2024

SUFFOLK COUNTY

DEPARTMENT OF PUBLIC WORKS

DIVISION OF VECTOR CONTROL

ANNUAL PLAN OF WORK

Vector Control crew clearing blocks in a ditch

Contents

Suffolk County Vector Control

Mission
Suffolk County Vector Control seeks to protect public health and welfare by reducing disease incidence and impacts caused by mosquitoes and ticks in an environmentally sensitive approach.

Governance
The Suffolk County Department of Public Works, Division of Vector Control is responsible under the County Charter to use every means feasible and practical to suppress mosquitoes, ticks and other arthropods which are vectors of human disease requiring public action for their control §C8-4(B). The Division's responsibility is to control infestations of mosquitos, ticks and other arthropods that significantly threaten public health, or create social or economic problems for the communities in which they occur. The Division meets its responsibilities in consultation with the Suffolk County Department of Health Services (SCDHS) and appropriate federal, state and local agencies.

Executive Summary

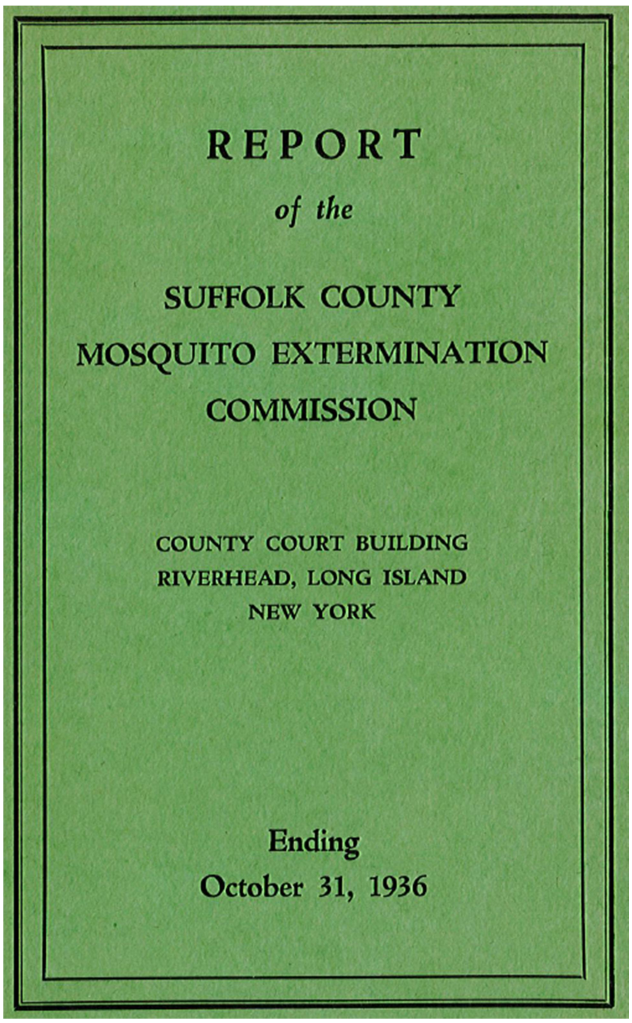
The Suffolk County Department of Public Works – Vector Control Division seeks to control mosquitoes and ticks of public health importance using integrated management techniques in an environmentally sensitive manner. Protection of Suffolk County resident and visitor's health who appreciate our picturesque towns and villages is carried out using best practices which are least impactful to the environment. This report reviews SCVC accomplishments for 2023 and presents its operational plans for 2024.

Using an integrated holistic approach need not only incorporate control or 'spraying' of the insect; but an understanding of the insect's life cycle and when and how to best to target the pest. The components of a successful integrated pest management (IPM) plan include biology of the species and its habitat, population surveillance and various control strategies using best practices during each stage of the insect's development. SCVC continues to monitor its control program and adopt new materials and techniques that best control the pest species in an environmentally judicious way.

The 2024 Vector Control Plan of Work has been developed to give the reader an improved understanding of the overall Suffolk County mosquito and tick control program. The Plan includes a summary of the 2023 season and issues of discussion that deserve mention. In addition, the 2024 Plan of Work will address future program goals during the upcoming year.

Background

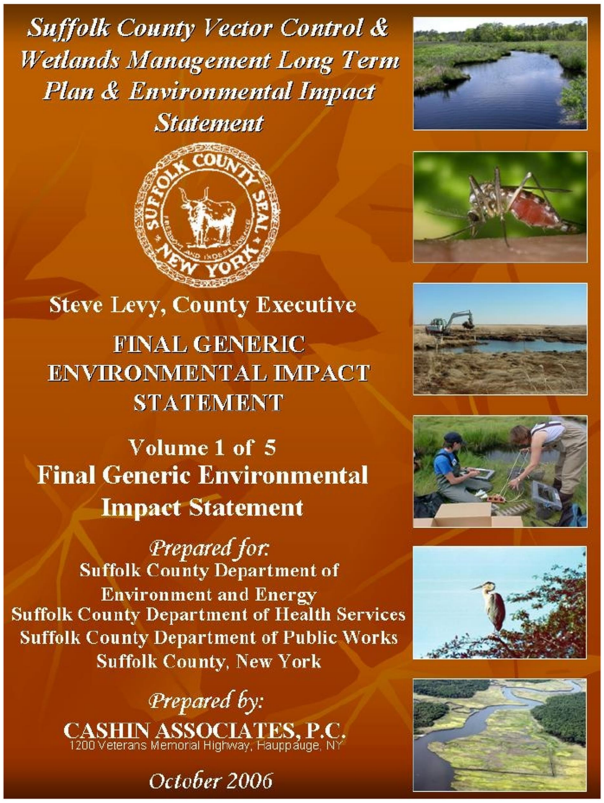
Suffolk County has a long history of mosquito control efforts that first began under the United States Department of Agriculture (USDA) in 1900 with experimental projects for malaria and salt marsh mosquito control. Additional control efforts were often undertaken by owners of large estates and resorts located along the coastline seeking control of salt marsh mosquitoes through private ditch construction. Demand for a structured mosquito control program grew in Suffolk as effective levels of mosquito control were seen in Nassau County, New York City and New Jersey through both wetland filling and the ditching of marshes. In 1933, a countywide mosquito control program began under the Suffolk County Emergency Work Relief Bureau, which provided jobs during the Great Depression. The Suffolk County Mosquito Extermination Commission was later created in 1934 to unite the individual town and private mosquito control efforts under a central agency. A significant increase in mosquito control efforts was further funded under the Federal Works Project Administration (WPA) in 1937 employing over 650 workers to assist the Suffolk County Mosquito Extermination Commission. It was during the years of 1933-1938 that the majority of our 9.5 million feet of mosquito ditches were created throughout Suffolk through these agencies. Mosquito control continued in Suffolk County through the Mosquito Control Commission from 1934 to 1974. The Commission consisted of the Mosquito Control Superintendent, a Board of Directors and included one representative from the Suffolk County townships through the Chair of the Board of Supervisors, as an ex-officio member of the Commission.



In 1974, the Suffolk County Charter was amended to transfer the mosquito control functions and authority from the Mosquito Control Commission to the Suffolk County Department of Health Services, Division of Public Health, Bureau of Vector Control. During 1992, due to budget deficits, the county legislature transferred Vector Control from Health Services to the Department of Public Works, Division of Vector Control where the program continues to reside today.

Annual Plan of Work Requirements

The Suffolk County Charter and New York State law requires an annual Vector Control plan of work for the succeeding year be submitted by resolution for legislative approval each year. This Plan of Work has been prepared pursuant to and in compliance with the Vector Control and Wetlands Management Long Term Plan and Generic Environmental Impact Statement (the Long Term Plan). The Long Term Plan was approved by the County Legislature as Resolution 285-2007 on March 20, 2007 and signed by the County Executive on March 22, 2007. The 2024 Annual Plan of Work is therefore governed by State Environmental Quality Review Act (SEQRA) Regulation 617.10(d)(1) which provides the following: "When a final generic EIS has been filed under this part (1) no further SEQR compliance is required if a subsequent proposed action will be carried out in conformance with the conditions and thresholds established for such actions in the generic EIS or its findings statement." This issue is also discussed in the Findings, appended hereto, pages 7 and 58. The 2015 Plan of Work added the use of a new active ingredient, prallethrin, which required a modification of the Long Term Plan. In accordance with the Findings, a SEQR review of prallethrin was conducted in order to allow the use of the new active ingredient. This review was completed with the issuance of a Negative Declaration as CEQ Resolution 34-2014 and the modification of the Long Term Plan approved by the Legislature as Resolution 706-2014.



This Annual Plan complies with the reporting requirements in Executive Order 15-2007 (Suffolk County Vector Control Pesticide Management Committee) and Resolution 285-2007 (which adopted the Findings Statement for the Long-Term Plan). The reporting requirements of Resolution 285-2007 are satisfied within this Annual Plan, and the Pesticide Management Committee submits a report to CEQ independently to satisfy Executive Order 15-2007.

Mosquito Control - IPM

The Vector Control Division employs an integrated control program also referred to as integrated pest management or IPM. Control measures are employed in a hierarchical manner that emphasizes prevention of the pest species and is guided by an active surveillance program to ensure that control measures are only directed to address a clear need. Control proceeds from long-term, environmentally sound measures such as wetland management, to use of biological controls, use of highly specific larvicides, and only incorporates chemical control for adulticiding if other measures prove to be either insufficient or not feasible. This integrated approach is recognized as the most effective and environmentally sound manner in which to conduct a mosquito control program.

Because mosquitoes are of high public health importance, the Division works closely with Suffolk County Health Services Arthropod Borne Disease Laboratory (ABDL). The ABDL concentrates its efforts on surveillance for mosquito-borne pathogens, primarily the arboviruses West Nile Virus (WNV), Zika and Eastern Equine Encephalitis (EEE). The Vector Control Division conducts laboratory work that concentrates on estimating populations of mosquito adults and larvae identification. The Division also conducts scientific work related to special projects designed to improve the control program and to evaluate the impacts of wetlands management. The results of this surveillance are used to guide and evaluate the Division's ongoing mosquito control work.

During times of a declared public health threat, the Division comes under the operational control of SCDHS for mosquito control operations. However, these declarations are infrequent and are issued through the New York State Health Commissioner as was the case in 2019 with the findings of EEE virus in Manorville.

The New York State Department of Health (NYSDOH) provides important support to the program by analyzing mosquito samples for pathogens, providing technical advice and guidelines and determining when a public health threat declaration is required. NYSDOH also provides significant assistance with public education, as well as financial aid for vector surveillance and control. Because mosquito control involves work in environmentally sensitive areas and the use of pesticides, environmental compliance and protection are important components of the program. The Division is heavily regulated and subject to inspection under a series of New York State Department of Environmental Conservation (DEC) permits, as well as regulations pertaining to the use of pesticides and licensing of applicators. Close contact is maintained with DEC, United States Fish and Wildlife Services (USFWS), EPA and other agencies throughout the year to ensure that all work is conducted to a high environmental standard.

2023 Climate Summary and Impacts to Mosquito Populations

Climate can impact mosquito numbers in vast ways. From a light summer rain storm that fills containers and causes an emergence of backyard mosquitoes to a hurricane that floods marshes and forests that can result in massive floodwater mosquito emergences. Warm, dry summers can result in WNV ramping up with spillover to humans, while wet cool spring weather may favor swamp dwelling mosquitoes and result in EEE findings. Each year is unique, much like the winter snow storm events, with precise planning for the coming mosquito season near impossible. An example could be an isolated storm in one part of Long Island may never impact other areas, but the lasting effects of that rain event may result in mosquitoes in that community for several weeks. Each year the Vector Control program can only prepare for a typical or average mosquito season and must respond accordingly as the season progresses.

The summer of 2023 was again particularly dry, with Suffolk County under a drought watch (Fig 1). The hot and dry summer was punctuated almost weekly with a quick intense rain event. The storm rainfall events would often measure between 1 to 4 inches within a few short hours, followed by several days of continued hot dry weather. The summer of 2023 was also an El Nino year, which generally presents as weather extremes across the world. While El Nino generally impacts New York less than other regions of the globe, it does tend to produce severe storm events; especially across the southern United States. This may have led to our summer drought conditions and the weekly intense rain events that impacted Suffolk.

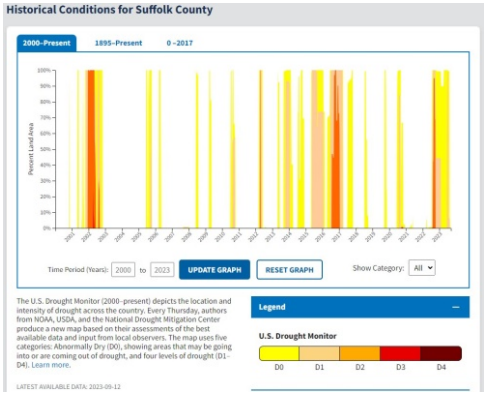


Figure 1. Drought.gov NY Suffolk 2000-2023

Long-term trends for freshwater swamps showed that they remained at or below normal levels during 2023, which resulted in reduced breeding potential for the *Culiseta melanura* mosquito that can carry EEE. USGS water level data for Manorville (Fig 2) shows a continued drop in groundwater from the 2019 highest levels, which coincided with our 2019 EEE virus findings in the Manorville area.

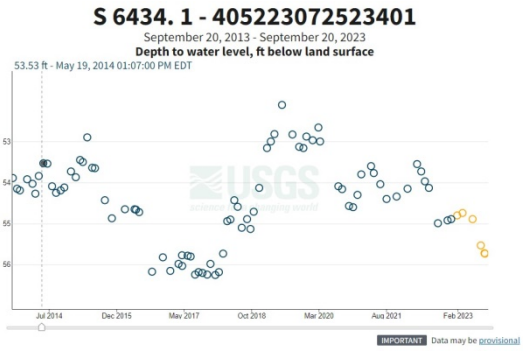


Figure 2. Waterdata.usgs.gov Manorville 2013-2023

Salt marsh mosquito numbers in Suffolk returned to moderate levels in only a few locations during 2023, but overall remained low. The highest mosquito numbers were seen in the Mastic Beach/South Shirley communities (Fig. 3) and Napeague/Beach Hampton in Amagansett. These salt marsh mosquito populations tracked closely to full and new moon tides, coupled with intense rain events. Additionally, the Fire Island breach at Old Inlet in Shirley was substantially closed this summer and may have had impacts to tidal exchange and mosquito development in the surrounding area.

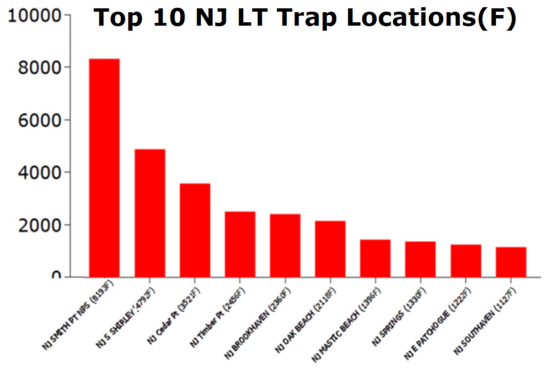


Figure 3. Top 10 NJ Mosquito Traps (2023)

Mosquito-Borne Disease Surveillance and Control

The Suffolk County Health Department's Arthropod Borne Disease Lab (ABDL) conducts surveillance for mosquito-borne viruses that pose a risk to human health. Activities performed include mosquito trapping and species identification for testing of mosquitoes and birds for disease, determining local areas of high risk, and providing surveillance information to assist SCVC in making control decisions. Efforts focus on WNV and EEE, which are the most common mosquito-borne viruses and pose the greatest public health risk in Suffolk County. Mosquitoes are also monitored for Jamestown Canyon, malaria, Zika and introductions of new mosquito-borne diseases.

West Nile

Virus isolations of what eventually was determined to be West Nile virus were first identified in NYC during the summer of 1999. Shortly after NYC's findings of WNV, including several human cases and deaths, Suffolk County also began to find isolations in mosquitoes and human cases of the disease. Virus isolations of mosquitoes carrying West Nile virus, reports of dead birds and human cases of WNV, has become an annual part of Suffolk County's Vector Control program. Vector Control in consultation with Suffolk County and NYS Health Departments reviews each year's virus isolations and on a weekly basis reviews risk to human health. The first years of WNV found clusters of mosquito isolations and human cases, but over the last several years WNV isolations and human cases have become more dispersed and haven't clustered in 'hot spots'.

Prevention is the key component to the limiting the number of human cases of WNV. Public education and larval source reduction or elimination of breeding sites is key to reducing risk. In addition, early larvicide of historic WNV breeding sites such as catch basins in high risk areas, and treatment of abandoned swimming pools and recharge basins/sumps help limit the number of *Culex* mosquitoes that amplify the virus (Fig 4). A major part of breeding source reduction involves community outreach and education to engage the help of the public. Preventing the mosquito larvae from emerging into adults is the easiest and most environmentally-sound way to reduce the number of mosquitoes that may transmit West Nile virus in Suffolk County. Larval habitats or breeding sources for WNV include stagnant water in artificial and natural containers: tires, birdbaths, tin cans,

clogged gutters, puddles, pot holes, tree holes and to a more limited extent marshlands and other wetland habitats.

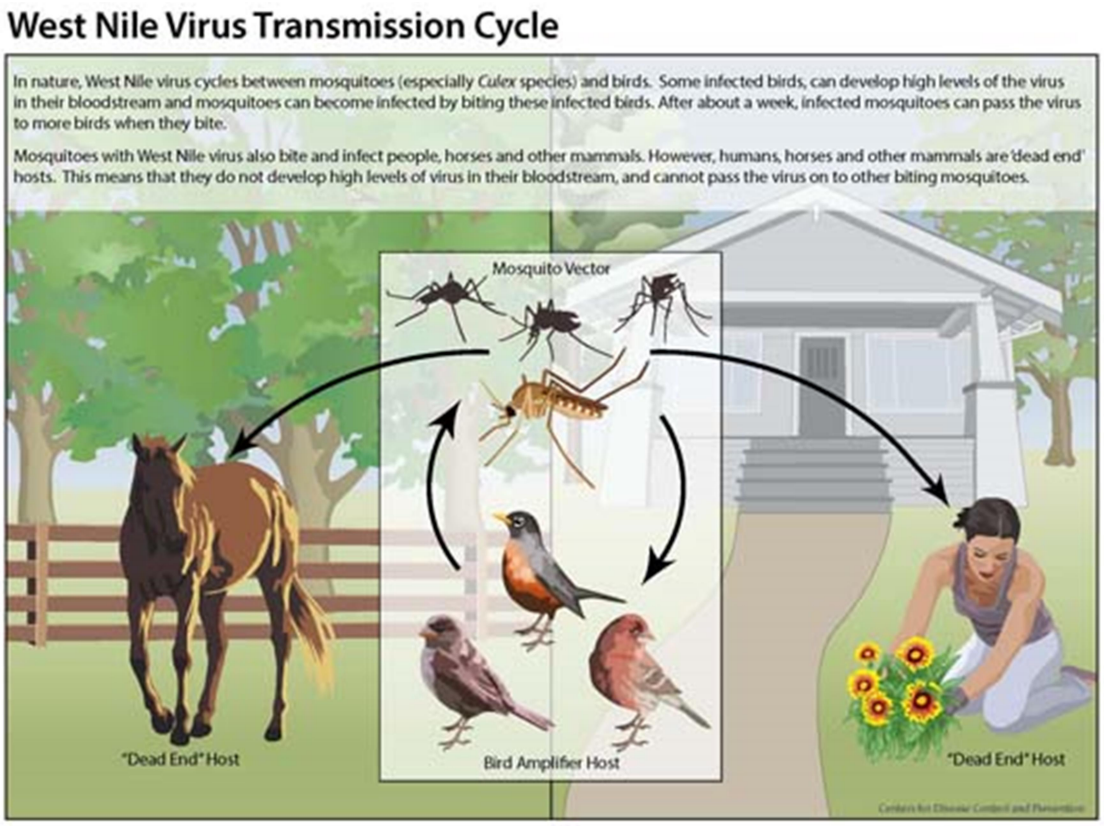


Figure 4. West Nile Transmission Cycle - CDC

The need for responding to a Health Threat is determined under the New York State Department of Health West Nile Virus Response Plan and the County's Zika Action Plan, adapted for local conditions by staff experts at Vector and Health Services. Because of the persistent presence of WNV in the County, the County perpetually begins each year in Risk Category 2. The New York State Department of Health has determined that there is an ongoing threat to the public health from West Nile Virus, and no longer declares new health threats each year. The determination of when the threat of west Nile rises to the level that requires adulticiding is made by the County Vector Control staff in consultation with the Health Commissioner and ABDL staff. As additional pathogenes including EEE, Zika, Dengue, Chikugunya viruses and malaria become established in the US; the CDC, NYS Health and Suffolk continually reevalute the risk to County residents. Currently, only travel related cases of Zika, malaria, Chikungunya and Dengue have been repoted in Suffolk County, but Health ABDL continues to monitor mosquitoes that have shown competence to carry these diseases. As of October 20, 2023 there have been four confirmed human cases of WNV infection in Suffolk County, with all cases reported to be recovering from the disease. Suspect human WNV cases can take several weeks to be lab confirmed, but data suggests that 2023 will be regarded as a moderate/low WNV risk year.

The need for adulticiding in response to WNV varies greatly from year to year. An analysis of Suffolk County's WNV history during the years 2000-2023 indicates that most years, (14 of 23) the number of human cases of WNV was low, 0-4 cases. Under such conditions, the WNV human transmisson risk level is low, even when WNV is found in the County. In these low risk years, determining exactly where and when to adulticide is nearly impossible with limited data. As a result, in low years, area wide adulticiding is usually not warranted due to the difficulty in delinating specific areas to target. High risk years are caused largely by environmental conditions favorable to virus amplification in birds and mosquitoes, such as a warm spring and a hot dry summer weather. These conditions manifest themselves in late June and early July through higher than normal numbers of positive mosquito samples and calculated infection rates.

WNV history also demonstrates that, in years when WNV activity is higher than normal, human cases are more likely to occur in certain parts of the County than other areas. In years with early indicators of high risk, adulticiding targeted to these high risk areas can measurably reduce the risk of human transmission and is therefore warranted. When a high risk year is identified, these WNV applications generally take place in late July and August during peak human transmission. Responding to early indications of high risk is important, because adulticiding should occur before peak human transmisson occurs in the first 2-3 weeks of August. Waiting to see transmission results in actual human cases is not appropriate because by the time cases are detected, transmission has been ongoing for several weeks and it may be too late to prevent further transmission. Whenever a virus isolation or human case is identified, Vector Control crews are sent to scout the surrounding area and treat any locations of standing water, including catch basins and recharge basins/sumps for mosquito larvae.

As indicators of risk of transmisson to humans accumulate, Vector Control and Health determine when control measures are best suited to the situation and which areas should be targeted for maximum benefit. The Commissioner of the SCDHS generally makes the final determination of the need for adult control in reponse to pathogens if a public health threat is declared. This strategy is consistent with the goal in the Findings to reduce the use of pesticides by a targeted tiered approach.

To ensure adulticides are used only when there is a clear need and a likely benefit, the criteria for conducting an adulticide treatment will include:

1. Evidence of high numbers of mosquitoes biting residents and visitors (Vector Control):

- Service requests from public - mapped to determine extent of problem.
- Requests from community leaders, elected officials.
- New Jersey trap counts higher than generally found for area in question (at least 25 females of human-biting species per night).
- Centers for Disease Control (CDC) portable light trap counts of 100 or more.
- Confirmatory crew reports from the problem area or adjacent larval habitat, with landing rates of over one biting mosquito per minute over a five minute period.

2. Higher than normal risk of human disease transmission that can be reduced by adulticiding (Health Threat):

- Indications of a higher than normal year for WNV activity County-wide as determined by such measures as infection rates and/or the number or proportion of positive mosquito

samples, especially by late July or early August. In a year with normal or below normal levels of WNV activity, adulticiding is generally not indicated.

- In a high risk year, adulticiding may be warranted when there are indications of higher than normal levels of WNV risk (such as the number of positive mosquito samples, infection rates, vector species populations and history of human transmission) in particular areas. Adulticiding priority will be given to those parts of the County where WNV cases have occurred in multiple years and at high densities compared to the rest of the County.
- Malaria, Zika, Dengue and other mosquito-borne disease responses will occur when positive mosquitoes are found in traps or local transmission by mosquitoes is suspected due to aquired cases without travel history.
- Adulticiding will be strongly considered if EEE is detected during July, August or September when human transmission is most likely.
- Adulticiding in reponse to other pathogens (such as Jamestown Canyon, dengue, chikungunya, malaria or other emerging pathogens) will be considered on a case-by case basis based on the vector ecology of the pathogen involved.

3. Control is technically and environmentally feasible:

- A target area can be clearly defined based on geographic features and the distribution of vector species and other risk factors.
- Weather conditions are predicted to be suitable for ULV application when mosquitoes are active. Aerial applications in response to WNV are particularly dependent on weather conditions, and near-ideal conditions of low wind combined with high temperatures and humidity are needed for truly effective results.
- The road network is adequate and appropriate when truck applications are considered.
- Legal restrictions on the treatment of wetlands, open water buffers, and no-spray list members in the treatment zone will not create untreated areas that would prevent adequate coverage to ensure treatment efficacy.
- There are no issues regarding listed or special concern species in the treatment area.
- Meeting label restrictions for selected compounds will not compromise expected treatment efficacy.

4. Likely persistence or worsening of problem without intervention:

- Considerations regarding the history of the area, such as the identification of a chronic problem area for biting mosquitoes or a history of virus transmission.
- Seasonal cycles of pathogen activity, such as whether or not the treatment is in time to prevent WNV transmission or whether it is too late and most transmission has already occurred.
- Determination if the problem will spread beyond the currently affected area absent intervention, based on the life history and habits of the species involved.
- Crew reports from adjacent larval habitats suggest adults will soon move into populated areas.
- Life history factors of mosquitoes present – i.e., if a brooded species is involved, determining if the brood is young or is naturally declining.
- Weather factors, in that cool weather generally alleviates immediate problems, but warm weather and/or the onset of peak viral seasons exacerbate concerns.

- Determining, if the decision is delayed, will later conditions prevent treatment at that time or not. Conversely, adverse weather conditions might reduce the threat of disease transmission.

Criteria 1 or 2 are necessary thresholds which should be met prior to a treatment being considered. While criteria 3 and 4 are factors that would determine the extent of the treatment or capability to meet the the goals of the control plan. Treatment will not occur unless criteria 1 or 2 are satisfied through a combination of surveillance indicators, although not all surveillance techniques may be feasible in every setting and situation. The County is not aware of any new data, studies or reports which contravene the research, reports and Findings of the Long Term Plan with respect to adulticide treatment guidelines or thresholds. Therefore, those Findings remain valid and guide this Annual Work Plan.

Some key recommendations for preventing WN virus in humans include:

- People, especially those 50 and older or those with underlying health conditions, should take special care to prevent WN virus because they are more susceptible to severe WN virus symptoms
- Know the symptoms of diseases to receive early treatment
- If outside at dusk or dawn, or if mosquitoes are biting during the day, wear long pants, long-sleeved shirts and socks
- Consider the use of an EPA and DEC approved insect repellent containing: DEET, picaridin, IR3535, 2-undecanone or oil of lemon eucalyptus according to the label's directions
- Make sure doors and windows have tight-fitting screens. Repair or replace screens that have tears or holes
- Reduce the number of mosquitoes in your area by getting rid of containers with standing water that provide breeding places for the mosquitoes.

The CDC encourages surveillance programs to routinely incorporate a more informative index of relative virus activity, with the virus infection rate mosquito-based evaluation of local virus activity patterns. At the county level or below, weekly tracking of mosquito minimum infection rate (MIR) can provide important predictive indicators of transmission activity levels associated with elevated human risk. The graph below (Fig. 5) shows the 2010-2021 WNV MIR for Suffolk County [2022-23 data not available for this report]. The 2023 season tracked as an average year for human West Nile cases, with four cases reported by Suffolk County and 99 mosquito pool isolations. 2010 and 2012 were very high risk years for WNV due to the early findings, large number of mosquito positive isolations and the high number of reported human cases.

Disease Risk – MIR based on the number of WNV isolations each [CDC] week

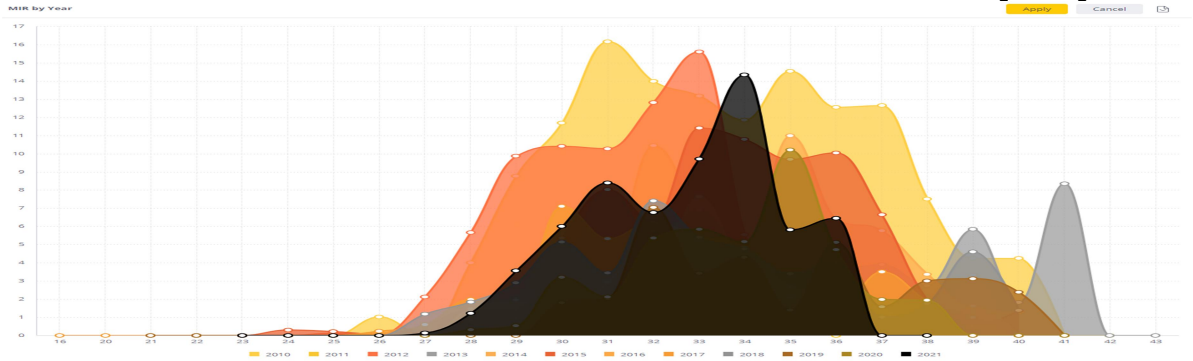


Figure 5. SC Health ABDL (2022-23 data not available)

Eastern Equine Encephalitis

Eastern equine encephalitis (EEE) virus is transmitted by a mosquito bite and that can cause severe infections (encephalitis) in humans with approximately a 30% mortality rate. Most at risk are children, especially those under age 15. The CDC states that symptoms of EEE infection (EEE, involving encephalitis, an inflammation of the brain) begin with the sudden onset of headache, high fever, chills, and vomiting. The illness may then progress into disorientation, seizures, and coma. Approximately a third of patients who develop EEE die, and many of those who survive have mild to severe permanent brain damage. In 2019 the EEE virus was again found in mosquitoes from the Manorville/Calverton area of Suffolk County in two traps near red maple swamps. This area is exceptionally conducive to the main mosquito that carries EEE - *Culiseta melanura* and the area has a long history of EEE virus isolations. This area was historically cranberry bogs with impoundments to control water levels adjacent to the Peconic River. The old cranberry bogs have been displaced by the red maple swamps with the flooded root crypts the *Culiseta* mosquito inhabits (Fig. 6).

No EEE mosquito pools, human or horse cases have been reported in 2023 for Suffolk County.

Figure 6. Culiseta melanura Red Maple Swamp Habitat for EEE

Jamestown Canyon

Jamestown Canyon virus is spread to people by infected mosquitoes and can result in neuroinvasive disease. Fever, headache, and fatigue are common symptoms with Jamestown Canyon virus disease. Although rare, Jamestown Canyon virus can cause severe disease, including encephalitis (inflammation of the brain) (CDC.Gov). Jamestown Canyon virus was found in an *Aedes cantator* pool of mosquitoes from Sayville in July. This virus has been previously found in Suffolk County in 2022, 2017 and 2008. No human cases for this disease have been reported in Suffolk County.

Mosquito-borne Viruses and Species Monitoring

There have been 52 distinct species (see list page 48) of mosquitoes documented in Suffolk County, with each unique species having its own habitat requirements and disease transmission potential. Staff in 2022 confirmed a new species for Suffolk County, *Aedes tormentor*. While this species is generally found in the southern United States, its range has expanded north in recent years as confirmed with recent findings in NJ.

The table below shows some of the most common mosquito species in Suffolk County and the potential diseases they can transmit. Concern mounts for human health risk when species habitats and disease potential overlap.

Such is the case with EEE where freshwater swamps are the most likely locations for virus amplification and transmission to occur. If the swamp is in close proximity to salt marsh mosquitoes, the disease risk to local residents increases significantly due to crossover of the virus to the more aggressive human biting species with greater flight ranges. This list only covers some of the most common diseases found locally, with new introductions of mosquitoes and diseases occurring frequently through globalization and rapid travel to previously isolated regions of the world. The following are just a few of the known arthropod-borne diseases with potential to spread into the United States and/or Suffolk County: Dengue, Malaria, Zika, Yellow Fever, Rift Valley, Murray Valley, Chikungunya, Japanese and Western Equine Encephalitis (Table 1).

Some common mosquito species in Suffolk County and the diseases they can carry and potentially transmit locally:

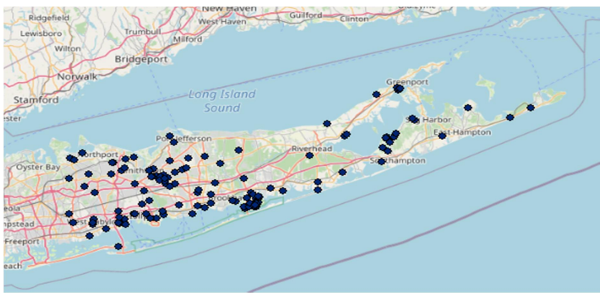
Scientific Name / Common Name	Diseases Transmitted	Habitat
Aedes albopictus - Asian Tiger mosquito (ATM)	*CHIK, ZIKA, WNV*	Container, Tarp, Tire
Aedes canadensis Woodland pool mosquito	*EEE, JCV, LAC, WNV*	Swamps
Aedes sollicitans Eastern salt marsh mosquito	*EEE, DHW, WNV*	Salt marsh
Aedes triseriatus Eastern tree hole mosquito	*LAC, WNV*	Treehole
Aedes vexans Common floodwater mosquito	*WNV, EEE, DHW*	Woodland puddles
Anopheles mosquito species	*MAL, WNV*	Pond edge, Streams
Coquillettidia perturbans Cattail mosquito	*EEE, WNV*	Ponds
Culex pipiens Northern house mosquito	*WNV, EEE, SLE, DHW*	Containers, Catch Basin
Culex restuans	*WNV, EEE*	Various freshwater
Culex salinarius Salt-marsh *Culex*	*EEE, WNV, SLE*	Brackish swamps
Culiseta melanura	*EEE, WNV*	Red maple swamp

CHK – Chikungunya	WNV – West Nile virus
DHW – Dog Heartworms	ZIKA – Zika virus
EEE - Eastern equine encephalitis	SLE – Saint Louis encephalitis
JCV – Jamestown Canyon virus	MAL – Malaria
LAC – La Crosse encephalitis	

Table 1

Service Requests:

Residents and visitors can report mosquito issues directly to Vector Control. Request can include notifying us of high numbers of adult mosquitoes, reporting a location of standing water for breeding, catch basin or recharge basin/sump check, reporting abandoned swimming pools and for drainage issues that impact mosquito breeding. Service requests are completed as promptly as possible, usually in under a week depending on the volume of requests, staffing and weather conditions. To report an issue, residents can call the office at (631) 852-4270 Monday through Friday from 8am to 3:30pm, dial 311, send an e-mail to SCVector@SuffolkCountyNY.Gov or via the web: https://dpw.suffolkcountyny.gov/vectorcomplaint/



The service request information is logged into the database and is sent to the field crews to investigate the issue. Each year we track the distribution of service request looking for clusters of activity. Often these areas have impacts from local marshes or a stream blockage that requires maintenance to reduce mosquto activity for the following season. Service requests in 2023 were up from 2022 for most issues. For 2023, there were 898 calls for mosquito control issues compared to 568 in 2022, an increase of 37%. Increase in call volume was primarily related to salt marsh mosquito requests for spraying of the Mastic Beach/Shirley and Amagansett communities.

Public Education:

Vector Control staff continue to give presentations to community associations and commercial pest control applicators on mosquito and tick issues including the expanding Asian Tiger mosquito and tick surveillance and control. Education of homeowners also occurs when field crews conduct inspections of private property advising residents on steps they can take around their home to reduce mosquito and tick encounters (Fig 7). If no one is home during an inspection, crews will leave an educational flyer on mosquito control to help inform residents. Health Services staff also holds informative meetings on mosquito and tick issues, post to social media and updates the County website with information and findings on mosquito borne diseases, including steps homeowners can take and updating postings for mosquito spray events. E-mail and web service requests sent to us also have an automatic e-mail response informing the sender of steps they can take to combat mosquitoes around their home.

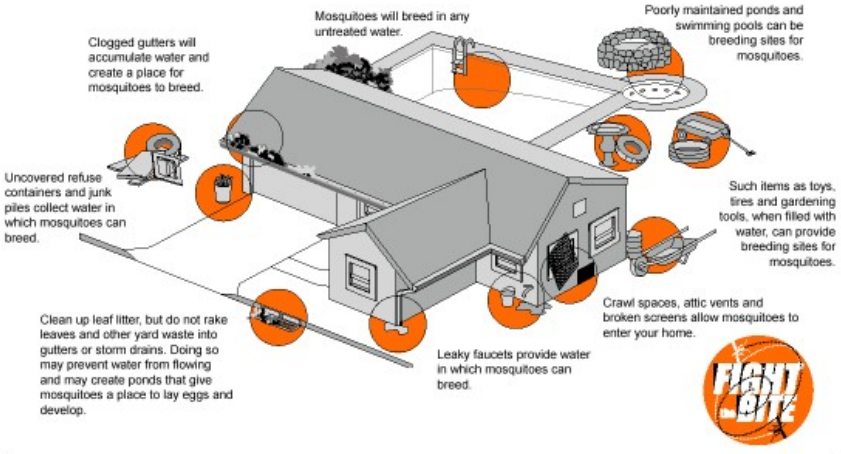


Figure 7. Potential mosquito breeding locations around your home

Surveillance

Spring tides and exceptional rainfall events are key factors driving floodwater mosquito populations and need to be understood to plan successful control. Spring tides occur around full and new moon events and can cause tidal flooding of salt marshes. These events often flood the upper fringe marsh where salt marsh mosquitoes are most common. Storm events with excessive precipitation/rain are also a trigger for freshwater flood mosquitoes. Low depressions in the forest floor can hold eggs dormant for long periods of time between rain events that trigger the eggs to hatch. These floodwater species can be quite aggressive but generally do not travel far from their breeding locations so the impact is more localized compared to salt marsh emergences. Most freshwater floodwater mosquitoes can carry several diseases of public health importance, so monitoring and control of these species is also of concern to Vector Control crews.

Adult Mosquito Population Monitoring:

Of the 52 species of mosquitoes in Suffolk County, only a limited number cause issues with disease transmission or generate calls for mosquito control services to Vector Control. Without exception, the salt marsh mosquitoes are the most aggressive and prolific species in generating request for spraying to control biting mosquitoes. While these mosquitoes can be a considerable nuisance, they also can carry risk of disease transmission to humans and heart worm parasites to pets. Three salt marsh mosquito species made up 67% of the adult mosquitoes collected in our NJ type light traps located throughout Suffolk in 2023. The remaining 33% of adult mosquitoes consisted of 24 species including freshwater/swamp, container and treehole breeding mosquitoes.

Aedes sollicitans: This mosquito species is usually of greatest turmoil to residents of coastal regions of Suffolk County. This aggressive species breeds prolifically in the upper reaches of salt marshes and can travel several miles seeking out a blood meal from an animal or human. A small salt marsh can produce millions of these mosquitoes, generally appearing 7-10 days after a lunar tide (full or new moon) event. Of our local waterbodies, the Great South Bay produces the majority of the *A. sollicitans* mosquitoes due to low tidal amplitude, causing puddles/pannes on the salt marsh where this species lays its eggs. Eggs that are laid in the marsh by the female mosquito can lay dormant for weeks, months or even years awaiting the next flood tide event to generate a new hatch. The aerial larvicide program in Suffolk County targets this species due to large acreage tracks of salt marshes where this mosquito lives. The following graph shows the 2023 *Aedes sollicitans* weekly population counts as compared to the 5 year average (Fig 8).

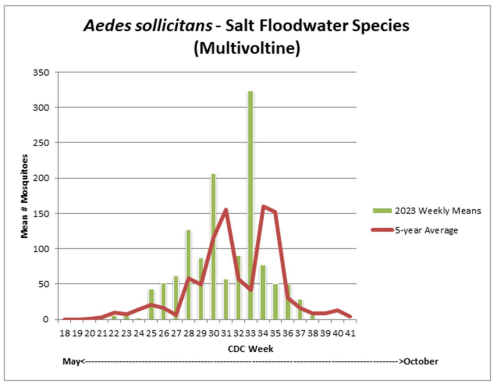


Figure 8

Culex pipiens/restuans complex: The *Culex* species of mosquitoes are container species with a strong link to West Nile virus cycling and potential transmission to humans. One of our predominant habitats for *Culex* mosquitoes includes catch basins that hold water for extended periods. Treatement of catch basins with larvicide in areas with active or historic WNV isolations and human cases is carried out in the early mosquito season in these hot spot locations. Larviciding the basins assists in breaking the WNV cycle and keeping mosquito populations low. In 2023, *Culex* numbers in our traps rose well above the 5 year average due to intense summer rain events that kept catch basins and other containers wet well into the fall (Fig 9).

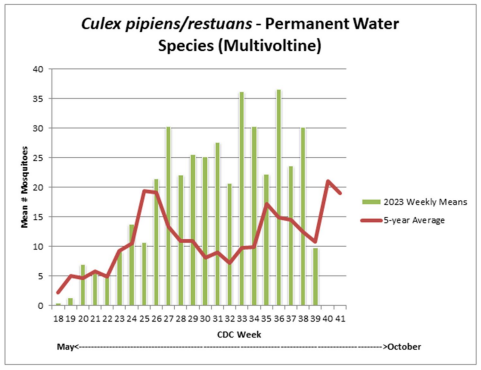


Figure 9

The Asian Tiger Mosquito (ATM) *Aedes albopictus*: is a prolific, aggressive, daytime biting mosquito that adapted rapidly to Suffolk County. This invasive Asian species can now be found throughout Suffolk County and has become a severe concern in areas that never before had to deal with mosquito issues. The ATM is a container breeder and a fierce daytime biter. The ATM usually will bite the ankles, legs and feet if not

covered. Because this species breeds in buckets, tarps, bird baths and any small water holding container, having Vector Control check every yard on a regular basis would be impossible. Instead, public education directed to homeowners is the best way to remind residents to 'Dump the water' especially after rain events. This mosquito does not travel far, typically under 300 feet from where it emerged and generally will avoid crossing open areas, including roads. Residents with ATM issues should seek out the source in their yard, or try to determine if a neighboring property is the source. The ATM season peaks late summer and they can continue their aggressive attack till the first hard frost.

Resistance Monitoring:

Pesticide resistance is of great concern, so for the past several years we have monitored resistance in several of our primary species of concern. In 2016 we began by using CDC bottle assays of our adulticide pesticides Anvil 10+10 ULV (sumithrin) and Duet (sumithrin and prallethrin) of *Aedes sollicitans, A. albopictus A. taeniorrhynchus* and *Culex pipiens* (Fig 10). We have also worked cooperatively with the Northeast Regional Center for Excellence in Vector-Borne Diseases (NEVBD) who in 2022 reported some resistance of Suffolk County mosquitoes to sumithrin. Our 2023 pesticide resistance testing results were not released to Suffolk by NEVBD in time for inclusion in this report. Synthetic pyrethroids are used in many lawn and garden pesticide formulations applied by homeowners and commercial applicators. Resistance to sumithrin, a synthetic pyrethroid, is likely based on regular contact from these lawn and garden applications to the local mosquito population. Vector Control continues to explore new control products as resistance to our control products continues to build. Unfortunately, there are few materials currently marketed for mosquito control that we could consider to replace sumithrin. Pyrethroid resistance is not only an issue here, but a world-wide concern. Pesticide researchers are looking into new classes of materials, but bringing these products to market takes many years to develop.

Figure 10

Larval Control:

All field personnel conduct larval control during the active mosquito season. Most crews conduct ground larviciding, while our heavy equipment crew also assists in helicopter larvicide applications. This component is conducted during the active mosquito season of May 1 to October 15. Larval control is required when water management has not been able to completely prevent mosquito production or is not appropriate for the site. Ground crews visit known larval habitats, check for the presence of larvae, obtain larval specimens for identification in the laboratory and will apply larvicide when required. Field crews also eliminate larval habitats by unclogging culverts, dumping or removing containers or otherwise removing standing water. While the acreage of these sites is often small, their proximity to residential areas makes them important sources. Ground crews also respond to complaints from the public. The Division's most intense efforts are directed to the major salt marshes and large wetland complexes, which

require use of the helicopter due to their substantial acreages. These large marshes are surveyed biweekly, or after extreme flood events. If larvae are discovered, a contract helicopter applies larvicide as directed by Vector Control. For salt marshes and similar habitats, either Bti (Bacillus thuringiensis israelensis), Altosid (methoprene), or a combination of materials are applied, based on larval stage, temperature, and weather conditions.

For 2023, crews perform approximately 9,943 inspections of larval sites. Checked and treat as required 6,572 catch basins in communities with a history of West Nile virus positive pools or human cases. Vector Control crews also investigated 127 abandoned swimming pools that were reported from the public and municipal agencies to be inspected by Vector staff.

Crews treated approximately 15,006 acres with the biorational larvicides: Bacillus thuringiensis israelensis (Bti), Bacillus sphaericus or methoprene. Material applied depends on mosquito stage of development, weather, coastal tides and virus findings [see table of pesticide usage on page 49 of the Plan]. Improvements to the aerial larval control program through incorporating the product VectoPrime FG, a granule with a Bti/methoprene mix allowed for better targeted application sites with reduced drift issues compared to the liquid droplet products. The granules also allow applications over upland vegetated transition zones, where tree canopy cover makes liquid applications to water below the tree canopy difficult. VectoPrime FG is also a fast acting, non-residual product that does not persist in the environment. Cost per acre is more expensive using the VectoPrime FG, but savings have been seen in the reduced need for follow-up adult control (ULV fogging) and through improved targeting of the larval breeding sites resulting in less material usage.

In 2020, VectoMax FG was also introduced to the larvicide program for freshwater locations. VectoMax FG is a combination product of Bti and *Bacillus sphaericus* two bacterial products that is best suited for semi-permanent waterbodies where potential for extended control is anticipated through natural recycling of the *B. sphaericus* bacteria. The cost of the material and high application rate make use of VectoMax ideal for remote locations where crews may have difficulty making more frequent site inspections, such as Fishers Island, Shelter Island and Fire Island. Positive reports on the products performance by the field crews supports the higher cost per acre for its continued use where required.

The equipment to be used for larval control includes various trucks for crew transportation, samplers such as dippers and mosquito traps, truck-mounted hydraulic sprayers, backpack sprayers and granular blowers, plus specially-equipped helicopters for larvicide applications on areas too large or inaccessible for ground treatment. All pesticide applications use USEPA and NYSDEC registered materials and are conducted under appropriate Article 15 Protection of Waters and Article 24 Freshwater Wetland DEC permits and in accordance with label directions and other relevant State and Federal laws.

The Division has developed technical guidelines for larval surveillance and control that determine where and when larvicides are used and what materials are best selected for a particular situation. These guidelines emphasize the use of bacterial products when possible and reserve methoprene for those situations where bacterial products alone are unlikely to be as effective. As per the Findings for the Long Term Plan and Executive order 15-2007, the Pesticide Management Committee has reported on the results of its review of literature on methoprene and potential impacts, as well as on research sponsored by the County. The Committee found no significant new concerns regarding the use of methoprene. The County is committed to implementing a Pesticide Reduction Action Plan, which will seek to further accelerate pesticide reduction. As part of this Pesticide Reduction Action Plan, the County will continue to work with technical experts to further refine protocols related to larval monitoring and larvicide usage, consistent with the Long-Term Plan and GEIS. The County is not aware of any new data, studies or reports which contravene research, reports and Findings of the Long Term Plan with respect to larval treatment guidelines or thresholds. Therefore, those Findings are still valid, and govern this Annual Plan. In 2019, the County contracted with SUNY Stony Brook researchers to undertake a pesticide literature review for the products used by the Vector Control program. This review encompassed any new findings since 2010 when the last literatre review was completed. Release of the SUNY Stony Brook methoprene literature review was completed in 2020 and included as an attachement with the 2021 annual plan. Updates to our other active ingedients are still in review, and will be released by Stony Brook researchers once finalized.

Adult Control:

Vector Control carries out adult treatment, spraying or 'fogging' when infestations are severe and widespread and/or necessary to respond to the presence of mosquito-borne pathogens. Community-wide requests for adult control increased in 2023 mainly within Mastic Beach/Shirley and Amagansett. The communities of Mastic, Mastic Beach and South Shirley that border the Fire Island National Seashore and William Floyd Estate reported increased service requests to Vector Control in 2023. While marshlands within the neighboring US Fish and Wildlife Refuge at Wertheim allow for regulated mosquito control activities under a special use permit, the National Park Service does not allow Vector Control to treat their land holdings, except under tiered conditions for virus response. This can create unique hardships on the neighboring communities to Fire Island Seashore lands due to periodic immense numbers of biting mosquitoes migrating into these areas. The extreme numbers of biting mosquitoes results in the need for repeated adult ULV spraying of adjoining residential areas. Many parts of the Mastic Beach community are also within NYSDEC mapped freshwater wetlands restricting our ability to undertake adult control treatments for residents living within areas adjacent to these wetlands. The extreme rain events over the summer kept small isolated pockets of water dispersed throughout the developed area of Amagansett/Napeague. This resulted in difficultly larviciding the many scattered marshy areas by the ground crews and led to several broods of mosquitoes impacting this coastal community. Due to the numerous mapped NYSDEC wetlands within this community, truck spraying proved ineffective due to the density of restricted areas we could not treat.

Adult control can be deemed to be necessary under two separate operational scenarios in the GEIS. One is defined as a "Vector Control" (public health nuisance) application, the other is defined as "Health Emergency" application. Vector Control adulticide applications are made to reduce excessive numbers of human biting mosquitoes that could impact public health and quality of life by their biting activities. These high populations also represent potential vectors if a pathogen is present or appears in the area. Health Emergency applications are made when an unacceptably high risk of disease transmission to humans is detected, based on the ongoing presence of pathogens in mosquitoes. In either case, pesticide use decisions are only made on the basis of scientifically-determined surveillance data.

The Long-Term Plan proposed a general reliance on resmethrin, a synthetic pyrethroid, as the primary adulticide pesticide. However, the Federal and State re-registration for resmethrin products was recently terminated by the manufacturer and this material can no longer be used for mosquito control. Sumithrin, a similar pyrethroid, was proposed by the Long Term Plan to be the primary back-up to resmethrin, and the primary pesticide for hand-held applications. Sumithrin has now become the Division's primary adulticide material. Sumithrin, like resmethrin has been found to be an effective pesticide for mosquito control, can be used for ultra-low volume (ULV) applications for truck and aerial delivery, undergoes rapid decay in the environment, and, as discussed below, has few identified non-target effects when applied as proposed under the Long-Term Plan. The Division has also begun use of Duet, with the Long Term Plan modified to include Duet and its active ingredients, sumithrin and prallethrin. Duet is similar to the Division's primary sumithrin product, Anvil, in that both products contain sumithrin and the synergist piperonyl butoxide (PBO). However, in addition to 5% sumithrin and 5% PBO, Duet also contains 1% prallethrin. This amount of prallethrin is not sufficient to control mosquitoes, but it does induce them to fly, a phenomenon known as "benign agitation". Benign agitation causes mosquitoes that are resting to fly so that they will encounter the aerosol droplets and increase the likelihood mosquitoes would be exposed to sumithrin. Duet has been shown to be particularly effective against mosquitoes that tend to rest during the optimal time of the day for aerosol treatment, that is, at night. The primary use for Duet will be against the Asian Tiger mosquito (ATM), *Aedes albopictus* and may be used for control of other active daytime species including salt marsh mosquitoes. The ATM is an introduced species that inhabits containers and tends to bite during the daytime, making it a significant biting pest that is difficult to control because it is less active at night.

A supplement to the 2020 Annual Plan of Work was requested by the Suffolk County Legislature due to concerns of Per- and polyfluoroalkyl (PFAS) found in samples of the pesticide Anvil 10+10 taken in Massachusetts. Anvil 10+10 has been the preferred adult mosquito control pesticide for Suffolk County Vector Control due to the favorable findings of the Long Term Plan compared to other alernative materials. In January, 2021 the PFAS contamination was traced by the manufacturer and US EPA to a flourinated coating used on the containers. The fluorinated treated HDPE containers have since been discontinued by the manufacturer.

Issuance of new Anvil material in PFAS-free packaging allowed Anvil 10+10 to remain the preferred adult mosquito control pesticide. Alternative pesticide products reviewed contain the

active ingredients permethrin, a synthetic pyrethroid and pyrethrin, a natural pyrethrum. All pesticides selected by Suffolk County for adult mosquito control under the Long-Term Plan are appropriately suited for ultra-low volume (ULV) treatments. The quantitative risk assessment and modeling (based on EPA guidance documents) indicates no, to little, detectable human health impacts and all have comparatively minor ecological impacts when applied according to the USEPA/NYSDEC approved label. The ecological impacts are further mitigated by the focused applications to problem areas, proper timing of applications and avoiding areas NYSDEC has identified of environmental concern. The probability model, based primarily on laboratory testing, also builds in buffers to overestimate the concentrations of pesticides.

Material actually delivered, including to aqueous environments, is overestimated by several factors, based upon testing conducted in association with Vector Control Long Term Plan/GEIS. In the Suffolk County Vector Control and Wetlands Management Long-Term Plan, two pesticide active ingredients are identified as suitable alternative materials permethrin and natural pyrethrum, pyrethrin. Alternative formulations generally will rely on the use of piperonyl butoxide (PBO) as a synergist to increase the pesticides effectiveness.

Permethrin is a widely consumed product, both for homeowner and commercial applications, increasing the risk for mosquito resistance. Natural pyrethrum products may include label clearances for use over cropland, although application to cropland is typically not required for mosquito control. Permethrin had higher ecological risks associated with its use, and also has label setback requirements that make it less practicable for use in shoreline settings.

Natural pyrethrum, generally considered an organic pesticide, did not receive as extensive a review as the synthetic pyrethroids in the quantitative risk assessment due to being an organic pesticide. Pyrethrins are natural pesticides harvested from some chrysanthemum plants (mainly Chrysanthemum cinerarnaefolium). Chemically, pyrethroids are esters of specific acids (e.g., chrysanthemic acid, halo-substituted chrysanthemic acid, 2-(4-chlorophenyl)-3-methylbutyric acid) and alcohols (e.g., allethrolone, 3-phenoxybenzyl alcohol). Pyrethrum does show a similar risk profile to the synthetic pyrethroids. It also degrades very rapidly, giving it a margin of error with regard to potential risks. Pyrethrum label often will allow for application over crops, which is not the case for some pyrethroids. It can be considerably more expensive (as compared to other pyrethroid products), and in the past has sometimes not been readily available due to its reliance on foreign production and supply-chain issues.

The pyrethroids are synthetic pyrethrin-like materials widely used for insect control. Pyrethrins and pyrethroids both have a similar mode of action, where they work on the nerve axons by keeping open sodium channels used to propagate signals along a nerve cell. Initially, they cause nerve cells to discharge repetitively; later, they cause paralysis. These pesticides affect both the peripheral and the central nervous systems. When applied alone, pyrethroids may be swiftly detoxified by enzymes within the insect. Thus, some pests will recover unless the pesticide's effect is augmented. To delay the enzyme action so a lethal dose is accomplished for pest control, a synergist (e.g., piperonyl butoxide) is generally added to pyrethroid formulations to improve efficacy.

Natural pyrethrum extract is composed of individual pyrethrins; including pyrethrin I and pyrethrin II, cinerins and jasmolins, which are the components that have insecticidal properties. Most of the public health protection pyrethrin pesticide products available also contain a synergist, such as PBO. Pyrethrin is somewhat costly, however, and can be difficult to acquire during high demand periods. It is somewhat less toxic than the synthetic pyrethroids, and suggests that, at the concentrations it would be applied in Suffolk County, no significant increases in risks for health or ecological effects would follow from its potential use. Natural pyrethrum products have an extremely short shelf life, generally for use within one year of manufacture, which presents additional stocking and disposal issues of unused pesticide.

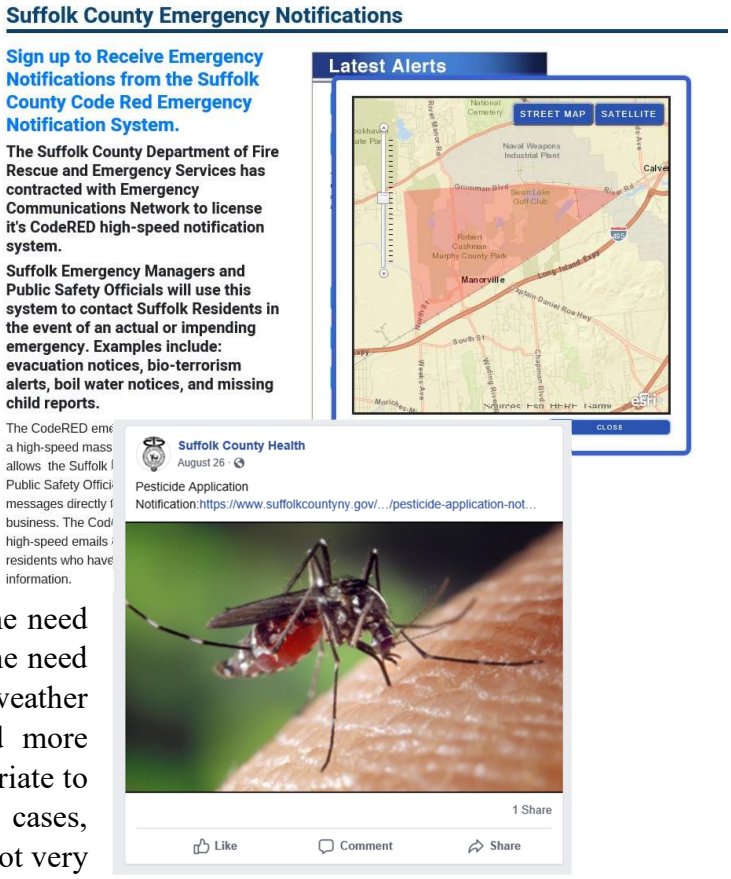
Pyrethrum formulations generally contain five percent pyrethrins with PBO at a one to five ratio. They are also applied via a ULV application. Pyrethrum can be used for resistance purposes, and over agricultural areas, if required. All pesticide product labels used by Suffolk County Vector Control, including the natural pyrethrums contain the EPA signal word "CAUTION." A potential pyrethrin based material Vector Control may consider would be EverGreen 5-25 Ground ULV (MGK), a synergized pyrethrin formulation for ULV adulticide applications. The oil based ground formulation contains 0.365 lb Pyrethrins and 1.824 lb of synergist (Piperonyl Butoxide) per gallon. EverGreen 5-25 Ground ULV is labeled for aerial and ground ULV treatment in a broad range of use sites. EverGreen 5-25 Ground ULV is approved for urban, rural, residential, agricultural areas, cropland (not certified for organic crops), wetland and recreational areas.

PBO is a derivative of piperic acid and, as discussed, is generally utilized as a chemical synergist in pyrethroid formulations. Pyrethroid products containing PBO are used to control mosquitoes in outdoor residential and recreational areas, as well as indoors to control insects such as fleas, ticks, and ants. Formulations of pyrethrins containing PBO are also used as a pediculicide to control body, head, and crab lice. PBO, in and of itself, at the concentrations modeled to result in the County from applications of PBO-containing pesticide formulations, was found by the risk assessment not to cause significant increases in risks for human health or environmental impacts. The pyrethroid/pyrethrin results of the risk assessment reported above included additive effects that may result because of PBO use as a synergist.

In addition to the pyrethroids, malathion, an organophosphate pesticide, was identified as a potential adulticide in the GEIS/Long-Term Plan. Malathion would only be considered as a last resort under very specialized conditions, such as in Zika response if a thermal fogging application was required, where emergency daytime applications were called for, or if resistance testing indicated pyrethroid applications would be ineffective for public health emergency.

All of these pesticides are US EPA and NYSDEC registered, applied at the label rates, used in the best way of achieving effective mosquito control and to avoid development of pesticide resistance. The adulticides included in this Annual Plan have been fully evaluated in the GEIS for the Long-Term Plan, and this Annual Plan is fully consistent with the attached Findings Statement. Vector Control continually reviews available pesticides and alternatives, including emerging materials and application techniques for the most environmentally suitable control methods.

PUBLIC NOTIFICATION AND THE "NO-SPRAY" REGISTRY:



In 2000, the County passed new laws to improve required public notification for adult mosquito control. As a result, there is now an increased use of the media and extensive outreach to local officials. The Health Services and Vector Control websites are used to post spray notices and maps of the treatment area. For each adulticide application, over e-mails and faxes are sent to various officials and other interested parties. Newsday and News12 sometimes will post spray schedules and maps but are not consistent in covering spraying events. Suffolk Health began posting spraying updates to social media including Facebook and X. It is important to recognize that adulticide applications are very sensitive to the weather, especially aerial applications. The need to inform the public needs to be balanced with the need to conduct operations promptly, within weather windows and before the problem spreads and more acreage needs treatment. It is usually not appropriate to provide more than 24 hours' notice in most cases, because beyond that time, weather forecasts are not very reliable. Attempts to provide more than 24-hour notice often result in aerial spray operations being announced and then cancelled. These cancellations are confusing to the public and difficult to reschedule. Despite these difficulties, the County provides 48-hour notice for aerial adulticide applications whenever possible for non-virus response.

In addition to the previous public notification procedures, the County has implemented a law, passed in 2010, requiring the use of its 'Code Red' automated calling and messaging system to provide more thorough public notice for adulticiding. In 2021, Code Red was replaced by Suffolk Fire Rescue and Emergency Services (FRES) with SuffolkAlert. The SuffolkAlert system allows automated phone calls to be placed to all landline telephones in an area designated for treatment. These messages provide basic information about the operation, such as spray hours, and refer the recipient to additional sources of information. The system ensures that nearly everyone in the area knows about the operation. Use of the SuffolkAlert system has been very successful and provides a new level of public information for the program. Residents can also register their cellphones or e-mail addresses to receive the SuffolkAlert updates through FRES.

The Division also maintains a "no-spray" registry of residences where adult mosquito control is not desired. During ground applications the application unit is shut off 150 feet prior to passing such a residence and not turned on until 150 feet after. This registry represents an effort to balance the desires of those residents who want control of adult mosquitoes with those who oppose the use of pesticides. The "no-spray" registry lists all properties not to treat. Requests included for health concerns, beekeepers registering hive locations, organic farms locations including backyard gardens, and no reason or opposed to all pesticide use.

When control is required to deal with a public health threat, the Commissioner of SCDHS can override the list. Even then, list members are contacted prior to applications in their area through the SuffolkAlert system or called directly. In addition to this legally required registry, the Division maintains on the list beekeepers and organic farms who register. Beekeepers' properties are generally avoided and beekeepers are notified via SuffolkAlert before treatments so that they can take any additional actions they may deem necessary to protect their hives. In addition, several steps are taken to avoid impacts to bees including timing of applications to the evening hours when bees are not foraging. Vector also uses mosquito control materials least likely to impact bees and through adjustment of spray equipment and technique using an ultra-low volume (ULV) droplet size that will impact mosquitoes, but not injure larger bodied insects, including bees. Certified organic farms are avoided and a buffer zone around the farm is included.

The County also provides public notification for aerial larviciding. An e-mail notice of the marshes to be treated by helicopter is sent each week to Legislators, local governments and other interested parties. In addition, a list of marshes to be treated is posted each week on the County Web site and on the Health Department's social media pages.

Mosquito Surveillance and Research:

All control mosquito operations are based on information obtained from surveillance and research. This is a cooperative effort between Vector Control staff in the Department of Public Works and the Arthropod Borne Disease Laboratory in the Department of Health Services. Knowledge of mosquito populations, species composition and arbovirus activity is used to guide and evaluate control measures. Arbovirus surveillance allows the Division, in cooperation with the County and State Health Departments, to gauge the potential for disease transmission and to take appropriate action.

New Jersey Light Trap

Mosquito population surveillance: Larval and adult mosquito surveys are analyzed each year for species abundance and location. These surveys are necessary for locating infestations, directing control efforts and evaluating the effectiveness of those efforts. The mosquito species that breed in various locations are determined from larval samples. Adult mosquitoes in residential areas are estimated from a network of approximately 20 New Jersey style light traps in fixed locations throughout the County. New Jersey style traps

provide staff with ongoing population trends (Fig 11) and are compared with service requests in a community to assist in determining the need for adult mosquito spraying. In 2023, over 27,000 mosquitoes from these traps were identified to species and counted. This tedious work is conducted by the Vector Control mosquito entomologist. Vector staff periodically use specialized mosquito traps to monitor seasonal cycles and long term trends. The introduced invasive container-breeding species *Aedes japonicus* and *Aedes albopictus* are species we periodically monitor with specialized traps as resources allow.

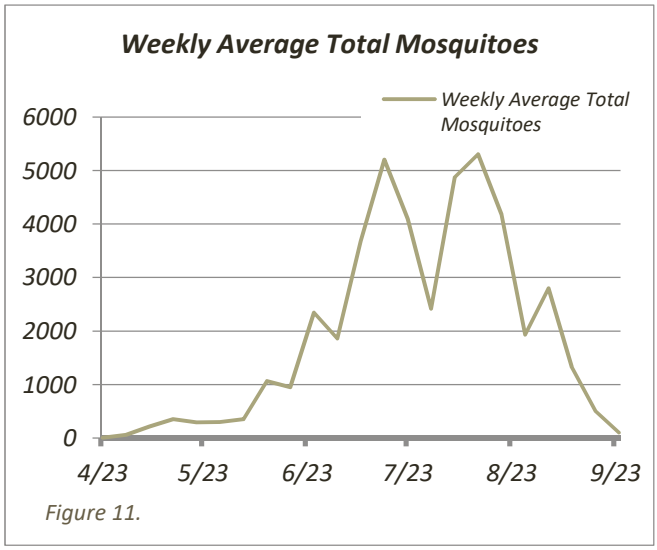


Figure 11.

Arbovirus surveillance in mosquitoes: Viral surveillance is conducted primarily by the ABDL and will be directed primarily at the main pathogens, WNV, Zika and EEE. Surveillance is conducted according to the latest CDC and State DOH guidelines, modified for Suffolk County's unique environment. To monitor virus activity, ABDL staff set CDC light traps and gravid traps on a weekly or rotating basis at various locations throughout the County. These sites are chosen based on their history of viral activity or the presence of viral indicators such as the finding of birds with WNV in the area. The ABDL collects and process approximately 50,000 live, adult mosquitoes annually for viral analysis (Fig 12). Mosquitoes collected are sorted by species, frozen, and sent to Albany for arbovirus analysis in the NY State Dept. of Health laboratory.

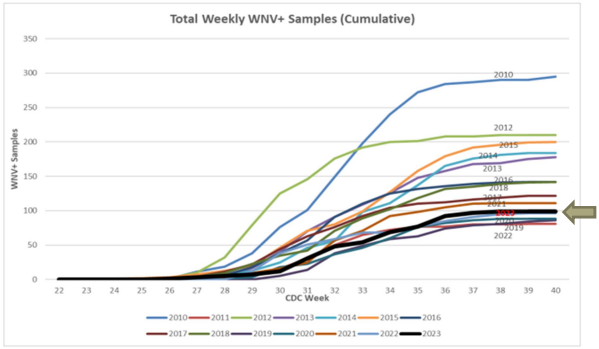


Figure 12. Total WNV Positive Mosquito Pools by Year; arrow points to 2023 (99 pools total)

Human, avian and other surveillance: SCDHS, State DOH, DEC and CDC monitor other WNV and EEE indicators such as unusual bird deaths or the number of dead birds sighted in a neighborhood. The presence of WNV-positive birds is an indicator of virus activity in an area, and ABDL picks up selected dead birds for WNV testing. ABDL conducts a rapid RNA test (the RAMP test) to check for WNV in dead birds. There are also indications that the number of dead bird sightings in an area is a surrogate indicator of risk. SCDHS and NYS also monitor hospitals, blood banks and outreach to physicians to quickly detect human cases of Zika, WNV and other emerging vector borne illnesses.

Efficacy monitoring: While the Division has always monitored the effectiveness of the control program in a variety of ways, there has been an increased effort in this area, based on trial work to develop methods conducted in 2007. In particular, trapping of adult mosquitoes before and after adulticide events is conducted using carbon dioxide baited CDC light traps, NJ traps or reviewing service request logs. In addition, indicators of virus activity before and after treatment are followed to be sure the desired effect is achieved. The number of adult mosquitoes in New Jersey type traps compared to historic averages (Fig 13) and the number of service requests in a community are key indicators of the overall success of the larval control program.

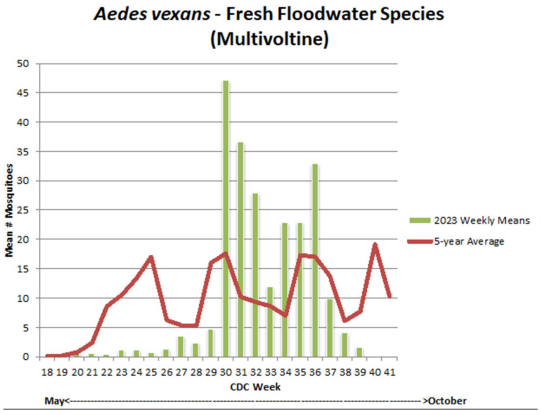


Figure 13

Special surveys and field investigations: Vector Control staff conduct special surveys to determine the source of mosquito problems when these turn up in places where they are not expected. Special surveys of problems that appear early in a season can allow larval crews to prevent further trouble through the summer. Given the somewhat unpredictable ways mosquitoes can cause problems for residents of and visitors to the County, it is important that the Division retain a flexible ability to investigate issues as they are identified.

Support for Wetlands Restoration/Stewardship activities: Vector Control continues to provide support for monitoring and other investigations related several wetland restoration activities. In particular, Division staff assist in the ongoing monitoring of the Integrated Marsh Management (IMM) projects at Wertheim and Seatuck National Wildlife Refuges. In addition, the Division will assist Wetlands Stewardship Programs in identifying and evaluating prospective sites for future IMM projects, particularly those that will help meet Long Term Plan goals for pesticide use reduction. With the completion of the Wetlands Stewardship Strategy and the availability of grant funding, this component of the program will continue in 2024 with grant funded restoration projects.

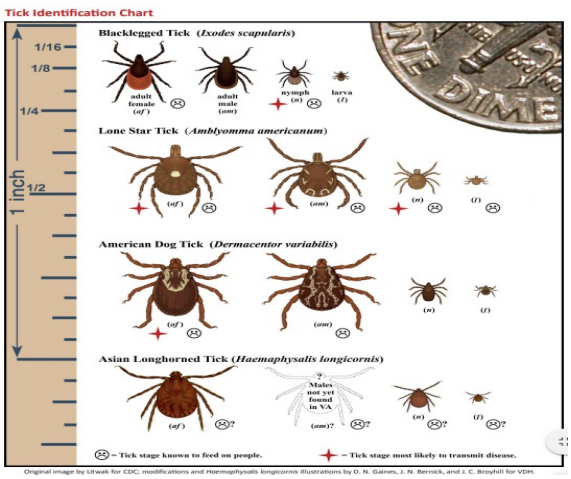
Cooperative efforts and outreach: Other provisions of the Work Plan notwithstanding, Vector Control continues to participate in research, monitoring, and demonstration projects in cooperation with other levels of government such as the State, Towns or Federal agencies such as the US Fish and Wildlife Service. These activities may be subject to separate DEC permitting and SEQRA compliance, and to CEQ and Wetlands Stewardship review as well.

Vector Control will also continue to work with the various local governments, including the cooperative effort with East Hampton Town to provide a framework to develop, plan and construct wetland restoration projects that will restore wetland functions and values, and lead to a reduction in pesticide use, while still protecting human health and quality-of-life through reduced mosquito numbers.

TICK RESEARCH SURVEILLANCE AND CONTROL:

On October 17, 2013, the County approved Resolution 797-2013 requiring this Plan of Work to include a section on the "steps being taken to reduce the incidence of tick-borne diseases in Suffolk County". Accordingly, the 2024 Plan of Work includes a section on current tick surveillance, research and control activities. These steps will continue to be focused on planning, information gathering, outreach, technical assistance, and small scale tick control trials and as such will be Type II actions under SEQRA Section 617.5 (c) (20), (21) and (27). In 2013, the Division began work under Resolution 797-2013 to determine how the County might best be able to reduce the impact of tick-borne diseases. This was a follow-up to the Tick Management Task Force (TMTF) report that was submitted to the Legislature in May of 2008 in response to Resolution 1123-2006. In addition, Resolution 132-2014 created the Tick Control Advisory Committee (TCAC) to advise Vector on tick control planning. Any large scale effort to reduce the number of ticks on a countywide landscape, such as those described by the TMTF, would have the potential for adverse impacts on the environment and would need full SEQRA review. While no large scale control efforts can be undertaken prior to an environmental review of tick control under SEQRA, and potentially an EIS tick control supplement to the plan, several interim actions are underway.

The development of a Tick Control Plan and environmental review, therefore, is a major effort that has yet to be funded. In 2015, the County took the first step and created a new tick entomologist position for tick-related surveillance activities. This full time entomologist is devoted to tick research and control and has been a major step forward in understanding the tick issues in Suffolk. Re-establishment of the TCAC under Resolution 1668-2016 is also assisting the County to develop a plan of action and identify the resources needed going forward to fully develop a County-wide environmentally sound tick control plan.



In 2024, Vector Control will continue the design phase of the County-wide tick control plan with available Capital resources. Current tick control efforts are restricted to research activities that do not require full environmental review under SEQRA. Vector is also working to improve the technical basis for control efforts and provide practical information to the various public and private entities currently undertaking localized tick control programs. These cooperative efforts can help leverage the County's limited resources through partnership and collaborative efforts, such as the Shared Services program.

Tick Seasonal Activity Surveillance

Bi-weekly site surveillance, initialized in 2015, has continued through 2023 to track seasonal activity, population density, species distribution, and environmental characteristics, which drive tick activity across the County. Collaborative surveillance with New York State Parks, which

began in 2018, has continued throughout 2023 to track the efficacy of the 4-poster programs within Connetquot River, Wildwood, Heckscher and Robert Moses State Parks. This collaboration doubled the size of the Suffolk surveillance network with no additional burden on County resources and is a great testament to the utility and cost savings that can be found when overlapping programs are able to effectively collaborate.

Since surveillance began in 2015 a clear species gradient has emerged across the County. Westerly locations consistently have greater densities of deer ticks, while lone star tick densities increase following an eastward trend. Differences in habitat, moisture consistency, and soil drainage class in the local environment help explain these trends.

Deer tick nymphs peak in early June with a slight resurgence in September when cooler temperatures return. Adult deer tick peak activity begins in November, generally once night-time temperatures are below 50°F. Weekly seasonal activity for Deer tick nymphs peaks in June while adults tend to peak in May (Fig. 14).

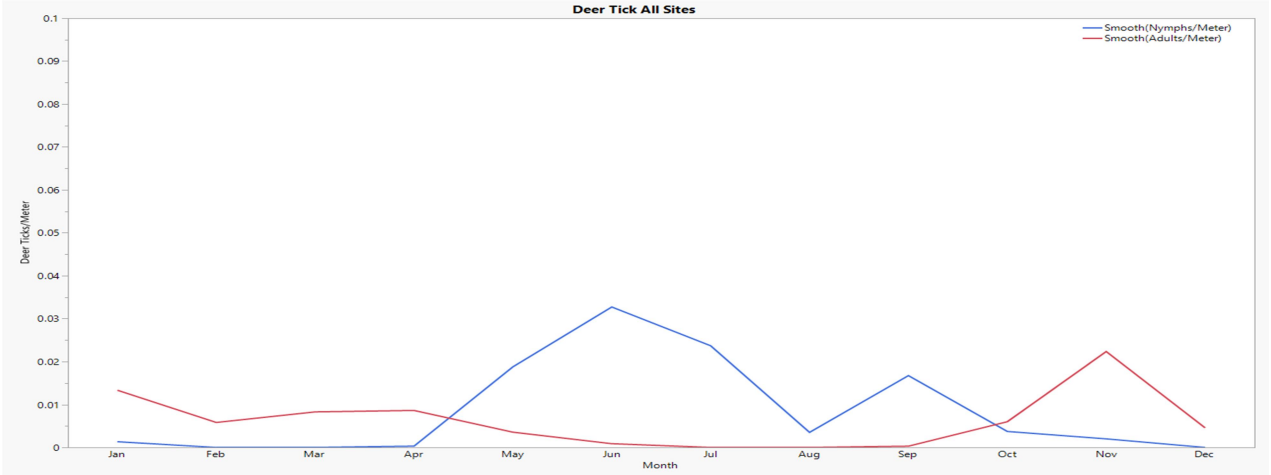


Figure 14 Lone Star and Deer Tick Seasonal Activity

Lone star tick nymph activity begins in April and peaks in early June (Fig 15). Adult activity begins in early April and rapidly peaks mid-May and generally subsides by the end of July. Compared to deer ticks the general density of lone star ticks is approximately 5 times greater for

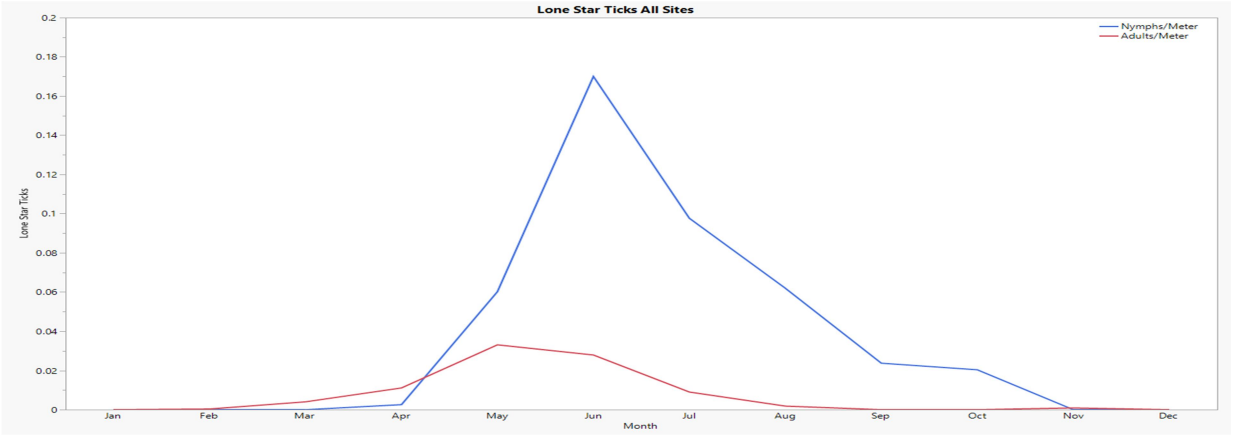


Figure 15 Lone Star and Deer Tick Seasonal Activity

nymphs while adult densities are similar. The disparity in density is also obfuscated by the aggressive nature of the lone star tick when compared to the deer tick which is known to elevate sampling numbers. Larval Lone Star ticks generally peak in late summer and are often misidentified as chigger bites on the feet and lower legs by the public.

An opportunity to expand the tick surveillance program in 2024 is anticipated with the assistance of a grant funded technician and the initiation of CP-8739.

Invasive Asian Longhorned Tick Surveillance (*Haemaphysalis longicornis*)

Since 2018, invasive Asian longhorned ticks have spread to and are regularly found at most sampling locations throughout Suffolk County. Vector staff acquired reference samples in 2018 of this tick to aide in confirmation of species identification (Fig 16). This species is spread via bird hosts and to date populations have continued to become more common at all sampling locations.

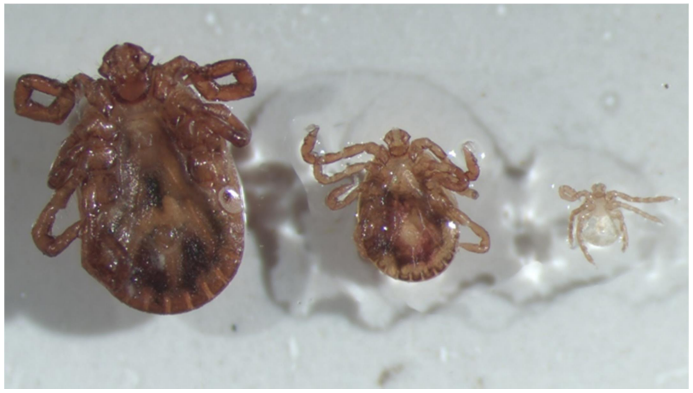


Figure 16 Asian Longhorned Tick

Between 2019 and 2023, 7 new locations have been identified through tick surveillance. Larvae, nymphs and adults are being consistently found at multiple locations indicating the invasive, parthenogenetic species is successfully reproducing locally. Throughout 2023 we have found this invasive species within every township within the County, however not every location has consistent, or numerous populations. This invasive species will continue to become better established over the next few years, based on the current trends we have seen. Surveillance efforts will continue in 2024 to track the spread of this invasive species.

Invasive Gulf Coast Tick (*Amblyomma maculatum*)

The Long Island Invasive Species Management Area group encountered an adult male Gulf Coast tick in July of 2022 (Fig 17). This species had yet to be positively identified within Suffolk County. Vector staff confirmed the identification of the tick and sent the specimen to the USDA for recording purposes. Prior, in 2021, a single male specimen was found within Suffolk County but the finding was not recorded through the USDA. In 2023 a 3rd male of the species was found by NYS Parks staff during their routine surveillance efforts. Vector assisted in validating the identification and NYS Park staff sent the tick out for pathogen assessment. Sightings of this invasive species have taken place in neighboring Counties in NYS and isolated individuals are found in CT. In 2023, an adult male was again found at a new location, although is seems to be another isolated finding. This species is of public health importance as other established populations within the United States are associated with multiple tick-borne pathogens.

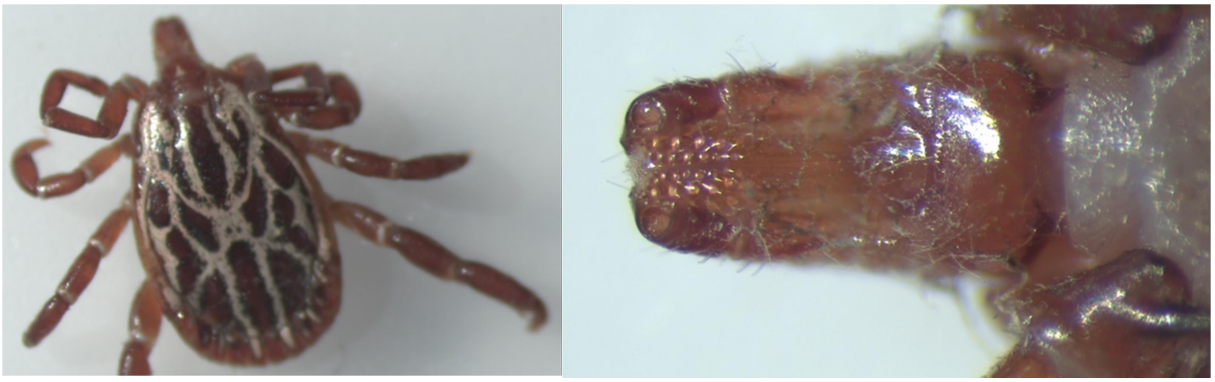


Fig 17 Adult Male Gulf Coast Tick: Dorsal View and Close up of Hypostome

Follow up surveillance yielded no additional ticks of this species. Currently there are established populations in NYC and NJ. Likely, we will see establishment within Suffolk County in the coming years as the population has consistently moved along the east coast of the Unites States.

Technical Advice and Guidance on Tick Mitigation

Vector staff continue to provide technical advice and guidance for landowners, government agencies, municipalities and civic groups that are conducting tick control or are considering doing so. These activities will continue to provide further opportunities to learn what techniques local entities are interested in adopting, currently using, or which may be useful to the County and other entities.

Advisory Committees and Working Groups

We continue to work with the Tick Control Advisory Committee (TCAC) to explore tick control strategies and potential funding opportunities. Most importantly, the TCAC will allow for the continued input and feedback from stakeholders needed to gauge what options might be feasible and acceptable for implementation at each local level. This is a significant task, since each of the available control options have their own unique local benefits and drawbacks. Public acceptance of various tick control options may also vary considerably across Suffolk County.

Vector Control collaborations organized through the Northeast Regional Center for Excellence in Vector-Borne Diseases (NEVBD) have continued through 2023. This entity was established through CDC funding to fill a growing need for guidance on tick population and pathogen surveillance, tick control, outreach and educational efforts for the broader northeast regional community. Starting in late 2023 Suffolk County Vector Control is partnering with the NEVBD-Teaching and Education Center (TEC) to assess existing tick control efforts by NYS Parks within Suffolk and evaluate a novel Lyme disease targeted control method.

We continue to reach out to local and nationally recognized tick experts for their advice and input on research and control strategies. Staff attended regional seminars and conferences to discuss emerging diseases, introduced species and new developments. These efforts have already

proven very helpful in gaining knowledge that may not be published but is highly valuable and have allowed the fostering of mutually beneficial collaborations and potential funding sources.

Non-County Funding Awards and Grants

For the prior four years, Vector Control was awarded a student internship though CCE and Cornell University. In 2023, no new student internships were funded as the previous grants allowing for the staffing had been expended.

In collaboration with Cornell University's Northeast Regional Center For Excellence in Vector-Borne Diseases and the Suffolk County Cornell Cooperative Extension the joint proposal: "Novel Evaluation of Control and Prevention Strategies for Ticks and Tick-Borne Diseases" was awarded a three year grant supported by the Deployed Warfighter Protection Research Program (DWFP), a Department of Defense sponsored research grant administered by the Armed Forces Pest Management Board (AFPMB). These collaborative research efforts will evaluate numerous tick management strategies, products, and application methods along with developing guidelines for management initiatives to reduce tick-borne disease incidence (Fig 18). Vector Control's role was evaluating several natural oil and traditional acaricide/pesticide products that have potential application for use in Suffolk County. Resulting data will directly assist with the design of and choice of acaricide products and application methods for developing best management practices in a tick control program. In addition, this funding allows purchase of additional equipment for the Tick Laboratory at Vector Control. In 2023, the final update report for these efforts were completed by Vector Control and Cornell Cooperative Extension of Suffolk County where we reported results for two synthetic and two 25(B) exempt tick control products on deer tick nymphs, lone star nymphs, and lone star adults by examining product longevity and general efficacy in the field.

Chart of Tick Species and Tick-borne Diseases

Illness or Condition	Vector Tick Species	Tick Stage(s) Transmitting Disease	Minimum Feeding Time for Disease Transmission
Acquired Red Meat Allergy	Lone Star Tick	Larva, Nymph, Adult	Unknown
Anaplasmosis	Blacklegged Tick	Nymph, Adult	24 Hours
Babesiosis	Blacklegged Tick	Nymph, Adult	36 hours
Borrelia miyamotoi Disease	Blacklegged Tick	Larva, Nymph, Adult	24 Hours
Ehrlichiosis	Lone Star Tick	Nymph, Adult	24 Hours
Heartland Virus	Lone Star Tick	Nymph, Adult	Unknown
Lyme Disease	Blacklegged Tick	Nymph, Adult	36 Hours
Powassan Virus	Blacklegged Tick	Nymph, Adult	15 minutes
Rickettsia parkeri Disease	Gulf Coast Tick	Adult	Unknown
	Lone Star Tick	Larva, Nymph, Adult	
Rocky Mountain Spotted Fever	American Dog Tick	Adult	2-20 hours
	Brown Dog Tick	Nymph, Adult	
	Lone Star Tick	Larva, Nymph, Adult	
Southern Tick Associated Rash Illness (STARI)	Lone Star Tick	Nymph, Adult, ?	Unknown
Tularemia	American Dog Tick	Adult	Unknown
	Lone Star Tick	Nymph, Adult	

Figure 18. Virginia Department of Health

Capital Request – Capital Project No. 8739 Tick Control Plan

The prevention of tick-borne diseases in the County is a difficult and complex issue. It is particularly difficult because the biology of these vectors and their associated diseases are significantly linked to deer overpopulation, expansion of their range and limited management opportunities in a densely populated suburban landscape. In addition, tick control technology suitable for large scale application is not as well developed as mosquito control techniques. A proper plan with concurrent SEQRA compliance would require additional resources to undertake an EIS, beyond those currently available to Vector. However, tick-borne diseases and the adverse impacts ticks have on the ability of County residents to utilize the outdoors, and even their own property, are important issues that need continued investigation.

Beginning in 2018, capital funds were requested for the review of best management practices and to initiate a County Park based pilot program to inform and further develop a Tick Control Plan and related State Environmental Quality Review Act (SEQRA) environmental review. Capital Program 8739 was passed by the Legislature in November of 2019 and provided funding for phase 1 of the pilot program. Due to financial difficulties arising from Covid-19, the initial portion of year one funds were received in August 2021. In 2022 as we proceeded with the design phase of the project, we also pursued a grant opportunity with collaborators at NEVBD for operational funds for the project. We have also gained a great deal of feedback from stake holders and park managers, which has allowed us to assess the functional installation and maintenance of several tick control strategies by identifying any impediments early on.

Staff from Vector Control and numerous collaborators received a training based grant in mid-2023 and met with United States Geological Survey specialists to work through a Structured Decision Making (SDM) process for the Tick Control Pilot Program design. This fully funded weeklong training workshop allowed us to develop a significantly more robust assessment process for each management strategy. In addition, we developed multiple collection strategies designed as an integrated management program and each strategy with a specific foci. The SDM process has an internal weighting strategy developed to assess tradeoffs for each management strategy utilized within each focused control program design. Utilizing this process Vector staff and our collaborators now have a clear determination of what sampling strategies to utilize to measure the outcomes of the pilot program and standardized concepts and steps of comparing available management strategies for virtually any park environment utilizing this careful and organized analysis process.

The application of SDM to a tick management program is a rather novel application for the process, which was originally designed for natural resource management decisions. Results from the workshop are currently being compiled within a USGS based whitepaper to be released.

With the concepts and methods of the SDM process, we now have a new tool to assess our options within the pilot program based on feedback we have received from stakeholders and regulatory bodies. Surveillance design is now complete and grid-based sampling sites will be installed once agreed upon with local park manager.

In 2024, we will continue collecting pre-treatment sampling data to complete a full assessment of the forest and understory vegetation within Indian Island County Park. This will include mapping all invasive plants present. Utilizing data from this forest ecosystem level vegetation management plan each tick control strategy employed will have a greater level of efficacy and may be less intense that without the vegetation management. The overall pilot program will continue to move forward with the final design phase and related capital purchases. Equipment funds for CP-8739 are expected to be available in early 2024.

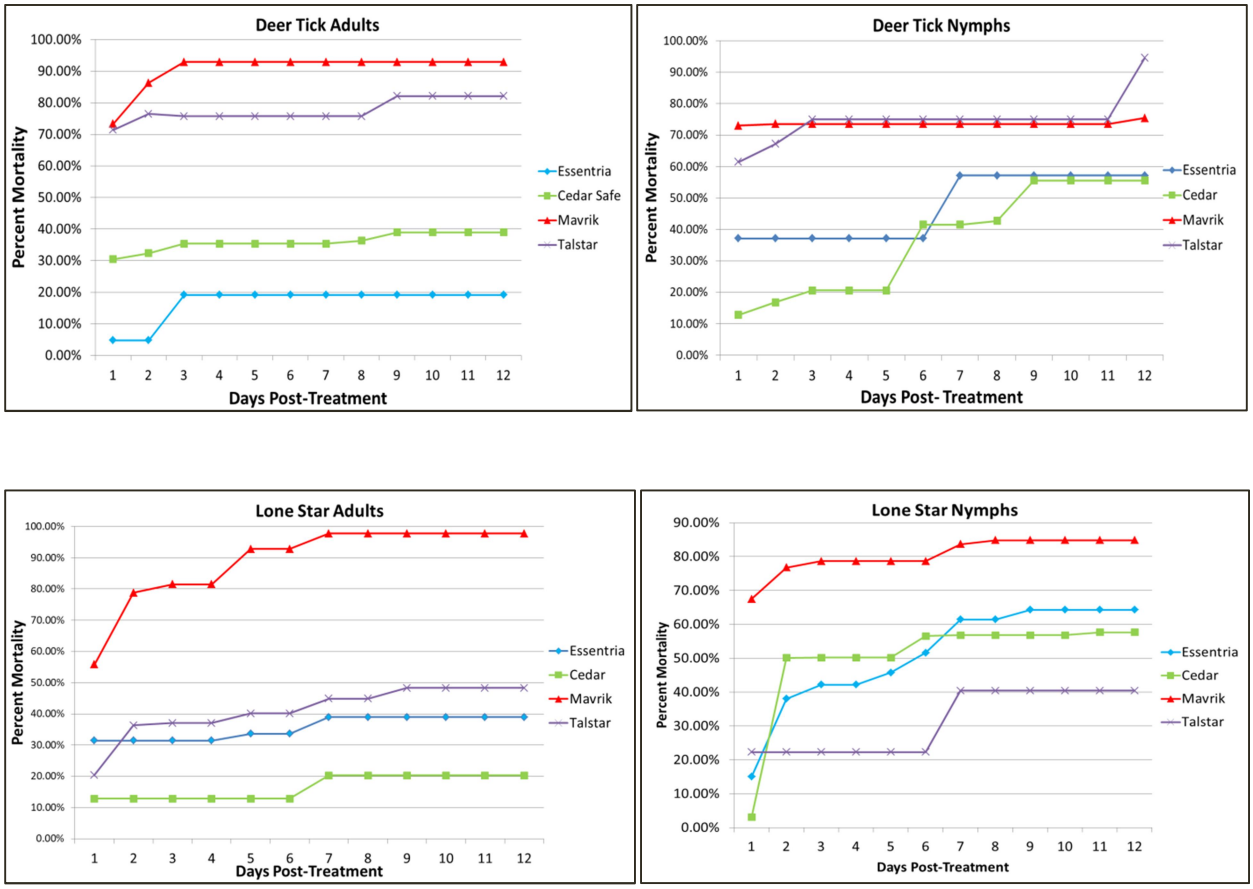
Field Efficacy Trials

Field testing of 25(b) Exempt and traditional tick control products has continued to yield novel information on the efficacy of these products when applied to park like environments (Fig 19).

Arena setup for field efficacy trials.

Figure 19

Complete data sets have been collected for deer tick nymphs, lone star nymphs, and lone star adult ticks. In addition, we have identified a more realistic total level of control that 25(b) Exempt products can provide when used for tick control (Fig 20). Environmental conditions appear to play a direct role in the overall efficacy of these products as does the activity of the tick population during the time of application. Time of year and seasonal temperatures also appear to play a role in the overall control provided by 25(B) Exempt products. These products also were found to have limited effective residual action on ticks. Additional review and statistical assessment of the data will be available in 2024.



(Figure 20) Arena trial field efficacy results for various tick control products

2024 Suffolk County Tick Control Advisory Committee

Recommendations to Vector Control

Suffolk County Government continues to support county efforts of addressing ticks and tick-borne illnesses by funding two entomologist positions and two capital programs for tick-borne pathogen surveillance and tick management. The Suffolk County Legislature directed the creation of a "Tick Control Advisory Committee (TCAC) to advise the Division of Vector Control in developing a successful plan to reduce tick-borne illnesses in Suffolk County." The development and funding of the plan should be noted as demonstration of an increased commitment to the challenge of reducing tick-borne illness, which can be built upon in future years. To this end, the TCAC has developed the following recommendations to guide and support Suffolk County Division of Vector Control with their yearly Plan of Work to reduce tick-borne illnesses in Suffolk County.

The Tick Control Advisory Committee recommends the following for the 2024 Vector Control Plan of Work:

- Collaborate with Suffolk County Department of Health Services for a comprehensive countywide tick and tick-borne pathogen surveillance program addressing tick management and tick-borne pathogens
- Collaborate with other agencies, local governments and committees
- Continue participation in the Suffolk County Shared Services Initiative (i.e. SuffolkShare Public Health Partnership) which is a partnership of more than 100 local governments that cooperate on data sharing, providing or bartering goods or services, joint procurement, coordinating activities and collaborative problem solving
- Include language that supports a commitment to studying and implementing tick and host management techniques
- Support and maintain dedicated staffing to effectively address ticks and tick-borne diseases
- Continue developing integrated strategies for managing tick populations through the County Park Pilot Program
- Provide tick-related data to enable policy makers the ability to properly prioritize budgetary decisions
- Monitor the Asian longhorned tick with concern to residents, pets, wildlife and livestock
- Share information and best practices with interested parties including county elected officials and municipalities
- Maximize efforts in education and public outreach, using public messaging (e.g. public service announcements) especially for the at-risk populations
- Maximize efforts in tick-related research and tick-related collaborations with municipal and private efforts that undertake research that benefits committee and county objectives
- Conduct new and replicate field trials on efficacy testing of minimum risk, conventional and other pesticides as needed
- Continue to conduct tick population surveillance at bi-weekly surveillance sites and make these data available on a public-accessible website
- Seek funding wherever possible to increase resources for staff, equipment and other necessary items
- TCAC should remain active and continue to assist Vector Control as it addresses the reduction of tick-borne illnesses in Suffolk County

These recommendations are based on Vector Control having sufficient staff and resources to undertake the tasks listed above. Vector Control is committed to continue working with the TCAC and seeking out best management practices for the control of ticks and tick-borne disease in Suffolk County.

Water Management and Wetland Restoration

Water Management:

Field personnel conduct this component from January 1 to April 30, and October 1 to December 31. Water management during the winter months is a functional way to reduce the need for pesticide applications during the summer, by keeping mosquito ditches and creeks free of blockages. The Division expects to conduct water management in each of the County's ten towns, as needed. Highest priority is assigned to larval habitats where adult mosquito infestations have the greatest potential for negative impact and in response to flooding issues. In particular, areas that had virus isolations or showed unexpectedly high infestations in 2023 will have high priority over the coming winter. Water management activities will be carried out in such a manner so that the primary goal of the work will be to protect the health of the marsh, while also reducing mosquito numbers.

Water management minimizes mosquito production through maintaining or improving systems of tidal channels, ditches, culverts and other structures that drain off surface water and/or allow access to potential larval habitats by predatory fish. In some cases, the current ditch system has become an important component of the wetland as it exists today, and maintenance of the system is necessary to maintain tidal flow, fish habitat, or existing vegetative patterns. Much of this is maintenance work that may not require a permit, but is nonetheless conducted after consultation with the New York State Department of Environmental Conservation (DEC) to ensure consistency with conservation of the wetland. More extensive work to rehabilitate wetlands in a manner that restores and preserves resource values while also reducing mosquito production is now underway under the umbrella term Integrated Marsh Management (IMM). In accordance with the Long Term Plan, all water management activities are conducted with appropriate notification to and oversight by the Council for Environmental Quality (CEQ), as outlined in the Findings Statement of the Suffolk County Legislature that was adopted by Suffolk County Resolution 285-2007.

The Wetlands Stewardship Committee completed its work in establishing standards for wetlands Best Management Practices (BMP's) and a Wetlands Stewardship Strategy was issued by Executive Order 01-2015 on July 13, 2015. With that Strategy in place, plans for 2024 include continuing work on several grant sponsored marsh restoration projects. These are projects that restore and enhance the natural resource values of the wetlands while also reducing or eliminating the need for pesticides to control mosquitoes. All work is planned in partnership with the landowner and NYSDEC, USFWS and other natural resources agencies and undergoes SEQRA/CEQ review as required.

Integrated Marsh Management - Wetland Restoration Projects:

National Fish and Wildlife Foundation (NFWF) Sandy Resiliency Wetland Restoration Grant:

This $1,310,000 NFWF grant with a County match of $688,849 was awarded for Coastal Resiliency via Integrated Salt Marsh Management. The goals of the project include coastal resiliency and wetland restoration, with natural mosquito control through habitat adaption and killifish access as secondary goals. Marsh restoration project at Gardiner SC Park east and the larger west side was completed in 2022. Wetland restoration at Timber Point NYSDEC wetlands occurred during the winter of 2021-2022. The West Sayville marsh restoration was performed and completed during the winter of 2022-2023. Suffolk County Community College student interns assisted to monitor site conditions including vegetation, mosquito breeding, water quality and fish usage of the marshes to track the success of the restoration projects.

The Nature Conservancy (TNC) was retained to help assemble a team of coastal wetland experts who reviewed the project plans and gave guidance on wetland restoration projects undertaken in their jurisdictions. These wetland scientists gave field visits to their sites and/or presentations on projects from work on marshlands including restoration work in CT, DE, NJ, RI and NYC. A key component of this project was the Regional Technical Workgroup (RTW) Report of saltmarsh restoration practitioners across the Sandy-impacted region which provides a forum for the exchange of ideas, experiences and best practices regarding saltmarsh restoration. TNC submitted the final report of recommendation to the County in the spring of 2021.

Summary of Work on the West Sayville NFWF Project: From January to April 2023, the most recent restoration project was undertaken at West Sayville Golf Course marsh under the NFWF Coastal Resiliency grant. The marsh had been historically grid-ditched and was undergoing marsh loss along the bay front and had extensive panne formation (Fig 21). Without the ditches being maintained on a regular basis, large segments of the marsh became severely waterlogged and the marsh edge developed into prime mosquito breeding habitat. The waterlogged marsh has additional deleterious effects on overall marsh health, including the impounded water causing die-back of marsh vegetation. This has also caused excessive encroachment of invasive *Phragmites australis* into the wetlands due to the poor tidal exchange in the higher marsh areas.

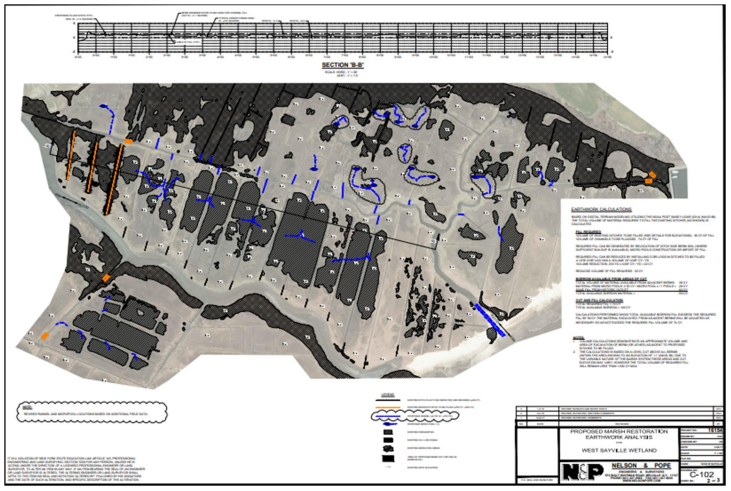


Figure 21. Wetland Restoration Plan West Sayville County Park

To reduce mosquito breeding habitat, foster a healthier marsh environment and return the marsh to a more "natural" state, IMM (Integrated Marsh Management) was implemented at West Sayville. Integrated Marsh Management is "a comprehensive approach to ecological restoration and mosquito control", and had been first used successfully by the Vector Control to restore 95 acres of Wertheim National Wildlife Refuge marshland in Shirley. Due to vegetation growth and wildlife use of the salt marsh over the summer months, NYSDEC imposes a seasonal winter only work window of December through April, when the restoration activities must end. This resulted in a short work window for completion of the West Sayville project, but we managed to successfully complete the restoration before the project window closed.

A Watershed Designed for Proper Tidal Exchange – Single Channel

Prior to the restoration at West Sayville, there were multiple interconnected 'grid' ditches that drained to the bay. The grid ditch pattern decreased overall effectiveness for tidal exchange within the marsh. A single, well planned tidal channel serving a watershed allows ponded floodwater to leave the marsh during low tides and during high tides greater exchange and nutrient cycling occurs within the marsh.

Top Left: Fill material being taken from the newly opened inlet (top left) and being placed on top of coir logs to plug a ditch (top right). Using a low pressure tracked excavator and dump carrier to create the single channel marsh system. Bottom Left: A finished fish micro-pool with a shallow connecting runnel allowing for killifish access. Bottom Right: Coir log being installed to fill an existing ditch.

This is due to the increased hydrological pressure of the single channel, which is even more pronounced in the micro-tidal environment of the Great South Bay. To correct for the tidal exchange, some existing ditches were cleaned and new tidal channels were created. To create one primary drainage channel in each "phase" connecting 'grid' ditches were filled and secondary exit channels were plugged. Small micro-channels or runnels were installed to connect pools of standing water in marsh pannes to the new drainage channel. Installation of runnels allows surface water in the pannes to drain during low tides to reduce marsh vegetation die-back in the flooded areas. At the West Sayville marsh, due to sea level rise and panne formation, large sections of the marsh were being lost at an exorbitant rate. Increased tidal exchange is when more water comes onto, and leaves the marsh every low/high tidal cycle. When supplemented with runnels, a host of benefits is brought to the marsh including:

Removal of consistent stagnant water: There were many areas that had consistent stagnant water. These areas had the capacity to be mosquito breeding habitat, and prevented new vegetative growth. By removing the stagnant water, mosquito habitat is removed and new vegetative regrowth can begin.

West Sayville post restoration: storm flooded marsh panne (left) and post storm rapid draining of standing water (right)

Increased Sediment deposition: As the tide comes in it brings along with it sediment, very fine particulate matter made of sand, eroded rocks and organic matter. This sediment would normally then go back out with the tide into the bay. Proper tidal exchange allows sediment to be trapped by vegetation, and the sediment gets settles onto the marsh. Over time this sediment gradually becomes the marsh surface, and increases elevation of the marsh. As such, a healthy marsh's elevation level will constantly rises due to sediment deposition. If a marsh cannot accrete sediment at a rate equal to or greater than sea level rise it will be subject to erosion. This is why proper drainage, tidal exchange and removal of stagnant water are so important. Removal of stagnant water allows new vegetation to grow, which in turn gathers more sediment and "builds" the marsh faster. With improved tidal exchange, a greater volume of sediment is brought onto the marsh to be deposited.

With sea-level-rise as a continuing threat, it is important to ensure our marshes keep up with the rising tides. If our marshes accrete material slower than sea level rises, we will lose an important ecosystem that provides us with many benefits such as storm protection, erosion protection, nutrient cycling and habitat for protected species.

Top and bottom left (June 2017) are photos of two different large impounded pannes that had developed in the southern portion of the West Sayville marsh; top and bottom right (May 2023) are photos of those same two pannes shortly after restoration of the site, showing panne drainage and vegetation beginning to regrow in the bare areas.

Filling of historic ditches

Pre-existing ditches that would disrupt the new planned drainage pattern were filled with a combination of reuse of peat material from the local marsh, and coir logs. Coir logs are fibrous biodegradable logs made out of coconut fiber. Once a ditch was slotted to be filled, the coir log was staked into the ditch and marsh material from cleaned tidal creeks was placed on top of the coir log. Coir logs will degrade over time, but will give vegetation time to grown over the ditch, restoring a resilient marsh environment.

Extensive sampling was done prior to the start of the project to ascertain where the mosquitos were breeding. In areas with the heaviest breeding, micro-pools were installed. Micro-pools are small ponds, less than 10 feet by 10 feet with shallow runnel connecting the pond to a tidal creek.

The goal of these micro-pools is to both modify the areas where mosquitos breed, and to provide a habitat for fish who then hunt mosquito larvae.

Pre/Post Mosquito Breeding at West Sayville:

West Sayville 2017 - pre-restoration year 1
Average Larvae per Sample: 1.64

West Sayville 2019 - pre-restoration year 3
Average Larvae per Sample: 0.22

West Sayville 2021 - pre-restoration year 5
Average Larvae per Sample: 0.34

West Sayville 2023 - post-restoration year 1
Average Larvae per Sample: 0.07

Pre- and post- restoration mosquito larvae sampling data from the West Sayville Golf Course wetland area. Hollow white circles represent negative samples while red points represent positive. Average larvae per sample is calculated using the total larvae found inside the restoration area during the summer breeding season over the number of samples taken in the site. The first year of post-restoration sampling in 2023 shows a dramatic decrease in both the range and density of larvae found.

Federal Emergency Management Agency (FEMA) Sandy Resiliency Wetland Restoration Grant:

This $534,000 federally funded FEMA/Hazard Mitigation Grant Program (HMGP) project had the goals of improving coastal resiliency and wetland restoration. Secondary goals included natural mosquito control through habitat adaption and killifish access to areas of mapped mosquito production. The Smith Point Marsh in Shirley is approximately 90 acres of wetlands restored using the same IMM techniques as the earlier NFWF projects. This project began in the spring of 2022 and was completed in February 2023. Post-restoration monitoring is ongoing and continues to show decreases in mosquito breeding range and density. The three maps below document the reduction of mosquito breeding pre and post restoration for this marsh.

Smith Point 2021 - pre-restoration
Average Larvae per Sample: 8.61

Smith Point 2022 - mid-restoration
Average Larvae per Sample: 1.32

Smith Point 2023 - post-restoration
Average Larvae per Sample: 0.05

FEMA/HMGP – Second Grant 2023

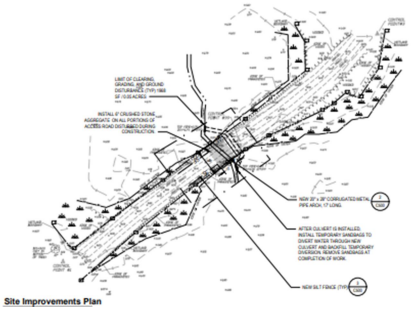
A second FEMA/HMGP grant for $3,922,650 was applied for in 2023 to undertake additional IMM marsh restoration projects at both the Scully and Islip Preserves in Islip and Cupsogue County Park in Westhampton Beach. The project area of the three coastal marshes within the South Shore of Long Island includes; Scully Marsh at 25 acres, Cupsogue Beach 80 acres, and Islip Preserve 35 acres, for a total of 140 acres of wetland area for restoration. IF Suffolk County is awarded the grant funding, project review and permits is scheduled for early 2024 and completion of restoration actions is targeted for 2026.

Indian Island Wetland Restoration Grant:

This NYSDEC funded grant of $759,000 with a County match of $300,000 has been awarded for restoration of this dredge spoil filled former wetland. The Peconic Estuary Partnership ranked this restoration as a Priority Tier 1 project. Restoration will reconnect the site for regular tidal exchange and assist in natural

mosquito control by use of native predacious killifish. The site is now regularly treated by Vector Control via aerial larvicide. The project is being bid in the fall of 2023 with restoration completion projected for June 2024.

Big Reed Pond Alewife Access Restoration:


Site Improvements Plan

The Peconic Estuary Partnership (PEP) reached out to Vector Control for assistance in restoring tidal flow at an impaired culvert connecting Lake Montauk to Big Reed Pond at Montauk County Park in Montauk. Restoration of tidal water was identified by PEP as a critical component to restoring alewife access to this historic fishery. Big Reed Pond contains one of only four major documented spawning streams in the Peconic Bay region for alewives, which migrate from the ocean to spawn in this shallow freshwater pond each spring. Permits for the project are in the process of being secured by the PEP consultant, with work expected for spring 2024, before the alewife migration begins.

Beaverdam Creek

The Beaverdam Creek County Park in Brookhaven Hamlet is being studied for the re-establishment of a wetlands complex at a dredge spoil impacted marsh. This project is a cooperative undertaking between several County agencies and the Post Morrow Foundation. SC Parks is lead agency on this project, but with Vector staff involvement in the planning. Vector Control marsh equipment would be used to restore impaired site to tidal wetland. Preliminary site plans were drafted and are under review. SC water quality program is funding the consultants and the restoration work would be undertaken by County staff. The goal of this restoration project is to return tidal circulation to a diked marsh that is a mostly phragmites and several low areas that breed salt marsh mosquitoes. A tidal creek will be created through the dike to allow for the return of salt marsh vegetation, phragmites control and a reduction in mosquitoes by allowing killifish access to the low areas of the site.

Mastic Beach

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

A USDA/NRCS grant of $795,000 was awarded to DPW for demolition of three homes destroyed during Sandy and restoration of these properties. Work on environmental permits and demolition agreements began in early 2023, with Brookhaven Town and asbestos abatement contractors undertaking the removal of the structures. Restoration of the acquired properties overlaps with a Brookhaven Town master wetland restoration plan for Mastic Beach, with restoration of the parcels now being included as part of the Brookhaven master plan.

Accabonac Cooperative Project 2017-2023:

Summary of the 2023 season saw continued reduction in pesticide use and acres treated at Accabonac Harbor through the cooperative project (Fig. 22).

Data collected in 2023 continues to confirm identified hot spots for mosquito breeding along the west side of the harbor in the marsh's upland fringe (Fig 23). There were five potential dates identified by the dip data for treating this area, but only three dates with applications (5/24, 7/21 and 8/3). Of the two dates without applications, one was due to fog along the bay, and the second date was due to operational scheduling issues with the aerial application.

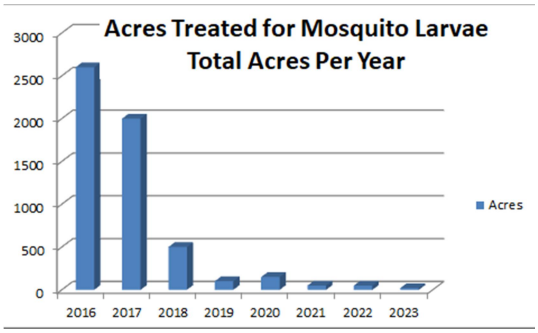


Figure 22. Acres treated at Accabonac Harbor 2016-23

This joint project was initiated between Suffolk County Vector Control (SCVC), East Hampton Town Trustees (EH) and the Nature Conservancy (TNC) in 2017 with the goal to reduce pesticide applications to Accabonac Harbor. The basis of the pesticide reduction program was to undertake a more targeted approach to mosquito larvicide treatments through detailed GIS mapping of mosquito breeding locations. In 2017, a pilot project covering 5 weeks was initiated and focused on 2 spray blocks in the southern section of Accabonac Harbor. The 2017 trial allowed the partners to see if this method could be a feasible approach to achieve the end goal of cutting pesticides applied.

Due to the success the group achieved in the 2017 trial where spray blocks were reduced greatly in size, the program was expanded for 2018 and continued through 2023. The survey team collects several thousand GIS data points over the summer, identifying positive dips. Dip data taken by the team includes GIS location (lat/long), larval stage (1-4 & pupae) including total number of each stage and any notes of the sampler. Information collected by the team was sent to Vector Control for review. Vector staff GIS map the larval distribution and review the dip data for a treatment decision. If treatment was deemed necessary, a revised map would be sent to the helicopter pilot to adjust the spray blocks at Accabonac Harbor to only target those 'hot spots' identified within the treatment block.

Data from the EH team continues to allow Vector to cut the spray blocks dramatically. The reduction of treatment block acres allows the County cost savings from less pesticide applied and reduced helicopter flight hours treating the site. The identified points by the team showed breeding was predominantly along the upper marsh edge moving

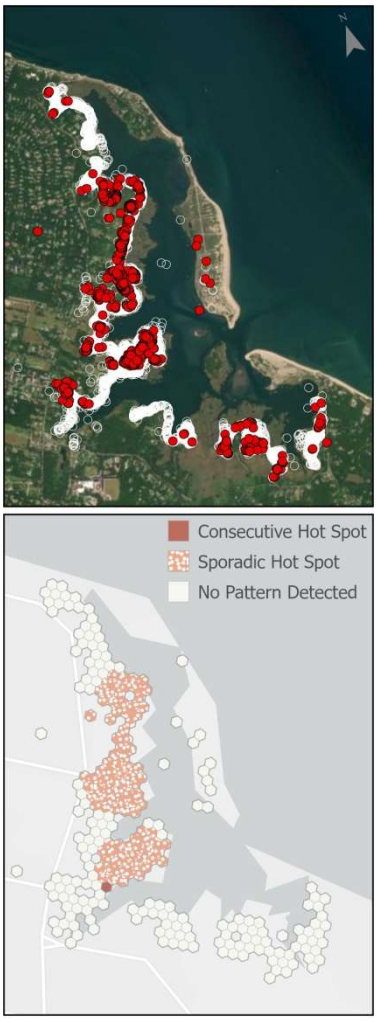


Fig 23.

***Top**: All larvae dip samples taken by the volunteers from 2019-2023 with hollow circles representing negative points and red representing positive.*

***Bottom**: Emerging Hotspot analysis. All points aggregated into 100 meter by one month cubes and analyzed temporally as well as spatially across the dataset.*

the applications further away from the harbor water's edge.

TNC is actively working with the partnership in developing wetland restoration plans for Accabonac. Suffolk County Peconic Estuary Program grant funding has also been sought for assisting in the restoration of this project. With input from the local community, initial project planning has begun and draft plans are being prepared through TNC. Once project plans and funding have been established, the next steps will be project review with the local community, securing regulatory permits and ultimately begin project implementation.

APPENDIX Description of Pesticide Materials SCVC 2024:

The mosquito larval control products to be considered for use in 2024 and the conditions under which they are employed are described as follows:

Altosid Liquid Larvicide Concentrate (methoprene, EPA 2724-446) – Aerial or ground application to tidal and freshwater marshes.

Altosid XR-G (methoprene, EPA 2724-451) – Ground or aerial application to tidal wetlands; ground application to intermittently flooded freshwater areas; aerial application in freshwater areas in response to Eastern Equine Encephalitis (EEE) or West Nile Virus (WNV) with required separate approval by NYSDEC.

Altosid XR Briquets (methoprene, EPA 2724-421) – Catch basins and other drainage or artificial structures that are not fish habitats, application to swimming pools.

Aquabac 200G (Bti, EPA 62637) – Ground application to intermittently flooded freshwater and tidal wetland areas.

Fourstar Briquets 90 (Bti and B. sphaericus, EPA 83362-3) – Catch basins, ground depressions, artificial sites, swimming pools

VectoBac 12 AS (Bti, EPA 73049-38) – Aerial application to tidal and freshwater marshes; ground application to intermittently flooded areas such as tidal and freshwater marshes.

VectoLex FG (B. sphaericus, EPA 73049-20) – Ground application to freshwater and brackish areas that hold stagnant water such as ditches, impounded marshes, swamps, puddled areas, sewage lagoons; late season application to catch basins.

VectoPrime FG (Bti and methoprene EPA 73049-501) – Ground and aerial application to tidal and freshwater marshes, as well as other temporarily flooded areas.

VectoMax FG (B. sphaericus and Bti, EPA 73049-429) - Ground and aerial application to freshwater marshes, as well as other semi-permanent flooded sites.

VectoMax WSP (B. sphaericus and Bti, EPA 73049-429) –Catch basins, swimming pools and other small flooded areas of standing water.

Any new larvicide material to be considered for incorporation into the 2024 program can only include the three active ingredients: Bti, B. sphaericus and/or methoprene as approved in the Long Term Plan and GEIS and would be used under a NYSDEC permit. New active ingredient pesticide materials would require SEQRA review and be included as a supplement to the GEIS.

Vector Control Pesticide Labels and SDS:

Pesticide labels and SDS safety sheets for all materials in use by Vector Control are posted on the Suffolk County Government website under Public Works – Vector Control at:

https://suffolkcountyny.gov/Departments/Public-Works/Vector-Mosquito-Control/Vector-Online-Form

2024 Suffolk County Vector Control Program Summary:

Ticks: Vector Control will continue to work on developing tick control strategies and will follow the TCAC recommendations for developing the tick control program in Suffolk. Work continues on developing a potential pilot project at Indian Island County Park to include environmental review of control strategies and review of emerging research.

Education/Outreach: In cooperation with SC Health, Vector Control will continue to work on public education on tick and mosquito issues, avoidance and control options for residents, commercial applicators and municipalities within Suffolk.

Resistance Testing: Vector Control will continue to monitor and test mosquito populations for pesticide resistance and will continue to work with the Northeast Regional Center for Excellence in Vector-Borne Diseases (NEVBD) Pesticide Resistance Lab. Resistance testing of ticks will be investigated in cooperation with work being developed by the NEVBD. Investigate alternatives to pesticides currently in use for resistance management.

Public Notification: Vector Control will continue the use of SuffolkAlert for adult spraying alerts. We will continue to work with Health on press releases and social media messages, County website updates and phone spray hotline (631 852-4939).

Pesticide Reduction: Vector Control is fully committed to implement pesticide reduction strategies whenever possible. Work on wetlands management and Integrated Marsh Management (IMM) with cooperators will continue, as IMM is the best management practice for reducing aerial larvicide applications to the greatest acreage consistently. Pesticide reduction through IMM not only greatly benefits the environment, but saves the County financially in reduced pesticide material requirements and in staff time checking and treating these sites.

Virus Response: Vector Control will continue to work closely with SC Health in safeguarding residents from mosquito-borne viruses including WNV, EEE and working on the control of tick-borne pathogens.

Adult and Larval Mosquito Control: Pesticides employed for adult and larval mosquito control will only be used if they are EPA and NYSDEC registered. Crews must follow label conditions and any applicable NYS permits for application. All active ingredients (AI) will match those reviewed and approved for use in the Vector Control Long Term Plan/GEIS unless a supplemental study is undertaken for new AI.

The Suffolk County Department of Public Works – Division of Vector Control
2024 Plan of Work was prepared by:

Department of Public Works – Vector Control
Thomas Iwanejko - Superintendent of Vector Control
Moses Cucura – Tick population, control and project summary
Malgorzata (Margaret) Kawalkowski – Mosquito population data and summaries, resistance updates
Nicholas Cormier – Wetland restoration project updates

Health ABDL –
Dr. Scott Campbell – Mosquito-borne virus data, TCAC updates
Christopher Romano – Mosquito-borne virus data

Checklist of the Mosquito Species Found in Suffolk County, NY			
1	*Aedes abserratus*	27	*An. crucians*
2	*Ae. albopictus*	28	*An. punctipennis*
3	*Ae. atlanticus*	29	*An. quadrimaculatus*
4	*Ae. atropalpus*	30	*An. walkeri*
5	*Ae. aurifer*	31	*Coquillettidia perturbans*
6	*Ae. canadensis*	32	*Culex erraticus*
7	*Ae. cantator*	33	*Cx. pipiens*
8	*Ae. cinereus*	34	*Cx. restuans*
9	*Ae. dorsalis*	35	*Cx. salinarius*
10	*Ae. dupreei*	36	*Cx. territans*
11	*Ae. excrucians*	37	*Culiseta impatiens*
12	*Ae. fitchii*	38	*Cu. inornata*
13	*Ae. flavescens*	39	*Cu. melanura*
14	*Ae. grossbecki*	40	*Cu. minnesotae*
15	*Ae. intrudens*	41	*Cu. morsitans*
16	*Ae. japonicus*	42	*Orthopodomyia signifera*
17	*Ae. sollicitans*	43	*Psorophora ciliata*
18	*Ae. sticticus*	44	*Ps. columbiae*
19	*Ae. stimulans*	45	*Ps. confinnis*
20	*Ae. taeniorhynchus*	46	*Ps. cyanescens*
21	*Ae. thibaulti*	47	*Ps. discolor*
22	*Ae. tormentor*	48	*Ps. ferox*
23	*Ae. triseriatus*	49	*Ps. howardii*
24	*Ae. trivittatus*	50	*Toxorhynchites rutilus septent.*
25	*Ae. vexans*	51	*Uranotaenia sapphirina*
26	*Anopheles barberi*	52	*Wyeomyia smithii*

Suffolk County Vector Control Pesticide Acreage Estimates for 2023

Pesticide	Active Ingredient	EPA No.	Amount Used	Units	Amount in use units	Units	Dose (units/acre)	Air/Ground Application	Total 2023 Acreage	Change in Acres +/- from 2022
									[Acres]	[Acres]
Ground Larvicide										
FourStar 90 Briquets	**Bti/B. sphaericus**	83362-3	507.00	EA	507.00	EA	435	Ground	1.17	-0.05
VectoBac 12AS	**Bti**	73049-38	17.95	GL	2297.38	FL	16	Ground	143.59	15.91
AquaBac 200G	**Bti**	62637-3	555.37	LB	555.37	LB	10	Ground	55.54	19.47
VectoPrime FG	**Bti/Methoprene**	73049-501	3602.14	LB	3602.14	LB	4	Ground	900.54	356.03
VectoLex FG	**B. Sphaericus**	73049-20	361.25	LB	361.25	LB	15	Ground	24.08	5.22
VectoMax FG	**Bti/B. sphaericus**	73049-429	6817.21	LB	6817.21	LB	15	Ground	454.48	315.03
VectoMax WSP	**Bti/B. sphaericus**	73049-429	658.00	EA	658.00	EA	871	Ground	0.76	-0.04
Altosid XR Briquets	**Methoprene**	2724-421	6323.00	EA	6323.00	EA	218	Ground	29.00	-13.46
Altosid Liquid Larvicide 20%	**Methoprene**	2724-446	1.12	GL	143.36	FL	1	Ground	143.36	21.45
Spheratax SPH 50G	**B. Sphaericus**	84268-2	1088.65	LB	1088.65	LB	15	Ground	72.58	72.58
Ground Larvicide Total Acres:								Ground Total:	1,825.08	792.14
Aerial Larvicide:										
VectoPrime FG	**Bti/Methoprene**	73049-501	52,725.82	LB	52,725.82	LB	4	Aerial	13,181.46	3487.21
Total Larvicide Acreage:									15,006.54	4279.34
Adulticide:										
Anvil 10+10	**Sumithrin**	1021-1688-8329	48.96	GL	6266.72	FL	0.62	Ground	3,885.37	2036.82
Duet	**Sumithrin+Prallethrin**	1021-1795-8329	0.00	GL	0.00		0.75	Ground	0.00	0.00
Adulticide Acreage:								Adulticide:	3,885.37	2036.82