

**2018 ANNUAL REPORT**

**OF THE**

**CHILOQUIN VECTOR CONTROL DISTRICT**

In compliance with:  
Oregon Revised Statutes  
452.120(5) (Partially)

**Prepared by:**

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Contracted IPM Program Manager

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**Three Rivers Mosquito and Vector Control**  
October 22, 2018



**District Name**

Chiloquin Vector Control District

**Operator Name/License**

Three Rivers Mosquito and Vector Control  
AG-L1021442CPO

**Applicator(s) Name(s)/License(s)**

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**Timeframe this Annual Report covers**

January 1, 2018 – December 31, 2018

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**SUMMARY**

In 2012, the Chiloquin Vector Control District (CVCD) contracted with Three Rivers Mosquito and Vector Control (TRMVC), a private company, to operate an Integrated Pest Management Program (IPM) for the District, utilizing the Districts equipment and materials. In April 2014, CVCD put an all inclusive contract out for bid, to outsource all control, including equipment and materials. CVCD also sold all pesticide application equipment and vehicles. In July 2014, TRMVC was awarded the bid for a term of three (3) years with an optional two (2) year extension. In 2018, CVCD entered into an agreement with TRMVC to establish a drone program for the District, with a 5-year implementation/project timeline. All equipment upkeep, maintenance and calibration is the sole responsibility of the contractor, rather than the CVCD Board of Trustees.

All procedures, materials and methods used were done so in accordance with the 2018 Pesticide Use Plan (PUP), submitted and approved in accordance with ORS 452.140 and in observance with an up-to-date Pesticide Discharge Management Plan (PDMP). TRMVC increased the accountability and recordkeeping by continuing GPS/GIS technology to record adulticide spray missions with the truck and ATV mounted ULV foggers. All application sites and inspection points are recorded digitally and maintained in accordance with Oregon Department of Agriculture Commercial Pesticide Application Recordkeeping standards.

A buffer of 100 meter was maintained from all-natural water bodies when necessary as defined in the PUP. In addition, if applications were at to be made within the 100-meter buffer, chemical sensitive strips would be used in order to ensure the buffer was adequate. In 2018, all areas where treatment was needed for adult mosquito control within the 100-meter buffer, Essentria IC<sup>3</sup>™, which requires no setback, was used.

**No adverse affects were detected with non-target species during surveillance pre or post application during the 2018 season.** No adverse incidents as described in Schedule B, Conditions 2-6 of the General Permit 2300A.

## **THE VECTOR PROBLEM**

A Vector shall mean any insect or arthropod, rodent, or other animal of public health significance capable of causing injury, or capable of harboring or transmitting the causative agents of disease to humans or domestic animals. The Chiloquin Vector Control District defines a vector as a mosquito capable of transmitting disease and/or pestiferous, reducing the quality of life of residents.

Most mosquito vectors are extremely mobile and often cause the greatest hazard or discomfort away from their breeding source. Each has a unique life cycle and most of them occupy different habitats.

The vector problem in Chiloquin is largely a human associated problem resulting from agricultural endeavors, increasing population, urbanization and lack of maintenance of drainage systems. Un-maintained fields, vegetation and overgrown vacant lots in and around the City of Chiloquin play a role in protecting adult mosquitoes from Ultra Low Volume (ULV) adulticides, making it difficult to control mosquitoes in these areas that have developed into adults. Additionally, the Nature's Conservancy's reclamation and creation of wetlands on the southwest portion of the District has created large mosquito sources. The Fort Klamath irrigated fields continue to play a major influence for mosquitoes migrating into the District, largely affecting the residents and visitors of Spring Creek, Collier Park and the northern portion of Modoc Point Road. In 2018, the effects of Fort Klamath's irresponsible irrigation practices were less noticeable within the CVCD boundaries due to some limited control activities in Fort Klamath. Smoke from the fires helped reduce the mosquito populations in Fort Klamath as well.

Additional problems will occur as urbanization continues into areas of high vector populations and as recreation and conservation areas expand.

New Federal and State regulations regarding the application of pesticides for Public Health Vector Control and the Clean Water Act/National Pollutant Discharge Elimination System (NPDES) have resulted in less pesticide applications and more monitoring and surveillance of vector populations. Fogging for adult for mosquitoes is not based on service requests or complaints, rather based on justifiable mosquito population data. TRMVC staff and/or CVCD Board Members confirm mosquito populations before applications of a broad-spectrum pesticide is applied.

In 2018, the Modoc Point Irrigation District discontinued irrigation water to properties earlier in the summer. This early termination of irrigation waters helped provide for an earlier than normal halt to mosquito hatchings. With the warm summer, these waters quickly created miles of stagnant mosquito sources. Several properties within the District changed irrigation practices which provided less desirable mosquito sources, producing fewer mosquitos than in the past.

The Chiloquin VCD Board of Trustees approved an early start to the season due to warmer spring weather. TRMVC pre-treated several sources that were historically known to cause significant spring mosquitoes. This reduced service requests from those locations significantly.

### **GOALS:**

The goals of the District are to prevent new vector sources from developing, to abate existing vector populations and their sources in order to protect public health and comfort, to reduce the level of vector populations throughout the District, as well as reduce vector and human interaction. Additionally, the District's environmental goals are to reduce mosquitoes with increased larviciding and incorporation of biological control measures, while being environmentally responsible by reducing adulticiding. Water soluble and non/petroleum based products are the first choice of the District. Overall reduction of pesticides while maintaining minimal mosquito populations is the long term goal of the District.

### **DISTRICT STAFF**

Chiloquin Vector Control District outsourced the labor for District operations beginning in 2002. In 2012, CVCD entered into a 3-year labor contract with Three Rivers Mosquito and Vector Control (TRMVC). In July 2014, CVCD disposed of all application equipment and outsourced not only labor but materials and equipment as well as an all-inclusive, Integrated Pest Management Program (IPM).

Edward S. Horvath  
*Contracted IPM Manager*

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## PROPOSED ANNUAL WORK PROGRAM FOR 2019

1. Provide mosquito abatement services utilizing outsourced services.
2. Continue the District's policy of mosquito control in compliance with Oregon Revised Statutes, Chapter 452 and DEQ General Permit 2300A. And in agreement with the Oregon Department of Health and the Oregon Department of Fish and Wildlife through a mutually approved Pesticide Use Plan (PUP).
3. Continue regular surveillance of all known mosquito sources throughout the District and investigate potential new ones.
4. Respond to service requests from residents of the District.
  - a. Conduct follow-up surveys utilizing Board members and/or contractor's staff.
  - b. Coordinate service request responses between CVCD Board and Contractor Staff.
5. Continue to request the cooperation of individuals in reducing the areas of mosquito production through proper irrigation and cultural practices.
6. Examine any new development in mosquito control for possible incorporation into our control program.
  - a. Continue the implantation of drone technology for the identification of potential new larval habitats.
  - b. Continue with the implementation plan of drones for aerial applications of pesticides (larvicides).
  - c. Support the research and trials of increased use of *Gambusia affinis* (Mosquitofish) locations within the District.
  - d. Support the research and trials of implementation of Copepods for the biological control of mosquito larvae.
7. Maintain communication between CVCD and agencies involved in water management.
8. Maintain good public relations through news releases and informative programs.
9. Contractor continue to maintain spray records in accordance with Oregon Department of Agriculture standards; monitoring mosquito production and spray costs.
10. Use District resources, when available, to assist property owners, municipalities and the Irrigation District in source reduction.
11. Create a long-term plan to reduce mosquito sources each year using contracted services.
12. Assist the contractor to develop and implement plans to reduce mosquito sources by manipulation of existing sources utilizing District funds.
13. Conduct of Arbovirus Surveillance when Arboviruses are present in Klamath County.
14. Increase the biological and cultural control measures, while reducing chemical control.
15. Become the first, biologically and environmentally responsible District on the West Coast, eventually eliminating the routine use of non-natural pesticides.

## SURVEILLANCE

TRMVC conducts surveillance through adult and larval surveys. Several techniques used by TRMVC and recommended by the American Mosquito Control Association include landing rates, CDC Light Traps, and larval dipper counts. In 2018, CVCD Board of Trustees conducted several night time light trap sessions throughout the summer and TRMVC conducted more than 510 inspections of sites within the District using landing rates and larval surveys. In 2018, 295 sites were monitored.

### ADULT MOSQUITO SURVEILLANCE



**Photo 1 CDC Light Trap**

TRMVC collects and monitors adult mosquito populations with CDC light traps and landing rates. CVCD Board members placed and monitored several randomly placed CDC light traps to monitor results (efficacy) of the control program. These traps were also used to provide justification per DEQ Pesticide General Permit 2300A; in accordance with our Pesticide Discharge Management Plan (PDMP) and our Pesticide Use Plan (PUP). TRMVC only applied adulticides when the application was justified in accordance with the annual PUP and PDMP. CDC light traps were used for justification for all adult mosquito control pesticide application utilizing ULV sprayers when landing rates at service requests did not justify spraying. In addition to CDC light traps, landing rates were monitored and recorded at more than 257 locations, weekly from March through September 15<sup>th</sup>. Non-target species were monitored for effects from pesticide applications. It was determined that there were

minimal, if any, effects on non-target species during the adult mosquito surveillance. In fact, it was noticed that there were more species of midges in Quality Control Inspection traps monitored by the CVCD Board of Trustees. ***In 2018, no adverse effects were discovered on non-target species within the CVCD.*** Several residents throughout the District reported an increase in Dragonflies, Mayflies and Caddis flies. Honey bee hives were monitored by CVCD Board Member Dennis Jefcoat; he reported no adverse effects created by the application of pesticides near his residence.

### LARVAL MOSQUITO SURVEILLANCE

TRMVC conducted routine larval surveillance and uses this data to justify larval control utilizing State and Federally approved Integrated Mosquito Management principles. Either chemical, biological or mechanical (by modifying the source so that it does not retain mosquito larvae) are used to control mosquito larvae once discovered during the larval survey. Post treatment inspection were conducted within a week or two after application to determine efficacy toward target pest and monitor any adverse affects on non-target species. ***In 2018, no adverse effects were discovered on non-target aquatic species within the CVCD.***



**Photo 2 Standard Larval Dipping Cup**

### RESISTANCE MONITORING



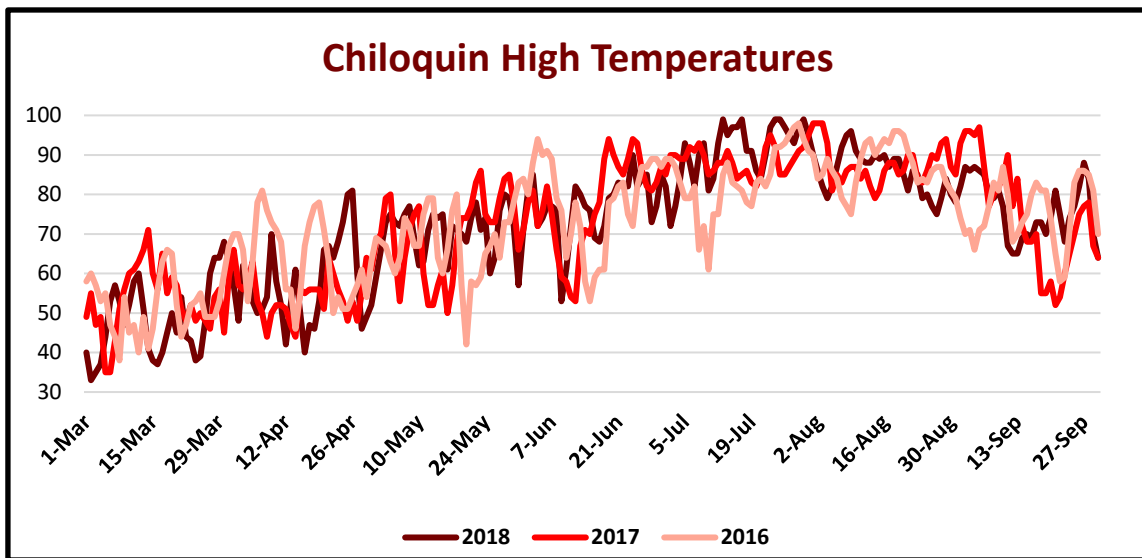
**Photo 3 Bottle Bio-Assay**

Three Rivers Mosquito and Vector Control conducts resistance analysis using industry standard bio-assays on a monthly routine. No resistance was discovered in the target species to pesticides used in the current year. In addition, TRMVC conducted efficacy testing for each pesticide used within the Chiloquin Vector Control District. Results indicate that current pesticides used are effective in accordance with industry standards with no resistance present. TRMVC recommends that the District continue to monitor resistance and efficacy results.

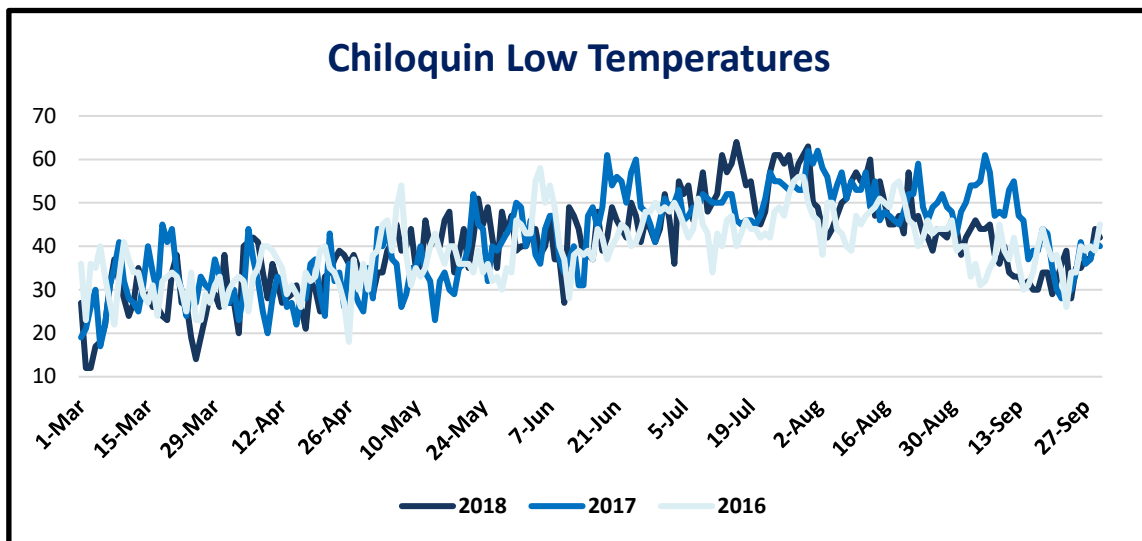
## WEATHER

Weather plays a major role in mosquito activity. In 2018, the high temperatures remained lower (for the most part) than in 2017 for the beginning of the season, then increased. A noticeable increase in larval activity started closer to the mid/late March 2018. While the CVCD Board of Trustees approved an early start to the 2018 season, treatments did not begin until closer to the end of March. This provided the District with the tools to be prepared if the season warmed up early, while saving the District funds by not treating until larvae was present, while also reducing the mosquito populations early.

There was no pre-treatment of troublesome sources prior to surveillance justifying the application of a larvicide. District Board of Trustees should consider pre-treating sources that have regularly produced mosquito larvae in March and April rather than wait for larvae eggs to hatch in order to produce even better results in 2019. Pre-treatment should also include areas outside the City of Chiloquin, to help reduce mosquitoes in outlying areas as well. These early treatments have been successful at reducing mosquitoes that are typically a nuisance in April-June.



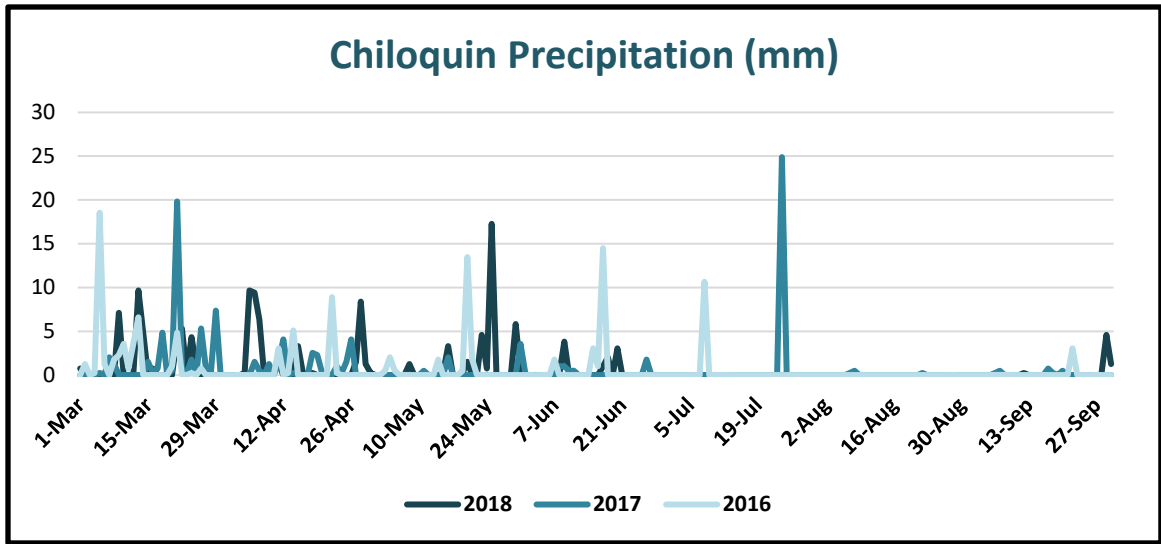
Graph 2 High Temperature Comparisons



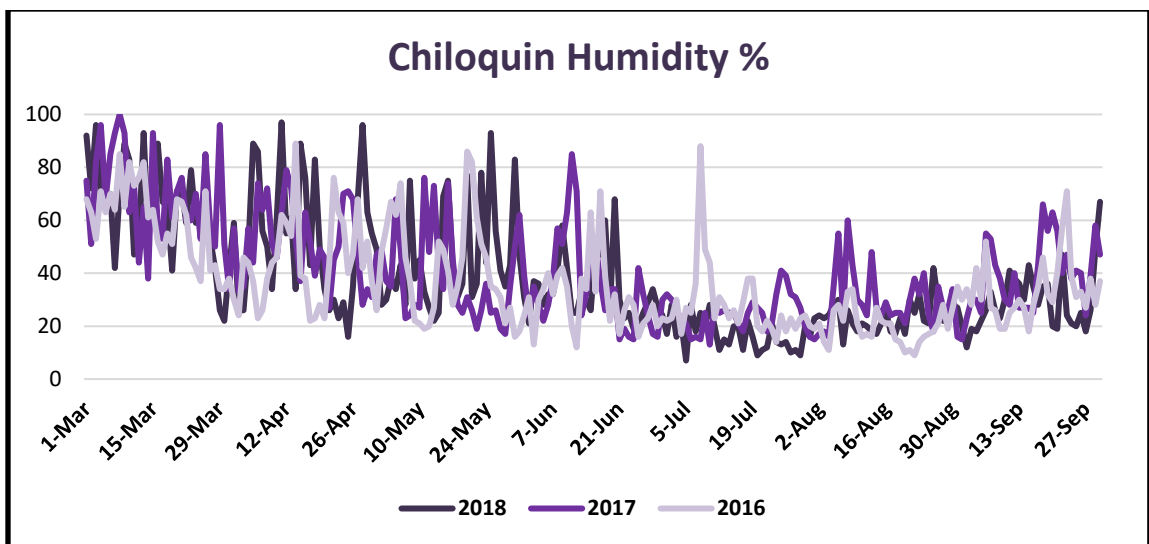
Graph 1 Low Temperature Comparisons

TRMVC staff recommends that we monitor future temperatures adjust the starting of operations accordingly.

Rainfall and humidity not only have an impact of the mosquito populations by providing the needed water, it also affects the aggressiveness of the female mosquito for acquiring a blood meal. From the data collected for temperature, rainfall and humidity, there is a direct correlation with the service requests for adult mosquito control. (see below graphs).



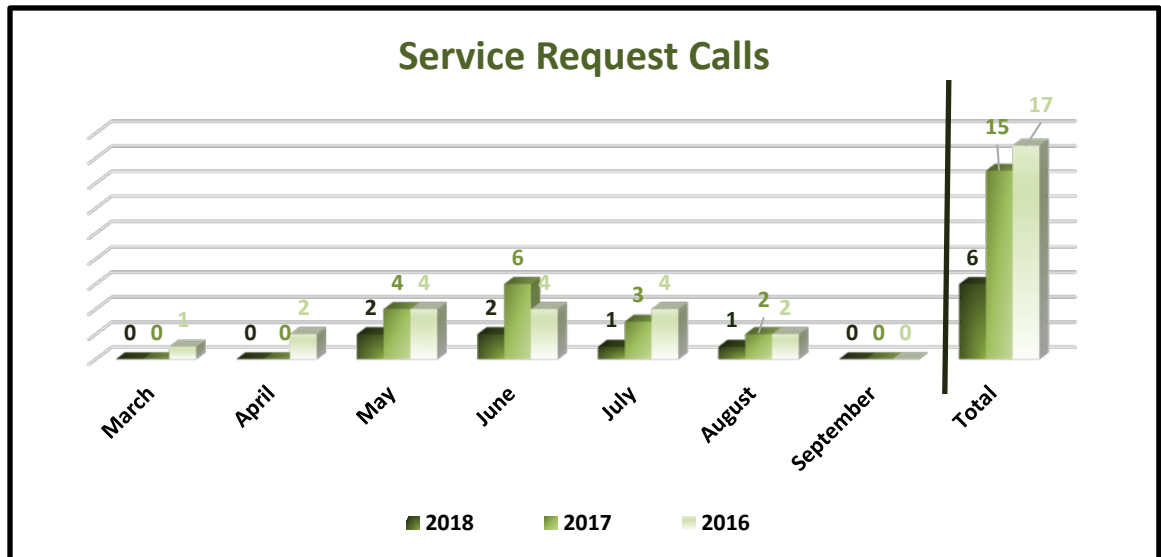
Graph 4 Precipitation Comparisons



Graph 3 Relative Humidity Comparisons

## SERVICE REQUESTS

While service requests numbers have reduced since 2014, it is important to note that call volumes may fluctuate seasonally as irrigation and weather changes each year. Early season larviciding combined with the lessened irrigation activities have directly affected the service request numbers.



Graph 5 Service Request Comparisons

## ARBOVIRUS

The Chiloquin Vector Control District has not had arbovirus activity since the discovery of an infected Shrubjay in 2006. In September 2015, a horse was discovered infected with the West Nile Virus approximately 12 miles east of the CVCD boundary. CVCD Board Chairman and TRMVC staff worked together with the County and State Health Departments in order to ensure that proper and timely notification was received in the future. This will better serve the residents of Chiloquin, Klamath County and the State in general. In 2016, all arbo-virus surveillance returned negative test results. In 2018, no arbo-virus testing was needed.

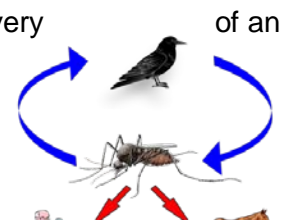


Figure 1 West Nile Virus Transmission Cycle

## CONTROL PROGRAM 2018

### **BIOLOGICAL CONTROL (LARVAE)**



Photo 4 *Gambusia affinis* (Mosquitofish)

During the 2018 season, *Gambusia affinis* (Mosquito Fish) were still of limited supply due to over fishing by adjacent Districts during drought conditions. Other Districts depleted the populations to a point that very few were available for CVCD. These fish are natural predators of mosquito larvae and have been known to consume their own weight in larvae in a single day. One of TRMVC's long term goals is to create a breeding reserve of *Gambusia affinis* for continuous and long term availability for Districts and residents. In 2018, TRMVC staff stocked three (3) ponds with *Gambusia affinis*.

The District also treated approximately 1.16 acres for the control of mosquito larvae with the biological insecticides *Bacillus thuringiensis*, var, *israelensis* (*Bti*) and *Bacillus sphaericus* (*BS*). These microbial insecticide are highly toxic to mosquito larvae and has no harmful effects on humans, domestic animals, wildlife, beneficial insects, fish and other aquatic life. Excellent results were obtained with *Bacillus sphaericus* controlling larvae on approximately 1.16 acres. A natural product (Natular™ XRT), containing *spinosad* was utilized as a trial in 2017. The sources in 2017 were not present in 2018, therefore Spinosad was not used.



## COPEPODS

In 2016, the District gave the endorsement to TRMVC to investigate the feasibility of creating another biological program to control mosquito larvae. The goals of the District are to reduce the applications of pesticides and create a control program that is predominately natural and biological in concept. In 2016, TRMVC staff began a survey of water sources to evaluate the current levels of Copepods and other naturally occurring mosquito predators. As continued through 2018, and planned for over the next couple years, TRMVC will be producing different copepod species to evaluate the efficacy and feasibility of using copepods within the District's boundaries. These efforts will be coordinated and approved through the appropriate government agencies (USDA, ODFW, ODA, etc.) before being put into field trials.

## CHEMICAL CONTROL (LARVAE)

The chemicals used by the District are non-persistent public health insecticides. They are used at median application rates and have been cleared for mosquito control by the Environmental Protection Agency, the Oregon State Health Division, the Oregon State Department of Fish and Wildlife and the Oregon State Department of Agriculture. TRMVC produces a "duplex" mixture using methoprene and Bti (utilizing Altosid™ supplemental label), however did not use any Duplex products in Chiloquin for 2018.



Figure 2 Mosquito Life Cycle

## CHEMICAL CONTROL (PUPAE)

TRMVC used Aqnique® MMF, a mono-molecular film applied to standing water where late in-star mosquito larvae and pupae were identified. Aqnique® MMF is a larvicide and pupicide with a unique physical mode of action rather than chemical toxicity. It is ideally suited for the District as it can be used in a wide range of habitats. Approximately 84.32 acres were treated using this product.

## CHEMICAL CONTROL (ADULT)

CVCD began phasing out Malathion which has historically been applied by a truck mounted ULV sprayer. Malathion (or other pesticide with similar mode of action) will only be used to control the potential of resistance within the mosquitoes of the District and will not be used as a sole adulticide. In 2014, TRMVC introduced the use of Aqualuer® 20-20, a permethrin based adulticide which is diluted with water and is formulated with a botanical, cold-pressed orange oils rather than petroleum products. The ULV sprayer was calibrated to ensure proper pesticide amounts were applied along with droplet sizes, monthly.

During the 2018 mosquito season, TRMVC treated approximately 4,453.83 acres for the control of larval and adult mosquitoes. No malathion was used in 2018. 3,750.35 acres were treated with Aqualuer® 20-20 in 2018 while in 2017, we only had to fog 2,323.14 acres with Aqualuer® 20-20, using both ATV and truck mounted ULV foggers.

TRMVC used an eco-exempt adulticide approximately 600.00 acres treated with an EPA exempt Eccentria™ IC<sup>3</sup> fogging/barrier treatment using an ATV mounted ULV sprayer. Essentria™ IC is a pesticide that targets the octopamine receptors of the adult mosquito. By targeting octopamine receptors, the essential oils that make up Essentria IC<sup>3</sup>™ provide insect control with a much wider margin of safety than other products. Because vertebrates like birds, fish, dogs and people don't have octopamine receptors; they are not affected by this unique mode of action. This product was used as both a barrier and fogging treatment when mosquito populations were unacceptable near natural bodies of water. ***It is possible that Escentria™ may not be available in the future, therefore, TRMVC is actively working with a company who is developing a replacement product.***

It is widely known that the Chiloquin Vector Control District had been historically known as a District that applied adulticides indiscriminately since its inception in 1969. Because of this, the District was discontinued from 1998-2000. The District was reinstated with the agreement that the District would establish and maintain an Integrated Pest Management (IPM) program and avoid all contact with the rivers, streams and creeks. Financial restrictions kept the District restricted to less services. In 2014, the Board of Trustees decided to outsource the program; the cost savings and increased control, while remaining the most environmentally responsible District, has been successful. Even with limited resources, the CVCD continues to maintain the recommended buffers.

All fogging operations are conducted during the evening and early morning hours for the control of adult mosquitoes with justification in accordance with NPDES General Permit 2300A.

**PUBLIC HEALTH INSECTICIDES APPLIED DURING 2018**

<b>ADULTICIDES</b>						
<b>Material</b>	<b>EPA Reg #</b>	<b>Acres Treated</b>	<b>Rate of Application</b>	<b>Lbs of AI Used</b>	<b>Amount Used</b>	<b>Method Used</b>
Aqualuer® 20-20	769-985	3,750.35	0.0035 lb AI/A	8.131 lb AI	960.37 oz	Truck/ ATV ULV
Essentria™ IC <sup>3</sup>	Exempt	600.00	0.83 fl oz/A	34.63 lb AI	498.00 fl oz	ATV ULV Fogger
Fyfanon® ULV	67760-34	0.00	0.03 lbs AI/A	0.000 lb AI	0.00 oz	Truck ULV Fogger
<b>Total Acres Treated (Adulticide)</b>		<b>4,350.35</b>				
<b>LARVICIDES</b>						
<b>Material</b>	<b>EPA Reg #</b>	<b>Acres Treated</b>	<b>Rate of Application</b>	<b>Lbs of AI Used</b>	<b>Amount Used</b>	<b>Method Used</b>
Aonique® MMF	2302-14	84.32	25.6–128.0 oz/A	24.33	366.42 fl oz	Hand can/Pres Spray
Bti Ffast™	432-1515	0.00	4.0-16.0 oz/A	0.00 B ITU	0.00 fl oz	ATV ULV Fogger
Methoprene 2.1%	2724-375	80 ft <sup>2</sup>	1 ea/ (up to 100 ft <sup>2</sup> )	0.00725	5 ea	Hand Toss
Natular™ XRT <i>Spinosad</i>	8329-84	0.00	1 ea/ (up to 100 ft <sup>2</sup> )	0.00	0.00 ea	Hand Toss
Vecto-Lex® FG	73049-20	18.00	5.0-10.0 lb/A	2.7788	156.58 lbs	Backpack Spreader
Vecto-Lex® WDG	73049-57	1.16	8.0-24.0 oz/acre	0.6380	8.55 oz	Pressure Sprayer
<b>Total Treated Acres <sup>1</sup> (Larvicide)</b>		<b>103.48</b>				
<b>Total Acres Treated</b>		<b>4,453.83</b>				

**Table 1 Pesticide used within the CVCD**

<sup>1</sup> Mixed pesticides are only counted once for total acres treated.

## GROUND APPLICATIONS

### RECORD KEEPING

All known mosquito sources were recorded in Geographic Information System (GIS) maps that serve as permanent records in TRMVC databases. Shape-files are contained in GPS enabled handheld computers and are used to dispatch ground surveillance and control. Labor cost for inspections, ground treatments and pesticide record keeping cost \$38,189.17 and conducted by TRMVC staff as a contracted service. In addition, the District contracted with TRMVC for the implementation of UAVs into the program for a cost of \$25,000. With the establishment of an all-inclusive IPM contract, the applications of adulticides with the truck and ATV mounted foggers were recorded with GPS and GIS technology. All applications are recorded and maintained in order to provide better accountability of where adulticide pesticides were applied, as well as not applied.



**Photo 5**  
Handheld PDA

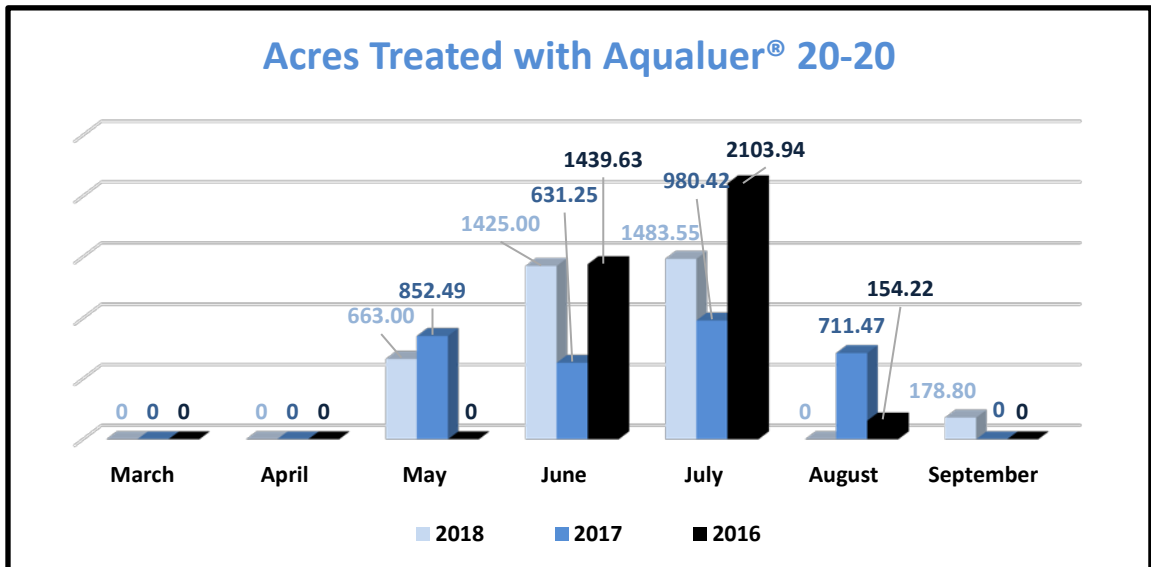
### TREATMENT METHODS

Fogging operations are conducted during the evening and/or early morning hours for the control of adult mosquitoes with justification in accordance with NPDES General Permit 2300A. The ULV foggers were calibrated to ensure proper pesticide amounts were applied along with droplet sizes, bi-weekly or whenever service to the machine was conducted.



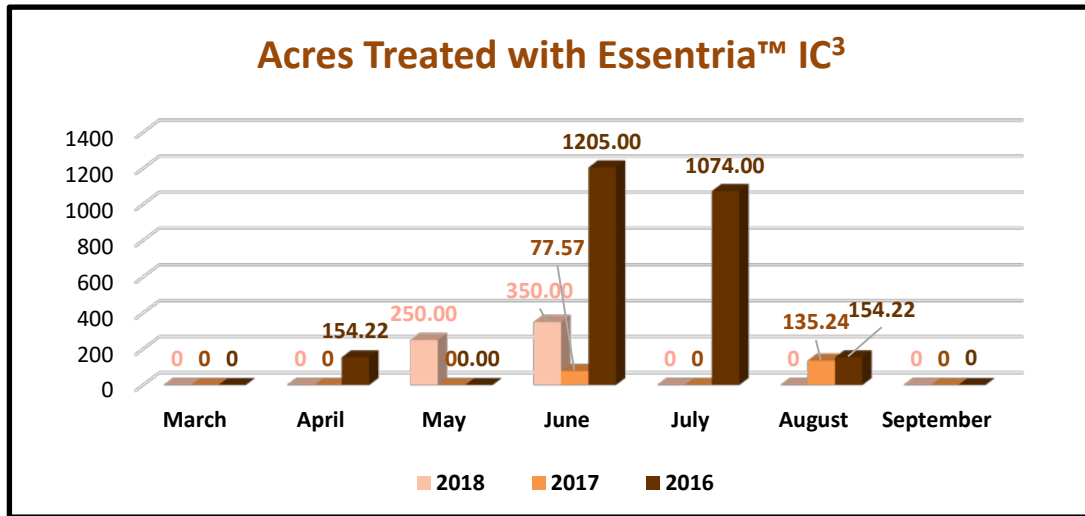
CVCD and TRMVC have partnered with the goals of using more environmentally responsible products, while increasing the control and satisfaction of residents of the District. One of the goals met was to reduce the amount of pesticides used while still increasing the control efficacy by targeted larviciding, water control and source reduction.

**Photo 6** ATV Mounted Fogger



**Graph 6** Acres fogged with Aqualuer® 20-20 via ULV

In 2014, the District approved the use of Essentria™ IC<sup>3</sup>, an EPA exempt natural product. Essentria IC<sup>3</sup>™ is a pesticide that targets the octopamine receptors of the adult mosquito. By targeting octopamine receptors, the essential oils that make up Essentria IC<sup>3</sup>™ provide insect control with a much wider margin of safety than other products. Because vertebrates like birds, fish, dogs and humans don't have octopamine receptors; they are not affected by this unique mode of action. This product was used as both a barrier and fogging treatment when mosquito populations were unacceptable near natural bodies of water. Essentria IC<sup>3</sup> was applied with an ATV mounted ULV machine. These treatments were limited to Spring Creek residential area, Collier Park and areas close to the Williamson and Sprague Rivers, when mosquito populations in the area created a nuisance for the local residents. In 2018, CVCD treated had to treat 600.00 acres with Essentria™ IC<sup>3</sup> while in 2017 treated only 121.81 acres.



**Graph 7 Acres treated with Escentria(tm) IC3**

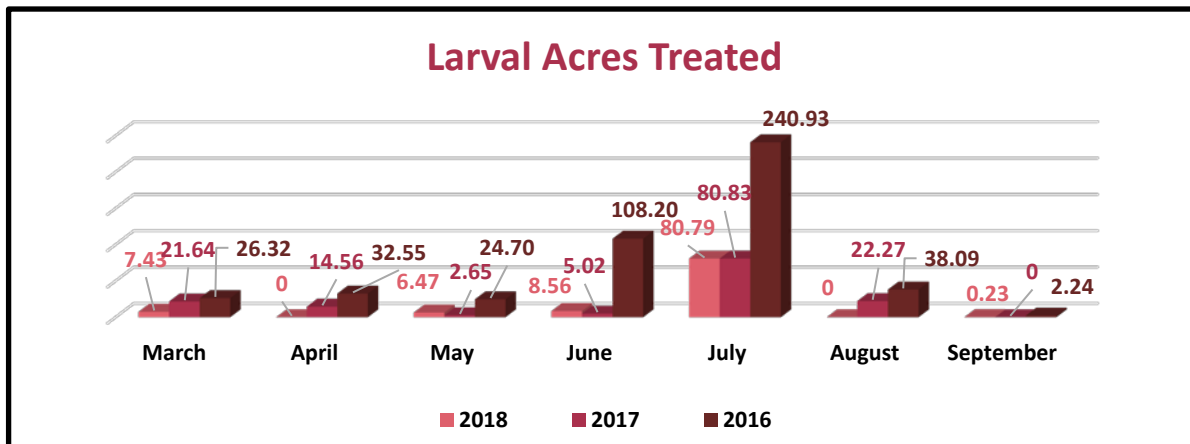
Biological pesticides continued as the focus of the District's operation in 2018. TRMVC's 2018 application of *Bti* and *Bs* to irrigated property, isolated ponds and ditches within the District decreased from 2013 by more than 300%. Granular *Bti* and *Bs* were applied by gas-powered Maruyama™ backpack blowers, belly grinder style seeders and by horn seeders.



**Photo 7 Larviciding w/ Backpack Blower**

Agnique® MMF™ was applied utilizing B&G pressurized hand cans, squirt bottles and a 12-volt pressurized, ATV-mounted sprayer. Agnique® MMF was used as a spot treatment to rid standing water of pupae. There was only a slight increase in the need for Agnique® MMF in 2018 from 2017 because the irrigation canals stopped flowing throughout the season, creating isolated areas with pupae, but dried up quickly.

This year's larviciding program was kept busy inspecting and treating the sources throughout the district that are known producers of predominately *Aedes* and *Culex* genera of mosquitoes and discovering new sources. Irrigated pastureland ranks as the number one problem for district technicians and is the cause for most of our complaints in the hot summer months. The most significant influx of mosquitoes was during mid-summer, along the shore of Agency Lake.



**Graph 8 Acres treated for larval mosquitoes**

## **INTEGRATED MOSQUITO MANAGEMENT (IMM)**

### **Mosquito Control Policy:**

Three Rivers Mosquito and Vector Control and the Chiloquin Vector Control District advocates management of mosquito populations when and where necessary by means of integrated programs designed to benefit or to have minimal adverse effects on people, wildlife, and the environment. This Integrated Mosquito Management (IMM) policy recognizes that mosquito populations cannot always be eliminated but often must be suppressed to tolerable levels for the well-being of humans, domestic animals, and wildlife and that selection of scientifically sound suppression methods must be based on consideration of what is ecologically and economically in the long-term best interest of mankind.

### **The following principles are advocated:**

- Mosquito control measures should be undertaken only when there is adequate justification based upon surveillance data.
- IPM programs should be tailored to the needs and requirements of the local situation. The combination of methods for mosquito control should be chosen after careful consideration of the efficacy, ecological effects, and costs versus benefits of the various options, including public education, legal action, natural and biological control, elimination of breeding sources, and insecticide applications.
- Mosquito breeding sources, whether natural or created by human activity should be altered in such a manner as to cause the least undesirable impact on the environment.
- Insecticides and application methods should be used in the most efficient and least hazardous manner, in accordance with all applicable laws and regulations and available scientific data. The registered label requirements for insecticide should be followed. When choices are available among effective insecticides, those offering the least hazard to non-target organisms should be used. Insecticides should be chosen and used in a manner that will minimize the development of resistance in the mosquito population.
- Personnel involved in mosquito management programs should be properly trained and supervised, and certified in accordance with relevant laws and regulation and should keep current with improvements in management techniques through continuing education and/or training programs.

All methods and materials used by TRMVC for the Chiloquin Vector Control District are based on these principles. An annual Pesticide Use Plan is prepared before every season and sent to the Health Division of the Oregon Department of Human Resources and the Habitat Conservation Division of the Oregon Department of Fish and Wildlife. These two agencies must give approval on a yearly basis to any agencies, such as the CVCD, intending to use chemicals for Vector Control.

## MOSQUITOES OF CHILOQUIN VECTOR CONTROL DISTRICT

1. <i>Aedes aboriginis</i>	9. * <i>Aedes Increpitus</i>	17. <i>Culex pipiens</i>
2. <i>Aedes campestris</i>	10. <i>Aedes intrudens</i>	18. <i>Culex tarsalis</i>
3. <i>Aedes cataphylla</i>	11. <i>Aedes melanimon</i>	19. <i>Culex territans</i>
4. <i>Aedes cinereus</i>	12. * <i>Aedes nigromaculis</i>	20. <i>Culiseta impatiens</i>
5. <i>Aedes communis</i>	13. <i>Aedes niphadopsis</i>	21. <i>Culiseta incidens</i>
6. * <i>Aedes dorsalis</i>	14. * <i>Aedes vexans</i>	22. * <i>Culiseta inornata</i>
7. <i>Aedes exrucians</i>	15. * <i>Anopheles freeborni</i>	23. <i>Culiseta minnesotae</i>
8. <i>Aedes fitchii</i>	16. <i>Culex peus</i>	

\* Indicates species that pose a control problem

(These lists were comprised during the CVCD mosquito surveys from 2002-2007 and 2012-2018).

### **MOSQUITO INFORMATION**

#### **I. Anopheles**

##### ***Anopheles freeborni***

*An. freeborni* (the western malaria mosquito) enters homes and animal shelters readily biting at dusk and dawn. In the fall, generally beginning in early September, the females seek shelter in buildings, culverts, cellars, and other protected places. On warm days in March and April females sometimes leave their shelters to feed and bite viciously. They are also a pest in the summer months with their peak period of biting activity during July and August.

Rain pools, river seepage areas, marshes, swamps, semi-permanent or permanent ponds in irrigated pastures and drainage ditches are sources commonly found to be breeding sites for this mosquito. Clear, sunlit water with emergent vegetation and floating algae is preferred.

Other *Anopheles* of lesser importance found in Chiloquin are:

- *An. punctipennis*
- *An. occidentalis*
- *An. Pseudopunctipennis*

#### **II. Aedes**

##### ***Aedes vexans***

*Ae. vexans* (the irrigated pasture mosquito) is associated with intermittently irrigated crops, primarily with irrigated pastures and alfalfa. A brood is usually produced in sequence with each irrigation cycle, which can occur every 7 to 14 days.

The irrigation season usually extends from May to October. This is a major pest mosquito in Chiloquin readily attacking humans and animals during the day, and is most active at dusk. Large populations can be an annoyance to domestic animals and to persons engaged in recreation and labor.

*Ae. vexans* larvae are vigorous swimmers and are usually found in open fields where water remains stagnant following an irrigation. The length of the aquatic stage is influenced by temperature and can vary from five days at 86 degrees F to 16 days at 50 degrees F. During midsummer the larvae grow rapidly and pupate in three days. Peak production is reached in July and August. This combination of rapid growth rate, adult populations of up to 15 million per acre, and a flight range of up to 20 miles makes this mosquito one of the toughest problems to control.

Other flood water mosquitoes that occur in Chiloquin are:

- *Ae. melanimon*
- *Ae. nigromaculis*
- *Ae. Melanimon*
- *Ae. dorsalis*
- *Ae. Sierrensis*

### ***Aedes increpitus***

In Chiloquin the larvae of *Ae. increpitus* are found in pools along streams left when spring floodwaters subside and in brush or tree covered depressions filled by heavy rains. The adult mosquitoes become active in late spring and early summer, sometimes flying several miles in search of a blood meal. *Ae. increpitus* are persistent biters and continue to be a problem in some areas of the County where housing developments have been built close to existing seasonal creeks and streams.

### ***Aedes communis***

*Ae. communis* (the snow water mosquito) is generally a mountain mosquito, associated with pools of water from melted snow. The females are often serious pests in the forests where they may be encountered in swarms in the spring, biting mostly in the shade or after sundown.

Other mosquitoes found in Chiloquin that are associated with pools of melted snow water are:

- *Ae. Fitchii*

## **III. Culiseta**

### ***Culiseta incidens***

*Cs. incidens* (the cool weather mosquito) are found throughout Klamath County in natural depressions filled with rain or irrigation water and in artificial containers. Examples include troughs, hoof prints, ground pools, rock pools, and log ponds. In our area where the winter climate is moderate, breeding may take place throughout the entire year.

*Cs. incidens* is a large mosquito and extremely annoying in some areas. Adult mosquitoes have been observed biting on sunny days in mid winter but have a peak activity period between May and August.

Other cool weather mosquitoes found in Chiloquin are:

- *Cs. impatiens*
- *Cs. inornata*
- *Cs. Minnesotae*

## **IV. Culex**

### ***Culex tarsalis***

*Cx. tarsalis* (the western encephalitis mosquito) is the most common of the *Culex* in Chiloquin. The larvae develop in nearly any conceivable containers holding water such as tires, rain gutters, bird baths, rooting buckets, discarded containers, standing pasture water, etc. The females are painful and persistent biters, attacking at dusk and after dark, and readily enter dwellings for blood meals. The adults hide in sheltered places during the day. Mosquitoes of this species can fly considerable distances (up to 16 miles) and when a large untreated source hatches off it can provide a community with several months of biting pests. *Culex* mosquito species are the species of mosquitoes known for the transmission of West Nile Virus.

### ***Culex peus***

This species is found in most types of moderately polluted types of water, such as mill ponds but are also found in road culverts, ornamental pools, and other semi-permanent sites.

***Culex pipiens*** (Northern House Mosquito)

The larvae of this mosquito are found in the polluted water of open septic drains and cesspools. They may be associated with *Cx. peus* past mid-summer in semi-polluted environments such as rain barrels or other artificial containers.

Other *Culex* mosquitoes found in Chiloquin are:

- *Cx. territan*