Boulder County Mosquito Control District 2015 Season Report

***Prepared for and in Cooperation with*:**
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SUMMARY

Boulder County Mosquito Control District (BCMCD) and Boulder County Public Health Department (BCPH) contracted OtterTail Environmental, Inc. (OtterTail) to operate an Integrated Mosquito Management (IMM) program to protect public health from the transmission of West Nile Virus (WNV) and other vector-borne diseases, and to suppress local populations of nuisance mosquitoes. Through surveillance of potential mosquito breeding sites (larval sites), areas that produced mosquito larvae were identified and treated with control materials known as larvicides. During the 2015 season, 15,193 individual larval site inspections were performed on 1,863 potential sites within the District. Of the sites inspected, 668 were found producing mosquitoes at least once over the course of the season. OtterTail conducted 3,051 site treatments covering approximately 776 acres of active mosquito breeding habitat.

Adult mosquito populations and WNV activity were also monitored during the season by using 23 adult mosquito traps placed throughout the project area. Weekly trap collections enabled OtterTail to monitor nuisance levels and provide any needed mosquito pools for WNV testing throughout the season. Adult mosquito monitoring also allowed county officials and OtterTail to make informed decisions on when and where adult mosquito control should occur.

During the 2015 season, adult control was performed along approximately 81 linear route miles (at an application rate of 0.0035 lbs Permethrin a.i. per acre) in the BCMCD. OtterTail and BCMCD continued to offer a Spray Notification and Shutoff Service as part of the adult control program. During the 2015 season, OtterTail received 8 shutoff requests and 10 requests to be notified before spraying. OtterTail's shutoff and notification list currently includes 714 households that want to be notified before spraying in their neighborhood and 319 households that have requested spray shutoffs. In 2015, OtterTail completed 120 notification calls.

The State of Colorado experienced a second consecutive year of relatively low WNV activity in 2015. The climate patterns and temperatures that occurred during the 2015 season caused mosquito populations to remain at below average levels throughout the majority of the season; consequently, there was relatively low WNV activity within the region. Boulder County's IMM program coupled with education and personal protection measures, also likely continued to help reduce mosquito populations and WNV activity in the county during 2015.

1.0 INTRODUCTION

Boulder County continued to partner with OtterTail Environmental, Inc. (OtterTail) in 2015 to operate an Integrated Mosquito Management (IMM) program. The county's goals were the same as they were in previous years, which were to protect local residents from the effects of mosquito-borne disease and to suppress the local populations of nuisance mosquitoes.

To accomplish this, specific objectives were established for the program. First, the county wanted to monitor possible mosquito breeding (larval) habitats and treat those sites when mosquito larvae were present. Treatment of these areas with control methods during this stationary larval stage, before mosquitoes become airborne, is the most cost-effective and efficient means to reduce mosquito populations. Secondly, they wanted to monitor adult mosquito populations and use the population numbers as a possible trigger for adult mosquito control to reduce nuisance to the public. The county also wanted to limit the effect on the environment from control materials and be as cost-effective as possible.

This report explains the methods used in the IMM program and provides a detailed summary of the results of this year's effort.

2.0 WEST NILE VIRUS (AND OTHER MOSQUITO-BORNE DISEASE) UPDATE

West Nile is a mosquito-transmitted virus that can cause a wide range of effects, from an asymptomatic infection to a neuroinvasive disease termed West Nile meningitis or encephalitis. West Nile Virus was first detected in the United States during the summer of 1999 in New York City while conducting routine St. Louis Encephalitis (SLE) and Eastern Equine Encephalitis (EEE) surveillance. The virus has since spread across the U.S. and has been confirmed in all continental states. Bird populations act as a reservoir for the virus until a mosquito bites an infected bird. Only then can an infected mosquito pass the virus on to humans, horses and other animals through their bite. While many people who contract WNV experience mild or no symptoms, the more severe cases of West Nile meningitis or encephalitis can result in severe illness and even death.

There are over 50 mosquito species in Colorado, yet only species from the genus Culex are known to be effective transmitters of WNV. Mosquitoes and other insects that transmit disease are called vectors; mosquitoes that are not known to transmit a disease are often called nuisance mosquitoes. The most abundant mosquito in Boulder County, *Aedes vexans*, is an aggressive nuisance mosquito. The two primary vector mosquitoes that are most likely to spread WNV in Colorado are *Culex tarsalis* and *Culex pipiens*.

As of September 29th, 2015, there were 1,028 WNV human cases and 54 WNV related deaths in 44 states and the District of Columbia (**Table 1**). Colorado ranked third in the national case count with 88 human WNV cases and 2 WNV related deaths reported as of October 2nd, 2015. Most WNV cases occurred in Colorado within the populous regions of the Front Range **(Table 2)**. The Colorado Department of Public Health did not report any mosquito pools, horses, birds or humans as positive for St. Louis Encephalitis or Western Equine Encephalitis during the 2015 season**.**

As of October 2, 2015 there were 11 WNV related illnesses and no WNV related deaths in Boulder County reported by Colorado Department of Public Health and Environment (CDPHE) **(Table 2)**. With widespread and frequent testing of mosquito pools throughout the county, 10 of the 132 submitted pools of mosquitoes tested WNV positive from Boulder County in 2015.

Adult mosquito surveillance data, submitted mosquito pools, and the resulting WNV infection rates were used by BCPH throughout the season to calculate Vector Index (VI) levels to help city and county officials determine local areas of concern for public awareness and safety. The VI is a tool used by health officials that takes into account the presence and density of Culex mosquitoes and their WNV infection rates, resulting in an early indicator for the risk of human WNV infection. Once the VI reaches levels above 0.75, state and local health departments typically recommend communities take higher levels of mosquito prevention and control. With the lower WNV activity in 2015, no widespread emergency spraying was conducted within Boulder County during the season.

The relatively low WNV activity and number of human infections in Colorado may be attributed to the temperature and precipitation patterns observed during the 2015 mosquito season and the affect they had on mosquito populations, as discussed further in **Section 3.0**.

Table 1 West Nile Virus Incidence, 2002 - 2015

Total WNV Human Cases	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Cases in the United States[1]	4,156	9,862	2,539	3,000	4,269	3,630	1,356	720	1,021	712	5,674	2,469	2,205	1,028
Deaths in the United States[1]	284	264	100	119	177	124	44	32	57	43	286	119	97	54
Highest State Count in United States[1]	884	2,947	779	880	996	578	445	115	167	158	1,868	379	801	201
Cases in Colorado[2]	13	2,947	291	106	345	578	71	103	81	7	131	317	118	88
Deaths in Colorado[2]	0	66	4	2	7	7	1	3	4	0	5	7	3	2
Cases in Boulder County[2]	0	421	14	5	74	95	18	12	6	2	1	51	10	11
Deaths in Boulder County[2]	0	7	0	0	1	2	0	0	0	0	0	1	0	0
Total WNV Positive Results	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Mosquito Pools in Boulder County[2]	0	118	8	0	107	55	3	4	1	9	8	69	16	10
Birds in Boulder County[2]	5	50	0	1	12	2	0	0	1	0	0	0	0	0
Horses in Boulder County[2]	3	18	0	0	1	0	0	0	0	0	0	0	0	1

1. Reported by the Center for Disease and Control (CDC); 2015 data reported as of September 29, 2015.
2. Reported by the Colorado Department of Public Health and Environment (CDPHE); 2015 data reported as of October 2, 2015.

There were no WNV related deaths in Boulder County and the number of Boulder County cases and WNV positive mosquito pools comprised approximately 12.5 percent and 6 percent of the state totals, respectively (**Table 2**). When populations of nearby Front Range Counties are taken into account, Boulder County had the second highest crude attack rate (cases per 100,000 individuals) in the region **(Table 3).** The relatively low number of human WNV cases and WNV positive mosquito pools suggests that the viral activity in Boulder County was significantly less in 2015 than during previous years with epidemic outbreaks. It is likely that the continued widespread mosquito control efforts to reduce mosquito populations, coupled with public education and personal protection measures, helped reduce the exposure and disease transmission within Boulder County.

Table 2 Colorado WNV Human Cases and WNV Positive Mosquito Pools, 2015

County	Human Cases[1]		Human Deaths[1]		Positive Mosquito Pools[1]	
	Number	% of State	Number	% of State	Number	% of State
Adams	5	5.7%	0	0.0%	4	2.4%
Alamosa	1	1.1%	0	0.0%	0	0.0%
Arapahoe	9	10.2%	0	0.0%	2	1.2%
Boulder	11	12.5%	0	0.0%	10	6.0%
Broomfield	1	1.1%	0	0.0%	0	0.0%
Costilla	1	1.1%	0	0.0%	0	0.0%
Crowley	1	1.1%	1	50.0%	0	0.0%
Delta	0	0.0%	0	0.0%	1	0.6%
Denver	9	10.2%	0	0.0%	9	5.4%
Douglas	2	2.3%	0	0.0%	0	0.0%
El Paso	1	1.1%	0	0.0%	0	0.0%
Freemont	2	2.3%	0	0.0%	0	0.0%
Huerfano	1	1.1%	0	0.0%	0	0.0%
Jefferson	5	5.7%	0	0.0%	2	1.2%
La Plata	1	1.1%	0	0.0%	0	0.0%
Larimer	19	21.6%	0	0.0%	102	61.1%
Logan	1	1.1%	0	0.0%	0	0.0%
Mesa	1	1.1%	0	0.0%	1	0.6%
Morgan	2	2.3%	0	0.0%	0	0.0%
Pueblo	4	4.5%	1	50.0%	7	4.2%
Rio Grande	1	1.1%	0	0.0%	0	0.0%
Washington	1	1.1%	0	0.0%	0	0.0%
Weld	9	10.2%	0	0.0%	29	17.4%
Colorado Totals	**88**		**2**		**167**	

1. Reported by CDPHE as of October 2, 2015

Table 3 Human WNV Crude Attack Rates[1] of Front Range Counties, 2015

County	Population	# of WNV Cases	% of Front Range Cases by # of Cases	2015 Crude Attack Rates (per 100,000)	% of Front Range Cases by Population	Crude Attack Rank
Adams	441,603	5	6.7%	1.13	4.7%	7
Arapahoe	572,003	9	12.0%	1.57	2.7%	10
Boulder	294,567	11	14.7%	3.73	15.6%	2
Broomfield	55,889	1	1.3%	1.79	7.5%	5
Denver	600,158	9	12.0%	1.50	6.3%	6
Douglas	285,465	2	2.7%	0.70	2.9%	9
El Paso	622,263	1	1.3%	0.16	0.7%	11
Jefferson	534,543	5	6.7%	0.94	3.9%	8
Larimer	299,630	19	25.3%	6.34	26.5%	1
Pueblo	159,063	4	5.3%	2.51	10.5%	4
Weld	252,825	9	12.0%	3.56	14.9%	3

***** WNV human case information used for Crude Attack Rate calculations was obtained from CDPHE (CDPHE 2015); Population information for Crude Attack Rate calculations was obtained from U.S. Census Bureau 's 2010 Census of Population (USCB 2011); Crude Attack Rates are listed as cases per 100,000 people.

3.0 REGIONAL 2015 CLIMATOLOGICAL DATA AND MOSQUITO ACTIVITY OVERVIEW

The weather patterns leading into and during the mosquito season (April – September) are important factors that influence mosquito abundance and WNV activity. The following section describes the regional climate, weather during the season, and how that may have affected the mosquito populations.

Boulder County is located in a semi-arid environment with elevations in the project area ranging from approximately 4,900 feet to 5,500 feet. The typical mosquito season for the Boulder County area is from April to September. Current and historical climate data from the National Oceanic Atmospheric Administration's (NOAA) Boulder, Colorado weather station was used for regional temperature and precipitation patterns.

Historical records for the mean monthly temperature at the station suggest that temperatures usually have a steady increase from April to July, making July, on average, the hottest month of the year. Typically there is then a steady temperature decrease into September. In 2015, every month of the mosquito season except May and July had temperatures above normal. The month of May experienced the highest variation from normal during the summer with a monthly mean temperature approximately 5 degrees below normal (**Figure 1**).

The historical averages for the monthly mean precipitation indicate that April, May and June are usually the wettest months of the year (**Figure 2**). During 2015, the accumulated precipitation from January through September was significantly higher than the historical average for the same period. During this time period in 2015, there was an accumulation of 21.96 inches. This is approximately 40 percent more than the normal amount of accumulation when compared to the historical average, which is 15.72 inches. Four of the nine months received precipitation amounts higher than their normal averages. The most significant variations during the mosquito season were the months of May and September. May received approximately 2.5 times more precipitation than average, making it wettest month of 2015, while September received approximately eight percent of its normal precipitation, making it the driest month of 2015 (NOAA 2015).

Temperatures and precipitation amounts varied throughout the 2015 mosquito season. A wetter and cooler than average month of May was followed by a slightly drier and warmer than average June. Similar to May, the month of July was then much wetter and cooler than average. These overall cooler temperatures during the first half of the 2015 mosquito season likely caused mosquito larvae to develop at a much slower rate, and the frequent rainstorms during May and July also allowed the mosquito larvae to be repeatedly flushed from their breeding habitats. August and September were then much hotter and drier than average, causing many of the sites to quickly dry up during the second half of the season. These climate patterns, along with the District's larval control program, were the likely causes of the below average abundances of nuisance and Culex mosquitoes throughout the majority of the 2015 mosquito season.

Figure 1 **2015 Monthly Mean Air Temperature and Historical Averages**

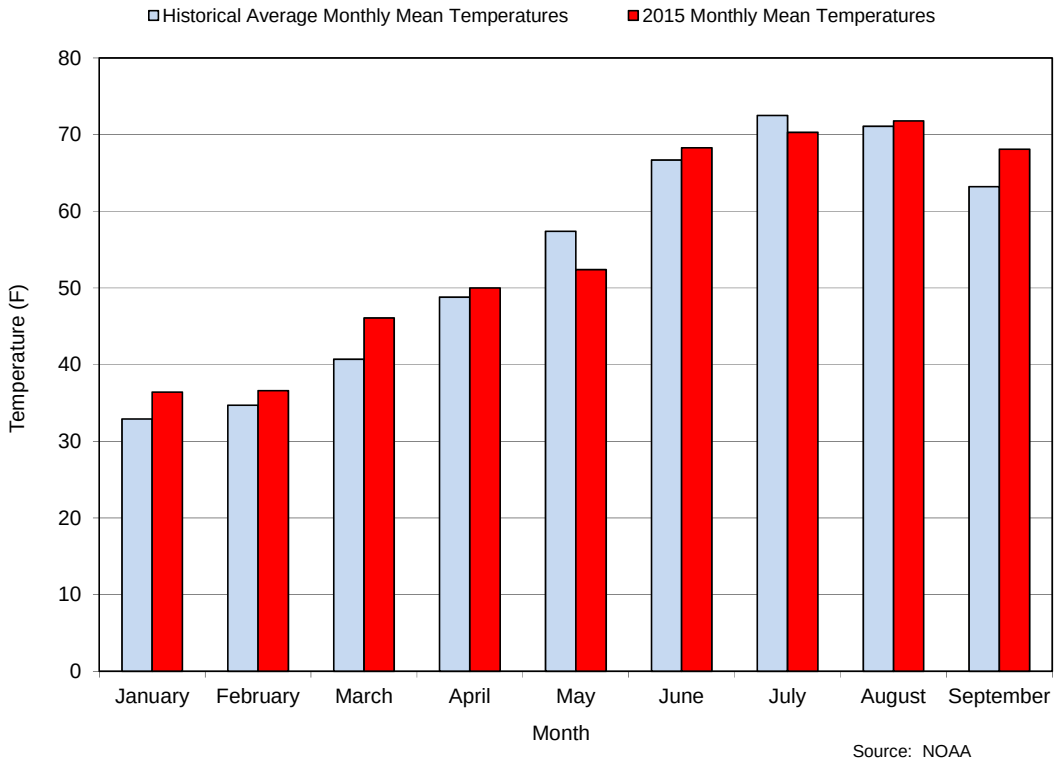
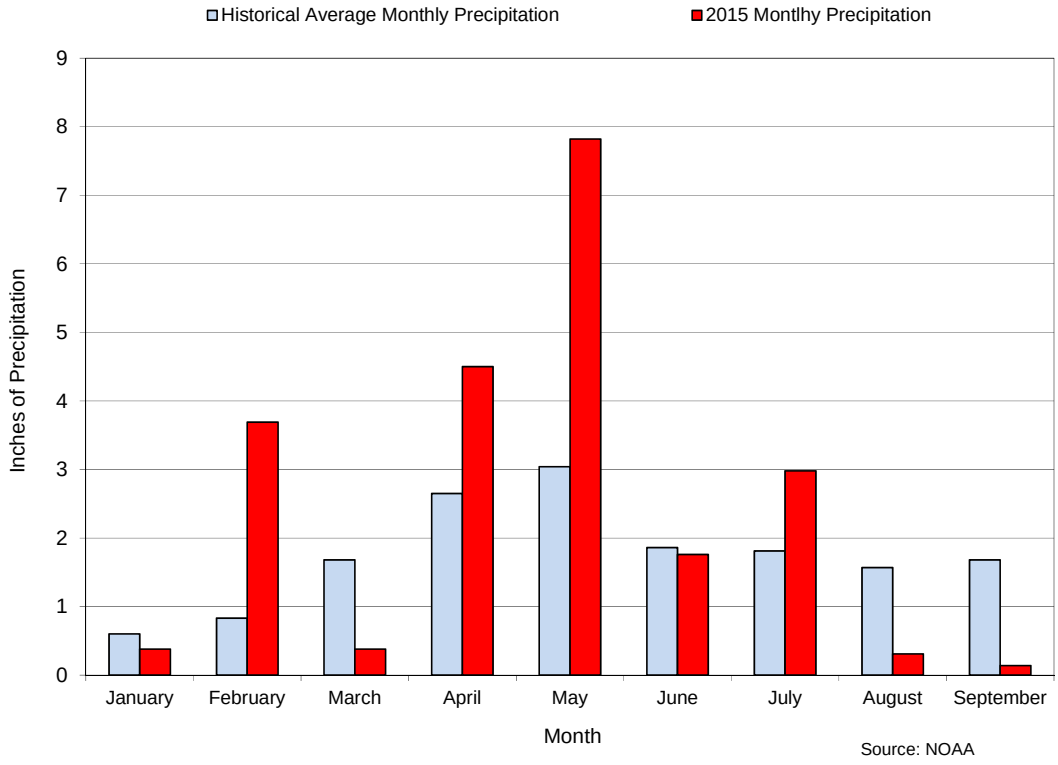


Figure 2 **2015 Monthly Total Precipitation Data and Historical Averages**



4.0 LARVAL MOSQUITO SURVEILLANCE AND CONTROL

LARVAL SURVEILLANCE METHODOLOGY

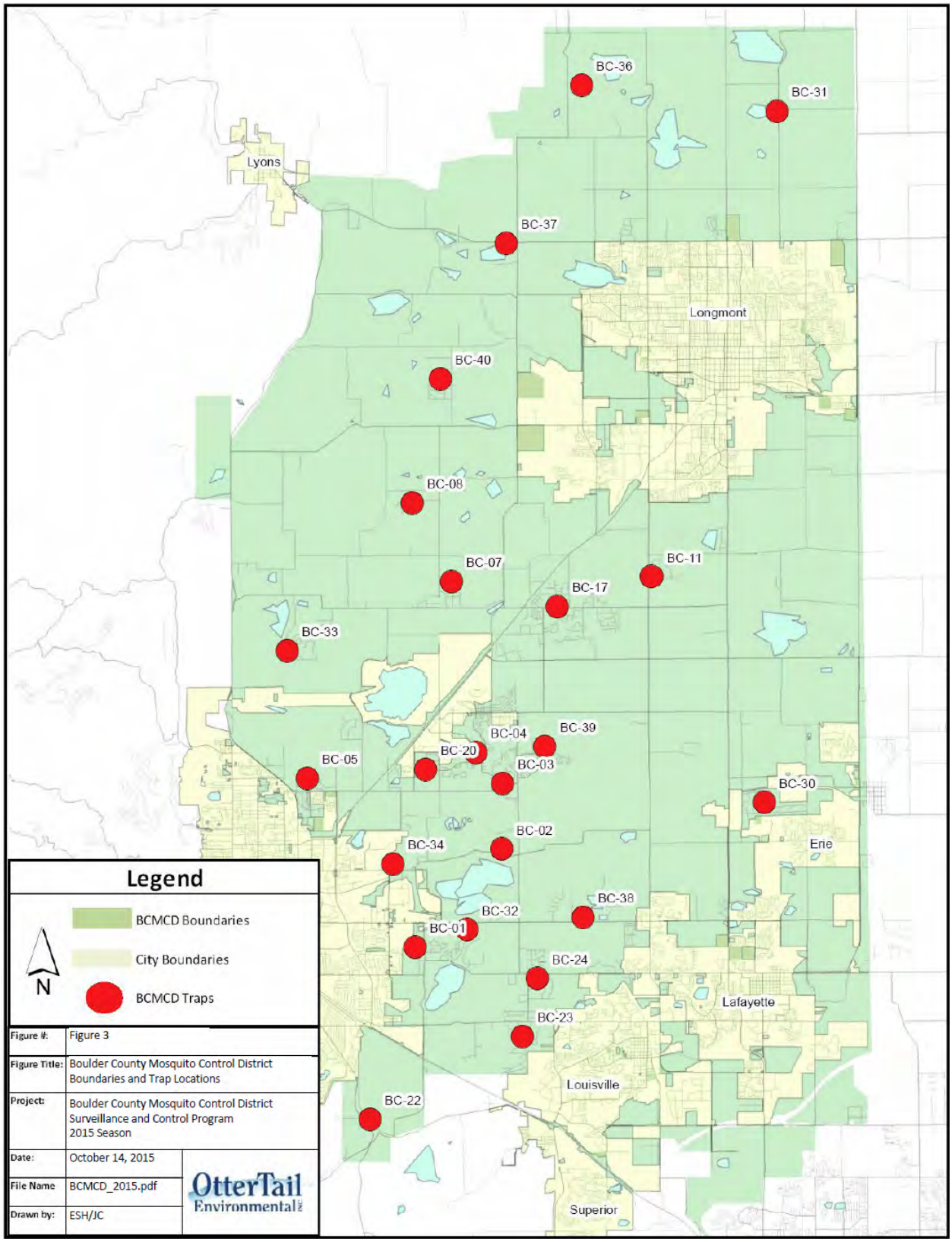
To inspect a mosquito source, a plastic dipper cup with a 3-foot wooden handle was used to collect water from the site. Each sample (dip) was closely examined for mosquito larvae presence. Many of the sites inspected had mosquito-sustaining habitat around the perimeter of the site, but the middle remained mosquito free due to water circulation and/or natural predators. At these sites, the dipping effort was completed using a *linear approach* (walking around the perimeter and sampling the margins).

In sites with widespread mosquito habitat, the entire site was methodically sampled using the *surface area approach*. With this approach, sites were dipped approximately every 10 to 20 square feet. Since each site's characteristics could vary as the season progressed (e.g., become drier, wetter, increased vegetation), there were changes made during the field season to adjust the appropriate number of dips.

OtterTail staff began the season in April by performing surveillance and control on habitats within the District that have historically been found to be breeding mosquitoes early in the season. This effort increased gradually during the season to a full crew by the beginning of June when several of the sites were producing larvae. Many of the habitats were those with stagnant water high in nutrients and organic matter including: cattail marshes, non-flowing drainage ditches, small stagnant ponds, and temporary pools. Larval habitat sites were routinely inspected throughout the season based on their production potential. Depending on the time of the season, sites found to have a high production potential were generally inspected every 5-10 days. During the height of the mosquito season (late June to mid-August), OtterTail re-inspected many of the sites that were found actively producing within 5 days to ensure efficient control. If potential sites were not found to be producing mosquitoes during this time, they were generally re-inspected in 7-10 days, depending on the site's breeding potential. Habitat sites continued to be added and refined throughout the field season as needed.

When larval mosquito habitat was observed on private property, efforts were made to gain permission to access the land for surveillance and treatment. As directed by the county, OtterTail only accessed private property if permission was granted by the owner.

Figure 3 2015 BCMCD Boundaries and Trap Locations



LARVAL CONTROL METHODOLOGY

The primary focus for OtterTail's IMM program is to control mosquitoes while they are in the larval stage. Larval mosquito control methods employed by OtterTail were aimed at preventing adult mosquito emergence, which reduces the potential of the mosquito-borne disease, WNV, and minimizes the annoyance level of mosquitoes to local residents. To achieve a high level of effectiveness and efficiency of larval control efforts, OtterTail identified and inspected mosquito larval habitats on a regular basis. The threshold for larval control was presence of any mosquito larvae. Finding and documenting consistent mosquito-producing sites was an important component of the program because it created a pattern that is monitored and systematically controlled to help understand mosquito populations and WNV trends. Being environmentally sensitive, Boulder County and OtterTail believe in concentrating on larval control to reduce the need for adult mosquito control spraying.

The application of *Bacillus thuringiensis israelensis* (*Bti*), *Bacillus sphaericus (Bs)* and BVA-2 mosquito larvicide oil (BVA-2) were the primary methods used for larval mosquito control. Control materials were applied within the labeled rates, thereby minimizing any potential adverse impacts to areas being treated. Routine post-treatment checks were conducted to ensure the larval control was effective. If any larvae were found during the post-check, a second application was conducted.

In balancing environmental resources, cost effectiveness, and public health needs, *Bti* was selected as the primary treatment product. *Bti* is a naturally occurring protein that is toxic to mosquito larvae upon its ingestion. It provides a residual treatment that lasts for approximately two days. Since new mosquito larvae may hatch after the product dissipates, the sites must be inspected for mosquito larvae every one to two weeks. The presence of mosquito larvae between monitoring periods has the added benefit of allowing these larvae to continue to be part of the aquatic food web. However, larvae are eliminated before they can emerge as adults. This helps protect the public from potential WNV transmission, while still providing a food source for many aquatic animals.

Bacillus sphaericus is a larvicide very similar to *Bti*, but has a longer residual time. The protein in *Bs* products is able to provide continuous treatment of mosquito larvae for up to four weeks and was typically used on sites found to be continuously producing mosquitoes. Although the longer residual time of *Bs* allows for fewer site checks and cost savings in labor and travel, it is only practical in certain situations because it costs substantially more than *Bti*.

Bti and *Bs* are the primary control materials used but they are ineffective if pupae are found at a site. Mosquitoes do not feed during their pupal stage; therefore, the use of *Bti* and *Bs* is ineffective against mosquito pupae since they must ingest the proteins. In these instances of pupae occurrence, BVA-2 is used. BVA-2 is a highly refined mineral oil that creates a thin film on the water surface. The film interrupts the air and water interface during the mosquito's larval and pupal development stages, causing them to drown.

OtterTail also used the predatory fathead minnow (*Pimephales promelas)* in limited habitats to serve as a biological control for mosquito larvae. Fathead minnows are a native fish species in Colorado that regularly feed off of surface dwelling aquatic organisms, including mosquito larvae. OtterTail provided minnows to residents that had "closed system" habitats such as ornamental ponds or small farm ponds that were isolated from streams or other areas where the fish could not spread out indiscriminately.

LARVAL DATABASE MANAGMENT

In an effort to improve the larval surveillance and control program, and the efficiency of field operations, OtterTail replaced the previously used handheld Personal Digital Assistants (PDA's) with Android Tablets in 2015. The PDA's had been used during the 2010-2014 seasons, but their use was discontinued prior to the 2015 field season due to advances in mobile applications and cloud data storage technology.

The new tablet-based larval surveillance collection and management system was designed in-house by OtterTail's computer database specialist and staff mosquito specialists. The tablets utilize and integrate several mobile and web applications to provide both the managers in the office and the technicians in the field with the resources needed to provide spatially accurate data for mosquito larvae habitat inspections and pesticide applications. The tablet resources include data recording forms, digital maps, web mapping and navigational aids, and access to site specific informational databases. This helps ensure that larval inspections and treatments are being conducted at the correct locations, while also improving the program's surveillance efficiency.

The tablets allow for site inspection and treatment data to be entered in the field at each site location. The data entry form guides the field technician through a step-by-step site-protocol using a series of menus requiring the technician to fill out each section before allowing the entry to be completed. This aids in a more consistent and accurate dataset by minimizing potential data-entry errors. In addition to typical site data that is recorded during a site visit, the tablets utilize Global Positioning System (GPS) technology to include date/time stamp and GPS coordinates for each recorded entry.

The information recorded on each tablet is immediately sent to OtterTail's cloud database. This instant upload of data directly from the tablet into the cloud eliminates the need for the manual electronic data transfer process and provides near real-time data to be available to managers and customer support staff. Although data entry errors can still occur when entering information into the tablets in the field, the new system has significantly increased efficiency in the data transfer process, and allows for immediate review of surveillance and control data.

LARVAL RESULTS AND DISCUSSION

The 2015 larval surveillance season started in April and continued through September. During the season, a total of 15,193 individual larval site inspections were performed on 1,863 sites within the District. Of the sites inspected, 668 sites were found producing mosquitoes at least once over the course of the season. Approximately 5,117 lbs of *Bti*, 25 lbs of *Bs*, and 157 gallons of BVA 2 Oil were used to treat approximately 776 acres of actively producing larval habitat. In addition to the control products used, OtterTail also distributed approximately 3,900 fathead minnows to District residents for private larval control (**Tables 4 and 5**).

Table 4 Larval Surveillance and Control Summary, 2009 - 2015

Habitat Site Surveillance & Control	OtterTail Contract							2008	Historical Average	Historical Range
	2015	2014	2013	2012	2011	2010	2009			
Site Inspections[1]	15,193	17,331	17,542	20,622	19,661	20,395	15,931	5,470	6,836	5,470 - 8,546
Total # Sites Wet[2]	11,649	14,418	12,824	13,289	14,189	13,632	11,711	3,958	4,875	3,958 -6,123
% of Sites Wet[2]	77%	83%	73%	64%	72%	67%	74%	72%	75%	72% - 80%
Site Treatments[1]	3,051	4,026	3,751	2,872	3,189	2,702	3,273	1,386	2,075	1,386 - 2,637
% Sites Treated[2]	26%	28%	29%	22%	22%	20%	28%	35%	37%	35% - 41%
Amount of Acres Treated[1]	776	2,056	2,693	1,515	2,341	1,225	1,265	1,128	1,554	1,113 - 2,470

Notes: **1.** Historical avg. and range based on 2004 - 2008 BCPH provided data; 2. Historical avg.and range based on 2006 - 2008 BCPH provided data

Table 5 Larval Control Types and Amounts Used, 2009 - 2015

Control Type	2015	2014	2013	2012	2011	2010	2009
AGNIQUE® MMF	N/A	1.9 gal	13.9 gal	7.5 gal	29.6 gal	22.5 gal	10.6 gal
Bacillus thuringiensis israelensis	5,117 lbs	13,477 lbs	16,204 lbs	9,657 lbs	13,696 lbs	7,726 lbs	5,350 lbs
Bacillus sphaericus	25 lbs	135 lbs	203 lbs	20 lbs	498 lbs	353 lbs	792 lbs
Fathead Minnows	3,900 fish	1,100 fish	1,200 fish	1,200 fish	1,000 fish	1,200 fish	3,000 fish
Methoprene	N/A	N/A	N/A	6.6 lbs	22 lbs	2.9 lbs	1.4 lbs
BVA 2 Oil	157 gal	123.6 gal	1.8 gal	N/A	N/A	N/A	N/A

Many of the habitat sites produced mosquito larvae multiple times during the season causing the treated acres at certain sites to be counted multiple times for the season total. As the season progressed, the sites were categorized according to larval abundance and occurrence. Low priority mosquito sites which were not producing mosquitoes had poor habitat or had the presence of aquatic predators. High priority mosquito sites typically had larvae when sampled and consistently produced mosquitoes every seven to ten days during the peak season.

As discussed in the **Boulder County Mosquito Control District 2009 Season Report**, OtterTail staff expended approximately 1,085 labor hours during its 2009 preseason mapping operations that were beyond the required scope of work for the project. This large expenditure of time and resources, along with the continual process of locating and adding additional habitat sites throughout the 2009-2015 seasons, has allowed OtterTail to add 712 new unique potential larval habitat sites to the District over the seven year contract period. Despite our intensive mapping effort of 2009, adding 526 sites, OtterTail was still able to add another 186 sites between the 2010-2015 seasons. The new sites added to the program far exceeded the BCMCD's goal of a 10 percent annual increase of the contract (**Table 6**).

Table 6 **Results of OtterTail's Mapping Effort to Find New Larval Breeding Sites, 2009 - 2015**

	2015 New Sites[3] Added		2014 New Sites[3] Added		2013 New Sites[3] Added		2012 New Sites[3] Added		2011 New Sites[3] Added		2010 New Sites[3] Added		2009 New Sites[3] Added		Existing Sites	Contract Goal Per Year[4]	
	# Sites	% Increase	# Sites	% Increase	# Sites	% Increase	# Sites	% Increase	# Sites	% Increase	# Sites	% Increase	# Sites	% Increase	(2008)	# Sites	% Increase
Total Sites	36	3%	34	3%	31	3%	18	2%	13	1%	54	5%	526	49%	1,072	107	10%
Preseason Site Mapping Effort[1]	3	---	0	---	---	---	---	---	---	---	---	---	457	43%	---	---	---
In-Season Site Mapping Effort[2]	33	3%	34	3%	31	3%	18	2%	13	1%	54	5%	69	6%	---	---	---
In Season Sites Added by Hotline Calls	17	2%	17	2%	13	1%	6	1%	4	0.4%	16	1%	20	2%	---	---	---
In Season Sites added by Field Techs	16	1%	17	2%	18	2%	12	1%	9	1%	38	4%	49	5%	---	---	---

Notes:

1. Preseason mapping is defined as an out-of-scope mapping effort that was conducted by full time staff, biologists with multiple years experience in mosquito surveillance and control. Because it was prior to the primary breeding season, they could focus on mapping rather than just during surveillance and control duties as is the standard procedure.
2. In-season mapping effort is defined as the more typical way sites are mapped. This consisted of seasonal field technicians finding new sites while they were out conducting their routine surveillance and control, or by resident calls alerting OtterTail of a possible new site.
3. New site is defined as unique site location completely separate from an existing 2008 site. Only sites that were considered probable mosquito breeding habitat were added as a "new site". The preseason mapping was conducted by experienced staff, because they could readily distinguish between areas worthy of being added as a site and those not likely to be habitat.
4. Contract goal was a 10 percent site increase per year (or 107 sites).

To ensure a comprehensive IMM program, OtterTail continued to maintain a toll-free telephone hotline for residents to report areas of concern. Calls received from the hotline resulted in 93 new potential mosquito producing sites being added to the program during the 2009-2015 seasons (**Table 6**).

5.0 ADULT MOSQUITO SURVEILLANCE AND CONTROL

ADULT SURVEILLANCE METHODOLOGY

Adult mosquito population surveillance is a crucial component of any successful IMM program. Adult surveillance provides information on what types of mosquito species are in an area as well as information on their abundance. Mosquitoes collected in the traps can be tested for a variety of mosquito-borne diseases and are critical for monitoring and forecasting vector threats, particularly WNV.

Most mosquito species prefer to rest during the heat of the day in areas known as harborage areas. A mosquito harborage area is usually a shaded, wind protected and moist area because adult mosquitoes can dehydrate quickly during the daylight hours if they do not have a shady area to rest and escape the heat. Relevant examples are groves of trees with a layer of shrubby undergrowth, dense bushes, tall live grasses, or in residential areas under roof eaves and inside tires. Adult mosquito trapping efforts target these harborage areas to monitor adult mosquito populations.

OtterTail used the CDC style carbon dioxide (CO_2) baited light trap to monitor the adult mosquito populations within the District. The CO_2 baited light trap is based on the principle that most adult mosquitoes are attracted to light, CO_2 (via respiration), and heat. The CO_2 baited light trap collects adult female mosquitoes that are seeking a blood meal, so that she may produce eggs. This type of trap is set overnight and, on the following morning, the nets are collected and returned to OtterTail's laboratory to be identified and counted. Once identified, the mosquitoes were sorted by species and the data were provided to BCPH. A detailed explanation of the trap used during the season can be found in **Appendix A**. Adult mosquito traps were placed and monitored at 23 sites around the county from the first week in June through the last week in August. Traps were set in areas of suitable harborage for adult mosquitoes and were set in the same locations used during previous years of the program (**see Figure 3**).

Boulder County Public Health submits vector mosquitoes collected throughout the county to CDPHE for WNV testing on a weekly basis during each mosquito season. As discussed in **Section 2.0**, the adult mosquito data, submitted mosquito pools, and the resulting WNV infection rates are used by BCPH throughout the season to calculate Vector Index levels to help city and county officials determine local areas of concern for public awareness and safety.

ADULT SURVEILLANCE RESULTS AND DISCUSSION

Over the season, from all 23 traps, there was an average of 49 total adult mosquitoes per trap per night and an average of 15 adult vector mosquitoes per trap per night. The total adult mosquitoes collected during the season resulted in Aedes/Ochlerotatus species being the most abundant (65.3 percent), followed by Culex /vector species (29.8 percent), Coquillettidia species (3.8 percent) and Culiseta species (1.1 percent); (**Table 7**). This results in approximately 70 percent non-vector vs. 30 percent vector adults being collected over the entire season.

As described in **Section 3**, Colorado experienced climate patterns that led to the third lowest mosquito populations on record during the 2015 season (**Figures 4 - 7**). Temperatures and precipitation amounts varied throughout the 2015 mosquito season. A wetter and cooler than average month of May was followed by a slightly drier and warmer than average June. Similar to May, the month of July was then much wetter and cooler than average. These overall cooler temperatures during the first half of the 2015 mosquito season likely caused the mosquito larvae to develop at a much slower rate, and the frequent rainstorms during May and July also allowed the mosquito larvae to be repeatedly flushed from their breeding habitats. August and September were then much hotter and drier than average, causing many of the sites to quickly dry up during the second half of the season. These climate patterns, along with the District's larval control program, were the likely causes of the below average abundances of nuisance and Culex mosquitoes throughout the majority of the 2015 mosquito season. Detailed seasonal information (including weekly populations and species compositions) for each individual trap can be found in **Appendix B.**

Figure 4 Season-Wide Weekly Adult Trap Counts of All Trap Stations, 2015

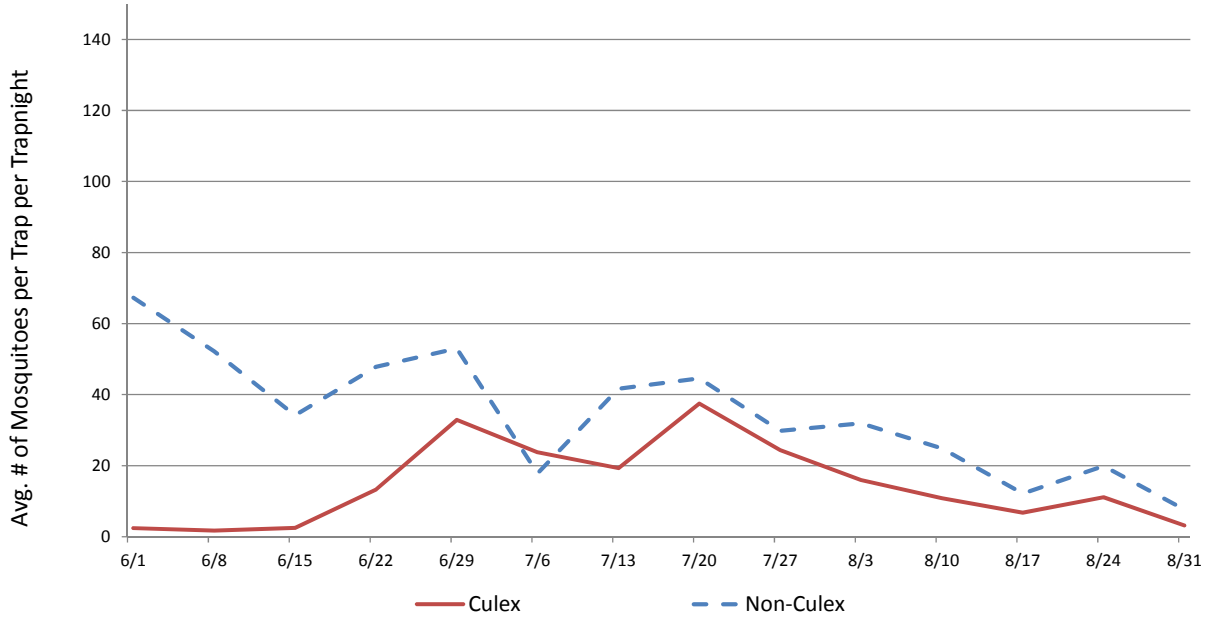


Figure 5 **Average Numbers of Non-Culex Mosquitoes, 2015 and 2009 - 2014 Average**

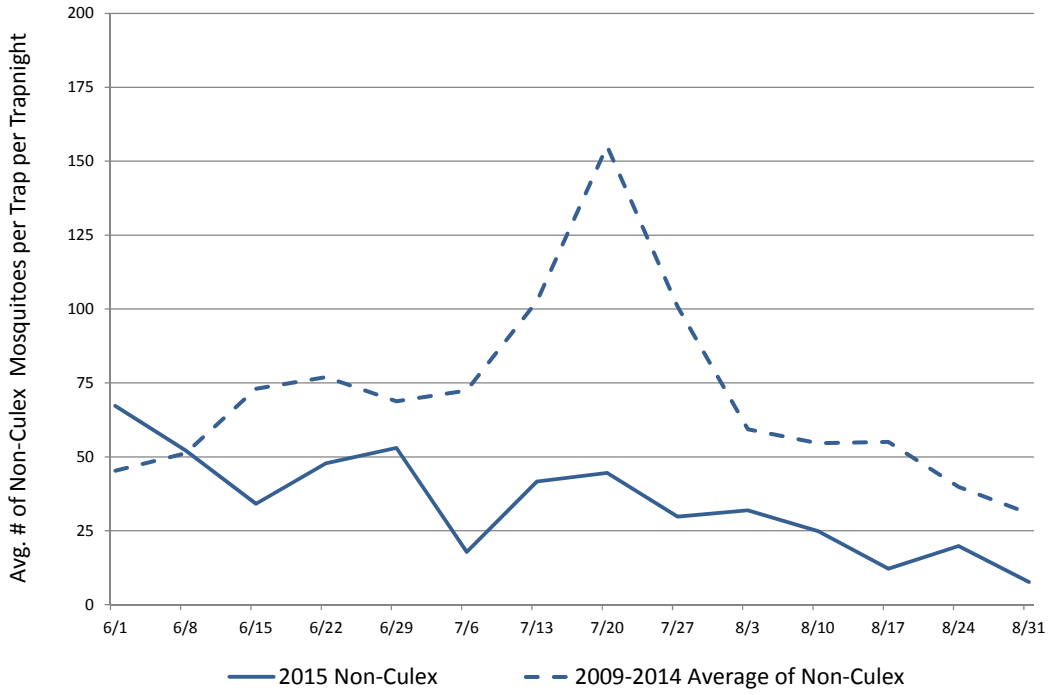


Figure 6 **Average Numbers of Culex Mosquitoes, 2015 and 2009 - 2014 Average**

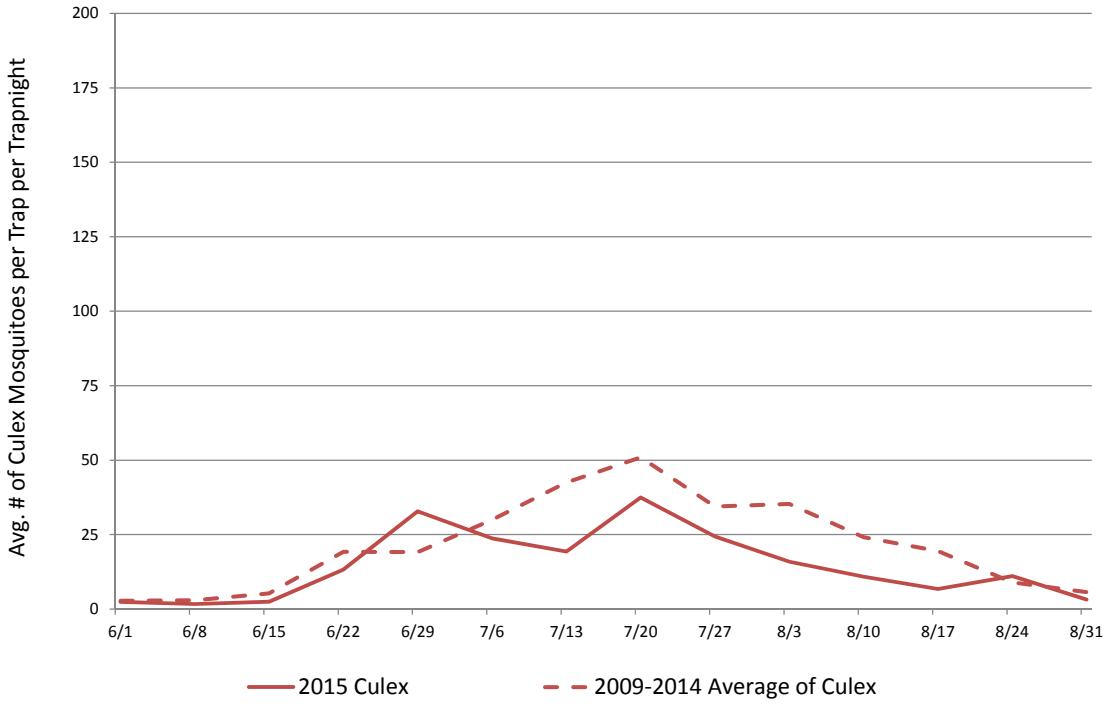
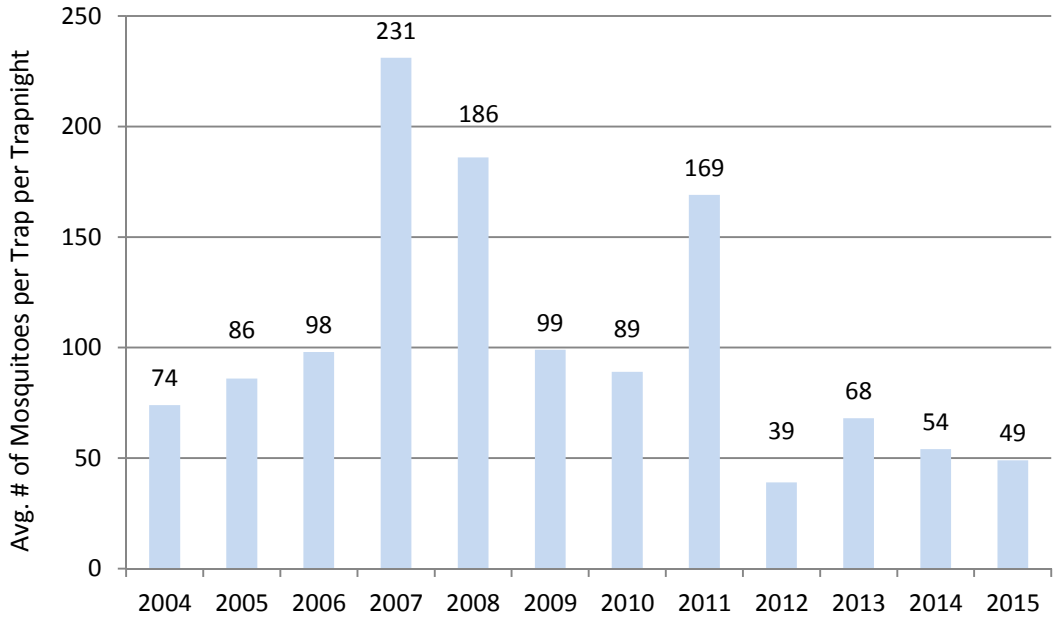


Figure 7 Average Numbers of Mosquitoes, 2004 - 2015*



*Note: 2004 - 2008 data provided by BCPH

Table 7 Total Number of Adult Mosquitoes per Trap for the 2015 Season[1]

Trap Name and Location	*Culex spp.*		*Ae./Oc. Spp.*		*Coquillettidia spp.*		*Culiseta spp.*		Trap Total	Avg. Per Trapnight	Trap %RA	Historical Avg. Per Trap Night	Range of Historical Trap Nights
	#	%RA	#	%RA	#	%RA	#	%RA					
BC-01[2] Old Tale Road	107	33.6	191	60.1	14	4.4	6	1.9	**318**	**23**	2.0	88	31 - 314
BC-02[2] Cottonwood Kennels	198	24.6	575	71.5	20	2.5	11	1.4	**804**	**57**	5.1	389	56 - 1,018
BC-03[2] Gunbarrel SE-Pali	233	42.2	296	53.6	19	3.4	4	0.7	**552**	**39**	3.5	114	45 - 257
BC-04[2] Gunbarrel NW-Idylwild	292	49.2	259	43.6	33	5.6	10	1.7	**594**	**42**	3.8	153	75 - 295
BC-05[2] Orange Orchard	156	50.5	145	46.9	4	1.3	4	1.3	**309**	**22**	2.0	110	14 - 271
BC-07[2] Brigadoon Glen	270	42.0	362	56.3	3	0.5	8	1.2	**643**	**46**	4.1	128	17 - 327
BC-08[2] Boulder Hills	395	32.6	800	66.0	1	0.1	17	1.4	**1,213**	**87**	7.7	156	56 - 448
BC-11[2] Niwot East - Majestic	310	43.4	391	54.7	1	0.1	13	1.8	**715**	**51**	4.5	98	25 - 255
BC-17[2] Niwot Central	109	30.6	244	68.5	0	0.0	3	0.8	**356**	**25**	2.3	44	10 - 94
BC-20[2] Willows	169	21.8	600	77.2	5	0.6	3	0.4	**777**	**56**	4.9	91	31 - 194
BC-22[2] Marshall / S.Boulder Creek	47	7.8	140	23.3	413	68.7	1	0.2	**601**	**43**	3.8	142	41 - 422
BC-23[2] Louisville Spanish Hills	82	45.8	87	48.6	5	2.8	5	2.8	**179**	**13**	1.1	33	8 - 63
BC-24[2] Louisville Wewonka Dr.	64	86.5	9	12.2	0	0.0	1	1.4	**74**	**5**	0.5	18	3 - 37
BC-30[3] Erie/Brownsville Random Ct.	100	25.8	284	73.4	0	0.0	3	0.8	**387**	**28**	2.5	64	22 - 124
BC-31[3] Divide Reservoir	285	18.8	1,213	80.0	0	0.0	18	1.2	**1,516**	**108**	9.6	159	58 - 403
BC-32[3] Baseline Heights	53	15.1	292	83.4	1	0.3	4	1.1	**350**	**25**	2.2	114	18 - 269
BC-33[4] Lake Valley Estates	217	59.6	123	33.8	18	4.9	6	1.6	**364**	**26**	2.3	81	17 - 238
BC-34[4] Cline Trout Farm	279	13.0	1,814	84.5	49	2.3	4	0.2	**2,146**	**153**	13.7	235	90 - 452
BC-36[4] Yellowstone Road	418	35.3	756	63.9	0	0.0	10	0.8	**1,184**	**85**	7.5	112	39 - 326
BC-37[4] Burch Reservoir	164	19.1	684	79.7	4	0.5	6	0.7	**858**	**61**	5.5	127	64 - 259
BC-38[4] Willow Glen Teller Lake	265	27.8	663	69.6	7	0.7	18	1.9	**953**	**68**	6.1	202	33 - 575
BC-39[5] Heatherwood	328	65.9	165	33.1	0	0.0	5	1.0	**498**	**36**	3.2	75	32 - 155
BC-40[5] Chance Acres	142	43.0	182	55.2	0	0.0	6	1.8	**330**	**24**	2.1	46	11 - 108
Total	**4,683**	29.8	**10,275**	65.3	**597**	3.8	**166**	1.1	**15,721**	**1,123**	100.0	2,777	- - -
Average	204	- - -	447	- - -	26	- - -	7	- - -	**684**	**49**	- - -	121	- - -

Notes: **1.** 2015 season includes one trap night per week from June 1 to August 31, 2015 for a total of 322 trap nights; **2.** Historical avg.per trapnight and range based on 2004-2014 BCPH data. **3**. Historical avg. per trapnight and range based on 2005-2014 BCPH data**; 4.** Historical avg.per trapnight and range based on 2006-2014 BCPH data; **5.** Historical avg.per trapnight and range based on 2009-2014 BCPH data due to new trap locations beginning in 2009; **%RA**= Percent Relative Abundance; **Ae./Oc.** = Aedes/Ochlerotatus

ADULT CONTROL METHODOLOGY

The overwhelming majority of the program's efforts are focused on larval control (**see Appendix D**), but many IMM programs still include ultra-low volume (ULV) adult control to enhance control options. Although every effort is made to identify and control all mosquito larval habitats within the District, it is possible that additional mosquito habitats occur in inaccessible lands and locations outside of the project area. Mosquitoes originating from these uncontrolled habitats can migrate into the project area, causing adult populations to exceed local annoyance levels, increase the populations in excess of the BCMCD's threshold level, increase the potential WNV risk, and trigger the need for adult control. OtterTail and BCMCD made adult control decisions based on a combination of the weekly trap counts, residential complaints, and WNV activity levels. When trap populations were high and there was a correspondingly high number of residential complaints, OtterTail would then perform adult control in those areas of the county with the increased mosquito activity.

OtterTail's philosophy with adult control applications is to provide effective control of adult mosquito populations and minimize potential impacts to the public and the environment. OtterTail's trained staff follows the appropriate application practices and utilize state-of-the-art equipment for adult control. OtterTail uses ULV equipment designed and calibrated to effectively control adult mosquitoes with a minimal amount of active ingredients. ULV delivery techniques, such as timing and weather monitoring, are also designed to minimize environmental and non-target impacts, while at the same time effectively managing populations of adult mosquitoes.

BCMCD recognized the need for increasingly accurate pesticide application and documentation. Ottertail's GPS/GIS based software and hardware implementation for ULV applications was added to the program in 2009 and continued its use through the 2015 season. OtterTail maintains a fleet of ULV-equipped vehicles enhanced with the Monitor 4 system, which is a GPS based variable flow pump and sprayer control system. This system gives OtterTail the ability to incorporate GPS and GIS into truck-mounted ULV applications, which can dramatically improve several components of an adulticiding program.

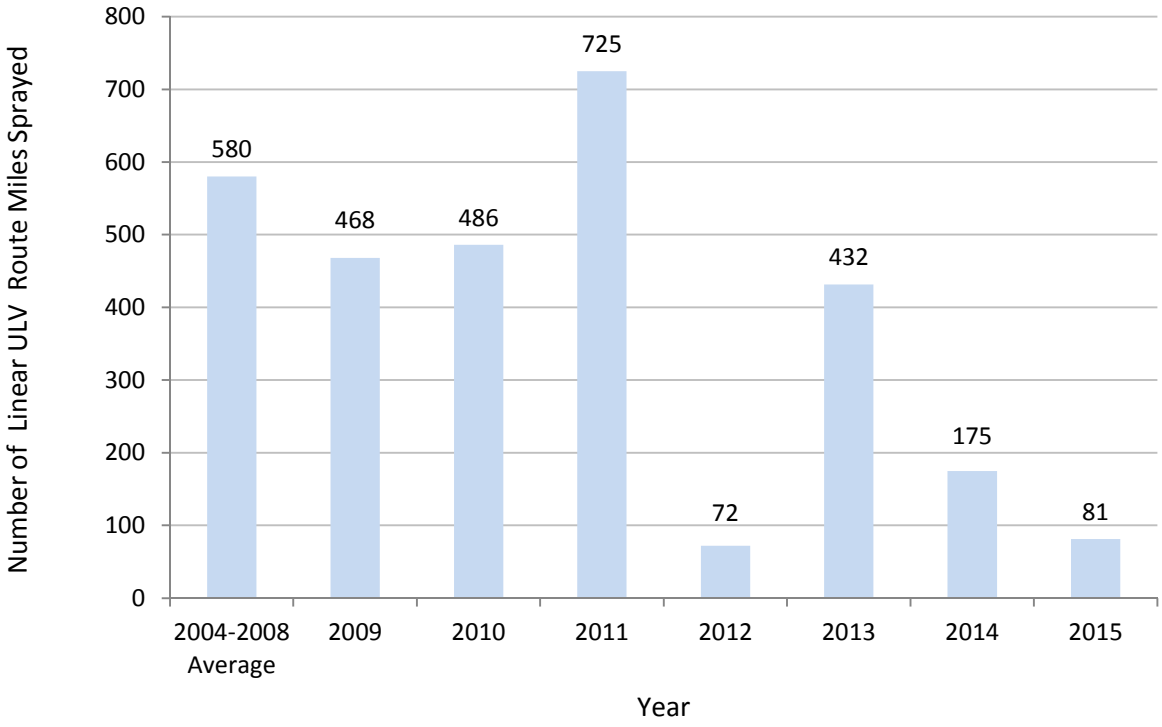
In general, this system has increased the accuracy of pesticide applications and documentation. Specific improvements include 1) complete documentation of specific locations and amounts of spray applications; 2) assurance of consistent application rate by its adjustment of spray volume with vehicle speed (including shutoff if vehicle speed exceeds pesticide label recommendations); 3) the ability to report linear miles of actual spraying rather than total vehicle trip miles; 4) the documentation of spray shutoff for residents on "no spray lists"; 5) enhanced GIS data management and reporting efficiency; and 6) the ability to graphically display data in GIS mapping formats. OtterTail's incorporation of these technologies into its entire fleet of ULV trucks has proven to be a valuable improvement to our adulticiding programs.

OtterTail's 2015 adult mosquito control applications were performed with the water-soluble adulticide Aqualuer® 20-20. This product is highly effective for the quick knockdown and control of adult mosquitoes and its water-soluble formulation is safer and easier to work with than more traditional pesticides. The active ingredient in Aqualuer® 20-20 is a synergized permethrin (a synthetic pyrethroid). Synthetic pyrethroids are synthesized derivatives of naturally occurring pyrethrins, which are taken from pyrethrum, an extract of chrysanthemum flowers. These products generally cause rapid knockdown of adult mosquitoes, exhibit low mammalian toxicity, and degrade rapidly in sunlight with little or no residual product.

ADULT CONTROL RESULTS AND DISCUSSION

During the 2015 season, approximately 81 linear route miles (at an application rate of 0.0035 lbs Permethrin a.i. per acre) of adult control were performed for the BCMCD (**Figure 8**). A detailed summary of the District's 2015 adult treatment applications can be found in **Appendix C**.

Figure 8 Total Linear ULV Route Miles Sprayed, 2004 - 2015*



*Note: 2009-2015 miles reported as route mileage, which includes shutoffs and turnarounds and should be used when comparing 2009-2015 data to historical data; 2004- 2008 data provided by BCPH.

OtterTail and BCMCD acknowledge that adult mosquito control can be a sensitive matter to many residents; therefore, we offer a *Spray Notification and Shutoff Service* as part of the adult control program. This allows residents to call OtterTail's Mosquito Control Hotline and request that they be notified before adult control applications are performed near their properties and/or request that the ULV sprayer be shutoff in areas bordering their address.

During the 2015 season, OtterTail received 8 shutoff requests and 10 requests to be notified before spraying. When these were added into the on-going list, OtterTail's shutoff and notification list included 714 households that wanted to be notified before spraying in their neighborhood and 319 households that requested spray shutoffs. OtterTail notified residents on both the notification and shutoff lists if their community was scheduled to be sprayed 24 hours in advance using an automated messaging service. In 2015, OtterTail completed 120 notification calls.

6.0 PUBLIC OUTREACH AND EDUCATION

Public education is an important component to any mosquito control program and is vital in combating WNV. BCPH continued to provide valuable educational materials to residents and the general public through local media outlets, bulletins, pamphlets and their internet website. The educational materials stressed the importance of actions that residents could take to aid in the effort to combat WNV; topics included personal protection, property maintenance for source reduction, and general information related to the WNV disease cycle. BCPH staff also provided insect repellent wipes, with the BCMCD website information printed on packaging, to communities within the county during the 2015 season. BCPH released several press releases throughout the season with detailed information regarding its mosquito control program. BCPH and OtterTail staff also conducted numerous interviews and provided an abundance of mosquito control related information to several media outlets throughout the 2015 season.

OtterTail offers an extensive amount of information on its website, including sections on mosquito biology and control, and actions residents and land users could take to help aid the District in its mosquito control efforts. The website provided online spray notifications for the areas where OtterTail would be performing adult control applications each week, as well as allowing residents to fill out an online request form to be included in OtterTail's *Spray Notification or Shutoff Service.* These notification systems allowed the District to cease running spray location advertisements in local newspapers beginning in 2011, which has provided a substantial cost savings to the District.

OtterTail provided a toll-free hotline and email address to residents in order to report mosquito complaints and request services. In 2015, OtterTail received 97 Mosquito Hotline calls from households within BCMCD, which were classified into five categories. As shown in **Table 8,** the majority of the calls received in 2015 were to report nuisance mosquito activity (29 percent) and to obtain habitat assessments (28 percent). Adult mosquito nuisance reports were used to shift surveillance into areas, if needed, and used in conjunction with trap counts to focus adult mosquito control operations. Habitat assessment calls received in 2015 resulted in an increase in monitored sites; 37 percent of these calls were reporting sites already being monitored and 30 percent of the calls resulted in the addition of 17 new mosquito habitat sites to the program (**Table 9**). Due to the low mosquito populations throughout the season, the total number of hotline calls received in 2015 (97) was significantly lower than the average number of calls typically received in recent years (**Figure 9**), which averaged 305 calls a year from 2009-2014. OtterTail provided site inspections and any consequential treatments to potential larval habitat as necessary. If landowners gave permission, then these sources were added to the project site list and incorporated into the surveillance schedule. OtterTail field technicians only accessed private properties if permission was granted by the owner.

Educating residents on the need for property maintenance, source reduction, and the use of personal protection measures continued to be crucial in the efforts to control WNV in 2015. Increased awareness and actions taken by the public likely prevented many more WNV cases from occurring in 2015.

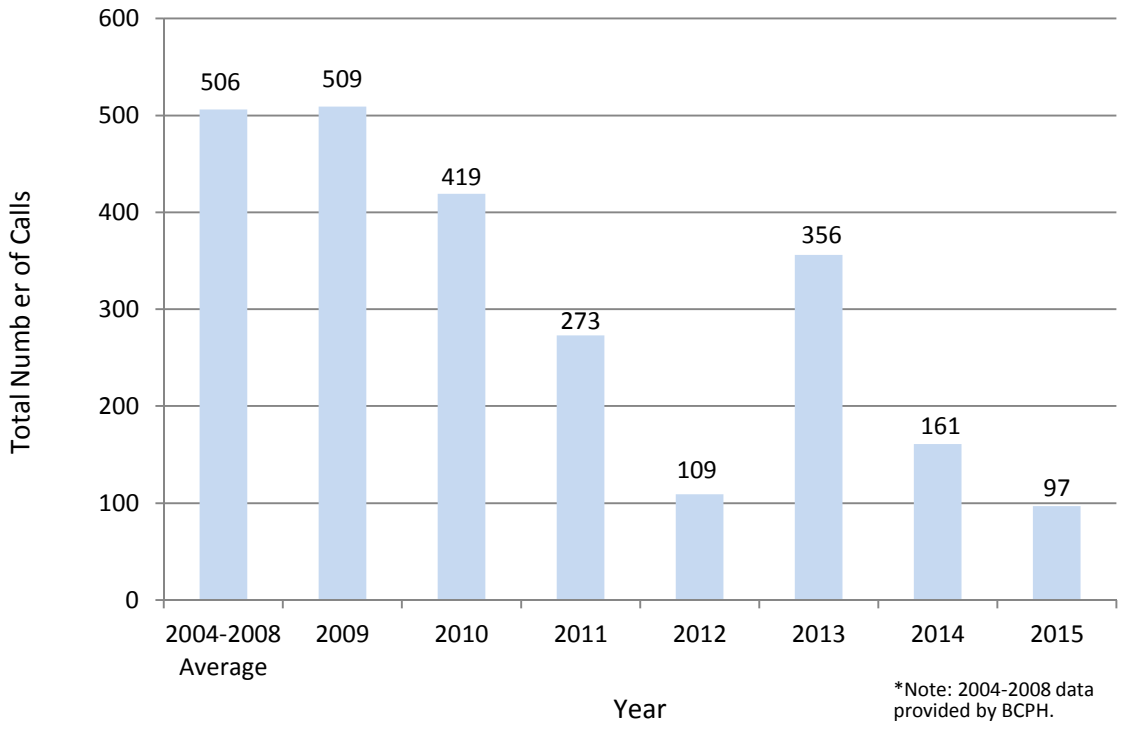
Table 8 **Service Requests by Type, 2009 - 2015**

Call Types	2015		2009-2014 Average	
	Number of Calls	Percentage	Number of Calls	Percentage
Nuisance Complaint	28	28.9%	148	48.6%
Habitat Assessment	27	27.8%	40	13.2%
Spray ShutOff	8	8.2%	31	10.1%
Spray Notification	10	10.3%	41	13.5%
General Info/Questions	24	24.7%	44	14.6%
Total	**97**	100.0%	305	100.0%

Table 9 **Results of Habitat Inspections from Hotline Calls, 2009 - 2015**

Results	2015		2009-2014 Average	
	Number of Calls	Percentage	Number of Calls	Percentage
Pre-Existing Site	10	37.0%	18	49.3%
Added New Site	8	29.6%	12	33.6%
Not a Suitable Site	9	33.3%	6	17.1%
Total	**27**	100.0%	**36**	100.0%

Figure 9 **Total Number of Hotline Calls, 2004 - 2015**



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APPENDIX A - ADULT MOSQUITO TRAP DESCRIPTION

For the 2015 season, the carbon dioxide (CO_2) baited Centers for Disease Control (CDC) Light Trap was incorporated into Boulder County's adult mosquito surveillance system. OtterTail followed the CDPHE trapping and handling protocol (CDPHE 2015) for the traps used in its WNV surveillance and testing program. The following is a detailed description of the CO_2 light trap used.

CO_2 Light Trap

To capture the most representative sample of adult mosquitoes in an area, CDC Light Traps are baited with CO_2 in the form of dry ice and set overnight in adult mosquito harborage areas throughout the mosquito season. The traps are designed with the knowledge that the female mosquito species are attracted to light, CO_2, and heat. The number and types of mosquitoes captured in these traps can provide local officials with a valuable early indication of the threat of WNV.

The traps consist of a plastic insulated thermos filled with enough dry ice (CO_2) to last throughout the trapping cycle. Units consist of a light, fan unit, and fine mesh net which hang below the thermos. The device is placed on a tree branch with the thermos approximately five to seven feet off the ground and is suspended by a small chain or rope to allow the thermos and net to hang free. Holes at the base of the thermos allow dissipating CO_2 to be emitted as an attractant around the trap. Batteries run the small fan and light positioned above the net. The light provides further attraction and once the mosquitoes are near the light, they are pulled down into the net by the downward force of the fan.

In the morning, the mosquitoes are removed and frozen to prepare for identification. During the identification process, the mosquitoes are sorted by species and sex. Female vector mosquitoes are routinely submitted to the Colorado Department of Public Health and Environment (CDPHE) lab for WNV testing as needed.

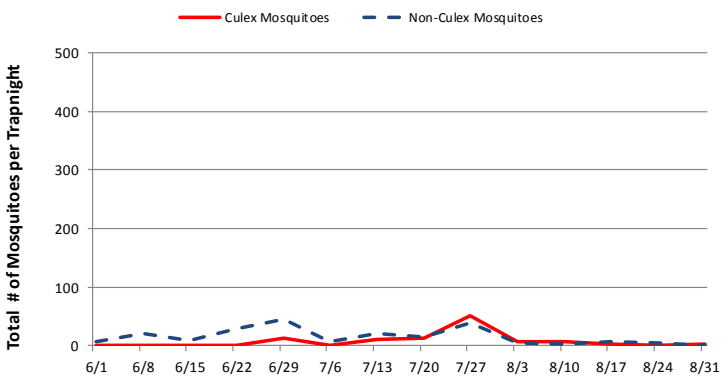
APPENDIX B - 2015 WEEKLY TRAP COUNTS

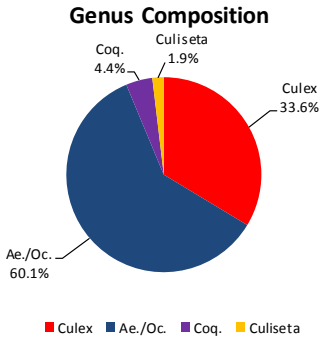
BC-01 Old Tale Rd

Trap ID/Trap Location	**BC-01/Old Tale Rd**
Trap Type	**CDC Light**
Total # of Trapnights	**14**

Species	**Number**	**%RA***
Culex pipiens	4	1.3%
Culex tarsalis	103	32.4%
Total Culex	**107**	**33.6%**
% RA Culex	**33.6%**	
Aedes vexans	105	33.0%
Oc. dorsalis	2	0.6%
Oc. hendersoni	24	7.5%
Oc. increpitus	51	16.0%
Oc. melanimon	5	1.6%
Oc. trivittatus	4	1.3%
Total Aedes/Ochlerotatus (Ae./Oc.)	**191**	**60.1%**
% RA Ae./Oc.	**60.1%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	14	4.4%
Total Coquillettidia (Coq.)	**14**	**4.4%**
% RA Coquillettidia	**4.4%**	
Culiseta inornata	6	1.9%
Total Culiseta	**6**	**1.9%**
% RA Culiseta	**1.9%**	
Trap Total	318	100.0%
Average # of Total Mosquitoes per Trapnight	23	
Average # of Culex per Trapnight	8	

*%RA= Percent Relative Abundance



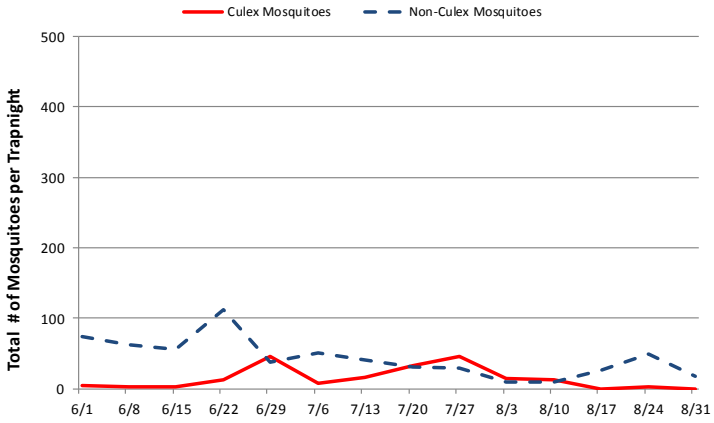


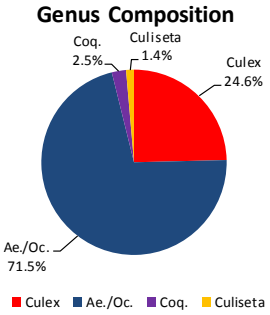
BC-02 Cottonwood Kennels

Trap ID/Trap Location	**BC-02 Cottonwood Kennels**
Trap Type	**CDC Light**
Total # of Trapnights	**14**

Species	**Number**	**%RA***
Culex pipiens	10	1.2%
Culex salinarius	4	0.5%
Culex tarsalis	184	22.9%
Total Culex	**198**	**24.6%**
% RA Culex	**24.6%**	
Aedes vexans	403	50.1%
Oc. dorsalis	41	5.1%
Oc. hendersoni	6	0.7%
Oc. increpitus	22	2.7%
Oc. melanimon	1	0.1%
Oc. trivittatus	102	12.7%
Total Aedes/Ochlerotatus (Ae./Oc.)	**575**	**71.5%**
% RA Ae./Oc.	**71.5%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	20	2.5%
Total Coquillettidia (Coq.)	**20**	**2.5%**
% RA Coquillettidia	**2.5%**	
Culiseta inornata	11	1.4%
Total Culiseta	**11**	**1.4%**
% RA Culiseta	**1.4%**	
Trap Total	804	100.0%
Average # of Total Mosquitoes per Trapnight	57	
Average # of Culex per Trapnight	14	

*%RA= Percent Relative Abundance

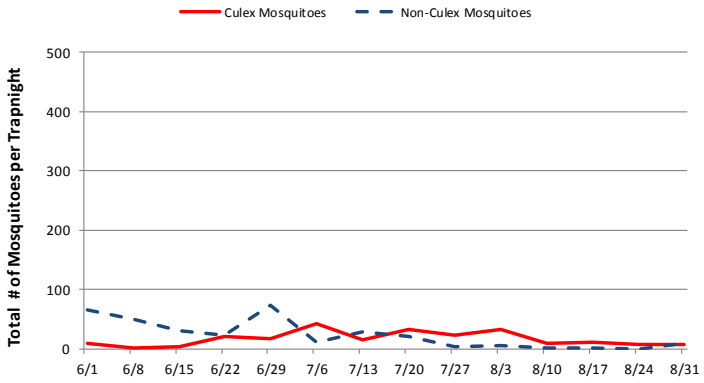


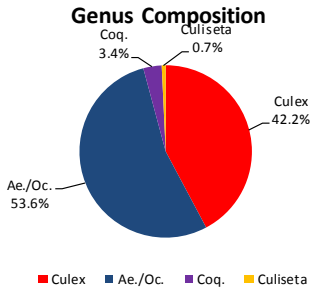


BC-03 Gunbarrel SE-Pali

Trap ID/Trap Location	BC-03/Gunbarrel SE-Pali	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	45	8.2%
Culex salinarius	14	2.5%
Culex tarsalis	174	31.5%
Total Culex	**233**	**42.2%**
% RA Culex	**42.2%**	
Aedes vexans	238	43.1%
Oc. dorsalis	21	3.8%
Oc. hendersoni	2	0.4%
Oc. increpitus	11	2.0%
Oc. melanimon	11	2.0%
Oc. nigromaculis	1	0.2%
Oc. trivittatus	12	2.2%
Total Aedes/Ochlerotatus (Ae./Oc.)	**296**	**53.6%**
% RA Ae./Oc.	**53.6%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	19	3.4%
Total Coquillettidia (Coq.)	**19**	**3.4%**
% RA Coquillettidia	**3.4%**	
Culiseta inornata	4	0.7%
Total Culiseta	**4**	**0.7%**
% RA Culiseta	**0.7%**	
Trap Total	552	100.0%
Average # of Total Mosquitoes per Trapnight	39	
Average # of Culex per Trapnight	17	

*%RA= Percent Relative Abundance

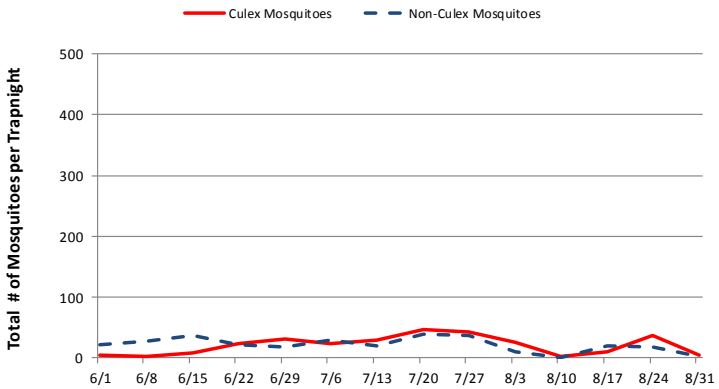


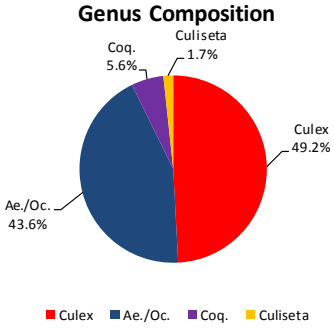


BC-04 Gunbarrel NW-Idylwild

Trap ID/Trap Location	BC-04/Gunbarrel NW-Idylwild	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	33	5.6%
Culex salinarius	7	1.2%
Culex tarsalis	252	42.4%
Total Culex	**292**	**49.2%**
% RA Culex	**49.2%**	
Aedes vexans	203	34.2%
Oc. dorsalis	28	4.7%
Oc. hendersoni	4	0.7%
Oc. increpitus	15	2.5%
Oc. melanimon	8	1.3%
Oc. trivittatus	1	0.2%
Total Aedes/Ochlerotatus (Ae./Oc.)	**259**	**43.6%**
% RA Ae./Oc.	**43.6%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	33	5.6%
Total Coquillettidia (Coq.)	**33**	**5.6%**
% RA Coquillettidia	**5.6%**	
Culiseta inornata	10	1.7%
Total Culiseta	**10**	**1.7%**
% RA Culiseta	**1.7%**	
Trap Total	594	100.0%
Average # of Total Mosquitoes per Trapnight	42	
Average # of Culex per Trapnight	21	

*%RA= Percent Relative Abundance

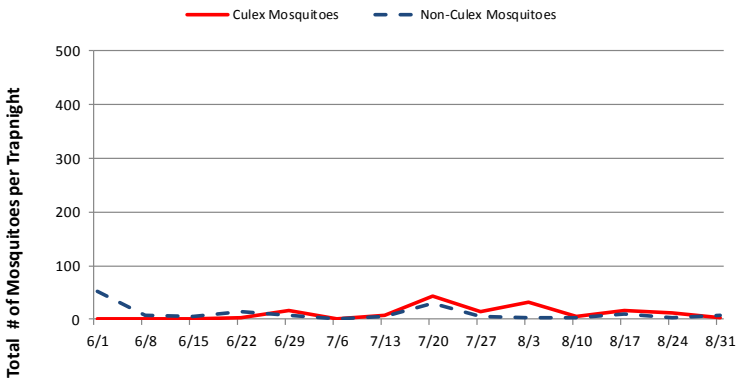


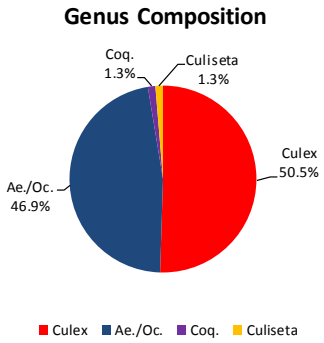


BC-05 Orange Orchard

Trap ID/Trap Location	BC-05/Orange Orchard	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	9	2.9%
Culex salinarius	17	5.5%
Culex tarsalis	130	42.1%
Total Culex	**156**	**50.5%**
% RA Culex	**50.5%**	
Aedes vexans	128	41.4%
Oc. dorsalis	6	1.9%
Oc. increpitus	1	0.3%
Oc. melanimon	5	1.6%
Oc. trivittatus	5	1.6%
Total Aedes/Ochlerotatus (Ae./Oc.)	**145**	**46.9%**
% RA Ae./Oc.	**46.9%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	4	1.3%
Total Coquillettidia (Coq.)	**4**	**1.3%**
% RA Coquillettidia	**1.3%**	
Culiseta inornata	4	1.3%
Total Culiseta	**4**	**1.3%**
% RA Culiseta	**1.3%**	
Trap Total	309	100.0%
Average # of Total Mosquitoes per Trapnight	22	
Average # of Culex per Trapnight	11	

*%RA= Percent Relative Abundance

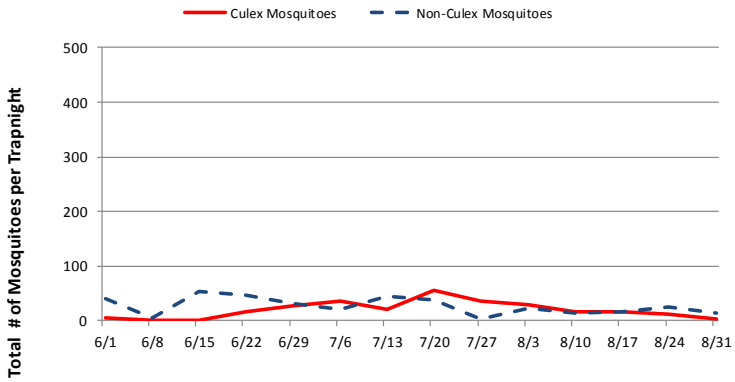


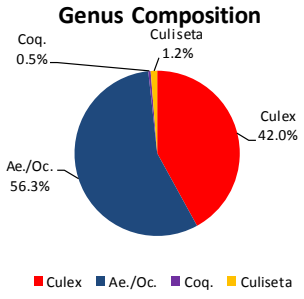


BC-07 Bridgadoon Glen

Trap ID/Trap Location	BC-07/Bridgadoon Glen	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	8	1.2%
Culex salinarius	2	0.3%
Culex tarsalis	260	40.4%
Total Culex	**270**	**42.0%**
% RA Culex	**42.0%**	
Aedes vexans	282	43.9%
Oc. dorsalis	50	7.8%
Oc. hendersoni	2	0.3%
Oc. melanimon	7	1.1%
Oc. trivittatus	21	3.3%
Total Aedes/Ochlerotatus (Ae./Oc.)	**362**	**56.3%**
% RA Ae./Oc.	**56.3%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	3	0.5%
Total Coquillettidia (Coq.)	**3**	**0.5%**
% RA Coquillettidia	**0.5%**	
Culiseta inornata	8	1.2%
Total Culiseta	**8**	**1.2%**
% RA Culiseta	**1.2%**	
Trap Total	643	100.0%
Average # of Total Mosquitoes per Trapnight	46	
Average # of Culex per Trapnight	19	

*%RA= Percent Relative Abundance

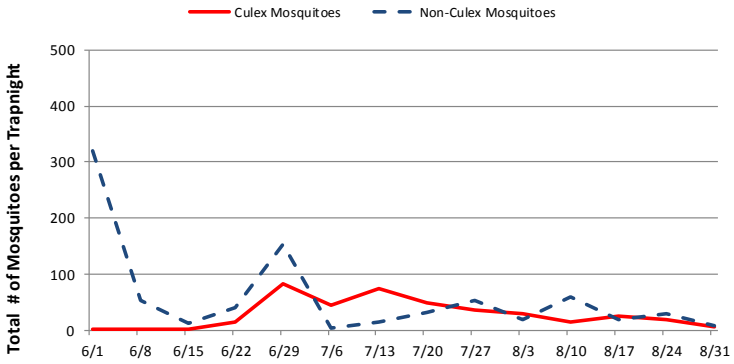


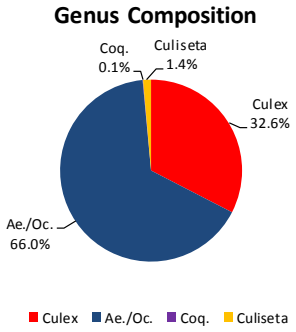


BC-08 Boulder Hills

Trap ID/Trap Location	BC-08/Boulder Hills	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	20	1.6%
Culex salinarius	6	0.5%
Culex tarsalis	369	30.4%
Total Culex	**395**	**32.6%**
% RA Culex	**32.6%**	
Aedes vexans	660	54.4%
Oc. dorsalis	97	8.0%
Oc. increpitus	10	0.8%
Oc. melanimon	3	0.2%
Oc. nigromaculis	1	0.1%
Oc. trivittatus	29	2.4%
Total Aedes/Ochlerotatus (Ae./Oc.)	**800**	**66.0%**
% RA Ae./Oc.	**66.0%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	1	0.1%
Total Coquillettidia (Coq.)	**1**	**0.1%**
% RA Coquillettidia	**0.1%**	
Culiseta inornata	17	1.4%
Total Culiseta	**17**	**1.4%**
% RA Culiseta	**1.4%**	
Trap Total	1,213	100.0%
Average # of Total Mosquitoes per Trapnight	87	
Average # of Culex per Trapnight	28	

*%RA= Percent Relative Abundance

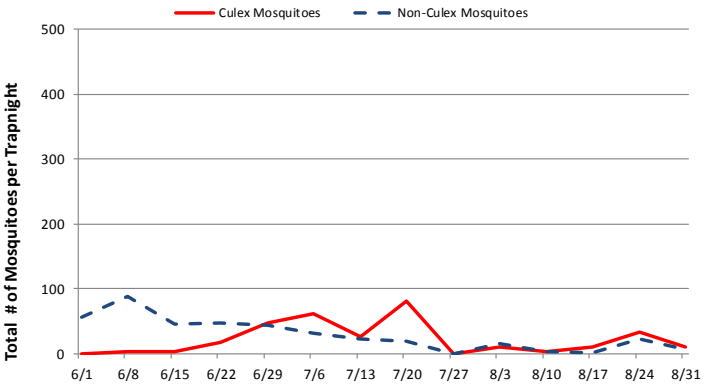


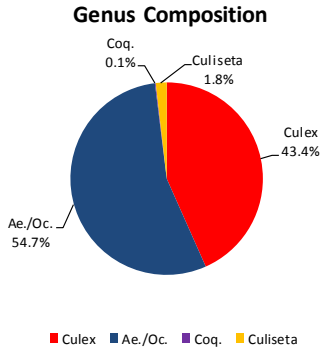


BC-11 Niwot East Majestic

Trap ID/Trap Location	BC-11/Niwot East Majestic	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	24	3.4%
Culex salinarius	1	0.1%
Culex tarsalis	285	39.9%
Total Culex	**310**	**43.4%**
% RA Culex	**43.4%**	
Aedes vexans	314	43.9%
Oc. dorsalis	56	7.8%
Oc. increpitus	14	2.0%
Oc. melanimon	3	0.4%
Oc. trivittatus	4	0.6%
Total Aedes/Ochlerotatus (Ae./Oc.)	**391**	**54.7%**
% RA Ae./Oc.	**54.7%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	1	0.1%
Total Coquillettidia (Coq.)	**1**	**0.1%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	13	1.8%
Total Culiseta	**13**	**1.8%**
% RA Culiseta	**1.8%**	
Trap Total	715	100.0%
Average # of Total Mosquitoes per Trapnight	51	
Average # of Culex per Trapnight	22	

*%RA= Percent Relative Abundance

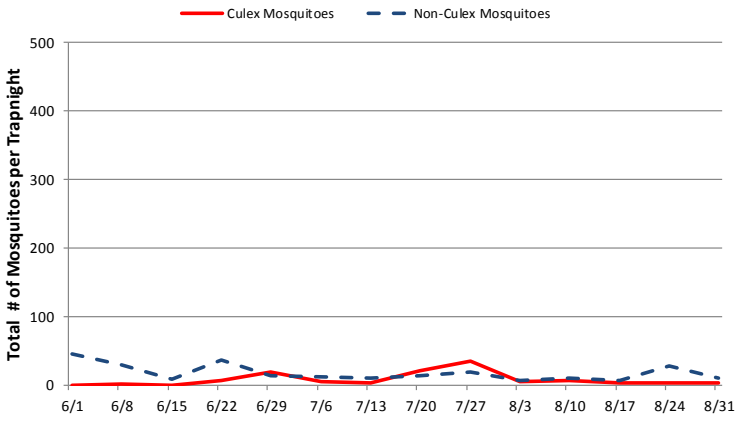


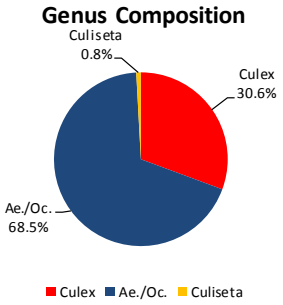


BC-17 Niwot Central

Trap ID/Trap Location	BC-17 Niwot Central	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	5	1.4%
Culex salinarius	1	0.3%
Culex tarsalis	103	28.9%
Total Culex	**109**	**30.6%**
% RA Culex	**30.6%**	
Aedes vexans	228	64.0%
Oc. dorsalis	11	3.1%
Oc. increpitus	3	0.8%
Oc. melanimon	1	0.3%
Oc. trivittatus	1	0.3%
Total Aedes/Ochlerotatus (Ae./Oc.)	**244**	**68.5%**
% RA Ae./Oc.	**68.5%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Total Coquillettidia (Coq.)	**0**	**0.0%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	3	0.8%
Total Culiseta	**3**	**0.8%**
% RA Culiseta	**0.8%**	
Trap Total	356	100.0%
Average # of Total Mosquitoes per Trapnight	25	
Average # of Culex per Trapnight	8	

*%RA= Percent Relative Abundance

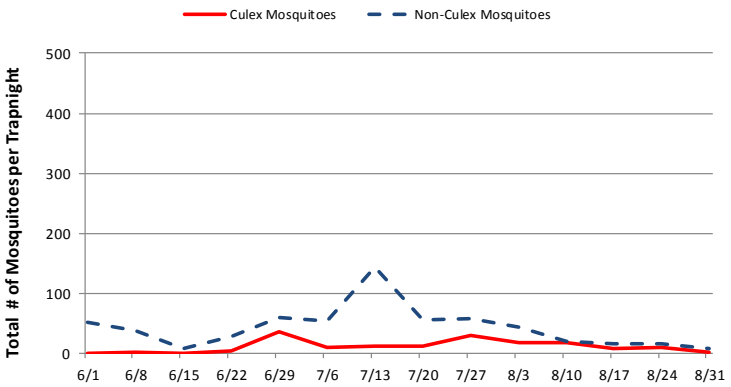


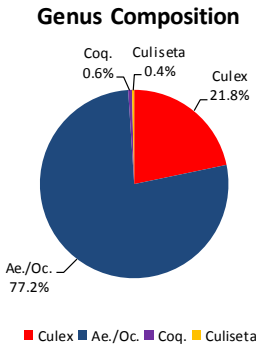


BC-20 Willows

Trap ID/Trap Location	BC-20/Willows	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	32	4.1%
Culex salinarius	5	
Culex tarsalis	132	17.0%
Total Culex	**169**	**21.8%**
% RA Culex	**21.8%**	
Aedes cinereus	1	0.1%
Aedes vexans	261	33.6%
Oc. dorsalis	9	1.2%
Oc. increpitus	310	39.9%
Oc. melanimon	4	0.5%
Oc. trivittatus	15	1.9%
Total Aedes/Ochlerotatus (Ae./Oc.)	**600**	**77.2%**
% RA Ae./Oc.	**77.2%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	5	0.6%
Total Coquillettidia (Coq.)	**5**	**0.6%**
% RA Coquillettidia	**0.6%**	
Culiseta inornata	3	0.4%
Total Culiseta	**3**	**0.4%**
% RA Culiseta	**0.4%**	
Trap Total	777	100.0%
Average # of Total Mosquitoes per Trapnight	56	
Average # of Culex per Trapnight	12	

*%RA= Percent Relative Abundance

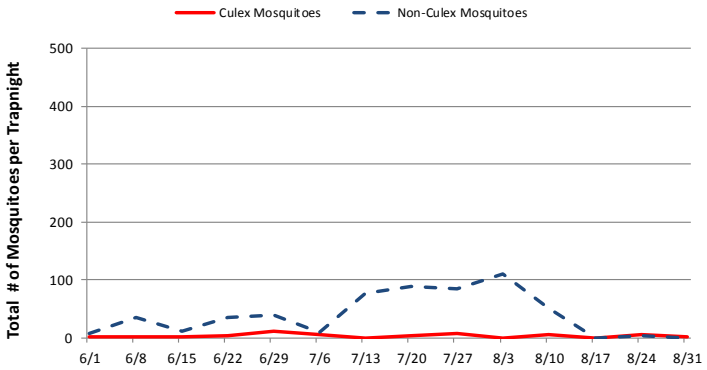


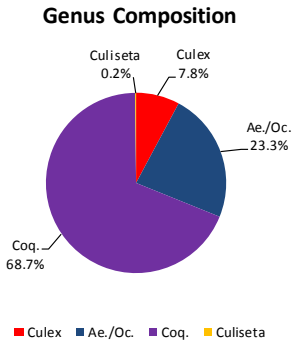


BC-22 Marshall-S Boulder Crk

Trap ID/Trap Location	**BC-22/Marshall-S Boulder Crk**	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	10	1.7%
Culex salinarius	1	0.2%
Culex tarsalis	36	6.0%
Total Culex	**47**	**7.8%**
% RA Culex	**7.8%**	
Aedes vexans	80	13.3%
Oc. dorsalis	14	2.3%
Oc. hendersoni	14	2.3%
Oc.increpitus	16	2.7%
Oc. melanimon	3	0.5%
Oc. trivittatus	13	2.2%
Total Aedes/Ochlerotatus (Ae./Oc.)	**140**	**23.3%**
% RA Ae./Oc.	**23.3%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	413	68.7%
Total Coquillettidia (Coq.)	**413**	**68.7%**
% RA Coquillettidia	**68.7%**	
Culiseta inornata	1	0.2%
Total Culiseta	**1**	**0.2%**
% RA Culiseta	**0.2%**	
Trap Total	601	100.0%
Average # of Total Mosquitoes per Trapnight	43	
Average # of Culex per Trapnight	3	

*%RA= Percent Relative Abundance

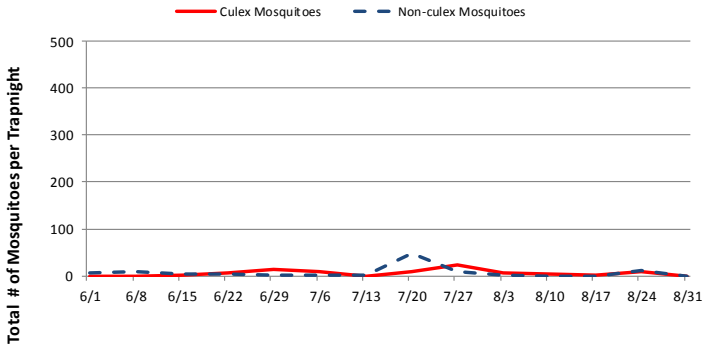


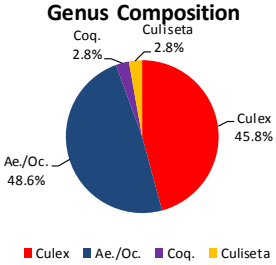


BC-23-Louisville-Spanish Hills

Trap ID/Trap Location	**BC-23/Louisville-Spanish Hills**	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	12	6.7%
Culex tarsalis	70	39.1%
Total Culex	**82**	**45.8%**
% RA Culex	**45.8%**	
Aedes vexans	34	19.0%
Oc. dorsalis	49	27.4%
Oc. increpitus	3	1.7%
Oc. melanimon	1	0.6%
Total Aedes/Ochlerotatus (Ae./Oc.)	**87**	**48.6%**
% RA Ae./Oc.	**48.6%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	5	2.8%
Total Coquillettidia (Coq.)	**5**	**2.8%**
% RA Coquillettidia	**2.8%**	
Culiseta inornata	5	2.8%
Total Culiseta	**5**	**2.8%**
% RA Culiseta	**2.8%**	
Trap Total	179	100.0%
Average # of Total Mosquitoes per Trapnight	13	
Average # of Culex per Trapnight	6	

*%RA= Percent Relative Abundance

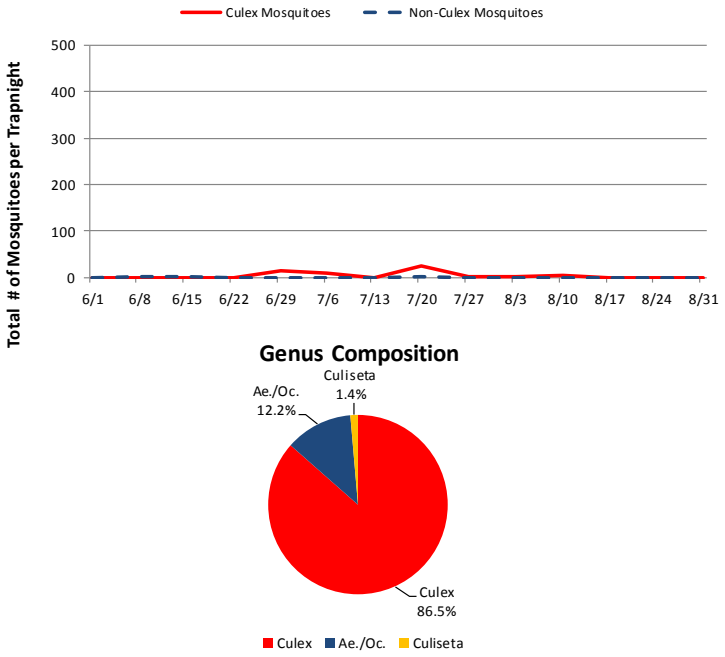




BC-24 Louisville-Wewonka Dr

Trap ID/Trap Location	**BC-24/Louisville-Wewonka Dr**	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	2	2.7%
Culex tarsalis	62	83.8%
Total Culex	**64**	**86.5%**
% RA Culex	**86.5%**	
Aedes vexans	7	9.5%
Oc. dorsalis	2	2.7%
Total Aedes/Ochlerotatus (Ae./Oc.)	**9**	**12.2%**
% RA Ae./Oc.	**12.2%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Total Coquillettidia (Coq.)	**0**	**0.0%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	1	1.4%
Total Culiseta	**1**	**1.4%**
% RA Culiseta	**1.4%**	
Trap Total	74	100.0%
Average # of Total Mosquitoes per Trapnight	5	
Average # of Culex per Trapnight	5	

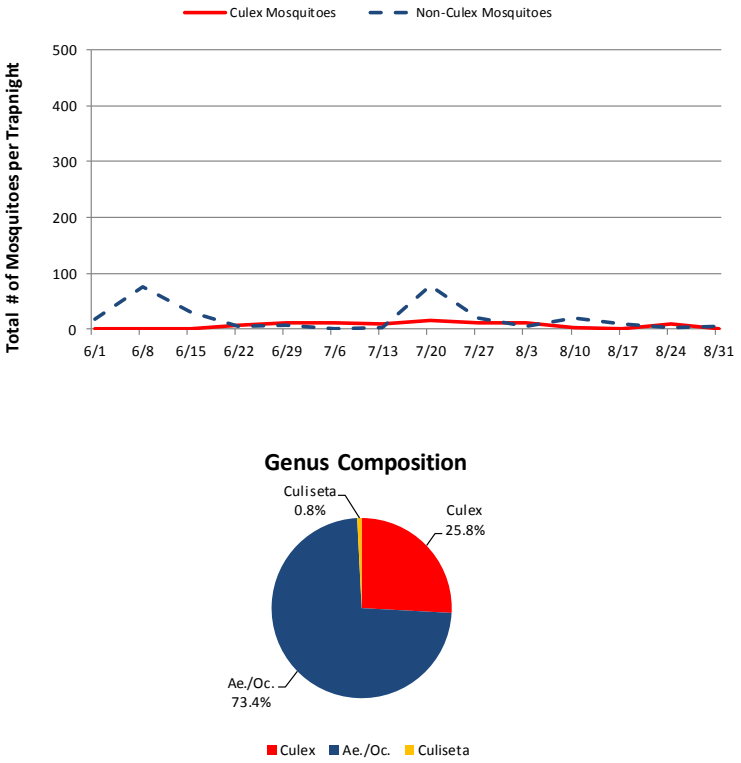
*%RA= Percent Relative Abundance



BC-30 Erie-Brownsville Random Ct

Trap ID/Trap Location	**BC-30/Erie-Brownsville**	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	2	0.5%
Culex salinarius	3	0.8%
Culex tarsalis	95	24.5%
Total Culex	**100**	**25.8%**
% RA Culex	**25.8%**	
Aedes vexans	259	66.9%
Oc. dorsalis	20	5.2%
Oc. hendersoni	1	0.3%
Oc. increpitus	3	0.8%
Oc. trivittatus	1	0.3%
Total Aedes/Ochlerotatus (Ae./Oc.)	**284**	**73.4%**
% RA Ae./Oc.	**73.4%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Total Coquillettidia (Coq.)	**0**	**0.0%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	3	0.8%
Total Culiseta	**3**	**0.8%**
% RA Culiseta	**0.8%**	
Trap Total	387	100.0%
Average # of Total Mosquitoes per Trapnight	28	
Average # of Culex per Trapnight	7	

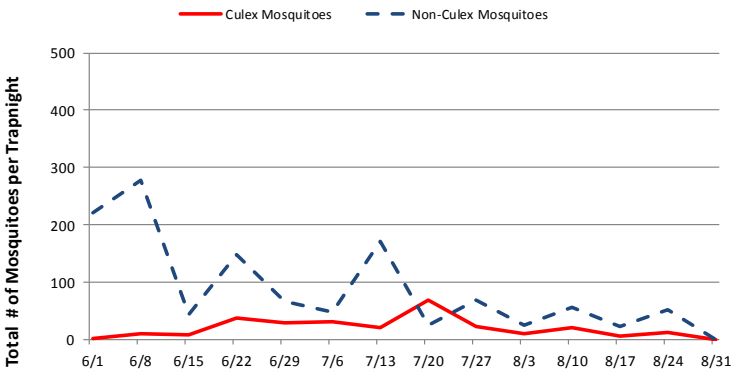
*%RA= Percent Relative Abundance

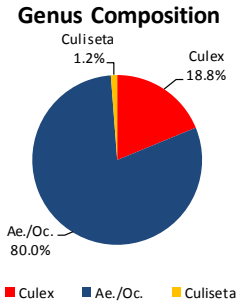


BC-31 Divide Reservoir

Trap ID/Trap Location	BC-31/Divide Reservoir	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	6	0.4%
Culex salinarius	3	0.2%
Culex tarsalis	276	18.2%
Total Culex	**285**	**18.8%**
% RA Culex	**18.8%**	
Aedes vexans	846	55.8%
Oc. dorsalis	239	15.8%
Oc. increpitus	12	0.8%
Oc. melanimon	65	4.3%
Oc. nigromaculis	2	0.1%
Oc. trivittatus	49	3.2%
Total Aedes/Ochlerotatus (Ae./Oc.)	**1,213**	**80.0%**
% RA Ae./Oc.	**80.0%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Total Coquillettidia (Coq.)	**0**	**0.0%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	18	1.2%
Total Culiseta	**18**	**1.2%**
% RA Culiseta	**1.2%**	
Trap Total	1,516	100.0%
Average # of Total Mosquitoes per Trapnight	108	
Average # of Culex per Trapnight	20	

*%RA= Percent Relative Abundance

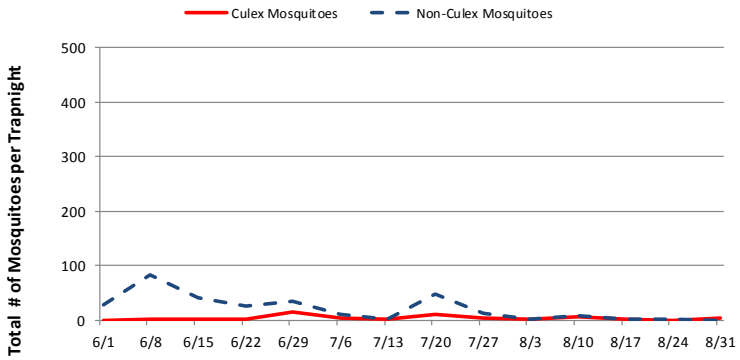


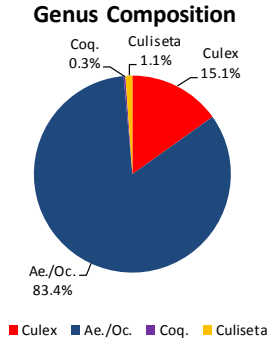


BC-32 Baseline Heights

Trap ID/Trap Location	BC-32/Baseline Heights	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	3	0.9%
Culex salinarius	1	0.3%
Culex tarsalis	49	14.0%
Total Culex	**53**	**15.1%**
% RA Culex	**15.1%**	
Aedes vexans	172	49.1%
Oc. dorsalis	91	26.0%
Oc. hendersoni	1	0.3%
Oc. increpitus	17	4.9%
Oc. melanimon	11	3.1%
Total Aedes/Ochlerotatus (Ae./Oc.)	**292**	**83.4%**
% RA Ae./Oc.	**83.4%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	1	0.3%
Total Coquillettidia (Coq.)	**1**	**0.3%**
% RA Coquillettidia	**0.3%**	
Culiseta inornata	4	1.1%
Total Culiseta	**4**	**1.1%**
% RA Culiseta	**1.1%**	
Trap Total	350	100.0%
Average # of Total Mosquitoes per Trapnight	25	
Average # of Culex per Trapnight	4	

*%RA= Percent Relative Abundance



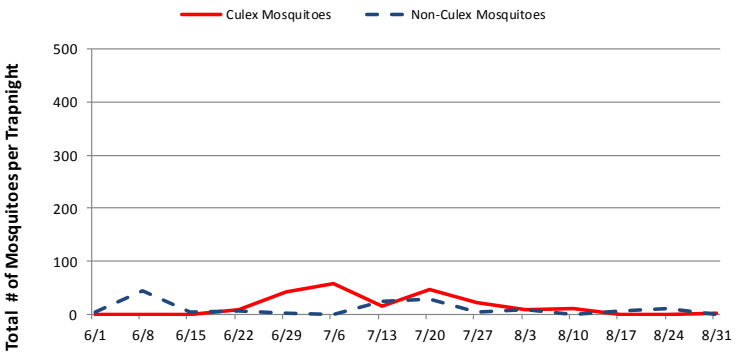


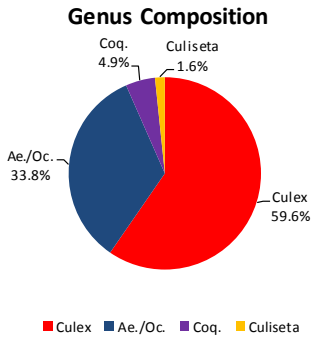
BC-33 Lake Valley Estates

Trap ID/Trap Location	**BC-33/Lake Valley Estates**
Trap Type	**CDC Light**
Total # of Trapnights	**14**

Species	**Number**	**%RA***
Culex pipiens	28	7.7%
Culex salinarius	2	0.5%
Culex tarsalis	187	51.4%
Total Culex	**217**	**59.6%**
% RA Culex	**59.6%**	
Aedes vexans	109	29.9%
Oc. dorsalis	1	0.3%
Oc. increpitus	2	0.5%
Oc. melanimon	2	0.5%
Oc. trivittatus	9	2.5%
Total Aedes/Ochlerotatus (Ae./Oc.)	**123**	**33.8%**
% RA Ae./Oc.	**33.8%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	18	4.9%
Total Coquillettidia (Coq.)	**18**	**4.9%**
% RA Coquillettidia	**4.9%**	
Culiseta inornata	6	1.6%
Total Culiseta	**6**	**1.6%**
% RA Culiseta	**1.6%**	
Trap Total	364	100.0%
Average # of Total Mosquitoes per Trapnight	26	
Average # of Culex per Trapnight	16	

*%RA= Percent Relative Abundance



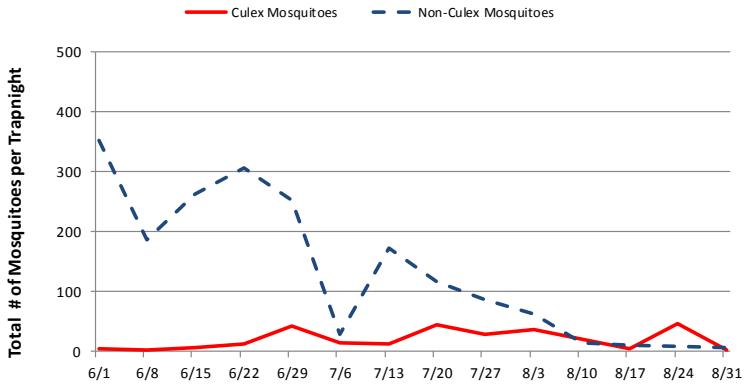


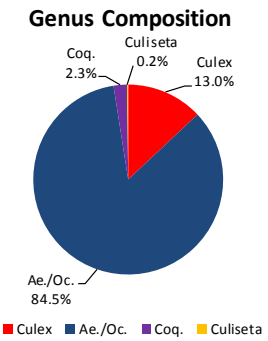
BC-34 Cline Trout Farm

Trap ID/Trap Location	**BC-34 Cline Trout Farm**
Trap Type	**CDC Light**
Total # of Trapnights	**14**

Species	**Number**	**%RA***
Culex pipiens	43	2.0%
Culex salinarius	5	0.2%
Culex tarsalis	231	10.8%
Total Culex	**279**	**13.0%**
% RA Culex	**13.0%**	
Aedes vexans	676	31.5%
Oc. dorsalis	43	2.0%
Oc. hendersoni	6	0.3%
Oc. increpitus	1,064	49.6%
Oc. melanimon	8	0.4%
Oc. trivittatus	17	0.8%
Total Aedes/Ochlerotatus (Ae./Oc.)	**1,814**	**84.5%**
% RA Ae./Oc.	**84.5%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	49	2.3%
Total Coquillettidia (Coq.)	**49**	**2.3%**
% RA Coquillettidia	**2.3%**	
Culiseta inornata	4	0.2%
Total Culiseta	**4**	**0.2%**
% RA Culiseta	**0.2%**	
Trap Total	2,146	100.0%
Average # of Total Mosquitoes per Trapnight	153	
Average # of Culex per Trapnight	20	

*%RA= Percent Relative Abundance

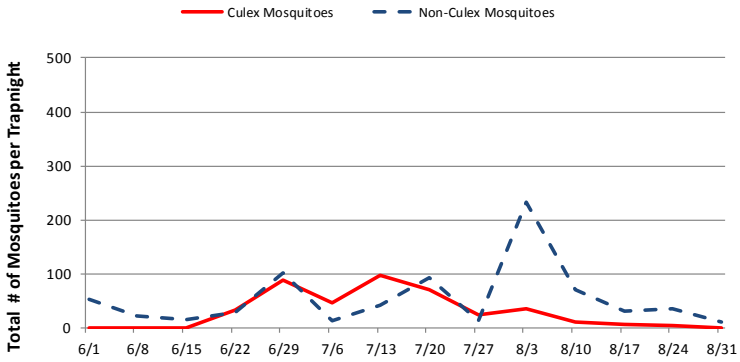


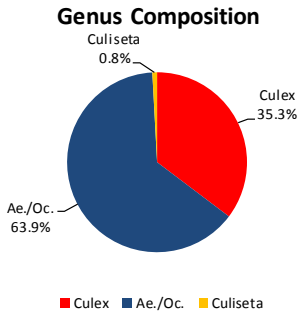


BC-36 Yellowstone

Trap ID/Trap Location	BC-36/Yellowstone	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	11	0.9%
Culex salinarius	1	0.1%
Culex tarsalis	406	34.3%
Total Culex	**418**	**35.3%**
% RA Culex	**35.3%**	
Aedes vexans	580	49.0%
Oc. dorsalis	9	0.8%
Oc. hendersoni	8	0.7%
Oc. melanimon	11	0.9%
Oc. trivittatus	148	12.5%
Total Aedes/Ochlerotatus (Ae./Oc.)	**756**	**63.9%**
% RA Ae./Oc.	**63.9%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Total Coquillettidia (Coq.)	**0**	**0.0%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	10	0.8%
Total Culiseta	**10**	**0.8%**
% RA Culiseta	**0.8%**	
Trap Total	1,184	100.0%
Average # of Total Mosquitoes per Trapnight	85	
Average # of Culex per Trapnight	30	

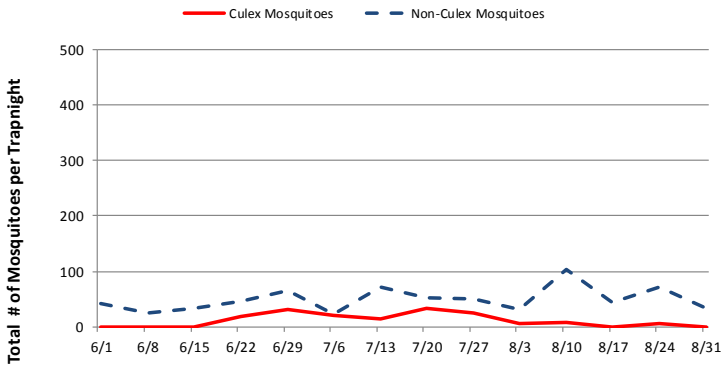
*%RA= Percent Relative Abundance

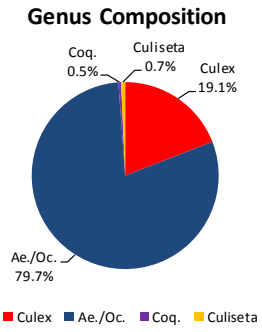




BC-37 Burch Reservoir

Trap ID/Trap Location	BC-37/Burch Reservoir	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	22	2.6%
Culex tarsalis	142	16.6%
Total Culex	**164**	**19.1%**
% RA Culex	**19.1%**	
Aedes vexans	582	67.8%
Oc. dorsalis	1	0.1%
Oc. hendersoni	6	0.7%
Oc. increpitus	9	1.0%
Oc. melanimon	1	0.1%
Oc. trivittatus	85	9.9%
Total Aedes/Ochlerotatus (Ae./Oc.)	**684**	**79.7%**
% RA Ae./Oc.	**79.7%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	4	0.5%
Total Coquillettidia (Coq.)	**4**	**0.5%**
% RA Coquillettidia	**0.5%**	
Culiseta inornata	6	0.7%
Total Culiseta	**6**	**0.7%**
% RA Culiseta	**0.7%**	
Trap Total	858	100.0%
Average # of Total Mosquitoes per Trapnight	61	
Average # of Culex per Trapnight	12	
*%RA= Percent Relative Abundance	12	

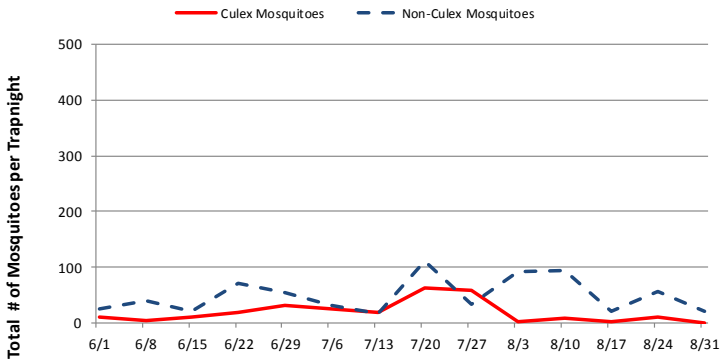


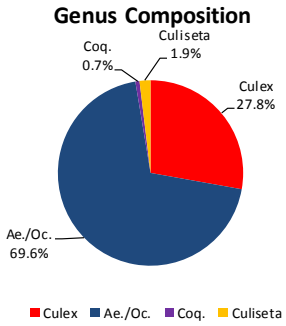


BC-38 Willow Glen- Teller Lake

Trap ID/Trap Location	BC-38/Willow Glen- Teller Lake	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	13	1.4%
Culex salinarius	6	0.6%
Culex tarsalis	246	25.8%
Total Culex	**265**	**27.8%**
% RA Culex	**27.8%**	
Aedes vexans	592	62.1%
Oc. dorsalis	11	1.2%
Oc. increpitus	20	2.1%
Oc. melanimon	27	2.8%
Oc. trivittatus	13	1.4%
Total Aedes/Ochlerotatus (Ae./Oc.)	**663**	**69.6%**
% RA Ae./Oc.	**69.6%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Coquillettidia perturbans	7	0.7%
Total Coquillettidia (Coq.)	**7**	**0.7%**
% RA Coquillettidia	**0.7%**	
Culiseta inornata	18	1.9%
Total Culiseta	**18**	**1.9%**
% RA Culiseta	**1.9%**	
Trap Total	953	100.0%
Average # of Total Mosquitoes per Trapnight	68	
Average # of Culex per Trapnight	19	

*%RA= Percent Relative Abundance

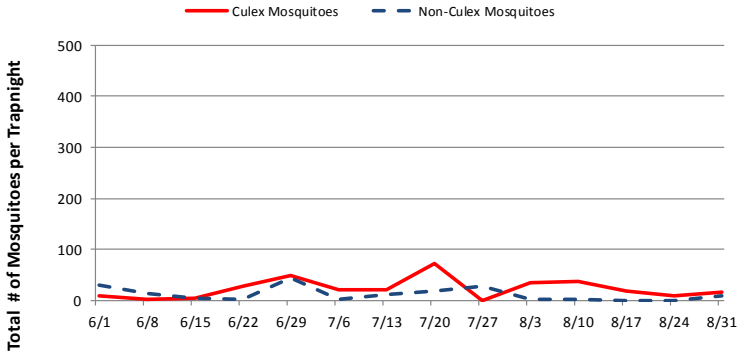


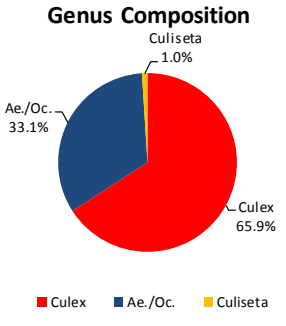


BC-39 Heatherwood

Trap ID/Trap Location	BC-39/Heatherwood	
Trap Type	**CDC Light**	
Total # of Trapnights	**14**	
Species	**Number**	**%RA***
Culex pipiens	50	10.0%
Culex salinarius	33	6.6%
Culex tarsalis	245	49.2%
Total Culex	**328**	**65.9%**
% RA Culex	**65.9%**	
Aedes vexans	86	17.3%
Oc. dorsalis	48	9.6%
Oc. increpitus	2	0.4%
Oc. melanimon	29	5.8%
Total Aedes/Ochlerotatus (Ae./Oc.)	**165**	**33.1%**
% RA Ae./Oc.	**33.1%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Total Coquillettidia (Coq.)	**0**	**0.0%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	5	1.0%
Total Culiseta	**5**	**1.0%**
% RA Culiseta	**1.0%**	
Trap Total	498	100.0%
Average # of Total Mosquitoes per Trapnight	36	
Average # of Culex per Trapnight	23	

*%RA= Percent Relative Abundance



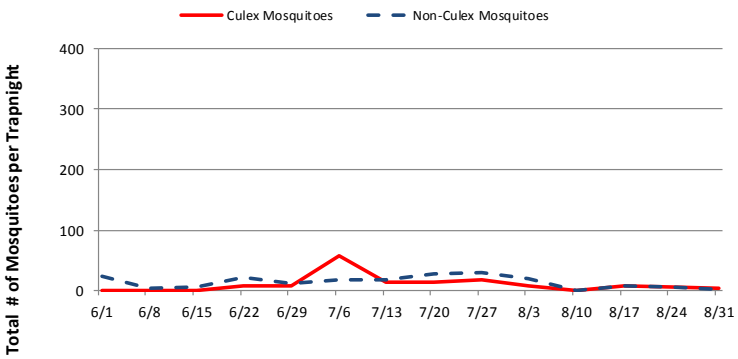


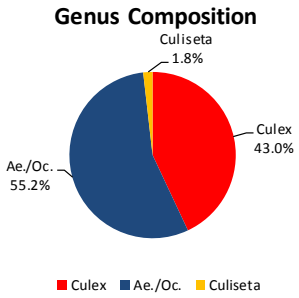
BC-40 Chance Acres

Trap ID/Trap Location	**BC-40/Chance Acres**
Trap Type	**CDC Light**
Total # of Trapnights	**14**

Species	**Number**	**%RA***
Culex pipiens	19	5.8%
Culex tarsalis	123	37.3%
Total Culex	**142**	**43.0%**
% RA Culex	**43.0%**	
Aedes vexans	127	38.5%
Oc. dorsalis	6	1.8%
Oc. melanimon	6	1.8%
Oc. trivittatus	43	13.0%
Total Aedes/Ochlerotatus (Ae./Oc.)	**182**	**55.2%**
% RA Ae./Oc.	**55.2%**	
Total Anopheles	**0**	**0.0%**
% RA Anopheles	**0.0%**	
Total Coquillettidia (Coq.)	**0**	**0.0%**
% RA Coquillettidia	**0.0%**	
Culiseta inornata	6	1.8%
Total Culiseta	**6**	**1.8%**
% RA Culiseta	**1.8%**	
Trap Total	330	100.0%
Average # of Total Mosquitoes per Trapnight	24	
Average # of Culex per Trapnight	10	

*%RA= Percent Relative Abundance





APPENDIX C - 2015 ADULT CONTROL APPLICATIONS

Boulder County Mosquito Control District

2015 Season

Adult Mosquito Control Summary

Truck Mounted ULV

Area	Material	Start Time	End Time	Route Miles[1]	Spray Miles[2]	Ounces Applied[3]
Divide Reservoir	Aqualuer 20-20	6/3/2015 20:16	6/3/2015 20:29	2.3	1.4	36.0
Boulder Hills	Aqualuer 20-20	6/3/2015 20:55	6/3/2015 21:22	4.9	2.6	65.8
San Lazaro and Cline Trout Farm	Aqualuer 20-20	6/3/2015 21:40	6/3/2015 21:51	1.4	0.7	16.9
Divide Reservoir	Aqualuer 20-20	6/10/2015 20:16	6/10/2015 20:33	2.7	1.4	36.9
San Lazaro and Cline Trout Farm	Aqualuer 20-20	6/17/2015 20:30	6/17/2015 20:45	2.1	0.8	21.6
Divide Reservoir	Aqualuer 20-20	6/24/2015 20:30	6/24/2015 20:47	3.1	1.4	35.0
Valmont and 75th	Aqualuer 20-20	6/24/2015 21:19	6/24/2015 21:28	1.0	0.6	15.6
Valmont and 61st	Aqualuer 20-20	6/24/2015 21:33	6/24/2015 21:57	3.4	1.9	48.2
San Lazaro and Cline Trout Farm	Aqualuer 20-20	6/24/2015 21:59	6/24/2015 22:13	1.8	1.1	26.9
Yellowstone	Aqualuer 20-20	7/1/2015 20:30	7/1/2015 21:07	7.0	4.8	122.0
Boulder Hills	Aqualuer 20-20	7/1/2015 21:28	7/1/2015 21:56	5.0	2.8	70.5
San Lazaro and Cline Trout Farm	Aqualuer 20-20	7/1/2015 22:13	7/1/2015 22:26	1.8	1.1	26.7
Divide Reservoir	Aqualuer 20-20	7/15/2015 20:27	7/15/2015 20:44	2.4	1.4	44.7
Yellowstone	Aqualuer 20-20	7/15/2015 20:51	7/15/2015 21:16	4.8	4.1	104.4
Willows	Aqualuer 20-20	7/15/2015 21:37	7/15/2015 21:58	3.7	1.2	33.1
Yellowstone	Aqualuer 20-20	7/22/2015 20:25	7/22/2015 20:53	4.8	3.9	104.4
Hillcrest Heights	Aqualuer 20-20	7/22/2015 21:12	7/22/2015 21:38	4.7	2.5	83.1
Park Lake	Aqualuer 20-20	7/22/2015 21:53	7/22/2015 22:07	2.4	1.5	37.2
Willow Glen and Fox Run	Aqualuer 20-20	7/22/2015 22:11	7/22/2015 22:22	1.8	1.3	31.5
Yellowstone	Aqualuer 20-20	8/5/2015 20:12	8/5/2015 20:40	4.7	3.9	98.7
Marshall Rd/Mesa Valley/Wildflower	Aqualuer 20-20	8/5/2015 21:15	8/5/2015 21:39	6.2	2.4	60.8
Hygiene Heights	Aqualuer 20-20	8/12/2015 20:05	8/12/2015 20:25	3.5	2.0	51.1
Park Lake	Aqualuer 20-20	8/12/2015 20:50	8/12/2015 21:07	2.9	1.5	38.2
Willow Glen and Fox Run	Aqualuer 20-20	8/12/2015 21:13	8/12/2015 21:24	2.7	1.3	31.6
			Total:	**81.1**	**47.6**	**1,240.9**
			Average:	**3.4**	**2.0**	**51.7**
			Minimum:	**1**	**0.6**	**15.6**
			Maximum:	**7**	**4.8**	**122**

Notes:

1. Includes entire mileage of route, including both ULV spray-on and spray-off miles; should be used when comparing 2015 data to historical data.
2. Only includes ULV spray-on mileage (excludes shutoffs, turnarounds, etc.)
3. Ounces of Aqualuer 20-20 and water applied at a 1:6.5 dilution rate (Aqualuer 20-20 to water) for an application rate of .0035 (Pounds of Permethrin a.i./Acre).

Historical BCMCD Annual Totals

Average	**478.0**
Minimum	**71.6**
Maximum	**725.2**

APPENDIX D - 2015 PROGRAM TIME EXPENDITURES BY CATEGORY

2015 PROGRAM TIME EXPENDITURES BY CATEGORY

Program Category	Approximate Hours	Percentage
Larval Surveillance & Control	9,376	89%
Adult Surveillance & Laboratory	579	5%
Adult ULV Control	76	1%
Public Education/Relations and Reporting	506	5%
Total	10,537	100%