

Integrated Mosquito and Vector
Management Program Plan

APPENDIX

I

SAN MATEO COUNTY MOSQUITO-
BORNE VIRUS SURVEILLANCE AND
RESPONSE PLAN



The *San Mateo County Mosquito-borne Virus Surveillance and Response Plan* was developed to provide a semi-quantitative measure of virus transmission risk to humans that could be used by District staff to plan and modulate control activities. This plan was developed in 2017 using the *California Mosquito-borne Virus Surveillance and Response Plan (2017)* with certain factors adjusted to reflect conditions in the District. Six surveillance factors are measured and analyzed to determine the level of risk for human infection and, thereby, gauge the appropriate response level:

1. Environmental or climatic conditions (e.g., snowpack, rainfall, and temperature)
2. Adult *Culex* vector abundance
3. Virus infection rate in *Culex* mosquito vectors
4. Sentinel chicken seroconversions
5. Fatal infections in birds
6. Infections in humans

Each of these factors is rated on a scale of 1 to 5, with 5 representing conditions indicative of a high risk of human infection with a mosquito-borne virus. An average rating is determined for the five factors and is correlated with the response level as follows:

- Level 1: Normal Season (1.0 to 2.5)
- Level 2: Emergency Planning (2.6 to 4.0)
- Level 3: Epidemic Conditions (4.1 to 5.0)

Table 1 provides a worksheet to assist in determining the appropriate rating for each of the risk factors for West Nile virus (WNV). While this table is specific to WNV, similar decision-making procedures should be followed for other vector-borne diseases.

Table 2 (Mosquito Risk Rating Worksheet) provides a worksheet to assist in determining the appropriate rating and response level based on the evaluation of risk factors. The term “average” refers to averages over non-epidemic years in a specific region, such as that within the boundaries of a local mosquito and vector control district. Averages typically are determined for the preceding 5-year period.

Surveillance data can be managed and risk level calculated in time and space using the CalSurv Gateway. Risk calculations should be applied within a defined area, typically encompassing a local mosquito and vector control district. Use of smaller spatial units (e.g., city boundaries) is ideal due to spatial variation in virus activity and the need to define potential target areas for mosquito control at finer spatial scales. Due to spatial variation in the distributions of humans and the dominant vector species, *Cx. tarsalis* and the *Cx. pipiens* complex, separate calculation of risk for urban and rural areas will be used where applicable.

For surveillance factors 4–6 (chickens, birds, and humans), the specific region is defined as the area within the agency’s boundary and the broad region includes the area within 150 miles (~241 km) of the agency’s boundary.

Each of these surveillance factors can differ in impact and significance according to time of year and geographic region. Climate is used prospectively to forecast risk during the coming season. Climatic factors provide the earliest indication of the potential for increased mosquito abundance and virus transmission and constitute the only risk factor measured in many areas from the start of the calendar year through mid-spring when enzootic surveillance commences. Other

factors that may inform control efforts as the season progresses are typically, in chronological order: mosquito abundance, infections in non-humans (e.g., dead birds for WNV, mosquitoes, and sentinel chickens), and infections in humans. Enzootic indicators measure virus amplification within the Culex-bird cycle and provide nowcasts of risk, whereas human infections document tangential transmission and are the outcome measure of forecasts and nowcasts. Response to the calculated risk level should consider the time of year (e.g., epidemic conditions in October would warrant a less aggressive response compared to epidemic conditions in July because cooler weather in late fall will contribute to declining risk of arbovirus transmission).

Table 1. Mosquito-borne Virus Risk Assessment.

WNV Surveillance Factor	Assessment Value	Benchmark	Assigned Value	
1. Environmental Conditions High-risk environmental conditions include above-normal temperatures with or without above-normal rainfall, runoff, or snowpack. Weather data link: http://ipm.ucdavis.edu	1	Avg daily temperature during prior 2 weeks $\leq 56^{\circ}\text{F}$		
	2	Avg daily temperature during prior 2 weeks $57\text{--}65^{\circ}\text{F}$		
	3	Avg daily temperature during prior 2 weeks $66\text{--}72^{\circ}\text{F}$		
	4	Avg daily temperature during prior 2 weeks $73\text{--}79^{\circ}\text{F}$		
	5	Avg daily temperature during prior 2 weeks $> 79^{\circ}\text{F}$		
			<i>Cx tars</i>	<i>Cx pip</i>
2. Relative abundance of adult female <i>Culex tarsalis</i> and <i>Cx. pipiens</i> complex mosquitoes* Determined by trapping adults, enumerating them by species, and comparing numbers to those previously documented for an area for the prior 2-week period.	1	Vector abundance well below average ($\leq 50\%$)		
	2	Vector abundance below average ($51\text{--}90\%$)		
	3	Vector abundance average ($91\text{--}150\%$)		
	4	Vector abundance above average ($151\text{--}300\%$)		
	5	Vector abundance well above average ($> 300\%$)		
3. Virus infection rate in <i>Cx. tarsalis</i> and <i>Cx. pipiens</i> complex mosquitoes* Tested in pools of ≤ 50 females. Test results expressed as minimum infection rate per 1,000 mosquitoes tested (MIR) for the prior 2-week period.	1	MIR = 0		
	2	MIR = 0.1–1.0		
	3	MIR = 1.1–2.0		
	4	MIR = 2.1–5.0		
	5	MIR > 5.0		
4. Sentinel chicken seroconversion Number of chickens in a flock that develop antibodies to WNV during the prior 2-week period. Number of flocks with seropositives in a region is an additional consideration. Typically 7- 10 chickens per flock. Only include this factor in calculations when sentinel chicken program is actively maintained.	1	No seroconversions in broad region		
	2	One or more seroconversions in broad region		
	3	One or two seroconversions in a single flock in specific region		
	4	More than two seroconversions in a single flock or two flocks with one or two seroconversions in specific region		
	5	More than two seroconversions per flock in multiple flocks in specific region		
5. Dead bird infection Number of birds that have tested positive (recent infections only) for WNV during the prior 3-month period. This longer time period reduces the impact of zip code closures during periods of increased WNV transmission.	1	No positive dead birds in broad region		
	2	One or more positive dead birds in broad region		
	3	One positive dead bird in specific region		
	4	Two positive dead birds in specific region		
	5	Three or more dead birds in specific region		
6. Human cases Do not include this factor in calculations if no cases are detected in region.	3	One human infection in broad region		
	4	Two or more human infections in specific region		
	5	One or more human infections in specific region		
			<i>Cx tars</i>	<i>Cx pip</i>
<u>Response Level / Average Rating:</u>				
Normal Season (1.0 to 2.5)			TOTAL	
Emergency Planning (2.6 to 4.0)				
Epidemic (4.1 to 5.0)			AVERAGE	

Table 2 Mosquito Risk Rating Worksheet

<p>Risk Rating: 1.0 to 2.5</p> <p>Conditions</p> <ul style="list-style-type: none"> Cool to moderate seasonal temperatures (< 65°F) <i>Culex</i> mosquito abundance at or below 5-year average (key indicator = adults of vector species) No virus infection detected in mosquitoes No recently infected WNV-positive dead birds No human cases <p>Response</p> <ul style="list-style-type: none"> Conduct routine public education (eliminate standing water around homes, use personal protection measures) Conduct routine mosquito and virus surveillance activities Comply with National Pollutant Discharge Eliminations System (NPDES) permit if applying pesticides to waters of the United States Conduct routine mosquito control with emphasis on larval control Inventory pesticides and equipment Evaluate pesticide resistance in vector species Ensure adequate emergency funding Release routine press notices Establish and maintain routine communication with local office of emergency services personnel; obtain Standardized Emergency Management System (SEMS) training
<p>Risk Rating: 2.6 to 4.0</p> <p>Conditions</p> <ul style="list-style-type: none"> Temperature above average (66–79°F) Adult <i>Culex</i> mosquito abundance greater than 5-year average (150% to 300% above normal) One or more virus infections detected in <i>Culex</i> mosquitoes (MIR < 5 per 1,000 tested) One to five recently infected WNV-positive dead birds in specific region One human case in broad or specific region WEE detected in small towns or suburban area <p>Response</p> <ul style="list-style-type: none"> Review epidemic response plan Enhance public education (include messages on the signs and symptoms of encephalitis; seek medical care if needed; inform public about pesticide applications if appropriate) Enhance information to public health providers Increase surveillance and control of mosquito larvae Increase adult mosquito surveillance Increase number of mosquito pools tested for virus Consider or increase localized chemical control of adult mosquitoes as appropriate Consider contacting commercial applicators in anticipation of large-scale adulticiding Review candidate pesticides for availability and susceptibility of vector mosquito species Ensure notification of key agencies of presence of viral activity, including the local office of emergency services

Risk Rating: 4.1 to 5.0

Conditions

- Temperature well above average (> 79°F)
- Adult vector population extremely high (> 300% above normal)
- Virus infections detected in multiple pools of *Culex tarsalis* or *Cx. pipiens* mosquitoes (MIR > 5 per 1,000 tested)
- More than five recently infected WNV-positive dead birds and multiple reports of dead birds in specific region
- More than one human case in specific region

Response

- Conduct media campaign
- Continue enhanced larval surveillance and control of immature mosquitoes
- Broaden geographic coverage of adult mosquito surveillance
- Accelerate adult mosquito control as appropriate by ground and/or air
- Coordinate the response with the local Office of Emergency Services or if activated, the Emergency Operation Center (EOC)
- Determine whether declaration of a local emergency should be considered by the County Board of Supervisors (or Local Health Officer)
- Determine whether to activate a Standardized Emergency Management System (SEMS) plan at the local level
- Continue mosquito education and control programs until mosquito abundance and enzootic virus activity are substantially reduced and no additional human cases are detected