

# Protecting Public Health since 1927



2012

annual  
report



CONTRA COSTA  
**MOSQUITO  
& VECTOR  
CONTROL**  
DISTRICT

protecting public health since 1927

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## *Healthy people...*

who can live, work, and play in a healthy environment is the vision of the Contra Costa Mosquito & Vector Control District.

The District exists to reduce the risk of vector-borne disease or discomfort to the residents of Contra Costa County. Besides being nuisances by disrupting human activities including the use and enjoyment of public and private areas, certain insects and animals (vectors) may transmit a number of diseases. Most vectors are extremely mobile and cause the greatest hazard or discomfort away from their breeding site. Each potential vector has a unique life cycle and occupies a specific habitat. In order to effectively control these vectors and their related disease(s), the District employs an integrated vector management program. There are seven key elements required to deliver a successful control program for infectious or vector-borne diseases: workforce, laboratory, vector ecology and surveillance, information systems, communication, policy and evaluation, and preparedness and response. The following pages explain these elements in more detail with highlights of activities for the year 2012.

### **Programs & Services**

**Most District programs and services are funded by tax dollars and are therefore provided at no charge.**

#### **Mosquitoes**

Our county's diverse ecological regions create a range of mosquito sources. The District regularly surveys more than 10,000 acres of marshland along the waterfront, acres of irrigated farmland in the eastern county, and numerous ponds, creeks, and residential sources countywide. Upon request for service, the District will inspect your property for mosquito problems and provide advice on controlling their populations. With 23 kinds of mosquitoes inhabiting a variety of water sources, we can determine where to look if the homeowner or caller provides our District employee with a mosquito sample. Simply swat and kill a mosquito (try not to squish it too much) and save it or tape it to a piece of paper for the District employee. Mosquitoes can transmit a variety of diseases including West Nile virus.

#### **Mosquitofish**

**FREE** mosquitofish are available for private ponds, horse troughs, non-maintained swimming pools and spas, rain barrels, and more. Mosquitofish can eat up to 500 mosquito larvae per day.

#### **Rats & Mice**

Homeowners, business owners or any group in Contra Costa County can request a site visit to assist them with rodent issues. District services include identification of rodent problems (rodent need not be present) and advice for prevention and control. A detailed report is issued. District employees do not bait nor set traps, but provide valuable, detailed information, guidance, and recommendations. Rats can transmit various diseases through contamination from their droppings and urine.

#### **Skunks**

In an effort to reduce the incidence of rabies by suppressing skunk populations, the District works with homeowners to discourage skunks from visiting their property. District employees survey properties, provide guidance and recommendations, and may loan live-catch skunk traps.

#### **Yellowjackets**

The District provides extermination of ground-nesting yellowjackets only. Simply locate the nest and call the District for service. The nest's location must be identified and the location shared with District employees. This can be achieved by drawing a map, pointing a garden tool, or identifying the site with a marker (red sock, garden glove, etc.). Yellowjackets are beneficial insects that eat garden pests and pollinate crops through daily foraging; however, if aggravated, they can sting repeatedly and painfully and their stings can be dangerous for those people allergic to their venom.

#### **Ticks & Lyme Disease**

The District surveys public parks and other areas for the ticks that transmit Lyme disease. The District also provides tick identification services to the public and doctors. People who are concerned about possible Lyme disease infections should contact their physician. Information on Lyme Disease testing on ticks may be found at [Lyme Disease Q & A](#). Several commercial laboratories will test ticks for Lyme disease for a fee. Visit [Tick Testing Labs](#) for more information.

#### **Public Information & Education**

The Public Affairs Department staff work closely with residents and the media to inform and educate about important health topics. Staff provide general and tailored presentations to various groups and school children of 12 or more people. District personnel also participate in social media interaction, a variety of events, workshops, and community discussions.

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# Principles

## Vision

Healthy people who can live, work, and play in a healthy environment.

## Mission

To protect and promote public health and welfare through Integrated Vector Management services and programs utilizing best management practices and least toxic components by:

### Community Value

Providing essential services to prevent, detect, and suppress public health pests, and to reduce the risk of vector-borne disease transmission to the people who live, work or play within the county

### Service Area

Serving all of Contra Costa County

### Public Confidence

Delivering accessible, accountable, efficient, transparent and cost effective services

### Public Relations

Working closely with all constituents, private and public, to ensure prompt delivery of accurate information, to raise public awareness, and to develop relationships that promote healthy living

### Environmental Commitment

Meeting or exceeding, federal, state, and local environmental standards, practicing responsible environmental stewardship, enhancing value of wetlands, and considering relevant environmental factors as an integral component of mosquito and vector control

### Research

Investigating environmental concerns and developing and/or testing new materials, methods and technologies to ensure quality control oversight on all services and programs, while anticipating resurgent and/or newly introduced vectors or vector-borne diseases

### Interagency Relations

Integrating and communicating District programs and services with other public agencies to ensure cooperative, cohesive, and innovative program delivery

## History

Contra Costa County encompasses some of the most diverse environments found in one area. This wide range of environments makes our county one of the most desirable places to live in Northern California. The Contra Costa Mosquito & Vector Control District plays a vital role in maintaining this environment while protecting the residents from insects and animals that can carry disease. The District helps to ensure Contra Costa County remains a great place to live where people can enjoy the outdoors.

As early as 1772, hordes of mosquitoes welcomed the first Europeans as they explored the San Francisco Bay Area. Interestingly enough, the diary of the expedition mentioned seeing few signs of "heathens." The Native Americans were smart enough to avoid the mosquito infested area.

More than 100 years later, thousands of men were dying of an unknown illness while working on the construction of the Panama canal. It was in the late 1800s that Dr. Walter Reed and Associates identified mosquitoes as the vector (carrier) of malaria and yellow fever. This discovery was not only important to the workers of the canal, but to Californians because some of them had contracted malaria. Not only were mosquitoes a nuisance, they carried diseases as well.

In California, mosquito abatement activities in the early 1900s focused on controlling the mosquito that carries malaria and reducing the numbers of nuisance salt marsh mosquitoes. Before 1915, mosquito control in the state was financed by subscription and donation. In 1915, a bill was passed through the State Legislature and signed by the governor that provided for the formation, organization, and financing of mosquito abatement districts. Noble Stover, manager for both Marin County Mosquito Abatement District and Three Cities Mosquito Abatement District in San Mateo County coauthored the Act.

Quite often, schools in Contra Costa County had to be closed, waterfront industry was periodically shut down, and recreational areas were abandoned, all due to salt marsh mosquitoes, a severe nuisance mosquito. Periodically, citizens of Pittsburg lined the street curbs with smudge pots in an attempt to drive the mosquitoes away. Realtors found it difficult to attract home buyers into mosquito-infested neighborhoods. So, the citizens of Contra Costa County, together with several waterfront industries, formed a committee in 1926 to address the need for mosquito control.

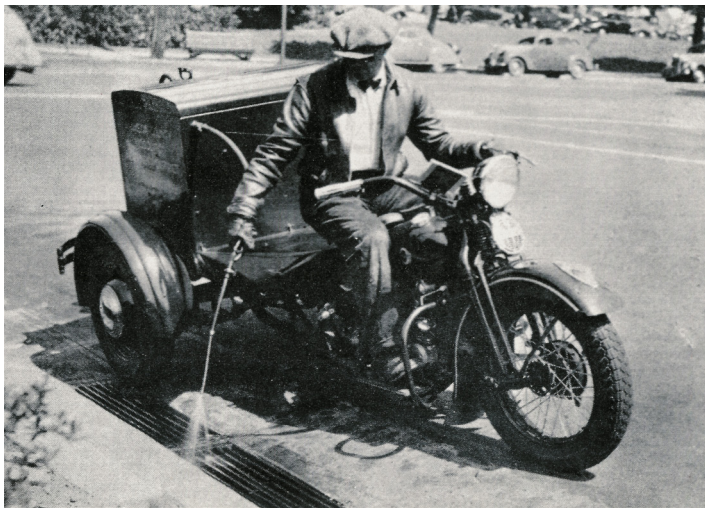


In 1926, Stover responded to requests from Contra Costa County and directed the first operations of Contra Costa Mosquito Abatement District (CCMAD #1), concurrently with his duties in Marin and San Mateo Counties. The purpose of the District was to control marsh mosquitoes in north central Contra Costa County. CCMAD #1 was formed and work began on April 15, 1927. The District, with two employees, began various engineering projects near the cities of Martinez, Concord, and Pittsburg. Much of the work was contracted out to dredging and construction companies. Stover was a pioneer in drainage and engineering methods, which were his primary approaches to controlling salt marsh mosquitoes. Many of those early projects still exist and are functional now more than 80 years later. Stover served as manager/engineer for CCMAD #1 until his death on September 17, 1935. Ernest Campbell, who had worked for the District since its inception, was appointed manager/engineer by the Board of Trustees upon the death of Stover.

In the summer of 1930 there was an outbreak of a horse plague in the San Joaquin Valley that resulted in the death of 3000 horses. In 1933, it became known that mosquitoes could transmit what is now called Western equine encephalomyelitis (WEE). This virus was isolated from the brain of a dead child in 1938. Human cases of another virus, St. Louis encephalitis (SLE), were isolated in California in 1938 as well. Before the early 1940s, people thought that it was only the *Aedes* mosquitoes that transmitted disease. In 1941, *Culex tarsalis* was found to transmit the encephalitis virus.

In its early years, CCMAD #1 relied primarily on engineering methods of control such as creating ditch networks, dredging, building or repairing levees, installing tide gates and pumps. In 1927, the District contracted with Delta Dredging Company to excavate ditches at the cost of \$5 per hour. The District supplemented the program by spraying standing water with light oil, such as stove or diesel oil to kill the mosquito larvae. They also stocked various sources with mosquitofish.

Until 1941, the District's jurisdiction only covered the waterfront and marsh areas from Martinez to Antioch. On November 25, 1941, the communities of Saranap, Danville, and the City of Walnut Creek petitioned the CCMAD #1 Board of Trustees, requesting annexation into the District. Annexation took place on December 19, 1941. In November 1943, CCMAD #1 annexed



*Mosquito Spraying in Contra Costa County. Date unknown.*

the area comprising the Lafayette and Orinda School Districts upon their request. Oak Grove School District was annexed in July 1946 upon their request. In the midst of these events, Ernest Campbell, while serving as District manager/engineer for CCMAD #1, helped found and manage Northern San Joaquin Mosquito Abatement District.

Other portions of Contra Costa County were also in need of mosquito control, which led to the formation of CCMAD #2, CCMAD #3, and Antioch-Live Oak MAD. Under the leadership of Ernest Campbell and the Board of Trustees, CCMAD #1 merged with Antioch-Live Oak MAD, CCMAD #2, and CCMAD #3 in December of 1952. As of January 1953, CCMAD #1 provided mosquito control for the communities of Orinda and Port Costa in the west to the Antioch-Live Oak school District in the east, an area of 509 square miles.

Mosquito control was established in the eastern portion of Contra Costa County by the formation of the Diablo Valley Mosquito Abatement District (DVMAD) in 1952. The Diablo District was 136 square miles in size and encompassed the communities of Oakley, Brentwood and Byron. The Diablo District's headquarters was located in the community of Brentwood. The primary purpose of creating DVMAD was for the control of pasture and irrigation mosquitoes.

Diablo Valley MAD came into existence in time for the largest human outbreaks of WEE the State had experienced. In 1952, there were 375 human cases of WEE and 45 human cases of SLE in California. There were eight reported human cases of WEE in Contra Costa County that same year. In the 1940s and 1950s, with the introduction of broad spectrum chemicals such as DDT the District changed to other strategies to control mosquitoes in the county. A "flit gun" was used to create a pesticide fog to kill adult mosquitoes. Jeeps were used to gain access to hard-to-reach areas and aircraft were used to spray large areas that were producing mosquitoes. The first entomologist, James Mallars, was hired in 1952. The District also expanded its focus from the marshes and began treatment of creeks in the county. In 1956, the District treated 1080 miles of creek at a cost of approximately \$5.10 per mile. By the late 1950s, the District began to see mosquitoes developing resistance to DDT.

From 1945 to 1957, CCMAD #1 retained a commercial telephone answering service, utilized part-time secretarial service, owned limited yard facilities for automotive and other equipment, and raised mosquitofish on Berrellessa Street in Martinez. In 1955, the District purchased approximately one acre of land on Concord Avenue in Concord and embarked on building its new headquarters, which opened in January 1957. Prior to that time, the District office was located in the various managers' homes from 1927 until 1957. The Board of Trustees held their board meetings at one of the local oil refineries until the completion of the new headquarters.



*Mosquitofish rearing. Date unknown.*

## Timeline

In April of 1955, CCMAD #1 expanded its program to include fly control. Contra Costa County in the 1950s was primarily a rural county with commercial rabbitries, poultry ranches, stables, cattle ranches, and orchards. This was the first time CCMAD #1 officially sought to control a disease vector other than mosquitoes. On occasion, the District would also remove or destroy bee hives.

In 1959, the employees joined the County Employees Association. From that date to the present, field employees of the District have been represented by Associations or Public Employee Unions.

In the 1960s, in response to DDT resistant mosquitoes, CCMAD #1 switched to organophosphate pesticides as the primary method for control of mosquitoes. By the 1970s, mosquitoes were beginning to show resistance to these pesticides as well.

Contra Costa County had its most recent reported human cases of SLE in 1967 and WEE in 1968. The District continued an active source reduction program into the 1970s. In 1970, the District started treating non-structural yellowjacket nests located in the ground.

Ernest Campbell retired in March of 1966 due to poor health. In July of 1966, John Brawley became the new manager. Under John Brawley's tenure the District annexed the western portion of the county in June of 1969. Before June 1969, West County, which included the City of Richmond and the communities of El Cerrito, Kensington, San Pablo, El Sobrante, Pinole, Hercules, and Crockett, had no organized mosquito control. However, in the 1930s, some ditching was conducted in the Richmond marshes under the supervision of Harold Gray, the manager of Alameda MAD. John Brawley retired in September 1976.

Brawley's replacement was Brad Anderson who became manager in November of 1976. His misfortune was becoming manager just before Proposition 13, which reduced funding for mosquito abatement districts throughout the state. CCMAD #1 lost 50 percent of its revenues. In response, the District's Board of Trustees laid off 13 of the 21 full-time employees in November of 1978. Brad Anderson chose to resign so that his position and the entomologist's position could be combined. Dr. Charles Beesley, who was already employed by CCMAD #1 as the entomologist, became the new manager. The Board chose to cease all services to the public except for mosquito and yellowjacket control. The District's source reduction program also ended at this time and equipment was sold to keep the District afloat. After Proposition 13, there were only four of 14 field personnel retained. Employees who worked for the District in 1978 remember it as a lean and depressing time.

Early in the century, Northern California suffered through epidemics of encephalitis and malaria, diseases transmitted by mosquitoes. At times, parts of Contra Costa County were considered uninhabitable, with waterfront areas and schools shut down during peak mosquito seasons.

1926 - mosquito control committee formed by Contra Costa County citizens and several waterfront industries

March 31, 1927- Contra Costa Mosquito Abatement District (CCMAD) began operations in Martinez

In the 1950s - CCMAD began using mosquitofish as biological control of mosquitoes

January 15, 1957 - CCMAD relocated to Concord

July 1, 1970 - CCMAD annexed to West County

In 1970 - CCMAD began treating ground-nesting yellowjacket nests

July 1, 1986 - CCMAD consolidated with east county to become countywide

In 1986 - CCMAD expanded services by conducting field surveys and testing ticks for Lyme disease

In 1993 - the District added the rodent control and rabies risk reduction programs previously operated by the county Environmental Health Department. Name changed to Contra Costa Mosquito & Vector Control District

In 1997 - the District began the Africanized Honey Bee ("killer bee") response program

2004 - West Nile virus detected for the first time in dead birds in Contra Costa County

2005 - First West Nile virus human case in Contra Costa County

2006 - Two residents die from West Nile virus in Contra Costa County

Today, the District services 736 square miles in Contra Costa County.

*In 1986,* CCMAD #1 and DVMAD merged to create one countywide agency, Contra Costa Mosquito Abatement District. In 1988, CCMAD purchased land on Mason Circle in Concord and built a new facility that included an indoor mosquitofish rearing greenhouse. The District began modernizing its equipment with the purchase of new vehicles, modern spray equipment, and eight-wheel all-terrain vehicles. The work that took 16 field employees before Proposition 13 (including DVMAD) was now being done by nine. The District expanded services by conducting field surveys and testing the *Ixodes pacificus* tick for the Lyme disease spirochete. Research projects on wetlands was also initiated to determine ways to eliminate mosquito production and enhance wildlife habitat in the county.

In 1993, the County of Contra Costa transferred its rat and rabies reduction programs to CCMAD. Along with the program, three employees and equipment were transferred to CCMAD from the county. Subsequently, the District changed its name to Contra Costa Mosquito & Vector Control District (District). In 1993, the District's mosquito arbovirus surveillance program detected WEE in sentinel chickens and in mosquitoes collected in Contra Costa County. Fortunately, there were no human cases reported. Surveillance and control of *Culex tarsalis* mosquitoes once again became the District's primary focus. In the spring of 1994, the District purchased a custom built landing craft from a boat builder in Seattle, Washington. The landing craft could transport all-terrain vehicles, which allowed for regular inspection and treatment of islands in the Sacramento and San Joaquin Rivers.

In 1993 and 1994, the State of California took 40 percent of the District's property tax revenues to be used to balance the state budget. Due to the leadership of the District manager and the Board of Trustees, the District was prepared for this event, unlike Proposition 13, and enacted a county parcel fee to replace the local property tax revenues that the state had taken.

The District was able to continue tick surveillance and Lyme disease testing while the mosquito control program relied more on "biorational" methods (biopesticides and mosquitofish) that have minimal environmental impact. The District was considered to be in the forefront of wetland restoration and protection of endangered species and the environment. In 1996, the District received an Environmental Achievement Award in marsh management. Due to changing legislation (Proposition 218), the District anticipated the loss of its parcel fee that originated in 1993 and established a benefit assessment fee to ensure sufficient operating funds in 1996 and beyond.

In 1999, West Nile virus was first detected on the East Coast of the United States and the District began preparing for its eventual migration into California.

In 2001, after 27 years of distinguished service, General Manager Charles Beesley, Ph.D., retired. The building at 155 Mason Circle in Concord was dedicated in his honor. Assistant Manager Craig Downs was promoted to general manager. Downs began his career at the District as a vector control technician in 1981, advanced to biologist, superintendent, and assistant manager prior to his appointment to general manager.

By 2003, West Nile virus reached California. The District detected West Nile virus in Contra Costa County for the first time in 2004 in dead birds submitted for testing. The first human cases were in 2005. The virus was also detected that year for the first time in mosquitoes. To date, every year since 2005, WNV has been detected in the county with several human cases. In 2006, two people died from the virus.

District employees continue to serve and protect the public by monitoring and controlling vectors of disease in Contra Costa County. For more than 85 years, the District remains steadfast in protecting public health from vector-borne diseases.



*A technician sprays a sedimentation pond for mosquitoes. Date unknown.*



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# Contra Costa Mosquito & Vector Control District

155 Mason Circle  
Concord, CA 94520  
925-685-9301  
www.ContraCostaMosquito.com

## Personnel

### General Manager: Craig Downs

Administrative & Finance Manager: Ray Waletzko

Accounting & Benefits Specialist: Tina Cox

Administrative Secretary: Allison Nelson

Clerk-Receptionist: Marta McCord

### Laboratory

Scientific Program Manager: Steve Schutz, Ph.D.

Vector Ecologist II/GIS Map Coordinator:  
Eric Ghilarducci

Vector Ecologist: Damien Clauson

Biologist/Fish Program: Chris Miller

### Public Affairs

Public Affairs Manager: Deborah Bass

Community Affairs Representatives:  
Andrew Pierce  
Nola Woods

### Shop & Facility Maintenance

Mechanic II: Tom Fishe

### Information Technology

IT Technician: Wayne Shieh

### Operations

Operations Manager: Carlos Sanabria

**Mosquito Control Operations: West**  
Program Supervisor: Sheila Currier

Inspectors:  
Lawrence Brown  
Felipe Carrillo  
Robert Stultz  
Jeremy Tamargo  
Patrick Vicencio  
David Wexler

**Mosquito Control Operations: East**  
Program Supervisor: Greg Howard

Inspectors:  
Reed Black  
Tim Mann

Technicians:  
Josefa Cabada  
Ceaser Gutierrez  
Joe Hummel

**Vertebrate Vector Control Operations**  
Program Supervisor: Jonathan Rehana

Inspectors:  
John Chase  
Joe Cleope  
Jason Descans  
Steve Fisher  
Dave Obrochta  
Danielle Wisniewski

## *Independent Special District Classification*

Contra Costa Mosquito & Vector Control District is classified as an independent special district and is *not* part of Contra Costa County's governmental system. Contra Costa County encompasses the District's physical jurisdiction for mosquito and vector control. Special districts are:

- Formed by local residents to provide local services
- Sanctioned by the State of California Government Codes
- Often the most economical means of providing public service
- Independent, self-governed agencies governed by a board of trustees
- Operated as non-profit organizations
- Responsible directly to the people
- Accountable - Accessible - Efficient

## *Board of Trustees*



**Standing Left to Right:** H. Richard Mank, Secretary, El Cerrito; Warren Clayton, Pinole; Richard Means, Pleasant Hill; Richard Ainsley, Ph.D., Pittsburg; Daniel Pellegrini, Martinez; Michael Krieg, Oakley; Jim Pinckney, Contra Costa County; Jim Fitzsimmons, Lafayette; Jeff Bennett, Vice President, Hercules

**Kneeling/Seated:** Rolando Villareal, Brentwood; Angela Micheals, Concord; Myrto Petreas, Ph.D., Moraga; Chris Cowen, Contra Costa County; Sohelia Bana, Ph.D., President, Richmond; Peggie Howell, Clayton; Diane Wolcott, Orinda; and Randall Diamond, Danville

**Not pictured:** Russ Belleci, Contra Costa County; Sharyn Rossi, San Ramon; and Jose Saavedra, Antioch

## *Administrative Staff*



**Standing:** Deborah Bass, Public Affairs Manager; Wayne Shieh, IT Technician; Ray Waletzko, Administrative/Finance Manager; Damien Clauson, Vector Ecologist; Greg Howard, Program Supervisor; Craig Downs, General Manager; Chris Miller, Biologist; Steve Schutz, Ph.D., Scientific Program Manager; Jonathan Rehana, Program Supervisor; Carlos Sanabria, Operations Manager; and Tina Cox, Accounting/Benefits Specialist **Seated:** Marta McCord, Clerk/Receptionist; Andrew Pierce, Community Affairs Representative; Nola Woods, Community Affairs Representative; and Sheila Currier, Program Supervisor  
*Not pictured: Eric Ghilarducci, Vector Ecologist II and Allison Nelson, Administrative Secretary*

## *Inspectors & Technicians*



**Standing:** David Wexler, VCI; Dave Obrochta, VCI; Felipe Carrillo, VCI; Jeremy Tamargo, VCI; Tom Fishe, Mechanic II; Joe Hummel, VCT; Lawrence Brown, VCI; Ceasar Gutierrez, VCT; and Jason Descans, VCI  
**Kneeling/Seated:** Patrick Vicencio, VCI; Josefa Cabada, VCT; Danielle Wisniewski, VCI; Steve Fisher, VCI; and Reed Black, VCI  
*Not pictured: John Chase, VCI; Joe Cleope, VCI; and Tim Mann, VCI*

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# Integrated Vector Management

Mosquito and vector control is based on scientifically planned management tactics and control strategies that reduce the abundance of target pests in a timely manner. Integrated Vector Management (IVM) is a comprehensive program that incorporates several coordinated activities:

VECTOR SURVEILLANCE  
BIOLOGICAL CONTROL  
PHYSICAL CONTROL (HABITAT MODIFICATION)  
CHEMICAL CONTROL (PESTICIDE APPLICATION)  
VEGETATION MANAGEMENT  
PUBLIC INFORMATION & EDUCATION  
TRAPPING

## Service Area

Our service area encompasses Contra Costa County, California, and the islands pertaining to the Concord Naval Weapons Station that are in Solano County. In addition, the District can take action in bordering areas of Solano County, Sacramento County, San Joaquin County, or Alameda County if needed to provide control of mosquitoes or other vectors for residents of Contra Costa County [California Health & Safety Code Section 2270]. Areas covered by the program include:

1. The incorporated cities of Antioch, Brentwood, Clayton, Concord, Danville, El Cerrito, Hercules, Lafayette, Martinez, Moraga, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, and Walnut Creek
2. The unincorporated areas of Contra Costa County
3. Those portions of the Concord Naval Weapons Stations that lie outside Contra Costa County (Roe and Ryer Islands and three small unnamed islands)
4. Other bordering areas in Solano, Sacramento, San Joaquin, or Alameda Counties

## Surrounding Land Uses

The service area, which is essentially within the borders of Contra Costa County, has a diverse set of land uses and environmental settings. The District divides the service area into four regions, corresponding roughly to the pattern of vector production found in each. East County is generally hot and dry, with land use dominated by agriculture and new residential communities. North County includes both the coastal marshlands and the established port and industrial cities from Martinez through Pittsburg to Antioch. West County, like the North, includes coastal areas, older cities, and parklands, but is generally cooler and wetter. South Central Contra Costa, on the other hand, is generally warm and dry, with land use dominated by moderate to low-density housing mixed with open space, including some grazing areas, woodlands, and intermittent creeks.

Mosquito production is associated with standing water of all types and sizes. This includes marshes, ponds, creeks, seasonal wetlands, wastewater ponds, storm-water detention basins, irrigated pastures, duck clubs, etc. as well as individual homes or commercial buildings. Other vectors, especially rats, inhabit an even wider range of natural settings, as well as virtually all types of structures. Because of the diversity of mosquito and other vector habitat, almost all land use categories in the District service areas may be affected by our efforts.

## Other Public Agencies Whose Review/Approval is Required

The District's IVM program as a whole, including the registration and continuing education of state-certified field personnel, is reviewed and approved by the California Department of Public Health through a formal Cooperative Agreement that is renewed annually.

For work on state lands and riparian zones, wetlands or other sensitive habitats, the District coordinates and reviews activities with the California Department of Fish and Wildlife and the California State Lands Commission as Trustee Agencies.

For minor physical control activities, the District obtains five-year regional permits from the U.S. Army Corps of Engineers (with review by the San Francisco or Central Valley Regional Water Quality Control Boards and/or the U.S. Fish & Wildlife Service, as appropriate), and from the San Francisco Bay Conservation & Development Commission.

For chemical control activities, the District reports to and is reviewed, at least annually, by the Contra Costa County Agricultural Commissioner.

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## Description of Services

The Integrated Vector Management program of the Contra Costa Mosquito & Vector Control District is an ongoing program of surveillance and control of mosquitoes and other vectors of human disease and discomfort. The program essentially consists of eight types of activities:

- **Surveillance** for vector populations, vector habitats, disease pathogens, and public distress associated with including trapping and laboratory analysis of vectors to evaluate populations and disease threats, direct visual inspection of known or suspected vector habitats, the use of all-terrain vehicles, maintenance of paths, and public surveys.
- **Public Education**— Encouraging and assisting reduction or prevention of vector habitats on private and public property.
- **Physical Control**— Managing vector habitat, especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities.
- **Vegetation Management**—Applying herbicides and other forms of vegetation management to improve surveillance or reduce vector populations.
- **Biological Control**—Rearing, stocking, and provision to the public of the “mosquitofish” *Gambusia affinis*; and possibly use of other predators or pathogens of vectors.
- **Chemical Control**—Applying bacterial products *Bacillus thuringiensis israelensis* (Bti), *Bacillus sphaericus* (Bs), and Spinosad. Applying non-persistent selective insecticides to reduce populations of larval or adult mosquitoes and other invertebrate threats to public health, and rodenticides to control rats and other rodent threats to public health.
- **Trapping**—Trapping and euthanizing skunks and rodents that pose a threat to public health and welfare.

Descriptions of these activities, including their typical annual frequency and intensity, and general District policies and procedures to ensure that they result in no significant environmental impact are provided in the following pages.

## Purpose and Need

The District exists to reduce the risk of vector-borne disease or discomfort to the residents of our service area. Besides being nuisances by disrupting human activities and the use and enjoyment of public and private areas, certain insects and animals may transmit a number of diseases. The diseases of most concern in the service area are West Nile virus (WNV), Western equine encephalomyelitis (WEE), St. Louis encephalitis (SLE), dog heartworm, and malaria, which are transmitted by mosquitoes; rabies transmitted by skunks; plague and murine typhus transmitted by fleas; leptospirosis and hantavirus pulmonary syndrome associated with rats and other rodents; and Lyme disease, babesiosis, and ehrlichiosis transmitted by ticks.

The California Health and Safety Code defines a vector as “any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal”. The District undertakes activities through its Integrated Vector Management Program to control the following vectors of disease and/or discomfort in the service area:

### MOSQUITOES

Certain species of mosquitoes found in Contra Costa County can transmit malaria, West Nile virus, St. Louis encephalitis, Western equine encephalomyelitis, and potentially other encephalitis viruses. Another species of mosquitoes is also capable of transmitting dog heartworm. Although some of the 23 species of mosquitoes found in our County have not been shown to transmit disease, most species can cause human discomfort when the female mosquito bites to obtain blood. Reactions range from irritation in the area of the bite to severe allergic reactions or secondary infections resulting from scratching the irritated area. Additionally, an abundance of mosquitoes can cause economic losses, and loss of use or enjoyment of recreational, agricultural, or industrial areas.

Upon request for service, technicians will inspect residential property for mosquito problems and provide recommendations to control their populations. With so many varieties of mosquitoes that inhabit a variety of water sources, it's important that the homeowner or caller provides a mosquito sample to the technician. The technician is then able to determine what type of mosquito is present and where the mosquito may be originating. Mosquito sources located outside the residential property are treated appropriately.

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## MOSQUITOFISH

Mosquitofish (*Gambusia affinis*) are used throughout the world for effective mosquito control. They are capable of eating enormous amounts of mosquito larvae daily. Mosquitofish are an important, natural mosquito control tool.

Mosquitofish are available to the public free of charge for private ponds, horse troughs, non-maintained swimming pools and spas, rain barrels and more.

## GROUND-NESTING YELLOWJACKETS

Ground-nesting yellowjackets have a painful sting, can fly moderate distances, and are found throughout Contra Costa County. A single nest can lead to loss of use of public recreational areas, and loss of the enjoyment of property. More significantly, yellowjacket stings can result in anaphylactic shock and rapid death for the approximately 0.5 percent of the public with severe allergies.

The District provides extermination of ground-nesting yellowjackets since these species are aggressive toward people. The District does not provide a service for other species of yellowjackets, nor those that make their nest on or in structures. For ground-nesting yellowjackets, simply locate the nest and call the District for service. The nest's location must be identified and the location shared with the technician.

## AFRICANIZED HONEY BEES

Africanized honey bees (AHB) were first detected in California on October 24, 1994 and were detected and successfully intercepted in Contra Costa County (Crockett) in 1997 and 2008. Africanized honey bees are not known to transmit disease and are no more venomous than European honey bees (EHB); however, AHB respond to threats more rapidly than EHB and will defend their hive with greater numbers of bees which could result in a massive number of stings to an individual. Although persons have died as a result of 100 - 300 stings, it is estimated that the average lethal dose of venom for an adult human is 1,100 bee stings; for a child it can be substantially less. Normal reaction to a bee or wasp sting includes redness, itching, swelling, and pain at the site of the sting. Some individuals are allergic to all bee and wasp stings. Allergic reactions may include swelling of an entire extremity, abdominal cramps, vomiting, diarrhea, upper respiratory distress, and constriction of the throat and chest. Bee stings, like yellowjacket stings, can result in anaphylactic shock and death within 15 to 30 minutes for the approximately 0.5 percent of the public with severe allergies.

## RODENTS

Two introduced species of rats, the Norway rat and the roof rat are present in the service area and are subjects of District action. In addition to being unsanitary, rats transmit a variety of organisms that infect humans. Rats are hosts to the worm that causes trichinosis in humans. Humans may become infected when they eat poorly cooked meat from a pig that has eaten an infected rat. Rat urine may contain the bacteria that cause leptospirosis, and their feces may contain Salmonella bacteria. Bubonic plague and murine typhus may be transmitted by infected rat fleas. Rat bites may cause bacterial rat-bite fever or infection. Gnawing by rats causes damage to woodwork and electrical wiring, resulting in shorted circuits and potential fires. Additionally, an abundance of rats can cause economic losses, loss of use of public recreational areas, and loss of the enjoyment of property.

Homeowners, business owners or any group in Contra Costa County can request a site visit to assist them with rodent issues. District services include rodent identification (rodent need not be present) and advice for prevention and control. District employees do not bait nor set traps, but provide valuable, detailed information, guidance and recommendations. They also issue a formal, detailed report.

## SKUNKS

The two primary reservoirs and vectors of rabies in California are skunks and some species of bats. Because of extensive residential development near natural areas and their ability to live in close proximity to people, skunks pose a potential health risk.

In an effort to reduce the incidence of rabies by suppressing skunk populations, the District works with homeowners to discourage skunks from visiting their property. District employees survey properties, provide guidance and recommendations and may loan live catch skunk traps if specific criteria are met.

## TICKS

There are three species of common human-biting ticks in the service area. Of these three, only the Western black-legged tick (*Ixodes pacificus*) is known to transmit Lyme disease in California. The District surveys public parks and other areas for the ticks that transmit Lyme disease and monitor the risk to people. Staff collect and test Western black-legged ticks from several locations throughout the service area. The District also provides tick identification services to the public and medical personnel.

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## OTHER ANIMALS OF IMPORTANCE

Although certain animal species such as bats, ground squirrels, fleas, ticks, opossums, and mice will not be regularly controlled, these animals play important roles in the transmission of rabies, plague, murine typhus, hantavirus, or Lyme disease and may be surveyed for diseases. The District routinely provides education and consulting services to the public about disease risk associated with these vectors and appropriate measures to protect human health. In extreme cases where the transmission of disease is likely, as with the other District IVM activities, control efforts may be employed. Control of these animals is done in consultation with the California Department of Public Health, Contra Costa County Department of Health Services, Contra Costa County Animal Control Department, Contra Costa County Agricultural Commissioner's Office, and other state and local agencies.

Most of the vectors mentioned above are extremely mobile and cause the greatest hazard or discomfort away from their breeding site. Each of these potential vectors has a unique life cycle and most of them occupy different habitats. In order to effectively control these vectors, an integrated vector management program must be employed. District policy is to identify those species that are currently vectors, to recommend techniques for their prevention and control, and to anticipate and minimize any new interactions between vectors and humans.

### General Vector Management Strategy

The District's activities address two basic types of vectors—mosquitoes and other insects; and rodents and skunks—but both share general principles and policies including identification of vector problems; responsive actions to control existing populations of vectors, prevent new sources of vectors from developing, and manage habitat to minimize vector production; education of land-owners and others on measures to minimize vector production or interaction with vectors; and provision and administration of funding and institutional support necessary to accomplish these goals. In order to accomplish effective and environmentally sound vector management, the manipulation and control of vectors must be based on careful surveillance of their abundance, habitat (potential abundance), pathogen load, and/or potential contact with people; the establishment of treatment criteria (thresholds); and appropriate selection from a wide range of control methods. This dynamic combination of surveillance, treatment criteria, and selection between multiple control activities in coordinated programs is generally known as Integrated Pest Management (IPM). Due to the specific nature of our programs, we refer to this as Integrated Vector Management (IVM).

The District's Integrated Vector Management program, like any other IPM program, by definition involves procedures for minimizing potential environmental impacts. The District's program employs IPM principles by first determining the species and abundance of vectors through evaluation of public service requests and field surveys of immature and adult pest populations; and then, if the populations exceed predetermined criteria, using the most efficient, effective, and environmentally sensitive means of control. For all vector species, public education is an important control strategy, and for some vectors (rodents, ticks) it is the District's primary control method. In certain situations, water management or other physical control activities (historically known as "source reduction" or "permanent control") can be instituted to reduce vector breeding sites. The District also uses biological control such as the placing of mosquitofish in some settings. When these approaches are not effective or are otherwise inappropriate, then microbial or chemical pesticides are used to treat specific vector-producing or vector-harboring areas or vector populations.

In order to maximize familiarity by the operational staff with specific vector sources in the service area, the District is divided into mosquito and other arthropod zones (currently 11) and also into vertebrate vector zones (currently six). Each mosquito and other arthropod zone is assigned a full-time vector control technician, and sometimes an aide, whose responsibilities include minor physical control, inspection and treatment of known vector sources, finding and controlling new sources, and responding to service requests from the public. Each vertebrate vector zone is also assigned one or more vector control technicians and sometimes aides; responsibilities in these zones include control of skunks, rodents, and potentially other vertebrate vectors.

Vector control activities are conducted at a wide variety of sites throughout the District's service area. These sites can be roughly divided into those where activities may have an effect on the natural environment either directly or indirectly (through drainage), and sites where the potential environmental impacts are negligible. Examples of "Environmental Sites" in the service area include tidal marshes, duck clubs, other diked marshes, lakes and ponds, rivers and streams, vernal pools and other seasonal wetlands, stormwater detention basins, flood control channels, spreading grounds, street drains and gutters, wash drains, irrigated pastures, or agricultural ditches. Examples of "non-environmental sites" include animal troughs, artificial containers, tire piles, fountains, ornamental fish ponds, swimming pools, animal waste detention ponds, and non-natural harborage, such as wood piles, residential and commercial landscape, trash receptacles, etc.

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The intensity of chemical, biological, or physical control activities in the District service area in general, or in any particular vector source, varies seasonally and from year to year because of weather conditions, size and distribution of vector populations, disease patterns, prevention of pesticide resistance, and other variables. Therefore, the scopes of work discussed in the sections below are illustrative of typical District activities levels, but they are expected to show continuing variation in the future.

### VECTOR SURVEILLANCE

The District's responsibility to protect public health and welfare involves monitoring the abundance of vectors, vector habitat, vector-borne pathogens, and interactions between vectors and people over time and space. Collectively, these monitoring activities are termed vector surveillance. Vector surveillance provides the District with valuable information on what vector species are present or likely to occur, when they occur, where they occur, how many there are, and if they are carrying disease or otherwise affecting humans. Vector surveillance is critical to an Integrated Vector Management program because the information it provides is evaluated against treatment criteria to decide when and where to institute vector control measures. Equally important is the use of vector surveillance in evaluating the efficacy, cost effectiveness, and environmental impacts of specific vector control actions.

The District routinely uses a variety of traps for surveillance of adult mosquitoes, regular field investigation of known vector sources, flocks of sentinel chickens for arboviruses, public service requests for vertebrate pests, adult mosquitoes, and other insect pests; and low ground pressure all-terrain vehicles to access these sites.

The District's vector and disease surveillance activities are conducted in compliance with accepted federal and state guidelines. These guidelines recognize that local conditions vary, and are thus flexible in the selection and specific application of methods. Therefore, the District's specific activities and their potential environmental impacts are described herein.

### PHYSICAL CONTROL (HABITAT MODIFICATION)

Dredging, placement of culverts or other engineering works, and other physical changes to the land can reduce mosquito production directly by improving water circulation or drainage, indirectly by improving habitat values for predators of larval mosquitoes, including fish and many invertebrates, or by otherwise reducing a site's habitat value for mosquito larvae. The District performs these physical control activities in accord with all appropriate environmental regulations (wetland fill and dredge permits, endangered species review, water quality review, etc.), and in a manner that generally maintains or improves habitat values for desirable species. Major physical control activities or projects (beyond the scope of the District's five-year regional wetlands permits with the U.S. Army Corps of Engineers and the S.F. Bay Conservation and Development Commission) receive individual California Environmental Quality Act reviews. Minor physical control activities are covered by the regional wetlands permits. These vary substantially from year to year, but typically consist of up to 2,000 feet of ditch maintenance.

### VEGETATION MANAGEMENT

The District periodically applies herbicides to reduce the mosquito habitat value of sites by improving water circulation or access by fish and other predators, or to allow access to standing water for inspections and treatment. Herbicides used by the District include Roundup® and Rodeo®, which are both based on the active ingredient glyphosate. Herbicides are applied in strict conformance with label requirements.

The District did not apply any herbicides during 2012. Some vegetation management was done using hand tools ("brushing") to improve access to inspection and treatment areas.

### BIOLOGICAL CONTROL

The District uses the mosquitofish *Gambusia affinis* in some types of mosquito larval habitat to provide biological control of mosquitoes through direct predation of larvae. Stocking by District personnel complies with strict guidelines designed to ensure that no significant impacts can occur to native species. District staff are also conducting research on several California native fish species as alternative biological control agents.



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## CHEMICAL CONTROL

### MOSQUITO LARVICIDES

Depending on time of year, water temperature, organic content, mosquito species present, larval density, proximity to human settlements, water temperature, presence of predators, and other factors, pesticide applications may be repeated at any site at recurrence intervals ranging from weekly to annually. District staff apply pesticides to the site in strict accordance with the pesticide label instructions.

The District uses several natural bacterial products for control of larval mosquitoes. These include Bti (*Bacillus thuringiensis israelensis*), a bacterium that is ingested by larval mosquitoes and disrupts their gut lining, leading to death before pupation. Bti is applied by the District as a liquid or bonded to inert substrate (sand, corn cob granules) to assist penetration of vegetation. Persistence is low in the environment and efficacy depends on careful timing of application relative to the larval growth stage. Therefore, use of Bti requires frequent inspections of larval sources during periods of larval production, and may require frequent applications of material. Application can be by hand, All-terrain vehicle (ATV), or helicopter. Bs (*Bacillus sphaericus*) is similar to Bti but has the additional capability of natural re-cycling in certain habitats, providing a longer duration of control. Spinosad ("Natular") is a bacterial fermentation product which acts on the nervous system of mosquito larvae and is also available in several liquid and solid formulations. All three materials have very low toxicity to non-target organisms.

Chemical larvicides routinely used by the District include Methoprene (Altosid), larvicidal oils, and Agnique. Methoprene, or Altosid, is a synthetic insect hormone designed to disrupt the transformation of a larval mosquito into an adult. It is applied either in response to observed high populations of mosquito larvae at a site, or as a sustained-release product that can persist for up to about four months. Application can be by hand, all-terrain vehicle (ATV), or helicopter. While highly effective against mosquitoes, it has very low toxicity to non-target organisms. Larvicidal oil is a petroleum distillate (mineral oil) with low toxicity to plants and fast environmental breakdown that forms a thin film on water and kills larvae through suffocation and/or direct toxicity. It is typically applied by hand, ATV, or truck. Unlike most other larvicides, this material is also effective against mosquito pupae. Agnique is the trade name for a monomolecular (one molecule thick) surface film larvicide, comprised of ethoxylated alcohol. It works by disrupting the surface tension of water, preventing mosquito larvae and pupae from being able to remain at the surface to breathe air. Sustained winds tend to disrupt the film, so this material is most useful in enclosed areas like swimming pools and other artificial containers.

### MOSQUITO ADULTICIDES

In addition to chemical control of mosquito larvae, the District also makes aerosol applications of pesticides for control of adult mosquitoes if specific criteria are met, including species composition, population density (as measured by landing count or other quantitative method), proximity to human populations, and/or human disease risk. As with larvicides, adulticides are applied in strict conformance with label requirements. Adulticides currently used by the District include natural Pyrethrins (derived from chrysanthemum flowers) and the synthetic pyrethroid Resmethrin (Scourge). Both contain the synergist PBO (piperonyl butoxide) which improves their effectiveness against adult mosquitoes while reducing the amount of active ingredient needed. Both materials are applied as ultra-low-volume (ULV) fogs by truck or potentially by aircraft. In addition to having low toxicity to humans, these materials are applied in very small amounts (approximately 1-2 oz. of active ingredient per acre) and are non-persistent (break down rapidly in sunlight). Applications are generally conducted at night or before dawn, when the target mosquitoes are most active, but bees and other nontarget organisms would not be exposed.

Malathion is an organophosphate material which the District may use for direct control of adult mosquitoes. This is not a routine operational material for the District, and its use is only contemplated in emergency circumstances or in the event that mosquito populations in our area develop significant resistance to other adulticides.

### OTHER INSECTICIDES

In addition to direct chemical control of mosquito populations, the District also applies insecticides to control bees and ground-nesting wasps that pose an imminent threat to humans or pets. This activity is triggered by a public request for assistance, rather than in response to direct population monitoring. The District does not control any bees that are located inside a structure or wasps that are on or inside a structure, so if a technician finds that a bee or wasp nest is located inside a structure or a wasp nest is above ground, the resident will be given a copy of a referral list which contains the names of all companies in Contra Costa County that are certified for structural control of bees and wasps. If a district technician elects to treat stinging insects, he or she will apply an insecticide directly to the insect or insect nest in accordance with District policies to avoid any drift and harm to other organisms, or place tamper-resistant traps or bait stations, selective for the target insect, in the vicinity of the problem animals.

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Pesticides that contain the active ingredient potassium salts of fatty acids (insecticidal soaps), such as M-Pede®, are used to control feral bees. Potassium salts of fatty acids are extremely low in toxicity. Drione® is used by the District against ground-nesting yellowjackets. This is an insecticidal dust containing pyrethrins, PBO and silica. The potential environmental impact of this material is very small because the active ingredients include Pyrethrins, and Piperonyl Butoxide (discussed above), and the mode of application, deep into underground nests, further limits the potential for environmental exposure.

## **RODENTICIDES**

The District uses the rodenticides (rodent poisons) bromadiolone, diphacinone and cholecalciferol. Most of the material is used in sewer systems, or is deployed in locked, tamper-resistant bait stations along creeks and in other natural habitats with no potential for direct human or pet exposure. Used bait is disposed of in accordance with the labels.

## **OTHER VERTEBRATE PEST MANAGEMENT**

In addition to the use of rodenticides for the control of rats and potentially other rodents of public health significance, the District also traps and humanely euthanizes skunks that have established dens on residential or commercial properties. Property owners are educated by inspectors or technicians on how to limit contact with skunks. Skunks can be a reservoir of rabies. The District has approximately 200 live traps which are distributed to residents and local business owners in the service area. Prior to delivering a trap, our technicians will conduct an inspection of the property to determine what existing conditions might be attracting skunks and provide recommendations for habitat modification. If the problem persists in spite of these efforts, a trap is provided. Members of the public with District traps on their property are instructed to check the trap daily and to call the District promptly if an animal is captured. If a skunk is trapped, it is humanely euthanized with carbon dioxide gas and transported to the District for storage before being transported to a landfill. Animals other than skunks in the traps are promptly released on site; however, our trap design makes capture of other animals unlikely. Public requests for routine assistance with trapping or removal of other vertebrate animals such as raccoons or opossums are referred to Contra Costa County Animal Control or to local private pest control companies.

Under some circumstances, the District might trap rodents of public health significance, or, in an emergency, other vertebrate vectors for disease surveillance and control.

## **PUBLIC INFORMATION & EDUCATION**

The District's outreach program educates and informs the public about mosquitoes and other vectors along with their associated diseases. Much emphasis is placed on prevention methods and reducing the risk of illness. The District utilizes the media, various advertising outlets extensively, and the District's website. Staff provide presentations to a plethora of groups and community organizations and disseminate health messages through events, health fairs, community newsletters, social media, city and county partnerships, and local groups.

## Mosquito & Vector Surveillance

Our entomology laboratory staff collect and analyze the following types of information to help guide and plan effective and environmentally sound control of vectors and vector-borne diseases in Contra Costa County:

- Mosquito population surveillance
- Encephalitis virus surveillance
- Surveillance for other mosquito-borne diseases
- Tick and Lyme disease surveillance
- Identification of ticks and other biting arthropods
- Quality control for pesticide applications
- Research and special projects

### Mosquito Population Surveillance

Mosquito surveillance is a key component of our IVM program. **Twenty-three different species of mosquitoes** are found in our county, and each one is different in terms of its habitat, biting habits, ability to transmit disease, flight range and appropriate control methods. The District's surveillance program monitors larval and adult mosquito populations countywide to track changes over time and identify potential risk areas for nuisance or disease issues. This information is used by our operations team to plan and carry out efficient, effective and environmentally sound mosquito control strategies.

#### Larval Mosquito Surveillance

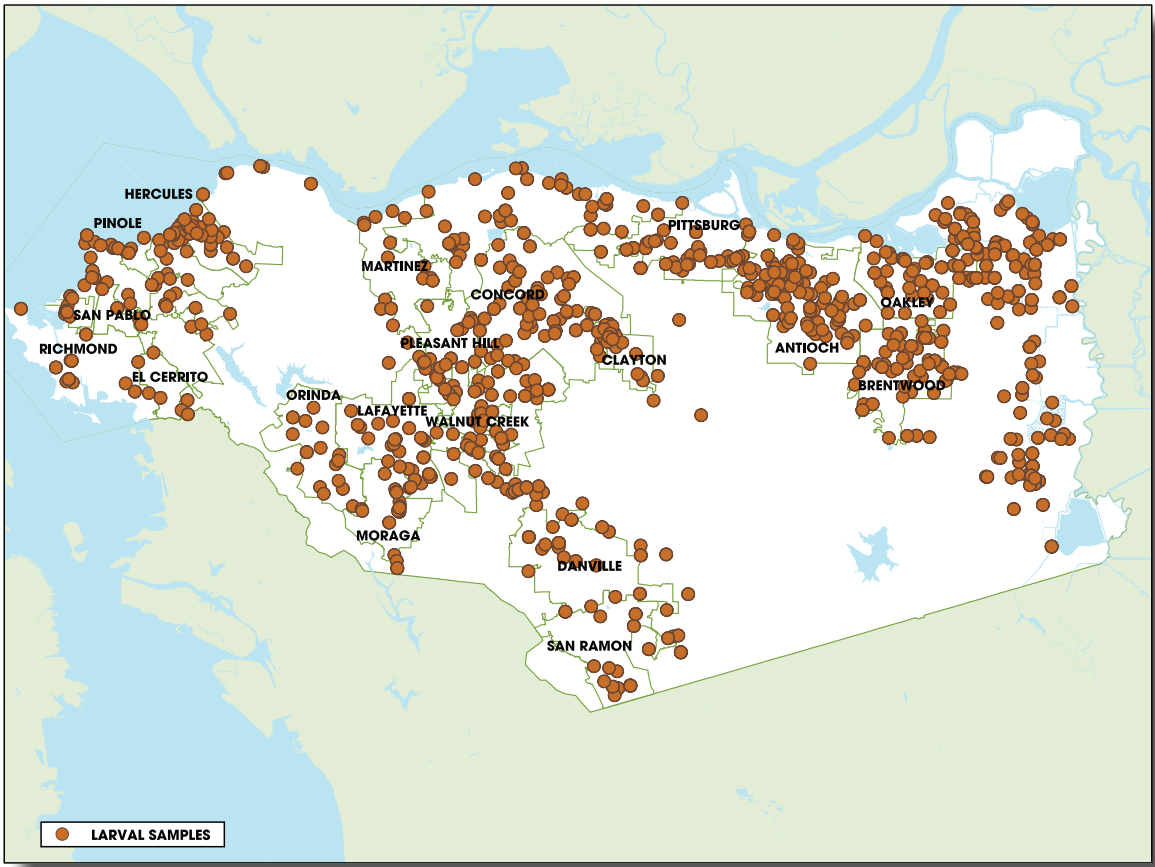
Field technicians and inspectors collect samples of mosquito larvae in the field daily and return them to our laboratory for counting and identification. Treatment decisions can then be made, based on species and density information in addition to other factors like habitat type, proximity to populated areas and presence or absence of natural predators. The data are stored in a database which enables us to make comparisons with historical averages and to map larval populations by species. In 2012, our laboratory staff counted and identified 176,975 mosquito larvae and pupae.

Larval samples by species	
pupae*	84,196
Cs incidens	47,869
Cx tarsalis	30,104
Cx pipiens	10,020
Ae washinoi	1,115
Cs inornata	936
Ae nigromaculis	697
Ae melanimon	696
Cx stigmatosoma	399
Ae dorsalis	231
Ae squamiger	201
Cx erythrorhax	183
Ae vexans	157
Cx apicalis	73
Ae sierrensis	44
An punctipennis	17
Cx boharti	14
Cs particeps	14
An franciscanus	5
An occidentalis	4
<b>Total</b>	<b>176,975</b>

\*pupae not identified to species



*A batch of larvae and pupae collected in the field await counting and identification*



2012 mosquito larval samples collected by the District

**Adult Mosquito Surveillance**

The District utilizes two types of traps to monitor adult mosquito populations throughout the county: New Jersey light traps and carbon dioxide traps (CO<sub>2</sub> traps). Both types are used at representative locations throughout the county.

**New Jersey light traps** use light from a 5-watt fluorescent bulb to attract night-flying mosquito species. The traps have light sensors which automatically turn them on at dusk and off at dawn, and are operated year-round at 25 locations, some of which have been in use for 20 years or more. Samples are collected once a week by field technicians and returned to our lab for counting and species identification. Each week, current trap counts are compared with historical averages for different regions of the county to identify population trends that might require additional scrutiny.

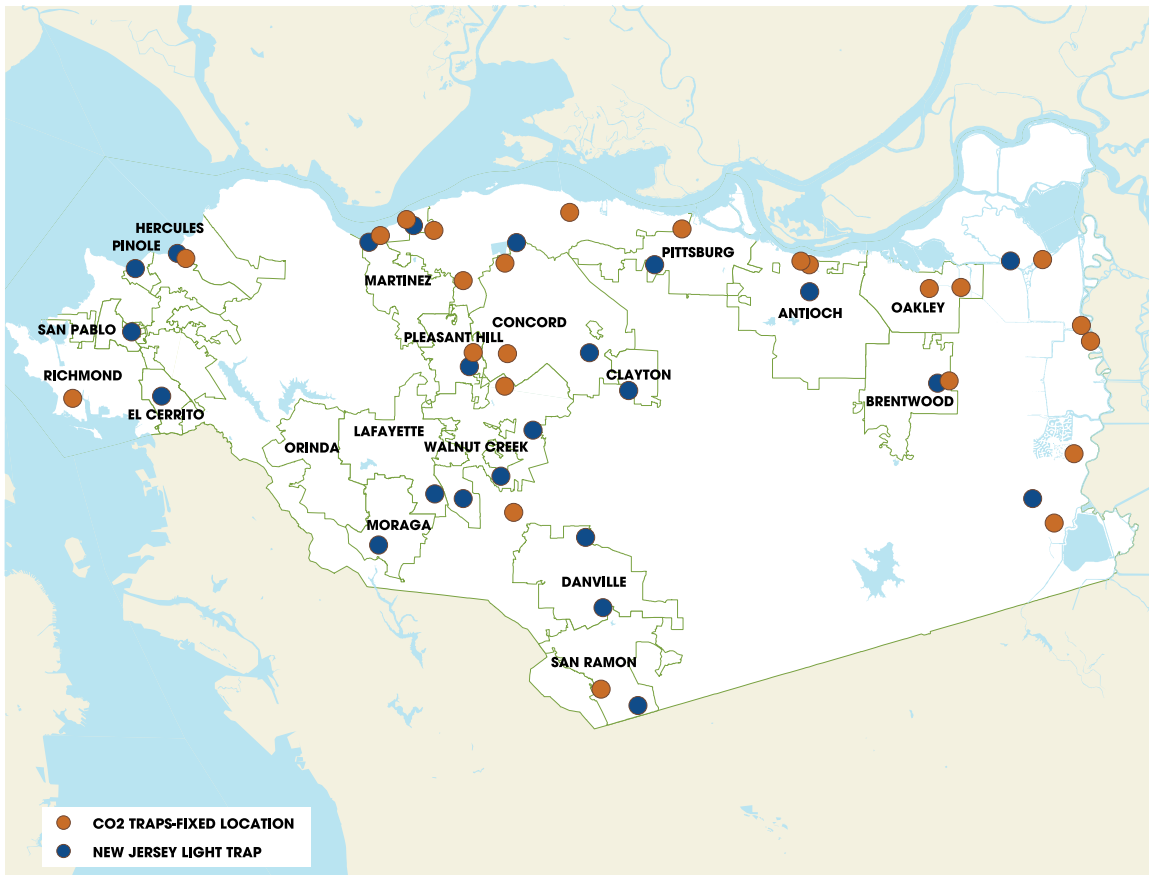


New Jersey Mosquito Light Trap

CO<sub>2</sub> traps are portable, battery powered, and use dry ice to produce carbon dioxide, which is a powerful attractant for mosquitoes, as well as a small LED light. Traps are set overnight once per week at 25 'fixed' locations throughout the county and as many as 12-30 variable locations which are chosen based on other surveillance information (dead bird reports, mosquito complaints, field observations by technicians, etc.). In addition to collecting both day and night flying mosquitoes, these traps also allow us to return the mosquitoes to our lab while still alive so they can also be tested for WNV and other viruses. Counts can also be compared with regional averages to track population changes and target control activities.

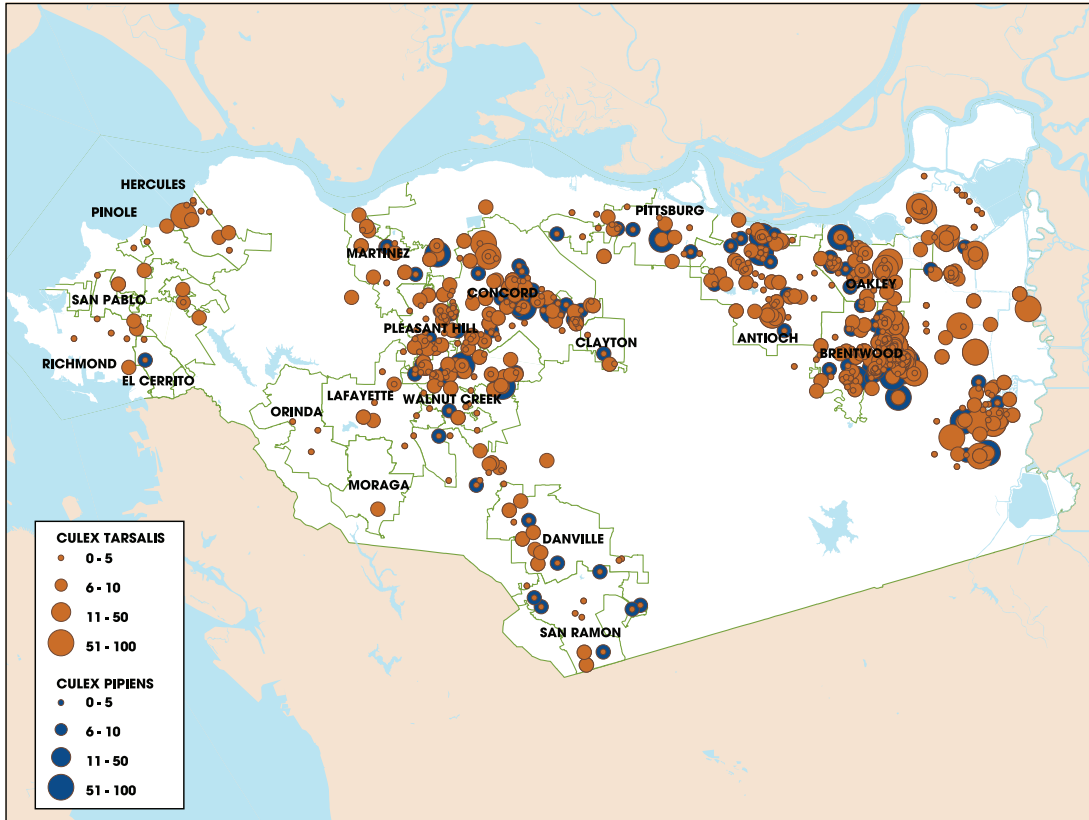


*A carbon dioxide adult mosquito trap hangs in a tree.*



**2012 FIXED ADULT MOSQUITO TRAP LOCATIONS**

*Both carbon dioxide (CO<sub>2</sub>), which simulates the breath of a person or animal, and light attract mosquitoes to the trap. Mosquitoes are then counted and identified per species to determine the risk of disease or nuisance to people.*



### 2012 RANDOM ADULT MOSQUITO TRAP LOCATIONS

Random traps set throughout Contra Costa County capture mosquitoes for surveillance and control applications. *Culex tarsalis* and *Culex pipiens* are primary vectors of West Nile virus and other diseases.

## Adult Mosquito Abundance Trends

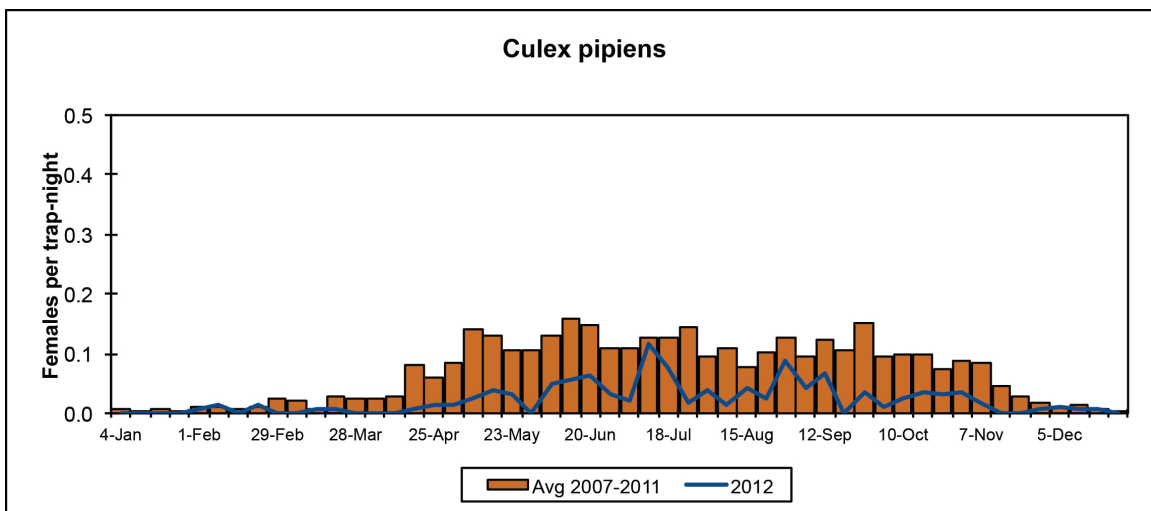
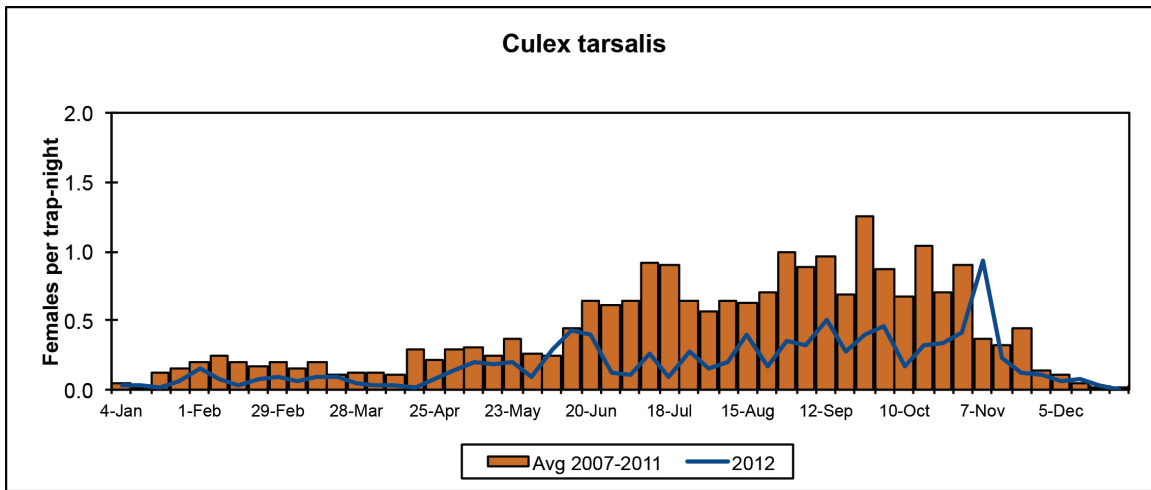
Although we are able to monitor abundance of most of the mosquito species present in Contra Costa County, two species—the Western Encephalitis Mosquito, *Culex tarsalis*, and the Northern house Mosquito, *Culex pipiens*,— are considered the most significant since they are the primary vectors of WNV and other encephalitis SLE viruses. Both species are widespread and abundant throughout the county. *Culex tarsalis* prefers clear water, and used to be more common in rural agricultural areas; however, in recent years it has become the most abundant species in abandoned or unmaintained swimming pools in residential neighborhoods. This mosquito may fly five miles or more from its larval habitat so a single ‘bad’ pool can affect a large area. *Culex pipiens* prefer water high in organic material and is most common in sewer plants, dairy farm ponds and underground storm drains. This mosquito usually doesn’t travel more than a few blocks from its larval ‘source’, but may be extremely widespread in residential neighborhoods during the summer due to over watering of lawns and other urban water runoff that keeps the storm drains constantly wet.

Rainfall and summer temperatures were both below average in 2012, and countywide populations of *Culex tarsalis* were below average throughout most of the season. The seasonal peak did not occur until November in response to a brief late-season ‘heat wave’. *Culex pipiens* counts were similarly below average

countywide throughout most of the mosquito season. Despite these overall below-average counts, there were several locations, mainly in East County, where trap counts repeatedly exceeded our adult mosquito treatment thresholds. A total of more than 28,000 adult mosquitoes were collected in our traps and identified in 2012.

Adult Mosquito Samples by Species	
Cx tarsalis	20763
Cs inornata	2687
Cx pipiens	2463
Cx erythrothorax	729
Cs incidens	651
Ae melanimon	473
Ae dorsalis	294
Ae squamiger	146
Ae nigromaculis	124
Ae washinoi	113
Cx particeps	91
Ae vexans	88
Ae sierrensis	63
An franciscanus	13
An freeborni	10
An punctipennis	3
<b>Total</b>	<b>28711</b>

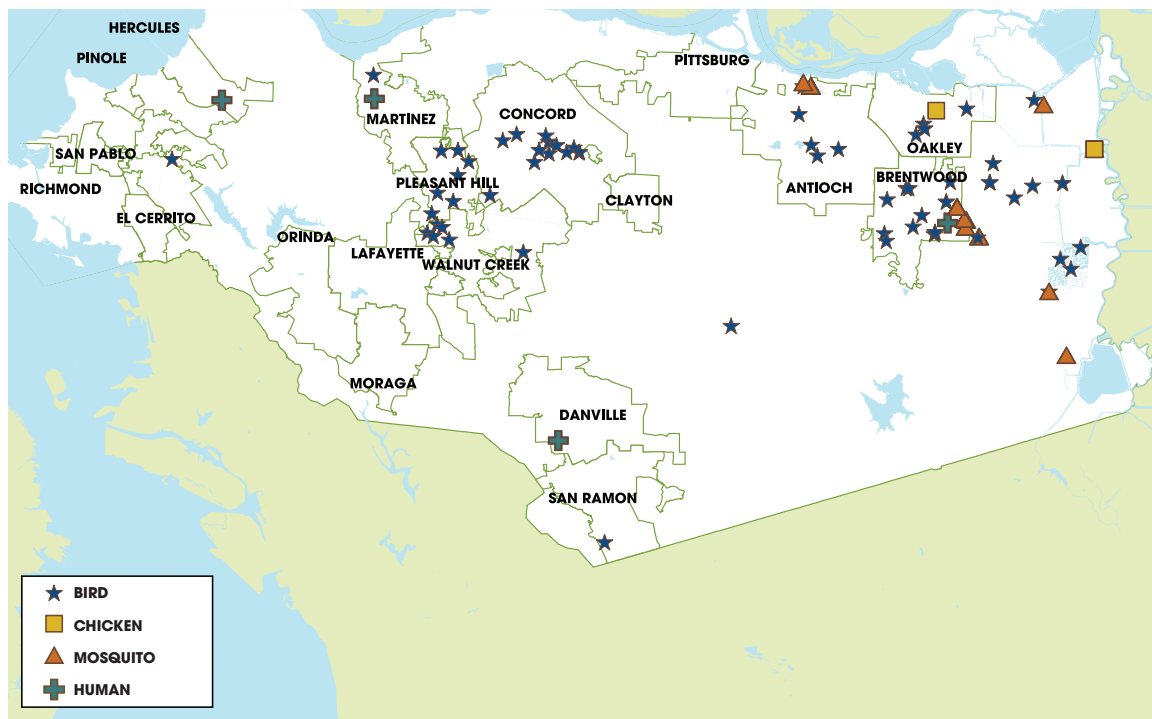
*Abundance of Vector Mosquito Species in Contra Costa County in 2012*



## Mosquito-Borne Disease

Our laboratory conducts a comprehensive surveillance program for diseases transmitted by mosquitoes, including West Nile virus (WNV), Western equine encephalomyelitis (WEE) and Saint Louis encephalitis (SLE) as part of California's statewide surveillance effort. We also collaborate with the California Department of Public Health, the University of California and other state and federal agencies on studies intended to detect or predict new mosquito-borne diseases which might be introduced to our area in the future. WNV, a virus native to Africa which first appeared in the U.S. in 1999, has been the most prominent mosquito-borne disease here in California since its arrival in 2004, with more than 3,600 reported cases and 129 deaths (the actual number of cases is probably much higher since only patients with the most severe form of the illness tend to be tested and diagnosed). Serious outbreaks of WEE and SLE occurred in California as recently as the 1950s and 1960s, and could re-occur at any time. The Contra Costa Mosquito & Vector Control District last detected WEE activity in 1997, when two chickens at our flock in the Martinez waterfront area tested positive for antibodies.

The Bay Area also had a **history of severe malaria outbreaks** in the early part of the 20th century. Pioneering mosquito control efforts by Stanley Freeborn and others led to the eradication of malaria in California. However, international travel still occasionally brings people infected with malaria to our area, and *Anopheles* mosquitoes capable of transmitting the disease to others still occur here. We work with the Contra Costa Department of Public Health to investigate and treat (if necessary) *Anopheles* mosquito breeding sites in the vicinity of reported human cases in order to prevent local disease transmission.



2012 Positive West Nile Virus Activity in Contra Costa County



## 2005-2012 Summary of Encephalitis Virus Surveillance

### Mosquito samples

Between 30 and 50 dry-ice baited mosquito traps are set every week, some at fixed locations and others at variable locations, based on dead bird reports, mosquito complaints, or other indicators of possible virus or nuisance risk. Mosquitoes from these traps are tested for mosquito-borne viruses in batches, or 'pools' of between 10 and 50 individuals of a particular species. Some testing (for WNV only) can be done in our own laboratory, but the majority of samples are sent to the University of California Center for Vectorborne Disease Research where they are tested for WNV, WEE, and SLE. Results of this testing enable us to determine areas of the county at risk for disease transmission and target our control resources efficiently.

		2005	2006	2007	2008	2009	2010	2011	2012
Mosquito Samples	Samples tested	425	523	721	729	814	536	484	468
	Total no. mosquitoes	20,309	24,358	28,290	23,502	27,436	16,820	14,321	11,571
	WNV positive	4	20	28	31	17	4	7	19
Chickens	Blood samples tested	800	904	669	851	717	773	600	590
	Total no. chickens	50	50	50	50	50	50	50	50
	Seropositive	18	24	5	15	13	4	0	7
Dead Birds	Total reported	5,589	3,472	2,042	2,227	1,221	923	1,057	1,816
	Total tested	518	388	158	115	80	32*	74*	106*
	WNV positive	94	92	29	88	45	8	43*	66
Dead Squirrels	Total tested	45	41	29	39	19	0**	0**	0**
	WNV positive	25	19	5	9	2	--	--	--

\*testing restricted to crows/jays only    \*\*squirrels not tested    +includes five 'chronic positive' birds

In 2012, 468 samples, comprising more than 11,500 mosquitoes were tested; 19 were positive for WNV (11 *Culex pipiens*, eight *Culex tarsalis*). Twelve of these samples came from areas in Brentwood where we were having a problem with inadequately maintained stormwater detention basins, which had become overgrown with vegetation and hence were difficult to inspect or larvicide effectively. The resulting increased risk of disease transmission (local mosquito infection rates briefly reached 'epidemic risk' levels) necessitated several adult mosquito fogging operations in the area to protect public health. The remainder of the positive mosquito samples came from other areas of East County, including Antioch, Knightsen, Byron and Discovery Bay.

### Dead birds

The dead bird surveillance program represents a very successful collaboration between the California Department of Public Health, the District and the residents of Contra Costa County. Dead birds are reported by the public to the statewide WNV Hotline (1-877-WNV-BIRD) or online at <http://westnile.ca.gov>. Hotline operators screen the calls to determine whether the birds are suitable candidates for testing; if so, they are referred to the District to be collected. Although not all birds are



candidates for testing, all reports are important since they are mapped and used to identify potential risk areas and to target additional surveillance (mosquito trapping and larval source inspections, for example).

Due to limited staff availability for bird pickups, testing in 2012 was again restricted to corvid (crow family) birds only (crows, ravens, jays, magpies). Although we have occasionally found WNV positive individuals of other species, corvids are the most highly susceptible and therefore represent the most sensitive indicators. Also, corvids tend to develop higher virus levels in their bodies than other birds, which means that the virus can often be detected in our own laboratory the same day the bird was collected, using a rapid screening test. Birds testing negative on our initial screening are sent to the University of California for further testing. Results typically take 10 days to two weeks.

During 2012, the WNV Hotline received 1,816 dead bird reports from Contra Costa County residents. Of those, 106 birds were suitable for testing and 66 tested positive. As in 2011, we continued to see clusters of positive birds in the Concord/Pleasant Hill/Walnut Creek area, although no infected mosquitoes were found there, in addition to several separate clusters in East County.

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## Sentinel Chickens

Chickens are naturally resistant to mosquito-borne viruses and do not become ill, nor can they pass the virus back to mosquitoes, but they do develop antibodies that can be detected in lab tests. This makes them ideal 'sentinels' for detection of virus transmission. The District maintains a total of 50 chickens (10 at each of five flock sites) within the county. New young chickens are obtained from a commercial chicken farm each spring to ensure that they have not been previously infected. Blood samples are collected twice a month from April through October and submitted to the California Department of Public Health's Viral and Rickettsial Disease Lab in Richmond to be tested for antibodies to WNV, WEE and SLE viruses. In 2012, seven of our chickens tested positive for WNV antibodies. Since chickens cannot pass the virus on to others, they are donated to charitable organizations for egg production or adopted by owners of the host properties at the end of each season.

## Human Disease Cases

Four human WNV cases were reported by the Contra Costa County Department of Public Health, one in East County, one in West County, and two in Central County. Three of the four patients experienced the severe, neuroinvasive form of the disease, but fortunately were reported as 'recovering'. Since the Centers for Disease Control statistics show that neuroinvasive disease represents approximately one in 150 of WNV cases, it can be estimated that more than 450 county residents may have been infected in 2012. The vast majority of milder cases go untested and unreported since they may be asymptomatic (no symptoms) or their symptoms mistaken for the 'flu'. Statewide, there were 479 human cases (19 fatal).

## Equine Disease Cases

No equine (horse) cases were reported in Contra Costa County in 2012 (an effective vaccine for horses has been available for several years). Statewide, 22 equine cases were reported.

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## *Mosquito Control Operations*

### Hottest Year on Record Creates Perfect Storm for Mosquitoes

2012 was the hottest year on record in the contiguous United States, this according to the National Oceanic and Atmospheric Administration. It was a fact not lost on mosquito control experts because warm temperatures increase the risk of mosquito-borne illness and in 2012 they suspect the phenomenon likely contributed to a near record-setting year for West Nile virus.

A disease that starts with birds, West Nile virus is transmitted when a mosquito becomes infected by biting an infected bird, and then bites another animal or human. Warm weather allows the virus to reproduce more efficiently. The weather also prompts migrating birds to return to many areas while triggering existing mosquitoes to emerge from winter hibernation and allowing new mosquitoes to develop from egg to adult much faster. Entomologists theorize that in 2012, infected birds seeking water in relief of the heat may have come within close proximity of mosquitoes that were laying their eggs in water, increasing the odds that the mosquitoes would bite the birds causing the virus to spread.

The result was a national West Nile virus season in which 5,387 people were diagnosed with West Nile virus, making 2012 the worst national West Nile virus season since 2003. West Nile virus is grossly under reported. The true impact of the virus in 2012, according to the Centers for Disease Control and Prevention's studies, illustrate that the true number of people infected with West Nile virus in 2012 included as many as 188,647 additional people who became sick, but did not receive a doctor's diagnosis.

Nationally, the center of the public health emergency created by West Nile virus in 2012 was the state of Texas. California had the second highest number of West Nile virus cases.

### East Contra Costa County Delivers Challenging West Nile Virus Season

While much of the country grappled with the all but record-setting West Nile virus season in 2012, Contra Costa County experienced a challenging West Nile virus season as well. The local season started nearly three months earlier than the previous year and proved taxing from the start.

The first bird that tested positive for West Nile virus in 2012 turned up in the area hardest hit by the virus in 2011; central Contra Costa County. However, by summer, it was clear that the true focus of the 2012 season would be east Contra Costa County. The community of Brentwood produced 12 of the 19 West-Nile-positive mosquito samples and 16 of the 66 West-Nile-positive birds that were collected countywide all year. In response, the Contra Costa Mosquito & Vector Control District utilized the District's Integrated Vector Management program which is designed to prevent mosquito production by using physical, biological, chemical and communication tools.

District employees provided inspections, treated underground storm drains and basins, and canvassed neighborhoods by going door to door in search of the source of Brentwood's mosquitoes, but birds and mosquitoes continued to test positive for West Nile virus. The infected mosquitoes raised the possibility residents could become ill, so the District conducted ultra low volume truck-mounted fogging of public health pesticides in an effort to knock down the adult mosquitoes before they could transmit disease to nearby citizens. At the same time, District inspectors followed the evidence of mosquito activity to storm water detention basins located near Heron Park in the eastern section of Brentwood.

During the home building boom of the late 1990s and early 2000s, developers installed the basins as a way to collect residential runoff and slow the water's progression into storm drains, thus reducing the risk of flooding. Once the water cleared the basins, usually within 72 hours, they were designed to remain dry and without vegetation. However, Brentwood's basins were neither dry nor vegetation-free. Vegetation not only grew, it flourished creating prime locations of mosquito production. The dense vegetation in the Brentwood basins created a major challenge for district employees who had a difficult time accessing each basin's floor to look for and treat any water to prevent mosquitoes. After multiple attempts produced limited results, the District turned to Brentwood officials, County Flood Control officials, and property developers to find a way to clear the vegetation. Using machinery to clear the area was the first consideration; however, the soggy ground made it likely the equipment could get stuck. That's when Flood Control officials turned to a unique solution.

## Goats Join the Fight Against Mosquitoes

Goats R Us is an Orinda-based company that uses goats to naturally mitigate vegetation-related issues. In the case of Brentwood's storm water detention basins, the goats cleared the foliage over several days, making the basins accessible to District inspectors. With easier access, district employees used time-release bacterial public health pesticides to kill young mosquitoes in the water, while reducing the risk of mosquitoes for many weeks at a time. The product does not harm other insects or animals in the water. Soon the number of infected mosquitoes the District caught in traps near the pond started to decrease, suggesting the goats had succeeded in allowing proper surveillance and treatment in that particular area. The true test of success will come if the basins can be maintained in the future and if that maintenance prevents a reoccurrence of West Nile virus in the same location.



*Goats clear vegetation from detention basins in Brentwood*

## Mosquito Zones

The Contra Costa Mosquito & Vector Control District uses a zone system to provide service countywide. Due to employee staffing changes resulting from retirements and necessary leaves of absences, in 2012 the District reallocated zone assignments in an effort to increase efficiency and productivity. What had been 11 zones became 10 zones represented by 10 of the District's state-certified inspectors and technicians. During particularly challenging periods of the year's West Nile virus season, District zone leaders used joint collaboration to meet the demands for mosquito control in some zones. And for the first time in three years, the District hired seasonal vector control aides to assist with mosquito control duties.

The zones are overseen by two District supervisors who each manage five employees in the mosquito program. In previous years, the county was divided into two main areas: the Waterfront Zones and the Inland Zones. However, in 2012, the District changed the county division to Eastern Zones and Western Zones. This way, each supervisor is responsible for overseeing both inland and waterfront mosquito sources.

Pastures and agricultural fields often require a great deal of attention due to seasonal flooding that can produce millions of mosquitoes. In 2012, District employees regularly inspected these areas and used open lines of communication as a critical tool to prevent mosquitoes. They met with landowners, irrigators and appropriate city or county agencies to encourage mutual cooperation to reduce the risk of mosquito-borne illness. When irrigators notified the District of impending flooding, District employees used bacterial public health pesticides to prevent mosquitoes from developing into adulthood. The District also encouraged agricultural workers responsible for infrastructure to maintain irrigation equipment to prevent unintended flooding that can also produce millions of mosquitoes and increase the risk of disease.

Rain water is a wildcard in mosquito control because it can enable mosquito production in many unexpected areas. The Western tree hole mosquito relies on rainwater to activate her eggs and allow her young to develop into adulthood. In 2012, District inspectors and technicians responded to reports of day-biting mosquitoes and found tree hole mosquitoes primarily in the western and central parts of Contra Costa County. These mosquitoes can spread canine heartworm disease most often to dogs, but rarely to cats. District employees treated tree holes when possible with a special absorbent which soaks up rain water, denying the young mosquitoes the water needed to complete their life cycle.

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Neglected swimming pools have increased the risk of mosquito-borne illness in Contra Costa County since the start of the national economic crisis in late 2007. During the years of the resulting national foreclosure crisis, neglected swimming pools appeared across the county creating a county-wide public health crisis. Each swimming pool can produce more than one million mosquitoes that can impact citizens up to five miles away. For the fifth year in a row in 2012, District employees responded to the pools, using mosquito-eating fish most often, as well as bacterial public health pesticides when needed. In many cases, the pools were located on abandoned properties, but a significant number were located on occupied properties where homeowners are not properly maintaining their swimming pools. As the economy shows signs of stabilization, it is the District's hope that the number of swimming pools that necessitate the District's services will decrease as more homeowners become able to properly maintain their swimming pools.

Industrial areas provided mosquito challenges in 2012, particularly when rainwater created additional areas that could produce mosquitoes. District employees worked with employees at refineries, power plants, sanitary districts, the former Concord Naval Weapons Station and other industrial areas to advise them about ways to reduce the risk of mosquito-borne illness at each location. Plants and other industrial operations can produce mosquitoes during maintenance on equipment that holds water, but in 2012 the biggest mosquito-related problems at industrial facilities involved mitigation ponds. District employees worked with supervisors at the various facilities to encourage changes to the ponds that would maintain flowing water or allow for vegetation removal to permit successful mosquito control to prevent young mosquitoes from developing into adulthood.

Landscaping over-irrigation was a serious area of concern in 2012 due to the excess water that collected in storm drains which are a common habitat for one of the county's two main mosquitoes capable of transmitting West Nile virus. The overwatering occurred on golf courses and private properties alike, resulting in an increase in *Culex pipiens* mosquitoes. *Culex pipiens* frequently lay their eggs underground, making the catch basins under curbside gutters an ideal location for them. District technicians and inspectors worked with property owners and landscapers when possible to educate them on how reduced irrigation could still maintain lush vegetation while lowering the risk of mosquitoes. In cases where mosquitoes were already present, District technicians and inspectors used storm drain misters to reduce the number of mosquitoes.

Marshes and wetlands pose a particular challenge when it comes to mosquito control because without natural or mechanical motion to keep water flowing, these locations can provide a place where millions of mosquitoes can live and have offspring, and have the ability to fly up to 20 miles. That is why District employees work closely with companies and agencies responsible for maintaining these sites to promote wetlands without mosquitoes. In 2012, a pump system used to keep water flowing in certain coastal marshes was not operating at optimum levels for the first half of the year. This required District inspectors to use amphibious, all terrain vehicles to distribute time-release bacterial public health pesticides to prevent mosquito production until the pumps could return to working order. The ARGO is a crucial piece of equipment in many of the county's coastal areas. District employees who are trained in the specialized use of these vehicles rely on their amphibious abilities to reach areas of mosquito production that would otherwise be inaccessible.

## Looking to the Future

Primarily due to employee retirements over the last few years that resulted in positions that were not filled, the District was able to hire two new vector control technicians in late 2012. In the New Year, these District employees will be working to meet new mosquito control demands by assisting zone leaders initially and taking responsibility for their own zones when needed.

As one of the main demands for mosquito control in recent years has been neglected swimming pools, the District expects neglected swimming pools and water features to remain a major source of mosquito production in need of the District's public health services until a full economic recovery is successful in establishing homeowners in many currently vacant homes. At the same time, as signs of economic recovery were apparent with the return of new construction projects in 2012, the District will be mindful and take appropriate preventive actions as these projects present the potential for new mosquito sources in the future.

While those same economic challenges encouraged the District to make prudent and responsible operational decisions during recent years, we are poised to approach the future with a continued emphasis on team work and sensibility as the District pursues the same mission we have had for 86 years—to protect public health.

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## *Rats & Mice*

### Rat & Mouse Inspections

Rats and mice can spread contamination and disease through their waste and nesting material and by doing so they can pose a threat to public health. The Contra Costa Mosquito & Vector Control District strives to protect public health from vectors such as rats and mice by providing free inspections and advice to county residents and business owners. The District also provides services to communities that experience rats in waterfront areas, commercial regions and in sewer systems.

During a property inspection for rats or mice, one of the District's state-certified inspectors who specialize in rat and mouse prevention conducts a visual inspection of the exterior of a structure to look for signs that the rodents are present or places where a rat or mouse could enter a structure. The District employee also examines vegetation and any items placed outdoors. Many times people do not realize items, including pet food that is left outside or the ivy in a yard, can actually attract rats and mice. The District employee may also conduct an interior inspection most often limiting that inspection to areas surrounding sinks and hot water heaters in a garage or kitchen. At the conclusion of the inspection, the District employee relies on his or her state training and expertise to provide the citizen with written recommendations and advice on how to get rid of the rats or mice and prevent them from returning in the future.



*Vector Control Inspector Steve Fisher consults with a resident about how rats and mice are entering his home*

In 2012, the District experienced a decrease in the number of times citizens requested rat or mouse service. Residents and business owners made 598 requests for service in 2012 compared to 803 requests in 2011. The larger number of requests in that year was due at least in part to a particularly long rainy season that allowed grass seed that serves as food for rats and mice to continue to grow through the year. The increase in food allowed the rat and mouse population to expand as well. However, in 2012, the weather returned to a dry, warm pattern. The change in climate may be at least partially responsible for the decrease of service requests if the weather resulted in a decreased rat and mouse population in Contra Costa County.

### Staffing Reduction & Service

The number of District inspectors who specialize in rat and mouse services declined from four to three in 2012 with the retirement of Vector Control Inspector John Chase after more than 30 years of protecting public health. In spite of this reduction in staffing, the District's remaining inspectors were able to maintain county-wide coverage of rat and mouse inspections, an accomplishment likely made possible based on the smaller number of requests for service in 2012.

Within Contra Costa County, citizens in the cities of Concord, Walnut Creek, and Antioch submitted the largest number of requests for rat and mouse service in 2012. There were 91 requests from Concord, 71 from Walnut Creek, and 51 from Antioch; all down from 2011.

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## Overirrigation and Sewer Baiting

The use of more water than necessary to maintain residential landscaping increases the risk of mosquito-borne illness because that excess water pools in storm drains giving mosquitoes more locations where they can lay their eggs resulting in more mosquitoes overall. But, overirrigation is not only an issue when it comes to mosquitoes, it also creates problems related to rats and mice.

Overwatering lawns leaves vegetation at a heightened state of humidity and that humidity attracts animals including rats and mice in search of a water source. And if they are attracted to a front or back lawn, rats and mice can easily search for shelter in a home or structure nearby. But the humidity found in landscaping isn't the only moist location to attract rats. Humid, dark sewer lines also attract rats, prompting the District to conduct sewer line baiting. In 2012 The District baited 55 sewer locations in 10 cities, down from 80 locations in 17 cities in 2011.

## Increased Regulation

2012 marked a change in rodenticide regulation that impacted how the District administered rat bait. Under the new requirements, rodenticide must be placed no further than 50 feet from a building in many situations. This forces rats and mice to travel closer to a building before encountering bait. Previous guidelines allowed rodenticide to be located more than 50 feet from a building allowing for a larger buffer zone before rats and mice could have the opportunity to search for an entry point to the building.

With the altered opportunity to expose rats and mice to bait under the new requirements, in 2012 the District conducted a rodenticide survey as part of an ongoing effort to ensure the bait is effective and environmentally appropriate. The results of the survey prompted the District to begin use of two new rodenticides that comply with the new EPA requirements while fulfilling the District's goal to use environmentally responsible public health pesticides.

## El Cerrito BART Project

While conducting an earthquake retrofit project along the Ohlone Greenway, the San Francisco Bay Area Rapid Transit District inadvertently precipitated a rat issue when workers disturbed vegetation at the location. The vegetation provided harborage to the rats, which fled in search of new shelter opportunities. The District was called to the scene to suppress the rats exiting the construction site and work to prevent them from flooding into the adjacent neighborhood. The District's state-certified inspector caught more than 100 rats that had taken up residence in the foliage under the BART tracks.

## In the Future

In 2012, the District experienced staffing challenges including scheduled retirements and unexpected employee leaves of absences. District managers and supervisors continue to look for the most efficient ways to protect the people of Contra Costa County from the insects and animals that can transmit disease and cause harm, while maintaining an effective number of vector control employees. Consistent cross training of newer employees between mosquito and vertebrate programs in the coming year and exploring zone reassignments to redistribute inspector responsibilities will enable the District to maximize customer service.

Adjustments such as these allow the District to provide excellent public health services to county residents, as well as prioritize the District's long standing effort to educate county residents on the often easy and always necessary steps to reduce the risk of vector borne disease for themselves and their families.

## Ticks & Lyme Disease

Lyme disease is a bacterial infection transmitted by the Western black-legged tick (also known as the deer tick). While Lyme disease is rare in Contra Costa County (on average there are two to four human cases reported per year), it can cause serious complications if not treated promptly. The District has monitored the risk of Lyme disease by collecting and testing black-legged ticks from several locations in the county for more than 15 years. On average, only one or two in one hundred black-legged ticks test positive, although we have found a few locations where the rate is higher, and these tend to change over time.



Vector Ecologist Eric Ghilarducci collects ticks for Lyme disease testing by dragging a cloth flag through the grass

District staff continue to identify ticks brought in by members of the public, as this is important because there are three species of ticks that commonly bite people and only one (Western black-legged tick) transmits Lyme disease. After careful consideration, the District entomologist and vector ecologist, along with biologists from the California Department of Public Health concluded that individual tick testing does not significantly reduce the risk of Lyme disease for patients since the data cannot confirm human disease. People who are concerned with possible Lyme disease should contact their physician.

In 2012, the number of tick related service requests was lower from the previous year and below the five-year average. Of the 57 ticks identified by our staff, 31 were Western black-legged ticks (the vector of Lyme disease). While this represents an increase in the number of *Ixodes* ticks identified this year when compared 2011, numbers are still below the five-year average.

### Ticks of Contra Costa County

There are three species of common human-biting ticks in Contra Costa County.

- Western black-legged tick (*Ixodes pacificus*)
- Pacific Coast tick (*Dermacentor occidentalis*)
- American dog tick (*Dermacentor variabilis*)

Of these three, only the Western black-legged tick (*Ixodes pacificus*) is known to transmit Lyme disease in California. Adult females of the species are about 1/8" long and reddish-brown in color. Males are slightly smaller and brownish-black.

### Protect Yourself from Tick Bites

Know where to expect ticks. Western black-legged ticks live in moist and humid environments, particularly in or near wooded or grassy areas. You may come into contact with ticks during outdoor activities around your home or when walking through vegetation such as leaf litter or shrubs. To avoid ticks, walk in the center of trails.

Use a repellent with DEET (on skin or clothing) or permethrin (on clothing and gear). Products containing permethrin can be used to treat boots, clothing and camping gear, which can remain protective through several washings. Repellents containing 20 percent or more DEET (N, N-diethyl-m-toluamide) can be applied to the skin, and they can protect up to several hours. Always follow product instructions. Parents should apply repellents to their children, taking care to avoid application to hands, eyes, and mouth.



The Western black-legged tick is one of three species of ticks in Contra Costa County and the only one of them known to transmit Lyme disease.



## Perform Daily Tick Checks

Check your body for ticks after being outdoors, even in your own yard. Conduct a body check upon return from potentially tick-infested areas by searching your entire body for ticks. Use a hand-held or full-length mirror to view all parts of your body and remove any tick you find. Take special care to check these parts of your body and your child's body for ticks:

- Under the arms
- In and around the ears
- Inside belly button
- Back of the knees
- In and around all head and body hair
- Between the legs
- Around the waist

Check your clothing and pets for ticks. Ticks may be carried into the house on clothing and pets. Both should be examined carefully and any ticks that are found should be removed. Placing clothes into a dryer on high heat effectively kills ticks.

## What to Do If You Are Bitten by a Tick

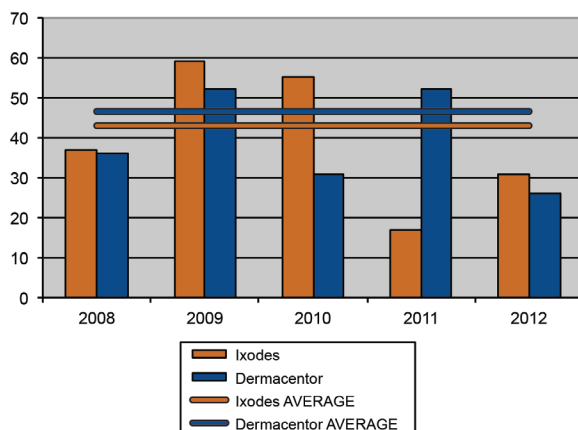
Remove an attached tick using fine-tipped tweezers as soon as you notice it. If a tick is attached to your skin for less than 24 hours, your chance of getting Lyme disease is extremely small. But to be safe, watch for signs or symptoms of Lyme disease such as rash or fever, and see a health care provider if these develop.

Your risk of acquiring a tick-borne illness depends on many factors, including where you live, what type of tick bit you, and how long the tick was attached. If you become ill after a tick bite, see a health care provider.

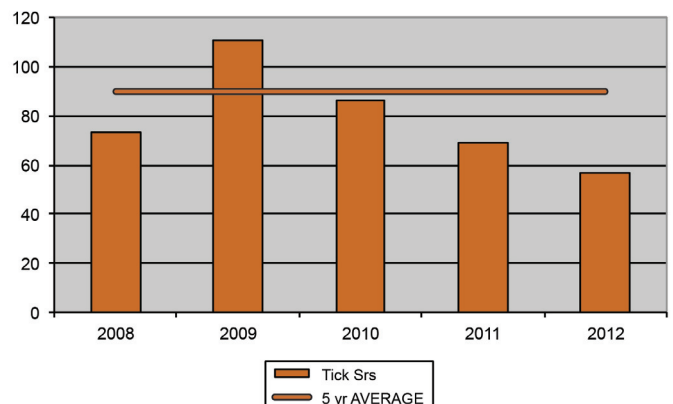
## Prevent Ticks on Animals

Prevent family pets from bringing ticks into the home. Maintain your family pet under a veterinarian's care. Two of the ways to get rid of ticks on dogs and cats are putting on tick medicine or using a tick collar. Be sure to use these products according to the package instructions.

Tick Service Requests by Type



Tick Service Requests



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## *Skunks and Rabies Risk Reduction*

Skunks can transmit rabies. That is why the Contra Costa Mosquito & Vector Control District provides free inspections and advice for skunks as part of the District's Rabies Risk Reduction program.

The Striped Skunk (*Mephitis mephitis*) is the most common species of skunk found in Contra Costa County. The Spotted Skunk (*Spilogale putorius*) also calls the county home, but is less prevalent than the striped skunk. In California, skunks are the second most frequent mammal to test positive for rabies. Bats are number one.

In 2012, the District assisted local, state, and federal public health investigators as they examined the case of a 34-year-old Contra Costa County man who died of rabies in Switzerland. The investigation pointed to evidence that the man had contracted rabies from a bat in Contra Costa County. A subsequent District inspection found no additional evidence of bats at the location where the man reportedly encountered the infected animal.

When it comes to reducing the risk of contracting rabies from skunks, the Contra Costa Mosquito & Vector Control works with residents and landscaping employees across the county to provide property inspections and educate them about the simple steps they can take to discourage skunks from taking up residence on both public and private properties. Those steps can include using hardware cloth screen that is buried into the ground to cover the space below a raised deck or building to prevent skunks from creating a home under the structure. Keeping wood piles elevated off the ground also prevents shelter opportunities. Removing food sources by not storing water and pet food outdoors, picking up fallen fruit, and keeping tight-fitting lids on garbage cans also deny skunks a source of food.

On properties where skunks have created a den, the District's public health inspector may find the situation has warranted a live-catch trap. Once a skunk is caught, the District employee removes the skunk from the property. By law and due to the risk of the spread of rabies, skunks caught may not be relocated. The District humanely euthanizes any skunks that are caught.

Two District inspectors with nearly 22 years of experience combined, provide the District's skunk services. In 2012, the number of requests for these services increased compared to 2011. In 2011, the District received 639 skunk service requests, but in 2012, that number grew to 728 requests. Cities with the largest number of skunk service requests were Concord with 94, Walnut Creek and Martinez with 92 each, and Danville with 82. The service requests resulted in the removal of 448 skunks in 2012, up from 302 in 2011. The reason for the apparent increase in skunk population is due to several factors.

First, 2012 was the warmest year on record in the United States and the third warmest year in California. Vector control experts hypothesize that the unusually warm temperatures that included an abnormally warm winter may have allowed more skunk offspring to survive and flourish. The unseasonably warm temperatures also failed to kill off or make vegetation dormant, instead allowing skunks to find plentiful food. At the same time, citizens who didn't properly remove fallen fruit or rotting remains of vegetable gardens provided the animals with food. That lack of do-diligence may be the reason in 2011, the District had to perform repeat service on nine properties, but in 2012, District inspectors returned to 53 properties because skunk activity reoccurred.

A common theme in the areas that experienced the most skunk activity in 2012 was the availability of food and shelter that prompted many skunks to leave nearby fields and open spaces to relocate in neighborhoods. Looking to the year ahead, education will remain a priority in the District's efforts to reduce the risk of rabies from skunks. By providing instruction on skunk prevention through outreach, which includes conversations with the public, newsletter articles, advertising, the District website, and presentations, the District continues its mission of protecting the people of Contra Costa County from skunks and other vectors — insects and animals that can spread disease or cause discomfort to people.



*A skunk peeks out from ivy in a homeowner's yard*

## Yellowjackets

Yellowjackets can repeatedly sting and bite anyone who threatens their home or well-being. Unlike their distant cousin the honey bee, the yellowjacket's stings and bites are more painful. And due to a yellowjacket's multiple attempts to induce pain, the assault can be dangerous for someone allergic to the aggressive insect. Because of this threat to public health, the Contra Costa Mosquito & Vector Control District provides free inspection and treatment services for this notorious arthropod.

There are four species of yellowjackets in Contra Costa County. Two build their nests above ground and tend to be less likely to engage in confrontation. Two more aggressive species build nests underground in abandoned animal holes or voids. Two species, the common yellowjacket (*Vespula vulgaris*) and the Western yellowjacket (*Vespula pensylvanica*), build their nests underground. Vibrations caused by humans or animals walking on the ground above the nest, or landscaping equipment being used nearby, can prompt the yellowjackets to exit the nest in defense of their home. With populations ranging from an average of 5,000 yellowjackets to a large nest that can have nearly 25,000 yellowjackets, the unsuspecting person or animal could be at significant risk.

In 2012, the District's public health inspectors, including a vector control aide hired by the District, were called out to inspect and or treat yellowjacket nests 675 times, fewer than the 856 requests for service in 2011. But, District employees who provide yellowjacket services report the differences between the two years go beyond the numbers. In 2011, District inspectors found multiple yellowjacket nests on a number of private properties, a likely reason for increased numbers of requests for service made by residents. In 2012, however, while a handful of properties had as many as six or eight nests, the majority appeared more typical in that there were only one or two nests on most properties. But the twist was that a number of nests were much deeper underground and some were quite large, requiring more time and effort to treat these nests.

Usually, a yellowjacket nest is one or two feet underground, but District employees actually found nests as deep as four feet underground in 2012. And in a few cases these nests were unusually large. One particular nest located on a central county golf course was observed to be nearly the size of a small car. Another large nest was located buried deep into a backyard hillside in Walnut Creek. With 2012, now the warmest year on record in the United States could the climate combined with the depth of nests give yellowjackets prolonged survival?

District records show residents began contacting the District for yellowjacket inspections in February of 2012, with the last call of the year coming in December for the second year in a row. The length of the season creates at very least the illusion that yellowjackets survived all year long. With this kind of evidence, District scientists will be monitoring the trends while they prepare for whatever Mother Nature brings by way of yellowjackets in 2013.



Vector Control Aide Heidi Budge treats ground-nesting yellowjackets.

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## *Africanized Honey Bees*

Contra Costa County's first detection of Africanized honey bees (also known as "killer bees") was in July of 1997 and the second was in December of 2008. Both incidents involved imported bees that hitched a ride on cargo ships and the bees were intercepted before they could escape and establish new colonies. As the lead agency for these aggressive bees, the District responds to public complaints of honey bee swarms and new hives in potentially hazardous locations.

The District receives approximately 30 service requests related to honey bees every year. In 2012, the District received 16 calls about honey bees compared to 23 calls in 2011 and 29 in 2010. Most calls are due to the presence of a honey bee swarm passing through or resting in a neighborhood. These swarms are generally not a threat as the bees are simply in search of a new hive location, but they can look rather alarming and may sting, but only if provoked.

Initial screening for Africanized honey bees is made by scientists measuring the wing span of the bees and comparing them to those of European honey bees, but they can only be positively identified through DNA testing.

Since Africanized honey bees have not colonized in Contra Costa County to date, the District advises homeowners who observe a swarm in their neighborhood to let the bees leave on their own, if they do not pose an immediate risk to health and safety. In any case, homeowners should ensure their home has no deficiencies that will allow bees to colonize, such as gaps or holes in the exterior of their homes or missing screens that might allow the bees to find harborage in the walls. District personnel work to educate individuals about the value of bees as pollinators and the difficulties that bee colonies have trying to survive in our county. District staff provides homeowners with contact information for local beekeepers who have agreed to retrieve feral bee swarms or hives. District employees always strive to leave the hive intact and only treat swarms or hives if they pose an imminent threat to public safety.

Currently, Africanized honey bees are established as far north as Fresno, California; however, the bees can be unwittingly transported into our county as evidenced by the previous incidents, or they may continue to move north into our county on their own. Either way, our District remains poised to respond and protect public health from this sometimes fatal vector.



[www.DesertUSA.com](http://www.DesertUSA.com)

*Africanized Honey bees ("killer bees") are slightly smaller than European honey bees, but only experts can tell them apart by measuring their wingspan.*

## Fisheries

The District distributed 92,482 mosquitofish (*Gambusia affinis*) in Contra Costa County and produced approximately 930,000 mosquitofish in 2012.

The District has continued to spawn California Roach (*Lavinia symmetricus*) in efforts to evaluate a native fish species for use in mosquito control. This was the first year we used our domesticated brood stock for spawning trials (as opposed to wild caught), which were produced in April and May of 2010. Six tanks were used in spawning trials to determine optimum size and densities for spawning, ease of maintenance, and egg collection. Three types of spawning vessels were used. One 208 liter aquarium was stocked with 16 roach, four 1,003 liter circular fiberglass tanks stocked with 25, 50, 100, and 200 fish respectively, and one 7,500 liter fiberglass tank stocked with 3,000 fish. One egg trap was placed in the 208 liter aquarium, two traps were placed in each of the 1,003 liter tanks, and two traps were placed in the 7,500 liter tank, but included one standard and one large trap. Traps were placed near inflow of water, thus providing a slight current over the trap. Eggs were first found March 21, 2012 in three of the 1,003 liter tanks and eventually in the remaining vessels in limited numbers (60 to 100 eggs). Some batches of eggs were found dead when first observed. No eggs were found after April 20, 2012. Eggs were collected from all egg traps totaling 874 larvae. No vessel performed better than the other. The large egg trap was hard to handle due to its weight and seemed to collect more debris than standard traps. Poor egg production is most likely due to the immaturity of our brood fish.

To evaluate their effectiveness in controlling mosquito larvae, a total of 22 swimming pools were stocked with California roach in 2011 and 2012. Mosquito production was eliminated in all pools except for two, in which first in-star larvae were observed. In 2013, we plan to continue monitoring these pools and stock additional sites.



*Egg traps used with the California Roach fish.*



*Examples of the small and large traps used for the California Roach fish project.*

## Public Affairs & Community Outreach

### Multifaceted Outreach

Each year, the public affairs department conducts research and evaluates the current outreach campaign and advertising programs to ensure that residents of Contra Costa County receive the best information in an effective and efficient manner. With more than 1.1 million residents in more than 400,000 households across an environmentally-diverse 736 miles, a variety of tactics is used to reach and teach constituents about important health issues.

Our outreach includes presentations to a variety of groups and audiences, information displays at libraries, meet-and-greet tables at farmer's markets, and informational booths at fairs and events. The number of events we participated in 2012 increased by 53 percent compared to 2011 and had an increase in attendance by 69 percent.

### Website

The District's award-winning website remains the No. 1 communication tool for residents wanting to learn more about vectors, the diseases they transmit, reporting dead birds, and more. Updating the website is a daily routine at the District so we can ensure the best possible and most up-to-date communication is available. From featured stories and videos to breaking news and West Nile virus updates—to making requests for service or just using the interactive map to see if adult mosquito fogging is taking place on a particular street, the website is the go-to resource for mosquito and vector information 24 hours a day.

### BART

Each BART station in Contra Costa County displays one or more District posters designed to quickly remind people to prevent mosquitoes and West Nile virus. Three key points are illustrated: drain standing water, wear mosquito repellent, and report neglected pools.

The advertisements have proved successful, in part due to QR codes. QR codes are Quick Response codes that allow people to scan the code with their smart phones and be directed to a specific webpage or link.

This year we secured placement of the posters on some of BART's platforms that are in direct line with passenger's views. They view the ads while waiting to board a train.



*An advertisement illustrating three important ways to prevent mosquitoes and West Nile virus is shown on a platform in full view of passengers waiting for the BART train. More than 2 million people have the opportunity to see our message over the a couple of summer months. Note the popular Quick Read (QR) code on the bottom left of the advertisement. Click on the code with a smart phone and be directed immediately to the District's website for more information.*

### Publications

Contributing timely articles for publication in community newsletters has proven quite successful in the past, specifically in 2011 when we reached more than 107,000 constituents with our stories in 21 outside publications. This year, however, the number of publications decreased 38 percent to stories published in just 13 outside publications. Many organizations have narrowed their content to include only stories specific to their own core business or the online newspaper shut down.

Our own newsletter, Mosquito Bytes, grew by 20 percent in subscriptions. Mosquito Bytes is delivered electronically by Constant Contact® through a free subscription. To sign up for the monthly publication, simply **opt in using your email address**.

Relevant and timely stories written for the newsletter have a triple function. In addition to the online newsletter itself, the stories are used as a feature story on the District's website, are placed in independent newsletters as mentioned above, and are tweeted to the media. Feature stories often result in media coverage as was the case with the story about District entomologist and Scientific Program Director Steve Schutz **who feeds mosquitoes his own blood** to sustain the colony. Read more about this topic in the Videos category and the Social Media category on the next page.

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## Media

Media is a crucial component of the public affairs department as it helps the District reach the greatest amount of people free of charge. In addition to news stories, just like the public, reporters can opt to receive three communication pieces: media releases, adult mosquito spray notifications, and the Mosquito Bytes Newsletter. The District is well connected with and relies on the media to share information and breaking news.

In 2012, television news stories and postings increased 181 percent, print news and postings 45 percent, and radio broadcasts by 275 percent. The year proved to be the second busiest West Nile virus year, and thus the same in terms of media attention. The District's public affairs manager works closely with reporters to ensure that they have the information they need to distribute to the public. We rely heavily on the media to broadcast important health information, such as West Nile virus and to encourage the public to do their part in the community through proactive vector control. Not only are news stories economical—free, actually—for the District, but a past countywide survey conducted by the District illustrated that residents prefer to get important news information from newspapers and television. The media have done an excellent job in keeping the public informed about West Nile virus, vector issues, fogging events, and important legislation that impacts mosquito control operations.

## Social Media

Twitter has evolved into a key communication tool for the District. The 140 maximum-allowed-character posts make the communication incredibly concise. The District tweets all fogging or operational decisions, as well as updates on topics about vector control in general, research, breaking news, and more. The response from the media is usually immediate, sometimes within one minute, which makes the communication efficient.

We tweeted our most popular story, “Entomologist Endures 15,000 Mosquito Bites a Year to Sustain Colony for Science” and it was re-tweeted, “liked” and posted more than 800 times. The story was picked up by local and worldwide media, spreading across American websites, then branched out to Mexico, Spain, Portugal, and China. Health and science magazine Discover, which has a paid circulation of nearly 7 million readers, also published the story.

## Bus Advertisements

The mobility of buses allows the District's key messages to be delivered throughout Contra Costa County on a routine basis. Bus tails, advertisements placed on the back of buses, are an effective way to build awareness of key issues and announce our call to action. All three bus lines, County Connection, Tri Delta Transit, and WestCAT in Contra Costa County display the ads.

## Awards

Constant Contact® presented the District with an All Star Award for exemplary customer reach, communication and engagement for our news releases, Mosquito Bytes Newsletter, and our Adult Mosquito Fogging Notification. Awards are given to those companies who illustrate effective communication and engagement with their customers. They must use an opt-in only program—no spam allowed—and the evaluation must prove that emails are opened, read, and have engagement. To view all of the District's awards over the years, please [visit our awards page](#) on our website.

## It's in the Mail

One of the most popular and used resources by our residents is the weekly Penny Saver that is delivered to residents in their mailbox. This year, we redesigned the District's advertisement on the front and back covers of the Penny Saver to include both English and Spanish language. Eliminating the larger size, loose flyers used in previous years' publications enabled us to afford communication to be delivered three to four times to all households in Contra Costa County throughout the peak season—unprecedented reach and frequency for a mosquito and vector control agency. This publication outlines key mosquito control tips and West Nile virus information, and lists the District's free services.

In addition to placing information on the back cover, we place various advertisements inside the Penny Saver. These ads illustrate our rat services, a request to readers to call in dead birds, and information about the importance of reporting neglected swimming pools.

## Videos

The number of times our videos have been viewed increased in 2012 by 31 percent. Residents have watched our videos more than 53,000 times since we began posting them on our YouTube Channel. Our most popular video to date is the “[Entomologist Endures 15,000 Mosquito Bites a Year to Sustain Colony for Science](#)”, which registered more than 12,000 views. This story, which the District published in the Mosquito Bytes newsletter, triggered widespread curiosity resulting in several featured stories in the media published from Concord to China.

## *Environmental*

In addition to protecting public health, the District is also dedicated to protecting the natural environment. Healthy wetlands support populations of natural predators, producing fewer mosquitoes than habitats modified or damaged by human activity. The District plays a leadership role in the conservation and restoration of Bay Area wetlands, protection of endangered and threatened species, and promotion of biorational (environmentally compatible) control methods in order to protect both human and environmental health.

No deed is too small when it comes to protecting the environment. The District has made many small changes that have added up to big differences. We are a past recipient of an award for our water recycling program that ensures water from trucks using pesticide products is diverted from catch basins that carry water to creeks and waterways. Solar panels were installed to capture the sun's energy and support District operations. Finally, the District installed a water filtering station for employees, eliminating disposable plastic water bottles from daily use.

## *Continuing Education*

The District employs vector control technicians certified by the California Department of Public Health. In order to become certified, technicians are required to pass an exam in pesticide use and safety, in addition to at least one of the following: Mosquito Biology and Control; Terrestrial Invertebrate (insect) Biology and Control; Vertebrate (animal) Biology and Control. Certificates are renewed every two years provided the following continuing education requirements have been met during that period: Pesticide Use and Safety, 12 hours; Mosquito Control, 8 hours; Terrestrial Invertebrates, 8 hours; Vertebrate Vectors, 8 hours. In addition to these basic requirements, the District conducts annual in-house training and frequent reviews and updates of policies and procedures at weekly and monthly staff meetings.

## *Shop & Facility Maintenance*

The District employs one mechanic responsible for all automotive and facility repair and maintenance. He maintains 41 field vehicles, 4 staff vehicles, 18 vehicles sprayers, 2 boats and their trailers, 7 8-wheel ARGOs, 3 4-wheel All Terrain Vehicles, 11 trailers, 3 Ultra Low Volume sprayers, 1 catch basin mister, 1 Africanized Honey Bee sprayer, and 1 forklift. The mechanic designs and fabricates specialized equipment, provides most needed repairs and maintenance of grounds and equipment, such as electrical upgrades, plumbing repairs, solar panel maintenance, flooring and miscellaneous projects.

## *Information Technology*

The IT technician is responsible for all communication technology at the District, maintaining all aspects of the administration phone system, cell phones, computers and internet services. The IT technician maintains 40 computers and their associated software, including programming and maintaining VXS, a specialized database the District developed and uses for vector control surveillance, monitoring pesticide usage, workload management and more.

In 2012, a server virtualization project was completed by the IT technician. This helps the District to acquire all of the benefits of virtualization technology, which includes reducing hardware costs, saving energy, and experiencing higher uptime/availability.

## *Administration*

Administrative staff serve the residents of Contra Costa County by responding to telephone inquiries, scheduling service requests, compiling mandated reports and maintaining public records. Staff responsibilities also include processing service requests, contract billing, payroll and accounts payable, as well as providing administrative support. Working closely with city and county personnel, staff also correspond and work extensively with city and county entities regarding compliance and enforcement on vector control issues.



*The Contra Costa Mosquito & Vector Control District is located in Concord, CA.*



## Financial Statement

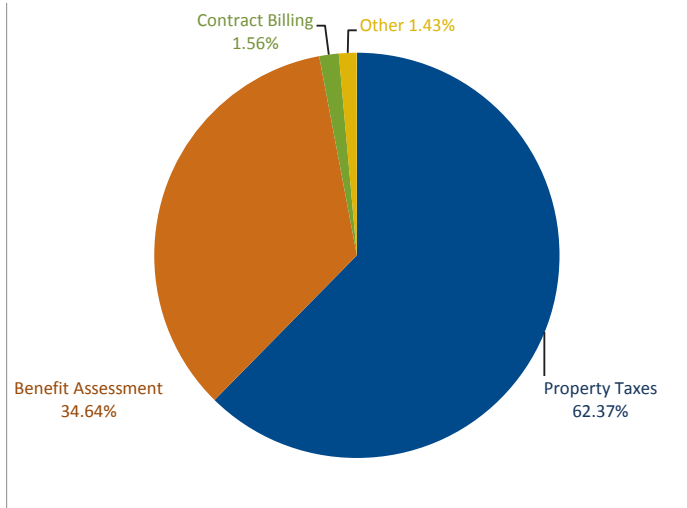
The District depends on property tax revenues and benefit assessment charges in Contra Costa County to fund operations.

District property tax revenues declined approximately one percent in fiscal year 2011/2012 due to the economic crisis and lower property tax values in Contra Costa County. Despite the continued decline in values last year, the one percent decline is an improvement from the sharp declines we saw in previous years. We are now seeing signs that Contra Costa County property tax values are beginning to stabilize and may even start to rise as economic conditions show improvement.

Additionally, local property taxes earmarked for the District are diverted annually to the State of California's Educational Revenue Augmentation Fund (ERAF). In 1996, the District implemented a countywide benefit assessment to replace these lost funds. This nominal annual charge varies among four zones in Contra Costa County according to benefit of our services, and generates revenues that are used to provide mosquito and vector surveillance and control projects to the properties in Contra Costa County.

The District's board of trustees created a trust and adopted a policy to begin funding Other Post Employment Benefits— "OPEB". Under Government Accounting Standards board recommendations, public agencies need to start funding future retiree health benefits. Based on studies completed by an independent outside actuary, the District currently contributes \$200,000 from reserves to this trust fund. This contribution is the major reason for the necessary transfer from reserves noted in the District financial statements.

As mandated by government code, the District is annually **audited** by an outside agency. The agency audits the District's financial statements to obtain reasonable assurance that the financial statements are free of material misstatement, they review the accounting principles used, all financial disclosures, and the overall financial statement presentation. The District annually receives an *Unqualified Opinion*, which is the best opinion bestowed.



Revenues	2011/2012*	2012/2013**
Property Taxes	\$3,516,466	\$3,592,845
Benefit Assessment	1,990,334	1,994,309
Contracts	79,448	90,000
Interest	23,779	20,000
Miscellaneous	68,889	63,704
<b>Total Revenues</b>	<b>\$5,678,916</b>	<b>\$5,760,858</b>
Expenditures	2011/2012	2012/2013
Salaries & Wages	\$4,466,230	\$4,548,616
Operations	1,382,780	1,506,860
Capital	35,050	29,486
<b>Total Expenditures</b>	<b>\$5,884,060</b>	<b>\$6,084,962</b>
(transfer from reserves)	(205,144)	(324,104)

\*Audited    \*\*To be audited



**Protecting Public Health Since 1927**  
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