ALAMEDA COUNTY

VECTOR CONTROL

ANNUAL REPORT 2022

Mission

The mission of the Vector Control Services District is to prevent the spread of vector-borne diseases, injury, and discomfort to the residents of the District by controlling insects, rodents, and other vectors and eliminating causal environmental conditions through education and integrated pest management practices.

Introduction

This 2022 Annual Report for County Service Area (CSA) VC 1984-1 for Vector Control is presented to the Alameda County Board of Supervisors (BOS) in compliance with Section 25214 and 25215.3 of the Government Code; County Service Area Law Chapter 13.20, and California Health and Safety Code Section 116110-116180.

This report gives a history on how and why the County Service Area (CSA) (known as the Alameda County Vector Control Services District, or "the District") was formed, explains how the assessments are calculated, and includes assessment tables since the CSA was formed in 1984.

In addition, this report includes highlights from the District's field operations as well as a summary of disease surveillance activities and our public outreach program.

This report is available for public review at the Vector Control Services District, 1131 Harbor Bay Parkway, Suite 166, Alameda, CA 94502, and is also posted on our website at (http://www.acvcsd.org).

In 2022 the Alameda County Vector Control Services District underwent additional staffing changes and contributed to protecting human health in new and unique ways.

Among the 2022 highlights were the following:

- The retirements and departures of key staff members opened positions which were subsequently filled during the year by hiring five new employees. Their backgrounds include careers in pest control and educational degrees in entomology, ecology, and evolutionary science. Current staffing now includes individuals with 11 bachelor's degrees (biochemistry, horticultural forestry, general biology, health education, human development, and environmental science), 7 master's degrees (physics, entomology, public administration, and public health), and two PhDs (entomology).

- Norway rat populations at homeless camps have been an ongoing problem. District staff continued performing surveillance operations at older established camps, as well as initiating surveillance at several new camps.

- The District significantly increased its hantavirus surveillance program, exploring several new locations, in addition to re-visiting previous areas.

- The District's lab expanded its testing of tick pathogens by including surveillance for *Anaplasma phagocytophilum*, a bacterium that causes human disease. In 2022 it was detected for the first time in Alameda County.

- District staff coordinated with the California Department of Fish and Wildlife, the US Department of Agriculture, and the County Public Health Department, assisting with the surveillance of H5N1 bird flu (Highly Pathogenic Avian Influenza). Several locations were identified where this pathogen appeared in Alameda County.

- During the summer of 2022, an unusual harmful algal bloom (HAB), or "red tide" appeared at several sites within the Oakland estuary and Lake Merritt. District staff were responsible for posting warning signs near these areas.

- As 2022 ended, the total number of requests for service for the year totaled lower than any time in the previous 8 years. Possible reasons for this decline are discussed below.

District Services

Request for Service: Overview

- Conduct investigations in response to requests for service from the public for rodent, wildlife, and insect vectors of disease, assess environmental conditions for vector harborage and access, and recommend solutions to reduce vector activity and associated public health risks.
- Investigate reported public health and vermin problems related to rodents, cockroaches, flies, fleas, bed bugs, lice, stinging insects (yellowjackets and bees), ticks, mites, and spiders, and render or recommend the appropriate control services based on integrated pest management strategies.
- Provide insect, tick, and spider identifications and recommend the least–toxic control strategies.
- Conduct surveys of rodents, insects, and arthropods of public health importance and maintain a reference collection.

- Survey and control cockroaches in public sewers, utility boxes, and storm drains.
- Conduct yellowjacket and bee control in public areas.

Wildlife Management and Rabies: Case Investigation

- Conduct investigations of nuisance wildlife problems relating to bats, skunks, opossums, raccoons, turkeys, feral pigs, foxes, coyotes, dogs, cats, rabbits, and birds (especially pigeons).
- Trap nuisance animals when preventive alternatives or exclusion practices are not possible or unlikely to be effective.

- Work in coordination with local animal control agencies and the Alameda County Public Health Department to monitor and test wildlife (bats, skunks, opossums, cats, etc.) for rabies and submit an annual report to the California Department of Public Health.

Rodent Control

- Provide recommendations for rodent proofing and population control in homes, neighborhoods, open areas, and businesses.

- Conduct rodent suppression during vector-borne disease outbreaks, public health emergencies, or when residents are experiencing a public health risk from rodents and their ectoparasites.

- Conduct surveys of rat populations to assess species abundance, distribution, and disease-carrying potential.

- Conduct inspections and rodenticide baiting of sanitary sewers for rats within the City of Oakland.

- Inspect and test sewer laterals and mains to detect breaks, which may provide an egress for rats to move into adjacent neighborhoods.

Solid Waste Problems

- Investigate complaints regarding solid waste involving garbage, human or animal wastes, and odors at residential properties and businesses. These issues often attract or harbor rodent and wildlife vectors.

Vector-Borne Disease Surveillance and Control

- Investigate reports of animal or human cases of disease such as Lyme disease, Psittacosis, Plague, Hantavirus (HCPS), Flea-borne Typhus, Tick Relapsing Fever, Chagas disease, Reptilian salmonellosis, Ehrlichiosis, Anaplasmosis, and Rabies to determine cause, incidence, distribution, and appropriate prevention and remediation measures.

- Assist the public with tick identification and submissions of ticks to laboratories for Lyme disease testing.

- Collect rodent ectoparasites and determine Plague potential (or other vector-borne disease transmission potentials) and implement rodent suppression and ectoparasite elimination strategies as required.

Public Education and Information

- Provide educational presentations to schools, civic groups, property managements, homeowner associations, and the general public.

- Disseminate educational materials on vector-borne diseases to residents and interested groups.

- Engage with the public through interactive outreach booths at local health fairs, special events, and the Alameda County Fair.

- Post annual shellfish harvesting quarantine notices at the Alameda County bay shoreline.

- Maintain a current, informative, and interactive web site.

- Provide timely and informative media releases on vector control issues.

Legal Enforcement

- Provide assistance to local code enforcement agencies to enforce state laws, regulations, and local ordinances related to rodent, wildlife, or insect vectors that pose a threat to public health and safety.

History

The County Service Area (CSA) 1984-1 for Vector Control was established in June 1984 to serve the public needs by providing a comprehensive vector control program. Prior to 1984, the Environmental Health Department was experiencing fiscal shortfalls, and had to reduce vector control services in Alameda County. In response, the Board of Supervisors (BOS) created the County Service Area after the passage of Measure A, which received over 70% voter's approval for the formation of the CSA. Initially, Dublin, Emeryville, and Fremont were not included in the District and opted to seek alternative sources for providing vector programs.

In 1987, the City of Oakland recognized that it had a severe rat problem emanating from the sanitary sewers which exceeded the District's staff capabilities to control. Subsequently, Oakland voters approved a supplemental assessment, which was first levied in fiscal year 1988-89, and provided additional funding to control rodents in the sewers.

In 1992, at the request of the Dublin City Council, Dublin voted to join the District and subsequently Dublin was annexed by the BOS.

In 2009, both Emeryville and Fremont were annexed to the District by the BOS after a successful Proposition 218 mail ballot process. Currently, the CSA is a countywide District, providing vector control services to all 14 cities in Alameda County, including the unincorporated county areas.

The City of Berkeley already had an existing vector control program when the CSA was formed in 1984. It is currently funded by a formal contract between the City of Berkeley and the CSA.

Background

The County Service Area (CSA) VC 1984-1 is solely funded through two benefit assessments (BA) charged to parcels benefitting from District services. In 1997, California voters approved Proposition 218, requiring that all parcel owners subject to the assessment receive a mailed ballot regarding any proposed change in an assessment prior to imposing an increase. Since then, the District (CSA 1984-1) is not able to increase revenues without conducting a new revenue measure.

In 2007, the SCI Consulting Group was awarded a contract by the BOS to conduct a survey among the property owners to gauge their support for a new vector control benefit assessment. The survey showed that there was overwhelming support for an additional benefit assessment at the rate of $4.08 which when added to the existing levy of $5.92, would result in a total rate of $10 per single-family residence. Assessment ballots were mailed to all property owners within the original District boundary areas in May 2007. The ballot measure received 67.7% voter support, and the BOS approved the new assessment of $4.08 in July of that same year.

Previously, in May of 1995, the Alameda County Department of Public Health contracted with a private consultant to prepare a Strategic Marketing Plan. The recommendation for the CSA was to work with the Cities of Emeryville and Fremont toward incorporation into the CSA. The City of Emeryville contracted for services with the District in the late 1980's but discontinued the contract for financial reasons. The City of Fremont attempted to create its own Vector Control program but was not able to secure the necessary funding to develop an effective program.

In 2006, the Alameda County Local Agency Formation Commission (LAFCO) contracted with Burr Consulting to review all the County Service Areas for possible consolidation. Burr Consulting recommended that the Vector Control District and the Mosquito Abatement Districts conduct balloting to provide countywide services and work toward consolidation.

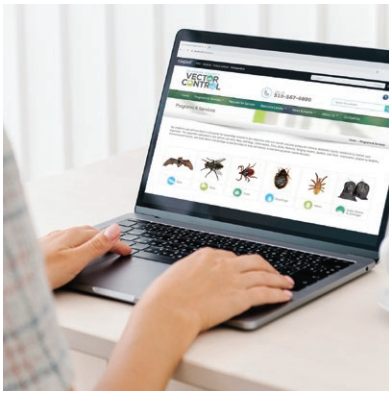
In January of 2008, SCI Consulting surveyed a sample of residents in Emeryville and Fremont; results from both cities were favorable for creating a new benefit assessment that would permit the CSA to provide vector services. In March, 2008, the BOS authorized the CSA to proceed with an application to the LAFCO to obtain approval of the annexation process to annex Emeryville and Fremont. The CSA submitted the application which included environmental documents (Initial Study, Negative Declaration) pursuant to the California Environmental Quality ACT (CEQA). In July of 2008, the LAFCO approved the CSA application of annexation and issued a Certified LAFCO Resolution. On September 9, 2008 the LAFCO adopted a Resolution and ordered the annexation. In compliance with Proposition 218, the CSA mailed out ballots to all parcel owners subject to the assessment in Emeryville and Fremont regarding the proposed New Vector and Disease Control Assessment of $10 for single-family residence. The results were favorable (Emeryville – 70.23% and Fremont – 66.36%) to support the new assessment in providing the vector services in both cities. In response, subsequently, the BOS approved the newly proposed Vector and Disease Control Assessment of $10 for a single-family residence. As of July 1, 2009, the CSA has extended the vector control services to Emeryville and Fremont and became a county-wide service District.

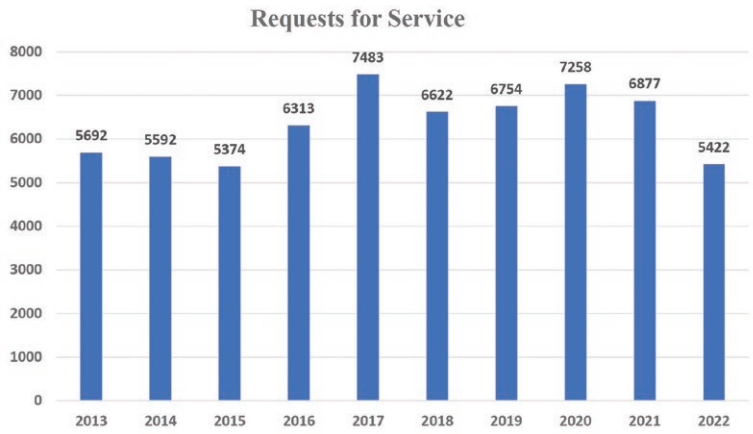
Since the CSA's original assessment and Emeryville and Fremont's annexation, BA rates remained at $4.08 and $10.00 per single-family residence, respectively. For FY 2019-20, the BA rates increased $1.00 to $5.08 and $11.00 per single-family residence. With BOS approval, CSA assessed $5.92 and $6.01 for basic and secondary vector control services throughout the county for FY 2022-23, an increase of $0.93 from the previous fiscal year. For Emeryville and Fremont, the assessment rate increased by $0.93 to 11.93 per single-family residence. Vector control services throughout the County are funded by the assessments.

Vector Control Field Services – Operations

Requests for Service

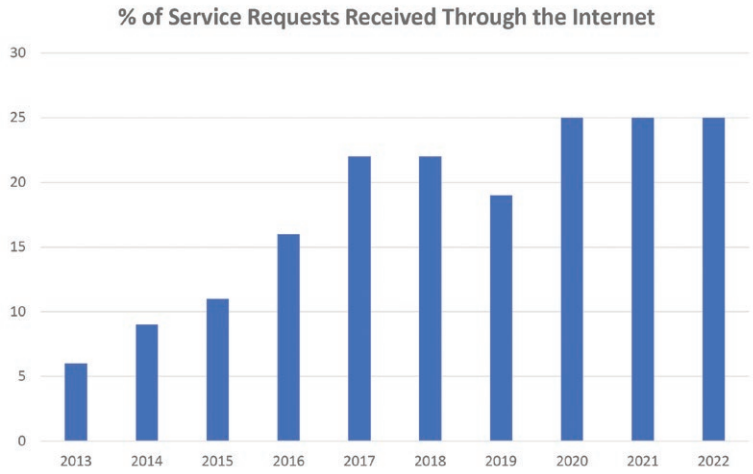
In 2022, the District's total requests for service (RFS) dropped significantly. A total of 5,422 requests were logged, a drop of 1,422 (21%) from 2021. This represents the lowest number in the past eight years since 2015, when 5,374 were logged. The 10 ten-year average of RFS is 6,339, so the 2022 drop in numbers is noteworthy. Some of the largest declines from 2021 were seen in RFS for roof rats (27%), Norway rats (16%), raccoons (17%), and yellow jackets (66%). Reasons for this decline are unclear but several causes may be at play. While there was an increase in RFS (especially from first time callers) during the first two years of the COVID pandemic, by the third year, residents returned to the workplace, resulting in less contact with vectors. Thus, 2022 reflects a return to the norm. In addition, there are several biotic and abiotic factors that may have impacted vector populations. Three previous years of extreme drought in the State may have affected some vector populations by limiting access to food and water. Natural fluctuations of diseases, parasites, and predators regularly cycle through vector communities, and may be responsible for the "booms and busts" seen in some of these populations.





Requests for Service Received Through the Internet at an All Time High

In 2013, the District made an important modification to its website by creating the ability to submit a request for service online. In our expanding digital age this important adaptation was necessary and done to extend our outreach to the public. It also helped alleviate the bottleneck of thousands of phone calls received annually. In the nine years since its inception and peaking in 2020, 2021, and again in 2022, this new feature now accounts for one quarter of all the requests for service received by the District.

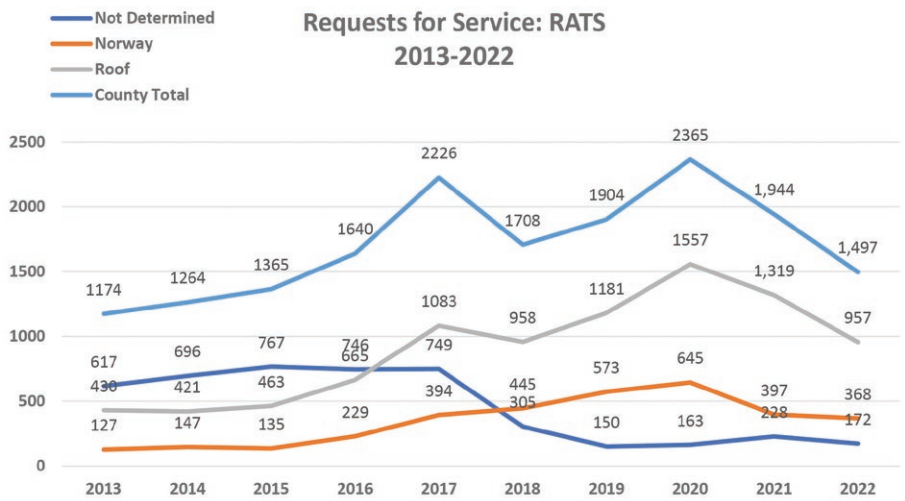


Urban Rodent Surveillance and Control

The urban rodent surveillance program focuses on monitoring and controlling commensal rats (Norway and roof rats) and mice in residential, commercial and business properties. In 2022, the District received 1,735 requests for service (1,497 rats, and 238 mice) from the public for domestic rodents, representing 32.0% of all service requests. This is the second consecutive decline in rodent requests for service since the peak seen in 2020. Those 1,735 rodent service requests lead to staff biologists performing 10,889 field services operations related to domestic rodents. The field service operations included smoke and dye tests of sewer lines for breaks, field and residential surveys for rodent activity, recommendations and follow-up evaluations of rodent control measures, and assistance of enforcement actions.

Staff biologists responding to a rodent service request will carry out thorough inspections of the exterior and interior premises of a property looking for rodent harborage or activity and will advise the property owner on necessary structural modifications to prevent rodent entry into their home or business. They will hand out brochures to neighbors and will inspect adjacent properties with approval when necessary. Staff biologists also evaluate and survey neighborhoods that

have significant rat activity based on clusters of complaints or where residents report seeing rats roaming on surface streets. Staff biologists will locate rodent sources (sewers, food items, infested buildings nearby, etc.) and implement rodent suppression strategies to prevent public health issues related to rodent-borne diseases.



When evidence indicates that rats are surfacing near sewer laterals, staff biologists conduct inspections to locate broken sewer lines within the system and notify the homeowners or the Public Works Department to ensure repairs are made. In 2022, staff biologists found 17 broken sewer laterals and performed dye tests or smoke tests to verify the breaks.

As part of the City of Oakland's supplemental assessment targeting rodent populations in sanitary sewers, staff biologists conduct weekly inspections of underground sewer access structures (manholes) for signs of rodent activity (live rats or their droppings). To control rodent populations in areas with activity, rodenticide bait blocks are suspended in sewers to allow easy access for feeding. In 2022, a total of 8,085 sewer inspections were made in Oakland. Those sewers in Oakland that had active rodent activity totaled 2,024 and they were treated with a Contrac rodenticide bait block. In some cases, where signs of heavy rat activity were observed, sewers were double baited (218) or triple baited (2).

Wildlife Management Programs

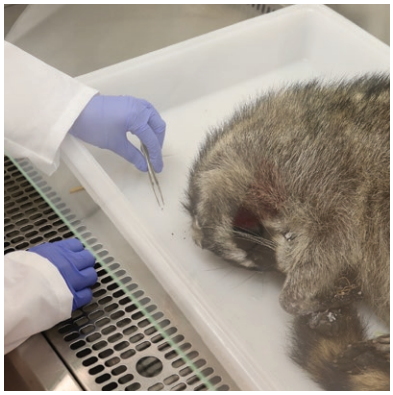
In 2022, the District responded to 1,923 service requests concerning wildlife, and those service requests led to staff performing 12,127 field service operations within or near residential areas. Most of these service calls involved raccoons, skunks, opossums, and foxes. We advise homeowners to employ harassment techniques, make exclusion repairs, reduce food or other attractants, and modify the habitat to eliminate or prevent recurrence of the wildlife problem. Our staff biologists assist property owners by coordinating with the District's USDA Wildlife Specialist (WS) who uses integrated pest management (IPM) techniques and offers a wide range of preventive (indirect control) and population reduction (direct control) methods. Below is a breakdown of the common wildlife nuisance species (raccoons and skunks) that account for the most wildlife service requests.

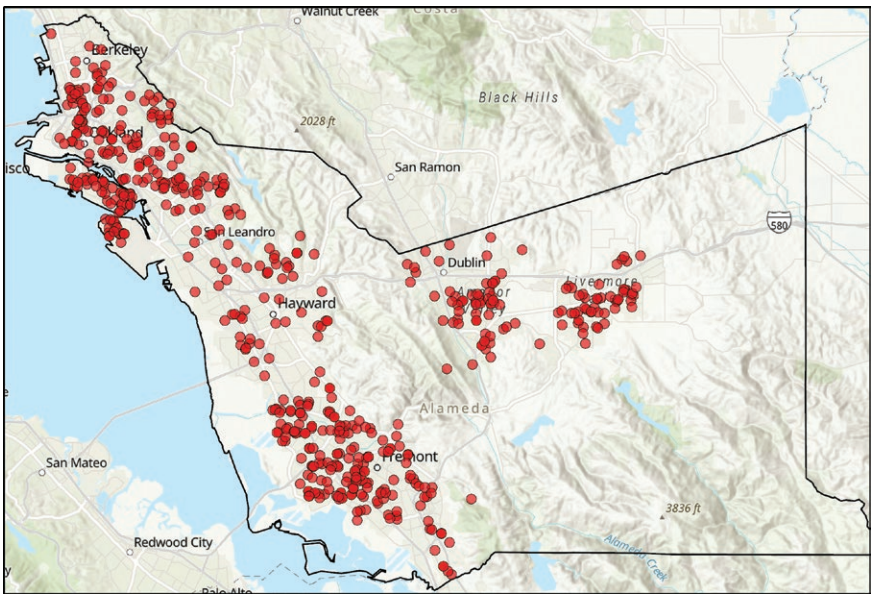
Raccoons

In 2022, the District responded to 467 service requests related to raccoon problems. Raccoons often den in backyards, beneath decks, under homes, or in attics; they feed on backyard fruits, insects, vegetables, garbage, and pet foods left outside overnight. At certain times of the year, they also dig for beetle grubs in lawns and can cause significant property damage. Raccoon "grubbing" on lawns was one of the leading reasons for raccoon related requests for service.

To prevent damage to lawns, staff biologists and the WS may suggest applying commercial grub killer products, repellents, and cutting back on watering the lawn.

Young raccoons are generally born in April/May. Female raccoons readily nest and care for their young in attics and crawl spaces. This can result in urine and feces accumulating inside or underneath homes, creating an objectionable odor and a public health risk. These situations are a common service request we receive for raccoons. Eviction and exclusion are the keys to eliminating den sites in structures. Raccoon eviction fluid, one-way doors, and harassment strategies can remove raccoons that have gained access to structures. The home then must be wildlife proofed by sealing all entry points. In situations where public safety is threatened, or property damage is recurring, trapping a nuisance raccoon may be necessary.

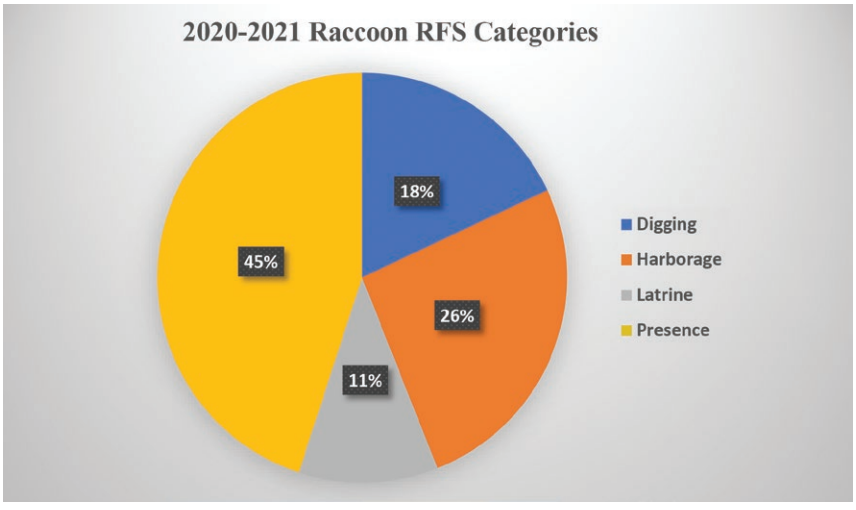




Raccoon requests for service 2022.

Raccoon Requests for Service: Categories

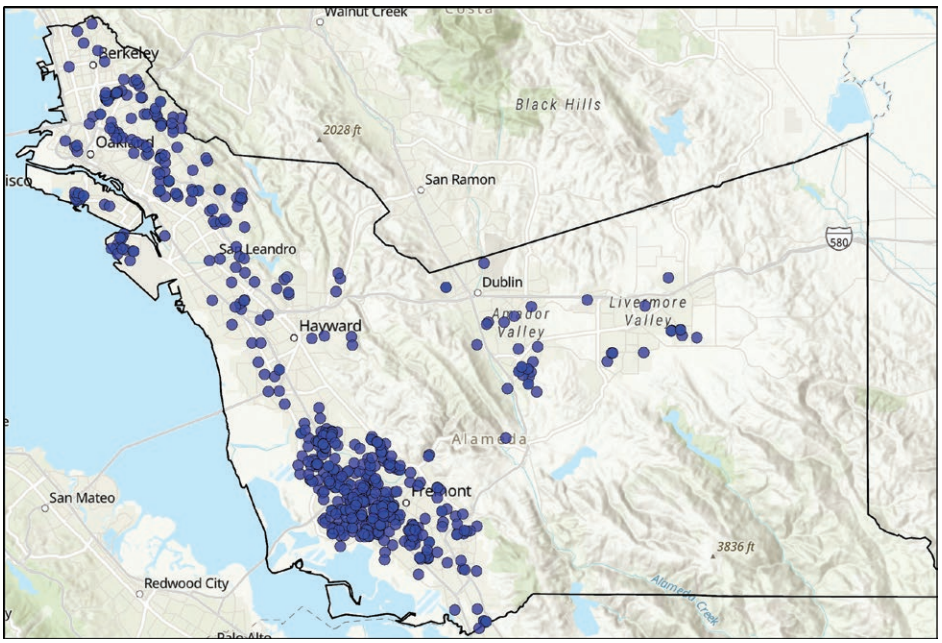
An analysis of 965 raccoon requests for service over a two-year period (2020 and 2021) was performed and revealed that these calls can be divided into four main groups. "Digging" (18%), also called "grubbing" can occur any time of the year, but these calls tend to increase in the late summer and fall. "Harborage" (26%) calls are those in which the animal is denning in a residential or commercial structure on a semi-permanent basis and often involves a mother raccoon with her offspring.



A “Latrine” request for service (11%) is the discovery of a scat pile left by a returning raccoon or raccoons and presents a disease risk. The largest type of call is “Presence”, and accounts for nearly half (45%) of the raccoon requests for service received by our District. Examples of these calls may include the observation of raccoons in a backyard, beneath a deck, on a fence, in a tree, or emerging from a storm drain. In many cases the raccoon is simply traveling through the property and residents may request an inspection to determine if their home is animal proof and learn how to minimize wildlife attractants.

Skunks

Skunk problems were the most common wildlife-related service request in 2022, totaling 604 service requests. Skunks utilize residential areas because of the availability of food, water, and shelter. Skunk problems peak during their mating season (December through February), and young are born about 9 weeks later. During mating season, competing males will often spray, creating a nuisance. Females will often den in crawl spaces of homes. Additionally, skunks can be a carrier of rabies in California, creating a potential serious public health risk.



Skunk requests for service 2022.

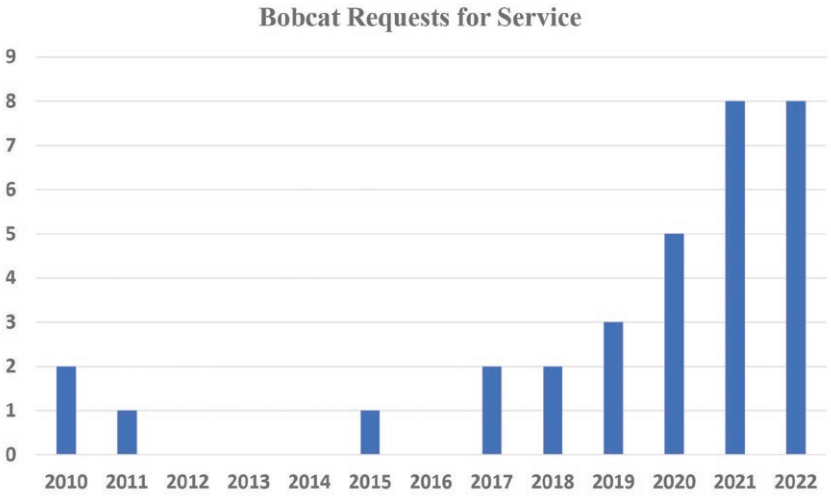
Skunk control methods focus on harassment, eviction and exclusion through modifying den sites and access points, using one-way doors, and other deterrents like cayenne pepper and ammonia. Trapping may be warranted if these methods are not sufficient. Exclusion after successful evictions involves denying future access through screening and the use of 1/4-inch mesh hardware cloth. Homeowners can spray lawns with an approved insecticide to control grubs and other insects, thus discouraging grubbing behavior.

Wild Turkey Calls Now Recorded in District Database

Over the last few years calls from the public regarding wild turkey issues have increased. In 2020, a new “reason code” was created in the District’s database to closely monitor these calls. For the year 2022, 22 wild turkey requests for service were documented from nearly all parts of the County. Turkeys can cause property damage such as cracking roof tiles, scratching cars, or disturbing landscaping. In addition, they may defecate in areas frequented by the public. Male turkeys (toms) can act aggressively towards people. Nuisance birds cannot be removed (euthanized) unless the reporting party obtains a depredation permit from the California Department of Fish and Wildlife.

Bobcat Requests for Service Trend Upward

Although the overall number is low, Alameda County has observed a noticeable increase in the number of bobcat (*Lynx rufus*) requests for service over the last 9 years. These adaptable species have a large range, and feed primarily on rodents, rabbits, and birds. Adults are distinctly larger than house cats, reaching up to 4 feet in length and weighing up to 40 pounds, giving them an intimidating appearance. Most requests for service are either simple sightings on a property, or a mother has established a den with her kits beneath a deck in a backyard. Human contact with these animals is rare, but an unusual encounter occurred in Alameda County in the fall of 2020. A resident was tending to her chicken coop and one of her pet chickens was on her shoulder when a bobcat jumped on her back and grabbed the bird. The resident was scratched and required rabies prophylaxis. Subsequent trapping attempts of the aggressive cat were unsuccessful.



Venomous Arthropod Programs

Venomous arthropods include mites, ticks, spiders, wasps (and other insects) that can sting, bite, secrete venoms, or cause allergic reactions in humans and domestic pets. In 2022, the District received 463 service requests for venomous arthropods. County residents can request the identification of various stinging insects and arachnids that they find in and around their homes. A staff biologist will collect and identify the arthropod and advise residents on how best to control the insect while minimizing the risks of bites and stings.

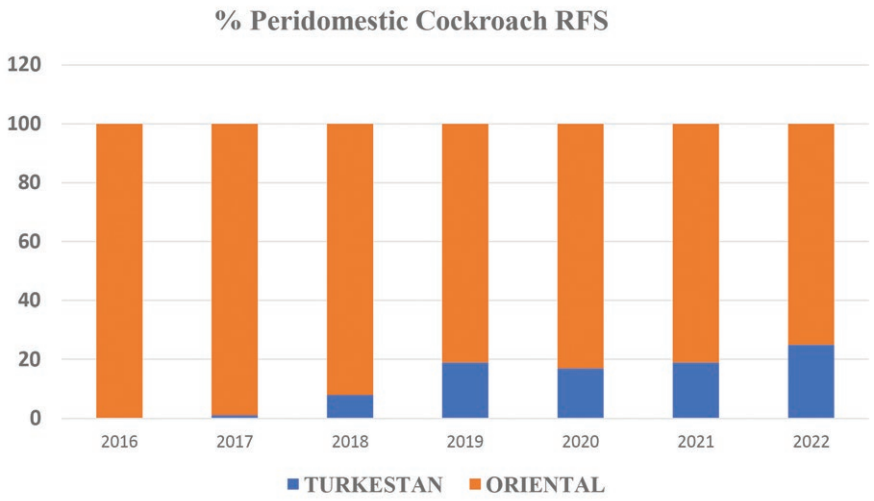
The District works quickly to treat yellowjacket and wasp nests located near residential and public areas because of the public health risk these insects may pose. Staff biologists may contact the Alameda County Beekeepers Association to safely remove honeybee swarms and hives when possible. In 2022, the District responded to 277 venomous wasps and 78 honeybee complaints.

Miscellaneous Arthropod Programs

In 2022, the District responded to service requests on a variety of nuisance pests such as ants (26), cockroaches (296), flies (95) and fleas (69) infesting homes, yards, and commercial facilities. Our staff biologists frequently identify insect and other arthropod species collected by concerned residents. Staff biologists will conduct inspections to locate insect breeding locations and recommend control options. Additionally, residents frequently request treatment of residential or commercial areas where they see cockroaches openly roaming sidewalks and streets. With their ongoing research programs, staff biologists are developing new operational strategies for controlling cockroaches in sewers, water meter boxes and storm drains. The Turkestan cockroach, introduced into California in 1978, was first recorded in Alameda County in 2013 and since then has significantly increased its range and abundance.

Turkestan Cockroaches Displacing Oriental Cockroaches

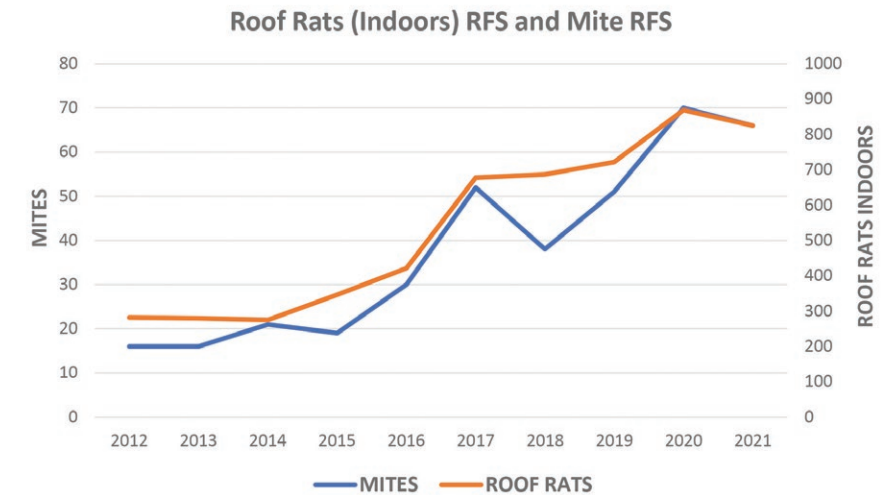
The three most common outdoor cockroach species found in Alameda County are the oriental, the American, and the Turkestan. The American cockroach (*Periplaneta americana*) dwells primarily in sewers, where it thrives under warm, humid, and dark conditions. They occasionally emerge from sewers and may be found in crawl spaces or basements. The Turkestan cockroach (*Blatta lateralis*) and the oriental cockroach (*Blatta orientalis*) are both considered peridomestic, meaning they live around human homes and accidently find their way indoors.



Fortunately, neither species are considered to pose a risk to public health. They both have similar habits, finding refuge in water meter boxes, drains, wood piles, or pavement cracks. They may take up residence in outdoor sheds, garages, or basements, and at night move into homes in search of food, water, or mates. Despite these similarities, female Turkestan cockroaches reach maturity faster and produce more eggs than oriental cockroaches. As a result, the oriental cockroach is slowly being displaced by the newer invasive Turkestan cockroach.

The Roof Rat and Tropical Rat Mite Connection

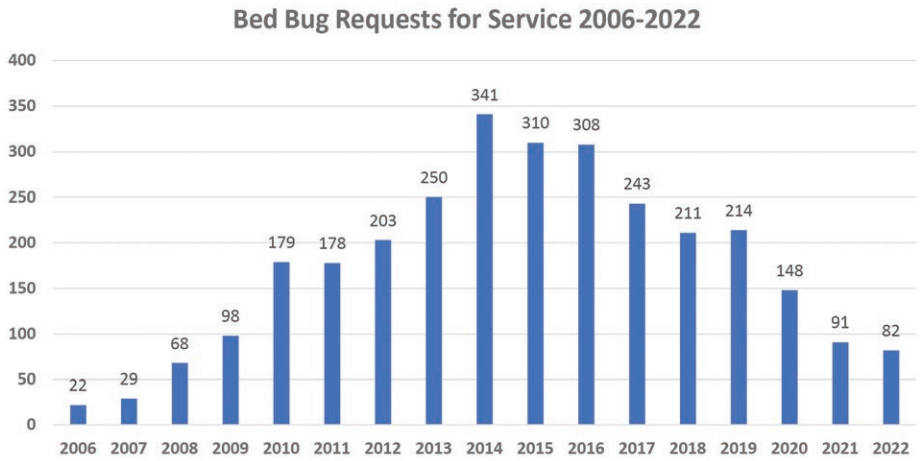
There are several mite species that bite humans, but by far the most common one seen in Alameda County is the tropical rat mite, *Ornithonyssus bacoti*. Although it is not associated with any disease transmission, this mite readily bites people and can cause an itchy dermatitis. Because of its small size it often goes undetected, and victims often report that they are receiving bites from an unknown source, which leads to an increase in mental anguish. In our county it has a close association with the nest of the roof rat, *Rattus rattus*. The roof rat is extremely efficient at finding access into residential structures, where they may nest in attics, wall voids, or sub areas.



Once the rat dies or leaves the home, the mites spread from the nest, looking for a blood meal. Complete control of a tropical rat mite infestation is best achieved by eliminating roof rats from the property. Once this is achieved, mite populations decline significantly after 2 months. Over the past 10 years, Alameda County has seen a steady increase in mite requests for service, and this is positively correlated with an increase in indoor roof rat complaints.

Bed Bugs Request for Service Trend Downward

Although bed bugs continue to be a difficult nuisance pest problem in Alameda County, a positive trend has been observed over the past several years. The District responded to 82 bed bug service requests in 2022, a 76% decline from the peak year, 2014. Several factors may be responsible for this decline. New community-based programs have been developed to educate and control the spread of bed bugs throughout low-income housing, multi-family units, rapid transit systems, recreational facilities, hotels and motels, and residential properties. In addition, the passage of California State Assembly Bill 551 places a greater responsibility on landlords to address bed bug infestations before they reach critically high levels. Finally, improvements in pest control practices and techniques have likely played an important role in suppressing outbreaks.



Swimmer's Itch Program

Swimmer's itch, also called cercarial dermatitis, appears as a skin rash caused by an allergic reaction to certain parasites found in specific birds and mammals. When these microscopic parasites are released from infected snails, they can burrow into the nearby swimmer's skin, causing an allergic reaction and rash. In 2022, between February 9th and June 10th, 7 cases were reported at Robert W. Crown Memorial State Beach in Alameda. Cases at Crown Memorial Beach in Alameda typically occur during low or extremely low tides.

This year there were no cases of swimmer's itch reported at Shadow's Cliff in Pleasanton, likely due to park closures from the COVID pandemic.

None of these cases were diagnosed, they were all alleged. This is not a reportable disease by the county's Public Health Communicable Disease program, and the District will not be notified unless an outbreak of human cases has occurred.

Inventoried Animal Holding Facilities Program

The District maintains an inventory of stables and kennels and inspects them occasionally to prevent nuisance problems such as odors, insects, or rodents. Upon request by the Alameda County Animal Control, animal hobbyist facilities are inspected during annual permit renewal. Currently, there is no statutory requirement or authority to inspect pet shops, animal grooming salons, or livestock holding facilities; however, when there are nuisance complaints, we will conduct inspections.

Nuisance Abatement Program

Garbage, rubbish, abandoned vehicles, furniture/appliances, dog and cat wastes, and animal manure stockpiles can become public nuisances when left unattended prior to disposal. In addition, these situations may provide harborage and food sources for rodents, flies, and other pests that might result in disease transmission to humans.

In 2022, staff biologists responded to 187 nuisance service requests of furniture, garbage, abandoned vehicles, overgrown vegetation, or rubbish. This resulted in 436 field services that included investigations, progress assessments, correspondence, and compliance inspections. When necessary, staff biologists work with local code enforcement agencies and public works to seek compliance to mediate problems.

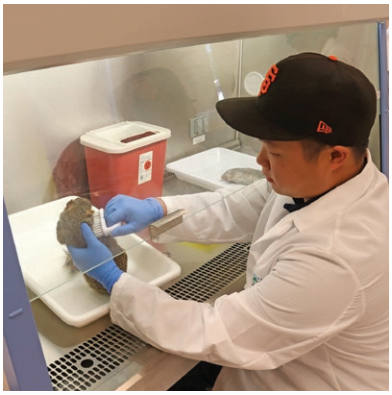
Vector Control Laboratory Surveillance Operations

Participation in Avian Influenza Surveillance

In the fall of 2022, the District assisted the USDA Wildlife Services Branch and the California Department of Fish and Wildlife with surveillance of Highly Pathogenic Avian influenza (HPAI) H5N1. Samples taken from waterfowl in Union City in September 2022 confirmed the first cases of Avian influenza in the County. In total, nine birds from different locations were tested and seven were confirmed as positive.

Avian influenza is an infectious disease of birds caused by type A influenza viruses. The HPAI H5N1 strain causes significant disease in poultry, resulting in mortality of backyard and commercial flocks. Infections in wild birds may cause mild to severe disease or death, depending on the species. These viruses naturally circulate among waterfowl and waterbird populations. Raptors that scavenge on these species are in jeopardy of acquiring infection. The Center for Disease Control states that the probability of infection in humans is low, however some individuals may be at higher risk due to job-related or recreational exposure.

Ectoparasite Surveillance on Sylvatic Rodents, Commensal Rodents and Wildlife



Sylvatic rodents such as pinyon and deer mice, woodrats, ground squirrels, and meadow voles are commonly found in rural and semi-rural areas of Alameda County. Commensal rodents refer to those rodents that live near humans and are typically nonnative species. Wildlife species include the more common opossum, raccoon and skunk, but also include the less common fox, coyote, feral pig, bats, squirrels, and jackrabbits.

Many of these animals serve as reservoir hosts of zoonotic diseases such as Plague, Hantavirus Pulmonary Syndrome (HPS), Tularemia, Lyme disease, and Babesiosis. A reservoir host is an animal that remains infected with a pathogen for an extended period and may or may not develop symptoms of the disease. They serve as a source of infection. Ectoparasites (vectors) which feed on the host will transmit the pathogen to other animals or humans. Some reservoir hosts, such as deer mice, can spread pathogens through their feces and urine without ectoparasites. Our vector ecologist and staff biologists routinely collect sylvatic and commensal rodent samples for surveillance and monitoring of ectoparasite abundance, diversity, and disease testing.

Host Species 2021	# of Hosts	# w/Fleas	# of Fleas	Flea Species (# of Fleas)	Flea Index
SYLVATIC RODENTS					
Pinyon Mouse *Peromyscus truei*	28	0	0		0
Deer Mouse *Peromyscus maniculatus*	11	0	0		0
California Vole *Microtus californicus*	1	0	0		0
COMMENSAL RODENTS					
Norway Rat *Rattus norvegicus*	338	125	602	*Nosopsylla fasciatus (248)* *Xenopsylla cheopis (213)* *Ctenocephalides felis (135)* *Leptopsylla segnis (6)*	1.8
Roof Rat *Rattus rattus*	42	10	14	*N. fasciatus (10)* *X. cheopis (4)*	0.3
WILDLIFE					
Ground Squirrel *Otospermophilus beecheyi*	8	7	31	*Oropsylla montana (17)* *C. felis (8)* *Hoplopsylla anomolus (4)* *X. cheopis (2)*	3.9
Fox Tree Squirrel *Sciurus niger*	26	24	83	*Orchopeas howardii (83)*	3.2
Opossum *Didelphis virginica*	12	6	331	*C. felis (319)* *Pulex spp. (11)* *X. cheopis (1)*	27.6
Skunk *Mephitis mephitis*	6	5	70	*C. felis (41)* *Pulex spp. (28)* *N. fasciatus (1)*	11.7
Raccoon *Procyon lotor*	4	3	21	*C. felis (14)* *Pulex spp. (7)*	5.3

Table 1. Ectoparasites (fleas) collected from commensal and sylvatic rodents and wildlife from urban and sylvatic areas (including rodents from homeless encampments).

Hantavirus Cardiopulmonary Syndrome (HCPS)

Hantavirus Cardiopulmonary Syndrome (HCPS) was first recognized in 1993; it is a respiratory illness spread through airborne particles of rodent urine and feces contaminated with the *Sin Nombre* virus (SNV). The Deer mouse (*Peromyscus maniculatus*) is the principal reservoir host. Occasionally, deer mice will enter buildings and potentially expose human occupants to the virus. Past surveillance conducted at various localities within the county detected 6-18% of deer mice are infected with SNV.

In collaboration with the California Department of Public Health (CDPH), the CSA conducts hantavirus surveys in local parks to increase public awareness of the disease and to reduce exposure to deer mice and the structures they may inhabit.

Ten hantavirus (SNV) surveys were conducted in 2022. One site was surveyed twice this year at the North Oakland Sports Center due to a Pinyon mouse that tested positive for SNV in 2021. In total, 40 rodents were tested for SNV in 2022. None tested positive via serology or PCR.

Date	Site	Specific Location	Species	Number Tested	Result
8/16	Oakland Parks	North Oakland Sports Center	*Peromyscus truei* Pinyon Mouse	2	Negative
9/1	Sunol	Backpack Camp	*Microtus californicus* California Vole	1	Negative
		Little Yosemite	*P. truei*	4	Negative
9/13	Brushy Peak	Laughlin Ranch	*Peromyscus maniculatus* Deer Mouse	3	Negative
9/15	Del Valle	Eagles View Group Camp	*P. truei*	4	Negative
9/28	Oakland Parks	Leona Heights Park	*P. truei*	1	Negative
10/11	Anthony Chabot	Marciel Road Staging Area	*P. maniculatus* *P. truei*	2 7	Negative Negative
		Group Camp Rd x Marciel Rd	*P. maniculatus* *P. truei*	3 6	Negative Negative
10/27	Garin	Carden Ln Entrance	*P. maniculatus* *P. truei*	2 1	Negative Negative
11/22	Oakland Parks	North Oakland Sports Center	*P. maniculatus* *P. truei*	1 1	Negative Negative
11/29	Claremont Canyon	Fire Trails	*P. truei*	2	Negative

Note: Testing was conducted by California Department of Public Health, Richmond, CA by serology and PCR.

Table 2. Hantavirus Surveillance 2022

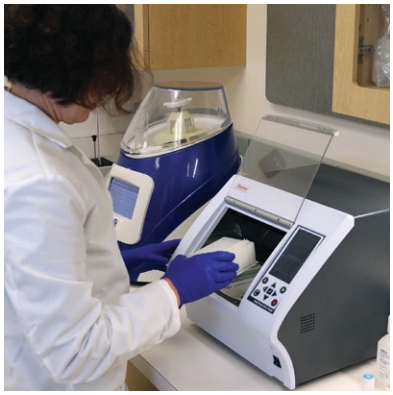
Seoul Virus Surveillance

Seoul virus belongs to the hantavirus family of rodent borne viruses. This family also includes *Sin Nombre* virus, which is the most common hantavirus causing disease in the United States. Seoul virus is transmitted from rats to humans after exposure to aerosolized urine, droppings, or saliva of infected rodents, or after exposure to dust from their nests or bedding. This virus has been found in both pet rat and wild rat populations around the world. The natural hosts for Seoul virus are Norway rat (*Rattus norvegicus*) and roof rat (*Rattus rattus*). In 2017, the United States Center for Disease Control and Prevention (CDC) reported 8 cases of infection with Seoul virus in the states of Wisconsin and Illinois. Symptoms in humans range from mild to severe, with most cases going unnoticed. In 2019, District staff began collecting Norway rat blood samples to test for this uncommon rodent-borne virus. Through 2022, 855 Norway and roof rat blood samples have been tested by our lab or submitted to an independent (CDC recommended) lab for the detection of Seoul virus. To date we have not had any samples test positive for Seoul virus. In 2022, a total of 109 rat samples were tested from four cities in the County (Table 3).

City	# of Locations	# of Norway Rats Tested
Alameda	2	4
Oakland	11	90
Emeryville	1	3
Union City	1	12

Table 3. 2022 Seoul virus testing.

Leptospirosis Surveillance



Leptospirosis is the most widespread zoonosis in the world and is most common in temperate and tropical zones. It is caused by a bacterium that is spread through the urine of infected animals, which can get into water and soil and survive there for weeks to months at a time. Various domestic and wild animals can carry the bacterium and excrete it for months up to several years. Dogs are the most infected domestic animal. Animals that are infected may show no symptoms of the disease. Humans can become infected through contact with urine, or other bodily fluids (except saliva) from infected animals or contact with soil, water or food that has been contaminated with the urine of infected animals. People most at risk are those that work outdoors or with animals. Symptoms in humans range from mild to severe, with most cases going unnoticed. Leptospirosis was reinstated as a nationally notifiable disease by the CDC in 2013.

City	# of Locations	# of Rats Tested	Species
Alameda	6	14	Norway & Roof Rat
Albany	1	9	Norway Rat
Berkeley	4	22	Norway Rat
Oakland	29	189	Norway Rat
San Leandro	1	1	Norway Rat
Fremont	1	3	Roof Rat
Union City	1	12	Roof Rat
Emeryville	1	3	Norway Rat

Table 4. 2020-2022 Leptospirosis testing.

Using an antibody test kit, the District began testing for Leptospirosis at the end of 2020. To date we have tested sera from 253 rats (Norway and roof) from eight cities within the County and have not detected the presence of Leptospira at those locations (Table 4).

Homeless Encampment Rodents, Fleas, and *Rickettsia spp.* Surveillance and Control Operations

In 2018, the District began conducting surveillance of commensal rodent and ectoparasite populations in homeless encampments within the City of Oakland.

The most common commensal rodent associated with homeless encampments is the Norway rat, *Rattus norvegicus*, which is a host for fleas, lice and mites that can vector diseases such as plague, flea-borne typhus, and salmonellosis.

It was found that several of these encampments had active Norway rat populations as indicated by active burrows within, and adjacent to the camps. These observations coincided with reports of rat sightings by residents of the encampments, surrounding businesses, and members of the public. Staff biologists began live-trapping at a few of the larger encampments to ascertain the size of the Norway rat populations. Our Norway rat surveillance stopped for a time due to the COVID-19 pandemic but resumed in 2021. In 2022, staff biologists conducted 20 separate trapping events at 11 different homeless encampments around the City of Oakland and collected 299 Norway rats (Table 5).

Staff biologists set out live-wire cage traps in the afternoon and the traps are collected the following morning. Trapped rats are brought back to the laboratory for analysis, where they are combed for associated ectoparasites. Ectoparasites (especially cat fleas, *Ctenocephalides felis* and Oriental rat fleas, *Xenopsylla cheopis*) are sorted by species and tested for pathogens, specifically *Rickettsia felis* and *Rickettsia typhi*.

Suppression was conducted during 2022 at five of the homeless encampments where Norway rat populations were determined to be extremely high. Burrows were baited with rodenticide and rat carcasses were picked up post-treatment to reduce the risk of non-target effects on other domestic animals and wildlife.

Homeless Encampments Surveyed	# of Separate Trapping Events	# of Norway Rats Trapped	# of Fleas Collected for Disease Testing	# of Rodenticide Applications for Norway Rat Suppression
11	20	299	521	5

Table 5. Homeless encampment data 2022.

Suppressing the Norway rat populations will continue by staff biologists following the clean-up of the encampments by Public Works staff and the relocation of encampment residents and their pets into more permanent housing as they become available.

Ongoing Norway rat suppression is conducted in coordination with Public Works and other city/county agencies engaged with encampments.

Flea-borne Rickettsial Diseases Surveillance

Rickettsial diseases are found worldwide and are transmitted to humans via an arthropod host, specifically fleas, lice, ticks and mites. Most cases of flea-borne typhus occur in Texas, Hawaii and California, with approximately 300 human cases per year. Los Angeles and Orange counties are known endemic areas for flea-borne rickettsioses but sometimes cases are reported from other parts of California. Humans become infected with flea-borne *Rickettsia* through the infectious bite of a flea or through infectious flea fecal material.

In 2020, the Alameda County Vector Control Services District began a surveillance program investigating the incidence of flea-borne Rickettsial disease by collecting fleas from different host animals throughout the County. The cat flea (*Ctenocephalides felis*) and the Oriental rat flea (*Xenopsylla cheopis*) are the primary focus of the surveillance program.

The cat flea is a common species with a global distribution. It is highly associated with people and pets and is a vector of flea-borne typhus, *Rickettsia typhi*, which causes cases of human pathogenicity. It is also a competent vector of *Rickettsia felis*, a newly described Rickettsial species that has been linked to human illness in other parts of the world. The Oriental rat flea is the main insect vector of plague and flea-borne typhus worldwide, and we have historical populations of both fleas and associated rodent hosts in Alameda County.

Rickettsia typhi, the causative agent of endemic typhus, is maintained in a rat-flea-rat cycle involving Norway rats, *Rattus norvegicus*, and the Oriental rat flea, *Xenopsylla cheopis*. Although *X. cheopis* is considered the major vector of murine typhus, natural infection with *R. typhi* has been reported in other flea species including *Leptopsylla segnis*, *Pulex* spp., and *Nosopsylla fasciatus*.

Rickettsia felis, the etiologic agent of flea-borne spotted fever, is suspected to be a human pathogen. *Rickettsia felis* appears to share the same suburban transmission cycle as *Rickettsia typhi* with the cat flea, *Ctenocephalides felis*, serving as the primary vector and domestic animals and urban wildlife as potential reservoir hosts. The cat flea is cosmopolitan in nature and is highly associated with people and pets.

In 2022, the Alameda County Vector Control Services District continued its flea-borne Rickettsial diseases surveillance program, collecting and testing fleas from different animals. Based on the surveillance data from 2018-2021, the

District tested *X. cheopis*, *C. felis*, *N. fasciatus*, *Pulex spp.*, and *L. segnis* from commensal rodents and wildlife from various parts of the County. In total, 882 fleas were tested in pools (up to five fleas per pool, up to 50 fleas per host) using real time PCR assays. Out of 153 animals, 29 were infested with fleas that showed presence of Rickettsial DNA (Table 6). Out of the 29 animals, 14 were Norway rats and 6 were opossums.

Host	# of Animals	# of Fleas Tested	Animals with Positive Fleas	Percent of Animals with Fleas, %
Norway rat	125	585	14	11
Opossum	6	170	6	100
Roof rat	10	14	2	20
Skunk	5	70	2	40
Raccoon	4	23	3	75
Fox squirrel	1	2	0	0
Feral cat	3	18	2	67
Total	153	882	29	19

Table 6. Infestation of commensal rodents and wildlife animals with Rickettsia spp. positive fleas.

In total, 213 *X. cheopis*, 135 *C. felis*, 227 *N. fasciatus*, and 6 *L. segnis* from 125 Norway rats collected in Oakland, Alameda, and Emeryville were tested for the presence of Rickettsial DNA (Table 7). The highest percent of infected pools was found in *C. felis* fleas (20%). Our results show that Rickettsial infections are not common in *X. cheopis*, *N. fasciatus*, and *L. segnis* fleas but widespread in *C. felis* (9-20%) fleas from Norway rats.

Flea spp.	# of Fleas Tested	Pools Tested	Positive Pools	Percent of Positive Pools, %	Minimum Infection Prevalence, %
C. felis	135	61	12	20	8.9
X. cheopis	213	93	5	5	2.3
N. fasciatus	227	99	4	4	1.8
L. segnis	6	6	0	0	0
Total	585	259	21	8	3.6

Table 7. Rickettsia felis and Rickettsia felis-like Infections in fleas from Norway rats.

In total, 158 *C. felis*, 11 *Pulex*, and 1 *X. cheopis* fleas from 6 opossums collected in Oakland, Alameda, and Livermore were tested for the presence of Rickettsial DNA (Table 8). Our results show that Rickettsial infections are very common in *C. felis* (20-94%) fleas from opossums.

Flea spp.	# of Fleas Tested	Pools Tested	Positive Pools	Percent of Positive Pools, %	Minimum Infection Prevalence, %
C. felis	158	33	31	94	19.6
Pulex	11	3	0	0	0
X. cheopis	1	1	0	0	0
Total	170	37	31	84	18.2

Table 8. Rickettsia felis and Rickettsia felis-like infections in fleas from opossums.

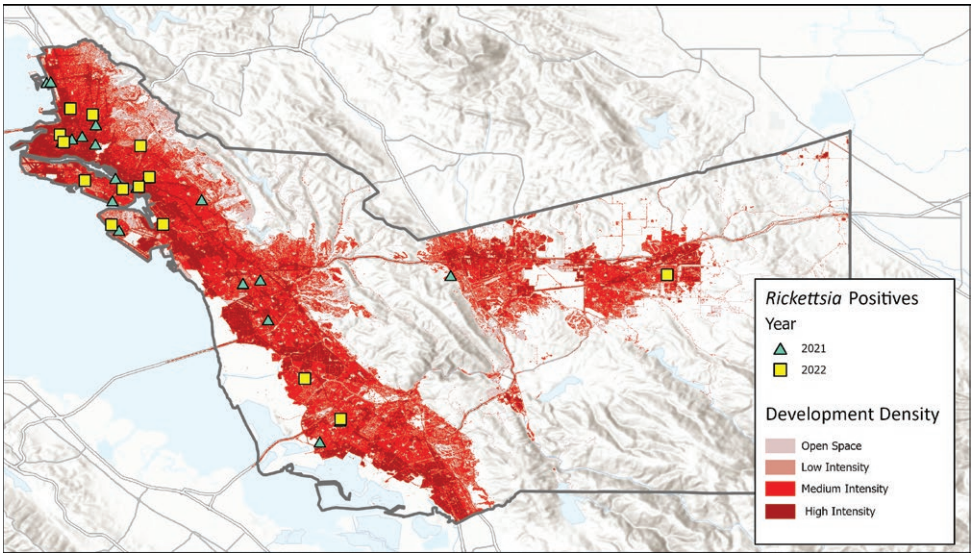
Table 9 summarizes the results of testing of all fleas for *Rickettsia*. In total, 66 flea pools were positive. Rickettsial DNA was found commonly in *C. felis* with the Minimum Infection Prevalence of 16.4% (55 positive pools, 336 cat fleas).

Host	# of Animals	*X. cheopis* Positive Pools (Fleas Tested)	*C. felis* Positive Pools (Fleas Tested)	*N. fasciatus* Positive Pools (Fleas Tested)	*Pulex* Positive Pools (Fleas Tested)	*L. segnis* Positive Pools (Fleas Tested)	Total Positive Pools (Fleas Tested)
Norway rat	125	5 (213)	12 (135)	4 (227)		0 (6)	21 (585)
Opossum	6	0 (1)	31 (158)		0 (11)		31 (170)
Roof rat	10	0 (2)		2 (12)			2 (14)
Skunk	5		5 (41)	0 (1)	0 (28)		5 (70)
Raccoon	4	0 (2)	4 (14)		0 (7)		4 (23)
Fox squirrel	1	0 (2)					0 (2)
Feral cat	2		3 (8)				3 (18)
Total	153	5 (220)	55 (336)	6 (240)	0 (45)	0 (6)	66 (882)

Table 9. Rickettsia spp. in fleas by host animal and by flea species.

To identify *Rickettsia* species, the positive pools were screened using a real time PCR assay specific for *Rickettsia felis*. *Rickettsia felis* was confirmed in fleas from Norway rats, opossums, roof rats, skunks, raccoons, and feral cats. The samples that were not confirmed for the presence of *R. felis* were tested using a different *Rickettsia* genus-specific protocol to identify *Rickettsia* species by sequencing. *Candidatus Rickettsia senegalensis*, species related to *R. felis*, was found in fleas from opossums, skunks, raccoons, and feral cats. *R. typhi* was not detected in any flea pools. Our results show that R. felis bacterium is widespread in cat flea populations in Alameda County.

The analysis of flea-borne surveillance data for 2020-2022 shows that *Rickettsia* positive fleas are distributed throughout the County with a high density in some areas of Oakland. Most of these locations are considered urban or suburban. Due to ecological, biological, and behavioral factors promoting contact between humans and fleas, it is important to continue monitoring flea-borne rickettsioses in Alameda County.



Distribution of Rickettsia positive fleas in Alameda County in 2021 and 2022.

Tick Surveillance Program

Tick-borne diseases threaten the health of people. For over 25 years, Alameda County Vector Control Services District has conducted a tick surveillance program concurrent with the surveillance for pathogens in ticks that may cause disease in humans. Using a standard flagging method, ticks are collected in

regional parks, city parks and public open spaces. In total, 4,778 *Ixodes pacificus*, 2,793 *Dermacentor occidentalis*, 62 *Dermacentor variabilis*, 13 *Ixodes spinipalpis*, 1 *Haemaphysalis leporispalustris* and 6 *Rhipicephalus sanguineus* ticks were collected. The largest number of ticks (2,667) was collected in Anthony Chabot Regional Park. Also, Anthony Chabot Regional Park demonstrated the highest tick species diversity (5 species). (Table 10)

Location	*Ixodes pacificus*	*Dermacentor occidentalis*	*Dermacentor variabilis*	*Ixodes spinipalpus*	*Haemaphysalis leporispalustris*	*Rhipicephalus sangineus*	Total
Anthony Chabot Regional Park	1,908	730	23	5	1		2,667
Augustin Bernal Park	163	767	6				936
Coyote Hills Regional Park	2						2
Del Valle Regional Park	157						157
Garin Regional Park	137	122		2			261
Joaquin Miller Park	744	225	7	6			982
Mission Peak Regional Park	63	2	2				65
Pleasanton Ridge Regional Park	228	40					268
Redwood Regional Park	836	580	15				1,431
Sunol Regional Park	43	1					44
Tassajara Creek Regional Park	8	13					21
Open Spaces, Berkeley	74	54	7				135
Open Spaces, Dublin	54	46	2				283
Open Spaces, Hayward	45	13					58
Open Spaces, Oakland	19	3				6	28
Open Spaces, Pleasanton	78	189					78
Open Spaces, Sunol	219	8					227
Total Per Species	4,778	2,793	62	13	1	6	7,643

Table 10. Tick Collection Summary: Locations and Species.

Ixodes pacificus Tick Surveillance

Borrelia spirochetes

Ixodes pacificus (*I. pacificus*) or western blacklegged tick is the vector of Lyme disease which is caused by the bacterium *Borrelia burgdorferi* and the vector of tick-borne relapsing fever (TBRF) which is caused by the bacterium *Borrelia miyamotoi*. Both pathogens are primarily transmitted to humans through the bite of an infected western blacklegged tick. The western blacklegged tick has three life stages: larva, nymph, and adult. All three stages can be found in parks and open spaces in Alameda County, but tick abundance varies across the County. Nymphal and adult ticks can bite humans and transmit bacteria. In 2022, 3,786 adult and 941 nymphal *I. pacificus* ticks were collected as a part of the tick surveillance program. (Table 11)

Location	Female	Male	Nymph	Larvae	Total
Anthony Chabot Regional Park	912	860	136		1,908
Augustin Bernal Park	70	70	23		163
Coyote Hills Regional Park			2		2
Del Valle Regional Park	84	73			157
Garin Regional Park	36	49	42	10	137
Joaquin Miller Park	190	217	316	21	744
Mission Peak Regional Park	32	31			63
Pleasanton Ridge Regional Park	80	94	54		228
Redwood Regional Park	365	384	87		836
Sunol Regional Park			43		43
Tassajara Creek Regional Park	5	3			8
Open Spaces, Berkeley	21	13	40		74
Open Spaces, Dublin	32	22			54
Open Spaces, Hayward	23	22			45
Open Spaces, Oakland	10	9			19
Open Spaces, Pleasanton	41	36	1		78
Open Spaces, Sunol	1	1	197	20	219
Total	1,902	1,884	941	51	4,778

Table 11. Ixodes pacificus Collection Summary.

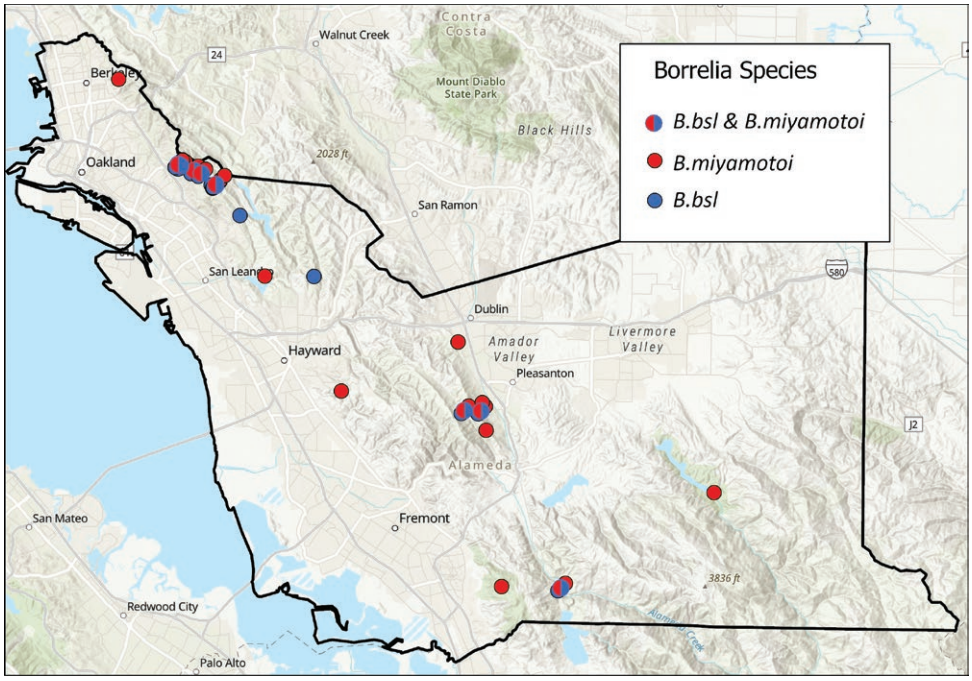
Based on the previous tick surveillance data and an estimated human risk of being bitten by a tick, *I. pacificus* from selected locations were tested in groups, or "pools", of a maximum of five adults or two nymphs, for presence of *Borrelia sensu lato (Bbsl)* and *Borrelia miyamotoi (B.miya.)*. In 2022, 2,010 ticks (1,340 adults and 670 nymphs) were evaluated using real-time PCR. The results are reported as a minimum infection prevalence, or MIP. This is the standard way of expressing the proportion of vectors tested that are infected with a specific pathogen and assumes that only one tick in a given pool is infected.

County-wide, *Borrelia sensu lato* and *B. miyamotoi* were detected at 1.9% and 1.1% MIP in adult *I. pacificus* ticks respectively. In nymphal *I. pacificus* ticks, *Borrelia sensu lato* and *B. miyamotoi* were detected at a MIP of 5.1% and 1.8% respectively. The MIP values recorded in 2022 are typical for Alameda County (Table 12).

I. pacificus Life Stage	# of Ticks	Pooled Samples	*Bbsl* Positive Pools	*B.miya* Positive Pools	*Bbsl* MIP, %	*B.miya* MIP, %
Adult	1,340	288	25	15	1.9	1.1
Nymph	670	336	34	12	5.1	1.8
Totals	2,010	624	59	27		

Table 12. Borrelia sensu lato and Borrelia miyamotoi infections in Ixodes pacificus ticks.

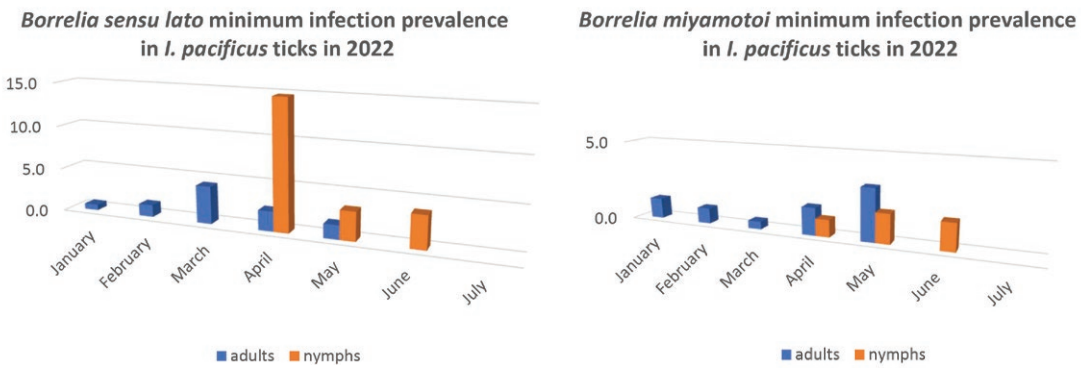
The spacial analysis of *Borrelia* infected ticks illustrates a patchy distribution of *Borrelia* which maintenance depends on tick vectors, vertebrate hosts, habitat, and climate. Two areas in Alameda County have an elevated risk for both infections: *Borrelia sensu lato* and *B. miyamotoi*.



Distribution of Borrelia Positive Ticks in Alameda County 2022.

The temporal analysis of infection prevalence showed that *Borrelia sensu lato* and *B. miyamotoi* minimum infection prevalence varied during the year in adult and in nymphal ticks.

The variations reflect seasonality in *I. pacificus* activities and demonstrate that *Bbsl* and *B. miyamotoi* infected adults and nymphs can be found in Alameda County during the spring months of April and May. The highest *Bbsl* MIP in adults (4.3%) was documented in March and the highest *Bbsl* MIP in nymphs (14.7%)



Seasonal variation of Borrelia infection rates in I. pacificus.

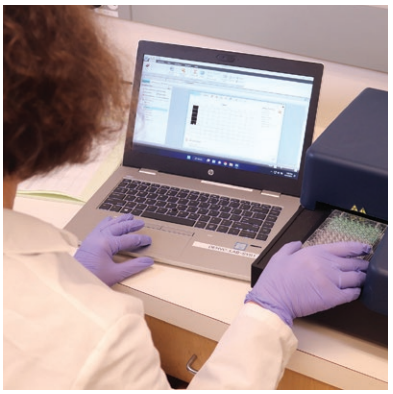
was recorded in April. The minimum infection prevalence of *B. miyamotoi* was 1-2% during the entire tick season.

Anaplasma phagocytophilum

Ixodes pacificus ticks can transmit *Anaplasma phagocytophilum*, a bacterium which causes human granulocytic anaplasmosis. The annual incidence of anaplasmosis has increased nationwide in recent years and in 2022 the District started to test *I. pacificus* ticks for *A. phagocytophilum*. 1,340 adult ticks from various sites were evaluated using real-time PCR. Out of 288 pools, 12 pools were positive for *A. phagocytophilum* which corresponds to the county-wide MIP of 0.8%. The infected ticks were found on the trails in Joaquin Miller, Augustin Bernal, Anthony Chabot Regional, Mission Peak Regional, and Garin Regional Parks. Fifty percent of the *A. phagocytophilum* positive pools came from one area in Joaquin Miller Park where the minimum infection prevalence in 164 screened ticks was 3.7%.

Dermacentor Tick Surveillance

In 2022, the District continued surveillance for the tick-borne diseases in *Dermacentor occidentalis* and *Dermacentor variabilis* ticks which started in 2019. According to California Department of Public Health records, *D. occidentalis* is second only to *I. pacificus* in total numbers of tick attachments to humans. The Pacific Coast tick (*D. occidentalis*) and the American dog tick (*D. variabilis*) may be found year-round in Alameda County but are most abundant late spring-early summer. In total, 2,713 *D. occidentalis* and 63 *D. variabilis* adult ticks were collected in regional parks, city parks and open spaces. (Table 13)



Location	*Dermacentor occidentalis*		*Dermacentor variabilis*		Total
	Females	Males	Females	Males	
Anthony Chabot Regional Park	371	334	13	10	728
Augustin Bernal Park	387	377	3	3	770
Garin Regional Park	61	61			122
Joaquin Miller Park	120	97	3	4	224
Mission Peak Regional Park	0	2	2	2	6
Redwood Regional Park	310	267	6	9	592
Sunol, Open Spaces	1	0			1
Tassajara Creek Regional Park	4	9			13
Open Spaces, Berkeley	35	16	5	2	58
Open Spaces, Dublin	28	23			51
Open Spaces, Hayward	11	2			13
Open Spaces, Oakland	1	2			3
Open Spaces, Pleasanton	101	88	0	1	190
Open Spaces, Sunol	2	3			5
Total	1,432	1,281	32	31	2,776

Table 13. Dermacentor spp. Collection Summary.

In 2022, 840 *D. occidentalis* and 53 *D. variabilis* were tested in pools for the presence of Rickettsia spp. pathogens using real time PCR. Ten pools were infected with Rickettsia spp. *Rickettsia rhipicephali* infected *D. occidentalis* ticks were found in Joaquin Miller Park and in open spaces in Berkeley Hills. *Rickettsia bellii* was found in *D. variabilis* ticks from Anthony Chabot Regional Park, Joaquin Miller Park, and Redwood Regional Park. To date, neither *R. bellii* nor *R. rhipicephali* have been associated definitively with disease in humans or animals. *Rickettsia philipii*, a human pathogen, was not detected in *D. occidentalis* ticks in 2022.

Rabies Surveillance

The authority for the Rabies Program is the responsibility of the County Health Officer at the Alameda County Department of Public Health, which provides laboratory support for the program, and performs human case investigations. The District manages the statistical data and works cooperatively with the 13 local animal control agencies to administer the rabies surveillance program in Alameda County. Moreover, the District responds to service requests and conducts surveillance on skunks, bats, and other wildlife that are susceptible to rabies. Suspected animals involved in biting or exposure incidents may be euthanized, and their heads removed and submitted to the Alameda County Public Health Laboratory (ACPHL) for rabies testing.

If requested, the District also investigates with Animal Control Agencies animal bite incidents and prepares an annual report for the California Department of Public Health (CDPH). Bats and skunks are the primary rabies-infected animals in California. Rabies is almost never found in squirrels, rabbits, rats, or mice. In 2022, the District submitted 134 animal heads, including bats, cats, dogs, fox, opossums, raccoons, squirrels and skunks to the ACPHL for rabies testing. Two (2) bats collected from Castro Valley (1) and Fremont (1) tested positive for the rabies virus. Four submitted specimens were not testable.

Type of Animal	Number Negative	Number Positive	Total Tested
Bat	54	2	56
Cat	36	0	36
Dog	19	0	19
Fox	1	0	1
Oppossum	1	0	1
Raccoon	3	0	3
Skunk	17	0	17
Squirrel	1	0	1
Total	132	2	134

Public Information and Engagement 2022

We attract a large audience through our web site, social media such as Twitter, YouTube and Facebook, media contacts, group presentations, responding to requests for service (RFS) and event participation. The year 2022 came closer to a normal year as previously canceled live outreach events (due to the SARS-CoV-2 pandemic) were now regularly scheduled. Though some events were still cancelled due to SARS-CoV-2 concerns, we nonetheless participated in 48 days of fairs, shows and exhibits, such as the Sobrante Park Health and Information Fair in Oakland, the Festival of India in Fremont, Newark Days Information Fair, Science in the Park (held at Cal State Hayward) and the wonderful 19-day Alameda County Fair in Pleasanton.

Our District continues to expand our outreach program to the public and our ethnically diverse communities by delivering our services directly to all Alameda County residents. Our District received 5,422 Requests for Service (RFS) in 2022 that were investigated by our 18 Vector Control Biologists. This is a powerful outreach team, meeting, discussing, and investigating the vector problems our residents were experiencing, which amounted to many thousands of hours of community outreach. In addition to issuing press releases, we respond to media requests for information and interviews.

Our website provides valuable information to visitors and is a conduit for the public to request our services. The District completed the development of a new and improved website in December 2016 and continued to enhance and update it during 2022. The public can access information on current vector-related issues, and the user-friendly on-line form simplifies making service requests.

The District provides an on-going educational program aimed at "rental property management professionals" regarding bed bugs, cockroaches and other vector issues. Our goal is to be an educational resource to help rental property owners, property managers, tenants, and Alameda County residents to effectively respond to vector issues, such as bed bugs, cockroaches and rodent infestations in housing.

In addition, staff provided several presentations to groups such as the Tri-Valley Rotary Club, Health Care for the Homeless and the services provider network, Pesticide Regulation continuing education, and the Oakland Encampment Management Team. Six of our staff gave presentations at the Mosquito and Vector Control Association's Annual Conference.

Mussel Quarantine (due to dangerous levels of paralytic shellfish poisoning (PSP) toxins) signs and "Bay Caught Fish" advisory signs were posted along the Alameda County shoreline to inform the public about the potential risks of consuming local fish and shellfish. Our Community Relations Coordinator designed new, multi-language, mussel quarantine signs that were made for permanent posting, since every year we have the mussel quarantine, during the same timeframe (May 1st thru October 31st). This should result in long-term cost and labor savings.

Harmful Algae Bloom Outbreak in Oakland Estuary and Lake Merritt

Red-Tide, caused by harmful algae bloom (HAB) hit our bay coastline and several inland waters in 2022. In August 2022, an email was received from the State Water Resources Control Board Freshwater and Estuary Harmful Algal Bloom Program Manager reporting an increase of HAB in the Oakland Estuary and suggested "caution" signage be placed in areas where individuals may have contact with water.

The Problem: Blooms can develop from resting cysts. *Heterosigma akashiwo* blooms can be dangerous to fish and are responsible for massive fish mortality events in both wild and farmed fish populations. An unidentified toxin can be produced during blooms, though the mechanism for mortality events is poorly understood. Blooms and bloom toxicity are strongly correlated with water temperature and salinity. Blooms can form from cysts once bottom temperatures reach 15° C. The CA Water Board recommends that people and pets stay out of discolored water until the bloom dissipates. Contact with the bloom can cause an allergic reaction or irritation.

Cause: Besides hot weather, a primary cause of the toxic blooms is the excess of nutrients found in bodies of water, which, in the San Francisco Bay Area, often come from urban runoff that enter flood control channels, creeks and storm drain systems.

Response: Our Alameda County Health Officer approved for the immediate HAB caution postings along the Oakland Estuary and Lake Merritt.

The District's Community Relations Coordinator contacted our local stakeholders – the City of Oakland, East Bay Regional Parks, the Port of Oakland, Coast Guard Island Base and all the local marinas to arrange for posting of signage.

As a result of the HAB, during the last week of August there was a massive fish die-off at Lake Merritt that required an immediate response from the City of Oakland. A large-scale cleanup of the dead fish around the lake was quickly organized. Fortunately, the die-off was a onetime event and did not continue.

Integrated Pest Management Strategy

The District participates in a countywide *Integrated Pest Management* policy set in place by the Board of Supervisors. Most pesticide applications are used to suppress Norway rats in sanitary sewers or to destroy ground-nesting yellowjacket nests. The total pesticide usage is listed below and is reviewed by the Alameda County Agricultural Commissioner, the Department of Pesticide Regulation and the California Department of Public Health.

2022 Pesticide Use

Pesticide	Manufacturer	Formulation	Target Pest	Amount Used	Applications
Contrac California Bromethalin Blox	Bell Labs	1 oz Block	Domestic Rodents	832 oz	22 (# of Census Tracts)
Contrac Bulk Pellets	Bell Labs	Pellets	Domestic Rodents	846 oz	6
Contrac Super Size Blox	Bell Labs	8 oz Block	Domestic Rodents	19,166 oz	155 (# of census tracts)
Delta Dust	Bayer	Insecticidal Dust	Fleas/Wasps/ Yellowjackets	3.1 oz	5 (# of census tracts)
Drione Dust	Bayer	Insecticidal Dust	Yellowjackets/ Wasps	89.7 oz	112
EcoExempt D	EcoSMART Technologies Inc.	Aerosol Spray	Yellowjackets/ Wasps	5 oz	5
EcoExempt Essentria Wasp & Hornet Spray	Zoecon	Aerosol Spray	Yellowjackets/ Wasps	40.3 oz	17
Maxforce Roach Gel Bait – FC Select	Bayer	Gel	Cockroaches	46.3 oz	39
Maxforce Roach Bait – Impact	Bayer	Gel	Cockroaches	16.5 oz	36
ProVerde Wasp & Hornet Killer (PV1)	Envance	Aerosol Spray	Yellowjackets/ Wasps	2 oz	3
Prescription Treatment P. I.	Whitmire	Aerosol Spray	Yellowjackets/ Wasps	1.5 oz	2
Prescription Treatment Wasp Freeze (PT515)	Whitmire	Aerosol Spray	Yellowjackets/ Wasps	5 oz	1
Prescription Treatment Wasp Freeze II (PT18)	BASF	Aerosol Spray	Yellowjackets/ Wasps	56.5 oz	7
Victor Poison-free Wasp & Hornet Killer (P15)	Woodstream	Aerosol Spray	Yellowjackets/ Wasps	10 oz	6

City of Berkeley Vector Program

The City of Berkeley is one of four cities in California with its own environmental health jurisdiction. In 1976, the City adopted several environmental health ordinances that provide a mechanism to protect public health from vectors. The voters of Berkeley approved Measure A in 1984 and became part of the CSA. Since the Berkeley Division of Environmental Health already had a vector control program that has enforceable regulations for controlling rodents and other vectors, the CSA authorizes a contract each fiscal year to fund the City's vector program through the benefit assessment. In the years since 1984, the Berkeley vector program has been limited in their ability to perform all the duties expected of the CSA, and District staff continue to provide field services within Berkeley to enhance their program.

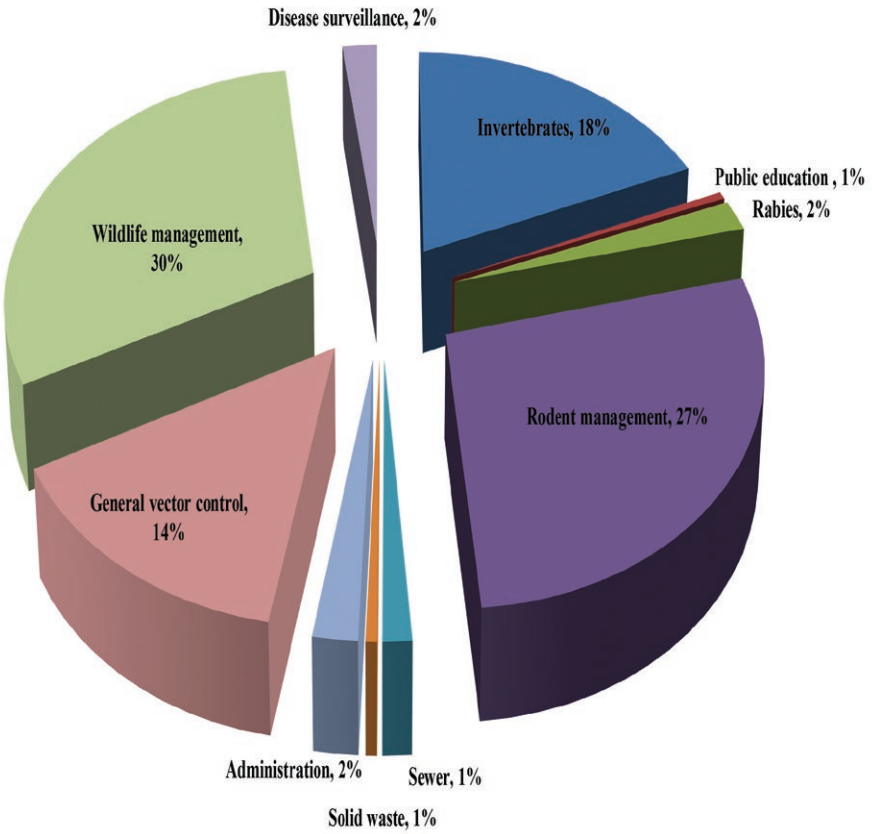
In 2022, the City of Berkeley Environmental Health Division, Vector Control Program, responded to and investigated a total of (794) service requests and complaints in the following categories: rats and mice (382), wildlife (46), venomous arthropods (119), miscellaneous arthropods (165), nuisance abatement (26), sewage (12), neighborhood block surveys (11), waterfront surveys (4), general surveys (12) and park surveys (17).

Pesticide Use for Berkeley 2022

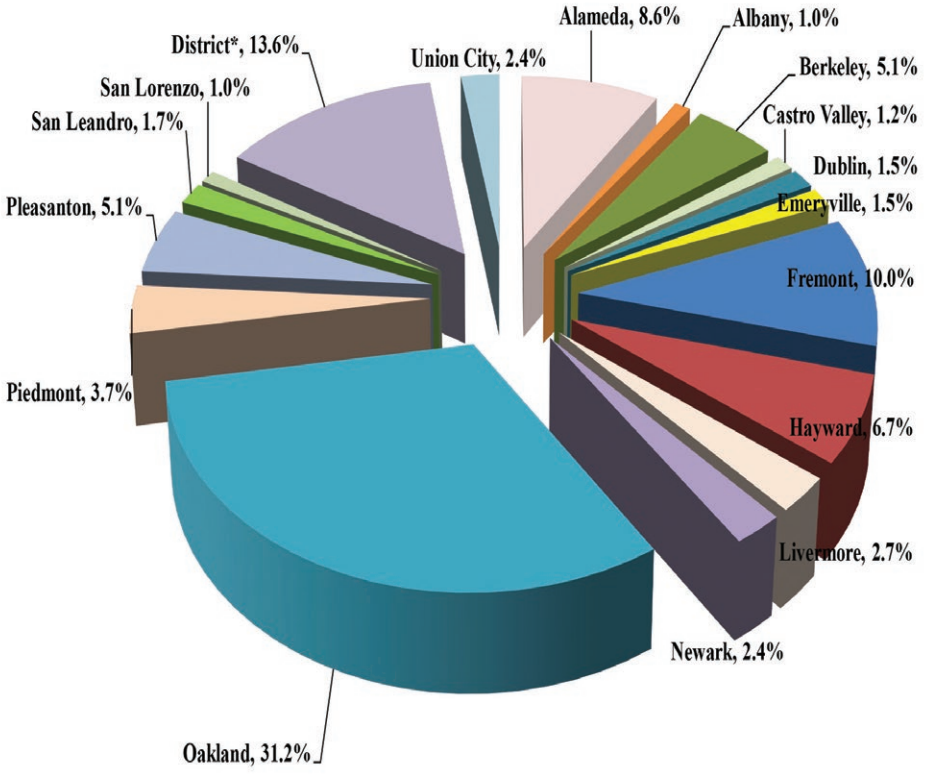
Pesticide	Manufacturer	Formulation	Target Pest	Amount Used	Applications
Drione	Bayer Environmental Science	Dust	Yellowjackets	32 oz	16

ACVCSD: Funding and Services

Services by Program, 2022

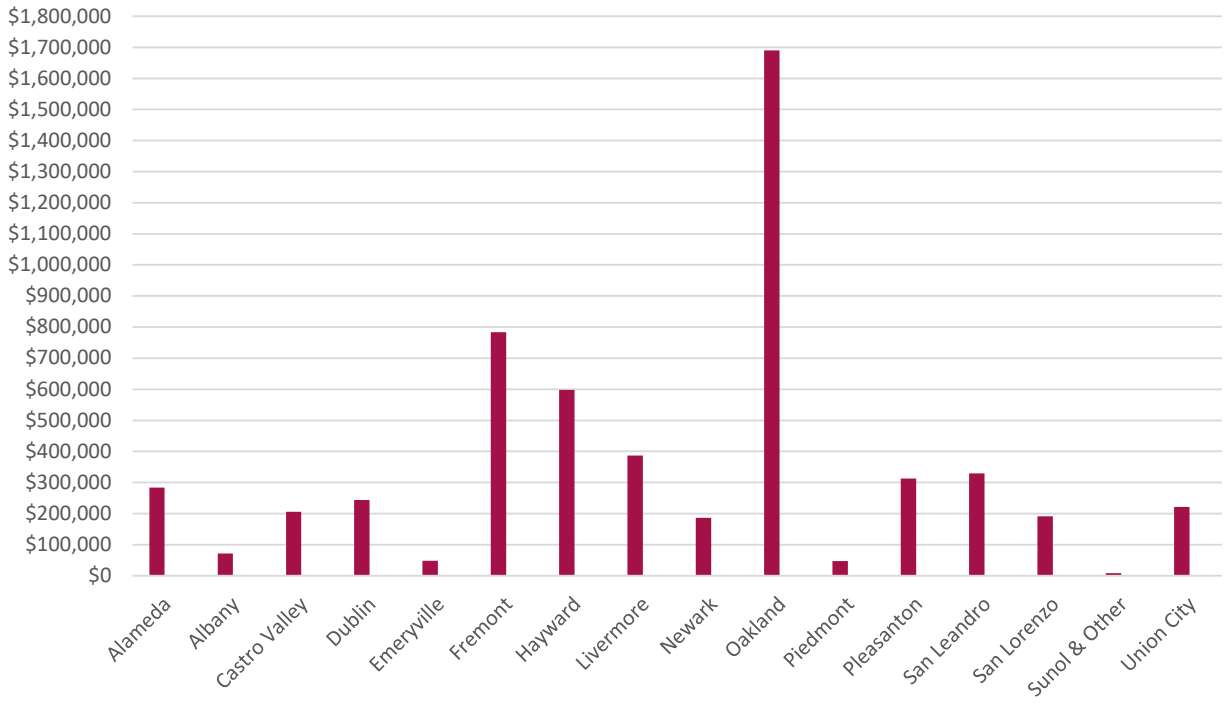


Total Services Provided to Cities, 2022

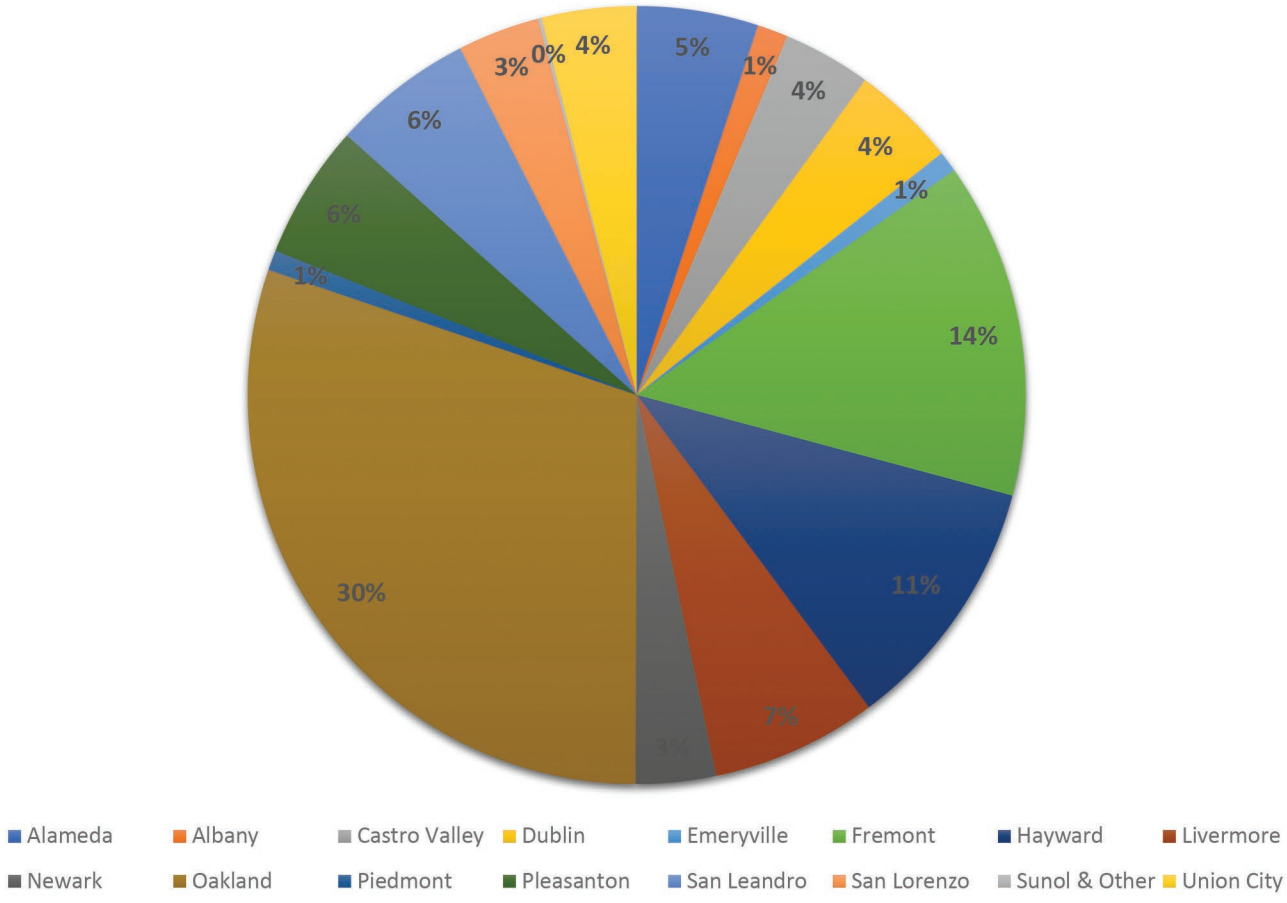


** District initiated includes disease surveillances and services to Sunol and Ashland.*

Funding Measure Revenue Totals by City, FY 2022-23



Funding Measure Revenue Percentages by City, FY 2022-23



CSA Vector Control Benefit Assessment

The Board of Supervisors annually reviews the planned operations and budgets, and the corresponding proposed rate of assessment and then conducts a public hearing to establish the assessment for the upcoming fiscal year. Funding for vector services comes from two funding sources described below.

Established in 1984, the CSA Vector Control Benefit Assessment (Initial Benefit Assessment) created a rate formula and methodology primarily based on land/property use as classified by the Assessor's Office.

Established in 2007, the Vector and Disease Control Assessment (Secondary Benefit Assessment) created a rate formula and methodology determined by several factors including the ratio of population density factors in relation to the usage density for different types of property. The table below depicts some of the differences between the two rate calculation methods.

Both funding sources are levied and collected at the same time and in the same manner as the general county property taxes. These levies are subject to the same fines, penalties, and forfeiture as property taxes.

Land/Property Use Categories

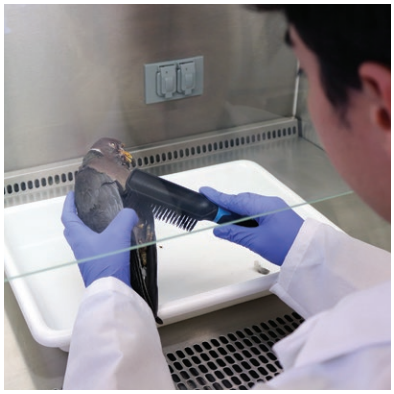
Property Use Categories	CSA Vector Control Benefit Units/Per Property Type (Initial Benefit Assessment)	CSA Vector Control Benefit Units/Per Property Type (Secondary Benefit Assessment)
Single Family Residence/Condominium	1 BU	1 BU/0.61 BUs
Vacant Land Parcel	1 BU	0.25 BUs
Multiple Residential Small (2-4 units)	2 BUs	0.46 BUs
Commercial, Industrial	2 BUs	0.5 BUs
Large Rural Property	2 BUs	0.017 BUs (per 10 acres)
Multiple Residential (5+ units)	5 BUs	0.32 BUs
Large Commercial (Hotels, Mobile Home Parks)	5 BUs	0.5 BUs (per 1/4-acre increments)

Benefit Assessments, FY 2022-2023

Use/Size	CSA Vector Control Initial Benefit Assessment	Oakland (Residence Only) + Supplement Assessment ($1.28)	CSA Vector Control Secondary Benefit Assessment	CSA Vector Control Emeryville/Fremont Assessment
Single Family Residence/Condominiums	$5.92	$7.20	$6.01/3.61	$11.93/7.16
Vacant Land	5.92	7.20	1.50	2.98
Multiple Residential Small (2-4 units)	11.84	14.40	2.76[1]	5.49[1]
Commercial, Industrial	11.84	14.40	3.00[4]	5.97[4]
Large Rural Property (10+ acres)	11.84	14.40	0.48[3]	0.95[3]
Multiple Residential (5+ units)	29.60	36.00	1.92[2]	3.82[2]
Large Commercial (Hotels, Mobile Home Parks)	29.60	36.00	3.00[4]	5.97[4]

1. This rate is per unit. There would be a minimum of 2 units for this category.
2. This rate is per unit. There would be a minimum of 5 units for this category.
3. A property would be charged this minimum. It would be $.48 for 10 acres.
4. These estimates are based on per 1/4-acre increments.

Assessment for One Benefit Unit
(Single-Family Residence – CSA Basic Rate and Oakland)



Fiscal Year	CSA Basic Rate	Oakland Supplement Rate*	Oakland Total Rate
1984-85	$3.15		$3.15
1985-86	2.66		2.66
1986-87	2.66		2.66
1987-88	3.24		3.24
1988-89*	3.30	0.70	4.00
1989-90	3.58	0.66	3.84
1990-91	3.80	0.70	4.50
1991-92	3.96	0.70	4.66
1992-93	3.96	0.70	4.66
1993-94	4.72	1.04	5.76
1994-95	4.82	1.06	5.88
1995-96	5.82	1.26	7.08
1996-97	5.92	1.28	7.20
1997-98	5.92	1.28	7.20
1998-99	5.92	1.28	7.20
1999-2000	5.92	1.28	7.20
2000-01	5.92	1.28	7.20
2001-02	5.92	1.28	7.20
2002-03	5.92	1.28	7.20
2003-04	5.92	1.28	7.20
2004-05	5.92	1.28	7.20
2005-06	5.92	1.28	7.20
2006-07	5.92	1.28	7.20
2007-08**	10.00	1.28	11.28
2008-09	10.00	1.28	11.28
2009-10***	10.00	1.28	11.28
2010-11	10.00	1.28	11.28
2011-12	10.00	1.28	11.28
2012-13	10.00	1.28	11.28
2013-14	10.00	1.28	11.28
2014-15	10.00	1.28	11.28
2015-16	10.00	1.28	11.28
2016-17	10.00	1.28	11.28
2017-18	10.00	1.28	11.28
2018-19	10.00	1.28	11.28
2019-20	11.00	1.28	12.28
2020-21	11.00	1.28	12.28
2021-22	11.00	1.28	12.28
2022-23	11.93	1.28	13.21

* *Includes Oakland Supplemental (initiated 1988-89)*
** *Includes Initial and Secondary Benefit Assessments*
*** *Includes Emeryville and Fremont (annexed 2009-10)*

ALAMEDA COUNTY
VECTOR CONTROL

1131 Harbor Bay Parkway, Ste. 166
Alameda, CA 94502 • (510) 567-6800 • www.acvcsd.org

Alameda County Department of Environmental Health