messages are also disseminated to the public by participating in a variety of community events, health fairs, presentations to schools and community organizations as well as partnerships with local groups.

Mosquito & Vector Surveillance

The District closely monitors mosquito activity, climate change and arbovirus activity by testing mosquitoes, sentinel chickens, wild birds and ticks for the presence of pathogens, parasites or arboviruses. This research and surveillance information helps guide efficient control of vectors and vector-borne diseases in Sacramento and Yolo Counties.

Biological Control

Biological control is the use of specially chosen living organisms to control a particular pest. This chosen organism might be a predator, parasite, or pathogen which will attack the harmful insect resulting in a desired reduction of pest population levels. The most common biological tool against immature mosquitoes in California are mosquito-eating fish such as the mosquitofish, *Gambusia affinis* and the Guppy, *Poecilia reticulata*. When introduced to a mosquito breeding source, these fish quickly adapt, multiply and become numerically capable of sustaining an effective control level.

Physical Control

Physical control (environmental management) is achieved by altering the ecological components of the pest’s environment such as: promoting effective drainage, controlling emergent vegetation, promoting appropriate timing of irrigation, and encouraging mosquito reduction best management practices in urban, agricultural, and conservation areas. By managing aquatic sources, opportunity for mosquitoes to develop is eliminated.

Microbial & Chemical Control

Microbial and chemical control are the prudent use of specific microbials and chemical compounds (insect growth regulators and insecticides) that reduce mosquito populations. These materials are applied when other methods are unable to maintain mosquito numbers below a level that is considered tolerable or when emergency control measures are needed to rapidly disrupt or terminate the transmission of disease to humans and animals. These products and application methods used are registered for public health use by the California Department of Pesticide Regulation, as well as California Environmental Protection Agency, and are designed to minimize non-target effects. Larvicides target immature mosquitoes; adulticides are chemicals that reduce adult mosquito populations.



Public Information & Education

The District's award winning public information and education department strives to raise awareness of mosquitoes and of vector-borne diseases such as WNV, Zika, dengue and chikungunya. This is done through extensive media coverage obtained on television, radio, print and various news websites using an aggressive advertising campaign which includes radio and television advertisements in English and Spanish, extensive social media, outdoor creative ads and online digital ads. The District's media strategy also includes participation in various radio and television public affairs shows and television programs used to disseminate District messages. Two additional elements important to the department are community outreach and the school program. The District hosts information booths at several community events throughout Sacramento and Yolo counties where educational materials are disseminated and the public receives information about available District services. Another element of outreach is the school program which includes classroom presentations and an annual spring Fight the Bite Contest for all students and schools within Sacramento and Yolo counties.

In 2021, ongoing Covid-19 concerns continued to have an impact on the outreach activities the District engaged in. Community presentations and outreach to elected officials had to be done virtually and the community events we attended were those that were "drive by" and that included limited contact. We were successfully able to disseminate mosquito prevention information via social media, through our extensive advertising campaign and by giving out public relations bags at all service request appointments conducted by field staff. In addition, technicians were instrumental in helping to deliver repellent to community groups, senior centers and park districts.

In 2021, the invasive mosquito species, *Aedes aegypti* continued to spread into new areas in both Sacramento and Yolo counties. Upon any new detection, a press release was issued to inform the public and a door to door response was initiated where District technicians educated residents on how to prevent these mosquitoes on their property. Residents received brochures, repellent and a door hanger with information and prevention tips. Since the infestations of invasive *Aedes* were intense in some areas we launched social media and print ad campaigns to further disseminate information regarding invasive mosquitoes. To target residents even further, we mailed out postcards to all residents in affected communities. In addition, we collaborated with city hall and local elected officials to disseminate information via the city website, newsletters, and social media. Repellent was delivered to the chamber of commerce and delivered to businesses. Invasive mosquitoes were also detected in the Arden area of Sacramento County and very similar outreach efforts were conducted.





Further Outreach Activities

PRESENTATIONS TO LOCAL ELECTED OFFICIALS

In 2021 in lieu of traditional in person presentations during council meetings, we provided our annual Fight the Bite update to local elected officials virtually via Zoom. Written reports were also submitted to some cities that made this request.

COMMUNITY EVENTS

The District typically participates in a variety of community events throughout the year, however in 2021, due to Covid-19 concerns we only participated a limited number of outdoor "drive by events" where repellent and information was handed to people in their cars as they drove past our informational displays. We also participated in 2 vaccination clinics where we engaged with residents as they waited in their cars after getting their Covid vaccines.

FIGHT THE BITE CONTEST

Despite the pandemic, our annual Fight the Bite Contest was able to continue. Contest fliers were disseminated and students in grades K-12 were asked to create artwork encouraging the audience to practice one or all of the District D's of Mosquito Prevention. Winners were selected and announced during Mosquito Awareness Week in April.

REPELLENT DISTRIBUTION

An important component of the education and outreach program is to promote the use of mosquito repellent as a way to have the public protect themselves from mosquito bites. The District offers free mosquito repellent wipes for agencies and community organizations to use during outdoor evening activities. In 2021, field technicians delivered boxes of repellent to agencies that serve homeless populations, parks and recreation departments, senior centers and businesses. To request mosquito repellent you may send an email to info@fightthebite.net.



Mosquito & Vector Surveillance

The laboratory provides the following technical information to help guide efficient control of vectors of diseases in Sacramento and Yolo Counties:

- Surveillance of mosquitoes
- Encephalitis virus surveillance
- Surveillance for other mosquito-borne diseases
- Tick and Lyme disease surveillance
- Surveillance of bees and wasps
- Identification of arthropods of public health significance
- Pesticide resistance testing and management
- Research and special projects

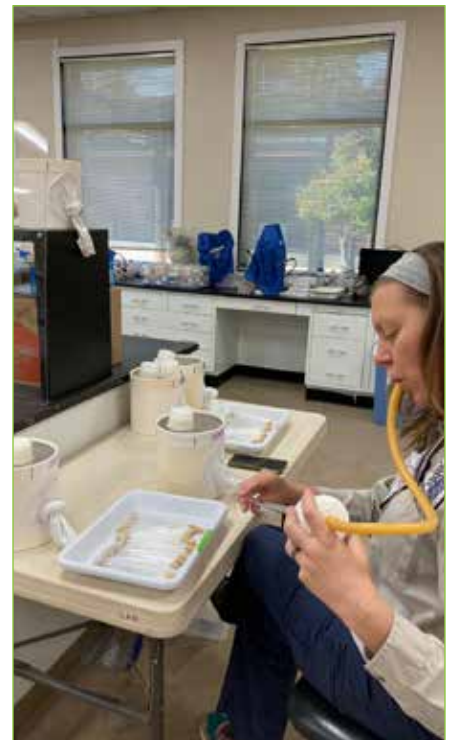
Surveillance of Mosquitoes

Mosquito surveillance is an essential component of the District's Integrated Vector Management (IVM) program and a considerable amount of effort is devoted to it. The District's surveillance program consists of a systematic approach for locating areas with high mosquito abundance and mosquito-borne disease activity over time and space. The laboratory collects and analyzes data on seasonal changes in relative abundances of mosquito species, monitors geographic and environmental distribution patterns of mosquito species, determines maximum and minimum risk periods of public exposure to mosquito-borne diseases, and evaluates mosquito control activities. The data collected are combined with data from previous years and provide information on the dynamics of mosquitoes and mosquito-borne diseases within the District's surveillance area.

In 2021, our District collected over 209,703 mosquitoes in fixed sites throughout Sacramento and Yolo Counties for mosquito abundance calculations. The mosquitoes collected were identified to species and counted by our laboratory technicians. The District used two types of traps for collection of abundance data — District "Locker" traps and Gravid traps. Both trap types were set in representative sites in both counties and were used to gather information on the distribution of all mosquito species and to monitor populations of mosquito species of concern. Data was interpreted in the context of historical records and mosquito abundance and compared to a 5-year average.

The District Locker traps capture host-seeking mosquitoes that are attracted to carbon dioxide emissions. The second type, the Gravid female trap, attracts female mosquitoes that are seeking to lay eggs in water rich in organic material. The organic water mixture is made of ground alfalfa, hog chow pellets and Brewer's yeast and is allowed to ferment before being used in the trap.

In addition to the mosquito species found in Sacramento and Yolo Counties, District technicians are also trained to recognize any exotic or introduced species, if present, in any of the thousands of samples they collect each year.

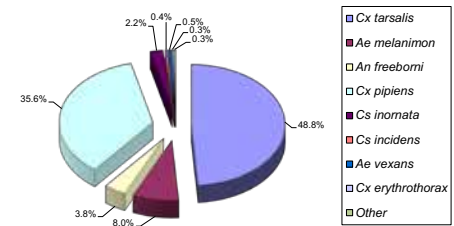




LOCKER TRAPS

The District used a total of 24 Mosquito Locker traps in 2021 in Sacramento and Yolo Counties. A total of 146,613 mosquitoes were collected by these traps, and most (94%) were females. The most abundant species collected were *Cx. tarsalis*, *Cx. pipiens*, *Ae. melanimon* and *An. freeborni*.

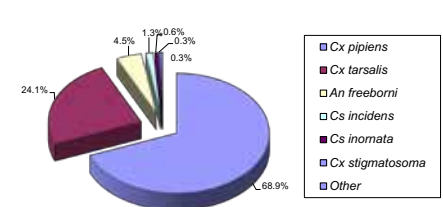
LOCKER TRAP COLLECTION



GRAVID TRAPS

A total of 24 Gravid traps were used in 2021 in Sacramento and Yolo Counties for adult mosquito abundance tracking. A total of 63,090 mosquitoes were collected by these traps, and most (74%) were females. The most abundant species, as expected, were *Cx. pipiens*, followed by *Cx. tarsalis*, *An. freeborni* and *Cs. incidens*. Other mosquito species constituted less than 2% of the total collection.

GRAVID LIGHT TRAP COLLECTION



ADULT MOSQUITO ABUNDANCE TRENDS

All mosquito species are monitored throughout the year, but the District is particularly interested in the abundance of certain species from the standpoint of disease transmission and nuisance. Two *Culex* species, namely *Cx. pipiens* and *Cx. tarsalis* are considered the main vectors of West Nile virus in Sacramento and Yolo Counties. The abundance of these species is closely monitored and is used in the risk assessment for West Nile virus transmission. *Cx. pipiens*, the northern house mosquito, is a medium-sized, brown mosquito, which usually breeds in foul or polluted waters, such as artificial containers, fish ponds, improperly maintained swimming pools, catch basins, septic tanks, dairy drains, waste treatment ponds, etc. It tends to bite in the dusk or early evening hours of the day and feeds mostly on birds, but will also readily bite mammals, including humans. This species peaks in June- July, with high populations maintained through October. Abundance for this species in 2021 was very closely aligned with the 5-year average.

Cx. tarsalis, the western encephalitis mosquito, is also a medium- sized and brownish mosquito, but has a distinctive median white band on the proboscis and white bands on the legs. This species commonly colonizes a wide variety of aquatic sources, such as wetlands, duck clubs, rice fields, and irrigated crops. However, in recent years, it has been commonly found in significant numbers breeding in abandoned or not maintained swimming pools in suburban and urban environments. It is also a bird feeding mosquito that may feed readily on humans, and it is most active at dusk and early hours of the evening. Abundance numbers for *Cx. tarsalis* in 2021 showed an early peak above the 5-year average in mid-June, but then dropped to mimic the 5-year average for the remainder of the season.

Culex erythrothorax is a distinctive orange to light brown mosquito which inhabits tule pond areas. It does not fly long distances and usually stays near the location of its breeding source. Another *Culex* species, *Cx. stigmatosoma* is a foul water breeding mosquito and has banded legs like the *Cx. tarsalis* mosquito. These mosquitoes can vector West Nile virus, but are not particularly widespread. We also find *Cx. thriambus* in our District's area, but in much smaller numbers. Abundance numbers for *Cx. stigmatosoma* in 2021 were similar to the 5-year average while *Cx. erythrothorax* abundance had several peaks during the season above the normal baseline levels due to two areas of habitat having high abundance this year (Hansen Ranch and Twitchell Island in Sacramento County).

Anopheles freeborni, the western malaria mosquito, is a large mosquito which is most active at dusk, and will readily enter houses. It can be a significant nuisance during its peak population periods. Females feed on most mammals and are most active in the dusk and early evening hours. This species may be abundant in rice fields, and occurs in clear, seepage water in sunlit algae-laden pools. It usually has a bi-modal population trend with the first peak in early February and a second, much greater peak in August and September, when it can be considered a major pest due to its biting activity. In 2021, *An. freeborni* population counts tracked very closely to the 5-year average. Other *Anopheles* species found in our area are *An. franciscanus* and *An. punctipennis*. These two species are found at very low levels.

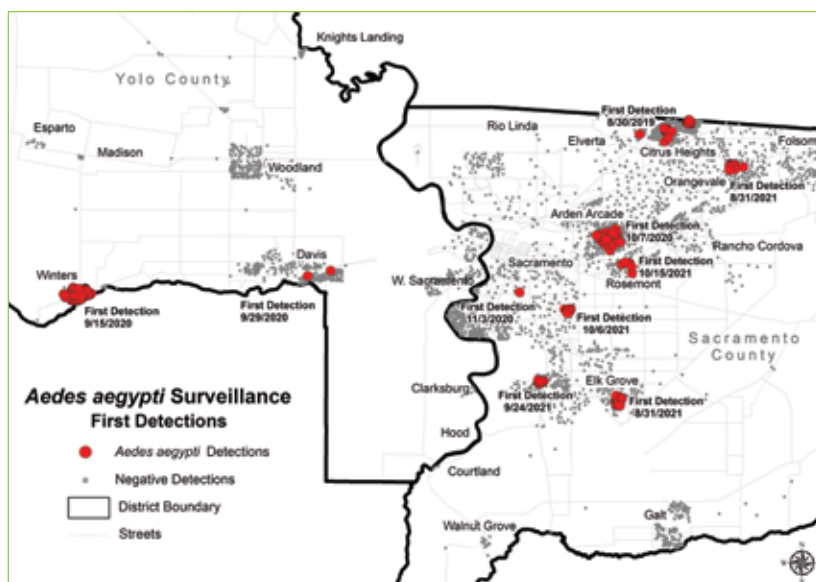
There are several *Aedes* species of mosquitoes which are also of concern to the District. *Ae. melanimon* and *Ae. nigromaculis* are floodwater mosquitoes. They lay eggs on ground which will become flooded later, either by natural precipitation, flooding, or by agricultural practices. When the fields containing eggs are flooded, large numbers of larvae can emerge and develop rapidly to the adult stage. When this occurs the resulting biting activity on humans and other mammals in the area is significant. For this reason, even though these mosquitoes are not primarily involved in disease transmission, they are a nuisance concern. *Aedes* are day and dusk biting mosquitoes rather than the principally dusk biting type of the *Culex* and *Anopheles* species. Another *Aedes* mosquito of interest found in our District's area is *Ae. sierrensis*, the western treehole mosquito. Unlike *Ae. melanimon* and *Ae. nigromaculis*, this mosquito is involved in disease transmission and is the primary vector of canine heartworm in our area. It is unique in that its natural breeding source is treeholes. This species is difficult to control as there can be numerous trees with treeholes in a given wooded area. In addition, the treeholes can be at varying heights and are cryptic in nature, thus making treatment with mosquito control products difficult, even though the mosquito species itself has a limited flight range. This small black and white mosquito is active during the day as well as at dusk. All of these *Aedes* mosquitoes are primarily mammal biting mosquitoes and can become a significant nuisance. Other less common *Aedes* species that can be found in our area and can be a localized nuisance or concern include: *Ae. washinoi*, *Ae. vexans*, *Ae. sticticus*, and *Ae. bicristatus*. *Orthopodomyia signifera* is another mosquito species which can be found in treeholes and sometimes artificial wooden containers in our District's area, but it is not nearly as common as *Ae. sierrensis*.

In addition to the species mentioned above, which are all active primarily during the spring and summer months, the *Culiseta* species mosquitoes are active either primarily in the winter months (*Cs. inornata*) or all year long (*Cs. incidens*). These are large mosquitoes and are primarily mammal biters which commonly feed at dawn and dusk. *Cs. inornata* and *Cs. incidens* breed in a variety of natural aquatic habitats, with *Cs. incidens* also being adapted to artificial containers and more polluted sources. These mosquitoes are primarily nuisance mosquitoes; however *Cs. incidens* has been suggested as a canine heartworm vector and is a secondary vector of West Nile virus. *Culiseta particeps* is also found in our District area, but is not as common in our traps as *Cs. inornata* and *Cs. incidens*.

In 2021 ongoing surveillance and control efforts continued to detect the invasive mosquito *Aedes aegypti* in various areas within District boundaries. The first detection of invasive mosquitoes for the season occurred in April in the City of Winters in Yolo County. While this was a known infestation site from the previous year the discovery came very early in the season for this species on mosquito. An additional detection of larvae and adult mosquitoes occurred in May in the Arden-Arcade area of Sacramento County.

As the season continued the extent of known infestation sites became larger and more widespread as immature and adult mosquitoes were found in additional homes and new neighborhoods. The District's surveillance efforts also identified new areas of *Aedes aegypti* activity; two locations in Elk Grove, sites around Orangevale/Carmichael and the City of Sacramento. After each new finding the District launched a variety of public outreach efforts with the goal of educating residents about invasive mosquitoes. Field technicians conducted intense door-to-door inspections canvassing entire neighborhoods within detection areas looking for larval sources and adult mosquitoes. As detailed in the District invasive *Aedes* response plan, technicians conducted many localized backyard treatments in addition to extensive truck mounted larviciding and adulticiding to reduce breeding sites and overall adult mosquito populations in affected neighborhoods. After an intense season of finding invasive mosquitoes in many new areas, temperatures dropped significantly and mosquito populations declined. The last time *Aedes aegypti* mosquitoes were detected was in November.

The map below illustrates laboratory surveillance efforts specific to *Aedes aegypti* and the known infestation sites in both counties from 2019 when invasive mosquitoes were initially detected in Citrus Heights to all new detections in 2021.





Encephalitis virus surveillance

SENTINEL CHICKENS

In an effort to use all available surveillance tools and increase the chances of early detection of arbovirus activity, the District uses sentinel chickens as part of the encephalitis virus surveillance program. Chickens usually do not develop symptoms of disease when infected with West Nile virus and are considered dead-end hosts for it, meaning they do not produce sufficient viremia to infect mosquitoes when subsequently bitten by them. More significant to our program, chickens stay inside a coop in a fixed area and the presence of antibodies in their blood indicates local virus transmission. Therefore, they are used by some mosquito control agencies in their surveillance programs and may serve as an early indicator of local arbovirus activity in an area.

In 2021, the District maintained a total of 25 chickens distributed in 5 flock sites within Sacramento and Yolo Counties and an additional flock kept for replacement of positive chickens during the season. Five chickens were kept per flock at a time, and they were replaced whenever their test showed antibodies towards Saint Louis Encephalitis (SLE), Western Equine Encephalitis (WEE), or West Nile virus (WNV). Blood samples were collected from April 15 through October 14. Samples were tested for the presence of antibodies towards SLE, WEE, and WN viruses. The first West Nile virus-positive chicken sample was detected on a collection made on August 18, 2021. At the end of the sampling period, antibody conversions had been found in three of the five flocks with a total of 5 chickens positive for antibodies towards West Nile virus. No seroconversion for other viruses was detected.

2021 SENTINEL CHICKEN TESTS

SACRAMENTO COUNTY			
Flock Location	WEE positive	SLE positive	WNV positive
Tyler Island	0	0	1
Gibson Ranch	0	0	0
Rancho Murieta	0	0	0

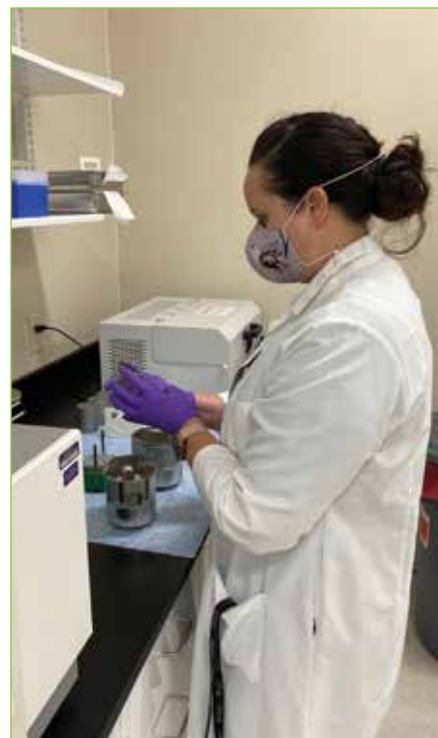
YOLO COUNTY			
Flock Location	WEE positive	SLE positive	WNV positive
Dunnigan	0	0	1
Knights Landing	0	0	3



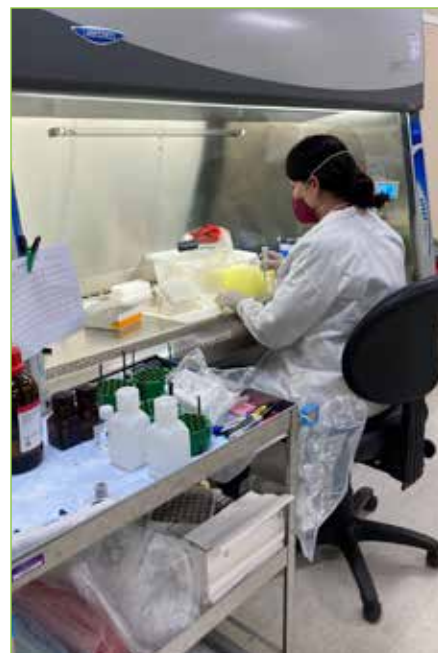
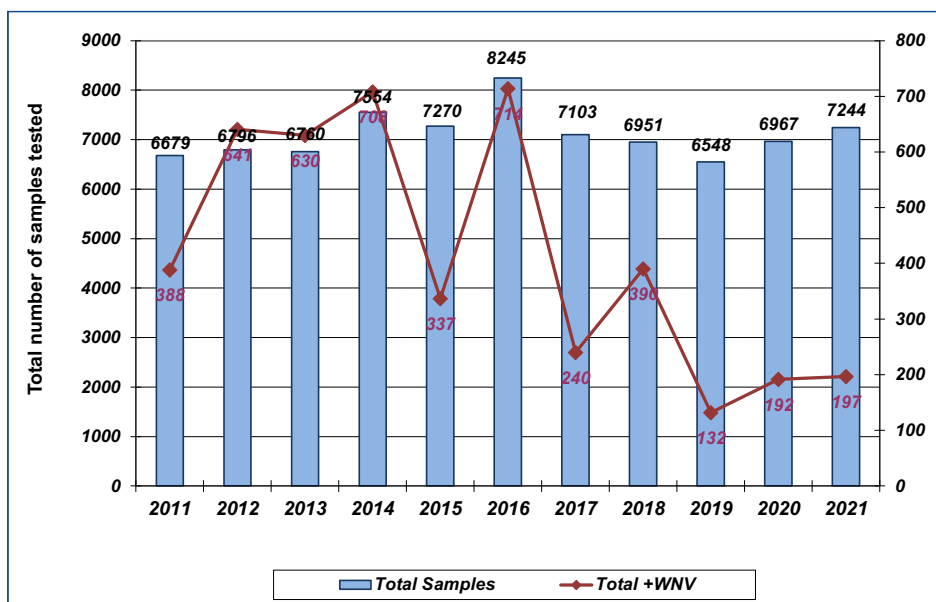
ENCEPHALITIS VIRUS SURVEILLANCE TRAPS

The District uses two types of traps for Encephalitis Virus Surveillance (EVS): dry ice-baited traps and Gravid female traps. These traps are battery-operated and are placed in each specific site and collected the following morning. Samples are then brought to the District's laboratory for processing and the collected female mosquitoes are grouped by species in vials containing one to 50 mosquitoes. Samples of the species of concern are then tested for the presence of SLE, WEE, and WN viruses by TaqMan real-time polymerase chain reaction (RT-PCR).

A total of 140,416 mosquitoes were captured with the two EVS trap types in 2021. Most of the mosquitoes captured were females (96%) and 86% of them were captured in the dry ice-baited traps. A total of 7,244 mosquito samples (of one to 50 female mosquitoes each) were tested by the District in 2021. The first West Nile virus-positive mosquito sample was a sample of *Cx. pipiens* mosquitoes collected on May 28, 2021 from Sacramento County. The last positive sample was also a *Cx. pipiens* sample from Sacramento County collected on October 15, 2021. A total of 197 mosquito samples tested positive for West Nile virus in 2021 – 132 from Sacramento County and 65 from Yolo County. No seroconversion for other viruses was detected.



WEST NILE VIRUS ACTIVITY 2011-2021



2015-2021 SUMMARY OF ENCEPHALITIS VIRUS SURVEILLANCE

		2015	2016	2017	2018	2019	2020	2021
Mosquito pools	Total tested	7270	8245	7103	6951	6548	6967	7244
	WNV-positive	337	714	240	390	132	192	197
Chicken samples	Total tested (Total no. chickens)	420 (30)	278 (30)	230 (30)	375 (25)	350 (25)	282 (25)	302 (25)
	Seropositive	8	7	4	10	5	6	5



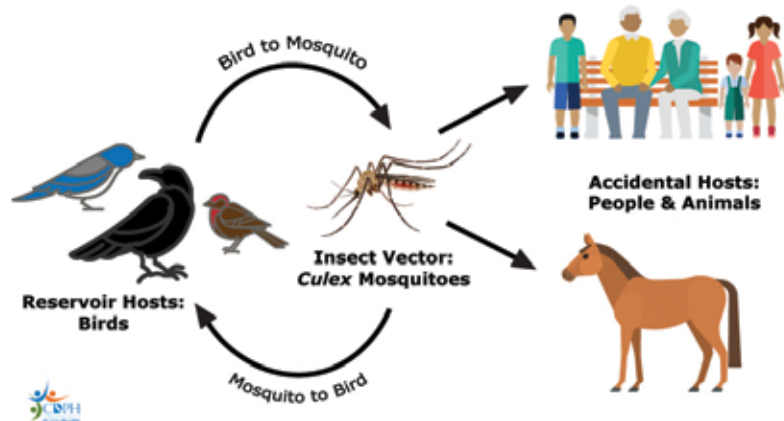
DEAD BIRDS

The dead bird surveillance program was established in 2000 by the California Department of Public Health (CDPH) in collaboration with local agencies. Bird mortality can be a sensitive indicator of West Nile virus activity. Dead birds are reported by the public to the WNV hotline (1-877-WNV BIRD, or online at westnile.ca.gov), and are then collected and identified by the local agencies. Our technicians try to collect every dead bird reported to our District. Samples are collected from suitable specimens and tested for the presence of SLE, WEE, and WN viruses by TaqMan real-time polymerase chain reaction (RT-PCR). Often the first indication of virus activity in a certain area comes from reported dead birds, therefore this program is a very important component of our laboratory's surveillance program because it helps the District better allocate resources and focus on areas where virus activity has been detected.

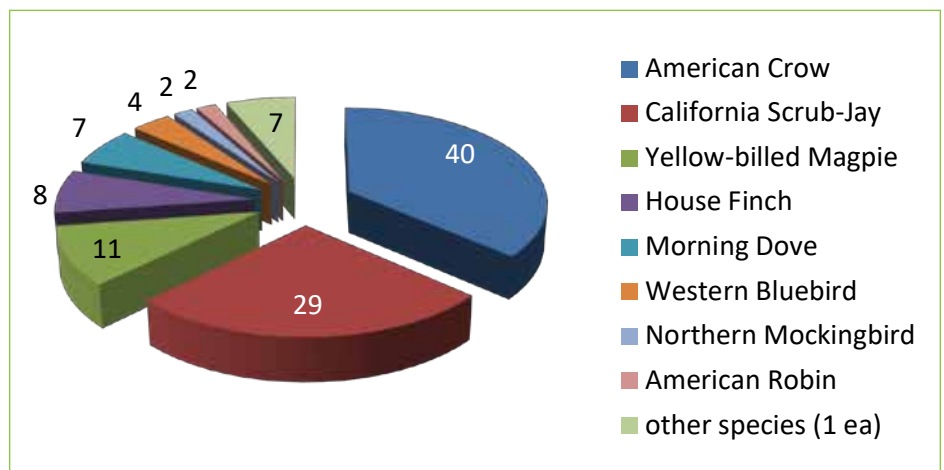
In 2021, 847 dead birds from Sacramento and Yolo Counties were reported to the WNV hotline. A total of 473 dead birds were tested for WN, WEE and SLE viruses and 110 were found positive for WNV (100 from Sacramento County and 10 from Yolo County). Most of the positive dead birds were American Crows (40) and California Scrub-Jays (29), followed by Yellow-billed Magpies (11), House Finches (8), Mourning Doves (7) and Western Bluebirds (4). Various other bird species constituted the remaining 11 of the total WNV-positive birds tested.



WEST NILE VIRUS TRANSMISSION CYCLE



WNV POSITIVE DEAD BIRDS 2021

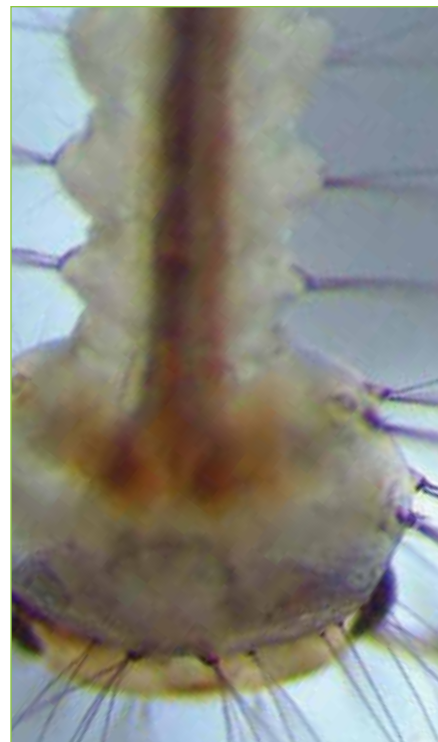


Surveillance for Other Mosquito-Borne Diseases

In addition to encephalitis virus surveillance, the District's laboratory conducts surveillance for other mosquito-borne diseases, such as Canine Heartworm, Malaria, Dengue, Chikungunya, Zika, and others. Canine heartworm is a filarial nematode (*Dirofilaria immitis*) primarily vectored in this region by *Ae. sierrensis*, the western treehole mosquito. The District's field technicians inspect all known sources of this species, but they may be very difficult to find, inspect and treat. In a wooded area there may be hundreds of hidden treeholes at many different heights. The District's laboratory conducts regular surveillance for *Ae. sierrensis* in its routine adult mosquito trapping.

Malaria is a mosquito-borne infectious disease, caused by a protozoan parasite and transmitted to people primarily by *Anopheline* mosquitoes. In Sacramento and Yolo Counties, there are two species that can transmit the malaria parasite: *An. freeborni* (the western malaria mosquito) and *An. punctipennis* (the woodland malaria mosquito). Malaria cases are reported to the District by the Sacramento and Yolo County Health and Human Services Departments. After receiving the report, the District laboratory responds by trapping mosquitoes in the area surrounding each malaria case. The captured mosquitoes are then brought to the laboratory for identification, and all female *Anopheline* mosquitoes are tested for malaria parasites. In 2021, the District received nine reported malaria cases, and in all of them the person had traveled outside of the United States. After the initial discovery of each malaria case and subsequent trapping and testing of any *Anopheline* mosquitoes captured, there was no evidence of additional transmission.

Dengue, chikungunya, and zika are also diseases caused by viruses transmitted to people by mosquitoes, specifically the invasive species; *Ae. aegypti* and *Ae. albopictus*. Whenever the District receives a report of a case, the laboratory initiates trapping for any of these invasive *Aedes* species around the reported location. Five dengue cases were reported to the District by the Sacramento County Health and Human Services Departments and all were related to travel outside of the United States. There were no mosquitoes of concern trapped near these reported cases.





Tick and Lyme Disease Surveillance

Lyme disease, caused by the bacterium *Borrelia burgdorferi*, is primarily vectored in Sacramento and Yolo Counties by the tick *Ixodes pacificus*, also known as the western blacklegged tick. The District's laboratory collects tick specimens from twenty fixed locations from November to April, using a technique called tick-flagging, where a flannel sheet is dragged along the side of a trail. The District also identifies tick samples brought to the laboratory by the public. Ticks are tested by polymerase chain reaction (PCR) with a specific primer and probe set for *B. burgdorferi*. Results are communicated to the surveillance locations and signs are posted to create public awareness of the potential presence of the Lyme disease agent and vectors in the area.



2021 LYME DISEASE SURVEILLANCE DATA

YOLO COUNTY	Total Ticks	Pools Tested	Positive Pools
Cache Creek – site 1	108	25	0
Cache Creek – site 2 (No site access 2021)	n/a	n/a	n/a
Camp Haswell	51	13	0
Putah Creek – site 1	9	6	0
Putah Creek – site 2	33	11	0
SACRAMENTO COUNTY	Total Ticks	Pools Tested	Positive Pools
Ancil Hoffman Park	22	7	0
Bannister Park	66	18	0
East Lake Natoma	232	48	4
Folsom Zoo Trail	6	4	0
Gold Lake Dr	72	18	0
Hinkle Creek Trail	9	7	0
Willow Creek - Humbug Trail	60	15	0
Lower Sunrise	30	12	0
Mississippi Bar	78	17	3
Negro Bar	165	35	1
Nimbus Dam	73	18	1
Sailor Bar	64	18	0
Snipes Park	264	56	1
Upper Sunrise	92	20	2
Willow Creek	417	85	6
TOTALS	1,851	433	18

Surveillance of Bees and Wasps

The District maintains honey bee swarm traps with swarm trap lures in locations which may give an early indication of arrival of the Africanized honey bees to our counties. The program currently consists of several locations in Yolo County and Sacramento County. No swarms of concern were noted in 2021.

The District's yellowjacket monitoring and control programs were established due to nuisance and safety issues associated with high yellowjacket populations. The program consists of trapping at different times of the year to target different populations of yellowjackets. In the spring, the District initiates apple juice-baited trapping to capture queens before nests can be established. In addition to queen traps, worker traps are set throughout the year. These are baited with heptyl butyrate as the attractant. These traps are set in numerous locations throughout Sacramento and Yolo Counties.

Identification of Arthropods of Public Health Significance

Mosquitoes are vectors of various diseases such as the ones mentioned above, while ticks serve as the main vectors of Lyme disease, Babesiosis and Ehrlichiosis among others, and fleas are potential vectors of the plague. Besides identifying mosquitoes and ticks collected through our surveillance program, our laboratory receives and identifies many other arthropods brought in by the public, such as ants, termites, springtails, mites, solitary and carpenter bees, long-horned beetles, honey bees, yellowjackets and other wasps, spiders, stored product pest beetles, moths, bedbugs, midges and other species of flies.

Pesticide Resistance Management

Pesticides play an important role in mosquito and vector control Integrated Vector Management (IVM) programs. We have to remain wary of resistance to pesticides, which may threaten the efficacy of our current control programs and allow the potential for new and reemerging vector-borne diseases. Therefore, our laboratory performs resistance testing on mosquito samples collected from areas of concern throughout both counties. In order to do that, our laboratory maintains mosquito colonies that have been tested and are susceptible to the active ingredients in the products used by our District. These susceptible reference colonies are used as comparison when testing mosquitoes collected from the field, following resistance testing protocols from the Centers for Disease Control and Prevention (CDC) and recommendations from the Mosquito and Vector Control Association of California.

Research and Special Projects

The laboratory is responsible for performing analyses of the effectiveness of ULV treatments in Sacramento and Yolo Counties. Bioassay cages with live adult mosquitoes and slide spinners that collect pesticide droplets for analysis are used to monitor select spraying events. In addition, our District is involved in many research projects that may directly affect some aspects of our operations, such as ongoing evaluation of control methods and products, and alternative materials and control methods. The District also works closely with researchers from academia and the industry sector on collaborative research projects involving the ecology of West Nile virus in California, effectiveness of treatments, pesticide deposition, evaluation of different products and formulations for mosquito control, and tick-borne diseases.

The District provides immature and adult mosquitoes from the colonies kept on its premises or wild-caught, upon request, to a variety of researchers from the National Institutes of Health (NIH), the California Department of Public Health (CDPH), the University of California, California State University, Industry sector, public schools, and other Mosquito Control Districts throughout the country.



Biological Control



Biological control elements are natural predators, parasites or pathogens that can be used to achieve desired reductions in pest population levels. The Fisheries Department is responsible for breeding mosquitofish and other fish species that prey on mosquito larvae. Mosquito-eating fish are readily available for the District's field technicians and to the general public through the service request program.

The District maintains 22 ponds which produce 2,500 to 5,000 pounds of fish annually. Today, the District is one of the largest mosquitofish producing facilities in the nation.

MOSQUITOFISH, *Gambusia affinis*

The most successful biological tool against immature mosquitoes in California is the mosquitofish, *Gambusia affinis*. When introduced to a mosquito breeding source, the mosquitofish quickly adapts, multiplies and becomes numerically capable of sustaining an effective control level.



The mosquitofish, a live-bearing American fish, is utilized as a predator of mosquito larvae in many diverse aquatic habitats throughout the world. A comparatively small species, the full-grown females are usually less than 2½ inches in total length, while males are typically under 1½ inches. The muted silver and light olive green body color is common to both sexes. In addition, they are able to lighten or darken their body color pigmentation to more closely match their immediate environment.

GUPPIES, *Poecilia reticulata*

The guppy, *Poecilia reticulata*, has been used for biological mosquito control since World War I. It has been introduced almost all over the world from the areas of tropical South America to which it is indigenous. In many areas, the guppy has provided good control of mosquitoes in highly polluted sources, such as sewage pools, dairy lagoons, chicken ranch ditches and slightly acidic sources. Unlike the mosquitofish, the guppy's ability to reproduce or control mosquitoes is not reduced by low levels of dissolved oxygen and thrive in areas where mosquitofish cannot successfully develop.



Biological Control Distribution

SYMVCD's state-certified mosquito and vector control technicians provided mosquitofish and guppies to residents of Sacramento and Yolo Counties free of charge.

BIOLOGICAL CONTROL DATA FOR 2021

RICE FIELDS STOCKED WITH MOSQUITOFISH

Number of Fields.....	155
Pounds of Fish*	2,238.8
Acres Stocked.....	9,659

WILDLIFE REFUGES AND DUCK CLUBS STOCKED WITH MOSQUITOFISH

Number of Fields.....	40
Pounds of Fish.....	609
Acres Stocked.....	2,633

SOURCES STOCKED WITH GUPPIES

Number of Sources	14
Pounds of Guppies.....	0.75
Acres Stocked.....	0.055

MOSQUITOFISH SUPPLIED TO TECHNICIANS

Woodland Facility.....	104
Elk Grove Facility	370.675

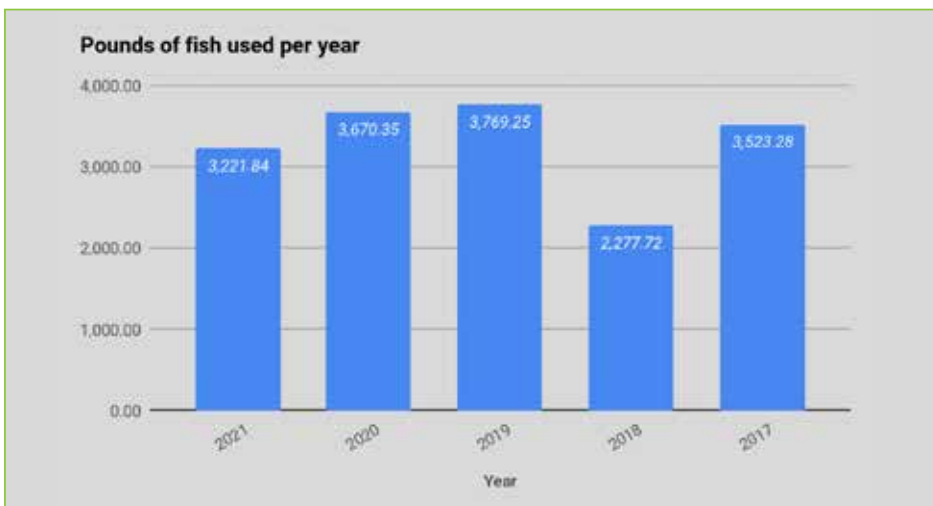
SUMMARY OF ALL MOSQUITOFISH PLANTS IN 2021

Number of Sources	3,187
Pounds of Fish.....	3,221.836
Acres Stocked.....	13,816.531

* 1 pound of fish equals approximately 450 fish.



A COMPARISON OF MOSQUITOFISH USED 2017-2021



Physical Control



The Ecological Management Department manages the physical and cultural control aspects of the District's Integrated Pest Management Program by actively pursuing opportunities to eliminate mosquito development sites. This is accomplished through the implementation of ecologically-based, site specific Mosquito Reduction Best Management Practices (BMPs) that reduce or eliminate the need for chemical control measures and initiates the abatement process in instances of continued Health and Safety Code section §2060 violations. The Department also provides assistance to all District departments on an as needed basis, including additional field and evening ULV applications.

MOSQUITO REDUCTION BEST MANAGEMENT PRACTICES (BMP) MANUAL

In 2021 The Ecological Management Department pursued landowner implementation of the Best Management Practices (BMP) as outlined in the District's Mosquito Reduction Best Management Practices Manual. This manual provided specific information regarding the District BMP policies, mosquito biology, and various BMPs that can be useful in reducing mosquito populations. Land-use specific sections provided guidance for landowners and land-managers who dealt with programs such as: managed wetlands, stormwater and wastewater systems, irrigated agriculture, rice production, dairies, swimming pools, cemeteries, and tire storage facilities. The Ecological Management Department provided detailed guidance to property owners on how to best implement the BMPs, and in some cases assisted with physical improvements. The BMP manual is available for download at: www.fightthebite.net/programs/ecological-management/.

The BMP manual serves as the basis for all Ecological Management Department programs which fall under four main BMP categories. All projects strive to reduce or eliminate mosquito breeding in Stormwater, Managed Wetlands, Agriculture, or Urban and Industrial sources. Technician zone project requests remain a Department priority; however environmental and regulatory development policies have also become a driving force of project and planning development.

ECOLOGICAL MANAGEMENT PROJECTS IN 2021

The Ecological Management Department handled twenty individual work requests in addition to eleven annual mowing projects. The mowing projects are designed to improve site access for the technician and in many cases provide the necessary base maintenance required for the property owner to continue the required maintenance for the remainder of the year. Each work request was evaluated for implementation of BMPs as outlined in the District Mosquito Reduction Best Management Practices Manual. Landowners were contacted and worked directly with the Department to reduce standing water, mosquito breeding, improve mosquito control product efficacy, and ensured safe technician access. A few sites required the District to perform access projects involving removal of brush and debris to secure safe access to mosquito sources. These mowing and access projects were designed to keep access routes open for mosquito control operations around dairies and other water sources. All projects improved cooperative relationships and site conditions that resulted in mutually acceptable courses of action while upholding the District's responsibilities to protect public health.



PLANNING REVIEW PROGRAM

In 2021, the Ecological Management Department reviewed sixteen development projects from cities, counties, federal and state agencies, requesting the District to offer comments relating to mosquito production. The Department evaluated each plan or project for areas of concerns, and responded to the appropriate agencies with comments where appropriate.

STORMWATER/DRAINAGE PROGRAM

The Department's Stormwater Program continues to monitor the various types of storm water conveyance and treatment facilities. In addition to new development issues, The Department continued to address drainage blockages, access issues associated with dense riparian or vegetated stream banks, and upland mosquito breeding within drainage corridors. Department staff responded to multiple West Nile virus hotspots near stormwater conveyance or stream corridors in 2021.

Flooding due to beaver dams has been an on-going problem for several years and causes significant mosquito breeding development sites to form in flooded pastures or other nearby dry grassy land. While direct population reduction methods (e.g. depredation) are the standard for beaver control, the Ecological Management Department utilizes an integrated approach to reducing the mosquitoes associated with beaver activity. Regular inspection and removal of beaver dams by hand or with equipment is typically the first approach. Due to lower spring and summer flows, beaver issues remained at a minimum for the 2021 season; however existing Clemson Pond Leveler (CPL) leveling devices and known areas prone to flooding were maintained in various locations to help manage any pulse flows to keep water contained in existing low flow channels.

The Ecological Management Department worked closely with numerous Federal, State, and local Agencies to remove blockages and vegetation to prevent water from backing up into areas where mosquito breeding would occur.

MANAGED WETLAND PROGRAM

The practice of flooding previously dry land, during the early fall season for the purposes of attracting waterfowl for conservation and recreational purposes creates favorable mosquito development habitat. High temperatures may promote rapid mosquito development as well as amplification of some vector-borne viruses (e.g. West Nile Virus). In addition, dense emergent vegetation and relatively slow speed of flooding during the fall may also increase the numbers of mosquitoes produced, and impede the success of other mosquito control practices such as the use of larvicides and mosquito fish. The District works throughout the year with public and private landowners of waterfowl hunted and other preserved properties to implement BMPs that will reduce mosquito breeding or enhance mosquito control activities during major water events such as early flooding. The District meets annually with wetland managers to develop annual management plans and to coordinate all irrigation and flooding activities.

Staff participated in multiple stakeholder meetings over the year on a variety of local and statewide policy, restoration and wetland management concerns. In addition to promoting the implementation of BMPs, the Department administered the tiered fall flooding cost share program designed to discourage early flooding prior to October 1st of each year.

In 2021 eleven private and agency owned wetland properties were flooded prior to October 1st and where appropriate, were billed for mosquito control costs under the cost share program. The wetland program requires a significant amount of staff time to properly monitor and respond to site changes that zone technicians experience on a weekly basis throughout the season. Wetland managers routinely request advice from the Ecological Management Department to assist with maintaining their habitat goals while reducing mosquito production.

2021 WETLANDS MOSQUITO CONTROL COST SHARE PROGRAM

FLOODING STARTED ON OR AFTER DATE	PERCENT OF MATERIAL COSTS TO BE PAID BY LANDOWNER UP TO OCTOBER 7 TH
Summer-September 17	100%
September 17	50%
September 24	25%
October 1	none





AGRICULTURE PROGRAM

The Department responded to seven technician requests to reduce standing water or improve access in or around irrigated agricultural lands. Often off-site drainage issues are resolved by reducing irrigation runoff, and encouraging sound BMP implementation as outlined in the District's BMP Manual. The department provided spring time mowing of key agricultural sumps and access roads and organized wintertime brush cutting projects to enhance District technician safety and product efficacy. The Department continued to develop and implement the UAS mapping and topographic modeling of agricultural fields and drainages..

URBAN / INDUSTRIAL PROGRAM

Staff inspected most cemeteries within the District on a routine basis using clear siphons as the preferred inspection method. No major violations were noted with minor issues being resolved with brief site meetings with cemetery management. Most Managers were able to treat their vases with Watersorb with the Department helping with the applications where necessary.

PROPERTY ACCESS AND UNMAINTAINED SWIMMING POOL ENFORCEMENT PROGRAM

The District's swimming pool enforcement program involves the Department making numerous attempts to contact pool owners to gain access for the purpose of treating the pool with mosquito larvicides and mosquito fish that offer long term mosquito control. Within this program, District policies direct the Ecological Management Department to pursue legal access and enforcement when all other communication attempts have failed. The Department responded to thirty pool access and enforcement requests from zone supervisors. While most pool entry requests were resolved by contacting the property owners, twenty five Final Notices were still sent via US certified Mail. The Final Notice letter typically resolves the access issue; however access can sometimes only be gained with the use of a Search and Inspection Warrant. In 2021, fourteen Inspection and Abatement Warrants were granted to the District by the Sacramento County Superior Judge, with only ten being served in conjunction with local Law Enforcement Agencies.

UAS (DRONE) PROGRAM

The District's Unmanned Aerial Systems(UAS) program consists of four FAA Licensed UAS pilots, five imaging UAS units, and two heavy lift larvicide application units. The program provides aerial imagery, precision mapping, surveying, wind speed monitoring, BMP project design analysis, topographic modeling, and UAS based mosquito control applications and support. The Department works closely with the FAA to conduct safe and legal flights throughout the District, and holds numerous airspace and flight waivers.

Departmental staff conducted more than fourteen individual imagery flights for a variety of operational needs including the mapping of standing water, aerial treatment block design, fall flooding documentation and topographic modeling for BMP projects with additional analytical support provided by the GIS Department.

In addition to conducting imagery missions, the Department also coordinated pesticide applications over four thousand eight hundred and eighty two acres utilizing a private UAS contractor. Applications were conducted using granular larvicides over flooded pastures, organic rice fields, fall flooded wetland areas, and rural riparian areas.

The Department partnered with a variety of stakeholders to test new UAS technologies over the course of the year, including the use of LiDAR sensors to help determine the actual footprint of flooded areas. The District conducted flights and software analysis to test technologies that may provide beneficial to District operations if implemented. Staff participated in multiple continuing education events and conferences regarding the use of UAS technologies in mosquito control and will continue to be involved with industry venues as they become available.



Microbial & Chemical Control

Microbial and chemical control are the use of specific microbials and chemical compounds (insect growth regulators and insecticides) that eliminate immature and adult mosquitoes. They are applied when biological and physical control methods are unable to maintain mosquito numbers below a level that is considered tolerable or when emergency control measures are needed to rapidly disrupt or terminate the transmission of disease to humans. Larvicides target immature mosquitoes. Adulticides are insecticides that reduce adult mosquito populations. All products applied by the District are registered with the California Environmental Protection Agency.

MOSQUITO AND VECTOR CONTROL OPERATIONS

The Sacramento-Yolo Mosquito and Vector Control District provides year-round mosquito and vector control services to the residents of Sacramento and Yolo Counties. The two counties combined comprise 2,013 square miles of urban, commercial and agricultural land. The District is divided into 27 geographical zones, with state-certified technicians responsible for all aspects of mosquito and vector control in each zone, from larval surveillance to treatment.

The primary goal of field technicians is to manage mosquito populations so they do not pose a significant health risk to the public. To achieve this, field staff conduct year round inspections of various types of mosquito breeding sources. When breeding sources are found, the technicians will apply a larvicide or mosquitofish to take care of the problem. When WNV activity or high abundance numbers are detected in any given area, technicians conduct ground treatments with truck mounted foggers and back packs in order to quickly reduce adult mosquito populations. When WNV activity is spread over large urban areas, aerial applications may also be conducted in order to protect public health. Aerial spraying over known agricultural sources that produce mosquitoes are also performed in order to reduce nuisance mosquitoes and/or respond to WNV activity.

Technicians respond to year-round home service requests which include general inspections, treating neglected swimming pools, delivering and stocking mosquitofish where they are needed, and looking for and treating yellowjacket.

Control operations staff work closely with all other District departments. Field technicians assist with education and outreach efforts by participating in community events and giving classroom presentations. They support the Laboratory surveillance program by picking up dead birds and collecting larvae. They lend a hand to the Ecological Management program by completing brush cutting projects and ditch cleaning whenever necessary. Staff also update zone work books, calibrate field vehicles and winterize all necessary equipment.

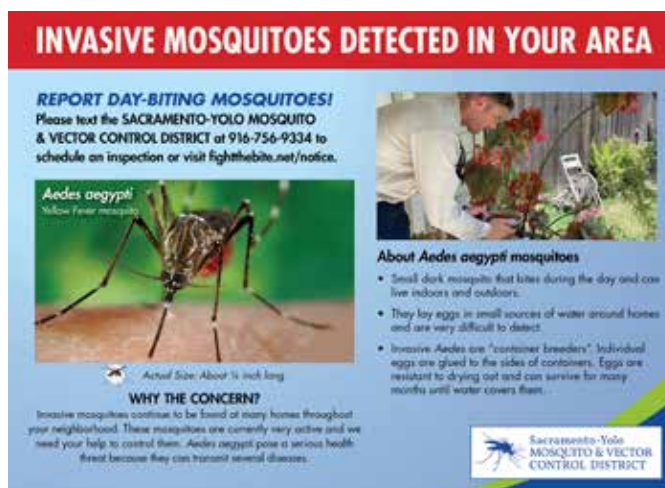
The District's primary goal is to protect public health by managing immature and adult mosquitoes so they do not present a significant health risk to our community. In the event mosquito populations pose a threat or become a significant public nuisance, the District will respond by implementing its Mosquito and Mosquito-borne Disease Management Plan. This plan has been approved by the District's Board of Trustees. The following page outlines the District's response plan.





DETECTION OF INVASIVE Aedes Aegypti MOSQUITOES

In September 2021 Yolo County had its first detection of the invasive mosquito, *Aedes aegypti*, when a gravid trap set by the District laboratory captured an invasive mosquito in the city of Winters. After significant surveillance, an extensive infestation of invasive mosquitoes was detected throughout the city. Immediately, field technicians conducted public outreach and an intense door to door campaign, canvassing the entire town looking for mosquito breeding sources. After finding both immature and adult mosquitoes breeding in multiple locations, a control plan was put into place that included many localized treatments to backyards as well as truck mounted larviciding and adulticiding. A few weeks after the initial detection of invasive mosquitoes in Winters, *Aedes aegypti* were also found in the Arden Area of Sacramento County. Field technicians responded with outreach, extensive door to door inspections, and ongoing mosquito control treatments in this new detection site. The last time *Aedes aegypti* mosquitoes were detected within District boundaries was in November.



MOSQUITO AND MOSQUITO-BORNE DISEASE MANAGEMENT PLAN

Level I – Normal Season

The District performs routine mosquito, mosquito-borne disease and public health pesticide efficacy surveillance activities. The District also attends community events, provides presentations and distributes outreach material to various community organizations.

Level II – Positive Dead Birds and/or Mosquito Pools

Response is initiated when the District's Laboratory detects a mosquito-borne virus [i.e., West Nile virus (WNV), Western Equine Encephalomyelitis (WEE), St. Louis Encephalitis (SLE)] in mosquito pools or dead birds within the District's boundaries.

Level III – Positive Sentinel Chickens/Animals

A response is initiated when the District's Laboratory detects a seroconversion to a mosquito-borne virus (i.e., WNV, WEE, or SLE) in a sentinel chicken(s) or when the District is notified of a mosquito-borne infected horse or other animal within the District's boundaries.

Level IV – Positive Human Case

A response is initiated when the Sacramento/Yolo County Public Health Laboratory officials notifies the District that a human has locally acquired a mosquito-borne virus (i.e., WNV, WEE, SLE) disease within the District's boundaries.

Level V – Multiple Human Cases, Epidemic Conditions

A response is initiated when County Public Health Laboratory or CDPH officials notifies the District that multiple mosquito-borne virus (i.e., WNV, WEE, or SLE) infections have occurred in humans within a specific area or there is evidence that epidemic conditions exist. The epidemic area is defined as the geographic region in which human cases are clustered (incorporated city, community, neighborhood, or zip code).



CATCH BASIN PROGRAM

The Catch Basin Program was formed in 2005 to address the high volume of catch basins in Sacramento and Yolo counties and the potentially disease-spreading mosquito that prefers to breed in them: the *Culex pipiens*. A catch basin is a chamber, well, or inlet designed to collect water from storm events and urban runoff while also collecting debris to prevent the clogging of sewer systems. The Catch Basin Program's technicians monitor and treat over 300,000 storm drains each year, many of which are only a few feet in front of a residence or place of business and are capable of producing thousands of mosquitoes in a single day.

In 2021, the department began using a custom mobile application made in-house to inspect, treat, and aggregate data for better managing catch basin information. The crew carried out two concurrent, season-long larvicide efficacy trials in over 50 catch basins, monitoring mosquito emergence and collecting water samples weekly. This year also marked the arrival of several right-hand drive Jeeps for department use. The Jeeps eliminate the need for two technicians working in one vehicle together and allow for an efficient distribution of manpower in the field. They were outfitted with rear bike mounts by our shop mechanics, making them an all-in-one solution for accessing catch basins in any area.



SWIMMING POOL PROGRAM

In 2021, the swimming pool program continued to be a large focus of the District's urban larval control efforts. Stagnant water in swimming pools was a major concern as one pool alone can produce thousands of mosquitoes and put an entire neighborhood at risk for West Nile virus. Many neglected pool reports came from the general public as well as from aerial images.



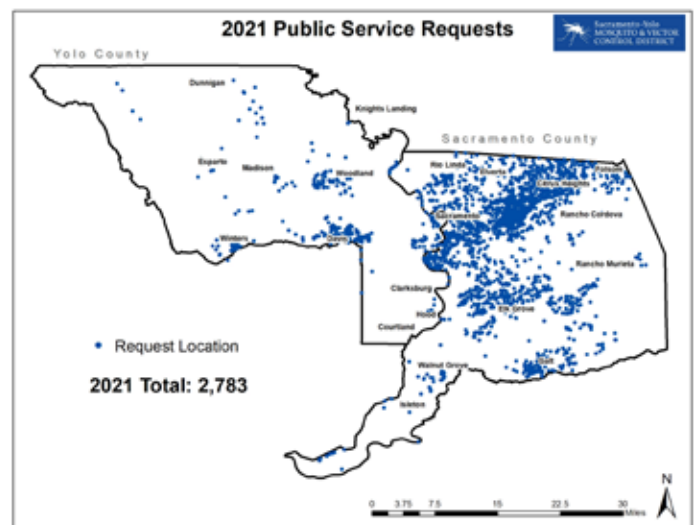
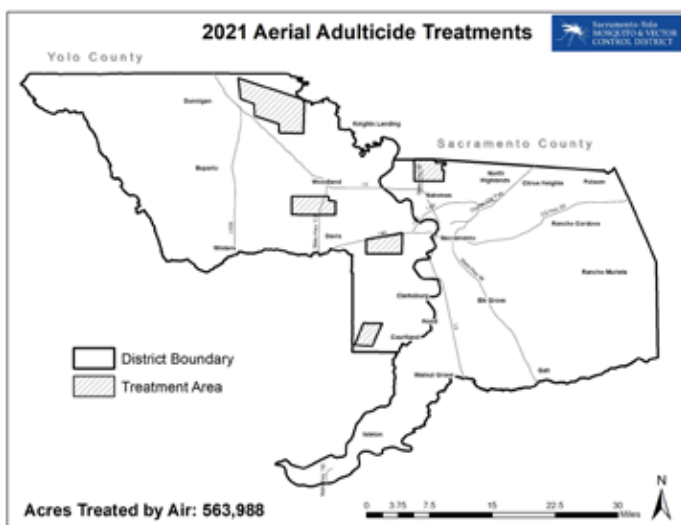
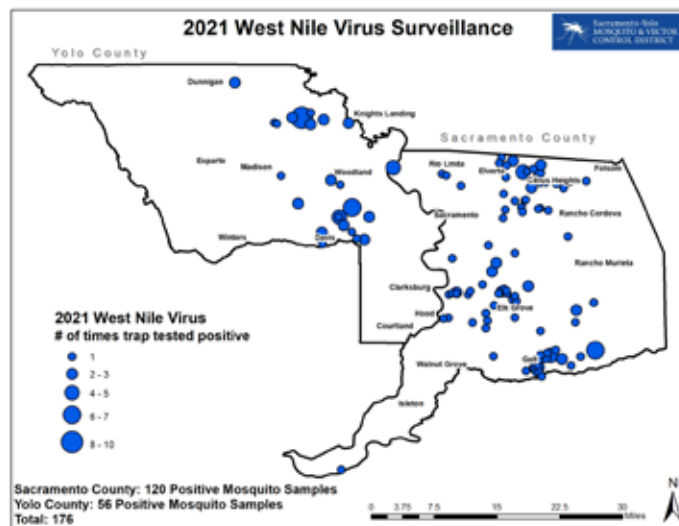
2021 MATERIALS USAGE

LARVICIDE MATERIALS	ACRES TREATED	AMOUNT OF MATERIAL	NUMBER OF APPLICATIONS
Agnique MMF	1.8	1.8 gal	134
Agnique MMF G	<1	3.8 lbs	21
Agnique MMF G Pak35	<1	1 lb	14
Altosid Briquete	<1	2 lbs	46
Altosid Liquid and Liquid Concentrate	953	8 gal	593
Altosid P35	1,203	6,830 lbs	638
Altosid Pellets	<1	2.8 lbs	11
Altosid XR Briquets	<1	42 lbs	160
Altosid XR-G	3,708	21,971 lbs	172
Lambda 9.7 CS	11.4	3.1 gal	401
Mosq oil BVA2/Cocobear/Kontrol	150	680 gal	617
Natular DT	<1	<1	21
Natular G30	2,345	12,164 lbs	804
Natular G30 WSP	2.2	44 lbs	289
Natular XRT	1.8	62 lbs	401
Natular2EC	1,246	15 gal	563
OneGuard	3	1 gal	127
Sumilarv 0.5G	1.6	33 lbs	243
Suspend Polyzone/SC	16	4.1 gal	335
Vectobac 12AS	20,329	1,843 gal	2,240
VectoBac GR	10,550	53,095 lbs	235
VectoBac GS	107,675	539,684 lbs	1,539
Vectobac WDG	11,353	2,752 lbs	112
VectoMax FG	297	3,059 lbs	179
Vectomax WSP	56	129 lbs	1,176
Vectoprime FG	10,678	54,673 lbs	162
LARVICIDE MATERIALS CATCH BASIN	BASINS TREATED	AMOUNT OF MATERIAL	NUMBER OF APPLICATIONS
Agnique MMFG DWSP	524	37 lbs	524
Altosid Briquets	439	5.2 lbs	439
Altosid Pellets WSP	6,504	100 lbs	6,504
Altosid XR-B	27,570	2,218 lbs	27,570
Natular G30 DWSP	8,073	89 lbs	8,073
Natular XRT	41,178	3,631 lbs	41,178
Sumilarv 0.5g	32,786	1,457 lbs	32,786
Vectomax FG DWSP	7,210	80 lbs	7,210
Vectomax WSP	13,944	309 lbs	13,944
ADULTICIDE MATERIALS	ACRES TREATED	AMOUNT OF MATERIAL	NUMBER OF APPLICATIONS
Organophosphates (Naled)	265,446	1,266 gal	35
Pyrethrins	299,327	1,842 gal	44
Deltamethrin (Adult Mosquito)	77,568	408 gal	750
YELLOWJACKET CONTROL MATERIAL	AREA TREATED	AMOUNT OF MATERIAL	NUMBER OF APPLICATIONS
Drione	1	18	183
PT 565+ XLO	<1	<1	48

Geographic Information Systems & Information Technology

In 2021 the GIS Department recorded mosquito control treatments to 827,447 acres, which included 19,703 known mosquito breeding sources, 204,689 catch basins, 2,783 requests for service from the public, and 28,554 acres of rice. Besides the EPA registered products, mosquito eating fish were used in 13,817 acres of mosquito breeding habitat. The GIS Department provides spatial analytics, data visualization and implements multiple software platforms to evaluate and improve District operations.

The IT Department is responsible for aligning existing and future District goals with cost-effective scalable technology solutions. The Department maintains servers, wired and wireless networks and equipment, workstations, mobile devices, laptops and projectors for District meetings and public presentations. It also oversees web-based database programming, software and peripherals, as well as a virtual private data network and VoIP phone system connecting offices in Elk Grove and Woodland. Each field technician is equipped with truck-mounted laptops with mobile data and custom GIS software.



Administration

The tasks of the administrative personnel of the Sacramento-Yolo Mosquito and Vector Control District involve serving the residents of Sacramento and Yolo Counties as well as the employees of the District. Some of the many duties performed by the department include financial accounting, coordinating the annual audit, accounts payable/receivable, administering staff training programs, maintaining public records, responding to telephone inquiries and reporting to the Board of Trustees. The department strives to provide quality professional service to the public and the employees of the District.

CONTINUING EDUCATION

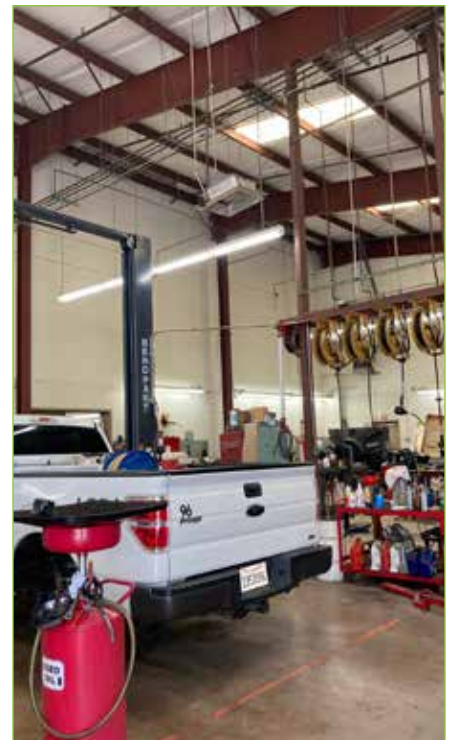
The District employs vector control technicians certified by the California Department of Public Health. Certificates are renewed every two years after established continuing education requirements are met. The Administrative Department tracks employees' continuing education units and helps organize the District's regional continuing education programs and workshops.



Shop

The District employs three Automotive Service Excellence–certified mechanics at the Elk Grove facility. The shop maintains 105 vehicles, 3 forklifts, 3 Argo all terrain vehicles, 18 quad-runners, 4 John Deer Gator utility vehicles, 11 utility trailers, 2 low bed trailers, 2 Wheel Tractors, 1 backhoe tractor, 1 case skid steer tractor, 17 London ULV Foggers, 7 Curtis Dyna foggers, 6 Longray electric backpack sprayers, 2 turbine sprayers, 1 Cobra turbine sprayer and 1 Acrease 57" mower.

The shop is also responsible for repairing and installing various types of equipment, including chainsaws, pole saws, weed eaters, hand cans, edge-trimmer, backpacks, spray guns, lab traps, pumps, and other items in need of repair.



Financial Statements

Sacramento–Yolo Mosquito & Vector Control District

Statement of Net Position June 30, 2021

		GOVERNMENTAL ACTIVITIES
ASSETS		
Cash and investments	\$	14,877,280
Restricted cash		23,447
Cash with fiscal agent		1,665,077
Accounts receivable		657,432
Other receivable		133
Interest receivable		8,352
Inventory		1,347,050
Capital assets, net of accumulated depreciation		4,021,318
Total Assets	\$	22,600,089
Deferred outflows of resources		
Related to net other post employment benefits (OPEB) liability		889,066
Related to net pension liability		4,520,441
Total Deferred Outflows of Resources	\$	5,409,507
Total Assets and Deferred Outflows of Resources	\$	28,009,596
LIABILITIES		
Accounts payable and other accrued liabilities	\$	364,953
Compensated absences		
Due within one year		201,176
Due in more than one year		194,819
Net other post employment benefits (OPEB) liability		
Due in more than one year		1,436,704
Net pension liability		
Due in more than one year		11,345,645
Total Liabilities	\$	13,543,297
Deferred inflows of resources		
Related to net other post employment benefits (OPEB) liability		491,114
Related to net pension liability		2,046,550
Total Deferred Inflows of Resources	\$	2,537,664
Total Liabilities and Deferred Inflows of Resources	\$	16,080,961
NET POSITION		
Net investment in capital assets	\$	4,021,318
Unrestricted		7,907,317
Total Net Position	\$	11,928,635
Total Liabilities, Deferred Inflows of Resources and Net Position	\$	28,009,596

Sacramento-Yolo Mosquito & Vector Control District

Statement of Revenues, Expenditures and Changes in Fund Balance

FOR THE YEAR ENDED JUNE 30, 2021

	GENERAL FUND	
REVENUES		
Property taxes	\$	15,638,905
Interest		73,947
Other tax revenue		1,085,511
Other revenues		161,447
Total Revenues	\$	16,959,810
EXPENDITURES		
Aircraft services		836,632
Auditing/Fiscal		16,000
Capital outlay		289,813
Communications		77,318
Control operations		38,467
District office expenses		14,509
Ecological management		7,401
Fisheries		25,508
Gas and petroleum		141,281
Geographic information systems		2,900
Information technology		76,127
Insecticides		608,213
Insect growth regulator		887,394
Laboratory services		160,232
Liability insurance		167,211
Materials and supplies		11,426
Member/Training		58,712
Microbial		940,994
Professional services		148,018
Public information		376,685
Research		20,000
Rents and leases		10,187
Safety program		1,560
Salaries and benefits		8,478,911
Structure and grounds		86,878
Utilities		102,623
Vehicle parts and labor		114,544
Total Expenditures	\$	13,708,544
Change in Fund Balance		3,251,266
Fund Balance - July 1, 2020		14,883,232
Prior Period Adjustment		79,320
Fund Balance - July 1, 2020, restated		14,962,552
Fund Balance - June 30, 2021	\$	18,213,818



**Sacramento-Yolo
MOSQUITO & VECTOR
CONTROL DISTRICT**

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8631 Bond Road
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Hours: 7:00 am to 3:30 pm

Yolo County
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