Region of Peel - Public Health

Vector-Borne Disease

2018 Technical Report &
2019 Prevention Plan
# Table of Contents

**Executive Summary** ......................................................................................................................... 1

**Introduction** ........................................................................................................................................... 3

**West Nile Virus** ................................................................................................................................. 3
  - Surveillance ................................................................................................................................................. 5
    - Human Case Surveillance .................................................................................................................. 5
    - Adult Mosquito Surveillance .......................................................................................................... 7
    - Larval Mosquito Surveillance ....................................................................................................... 13
  - Larval Mosquito Reduction ........................................................................................................... 15
  - Pesticide Effects and Monitoring .................................................................................................. 19
  - Risk Assessment and Adulticiding ............................................................................................... 21
  - Public Education and Community Outreach Activities .............................................................. 23

**Lyme Disease** ......................................................................................................................................... 26
  - Human Cases and Surveillance ......................................................................................................... 26
  - Tick Surveillance ............................................................................................................................... 28
  - Public Education Activities ............................................................................................................ 31

**Eastern Equine Encephalitis** ............................................................................................................. 32

**Other Vector-Borne Disease of Interest** ............................................................................................ 33

**Conclusion** ........................................................................................................................................ 33

**Appendix** ............................................................................................................................................ 33
Executive Summary

This report summarizes the Region of Peel - Public Health’s (Public Health) vector-borne disease (VBD) program activities in 2018 and outlines the activities planned for 2019.

Public Health delivers a VBD management program in accordance with the *Health Protection and Promotion Act* and the 2018 Ontario Public Health Standards. In Ontario, West Nile Virus (WNV) and Lyme disease are the two most common VBD of public health importance as both diseases can be acquired within the province.

2018 Surveillance Data for Planning

Public Health’s approach to VBD control emphasizes disease prevention in humans, protection of the environment, region-wide surveillance, Integrated Mosquito Management (through source reduction and larviciding) and public education. The activities planned for Peel’s 2019 VBD program are based on the surveillance data collected from previous seasons.

West Nile Virus

Mosquito surveillance provides early warning signs of WNV risk to human health. Surveillance data enhances mosquito reduction and education efforts about mosquito protection/prevention to mitigate the potentially significant impact on human health. Surveillance data indicate that WNV is endemic in Peel Region and WNV activity levels can fluctuate widely from year to year.

In 2018, there were 69 positive WNV mosquito pools, five confirmed human WNV cases and one probable WNV case. VBD staff followed up on 227 service requests related to mosquito control and identified 1,018 potential mosquito breeding sites on publicly-owned lands across Peel Region. Staff also worked in conjunction with Pestalto Environmental Health Services Inc. (Peel’s licensed larvicide service provider for 2018) to ensure that catch basins (approximately 100,000) were treated three times between June and September, and that the 285 stagnant water sites found by VBD staff were treated to control mosquito larval populations.

Lyme Disease

In 2018, 132 tick samples were submitted to Public Health. Seventy-eight ticks were likely locally acquired in Peel Region, with 21 (27%) identified as blacklegged ticks. All 21 locally acquired blacklegged ticks tested negative for *Borrelia burgdorferi* (*B. burgdorferi*), the bacteria responsible for Lyme disease.

Public Health also conducted active tick surveillance at seven locations in the City of Mississauga and the Town of Caledon in 2018. The locations were selected based on
passive tick surveillance indicators. A total of six blacklegged ticks were found near Credit River Valley in Mississauga and near the Humber Valley Heritage Trail in Caledon during spring and fall drag samplings. All the ticks tested negative for *B. burgdorferi*.

Because of these surveillance findings, Public Health Ontario has identified two estimated risk areas for Lyme disease in Peel Region for the first time. Estimated risk areas are calculated based on a 20 km radius surrounding a location where blacklegged ticks have been identified or are known to occur and where humans have the potential to encounter infected ticks. These estimated risk areas, which cover the majority of Peel Region, are shown on the 2019 provincial risk area map that Public Health Ontario produces yearly. Surveillance data suggests the risk of acquiring Lyme disease in Peel Region remains low but is growing.

VBD staff investigated 10 confirmed and two probable human Lyme disease cases reported in Peel residents. Eight of the confirmed cases were acquired outside of Peel (five within Ontario and three outside Canada). The exposure locations could not be determined for the remaining two confirmed cases. One probable case was likely locally acquired while the other may have been acquired outside Peel Region but within Ontario.

**Planned VBD Activities for 2019**

Public Health will continue to conduct surveillance and education activities for both the public and medical professionals related to VBD. Efforts to reduce mosquito breeding through source reduction and larviciding in urban and suburban areas of Peel will continue.

Public Health will continue surveillance related to Lyme disease and examine ticks submitted by Peel residents to identify sites where blacklegged ticks may be present. A communication campaign will be developed and deployed to inform Peel residents, health care providers and key stakeholders on the new Lyme disease estimated risk areas.
Introduction

This report summarizes the activities and findings of the 2018 vector-borne disease (VBD) program and presents a prevention plan, outlining planned activities for 2019. The goal of the program for 2019 is to minimize the impact of VBD on human health through region-wide surveillance and Integrated Mosquito Management (IMM) which emphasizes public education, source reduction and larviciding. The program will also continue to assess the community risk to Lyme disease through surveillance activities.

West Nile Virus

West Nile Virus (WNV) was first detected in Peel in birds and mosquitoes in 2001. Locally acquired human illness first occurred in 2002 when 112 residents had laboratory evidence of WNV infection (55 suspect cases, 20 probable cases and 37 confirmed cases, including two deaths). The surveillance program guides VBD activities which include mosquito larvae reduction, stagnant water site remediation, and education activities.

Surveillance activities indicate that WNV is endemic in Peel Region, though the number of human cases of WNV and the number of traps testing positive for WNV can fluctuate widely from year to year and are highly dependent on weather, with higher temperatures and rainfall being associated with more cases of WNV.

In 2018, the average daily temperature during spring and summer was higher than usual, except for in April, which was lower than usual. Figure 1 shows the average daily temperature for 2018 compared to the previous 10-year average. The number of heavy rainfall events with over 10 mm of rain was lower than usual in June, but higher than usual in August. Figure 2 shows the number of heavy rainfall events with over 10 mm in 2018 compared to the previous 10-year average.

---

1 Appendix A summarizes the VBD program objectives for WNV and Lyme disease.
2 The human case definition has changed since 2002. If current human case definitions were used, there would have been 18 confirmed cases in 2002.
Figure 1: Average Daily Temperature for 2018 Compared to 2008-2017


Figure 2: Number of Days with Rainfall Over 10mm by Month
Comparing 2008-2017 to 2018

Surveillance

Human Case Surveillance

- **Objective:** To monitor the incidence of human WNV cases in Peel Region as per the Infectious Disease Protocol under the 2018 Ontario Public Health Standards.

The human case surveillance program identifies human cases of WNV in Peel Region to determine the source of disease. All probable and confirmed human cases identified by hospitals and physicians are reported to the local public health department.

The Region of Peel - Public Health (Public Health) investigates all suspected, probable and confirmed WNV cases among residents in Peel Region, based on case definitions developed by the Ministry of Health and Long-Term Care (MOHLTC). Standardized medical information including demographics, symptoms, risk factors (such as travel history or having received blood products) and test results are entered into the MOHLTC’s Integrated Public Health Information System (iPHIS). Cases that are classified as confirmed or probable according to provincial case definitions are mapped onto a Geographic Information System (GIS) according to residential postal code to track trends and outbreaks. In 2018, there were five human confirmed cases and one probable case of WNV in Peel Region (Table 1).

**Table 1: Number of Human WNV Cases by Municipality (Confirmed and Probable), Region of Peel, 2012 – 2018**

<table>
<thead>
<tr>
<th>Year</th>
<th>Region of Peel</th>
<th>City of Mississauga</th>
<th>City of Brampton</th>
<th>Town of Caledon</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>25</td>
<td>12 (10 C, 2 P)</td>
<td>12 (5 C, 7 P)</td>
<td>1 (1 P)</td>
</tr>
<tr>
<td>2013</td>
<td>5</td>
<td>3 (2 C, 1 P)</td>
<td>2 (2 C)</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>2</td>
<td>1 (1 C)</td>
<td>1 (1 C)</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>6</td>
<td>6 (6 C)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>11†</td>
<td>7 (7 C)</td>
<td>4 (4 C)</td>
<td>0</td>
</tr>
<tr>
<td>2018</td>
<td>6</td>
<td>5 (4 C, 1 P)</td>
<td>1 (1 C)</td>
<td>0</td>
</tr>
</tbody>
</table>

C-Confirmed, P-Probable, S-Suspected

†Final numbers for 2017 which includes outcome of cases still under investigation at the time the 2017 VBD technical report was published.
Comparison with Other Ontario Public Health Units

As of November 3, 2018, there were 137 confirmed or probable WNV human cases in Ontario, three of which were travel-related.\(^3\) Cases were reported from:

- Toronto (39)
- Windsor-Essex County (13)
- Middlesex-London (11 including 1 travel-related)
- Niagara Region (8)
- Hamilton (7), and Ottawa (7 including one travel-related)
- Peel (6), Brant County (6), and Haldimand-Norfolk (6)
- Durham (5), and Waterloo (5 including 1 travel-related)
- Halton (4)
- York Region (3), Grey Bruce (3), and Lambton (3),
- Leeds-Grenville and Lanark District (2)
- One each from Simcoe-Muskoka District, Eastern Ontario, Peterborough County-City, Chatham-Kent, Haliburton-Kawartha-Pine Ridge District, Sudbury and District, Kingston-Frontenac and Lennox and Addington, Oxford County, and North Bay Parry Sound District.

In 2017, there were 159 human WNV cases in Ontario, in 2016 - 56, 2015 - 34 and in 2014 - 13.

Comparison with Other Provinces

As of December 15, 2018, there were a total of 367 human cases in Canada:

- Alberta (45)
- Manitoba (32)
- Ontario (136)
- Quebec (163).\(^4\)

In 2017, there were 193 cases, 104 cases in 2016, 80 cases in 2015 and 21 cases in 2014.

---


**Planned Activities for 2019:**

- Public Health staff will investigate all reported suspected, probable and confirmed cases of WNV.
- Public Health will map all probable and confirmed cases of WNV.
- Public Health will work closely with Public Health Ontario to ensure that surveillance information is standardized, and that personal medical information remains confidential.
- In early summer, Public Health will distribute a Health Professionals Update to Peel physicians about the importance of immediately reporting all suspected cases of viral encephalitis and viral meningitis. The update will communicate information on how to submit appropriate laboratory samples to determine if the cause is a mosquito-borne virus.
- In the spring, Public Health will present to physicians and health care providers at the local hospitals to educate and update them on WNV investigation, treatment, and reporting procedures.

**Adult Mosquito Surveillance**

**Objective:**

- To monitor numbers, species and locations of adult mosquito populations and to detect the presence of WNV in the mosquito population.

From June 17 to September 26, 2018, Public Health monitored WNV activity in the local adult mosquito population using 33 fixed light traps, developed by the U.S. Centre for Disease Control (CDC). The traps were located across the Region with 17 in the City of Mississauga, 11 in the City of Brampton and five in the Town of Caledon (Map 1). In 2017, two new mosquito trapping locations were added in Wards 6 and 9 in Brampton to account for significant population growth.

Public Health sent the adult specimens collected in the mosquito traps to Sporometrics, (Peel’s mosquito laboratory service provider), from June 20, 2018 (week 25) to September 26, 2018 (week 39). The mosquitoes in the pools were identified, homogenized, processed and tested for WNV and/or eastern equine encephalitis (EEE) using real time reverse transcription-polymerase chain reaction (RT-PCR) according to MOHTLC directives. Only female mosquitoes of vector species were tested using the assay. In total 494 traps were sent, with 33 traps sent every week for 15 weeks.
The laboratory analysis found that nineteen traps collected positive mosquitoes: seven in Mississauga, ten in Brampton, and two in Caledon. The red dots on Map 1 denote traps from which positive WNV mosquitoes were collected.

The year-to-year onset and peak of WNV-positive mosquito batches vary. The first positive trapping event in 2018 occurred in Brampton during week 29 (July 15 to 21). The last positive batches in 2018 occurred during week 38 (September 16 to 22) in Brampton and Mississauga (Figure 3). WNV activity occurred later in the season in 2018 compared to 2017, although in 2017, WNV activity happened unusually early during week 26 (June 24 to 30).

In 2018, 70,975 mosquitoes were collected and 31,449 were identified; of those, 23,027 were WNV vectors (Table 2). The most abundant vector species were *Culex pipiens/restuans*. There was a total of 69 WNV positive mosquito pools (Table 3). Of these pools, 33 were in Brampton, 32 in Mississauga, and four in Caledon. The majority of WNV positive pools (52 of 69; 75%) were *Culex pipiens/restuans*. 
Map 1: Mosquito Trap Location, Peel Region, 2018

West Nile Virus - Mosquito Trapping
Peel - Year 2018 (Week 25-39)

Legend
- Watercourse
- Bodies of Water
- Town / Township / City Boundary
- Trap
- Trap with Positive Results

The information on this map is subject to change and is based on surveillance data as of 2018.
Figure 3: WNV Positive Mosquito Pools by Week of Collection, Peel Region 2015-2018

Source: Sporometrics
Table 2: West Nile Virus Vector Species Abundance Totals, Peel Region, 2018

<table>
<thead>
<tr>
<th>Species</th>
<th>Specimens Identified</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Culex pipiens/restuans</em></td>
<td>7,792</td>
<td>33.8</td>
</tr>
<tr>
<td><em>Aedes vexans</em></td>
<td>5,194</td>
<td>22.6</td>
</tr>
<tr>
<td><em>Ochlerotatus trivittatus</em></td>
<td>3,179</td>
<td>13.8</td>
</tr>
<tr>
<td><em>Ochlerotatus stimulans</em></td>
<td>2,702</td>
<td>11.7</td>
</tr>
<tr>
<td><em>Anopheles punctipennis</em></td>
<td>1,315</td>
<td>5.7</td>
</tr>
<tr>
<td><em>Ochlerotatus canadensis</em></td>
<td>1,194</td>
<td>5.2</td>
</tr>
<tr>
<td><em>Ochlerotatus japonicus</em></td>
<td>1,120</td>
<td>4.9</td>
</tr>
<tr>
<td><em>Anopheles quadrimaculatus</em></td>
<td>240</td>
<td>1.0</td>
</tr>
<tr>
<td><em>Ochlerotatus triseriatus</em></td>
<td>214</td>
<td>&lt;1</td>
</tr>
<tr>
<td><em>Culex salinarius</em></td>
<td>62</td>
<td>&lt;1</td>
</tr>
<tr>
<td><em>Anopheles walkeri</em></td>
<td>14</td>
<td>&lt;1</td>
</tr>
<tr>
<td><em>Culex tarsalis</em></td>
<td>1</td>
<td>&lt;1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23,027</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Sporometrics

Table 3: West Nile Virus Vector Species Testing Pools, Peel Region, 2018

<table>
<thead>
<tr>
<th>Species</th>
<th>Pools Tested</th>
<th>Specimens Tested</th>
<th>Positive Pools</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Culex pipiens/restuans</em></td>
<td>400</td>
<td>5,663</td>
<td>52</td>
</tr>
<tr>
<td><em>Aedes vexans</em></td>
<td>282</td>
<td>3,491</td>
<td>8</td>
</tr>
<tr>
<td><em>Ochlerotatus trivittatus</em></td>
<td>140</td>
<td>1,179</td>
<td>3</td>
</tr>
<tr>
<td><em>Anopheles punctipennis</em></td>
<td>165</td>
<td>642</td>
<td>1</td>
</tr>
<tr>
<td><em>Ochlerotatus japonicus</em></td>
<td>61</td>
<td>376</td>
<td>1</td>
</tr>
<tr>
<td><em>Ochlerotatus triseriatus</em></td>
<td>57</td>
<td>140</td>
<td>2</td>
</tr>
<tr>
<td><em>Culex salinarius</em></td>
<td>28</td>
<td>56</td>
<td>2</td>
</tr>
<tr>
<td><em>Ochlerotatus stimulans</em></td>
<td>3</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td><em>Ochlerotatus canadensis</em></td>
<td>2</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td><em>Culex tarsalis</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Anopheles walkeri</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Anopheles quadrimaculatus</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,138</strong></td>
<td><strong>11,597</strong></td>
<td><strong>69</strong></td>
</tr>
</tbody>
</table>

Source: Sporometrics: based on PCR data
**Minimum Infection Rate**

The minimum infection rate (MIR) is used as an indicator of the prevalence of WNV transmission intensity and, therefore, the risk for human disease (Table 4). The overall MIR in *Culex* species in was 9.44 in 2018, which was lower than the MIR of 12.00 in 2017. Although a MIR cannot definitively convey the risk of WNV, Public Health uses the MIR in conjunction with additional surveillance indicators to determine the weekly WNV Risk Assessment Level (see page 22 for further details).

**Table 4: Minimum Infection Rates* of *Culex* Species by Municipality, Peel Region, 2018**

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Vector Species</th>
<th>2018 Actual Number Tested</th>
<th>2018 Positive Batches</th>
<th>2018 MIR*</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Mississauga</td>
<td><em>Culex pipiens/restuans Culex salinarius</em></td>
<td>2,078</td>
<td>21</td>
<td>10.11</td>
</tr>
<tr>
<td>City of Brampton</td>
<td><em>Culex pipiens/restuans Culex salinarius</em></td>
<td>3,200</td>
<td>29</td>
<td>9.06</td>
</tr>
<tr>
<td>Town of Caledon</td>
<td><em>Culex pipiens/restuans Culex salinarius</em></td>
<td>441</td>
<td>4</td>
<td>N/A*</td>
</tr>
<tr>
<td>Peel Region</td>
<td><em>Culex pipiens/restuans Culex salinarius</em></td>
<td>5,719</td>
<td>54</td>
<td>9.44</td>
</tr>
</tbody>
</table>

*The Minimum Infection Rate (MIR) is calculated as the number of positive batches of infected mosquitoes of a given species divided by the total number of mosquitoes of a given vector species that were tested for the presence of the virus, expressed by 1,000.

*MIRs are unreliable when the sample is less than 1,000. Fewer than 1,000 *Culex* mosquitoes were collected in Town of Caledon so the MIR could not be accurately calculated.

**Planned Activities for 2019:**

- From mid-June to early October, Public Health will trap adult mosquitoes at 33 permanent sites throughout the three municipalities. Mosquitoes will be collected using CDC light traps. Adult mosquitoes will be sent to Sporometrics for testing, speciation and viral testing.

- Public Health will continue to monitor the prevalence and distribution of new and invasive mosquito species such as *Ochlerotatus japonicus* and *Aedes albopictus*. 
Larval Mosquito Surveillance

Objective:

- To monitor numbers, species and locations of larval mosquito activity to inform larval reduction activities.

Larval surveillance guides WNV prevention and reduction activities. It is used to determine the location, species and population densities of mosquitoes and for establishing optimal times for implementing larval reduction measures. Potential breeding sites are identified by referring to breeding site information collected in previous years and by stagnant water complaints received through the Environmental Health Contact Centre or the on-line reporting form.

Between June and September, VBD staff surveyed aquatic habitats for the presence of mosquito larvae and identified 1,018 potential mosquito breeding sites on publicly-owned lands across Peel Region. Nearly half (41.5%) of the sites identified were ditches (Figure 4) and 15% were culverts. Ditches and culverts are the most difficult sites to achieve successful abatement of mosquito populations using control measures because of their relative abundance and effectiveness at holding standing water.

**Figure 4: Type of Sites Found to Contain Mosquito Larvae, Peel Region, 2018**

Source: Pestalto Standing Water Visits & Treatments
**Species Identification - Larval Analysis**

In 2018, VBD staff identified nine different species of mosquitoes. Consistent with previous years, *Culex (Cx.) pipiens*, a key WNV vector, was the most abundant species identified (Table 5). Nearly half of the larvae identified were *Cx. pipiens* (49.2%), followed by *Cx. territans* (13.5%), and *Cx. restuans* (11.0%), another key WNV vector. *Aedes vexans*, a confirmed WNV bridge vector in Ontario, accounted for 11.1% of larvae identified, which is incrementally more than the 9% identified in 2017. *Ochlerotatus japonicus*, an invasive species of concern that is also a WNV vector, accounted for less than one percent of larvae identified.

**Table 5: Larval Species Identified, Peel Region, 2018**

<table>
<thead>
<tr>
<th>Species Type</th>
<th>Total Count for Each Species (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Culex pipiens</em></td>
<td>1,394 (49.2%)</td>
</tr>
<tr>
<td><em>Culex territans</em></td>
<td>382 (13.5%)</td>
</tr>
<tr>
<td><em>Aedes vexans</em></td>
<td>314 (11.1%)</td>
</tr>
<tr>
<td><em>Culex restuans</em></td>
<td>312 (11.0%)</td>
</tr>
<tr>
<td><em>Ochlerotatus dorsalis</em></td>
<td>261 (9.2%)</td>
</tr>
<tr>
<td><em>Anopheles punctipennis</em></td>
<td>141 (5.0%)</td>
</tr>
<tr>
<td><em>Ochlerotatus japonicus</em></td>
<td>18 (0.6%)</td>
</tr>
<tr>
<td><em>Anopheles quadrimaculatus</em></td>
<td>9 (0.3%)</td>
</tr>
<tr>
<td><em>Ochlerotatus canadensis</em></td>
<td>3 (0.1%)</td>
</tr>
<tr>
<td><strong>Total Count of All Species</strong></td>
<td><strong>2,834 (100%)</strong></td>
</tr>
</tbody>
</table>

**Planned Activities for 2019:**

- Public Health will continue to work closely with other agencies to collect and map information on potential mosquito-breeding habitats.
- Public Health will regularly inspect priority breeding sites, identified through surveillance data gathered from adult mosquito trapping, and refer these sites for larviciding treatment when warranted.
Larval Mosquito Reduction

Objective:

- To reduce the abundance of adult mosquitoes that can transmit (WNV) to humans using Integrated Mosquito Management (IMM) practices.

The purpose of the larviciding program is to reduce mosquito abundance, especially in the *Culex* species. It is more efficient and cost effective to control mosquito populations by treating mosquito larvae with larvicides than reducing the number of adult mosquitoes.

Mosquito breeding habitats of importance include roadside catch basins, ditches, culverts, discarded tires, unused swimming pools, field pools and containers left outdoors. There are many different surface water breeding sites that can change from year to year requiring a systematic approach to their surveillance and treatment. Habitat modification, which includes altering the habitat to eliminate standing water, can also reduce the potential to breed mosquitoes.

Service Requests

In 2018, VBD staff responded to a total of 360 service requests (Table 6). The greatest number of service requests related to mosquito control were WNV mosquito control on private land (27.5%) followed by backyard catch basins (26.9%). Public Health worked with the area municipality to resolve service requests related to mosquito control on private land. In 2017, there were 426 service requests, with WNV mosquito control on private land and backyard catch basins comprising most of the complaints.

Table 6: Complaint Summary, Peel Region, 2018

<table>
<thead>
<tr>
<th>Complaint Type</th>
<th>Number of Complaints (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tick/Lyme Disease Investigation</td>
<td>133 (36.9)</td>
</tr>
<tr>
<td>WNV Mosquito Control, Private Land</td>
<td>99 (27.5)</td>
</tr>
<tr>
<td>Backyard Catch Basins</td>
<td>97 (26.9)</td>
</tr>
<tr>
<td>WNV Mosquito Control, Public Land</td>
<td>31 (8.6)</td>
</tr>
<tr>
<td><strong>Total Complaints</strong></td>
<td><strong>360 (100.0)</strong></td>
</tr>
</tbody>
</table>
**Catch Basin Treatment**

Catch basin networks are extensive in urban and suburban environments. They retain a small amount of water and organic matter in the form of sediment that collects in the sump of the catch basin. Most catch basins in Peel Region have been found to contain mosquito larvae.

The larvicides used in Peel Region are *Bacillus sphaericus* (Bs), *Bacillus thuringiensis* var. *israelensis* (Bti) and methoprene (Altosid®). Methoprene is a synthetic insect growth regulator which interferes with the development of mosquito larvae into adults. It has been widely used over many years, and its effectiveness and environmental impact have been extensively studied and documented. *Bti* is a biological pesticide that kills mosquito larvae before they develop into adults. *Bti* is be used in surface water breeding sites where impacts on species other than mosquitoes are more of a concern. *Bs* provides mosquito control over a period of time and is effective in controlling mosquito larvae in high organic environments like catch basins. Since 2005, *Bs* has been used in Peel to treat catch basins that drain directly into sensitive sites as well as some selected surface water sites.

In Peel Region in 2018, a total of 292,317 treatments were applied to approximately 100,000 roadside catch basins with 210.81 kg of Altosid® Pellets (including active ingredient methoprene). Under permit by the Ministry of Environment, Conservation and Parks (MECP), Pestalto also applied 260 treatments of VectoLex® water soluble pellets (WSP) of *Bacillus sphaericus* to Environmentally Sensitive Areas (ESAs) in two rounds. Altosid® XR Briquets were applied to 1,529 non-roadside catch basins once in the season which provided over 90 days of control. Non-roadside catch basins included those located in or along parks, private backyards, daycares, government buildings, social housing complexes and long-term care facilities.

Factors such as catch basin cleaning, parked vehicles and construction prevented access to some roadside catch basins and resulted in a variance in treatments during each round.

**Surface Water Treatment**

Monitoring mosquito larval habitats to assess the presence and abundance of mosquito larvae was conducted using a standard plastic dipper following the MECP sequential sampling method. On each surveillance visit, the standing water site was given a pool rating of low, moderate or high number of mosquito larvae observed based on a maximum of ten dip samples. Mosquito larval samples were also collected and identified by VBD staff. If vectors were identified, the surface water site was referred to Pestalto for treatment from May 31 to September 22.
There were 346 surface water treatments applied in 2018 (Table 7), compared to 788 treatments in 2017. The reduced number of treatments was primarily due to the relatively drier summer in 2018 compared to previous years.

Table 7: Number of Surface Water Sites Treated, Peel Region, 2018

<table>
<thead>
<tr>
<th>Site Type</th>
<th>Number of Sites</th>
<th>Number of Surveillance Visits</th>
<th>Area Treated (m²)</th>
<th>Number of Sites Treated</th>
<th>Number of Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditch</td>
<td>136</td>
<td>174</td>
<td>7,353</td>
<td>136</td>
<td>174</td>
</tr>
<tr>
<td>Field Pool</td>
<td>85</td>
<td>101</td>
<td>4,844</td>
<td>85</td>
<td>101</td>
</tr>
<tr>
<td>Pond</td>
<td>5</td>
<td>6</td>
<td>246</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Storm Water Management Pond</td>
<td>44</td>
<td>48</td>
<td>4,366</td>
<td>44</td>
<td>48</td>
</tr>
<tr>
<td>Woodland Pool</td>
<td>15</td>
<td>17</td>
<td>1,600</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>285</strong></td>
<td><strong>346</strong></td>
<td><strong>18,409</strong></td>
<td><strong>285</strong></td>
<td><strong>346</strong></td>
</tr>
</tbody>
</table>

Source: Pestalto Standing Water Visits & Treatments

*Stormwater Management Facilities*

Historical larval surveillance data has revealed that most stormwater management facilities (SWMF) generally do not support significant numbers of mosquito larvae. However, some facilities have the potential to be mosquito breeding sites. In 2017, a research review\(^5\) was conducted to identify attributes of SWMFs that contribute to mosquito breeding. The review found that mosquito activity is most commonly associated with SWMFs that are not constructed and maintained to eliminate standing water that collect in the areas of shallow shorelines with dense vegetation and SWMFs that do not contain mosquito predators. These conditions create a favourable environment for mosquito breeding. These findings were used to develop a risk assessment tool for managing mosquitoes around SWMFs.

In 2018, surveillance was conducted at 28 SWMFs in Mississauga that had consistently shown larval activity in previous years. Of those, 17 (61%) had mosquito larval activity resulting in treatment from Pestalto. In Brampton, seven SWMFs classified as high risk in 2017 were inspected. Of the seven sites, five had mosquito activity and were referred for treatment by Pestalto at least once during the season. The remaining 62 SWMFs classified as moderate risk in 2017 were re-visited during the 2018 season. Six of the moderate risk SWMFs were re-classified as high risk while two were re-classified as low risk.

Planned Activities for 2019:

- Public Health will encourage habitat modification (including changing the physical environment such as improving drainage or introducing predators) to make the environment less hospitable for mosquito breeding.

- Where Culex mosquito breeding cannot be effectively reduced by other means, larvicides will be employed. The larvicides that will be used in the Peel Region are Bs, Bti and methoprene (Altosid®).

- Municipal roadside ditches that hold water for longer than seven days will be referred to the local roads departments for assessment and remediation. Ditches containing mosquito larvae will be treated with Bti or Bs.

- Public Health will continue to work closely with local municipalities when investigating stagnant water complaints. Sites located on public property will be investigated by the VBD staff. Stagnant water issues on private property will be addressed by the local by-law enforcement staff under the existing municipal property standard by-laws.

- Public Health will work with municipal departments to ensure that existing sanitation and waste removal on public property (including green areas such as parks, cemeteries, golf courses) place emphasis on removing garbage that promotes mosquito breeding (e.g. tires, pails, etc.).

- Public Health will work with other agencies to identify areas of stagnant water associated with surface grading problems, road construction, clogged sewers and catch basins and obstructed waterways that are serving as mosquito-breeding habitats. These areas will be assessed on a site-specific basis as they are identified and may be treated with larvicide. Remediation will be performed if possible.

- Approximately 103,500 catch basins in Peel Region will receive three scheduled rounds of methoprene applications basins. A fourth round may be considered if high levels of WNV activity are evident. Public Health will work closely with the larviciding contractor to ensure larval surveillance findings are used to strategically time the three applications.

- The Medical Officer of Health will issue an Order under the Health Protection and Promotion Act to each local municipality directing them to assist and facilitate the application of larvicides to catch basins.
• Backyard catch basins will only be treated upon the request of the home owner. A consent form must be signed by the home owner prior to treatment. Methoprene will be the larvicide used to treat backyard catch basins.

• In catch basins draining directly into environmentally sensitive areas, the biological larvicide Bs will be used.

• A risk assessment approach will be used to monitor SWMFs in Peel. High risk SWMFs will continue to be under routine surveillance, medium risk SWMFs will be visited once for further assessment, and low risk and other SWMFs will be visited on a complaint basis only.

• If significant mosquito breeding is found at a SWMF site, Bti or Bs will be used as part of an IMM approach.

• Public Health will work with municipal departments to ensure SWMF design guidelines consider factors that will reduce or prevent mosquito breeding.

**Pesticide Effects and Monitoring**

*Objective:*

• To identify any unplanned impacts of pesticides used in mosquito control on human or ecosystem health.

**Environmentally Sensitive Areas (ESAs)**

There are two circumstances when a Sensitive Area and Species Protocol are required from the MECP to obtain a permit and apply a larvicide:

• The first situation occurs when a catch basin is either located within an ESA or it is known to be the last catch basin before an outfall into an ESA. In Peel Region, there were 130 municipal catch basins that met one of these criteria. Two rounds of VectoLex®WSP were used to control mosquito larvae in ESA catch basins.

• The second situation occurs when a standing water site falls within an ESA. In Peel, there are six standing water sites that meet this criterion including multiple sites within Rattray Marsh, Cawthra Woods, Heartlake Wetland Complex, Credit River Wetland (O’Neil Court Storm Water Management Pond), Credit River Marsh and Lorne Park Prairie.

In 2018, permits issued by the MOECP, with input from the Ontario Ministry of Natural Resources (MNR), and a special wetlands permit were obtained to allow for larviciding
within specific ESA’s in Peel Region. All six ESAs were noted in the permit. ESAs are defined by the MECP and spatial location data is obtained from the MNR.

**Pesticide Effects Surveillance**

In 2018, pesticide effects surveillance was included in the WNV component of the VBD plan. As in previous years, Public Health continued to work with other municipalities, conservation authorities and the MECP to ensure our larviciding program did not negatively impact the ecosystem. Public Health also ensured that the licensed service provider contracted to apply larvicide in Peel Region used larvicide products that have been identified as having the least environmental impact and that abided by MECP regulations.

**Efficacy and Quality Assurance Monitoring**

Catch basin grates were marked with coloured non-permanent spray paint to indicate a larvicide application had occurred. This marking allows an on-site determination of the completion of a treatment round and confirmation that catch basins were treated.

Roadside catch basins treated with Altosid® Pellets received the colour BLUE for the first treatment, ORANGE for the second, GREEN for the third and final round. ESA catch basins were marked with a YELLOW paint dot. Altosid® Briquet treated catch basins were marked with RED paint dots.

Public Health conducted quality assurance monitoring of roadside catch basins during all three rounds of treatment. VBD students were assigned map zones and noted the catch basins that did not have a coloured paint dot associated with the latest application round. Pestalto was notified of any missed catch basins which were to be revisited and larvicided within 24 hours of notification.

Public Health also conducts catch basin methoprene efficacy tests each year. VBD staff follow the post-larviciding monitoring for methoprene efficacy protocol noted in the MECP *Permit Applicant Guide for Municipalities and Health Units: Controlling Mosquito Larvae for Prevention and/or Control of West Nile Virus*.

Each year, VBD staff collect roadside catch basin water containing mosquito pupae from a select number of catch basins following each application round of the larvicide. The pupae were kept in jars covered with mesh lids and observed daily to see if viable adults successfully emerged over a period of four days. The number of dead pupae, dead adults and live adults were then counted. In 2018, 26 pupae were collected, and one viable adult emerged (3.8%), resulting in 96% pesticide efficacy, which is a slightly higher efficacy rate than the 92% recorded in 2017.
**Planned Activities for 2019:**

- Public Health will conduct field inspections to verify that Pestalto (Peel’s larvicide contractor for 2019) is applying the larvicides in accordance with MECP regulations.
- Public Health will continue to ensure service provider uses larvicide products that have the least environmental impact.
- *Bs* will be used in Peel to treat catch basins that drain directly into sensitive sites as well as some selected surface water sites.
- Public Health will conduct catch basin efficacy tests during each round of larviciding treatment to determine larviciding efficacy.

**Risk Assessment and Adulticiding**

**Objectives:**

- To monitor the level of risk from WNV in Peel Region that will be used to inform decisions of when increased public education or adult mosquito reduction techniques are needed.
- To reduce the abundance of adult mosquitoes in areas of elevated risk to human health from WNV through the judicious use of pesticides.

In 2018, from mid-June to late September (weeks 25-38), a weekly risk assessment was conducted based on the surveillance information collected during that week. The purpose of the risk assessment was to identify the relative risk of human WNV infection in Peel Region. Various surveillance factors that influence the risk of WNV infection were evaluated. The factors included were:

- Seasonal temperatures
- Adult mosquito vector abundance
- Virus isolation rate in vector mosquito species
- Human cases of WNV
- Local WNV activity (equine, mosquito)
- Time of year
- WNV activity in proximal urban or suburban regions
In 2017, an evaluation of the WNV risk assessment tool was completed in partnership with Ryerson University. The evaluation found that three factors (seasonal temperature, virus isolation rate in vector mosquito species, and local mosquito WNV activity) were significant factors in predicting human WNV cases or positive WNV traps in the following week.

Each surveillance factor was assigned a weighted score based on the observations of the previous week. The WNV Mosquito Adulticiding Risk Assessment form was completed weekly. When the risk assessment level exceeded a value of three, a decision tree process to consider additional actions would be invoked.

One possible additional action is adulticiding, which is the application of chemicals to kill adult mosquitoes by ground or aerial application. Adulticiding would only be considered in Peel if there was a significant risk to human health. The possibility of adulticiding is considered only when the risk level exceeds a value of four.

Adulticides are typically applied as an Ultra-Low-Volume (ULV) spray, where small amounts of insecticide are dispersed either by truck-mounted equipment or from fixed-wing or rotary aircraft. For effective adult mosquito reduction, the fine ULV droplets must drift through the habitat and make contact with flying mosquitoes. Adulticiding is the least efficient mosquito control technique since adult mosquitoes are widely dispersed and the pesticide must contact the mosquito to kill it. Nevertheless, targeted adulticiding, based on surveillance data, is an extremely important part of any IMM program. If an outbreak of human cases is occurring or imminent, it means that large numbers of WNV infected adult mosquitoes are likely present. This risk can only be mitigated in the short term through adult mosquito reduction.

In 2018, the risk level was highest in week 35 (August 26 to September 1) with a risk assessment level of 4.3. This level of activity did not warrant the need for adulticiding.

**Planned activities for 2019:**

- Adulticiding decisions will be made according to the assessed level of human risk of WNV in consultation with the MOHLTC and Public Health Ontario.
Public Education and Community Outreach Activities

Objectives:

- To inform Peel residents about WNV and the measures that they can take to prevent human illness, including mosquito breeding site reduction and personal protective measures.
- To provide clear, accurate and timely communication about the status of WNV in Peel, to all target groups.

Public Health has developed various educational resources about personal protective measures and individual and household activities that prevent or discourage the breeding of mosquitoes. Available resources include flyers, fact sheets, posters and newspaper advertisements. These resource materials are made available on the Region of Peel VBD website http://www.peelregion.ca/health/vbd. The website is also used to post WNV surveillance results, updates on larviciding activities and provide the public with access to the VBD Prevention Plan.

In 2018, as in previous years, educational materials on WNV were emailed or mailed to the following groups: long-term care facilities, child care centres, garden centres, golf courses, horticultural societies and multicultural associations. Residents and organizations were encouraged to sign up at http://www.peelregion.ca/health/vbd to receive email notification of positive WNV activity in Peel.

In addition, the electronic WNV notification database for institutions and for parks and recreation facilities that were located within a one kilometre range of each of the 33 fixed mosquito trap sites continued to be utilized. An email was sent to institutions and to parks and recreation facilities when a positive mosquito batch was reported in their area.

The only newspaper advertisement in 2018 was the larviciding application notice required by the MECP.

Planned Activities for 2019:

- Public Health’s 2019 VBD Plan will be available on the VBD website as will fact sheets on topics such as personal protection measures, reduction of mosquito breeding sites, larviciding, use of insect repellents, and information for outdoor workers, seniors, and camp attendees. The website will be regularly updated with information on the status of WNV activity in Peel and the catch basin larviciding schedule. An on-line stagnant water reporting form will continue to be available.
• An electronic mailout providing educational materials on WNV will be sent to groups identified as being at risk for exposure to WNV, including: long-term care facilities, garden centres, golf courses, horticultural societies and multicultural associations.

• Newspaper notices will be used to meet the MECP regulatory requirements for public notification of the use of larvicides.

• WNV updates will be distributed by email when there is positive WNV activity in Peel Region. The list of stakeholders the WNV updates will be sent to include Regional Councillors, local municipalities, neighbouring health units, conservation authorities, the media, and others as required. The public can sign up to be included on this mailout by registering at http://www.peelregion.ca/health/vbd/

• An electronic WNV notification database for institutions and for parks and recreation facilities that are located within a one-kilometre range of each of the 33 fixed mosquito trap sites has been developed. An email will be sent to them when a positive mosquito batch is reported in their area.

• Media relation activities will include news releases to the local media, interviews with the Medical Officer of Health and Associate Medical Officer of Health, if requested, and media briefings and/or news conferences, if required.

• Radio messages, sign boards, public meetings and website messaging will be considered if surveillance activities indicate significantly high levels of WNV activity in Peel.

• A contingency communication plan has been developed in the event of adulticiding. It includes tactics such as public meetings, advertising, direct mail, news conferences and briefings, media relations, news releases and website updates to inform the public about adulticiding treatment areas and schedules.

• A report to Council on the planned VBD activities for 2019 will be brought forward in May. It will focus on WNV and Lyme disease.

• Regional and Municipal Councillors will be notified by email of any WNV activity in their ward.

• Presentations on the WNV program will be made at Regional and area municipal Councils, if requested.
• An overview of the 2019 VBD program including WNV activities is available for Councillor’s newsletters upon request.

• Local health care providers will be notified about the status of WNV activity in Peel Region through a faxed Health Professionals Update. Early in the WNV season, information on WNV signs and symptoms, laboratory diagnosis, treatment, patient counselling and human case reporting to Public Health will be provided. Additional notification will be provided on the status of WNV should the situation progress or change.

• In the spring, Public Health will present to physicians and health care providers at the local hospitals to educate and update them on the investigation, treatment, and reporting procedures as it relates to WNV.
Lyme Disease

Lyme disease is passed to humans through the bite of certain species of ticks that are infected with a bacterium called *Borrelia burgdorferi* (*B. burgdorferi*). In Ontario, the disease is spread only by the blacklegged tick, sometimes called the deer tick (*Ixodes scapularis*). There are areas in which the bacterium is endemic, meaning the disease is well established and continuously present in that region.

Ticks can be spread by migratory birds, particularly songbirds that feed off the ground, so there is the potential for new populations of ticks to be spread across the province. Therefore, one does not necessarily have to be in a high-risk area to be at risk of encountering ticks and disease.

There are concerns that changes in climatic conditions such as warmer seasons could lead to conditions that are favourable for the establishment of blacklegged tick populations in many parts of the province including Peel Region.

Human Cases and Surveillance

*Objective:*

- To monitor the incidence of human Lyme disease cases in Peel Region as per the Infectious Disease Protocol under the 2018 Ontario Public Health Standards.

Lyme disease is a reportable disease in Ontario. When a Lyme disease report for a Peel resident is received, Public Health staff initiate an investigation of the case to confirm diagnosis, collect epidemiological information, and identify geographical location(s) where exposure to an infected tick may have occurred.

In 2018, there were 10 confirmed and two probable human Lyme disease cases in Peel residents (Table 8). Of the confirmed cases, five were acquired during travel in Ontario (outside of Peel), and four were acquired during travel outside of Canada. The exposure locations of the other two confirmed cases could not be determined as case interviews could not identify an exposure setting. One probable case was likely acquired during travel in Ontario (outside of Peel) while the other was likely acquired in Peel Region.
Table 8: Lyme disease Cases in Peel Region, 2008 – 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Confirmed or Probable Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>13</td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
</tr>
<tr>
<td>2011</td>
<td>7</td>
</tr>
<tr>
<td>2012</td>
<td>9†</td>
</tr>
<tr>
<td>2013</td>
<td>7</td>
</tr>
<tr>
<td>2014</td>
<td>6</td>
</tr>
<tr>
<td>2015</td>
<td>2</td>
</tr>
<tr>
<td>2016</td>
<td>5</td>
</tr>
<tr>
<td>2017</td>
<td>14††</td>
</tr>
<tr>
<td>2018</td>
<td>12</td>
</tr>
</tbody>
</table>


† Two cases were locally acquired
†† One confirmed case and one probable case likely locally acquired.

**Planned activities for 2019:**

- Public Health staff will continue to investigate all potential cases of Lyme disease among Peel residents.
- If there is evidence of a confirmed case of Lyme disease that has been acquired locally, then active surveillance including tick dragging will be undertaken.
- Local health care providers will be notified about the status of Lyme disease activity in Peel through a Health Professionals Update. The update will include information on symptoms, laboratory diagnosis, treatment and human case reporting to Public Health.
- In the spring, Public Health will present to physicians and health care providers at the local hospitals to educate and update them on the investigation, treatment, and reporting procedures as it relates to Lyme disease.
Tick Surveillance

Objective:

- To monitor the number, species and locations of ticks in Peel Region to detect the presence of blacklegged ticks and the bacteria that cause Lyme disease.

Public Health carries out both passive and active tick surveillance. Passive surveillance is the process whereby residents submit ticks to the local health unit for identification and, if a blacklegged tick, further testing. Passive tick surveillance results are followed-up with active tick surveillance if there are indications that the tick was locally acquired within the health unit. Active tick surveillance involves collecting ticks from their natural habitat through tick dragging. The results of active surveillance inform the designation of new Lyme disease risk areas.

Passive Surveillance

In 2018, 132 tick samples were submitted by Peel residents to Public Health through passive surveillance. Forty-one ticks were identified as blacklegged ticks (21 locally acquired; 17 from outside Peel Region; three from indeterminate locations) while 91 were tick species that were either poor Lyme disease vectors or do not spread Lyme disease (e.g. dog ticks).

Vector-borne disease (VBD) staff submitted 41 blacklegged ticks to Public Health Ontario for species identification and to the National Public Health Laboratory in Winnipeg for *Borrelia burgdorferi* testing. In total, three ticks from outside Peel Region and one tick from an indeterminate location tested positive while all other ticks tested negative. Figure 5 summarizes the tick submissions to Public Health (2010-2018).

Figure 5: Tick Submissions to Public Health, 2010 – 2018
Physicians can submit tick samples directly for laboratory identification and testing and may not notify Public Health about these submissions. Since 2009, 319 blacklegged tick samples have been identified as being acquired in Peel Region based on Public Health Ontario Laboratories (PHOL) and National Microbiology Laboratory (NML) data (Table 9). This includes ticks that were submitted by physicians and ticks that may have been submitted to other public health units. From 2009 to 2017, the number of blacklegged tick samples acquired in Peel Region has increased.

Table 9: Tick Sample Submissions (Tick Acquired in Peel), Peel Region, 2009-2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Blacklegged Tick Samples</th>
<th>Number Tested for <em>B. Burgdorferi</em></th>
<th>Number that Tested Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009#</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2010*</td>
<td>8</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>16</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>29</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>28</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>2014</td>
<td>39</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td>2015</td>
<td>44</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
<td>61</td>
<td>61</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>90</td>
<td>90</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>319</td>
<td>270</td>
<td>30</td>
</tr>
</tbody>
</table>

*Source: Public Health Ontario (2018) data request
# Data only available from June onward

Active tick surveillance

Since 2012, Public Health has conducted active tick surveillance (tick drags) at sites identified through passive surveillance to determine new risk areas. Public Health Ontario provides annual updates on the Lyme estimated disease risk areas map in the province. Estimated risk areas are locations where blacklegged ticks have been identified or are known to occur and where humans have the potential to come into contact with infected ticks. Risk areas are defined as potential tick habitats within a 20-kilometre radius zone around locations where blacklegged ticks have been found during two dragging events (once in spring and again in the fall; from May through October). Prior to 2018, Peel Region did not have a designated risk area with the closest area being Etobicoke with south-eastern Mississauga falling within the 20 km radius.

In 2018, VBD staff conducted a total of six tick drag sampling sessions in Mississauga and four sessions in Caledon at locations identified through passive surveillance (Table 10). The tick dragging sessions identified a total of three blacklegged ticks near the Credit River Valley in Mississauga and a total of two blacklegged ticks near the Humber Valley Heritage Trail in the Caledon during the spring and fall. All the ticks tested negative for *B. burgdorferi.*
Based on the results of the tick dragging, Public Health Ontario identified two new Lyme Disease estimated risk areas in Peel Region. These new estimated risk areas cover all of Mississauga and most of Brampton and Caledon. A map of Public Health Ontario’s estimated risk areas can be found on the Public Health Ontario website at: [https://www.publichealthontario.ca/-/media/documents/lyme-disease-risk-area-map-2019](https://www.publichealthontario.ca/-/media/documents/lyme-disease-risk-area-map-2019).

It is important to note that within an estimated risk area, the risk of encountering blacklegged ticks capable of transmitting Lyme disease is dependent on whether the appropriate habitat is present. Ticks require wooded and brushy areas to establish themselves. Therefore, if there are no wooded or brushy areas present within a section of the indicated risk area (for example, a parking lot), it is expected that blacklegged ticks will not be present and the risk of acquiring Lyme disease is low.

**Table 10: Active Tick Surveillance in Peel Region, 2014-2018**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number and locations of tick drag sessions</th>
<th>Number and location of blacklegged ticks found</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>1 (1 in Caledon)</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>3 (2 in Mississauga, 1 in Brampton)</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>2 (2 in Mississauga)</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>12 (3 in Mississauga, 9 in Caledon)</td>
<td>4* (3 in Mississauga, 1 in Caledon)</td>
</tr>
<tr>
<td>2018</td>
<td>10 (6 in Mississauga, 4 in Caledon)</td>
<td>6* (4 in Mississauga, 2 in Caledon)</td>
</tr>
</tbody>
</table>

*Ticks tested negative for *B. burgdorferi*.

**Planned Activities for 2019:**

- Public Health will continue passive tick surveillance to identify potential risk areas within Peel Region. VBD staff will work with Public Health Ontario to establish new risk areas if blacklegged tick activity was identified through active tick surveillance.

- If there is evidence of a blacklegged tick population or a confirmed or probable case of locally acquired Lyme disease, then active surveillance including tick dragging will be undertaken.

- Active tick surveillance (tick drags) will be conducted, as required, to monitor the prevalence of *B. burgdorferi* in Peel Region.
Public Education Activities

Objective:

- To inform Peel residents about Lyme disease activity and the measures they can take to prevent human illness.

Public Health has developed various educational resources about the symptoms, cause and preventative measures people can take to prevent Lyme disease. These resource materials are available on the Peel VBD website [http://www.peelregion.ca/health/vbd](http://www.peelregion.ca/health/vbd). The website is also used to post Lyme disease human case surveillance results, updates on the Lyme disease risk areas in Ontario, and instructions on how to remove ticks and submit ticks to Public Health for identification.

As in previous years, educational materials on Lyme disease were also emailed or mailed to the following groups: municipal recreation and parks departments, golf courses, horticultural societies, summer camps and multicultural associations.

In 2018, three Health Professional Updates related to Lyme disease were distributed to physicians in Peel. These updates can be found at: [http://www.peelregion.ca/health/professionals/tools/updates2018.htm](http://www.peelregion.ca/health/professionals/tools/updates2018.htm).

Planned Activities for 2019:

- Lyme disease information is available for Councillor newsletters upon request.

- A communication campaign will be developed to inform Peel residents, health care providers, and other key stakeholders on the new Lyme disease risk area in Peel.

- A print or electronic mailout providing educational materials will be sent to groups identified as being at risk for exposure to Lyme disease including: summer camp providers, golf courses, horticultural societies and multicultural associations.

- In the spring, Public Health will present to physicians and health care providers at the local hospitals to educate and update them on the investigation, treatment, and reporting procedures as it relates to Lyme disease.

- The Lyme disease algorithm will be updated with new information and continued to be shared with Peel physicians through Health Professional Updates.

- Educational materials on Lyme disease are available to the public through the Public Health VBD website ([http://www.peelregion.ca/health/vbd](http://www.peelregion.ca/health/vbd)) or by request.
• A Lyme disease newspaper advertisement has been developed. The use of the advertisement in 2019 will be considered if surveillance activities indicate a significant increase in Lyme disease activity in Peel.

• A report to Council will provide information about the 2019 VBD Plan and will include an overview of the Lyme disease component of the plan.

**Eastern Equine Encephalitis**

Eastern Equine Encephalitis, commonly referred to as EEE, is a viral disease of wild birds that is transmitted to horses and humans by mosquitoes. Among the North American mosquito-borne diseases, EEE appears to be the most severe human pathogen; approximately 33% of people who develop EEE die of the disease and many survivors have long-term health effects.

In Ontario, outbreaks of EEE have occurred sporadically among horses. To date, only one locally-acquired human case of EEEV has been reported in a resident of Ontario (2016) who has since recovered. In 2018, no EEE positive mosquito pools were reported. There were 13 equine cases reported in Ontario with one each from Hamilton and Hastings and Prince Edward Counties, four from Haldimand and Norfolk, and seven from Niagara Region (data as of October 30, 2018).6

Adult mosquito surveillance conducted over the last several years has found the key zoonotic species for EEE, *Culiseta (Cs.) melanura*, to be present in Peel but in very low numbers. In 2018, the Region of Peel - Public Health continued to monitor the prevalence and distribution of *Cs. melanura* using the region-wide adult mosquito CDC light trap network. No *Cs. melanura* mosquitoes were found in the CDC light traps. However, 258 pools of other EEE vectors including *Ochlerotatus canadensis*, *Coquillettidia perturbans*, and *Aedes vexans* were found. None tested positive for EEE. In 2017, three *Cs. melanura* were found, and none tested positive for EEE.

**Planned Activities for 2019:**

• Public Health will rely on adult and larval mosquito surveillance data in decision-making about EEE, public education and mosquito reduction activities.

---

Other Vector-Borne Disease of Interest

Malaria, dengue hemorrhagic fever and yellow fever are life-threatening diseases that are transmitted to people through the bite of infected female *Aedes* and *Anopheles* species of mosquitoes. Only dengue hemorrhagic fever must be reported to the local health unit as a reportable disease under the *Health Protection and Promotion Act*. As of May 2018, the Ministry of Health and Long-term Care removed malaria and yellow fever from the list of reportable diseases.

In Peel Region, the occurrence of these diseases is all travel-related. In 2018, there were no cases of dengue hemorrhagic fever reported to the Public Health.

**Planned Activities for 2019:**

- Public Health will investigate all reports of dengue hemorrhagic fever among Peel residents to determine the source of the mosquito bite that caused the illness and to provide educational information.

**Conclusion**

Surveillance activities continue to indicate that WNV is endemic in Peel Region and it is reasonable to assume that the virus will return to Peel at some level in 2019. Public Health will continue to conduct surveillance, public education and larval mosquito reduction activities as these are essential WNV program components in a jurisdiction where WNV has been detected in a previous season.

The designation of the majority of Peel Region as new estimated Lyme disease risk area by Public Health Ontario is significant for the VBD program. In 2019 Public Health will develop a communication campaign to inform Peel residents, health care providers, and key stakeholders of the new risk areas and provide education on Lyme disease symptoms, testing and prevention activities. Active surveillance will be increased in the Lyme disease risk areas to monitor the prevalence of *B. burgdorferi*.

From 2009 to 2017, the number of locally acquired blacklegged tick samples from Peel Region has increased. Passive surveillance will continue, and the data collected will inform active surveillance activities to determine if an established tick population is present in the remaining parts of Peel Region.

In 2019, Public Health will also continue to monitor the prevalence and distribution of *Aedes aegypti* and *Aedes albopictus* using the regional mosquito trapping network.
Appendix

Appendix A: Summary of VBD Objectives for WNV and Lyme disease

**West Nile Virus**

- To monitor the incidence of human WNV cases in Peel Region as per the Infectious Disease Protocol under the 2018 Ontario Public Health Standards.
- To monitor numbers, species and locations of adult mosquito populations and to detect the presence of WNV in the mosquito population.
- To monitor numbers, species and locations of larval mosquito activity to inform larval reduction activities.
- To reduce the abundance of adult mosquitoes that can transmit WNV to humans using IMM practices.
- To identify any unplanned impacts of pesticides used in mosquito control on human or ecosystem health.
- To monitor the level of risk from WNV in Peel Region that will be used to inform decisions of when increased public education or adult mosquito reduction techniques are needed.
- To reduce the abundance of adult mosquitoes in areas of elevated risk to human health from WNV through the judicious use of pesticides.
- To inform Peel residents about WNV and the measures that they can take to prevent human illness, including mosquito breeding site reduction and personal protective measures.
- To provide clear, accurate and timely communication about the status of WNV in Peel, to all target groups.

**Lyme disease**

- To monitor the incidence of human Lyme disease cases in Peel Region as per the Infectious Disease Protocol under the 2018 Ontario Public Health Standards.
- To monitor the number, species and locations of ticks in Peel Region to detect the presence of blacklegged ticks and the bacteria that cause Lyme disease.
- To inform Peel residents about Lyme disease activity and the measures they can take to prevent human illness.