Table of Contents

List of Figures

List of Tables

List of Maps

Executive Summary

Surveillance results of human cases, birds and mosquitoes in 2007 showed a decrease in West Nile Virus (WNV) activity in the Region of Peel and across Ontario. However, some western provinces such as Saskatchewan, Manitoba and Alberta saw increased activity. A record number of 1,422 human cases occurred in Saskatchewan. In comparison, 15 human cases occurred in Ontario.

The information collected in the various surveillance activities continues to be valuable in assessing the risk of human West Nile fever to Region of Peel residents. This information is used to assess the need for enhanced mosquito reduction activities which include larviciding and breeding site reduction. Public education and community outreach are a significant and important component of the program, particularly in preventing personal exposure and in eliminating breeding sites on private property.

WNV, first detected in North America in 1999, is transmitted primarily through the bite of infected mosquitoes. The spread across the continent has been rapid. In 2007, human cases were reported in seven provinces/territories and in 43 states within the continental part of the United States. WNV activity in the Region of Peel first occurred in birds and mosquitoes in 2001. The following year, 2002, marked the year with the greatest number of confirmed human cases in the Region, including two deaths.

In keeping with the Region of Peel WNV Prevention Plan, this sixth annual report presents surveillance information collected in 2007.

Human Case Surveillance

In 2007, there was only one WNV human case, a decrease from the two reported in 2006 and three in 2005. The one case was a resident of the City of Mississauga. The onset of the 2007 case was consistent with the timing of the first case in previous years; however, it is not clear whether the disease was acquired locally or abroad. There were no deaths in the Region of Peel or in any other health unit across Ontario due to WNV infection in 2007. Of the Ontario health units reporting cases, the Region of Peel had the lowest WNV case rate when adjusted for population size. The provincial rate of human WNV infection remains well below the 2002 rate.

Nationally, the rates of human WNV cases surged, particularly in the prairie provinces of Saskatchewan, Manitoba and Alberta. This unprecedented increase in Canada is thought to be due to various weather conditions present in 2007 and the characteristics of the specific WNV mosquito vector prevalent in these provinces. With respect to the weather conditions, the spring of 2007 was wet and the summer was extremely hot. These conditions were optimal for rapid reproduction of vector mosquitoes.

Dead Bird Surveillance

In 2007, there was a 60% decrease in the number of dead birds (all species) reported to the Peel Customer Contact Centre when compared to the previous year. Most dead bird reports (58%) were from the City of Mississauga.

The number of target birds (crows and blue jays) reported decreased by 47% in 2007 when compared to the previous year. Two birds tested positive for WNV in the Region of Peel; both occurred in Brampton.

The bird infection rate in the Region of Peel was 6.9% in 2007. This compares to an average provincial rate of 10.5% and 6.5% nationally. A complete assessment of the infection rate in birds is limited by the capping of bird submissions towards the end of the season. However, due to the low infection rate in Peel Region, there was no cap applied in 2007. This was not necessarily the case with other health units and provinces.

In the Region of Peel, the first positive bird was reported one week after the first human case and two weeks prior to the first positive mosquito batch.

Adult Mosquito Surveillance

Mosquitoes were collected weekly from 31 permanent, fixed-location traps throughout the Region of Peel. In total of 64,450 female adult mosquitoes were collected in the Region of Peel; 49% in the City of Mississauga, 36% in the City of Brampton and 16% in the Town of Caledon.

Three permanent traps were positive for WNV in 2007, for a total of three positive mosquito batches. This represents a decrease from the 14 positive batches that occurred in 2006.

In 2007, sixteen different mosquito species were found in the Region of Peel. The *Culex* species, *Culex pipiens* and *Culex restuans*, are associated with a greater risk of WNV transmission. In 2007, two of the three WNV positive batches in the Region of Peel were due to the *Culex* species. The abundance of the *Culex* species increased in 2007 to 7% from 5% the previous year. This compares to high of 30% seen in 2002 which was before the larviciding program was implemented in Peel Region.

Ochlerotatus japonicus, an efficient WNV vector, was monitored again in 2007. Its abundance relative to other species remained stable at 0.4%; however, the actual counts and trapping events continued to increase in 2007. *Ochlerotatus japonicus* tested positive for WNV for the first time in Ontario in 2007. The positive batch was found in the Chatham-Kent health unit.

In 2007, the presence of the Asian tiger mosquito (*Stegomyia albopicta*) was once again monitored. This was in response to finding this species in the Region of Peel and in two

other Ontario health units for the first time in 2005. This mosquito species is a known carrier of WNV and other viruses. The Asian tiger mosquito was not captured in the Region of Peel in 2007.

Larval Surveillance

Mosquito larval surveillance was undertaken at 2,400 potential breeding sites in the Region of Peel. Seventy per cent of the sites were in the City of Mississauga, 19% in the City of Brampton and 11% in the Town of Caledon. Mosquito larvae were found at 19% of the breeding sites monitored; 2% of all sites had only vector larvae present.

Ditches and woodland pools were the most common habitat where larvae were found. Thirty-one per cent of the breeding sites with larvae were ditches, and 20% were woodland pools.

In 2007, a total of 1,927 mosquito larvae were identified compared to 2,205 in 2006. Sixty per cent of the larvae identified were *Culex pipiens* and *Culex restuans*. Larvae first emerged in week 20 (May 13 to 19) and peaked in week 33 (August 12 to 18).

Larval Mosquito Reduction

As in previous years, the larval mosquito reduction activities involved several concurrent approaches. Four rounds of methoprene (Altosid®) pellets were applied to a total of 343,169 roadside catch basins between mid-June to beginning of September (on average 86,874 treated per round). Limited post-treatment monitoring indicated that the methroprene pellets were 98% effective in controlling mosquito larvae. An additional 2,275 non-roadside catch basins on Peel-owned and/or operated properties, private backyards and public parks were treated with methoprene briquets which were effective up to 86 days.

Vectolex® (*Bacillus sphaericus*) was used in 1,282 catch basins that drain to Environmentally Sensitive Areas.

A total of 221 surface water sites were treated with AquaBac 200G (*Bacillus thuringiensis var. israelensis)*. Some locations required multiple treatments. A total of 201 sites were treated in 2006. Across the Region of Peel, ditches, woodland pools, creeks and culverts were the surface water sites most often larvicided in 2007.

Conclusion

There is no information suggesting that the spread of WNV has stopped. While WNV activity, as measured by the three main surveillance factors, will vary from year to year, it is apparent that the disease has established itself in North America.

A number of factors influence the risk of human WNV infection requiring the implementation of multiple surveillance and risk reduction strategies to minimize the risk

of human WNV infection. The surveillance systems implemented in the Region of Peel suggest that prevention and reduction activities are resulting in reduced risk of human WNV infection in the Region of Peel. Of the nine health units in Ontario that reported WNV cases in 2007, the Region of Peel had the lowest rate of WNV cases, at 0.08 per 100,000 population.

The *Culex* species continues to be the predominant species responsible for the majority of WNV positive mosquito batches in the Region of Peel. Therefore, targeted mosquito vector reduction focussing on the *Culex* species should continue.

The results of the 2007 WNV surveillance program suggest that the 2008 WNV Prevention Plan should continue to focus on surveillance, mosquito reduction, public education and community outreach.

Introduction

West Nile Virus (WNV), a virus transmitted primarily through the bite of infected mosquitoes, was first detected in North America in 1999 when an outbreak was experienced in New York City. Since then, WNV has rapidly spread across the continent to other US states and Canadian provinces.

In early spring, the amplification of WNV begins when infected adult *Culex* mosquitoes that have survived throughout the winter emerge and/or infected migratory birds return to a region. *Culex pipiens* and *Culex restuans*, two mosquito species that feed primarily on birds, are the main vectors for the virus in Ontario and have been estimated to be responsible for up to 80% of WNV human infections in the north eastern United States, an environment similar to Peel Region.[1] They feed on birds and the virus is transmitted back and forth, resulting in an increase in the number of birds and mosquitoes infected. Later on in the season, typically in late July, there is a "spill over point" where the virus bridges out of the mosquito-bird cycle via bridge vectors. The bridge vectors are mosquito species that feed on humans and other mammals in addition to birds.

The type of WNV vector mosquito species will vary with geography. For example, the species responsible for the 2007 increase in human cases in the prairie provinces and the central United States, *Culex tarsalis*, is not found in significant abundance in Ontario.

In 2001, WNV was first detected in birds and mosquitoes in the Region of Peel. Locally acquired human illness of WNV first occurred in the Region of Peel in 2002. Many cases required hospitalization and intensive care. The only two deaths due to WNV infection in the Region of Peel occurred in 2002.

Ontario Regulation 199/03 (Control of West Nile Virus),[2] under the *Health Protection and Promotion Act*, requires that the local Medical Officer of Health (MOH) conduct a risk assessment of the conditions pertaining to WNV in their health unit. The risk assessment relies primarily on surveillance of human, bird and mosquito infections. This guides the MOH with respect to appropriate WNV risk reduction activities, including the need for additional mosquito reduction measures. Provincial regulation also requires the MOH to record, investigate and report any adverse or unintended human health effects attributed to mosquito reduction actions and to report any non-human environmental adverse effects to the Ministry of Environment and/or other relevant local or provincial authorities. WNV is both a reportable and communicable disease under Regulations 558/91[3] and 559/91,[4] respectively, requiring physicians and laboratories to report human cases to the local MOH.

Since 2003, the Region of Peel has had a WNV Prevention Plan. The goal of the plan is to minimize the impact of WNV with a regional surveillance program involving humans, birds and mosquitoes. The surveillance program guides the

integrated pest management activities which include mosquito larvae reduction and prevention, and the public education and community outreach activities.

This sixth annual West Nile Virus in the Region of Peel report presents the surveillance data and information on the risk reduction activities for 2007. This report follows the 2007 WNV Prevention Plan set out and adopted by the Region of Peel Council.[5] The 2007 surveillance information is compiled, analyzed and compared to previous years' information where appropriate. Larval reduction, public education and community outreach activities are also reviewed.

The scope of the 2007 report has been narrowed. In previous years, the annual report provided the detailed results of the Peel program plus details on the surveillance activities at the provincial, national and Great Lakes States level. This year's annual report will continue to provide information about the provincial and national level; however, details that have been articulated in previous reports and that have not changed from year-to-year will not be repeated. Rather, the reader is directed to those reports for more detail at the WNV web site (http://www.peelregion.ca/health/westnile/resources/). In addition, detailed explanations of process and methods will not be repeated because they are established elements of the program. Any changes in the program will be noted. The Ward Profiles chapter has not been included in this year's report. The WNV communications plan includes weekly updates to all stakeholders including local and regional councillors. Whenever a human case occurs the appropriate stakeholders are promptly informed.

Human Case Surveillance

Human Case Surveillance Highlights in 2007

- One confirmed human case in Peel Region occurred in Mississauga
  - The case was classified as non-neurological
  - It is unclear whether the disease was contracted locally or abroad
  - The onset date of the first Peel Region case was August 9, 2007 (week 32)
- Cases in adjacent municipalities - Toronto – 4; Halton – 2.
- Of the nine Ontario health units reporting WNV cases, Peel Region had the lowest rate of cases at 0.08 per 100,000 population.
- There were 15 cases reported in Ontario compared to 41 in 2006 and 101 in 2005. No deaths occurred in Ontario in 2007.
- Saskatchewan reported a record number of human cases (1,142) followed by Manitoba (576) and Alberta (320).

Approximately one in five people (20%) who are bitten by a mosquito infected with WNV will develop symptoms. Most people who are infected have either no symptoms or mild illness such as West Nile fever. The incubation period is estimated to be three to 14 days with symptoms lasting approximately three to six days. Cases are classified as West Nile Virus Neurological Syndrome (WNNS) or West Nile Virus Non-Neurological Syndrome (WN Non-NS). The Ministry of Health and Long-term Care (MOHLTC) has developed case definitions and diagnostic test criteria (refer to Appendix A).[6]

WNV fever is described as a sudden onset of fever that is often accompanied by malaise, headache, nausea, vomiting, anorexia, eye pain, myalgia and less commonly, rash and/or swollen lymph nodes. This is typically classified as WN Non-NS.[7]

In about 1% of infected individuals, WNV can cause serious illness including severe neurological disease which is classified as WNNS. Additional symptoms among those with severe disease include muscle weakness and a change in mental status.[7]

Long-term health effects are possible but less well understood. They can include physical (long-term muscle weakness and paralysis, fatigue and headache), cognitive (depression, confusion, and memory loss) and functional effects (difficulty with meal preparation and shopping).[7]

The human case surveillance program for WNV is intended to detect human illness in the Region of Peel. All probable or confirmed cases identified by hospitals and physicians are reported to the local public health department.

Peel Public Health staff investigate all reported probable and confirmed cases of WNV among Peel residents. Medical information including demographics, symptoms and risk factors (i.e. travel history, blood products recipient) is collected and entered into the integrated Public Health Information System (iPHIS).

Human Surveillance Program - 2007

In 2007, there was one confirmed human case of WNV in the Region of Peel. This case reported in week 32 (Aug 5-11) was a female resident of Mississauga. The case was classified as non-neurological with symptoms of dizziness, weakness, fever, headache and nausea. The patient has recovered from the virus.

Peel Public Health staff conducted assessment to determine risk factors. The case had travelled outside of Canada in mid-July to a country where WNV is present. Therefore, it is unclear whether the disease was acquired locally or abroad.

Upon notification of the positive human case, seasonal staff in the WNV program went door-to-door in the immediate area advising residents and offering to survey the property for mosquito breeding sites. In addition, educational material on symptoms of WNV, reduction of mosquito breeding sites and personal protection were provided to the residents. An intensified environmental scan around the area of the identified positive case was conducted to verify that roadside catch basins were treated and stagnant water sites were identified. Any mosquito breeding sites identified on public property were larvicided or remediated.

Table 1 presents comparative data of human cases in the Region of Peel between 2002 and 2007.[8] Human WNV cases have varied from year to year. In 2002, the greatest number of cases were reported; 57 WNV probable and confirmed cases based on the 2002 case definition. However, the case definition has changed since 2002. Two WNV-related deaths occurred in 2002. No WNV-related deaths have occurred in the Region of Peel in subsequent years.

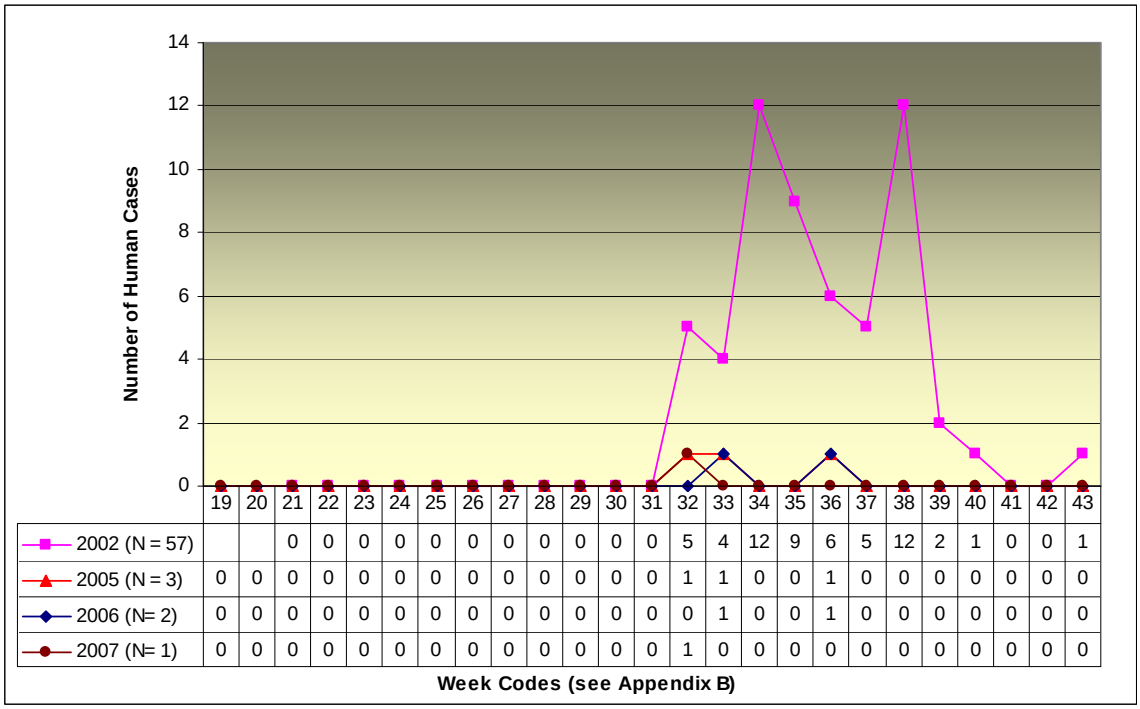
Figure 1 presents the temporal analysis of human WNV cases in Peel Region for 2007 and two previous years (2005 and 2006).[8] In addition, 2002 is included as the baseline year because it was the first year the program was implemented and the reference year upon which the risk assessment is based. This weekly analysis shows that most cases are consistently reported in the months of August and September. However, cases can be reported as late as October, as was the case in 2003.[8]

Table 1 Number of Human Cases by Municipality, Region of Peel, 2002-2007

	Peel Region	Mississauga	Brampton	Caledon
2002[†]	57	52	5	0
2003	10	10	0	0
2004	0	0	0	0
2005	3	2	1	0
2006	2	0	2	0
2007	1	1	0	0

[†]In 2002, there were a total of 112 cases with laboratory and/or clinical evidence of WNV infection; 57 cases were classified as probable or confirmed. In subsequent years, only confirmed cases were reported as a result of changes in disease classifications. If the present day classifications were applied there would have been 18 confirmed human cases in 2002.

Figure 1 Confirmed and Probable Human Cases, Region of Peel, 2002*, 2005 –2007



Week Code	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
2002 (N = 57)			0	0	0	0	0	0	0	0	0	0	0	5	4	12	9	6	5	12	2	1	0	0	1
2005 (N = 3)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0
2006 (N= 2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
2007 (N= 1)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

[*]In 2002, there were a total of 112 cases with laboratory and/or clinical evidence of WNV infection. 57 cases were classified as probable or confirmed. In subsequent years, only confirmed cases were reported as a result of changes in disease classifications. If the present day classification were applied there would have been 18 confirmed human cases in 2002.

Comparison with other Ontario Health Units

Across Ontario in 2007, there was a total of 15 human WNV cases compared to 42 in 2006 and 101 in 2005.[9] Table 2 presents the breakdown of human cases in Ontario by health unit. Nine out of 36 health units reported human cases in 2007. The City of Toronto reported the greatest number of cases, with four. There were no WNV-related deaths reported in Ontario in 2007 compared to two in 2006 and eight in 2005.[10]

Table 2 also presents the rate of cases per 100,000 population derived. Huron County and Thunder Bay health units had the highest human WNV case rate at 1.63 and 1.33 per 100,000, respectively. Of the nine health units reporting human cases, Peel Region had the lowest human WNV case rate at 0.08 per 100,000 population. With respect to the five health units adjacent to the Region of Peel, only Toronto (4), and Halton (2) reported human cases.

Map 1 shows the locations of human WNV cases by Ontario health unit for 2007.[9] As in the previous year, Northern Ontario health units reported human cases in 2007.

Table 2 Summary of Human WNV Cases, Deaths and Rates by Health Unit, Ontario, 2007

Health Unit	Cases*	Deaths*	Population†	# of cases per 100,000 population
Algoma	0	0	120,100	0.00
Brant County	0	0	136,900	0.00
Chatham-Kent	0	0	109,500	0.00
Durham Region**	1	0	595,300	0.17
Eastern Ontario	0	0	199,600	0.00
Elgin-St. Thomas	0	0	89,300	0.00
Grey Bruce	0	0	161,900	0.00
Haldimand-Norfolk	0	0	112,400	0.00
Haliburton, Kawartha, Pine Ridge District	0	0	176,200	0.00
Halton**	2	0	467,300	0.43
Hamilton	1	0	522,400	0.19
Hastings and Prince Edward Counties	0	0	163,400	0.00
Huron County**	1	0	61,500	1.63
Kingston, Frontenac and Lennox and Addington	0	0	189,300	0.00
Lambton County	0	0	132,100	0.00
Leeds, Grenville and Lanark District	0	0	171,200	0.00
Middlesex-London	1	0	438,700	0.23
Niagara Regional	0	0	435,800	0.00
North Bay Parry Sound	0	0	128,200	0.00
Northwestern	0	0	86,500	0.00
Ottawa	0	0	842,900	0.00
Oxford County	0	0	107,200	0.00
Peel Region**	1	0	1,291,300	0.08
Perth District	0	0	77,500	0.00
Peterborough County-City	0	0	134,600	0.00
Porcupine	0	0	84,100	0.00
Renfrew County and District	0	0	98,400	0.00
Simcoe Muskoka District	0	0	499,500	0.00
Sudbury and District	0	0	196,400	0.00
Thunder Bay District	2	0	150,500	1.33
Timiskaming	0	0	33,400	0.00
Toronto**	4	0	2,641,900	0.15
Waterloo Region	0	0	496,900	0.00
Wellington-Dufferin-Guelph	0	0	268,000	0.00
Windsor-Essex County	2	0	408,100	0.49
York Region	0	0	976,300	0.00
TOTAL	**15**	**0**	-	-

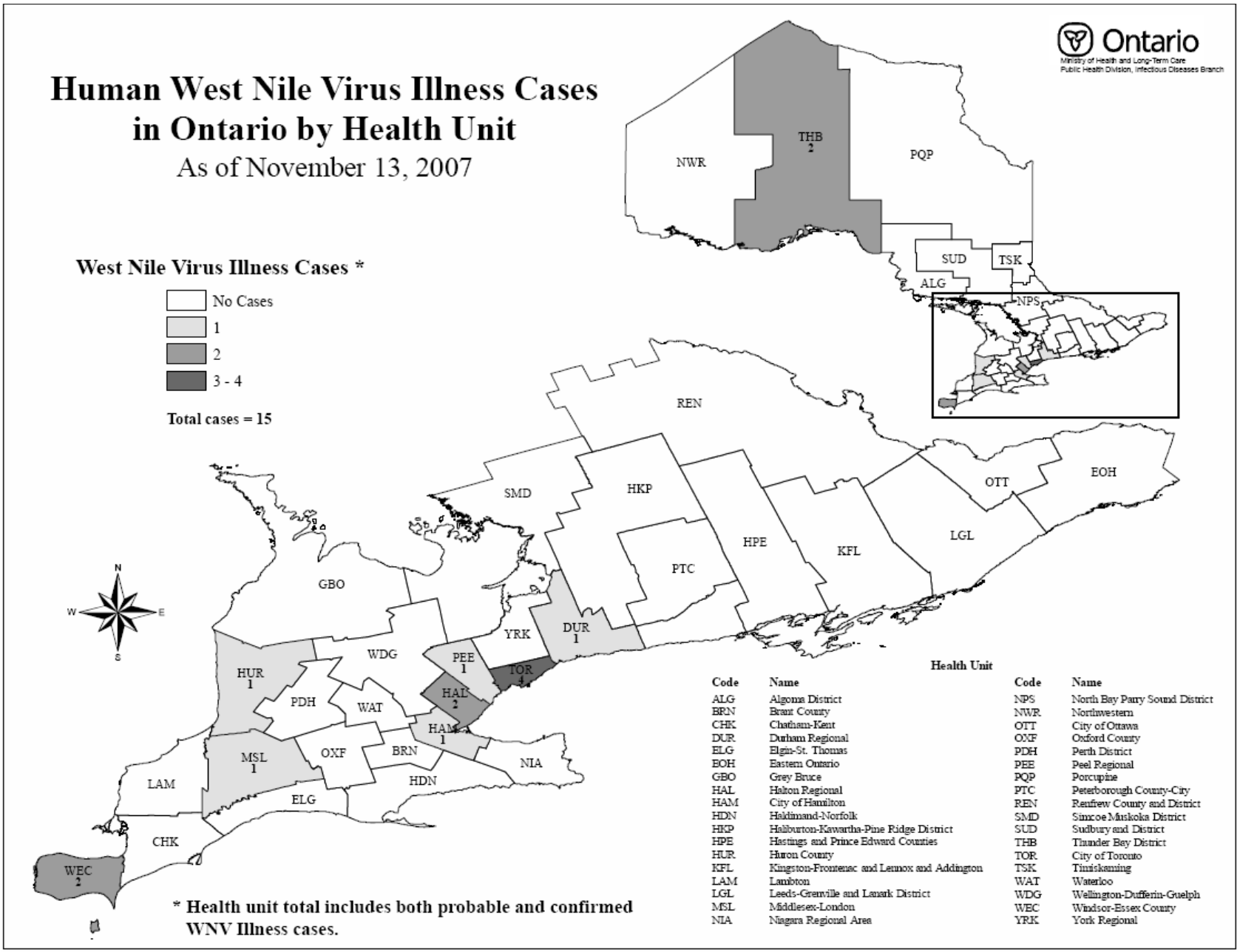
* Source: Ministry of Health and Long-Term Care, 2007, http://www.health.gov.on.ca/english/providers/program/pubhealth/westnile/wnv_07/wnv_humans.html [9]

** May include possible travel-related cases. Travel cases refer to patients with a history of travel out of Ontario in the 15 days prior to symptom onset, while endemic refers to cases with no travel history out of Ontario three weeks prior to symptom onset. Also, a case is called endemic if the case has been in both a region of Ontario with WNV activity and an area outside of Ontario with WNV activity in the three weeks prior to symptom onset.

† Source: Ontario Ministry of Finance Population Projections by county from 2006-2031, based on 2001 Census. Downloaded 2007/11/29 from the Provincial Health Planning Database, Vital Statistics.[11]

Rows shaded in blue are the municipalities adjacent to the Region of Peel, which is shaded yellow

Map 1 West Nile Virus Cases by Ontario Health Unit Region, 2007[9]



Comparison with other Provinces

A record number of WNV human cases were reported across Canada in 2007. There were a total of 2,353 human cases of WNV and eight deaths in 2007, compared to 128 cases and two deaths in 2006 and 226 cases and 12 deaths reported in 2005.[10]

Table 3 presents the provincial breakdown of cases and deaths by province. Saskatchewan reported a record number of cases, followed by Manitoba, Alberta and British Columbia. Fifty-two per cent of the cases across Canada were non-neurological.[10]

The unprecedented numbers of human WNV cases seen in Canada's prairie provinces in 2007 were largely due to a combination of certain weather conditions and the particular vector mosquito, *Culex tarsalis* that is abundant in these provinces. *Culex tarsalis* is known as an irrigation breeder where it prefers vegetation and open areas. It does not breed well in containers like the *Culex* species, the vector species of interest in Ontario. Therefore, it is very difficult to implement broad-based prevention programs such as larviciding which is routinely conducted in the urban areas of Ontario. With respect to the weather conditions, the spring of 2007 was wet and the summer was extremely hot. These conditions were optimal for rapid reproduction of vector mosquitoes.

Table 3 Number of Human Cases and Deaths by Province, Canada, 2006 and 2007

	2007		2006	
Province/Territory	**Cases***	**Deaths**	**Cases***	**Deaths**
Newfoundland and Labrador	0	0	0	0
Prince Edward Island	0	0	0	0
Nova Scotia	**1	0	0	0
New Brunswick	0	0	0	0
Quebec	**2	0	1	0
Ontario	15	0	41	2
Manitoba	576	3	51	0
Saskatchewan	1422	4	11	0
Alberta	320	1	24	0
British Columbia	**19	0	0	0
Yukon	0	0	0	0
Northwest Territories	0	0	0	0
Nunavut	0	0	0	0
TOTAL	**2353**	**8**	**128**	**2**

*sum of probable and confirmed: WNNS + WN Non-NS + Unclassified/Unspecified

**all cases likely related to travel outside the province / territory

Source: Public Health Agency of Canada, 2007;[10] Manitoba Government (2007);[12] Saskatchewan Ministry of Health (2007);[13] Ontario Ministry of Health and Long-term care (2007)[14]

Dead Bird Surveillance

Dead Bird Surveillance Highlights for 2007

- 415 dead birds were reported to the Peel Customer Contact Centre – the lowest number since 2002 and a 89% decrease since the peak of 3,919 in 2003.
- Approximately 58% of the dead birds were reported from the City of Mississauga, 26% from the City of Brampton and 17% from the Town of Caledon.
- The number of target birds (crows, blue jays) reported decreased by 47% compared to 2006.
- The first WNV-positive bird was observed in mid-August.
- 7% of birds tested were positive for WNV
    - Both positive birds were found in Brampton.
- In 2007, there was a 69% decrease in WNV positive birds in Ontario - from 256 in 2006 to 79 in 2007.
- Nationally, the number of dead birds decreased by approximately 48% - Ontario and Saskatchewan had the highest percentage of birds testing positive for WNV (11% and 25%) compared to the national average of 6.5%.

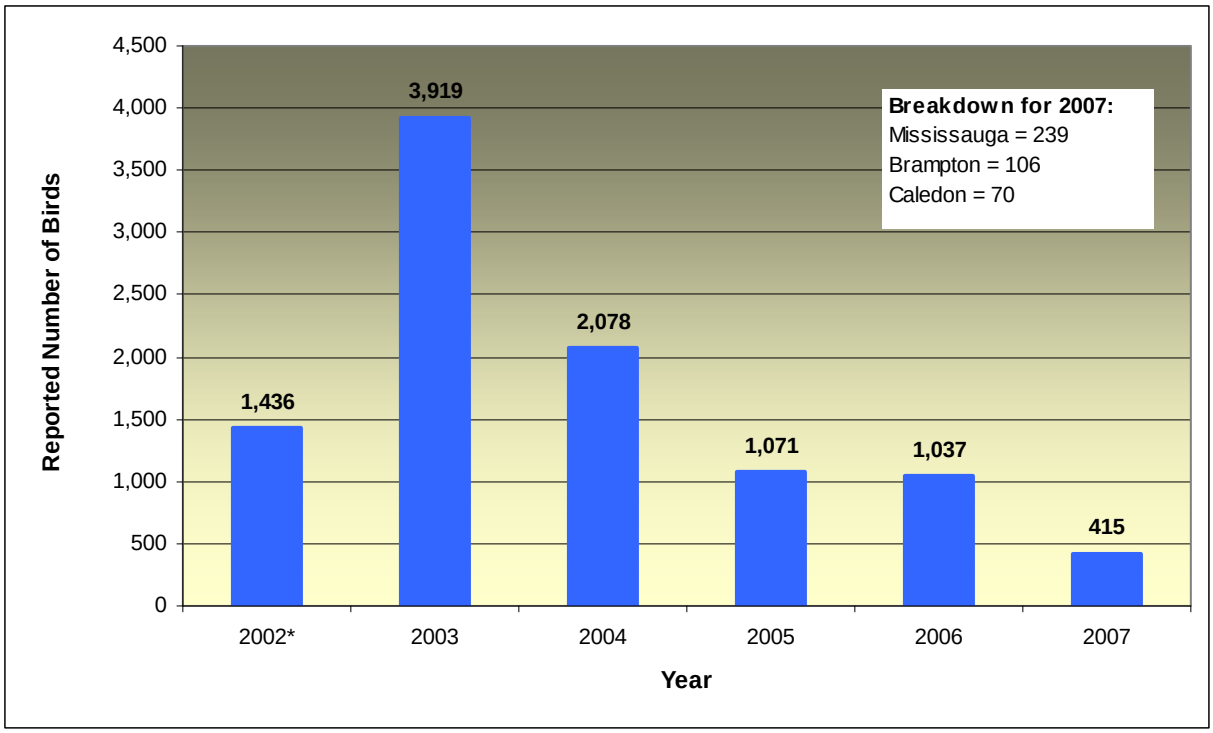
Historically, the sudden appearance of dead birds has been the first indicator of the presence of WNV in an area. The corvid species (crows, blue jays) and hawks are particularly sensitive to the effects of WNV and are the most likely to die once infected. For this reason, the Region of Peel maintains a Dead Bird Surveillance program. Telephone calls reporting dead birds are received by the Customer Contact Centre (CCC) on weekdays and by the staff at the Environmental Health duty desk on Saturdays and statutory holidays. Dead bird surveillance started in 2000 with the inclusion of only crows but has since expanded to include blue jays. Hawks were included for testing in 2004 for study purposes only.

Testing of dead birds for WNV was conducted by the Canadian Cooperative Wildlife Health Centre (CCWHC) located in Guelph, Ontario. Not every target bird was suitable for testing due its physical condition. Therefore, not every dead target bird reported within the season was tested. Reports of other dead bird species were noted and mapped but Peel Public Health does not collect or test these birds for WNV.

A private pest control company was contracted by Peel Public Health to pick up dead crows and blue jays for testing.

As shown in Figure 2, there were 415 dead bird calls to the Customer Contact Centre in 2007. This represents an 89% decrease in dead bird reports since the 2003 peak of 3,919.[8] This decline in the number of reports may be due to several factors including a general population decline of birds, especially those species sensitive to WNV that may have been significantly impacted in previous years.

Figure 2 Number of Dead Birds Reported to Customer Contact Centre, Region of Peel, 2002-2007



*In 2002 all dead bird reports are assumed to be crows.

Mississauga reported approximately 58% of the dead birds in the Region of Peel. The majority were found in locations south of Highway 401 with a small cluster in the northeast community of Malton. Twenty-six percent of the dead birds were from Brampton. Approximately 17% of the dead bird reports were from Caledon.

Table 4 shows the number of dead bird reports for the target species (crows and blue jays) for the years 2005-2007 plus 2002, the baseline year. There were 1,436 dead crows reported in 2002 in comparison to 59 dead crows and blue jays combined, in 2007. Forty of the 59 were crows and 19 were blue jays. This represents a 47% decrease in the number of target birds reported over the previous year. There was a significant decrease in dead crows reported from 2002 through to 2007, from 1,436 to 40, respectively.

When separating the dead target bird reports based on the local municipality the greatest number of reports were from Caledon (39%) followed by Mississauga (37%) and Brampton (24%).

Table 4 Number of Dead Bird Reports for Target Species by Municipality, Region of Peel, 2002, 2005-2007

	2002*	2005†	2006†	2007†
Brampton	485	41	36	14
Caledon	48	41	30	23
Mississauga	903	72	46	22
Total	1,436	154	112	59

* Target Birds were crows only
† Target Birds were crows and blue jays
Source: Region of Peel, 2006[8]

Figure 3 illustrates the temporal trend across the Region of Peel for dead target birds for each year of the program. As noted previously, the number of target birds being reported in 2002 was significantly greater than other years. For most weeks throughout the 2007 reporting season, the number of target birds reported was less than 2006. As in previous years (except 2002) the weekly report of dead target birds did not exceed 20.

As shown in Table 5, the first WNV positive bird in the 2007 surveillance season was reported in week 33 (August 17, 2007) in the City of Brampton. The reporting of the first positive bird in 2007 occurred later than in the previous years noted, one week after the first human case and two weeks prior to the first positive mosquito.

Figure 3 Total Target Birds* by Week, Region of Peel, 2002, 2005-2007

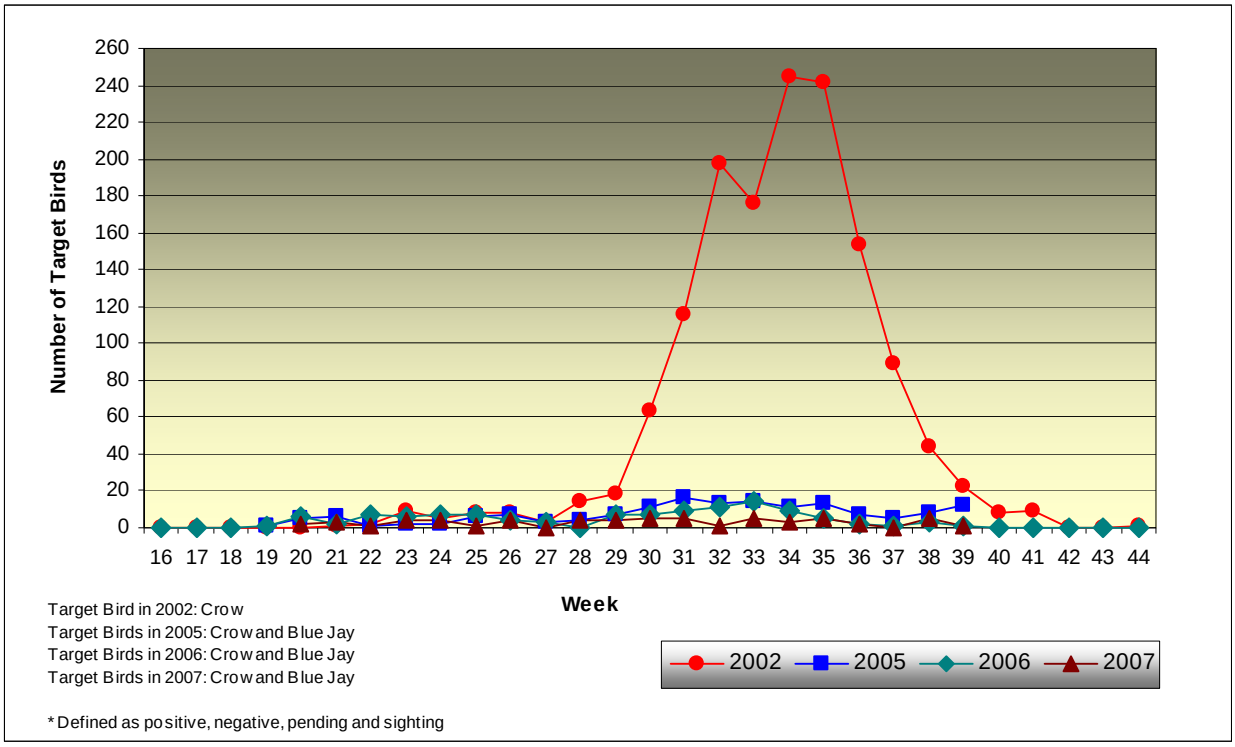


Table 5 Date and Location of First Positive Target Bird (Crow or Blue Jay), Region of Peel, 2002, 2005 - 5007

Year	Date	Location
2002	May 19, 2002 (week21)	Mississauga
2005	July 24, 2005 (week 30)	Mississauga
2006	July 31, 2006 (week 31)	Brampton
2007	August 17, 2007 (week 33)	Brampton

In 2007, there were two WNV positive birds in the Region of Peel. Both positives were found in Brampton and both were crows.

In Mississauga, reports of dead target birds were distributed across the city; in Brampton, they tended to cluster mostly around the centre of city; and in Caledon, they were dispersed throughout the town.

Bird Surveillance in other Ontario Health Units

Table 6 presents the data collected by the CCWHC on the birds tested and those that were positive for WNV in each Ontario health unit in 2007. There was a 69% decrease in the total number of birds tested positive for WNV in Ontario – 256 positive birds in 2006 compared to 79 in 2007.[8]

Table 6 also presents the proportion of positive birds to the total number of birds tested. The overall positive rate across Ontario was 10.5% (range 0% to 66.7%) which is a decrease from 2006 at 26%.[15] Peel Region had a below average percent positive rate of 6.9%.

Table 6 Dead Bird Results by Ontario Health Unit, Ontario, 2007

Health Unit	Total Submitted	Not Tested *	Tested	Total Positive	Per Cent Positive
Algoma	15	0	15	1	6.7
Brant County	11	0	11	0	0.0
Chatham-Kent	13	0	13	4	30.8
Durham Region	33	1	32	3	9.4
Eastern Ontario	6	0	6	0	0.0
Elgin-St. Thomas	3	0	3	0	0.0
Grey Bruce	14	0	14	1	7.1
Haldimand-Norfolk	13	1	12	0	0.0
Haliburton, Kawartha, Pine Ridge	29	1	28	0	0.0
Halton	23	0	23	7	30.4
Hamilton	43	1	42	5	11.9
Hastings & Prince Edward Counties	28	1	27	3	11.1
Huron County	7	0	7	0	0.0
Kingston, Frontenac, Lennox and Addington	14	0	14	1	7.1
Lambton County	13	0	13	2	15.4
Leeds, Grenville & Lanark District	17	0	17	0	0.0
Middlesex-London	12	0	12	2	16.7
Niagara Regional	28	1	27	1	3.7
North Bay Parry Sound	35	0	35	1	2.9
Northwestern	30	1	29	13	44.8
Ottawa	38	0	38	2	5.3
Oxford County	20	1	19	2	10.5
Peel Region	29	0	29	2	6.9
Perth District	6	0	6	4	66.7
Peterborough County-City	45	2	43	1	2.3
Porcupine	21	3	18	0	0.0
Renfrew County & District	16	0	16	0	0.0
Simcoe Muskoka District	42	0	42	2	4.8
Sudbury and District	41	0	41	2	4.9
Thunder Bay District	22	0	22	11	50.0
Timiskaming	10	0	10	0	0.0
Toronto	9	0	9	2	22.2
Waterloo Region	34	1	33	1	3.0
Wellington-Dufferin-Guelph	15	2	13	1	7.7
Windsor-Essex County	12	0	12	4	33.3
York Region	25	3	22	1	4.5
Total:	772	19	753	79	10.5

Red - highest per cent positive rate – this rate maybe unstable due to low numbers of birds submitted
Blue - Ontario health units adjacent to the Region of Peel
Yellow - Region of Peel
* Not tested – submitted birds may not be suitable for testing due to decomposition
Source: adapted from Canadian Cooperative Wildlife Health Centre, 2007[15]

Bird Surveillance across Canada

Table 7 presents dead bird data from selected Canadian provinces and territories for 2007. A total of 2,240 birds were submitted for testing in six provinces. Approximately 6.5% of all the birds submitted across Canada tested positive for WNV. The number of positive birds in 2007 (143) represents the decrease of 48% compared to 2006 (273).

Ontario and British Columbia submitted the greatest number of birds with 772 and 766 birds, respectively. Approximately 11% of the birds from Ontario were positive for WNV. As was the case in 2006, there were no positive birds submitted from British Columbia.[8] Saskatchewan was the only other province with WNV positive birds. Despite positive human cases in Alberta and Manitoba, these provinces did not submit any birds to the Canadian Cooperative Wildlife Health Centre for testing.

Table 7 Dead Bird Results by Selected Province, Canada, 2007

Province	Total Submitted	# not Tested	Tested	Total Positive	Per cent Positive
BC	766	12	754	0	0.0
NB	268	16	262	0	0.0
NS	63	1	62	0	0.0
ON	772	19	753	79	10.5
PE	108	5	103	0	0.0
SK	263	2	261	64	24.5
Total:	2,240	55	2,185	143	6.5

Source: adapted from Canadian Cooperative Wildlife Health Centre , 2007[15]
NB: Not all provinces have WNV bird testing program

Adult Mosquito Surveillance

Adult Mosquito Surveillance Highlights for 2007

- 64,450 female adult mosquitoes were collected and separated into species in Peel Region, a 9% decrease over the number collected in 2006.
- 16 different mosquito species and species groups were found in the Region of Peel
    - *Coquillettidia perturbans* and *Aedes vexans* were the most common species collected at 59% and 14%, respectively
    - 7% of all mosquitoes collected were *Culex* species
    - The proportion of the *Ochlerotatus japonicus* species remained at 0.4% but the abundance increased by 6%.
- A total of 31 permanent traps were set in Peel Region (Mississauga – 17; Brampton – 9; Caledon – 5).
- Three traps collected positive mosquitoes in 2007.
- The number of positive batches decreased to 3 from 14 in 2006
    - 2 positive batches were due to *Culex* species
    - 1 positive batch was due to *Aedes vexans*.
- The first positive batch was reported on August 28, 2007 (week 35) in Brampton, three weeks after the first human case and two weeks after the first positive bird.
- Of the nine health units reporting positive batches, Peel Region had the fifth highest number of positive mosquito batches in the province.
- Nationally, four provinces reported positive mosquito batches – Manitoba had the greatest number, 948, followed by Saskatchewan with 460. Ontario had 51 positive batches, a decrease from 182 in 2006.
- No Asian tiger mosquitoes were collected in 2007.

West Nile Virus circulates between mosquitoes and birds when a female mosquito feeds on the blood of a WNV-infected bird. Once the virus has incubated in the mosquito, it can be passed to another host through the saliva of the mosquito. Mosquito surveillance programs serve to monitor the mosquito population both for their abundance and species. Certain species are associated with WNV transmission to humans with some species being more efficient transmission vectors than others. Therefore, it is important to monitor their occurrence in order to assess the potential human health risk. In Ontario, the species of particular interest due to their WNV transmission risk continue to be the *Culex* species, in particular *Culex pipiens* and *Culex restuans*.

Adult mosquitoes were collected once weekly from the fixed location trapping sites. In 2007, Peel Public Health used two types of mosquito traps. The majority of the traps were the Center for Disease Control (CDC) light trap. This type of trap uses light and carbon dioxide to attract adult female mosquitoes that are looking for a blood meal. Trap mosquitoes were packed on dry ice and sent by courier to GDG Environment Ltd. (GDG) in Trois-Rivières, Québec. Refer to the 2006 West Nile Virus in the Region of

Peel report for the methodological details associated with species identification, sorting and viral testing.[8]

The second type of trap, the Omni-Directional Fay-Prince trap was used to monitor the abundance of the Asian tiger mosquito. Five Omni-Directional Fay-Prince traps were situated in Brampton and Mississauga. Refer to the end of this chapter for more information on the Asian tiger mosquito work.

Map 2 shows the fixed locations for the traps set in the Region of Peel for 2007. Thirty-one fixed CDC light traps were distributed by Regional ward, with a minimum of one trap per ward, as follows: 17 in the City of Mississauga, 9 in the City of Brampton and five in the Town of Caledon.

Table 8 presents the estimated number of mosquitoes collected by species.[†] These estimates are based partially on actual counts, when the pool size was less the 50 mosquitoes, and partially on estimating methods when the pool size exceeded 50 mosquitoes.[16] Almost 65,000 mosquitoes were collected and identified by species. This represents a 9% decrease in the total number of mosquitoes collected over 2006 when 71,099 mosquitoes were collected.

Sixteen mosquito species or species groups were identified in the Region of Peel in 2007.[16] Less than one per cent of the mosquitoes were unclassifiable and were placed in an "other species" grouping. *Coquillettidia perturbans* and *Aedes vexans* were the most common mosquito species collected representing 59% and 14% of the total number of adult female mosquitoes collected respectively. These two species are consistently the most prevalent in the Region of Peel. Vector mosquitoes, *Culex* species, accounted for slightly more than 7%.

[†] These totals are based on the results of weekly reports provided to the Region of Peel by GDG Environment Ltd.

Map 2 Location of Mosquito Traps by Municipal Ward, Region of Peel, 2007

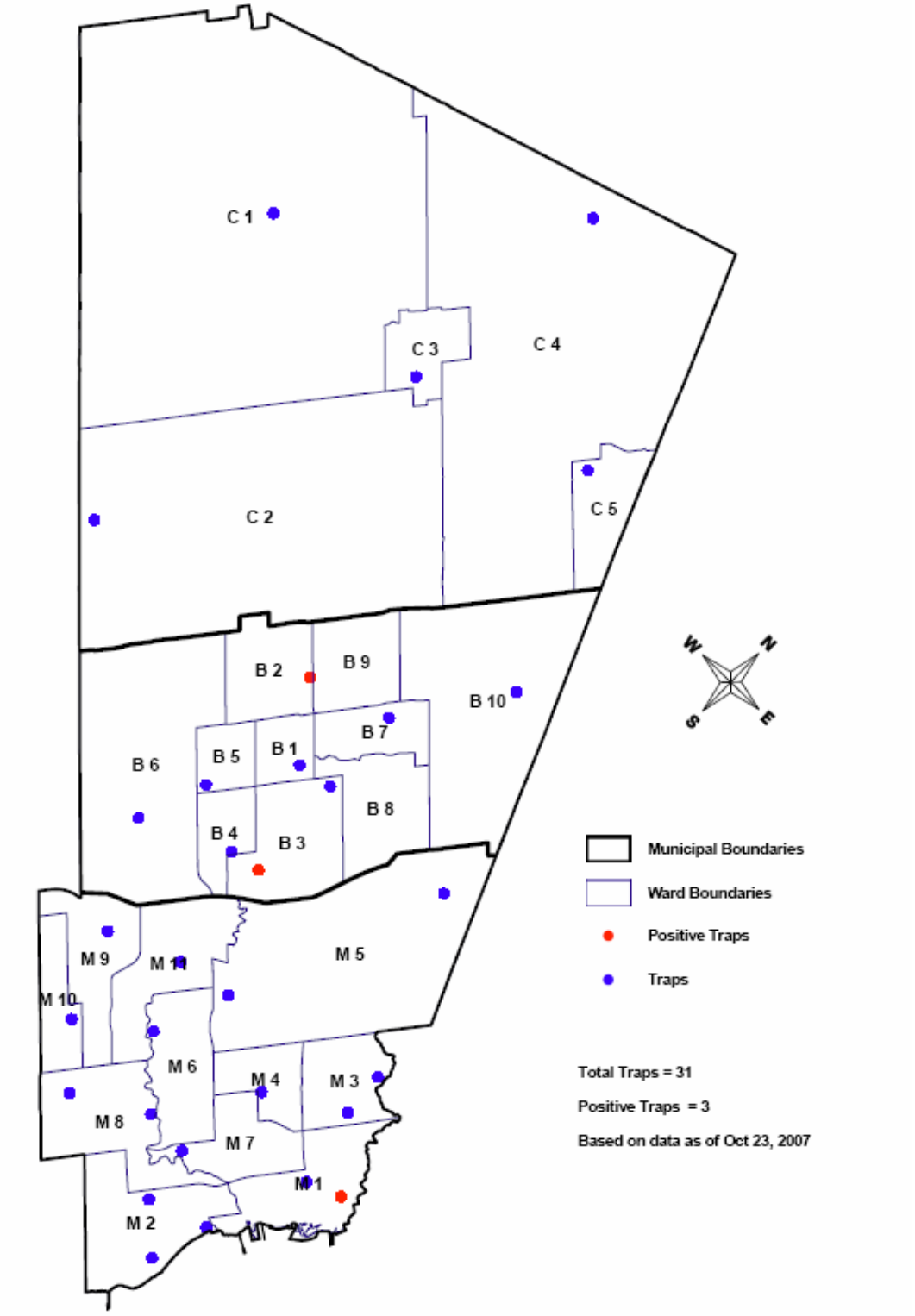


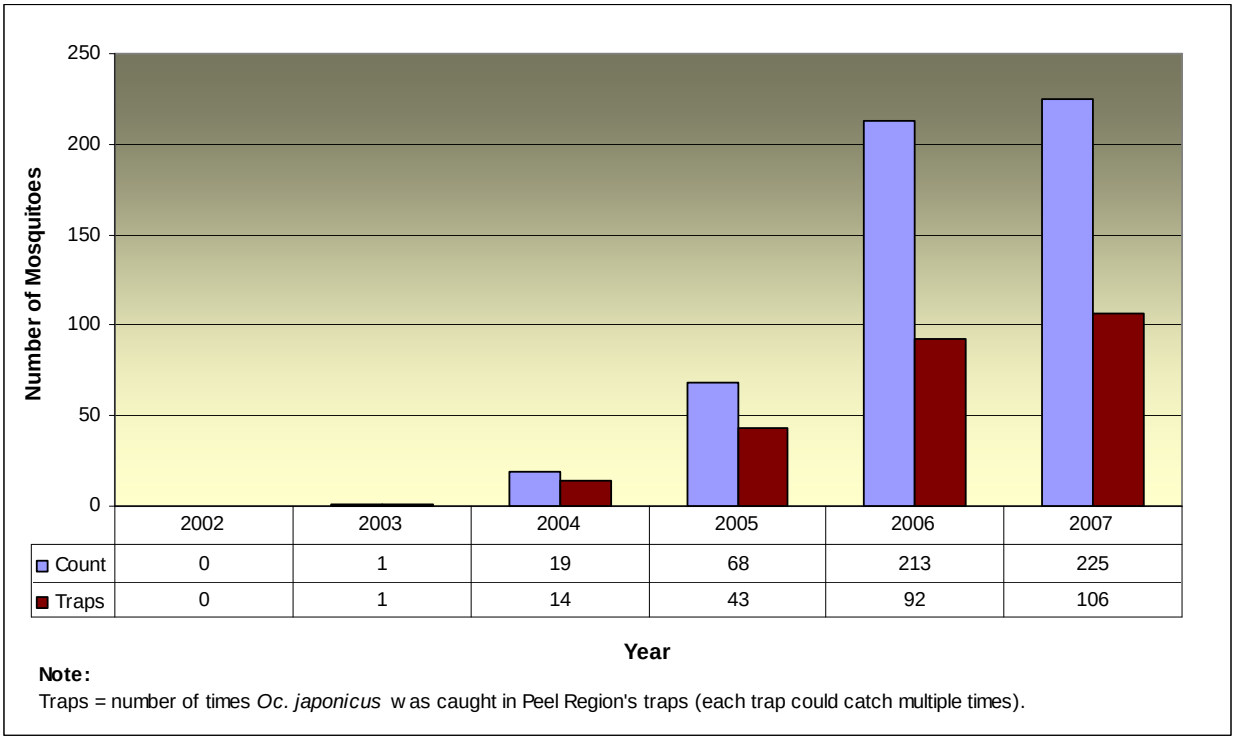
Table 8 Estimated Number of Female Adult Mosquitoes Collected and Identified by Species, Region of Peel, 2007*

Species	Brampton	Caledon	Mississauga	Peel	% of Total
Cq. perturbans	6,253	3,556	28,057	37,865	58.75
Ae. vexans vexans	5,163	696	3,021	8,880	13.78
Oc. stimulans	2,201	2,193	1,185	5,579	8.66
Cx. pipiens/restuans	1,419	89	2,814	4,322	6.71
Oc. canadensis	2,344	808	204	3,356	5.21
Aedes/Ochleorotatus species	460	293	357	1,110	1.72
An. punctipennis	219	158	350	727	1.13
Oc. triseriatus/hendersoni	137	21	541	699	1.09
Oc. trivittatus	243	32	106	380	0.59
Ae. cinereus	313	22	14	348	0.54
An. quadrimaculatus	135	107	86	328	0.51
Oc. japonicus	40	10	184	235	0.36
Oc. broad-banded	83	57	50	190	0.3
Cx. restuans	31	12	116	160	0.25
Anopheles species	89	28	6	124	0.19
Oc. black legged	11	44	10	66	0.1
Culex species	22		35	57	0.09
Other species	3	4	10	17	0.03
Oc. provocans		3		3	0
Culiseta morsitans		3		3	0
Total Mosquitoes	19,168	8,136	37,146	64,450	100

Source: sum of weekly reports provided to the Region of Peel from GDG Environment (personal communication)
*estimates based on CDC light trap surveillance data
+does not equal 100 due to rounding
WNV vector mosquitoes of particular interest for Ontario highlighted in green

Other than the species already noted, the abundance of most other species decreased in 2007. An exception remains *Ochlerotatus japonicus* (*Oc. japonicus*) which continues to increase in actual counts and trapping events (Figure 4). In 2007, the number of *Oc. japonicus* captured was 225 compared to 213 in 2006, approximately a 6% increase. The percentage of *Oc. japonicus* relative to other species remained stable at 0.4%. Laboratory studies indicate that *Oc. japonicus* is a very efficient vector of WNV. Several batches were positive for WNV in the United States in 2000, 2001, and 2002.[17] In 2007, the first WNV positive *Oc. japonicus* was reported in Ontario (Chatham-Kent).[18]

Figure 4 *Ochlerotatus japonicus (Oc. japonicus)* abundance in the Region of Peel, 2002 - 2007 (based on actual counts)



Of the total number of mosquitoes collected, most of them were collected in the City of Mississauga (58%), followed by the City of Brampton (30%) and the Town of Caledon (13%).

The species distribution across the municipalities varied. In Mississauga, the most prevalent species captured was *Coquillettidia perturbans* (76%) followed by *Aedes vexans* (8%) and *Culex pipiens/restuans* (8%). In Brampton the same species were prevalent, *Coquillettidia perturbans* (33%) and *Aedes vexans* (27%). However, in Caledon, *Coquillettidia perturbans* (44%) and *Oc. stimulans* (27%) were most prevalent.

In the case of vector mosquitoes, *Culex pipiens/restuans* exhibited yet a different distribution pattern. In Mississauga, 8% of mosquitoes captured in this municipality were *Culex pipiens/restuans* compared to 7% in Brampton and 1% in Caledon.

Table 9 presents the number of WNV-positive mosquito trapping events for 2002 and the years, 2005-2007 by area municipality. In 2007, there were three separate events where a mosquito trap tested positive compared to 14 in 2006 and 24 in 2005. The City of Mississauga had one positive trapping event and the City of Brampton had two positive trapping events in 2007. Since the beginning of the WNV surveillance program in the Region of Peel, 2002 remains the overall high with 128 positive trapping events.

Table 9 Number of Positive Trapping Events by Municipality, Region of Peel, 2002, 2005-2007

Year	Region of Peel	Mississauga	Brampton	Caledon	Date of First Positive
2002	128	106	22	0	June 20, 2002
2005	24	16	6	2	July 7, 2005
2006	14	10	4	0	July 25, 2006
2007	3	1	2	0	August 28, 2007

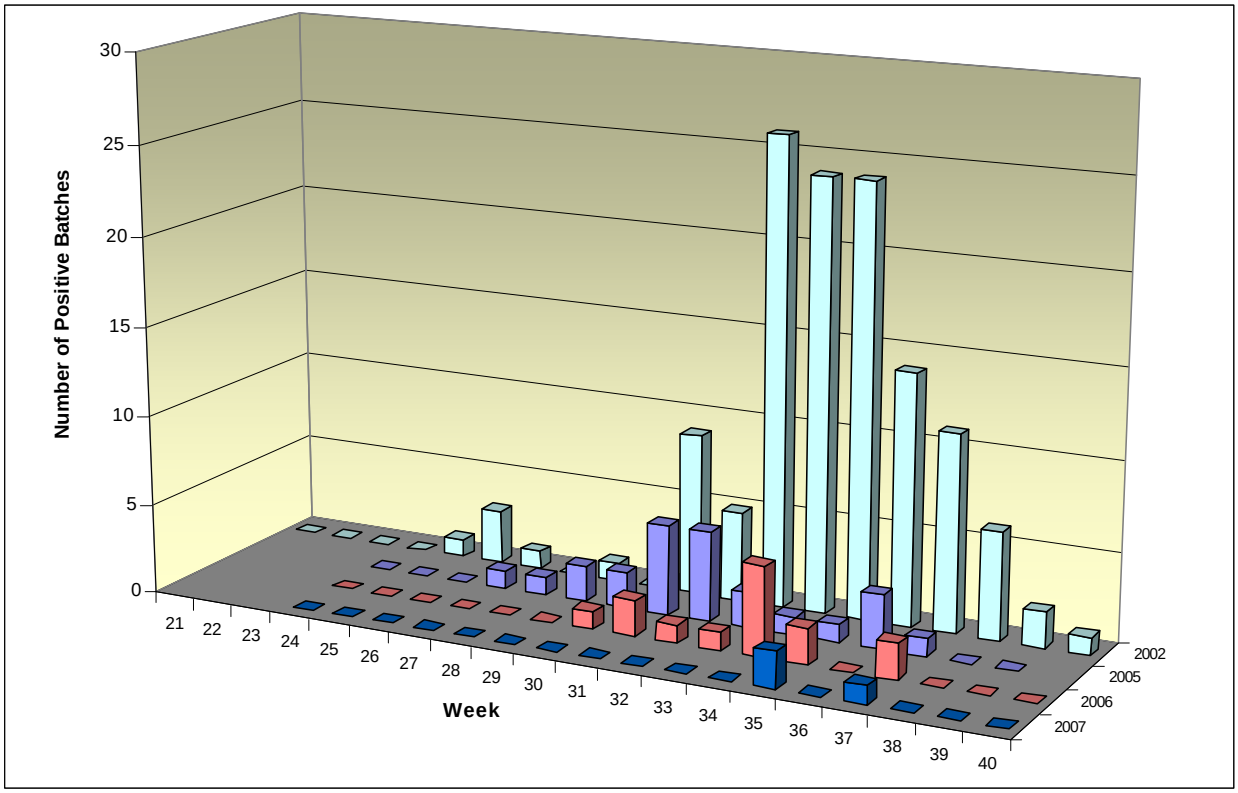
The first positive trapping event in 2007 occurred in week 35, on August 28th, in Brampton. This positive batch occurred three weeks after the first positive human case and two weeks after the first positive bird. In previous years the first positive trapping event occurred earlier, in the month of July.

In 2007, the pattern of the first WNV positive bird occurring before the first WNV positive mosquito batch resumed. In the two previous years, the first WNV positive mosquito batch preceded the first report of WNV positive bird in the Region of Peel.

Upon notification of a positive mosquito batch, seasonal staff in the WNV program went door-to-door in the immediate area advising residents of the positive batch and offering to survey the property for mosquito breeding sites. In addition, educational materials on symptoms of WNV, reduction of mosquito breeding sites and personal protection were provided to the residents. An intensified environmental scan around the area of the identified positive batch was conducted to verify that roadside catch basins were treated and to identify stagnant water sites. Any mosquito breeding sites identified on public property were larvicided or remediated.

Figure 5 compares the total number of positive batches per week for the 2002 baseline and the years, 2005-2007. Based on previous years' data, positive traps are likely to occur anytime after June (week 21). However, from year to year the onset and peak of WNV-positive traps vary. This is likely due to a range of factors including weather (temperature and rainfall) and the effectiveness of the multifaceted prevention program involving reduction of breeding sites on public and private property and larviciding catch basins and surface water on public property. In 2007, the occurrence of the first positive batch was the latest since the onset of the surveillance program in 2002. With respect to the last positive batch, it occurred in mid-September (week 37), the same as in 2006 and 2005.[8]

Figure 5 WNV Positive Mosquito Batches by Week of Collection, Region of Peel, 2002, 2005-2007



Culex spp. mosquitoes are of particular interest because they have been the predominant species positive for WNV in Peel Region. Table 10 presents the annual comparison of the number of female *Culex* mosquitoes. The relative percentage of *Culex* species mosquitoes to total mosquitoes captured increased from approximately 5% in the previous two years to 7%.

In 2007, two of the three positive batches were *Culex* species, while *Aedes vexans* was associated with the other positive batch. *Aedes vexans* act as a bridge vector, biting both animals and birds, and are a confirmed WNV vector in Ontario. Larval development occurs predominantly in roadside ditches and grassy fields.

Table 10 Annual Comparison of Female *Culex* Mosquitoes Collected and Positive Batches, Region of Peel, 2002, 2005-2007

Year	Female Mosquitoes Collected			Positive Mosquito Batches		
	Total Number	Number of *Culex*	% *Culex*	Total Number	Number of *Culex*	% Culex
2002[1]	24,269	7,278	30.0%	128	98	76.6%
2005[1]	90,769	4,276	4.7%	24	24	100.0%
2006[1]	71,099	3,627	5.1%	14	12	85.7%
2007[2]	64,450	4,539	7.0%	3	2	66.7%

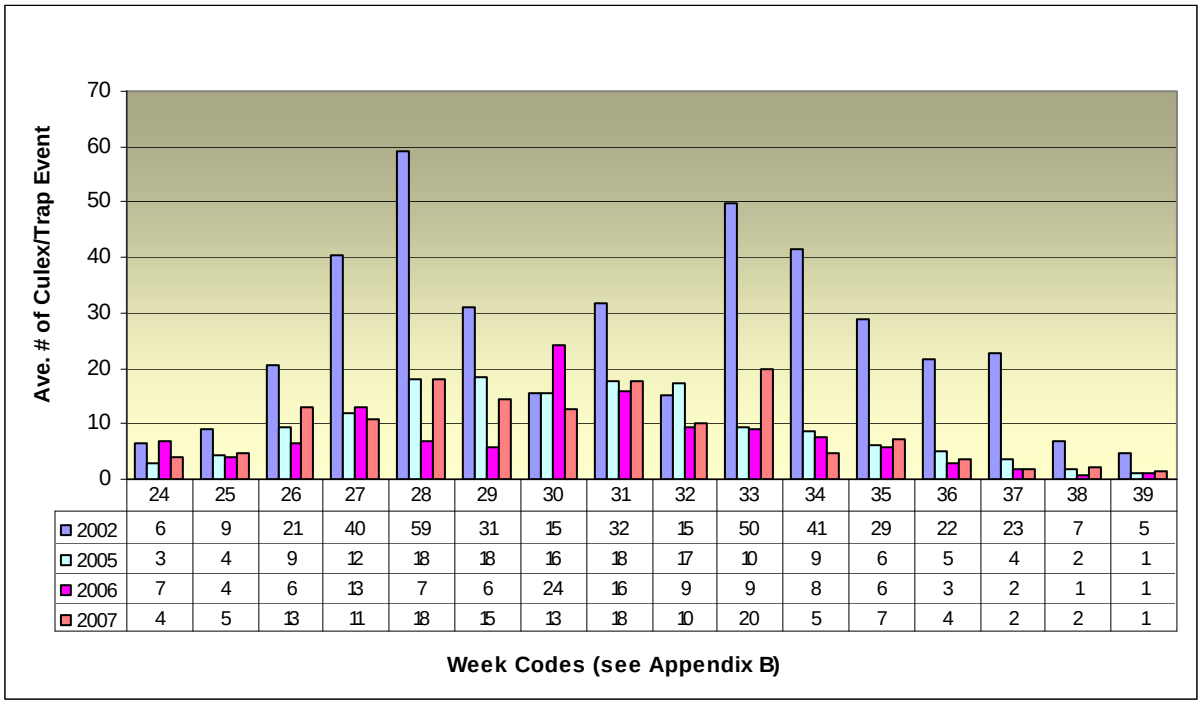
[1] Source: 2006 West Nile in the Region of Peel, 2006[8]

[2] Source: GDG Environment, 2007[16]

Figure 6 illustrates the average number of *Culex* mosquitoes collected per trapping event for each week. In 2007, an increase in the average number of *Culex* per trap (more than 10) started in week 26 through to week 33, peaking in mid-August at 20 per trap (week 33 - August 12-18). Overall, the average number of *Culex* per trap in 2007 was greater than 2006 for most weeks. The year 2002 remains the benchmark year when the number of *Culex* per trap regularly exceeded 30 per trap and approached or exceeded 50 per trap on two occasions.

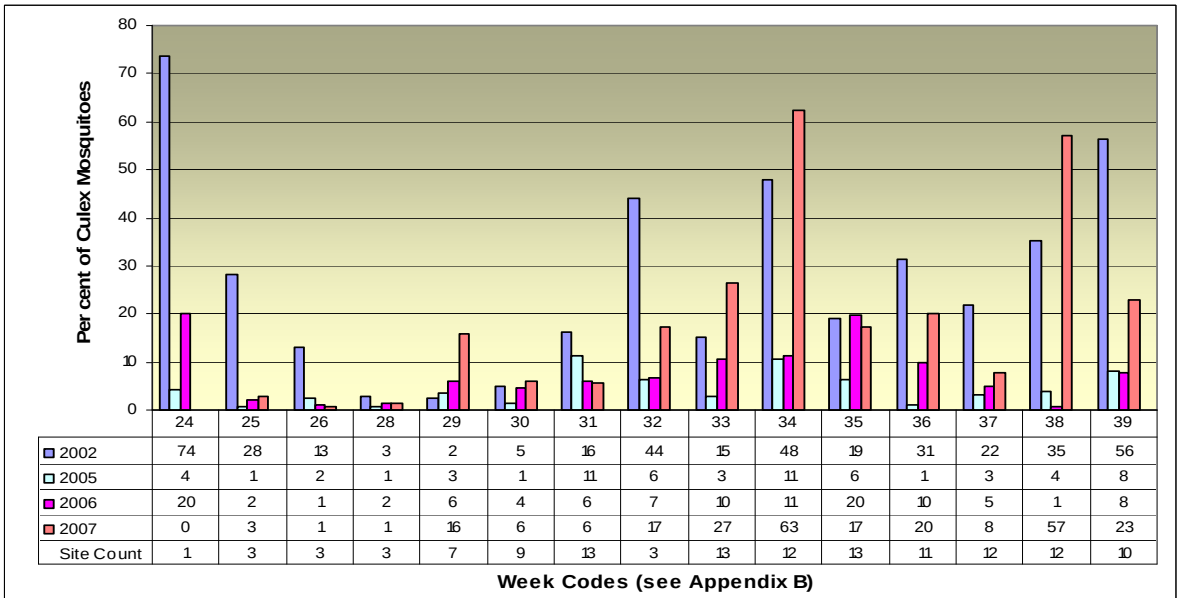
Figure 7 illustrates the weekly percentage of *Culex* species relative to the total number of mosquitoes present at 13 traps that were located at the same sites during the same time period in all years starting 2002 (2002 and 2005-2007 shown in the figure). The site count represents the number of traps included in a given weekly analysis. This value is not consistent throughout all weeks because trap data may not have been available for all weeks. In 2007, the percentage of *Culex* relative to the total number of mosquitoes collected was higher than in 2006 for most weeks except for weeks 24, 28 and 35. The weekly proportion of *Culex* mosquitoes compared to all species was equal to or greater than the seasonal average proportion of approximately 7% for nine weeks and exceeded 10% for eight weeks. This is much lower than the highest value seen in 2002 when the percentage of *Culex* at one particular trap location exceeded 70%.

Figure 6 Average Number of *Culex* Species per Trap Event by Week, Region of Peel, 2002, 2005-2007



	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
2002	6	9	21	40	59	31	15	32	15	50	41	29	22	23	7	5
2005	3	4	9	12	18	18	16	18	17	10	9	6	5	4	2	1
2006	7	4	6	13	7	6	24	16	9	9	8	6	3	2	1	1
2007	4	5	13	11	18	15	13	18	10	20	5	7	4	2	2	1

Figure 7 Proportion of *Culex* Species to Total Species in Selected Sites, Region of Peel, 2002, 2005-2007



	24	25	26	28	29	30	31	32	33	34	35	36	37	38	39
2002	74	28	13	3	2	5	16	44	15	48	19	31	22	35	56
2005	4	1	2	1	3	1	11	6	3	11	6	1	3	4	8
2006	20	2	1	2	6	4	6	7	10	11	20	10	5	1	8
2007	0	3	1	1	16	6	6	17	27	63	17	20	8	57	23
Site Count	1	3	3	3	7	9	13	3	13	12	13	11	12	12	10

Site Count - Number of trapping site locations in which Culex species were collected

Table 11 compares the top 12 mosquito species collected at 13 traps that have been located at the same location since the start of the WNV program in Peel Region. In 2002, the numbers of mosquitoes were based on actual counts. In subsequent years, the mosquito counts were based on estimating methods. *Coquillettidia perturbans* and *Aedes vexans* continue to rank first and second, respectively, as they have for all years prior to 2007.

In 2007, the percentage of *Culex* species collected in the common traps was lower (5%) than the percentage collected in 2006 (7%). The highest percentage of *Culex* mosquitoes that occurred in these common traps was in 2002 (25%) which was a year in which no larviciding or stagnant water site remediation was undertaken.[8] The consistent number of *Culex* mosquitoes collected based on all traps across the Region of Peel in recent years, may be attributed to a successful mosquito reduction program targeted to eliminate the *Culex* species, and a reduction in breeding sites preferred by the *Culex* species.

Historically, the *Culex* species has consistently been responsible for the majority of the WNV-positive mosquito batches in the Region of Peel. Once again in 2007, most of the WNV-positive mosquito traps in 2007 were due to the *Culex* species. Therefore, it is imperative to continue to decrease the vector abundance of the *Culex* species in particular. The WNV Prevention Plan needs to continue to focus on reducing the number of *Culex* mosquitoes and the *Culex* species abundance should continue to be reviewed in the weekly WNV risk assessment. However, other mosquito species are also WNV vectors, as seen in 2006 and 2007 with positive findings being non-*Culex* species. While reducing the abundance of the *Culex* species remains a priority for the Region of Peel, monitoring the abundance and WNV potential of various species remains very important in order to mitigate any risk in an informed manner.

Table 11 Annual Comparison of the Top 12 Mosquito Species Collected from Common Traps, Region of Peel, 2002, 2005-2007

2002				2005				2006				2007			
Rank	Species	Ave. Actual # of Mosquitoes Collected	%	Rank	Species	Ave. Estimated # of Mosquitoes Collected	%	Rank	Species	Ave. Estimated # of Mosquitoes Collected	%	Rank	Species	Ave. Estimated # of Mosquitoes Collected	%
1	*Cq. perturbans*	4,147	38.9	1	*Cq. perturbans*	27,302	61.8	1	*Cq. perturbans*	7,667	47.5	1	*Cq. perturbans*	21,757	81.5
2	*Ae. vexans*	2,300	21.6	2	*Ae. vexans vexans*	10,718	24.3	2	*Ae. vexans vexans*	4,686	29.1	2	*Ae. vexans vexans*	2,340	8.8
3	*Cx. pipiens/restuans*	1,173	11.0	3	*Oc. trivittatus*	2,433	5.5	3	*Cx. pipiens*	1,096	6.8	3	*Cx. pipiens/restuans*	1,341	5.0
4	*Cx. spp.*	608	5.7	4	*Cx. pipiens*	740	1.7	4	*Oc. trivittatus*	901	5.6	4	*Oc. stimulans*	408	1.5
5	*Cx. pipiens*	598	5.6	5	*Ae./Oc. spp.*	684	1.5	5	*Ae./Oc. spp.*	781	4.8	5	*Oc. trivittatus*	173	0.6
6	*Ae. vexans/cantator*	445	4.2	6	*Oc. black legged*	632	1.4	6	*An. punctipennis*	192	1.2	6	*Oc. canadensis*	172	0.6
7	*Ae./Oc. spp.*	318	3.0	7	*Oc. broad-banded*	506	1.1	7	*Ae. cinereus*	178	1.1	7	*An. punctipennis*	114	0.4
8	*Cx. restuans*	254	2.4	8	*Cx. pipiens/restuans*	296	0.7	8	*Oc. triseriatus/hendersoni*	174	1.1	8	*Ae./Oc. species*	103	0.4
9	*Oc. excrucians*	177	1.7	9	*Ae. cinereus*	222	0.5	9	*Oc. stimulans*	128	0.8	9	*Oc. triseriatus/hendersoni*	87	0.3
10	*Oc. trivittatus*	175	1.6	10	*Oc. triseriatus/hendersoni*	161	0.4	10	*Oc. broad-banded*	110	0.7	10	*Cx. restuans*	66	0.2
11	*Oc. canadensis*	120	1.1	11	*An. punctipennis*	156	0.4	11	*Oc. canadensis*	92	0.6	11	*An. quadrimaculatus*	62	0.2
12	*Oc. triseriatus*	93	0.9	12	*Oc. triseriatus*	101	0.2	12	*Oc. japonicus*	56	0.3	12	*Oc. japonicus*	41	0.2

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. The 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 per 1,000.

Table 12 presents the 2007 MIRs for the *Culex* species, grouped by municipality in Peel Region and compares these to MIRs for 2005 and 2006, where applicable. Higher MIRs are usually indicative of greater WNV activity among a given species but can be unreliable when the sample size is less than one thousand. In 2007, the MIRs were lower in Brampton and Mississauga and as a whole throughout the Region of Peel when compared to 2006 and 2005. The highest MIR was for Brampton at 0.73 compared to the Peel Region total at 0.50. The MIR decreased in 2007 by more than six times because of fewer positive batches.

One positive mosquito batch was attributed to non-*Culex* species. Table 13 presents the 2007 MIRs for the non-*Culex* species for each municipality and for Peel Region as a whole. The MIR for the City of Brampton was 0.59 for *Ae. vexans,* compared to 0.31 for Peel Region as a whole.

Table 12 Minimum Infection Rates of *Culex* Species in Each Municipality, Region of Peel, 2005, 2006 and 2007

Municipality	Vector Species	2007 Actual Number Tested	2007 Positive Batches	2007 MIR*	2006 MIR*	2005 MIR*
Mississauga	*Culex pipiens*	-	-	-	-	**8.59**
	Culex pipiens/restuans	2,531	1	**0.40**	**3.47**	4.78 †
	Culex restuans	-	-	-	-	6.85 †
Brampton	*Culex pipiens*	-	-	-	-	**4.47**
	Culex pipiens/ restuans	1,364	1	**0.73**	4.27 †	
	Culex restuans	-	-	-	-	11.36 †
Caledon	*Culex pipiens/restuans*	74	-	-	-	19.61 †
	Culex restuans	-	-	-		58.82 †
Peel	*Culex pipiens*	-	-	-	-	**6.76**
	Culex pipiens/restuans	3,969	2	**0.50**	**3.41**	5.90 †
	Culex restuans	-	-	-	-	11.95 †
Total		3,969	2			

* 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 per 1,000.

† MIRs based on numbers < 1000 are more likely to be unstable than those based on numbers > 1000 (bolded). Use estimates with caution.

Table 13 Minimum Infection Rates of non-*Culex* Species in Each Municipality, Region of Peel, 2007

Municipality	Vector Species	Actual Number Tested	Positive Batches	2007 MIR*
Mississauga	*Ae. vexans*	1,287	-	-
Brampton	*Ae. vexans*	1,700	1	**0.59**
Caledon	*Ae. vexans*	271	-	-
Peel	*Ae. vexans*	3,258	1	**0.31**

* 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 per 1,000.

Adult Mosquito Surveillance in other Ontario Health Units

Table 14 lists all results of the mosquito testing programs in Ontario health units and highlights those health units adjacent to the Region of Peel.[19] Nine of the thirty-six health units reported positive mosquito batches. The City of Toronto reported the greatest number of positive batches at 17, followed by Windsor-Essex County at 13 and then by Halton Region at eight. Of the health units adjacent to the Region of Peel only Toronto and Halton reported positive mosquito batches in 2007.

Adult Mosquito Surveillance across Canada

Table 15 presents the national mosquito surveillance data by province/territory. A total of 1,682 positive batches were reported from four provinces. The greatest increase from the previous year was seen in Saskatchewan with 460 positive batches compared to 36 in the previous year. Manitoba and Alberta also saw significant increases in the number of positive batches from the previous year. Ontario had fewer positive batches when compared to 2006.[8]

The Asian tiger mosquito is a vector for a number of viruses including WNV, Eastern Equine Encephalitis and Dengue Fever. In 2005, the Ministry of Health and Long-Term Care (MOHLTC) included the Asian tiger mosquito in their WNV Preparedness and Prevention Plan as a species to identify and be included in viral testing.[21]

For the first time since the establishment of the West Nile Virus program, the Asian tiger mosquito, was found in the Region of Peel in 2005. In 2006, the MOHLTC sponsored a special study, the purpose of which was to determine the abundance of the Asian tiger mosquito in the three Ontario health units that trapped the species in 2005. This study used a different trap, the Omni-Directional Fay-Prince trap, which is designed to attract specific species including the Asian tiger mosquito.

In 2007, five Omni-Directional Fay-Prince traps were used in the Region of Peel to monitor for the Asian tiger mosquito. The mosquitoes captured in these traps were not sent to the external laboratory for identification and therefore the capture counts are not reflected in the counts from the CDC light traps. Species identification for mosquitoes trapped was conducted in-house by a trained public health inspector. Consistent with the findings in 2006, no Asian tiger mosquitoes were trapped in 2007 in the Region of Peel.

Table 14 Mosquito Surveillance Statistics by Health Unit, Ontario, 2007

Health Unit	Total Positive Batches
Algoma Health Unit	0
Brant County Health Unit	0
Chatham-Kent Public Health Division	4
Durham Region Health Department	0
Eastern Ontario Health Unit	0
Elgin-St. Thomas Health Unit	0
Grey-Bruce Health Unit	0
Haldimand-Norfolk Health Unit	1
Haliburton-Kawartha-Pine Ridge District Health Unit	0
Halton Region Health Department	8
City of Hamilton-Public Health & Community Services Dept.	3
Hastings & Prince Edward Counties Health Unit	0
Huron County Health Unit	0
Kingston, Frontenac and Lennox & Addington Health Unit	0
County of Lambton Community Health Services Department	0
Leeds, Grenville and Lanark District Health Unit	0
Middlesex-London Health Unit	0
Regional Niagara Public Health Department	1
North Bay Parry Sound Health Unit	0
North Western Health Unit	1
City of Ottawa Public Health and Long-Term Care Branch	0
County of Oxford	0
Regional Municipality of Peel Health Department	3
Perth District Health Unit	0
Peterborough County-City Health Unit	0
Porcupine Health Unit	0
Renfrew County and District Health Unit	0
Simcoe Muskoka District Health Unit	0
Sudbury and District Health Unit	0
Thunder Bay District Health Unit	0
Timiskiming Health Unit	0
Toronto Public Health	17
Region of Waterloo, Public Health	0
Wellington-Dufferin-Guelph Health Unit	0
Windsor-Essex County Health Unit	13
York Region Health Services Department	0
ONTARIO TOTAL	**51**

Source: Ontario Ministry of Health and Long-Term Care, 2007[19]
- Rows shaded in yellow are the municipalities adjacent to the Region of Peel

Table 15 Mosquito Surveillance Statistics by Province, Territory, Canada, 2007

Province/Territory	No. Confirmed positive mosquito batches
Newfoundland and Labrador	0
Prince Edward Island	0
Nova Scotia	0
New Brunswick	0
Quebec	0
Ontario*	51
Manitoba	948
Saskatchewan	460
Alberta	223
British Columbia	0
Yukon Territory	0
Northwest Territories	0
Nunavut	0
Canada – Total	**1,682**

Source: Public Health Agency of Canada, 2007[10]
*Ontario Ministry of Health and Long-term Care[19]

Note: Not all provinces/territories conduct mosquito surveillance

Larval Mosquito Surveillance

Larval Surveillance Highlights for 2007

- Mosquito larval surveillance was undertaken at 2,400 potential breeding sites in the Region of Peel
    - 70% of the sites were in the City of Mississauga, 19% in the City of Brampton and 11% in the Town of Caledon
- Mosquito larvae were found at 20% of the breeding sites monitored (468 of 2,400).
- Sites with vector larvae only were found in 2% of all breeding sites.
- Ditches and woodland pools were the most common habitat where larvae were found
    - 31% of the breeding sites with larvae were ditches, 20% were woodland pools.
- A total of 1,927 mosquito larvae were identified in 2007 compared to 2,205 in 2006.
- 60% (1,151) of the larvae identified were *Culex pipiens* and *Culex restuans*
- The larvae first emerged in week 20 (May 13 to 19) and peaked in week 33 (August 12 to 18).

Larval surveillance is useful in guiding WNV prevention and reduction activities. It is used to determine the location, species and population densities of mosquitoes. Larval surveillance activities are vital for predicting adult emergence and establishing optimal times for implementation of larval reduction measures.

From early May to early September, seasonal staff surveyed a variety of aquatic habitats for the presence of mosquito larvae. These potential breeding sites were identified by referring back to breeding site information collected in previous years and by stagnant water complaints received through the Customer Contact Centre or from the on-line reporting form. This information is maintained in a database that allows for easy access and reference. Refer to the 2006 WNV in the Region of Peel report for details on the methods used for larval surveillance.[8]

In 2007, larval surveillance was undertaken at 2,400 potential mosquito breeding sites on publicly owned lands in Peel Region. Table 16 breaks down the number of surface water sites monitored by municipality and compares it to previous years. The total number of sites monitored across Peel Region is consistent with the previous three years – over 2,000 sites. Also, as in previous years, the greatest number of sites monitored were located in the City of Mississauga (70%) followed by the City of Brampton (19%) and the Town of Caledon (11%).

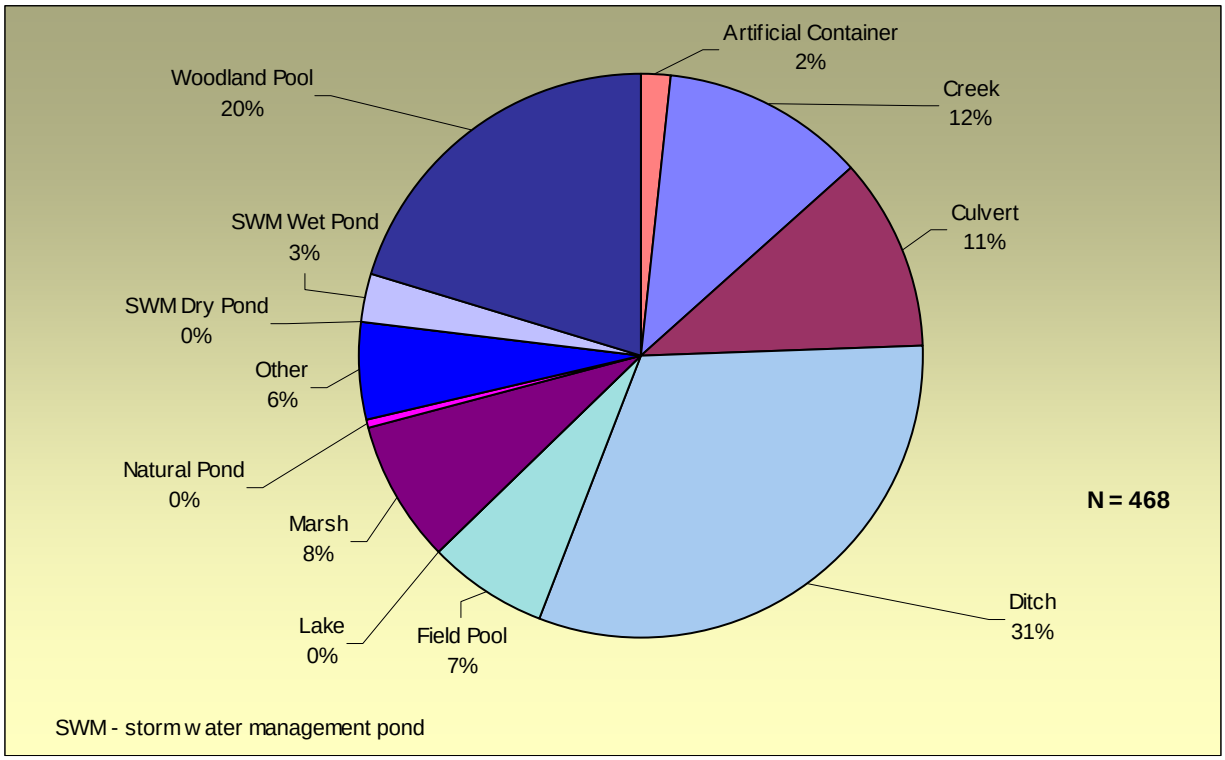
Table 16 Number of Surface Water Sites Monitored by Municipality, Region of Peel, 2002, 2005-2007

Year	Peel Region	Mississauga	Brampton	Caledon
2002	278	152	106	20
2005	2,138	1,135	651	352
2006	2,233	1,567	392	274
2007	2,400	1,689	451	260

In 2007, mosquito larvae were found at 20% (468 of 2,400) of the breeding sites monitored in the Region of Peel compared to 25% (551 of 2,233) in 2006. Sites with vector larvae only were identified in 2% (47 of 2,400) of all breeding sites, similar to 2006 with 2.3%.

In 2007 ditches, woodland pools, creeks, and culverts were the most common habitats where mosquito larvae were found across the Region of Peel (Figure 8). Thirty-one per cent of the breeding sites found to contain larvae were ditches, 20% were woodland pools, 12% were creeks and 11% were culverts.

Figure 8 Types of Sites Found to Contain Mosquito Larvae, Region of Peel, 2007



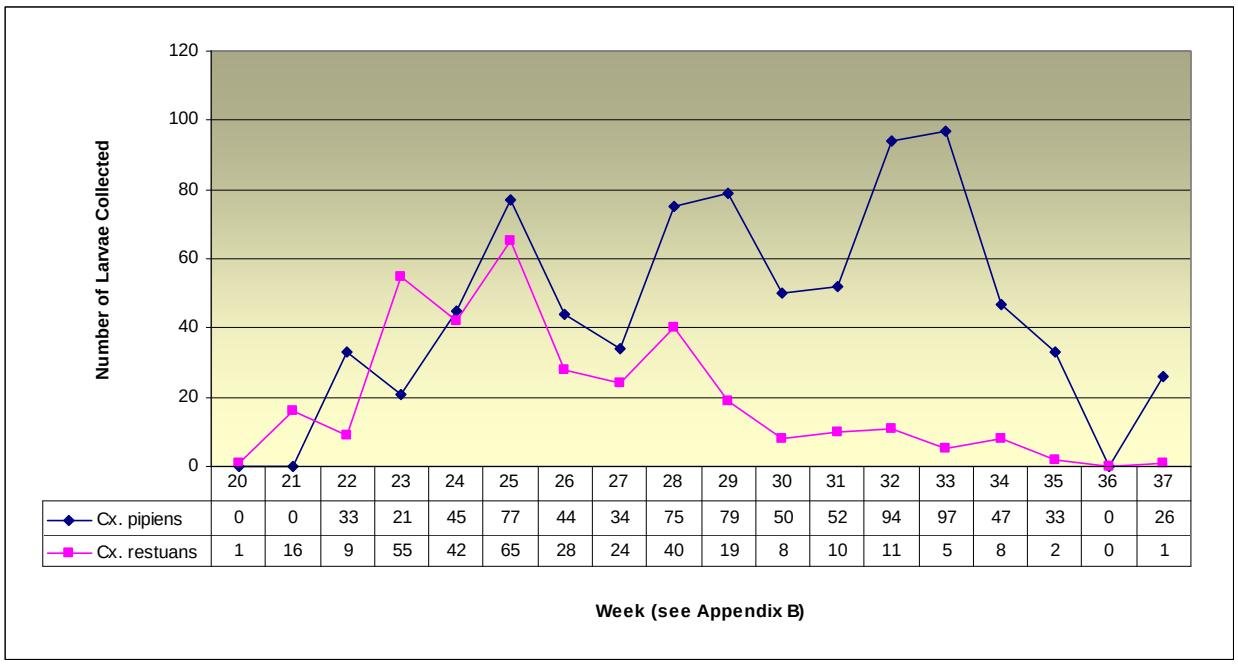
Species Identification – Larval Analysis

In 2007, a total of 1,927 mosquito larvae were identified from mid-May to the beginning of September in 2007. This represents a 13% decline from 2006 (2,205).

Nineteen different species were identified; 60% (1,151) were the two *Culex* species, *pipiens* and *restuans*. This represents a slight increase in percentage of the identified larvae from these two species – up from 56% in 2006. In 2007, these two species emerged around the same time – week 20 (May 13 to 19) for *Culex restuans* and week 22 (May 27 to June 2) for *Culex pipiens*. This is consistent with the previous year where the first larval emergence occurred during week 20 in 2006.

In 2007 the weekly temporal pattern of the two *Culex* species differed from 2006. Instead of consistently greater numbers of *Culex pipiens* larvae throughout the season starting in week 22, *Culex restuans* peaked earlier on in the season (week 25) whereas *Culex pipiens* peaked later on in week 33 (Figure 9). The timing of the peak in *Culex pipiens* coincides with the timeframe for the first positive human case (week 32), the first positive bird (week 33) and the first positive mosquito batch (week 35).

Figure 9 Numbers of *Culex pipiens* and *Culex restuans* Larvae by Week of Collection, Region of Peel, 2007



	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Cx. pipiens	0	0	33	21	45	77	44	34	75	79	50	52	94	97	47	33	0	26
Cx. restuans	1	16	9	55	42	65	28	24	40	19	8	10	11	5	8	2	0	1

Larval Mosquito Reduction

Larviciding Highlights for 2007

- Four rounds of Altosid® Pellet (methoprene) treatments were applied to 343,169 roadside catch basins from mid-June to the beginning of September
    - Up to 86,874 catch basins were treated per round.
- VectoLex® (*Bacillus sphaericus*) was used in catch basins draining to Environmentally Sensitive Areas (approximately 1,282 catch basins).
- Altosid® Briquets were applied to 2,275 non-roadside catch basins. This treatment was effective for up to 86 days.
- 221 surface water sites were treated with Aquabac 200G granules (*Bacillus thuringiensis var. israelensis)* – some locations were treated multiple times.
- Across the Region, ditches, woodland pools, creeks and culverts were the surface water sites most often larvicided.

A major tenet of the Region of Peel WNV prevention program is to employ activities aimed at reducing the number of vector mosquitoes. This goal can be achieved by preventing the emergence of mosquitoes by eliminating or altering habitats (source reduction) to make them less conducive to mosquito breeding and by pesticide treatment at the larval stage to impede their development into viable adult mosquitoes.

Source reduction is important and the Region of Peel's public education and outreach program highlights the need for eliminating stagnant water. However, it is very difficult and cost-prohibitive to eliminate all breeding sites because very little water is required for most female mosquitoes in which to lay their eggs, particularly in the case of the *Culex* species. Therefore, the prevention plan relies heavily on the larviciding program. The purpose of the larviciding program is to reduce mosquito abundance, especially the *Culex* species. It is easier, more efficient and cost effective to control mosquito populations by treating at the larval stage with larvicides before adult mosquitoes emerge and become more widely dispersed. The details regarding the methodology can be found in the previous year's technical report.[8]

Catch Basin Treatment

Table 17 summarizes the catch basin treatment activities across the Region of Peel. The number of catch basins treated per round can vary due to a number of factors including catch basin cleaning (vacuuming), construction and new subdivisions being added to the program.

Roadside municipal catch basins were treated four times from mid-June to the beginning of September. Approximately 240 kg of Altosid® Pellets were applied to

343,169 catch basins in the Region of Peel in 2007 (ranged from 84,954 to 86,874 per treatment round).[21] This represents an increase over 2006 and 2005 where 230 kg and 215 kg were used, respectively. Peel Public Health conducted quality assurance monitoring of roadside catch basins. Altosid® Pellets were found to be 98% effective in controlling mosquito larvae.

Altosid® Briquets were mostly applied early on in the season because of their extended period of residual activity. Altosid® XR Briquets were applied to 2,275 non-roadside catch basins (one application). Non-roadside catch basins included those located in, along or on:

- municipal green-spaces (1,561)
- agency-owned or operated sites, such as government buildings, social housing units, day cares and long-term care facilities (625)
- rear yards of residential properties (59)
- provincial highways (30)

VectoLex® water soluble pellets (WSP) were used in 1,282 catch basins draining into ESA. There were two applications of the VectoLex® WSP approximately six weeks apart.

Table 17 Summary of Catch Basin Treatment, Region of Peel, 2007

Treatment Round	Number of Catch Basins Treated			Cycle dates
	Roadside (Altosid® Pellets)	Non-Roadside (Altosid® XR Briquets)	Environmentally Sensitive Areas (Vectolex WSP)	
1	86,874	2,249	1,282	June 11th – July 1st
2	85,109	3	--	July 2nd – 22nd
3	86,232	7	1,282	July 23rd – Aug 12th
4	84,954	16	--	Aug 13th – Sept 2nd

Source: The Canadian Centre for Mosquito Management Inc., 2007[21]

Surface Water Treatment

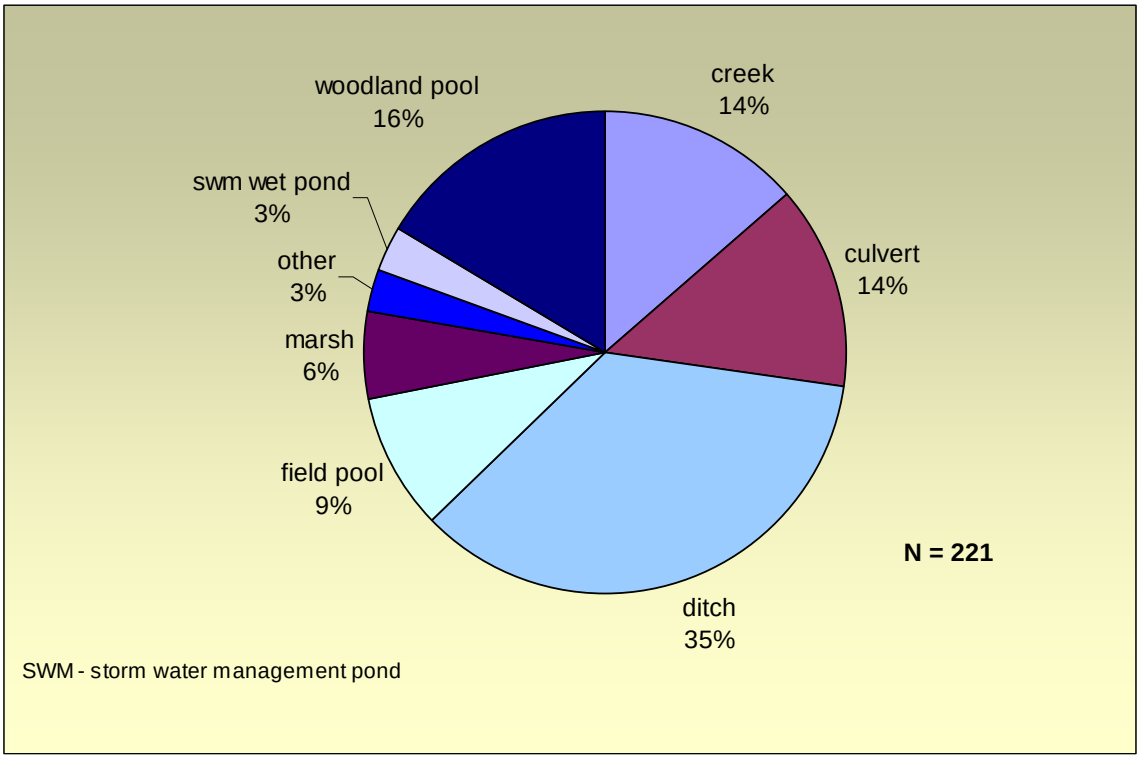
In 2007, 221 surface water sites received a total of 253 treatments with *Bacillus thuringiensis var. israelensis* (Aquabac 200G) covering 3.65 hectares of stagnant surface-waters.[21] This is the highest number since the larviciding program was established (Table 18). This represents a 10% increase in the number of sites treated in the Region of Peel in 2007 compared to 2006. This increase is solely due to increases in the number of sites treated in the City of Mississauga. Sixty-two per cent of the sites treated were in the City of Mississauga, 29% in the City of Brampton and 10% in the Town of Caledon.

Across the Region of Peel, ditches, woodland pools, creeks and culverts were the surface water sites most often larvicided at 35%, 16%, 14% and 14%, respectively (Figure 10). This varied from 2006 when ditches represented 54% of surface sites treated with culverts the second most common site at 17%.

Table 18 Summary of Surface Water Treatment by Municipality, Region of Peel, 2005-2007

Year	Total Sites Treated	Mississauga Sites Treated	Brampton Sites Treated	Caledon Sites Treated	Total Treatments (include multiple treatments at the same location)
2005	107	59	22	26	189
2006	201	88	72	41	249
2007	221	136	64	21	253

Figure 10 Surface Water Site Types Treated, Region of Peel, 2007



Risk Assessment

Ontario Regulation 199/03[2] requires the local Medical Officer of Health (MOH) to conduct a risk assessment of conditions pertaining to WNV in their respective health unit. The regulation offers guidance to the MOH regarding appropriate WNV reduction activities, including the need for additional mosquito reduction activities. The Region of Peel Public Health has an established risk assessment process that has been detailed in the Region of Peel Adulticiding Plan.

Each year, from mid-June to October, Peel Public Health's West Nile Virus Working Group carries out a weekly risk assessment based on surveillance information collected during that week to identify the relative risk of human infection in Peel Region. The working group consists of staff from various programs including environmental health, communications, epidemiology, and communicable disease. Various surveillance factors that influence the risk of WNV infection are evaluated. The factors included are:

- Seasonal temperatures
- Adult mosquito vector abundance
- Virus isolation rate in vector mosquito species
- Human cases of WNV
- Local WNV activity (bird, equine, mosquito)
- Time of year
- WNV activity in proximal urban or suburban regions

Each surveillance factor is assigned a weighted score based on the observations of the previous week. The WNV Mosquito Adulticiding Risk Assessment form is completed weekly and when the risk assessment level exceeds a value of three, a decision tree process is invoked whereby continued surveillance and the possibility of adulticiding are considered.

Public Education and Community Outreach

The prevention and reduction of WNV risk requires the involvement of many sectors. Engaging individual residents is integral in preventing human infections, particularly in advocating personal protective measures and the elimination of breeding sites on private property.

Seasonally, mid-June through mid-October, questions regarding mosquito protection measures are asked as part of the Rapid Risk Factor Surveillance System. This survey helps Peel Public Health staff understand the knowledge, attitudes and behaviours of Peel residents associated with WNV.

Table 19 illustrates the proportion of Peel Region residents that protected themselves from mosquitoes all or most of the time over a five year period 2002 and 2005 to 2007.[22] Preliminary 2007 data indicate that: 53% of respondents avoided areas with mosquitoes; 26% covered up with clothing; 26% limited outdoor activity; and 14% used a DEET-based (*N,N*-diethyl-3-methylbenzamide) repellent.

The proportion of respondents who covered up with clothing differed significantly ($p<0.001$) over the four years examined, with the most frequent use of this strategy in 2006. The proportion of respondents who used insect repellent with DEET differed significantly ($p<0.01$) over the four years examined, with this strategy being employed more in 2006 compared to other years.

Table 19 Proportion of Residents who Protected Themselves from Mosquitoes All or Most of the Time During the Month Prior to Interview, Region of Peel, 2002, 2005 – 2007

Method of Protection	2002	2005	2006	2007
	Per Cent	Per Cent	Per Cent	Per Cent
Avoided areas with mosquitoes	55.9	55.7	55.3	52.7
Covered up with clothing	26.8	22.1	34.9	25.6
Limited outdoor activities	23.4	26	29.7	25.9
Used repellent with DEET	11.5	17.8	19.1	13.7
Used repellent without DEET	NA	6.5*	5.8*	7.9*

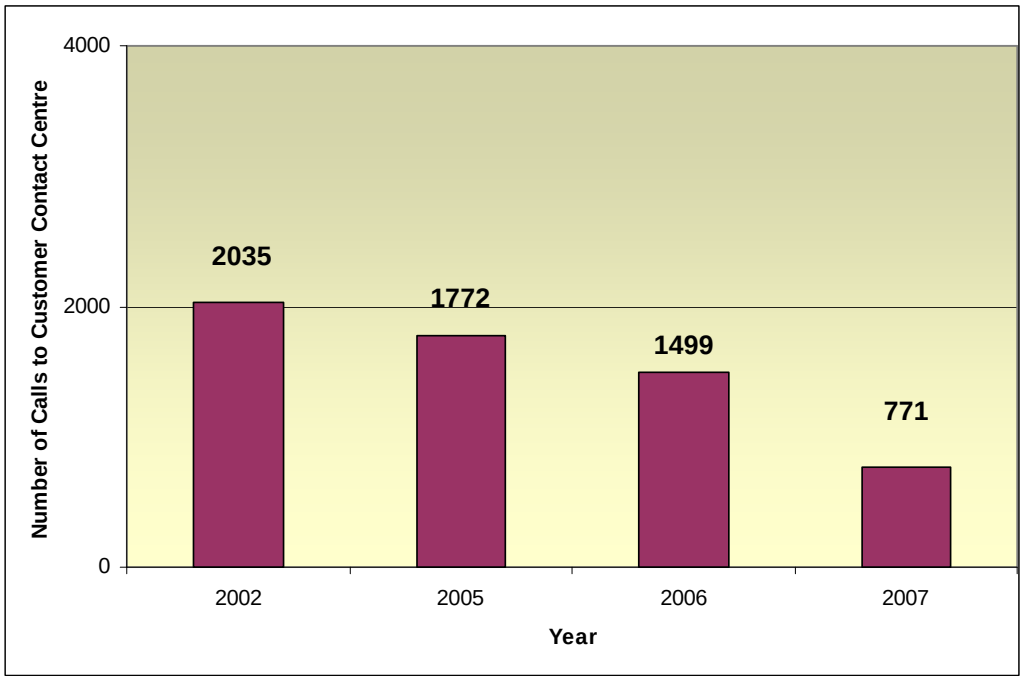
Notes: Data were collected May 11 to October 9, 2002, June 10 to October 9, 2005, June 12 to October 11, 2006, and June 12 to October 22, 2007.
* Use estimate with caution.
NA = Not applicable.
DEET - *N,N*-diethyl-3-methylbenzamide
Source: Rapid Risk Factor Surveillance System (2007)

West Nile Virus Calls

Peel Region residents were requested to call the CCC with their stagnant water complaints, dead bird reports and when there were any questions related to prevention and protection against WNV. The number of calls may be used as an indicator of public engagement and concern when compared over a number of years.

In 2007, a total of 771 calls were received, which included both stagnant water complaints and dead bird reports (Figure 11). The number of calls received annually continued to decrease with 2007 having the fewest number of calls since first starting to accept calls in 2002, one contributing factor over the last two years may be the fact that the dead bird surveillance program ended on September 30, whereas in years prior to 2005 the program ran until October 31.

Figure 11 Number of Calls to the Customer Contact Centre, Region of Peel, May 1 - September 30; 2002, 2005-2007



Peel Public Health has developed various resources to educate Peel Region residents about personal protective measures and encourage individual and household activities that prevent or discourage the breeding of mosquitoes. These resources included flyers, fact sheets, posters, mailers and newspaper advertisements. All the materials are made available on the Region of Peel website at http://www.peelregion.ca/health/westnile/resources/pamphlets.htm.

Conclusions

Surveillance of humans, birds and mosquitoes in 2007 showed a decrease in West Nile Virus (WNV) activity in the Region of Peel and across Ontario. However, WNV activity reached record numbers with respect to human cases in the prairie provinces. A number of factors influence the risk of human WNV infection requiring the implementation of multiple surveillance and risk reduction strategies to minimize this risk.

There is no information suggesting that the spread of WNV has stopped. While WNV activity, as measured by the three main surveillance systems, will vary from year to year, it is apparent that the disease has established itself in North America and Peel Region.

The information collected using the various surveillance activities continues to be valuable in assessing and minimizing the risk of human WNV infection to Region of Peel residents. This information is helpful in assessing the need for enhanced mosquito reduction systems which include larviciding and increased promotion of breeding site elimination.

The surveillance systems implemented in the Region of Peel suggest that prevention and reduction activities are resulting in reduced risk of human WNV infection in the Region of Peel. Given that the *Culex* species was predominantly responsible for the WNV mosquito pools in the Region of Peel in 2007 and in previous years, targeted mosquito vector reduction focussing on the *Culex* species should continue.

Public education and community outreach are also important components of the program, particularly in preventing personal exposure and in eliminating breeding sites on private property. The education program has built awareness of the WNV risks and prevention. Peel Public Health will continue to work with the Ministry of Health and Long-Term Care, the local municipalities and conservation authorities to identify strategies to promote taking personal protection measures against mosquito bites.

The results of the 2007 WNV program suggest that the 2008 WNV Prevention Plan should continue to focus on surveillance, mosquito reduction and public education and community outreach.

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Appendices

Appendix A

Provincial Surveillance for West Nile Virus – Case Definitions

Provincial Surveillance for West Nile Virus (WNV)

Section A: Case Definitions

The current Case Definitions were drafted with available information at the time of writing. Case Definitions and Diagnostic Test Criteria are subject to change as new information becomes available.

1) West Nile Virus Neurological Syndrome (WNNS):
Clinical Criteria:

History of exposure in an area where WN virus (WNV) activity is occurring[1]
OR
history of exposure to an alternative mode of transmission[2]
AND
onset of fever
AND NEW ONSET OF AT LEAST ONE of the following:

- encephalitis (acute signs of central or peripheral neurologic dysfunction), or
- viral meningitis (pleocytosis and signs of infection e.g. headache, nuchal rigidity), or
- acute flaccid paralysis (e.g. poliomyelitis-like syndrome or Guillain-Barré-like syndrome)[3] or
- movement disorders (e.g., tremor, myoclonus) or
- Parkinsonism or Parkinsonia like conditions (e.g., cogwheel rigidity, bradykinesia, postural instability) or
- other neurological syndromes as defined in the note below

[1] History of exposure when and where West Nile virus transmission is present, or could be present, or history of travel to an area with confirmed WNV activity in birds, horses, other mammals, sentinel chickens, mosquitoes, or humans.

[2] Alternative modes of transmission, identified to date, include: laboratory-acquired; in utero; receipt of blood components; organ/tissue transplant; and, possibly via breast milk.

[3] A person with WNV-associated acute flaccid paralysis may present with or without fever or mental status changes. Altered mental status could range from confusion to coma with or without additional signs of brain dysfunction (e.g. paralysis, cranial nerve palsies, sensory deficits,

abnormal reflexes, generalized convulsions and abnormal movements). Acute flaccid paralysis with respiratory failure is also a problem.

Note: A significant feature of West Nile viral neurologic illness may be marked muscle weakness that is more frequently unilateral, but could be bilateral. WNV should be considered in the differential diagnosis of all suspected cases of acute flaccid paralysis with or without sensory deficit. WNV-associated weakness typically affects one or more limbs (sometimes affecting one limb only). Muscle weakness may be the sole presenting feature of WNV illness (in the absence of other neurologic features) or may develop in the setting of fever, altered reflexes, meningitis or encephalitis. Weakness typically develops early in the course of clinical infection. Patients should be carefully monitored for evolving weakness and in particular for acute neuromuscular respiratory failure, which is a severe manifestation associated with high morbidity and mortality. **For the purpose of WNV Neurological Syndrome Classification, muscle weakness is characterized by severe (Polio-like), non-transient and prolonged symptoms.** Electromyography (EMG) and lumbar puncture should be performed to differentiate WNV paralysis from the acute demyelinating polyneuropathy (Guillain-Barré syndrome). Lymphocytic pleocytosis (an increase in WBC with a predominance of lymphocytes in the cerebrospinal fluid [CSF]) is commonly seen in acute flaccid paralysis due to WNV.

Other emerging clinical syndromes, identified during 2002 included, <u>but were not limited to the following</u>: myelopathy, rhabdomyolysis (acute destruction of skeletal muscle cells), peripheral neuropathy; polyradiculoneuropathy; optic neuritis; and acute demyelinating encephalomyelitis (ADEM). Ophthalmologic conditions including chorioretinitis and vitritis were also reported. Facial weakness was also reported. Myocarditis, pancreatitis and fulminant hepatitis have not been identified in North America, but were reported in outbreaks of WNV in South Africa. “Aseptic” meningitis without encephalitis or flaccid paralysis occurring in August and September when WNV is circulating may be due to non-polio enteroviruses circulating at the same time. This should be considered in the differential diagnosis.
[Sejvar J et al. JAMA (2003) Vol.290 (4) p. 511-515, Sejvar, J. et al. Emerg Infect Dis (2003) Vol 9 (7) p.788-93 and Burton, JM et al Can. J. Neurol. Sci. (2004) Vol.31 (2) p.185-193]

Suspect WN Neurological Syndrome Case:

Clinical criteria IN THE ABSENCE OF OR PENDING diagnostic test criteria (see below) AND IN THE ABSENCE of any other obvious cause.

Probable WN Neurological Syndrome Case:

Clinical criteria AND AT LEAST ONE of the probable case diagnostic test criteria (see below).

Confirmed WN Neurological Syndrome Case:

Clinical criteria AND AT LEAST ONE of the confirmed case diagnostic test criteria (see below).

2) West Nile Virus Non-Neurological Syndrome (WN Non-NS):

Clinical Criteria:

History of exposure in an area where WN virus (WNV) activity is occurring[1]
OR
history of exposure to an alternative mode of transmission[2]
AND AT LEAST TWO of the following[5]:

- fever,
- myalgia[6],
- arthalgia,
- headache,
- fatigue,
- lymphadenopathy,
- maculopapular rash

[1] History of exposure when and where West Nile virus transmission is present, or could be present, or history of travel to an area with confirmed WNV activity in birds, horses, other mammals, sentinel chickens, mosquitoes, or humans.

[2] Alternative modes of transmission, identified to date, include: laboratory-acquired; in utero; receipt of blood components; organ/tissue transplant; and, possibly via breast milk.

[5] It is possible that other clinical signs and symptoms could be identified that have not been listed and may accompany probable case or confirmed case diagnostic test criteria. For example, gastrointestinal (GI) symptoms were seen in many WNV patients in Canada and the USA in 2003 and 2004.

[6] Muscle weakness may be a presenting feature of WNV illness. **For the purpose of WNV Non-Neurological Syndrome classification, muscle weakness or myalgia (muscle aches and pains) is characterized by mild, transient, unlikely prolonged symptoms that are not caused by motor neuropathy.**

Suspect WN Non-Neurological Syndrome Case:

Clinical criteria IN THE ABSENCE OF OR PENDING diagnostic test criteria (see below) AND IN THE ABSENCE of any other obvious cause.

Probable WN Non-Neurological Syndrome Case:

Clinical criteria AND AT LEAST ONE of the probable case diagnostic test criteria (see below)

Confirmed WN Non-Neurological Syndrome Case:

Clinical criteria AND AT LEAST ONE of the confirmed case diagnostic test criteria (see below)

3) West Nile Virus Asymptomatic Infection (WNAI)[7]:

Probable WN Asymptomatic Infection Case:

Probable case diagnostic test criteria (see below) IN THE ABSENCE of clinical criteria

Confirmed WN Asymptomatic Infection Case:

Confirmed case diagnostic test criteria (see below) IN THE ABSENCE of clinical criteria

[7] This category could include asymptomatic blood donors whose blood is screened using a Nucleic Acid Amplification Test (NAT), by Blood Operators (i.e. Canadian Blood Services or Hema-Quebec) and is subsequently brought to the attention of public health officials. The NAT that will be used by Blood Operators in Canada is designed to detect all viruses in the Japanese encephalitis (JE) serocomplex. The JE serocomplex includes WN virus and 9 other viruses, although from this group only WN virus and St Louis encephalitis virus are currently endemic to parts of North America. Blood Operators in Canada preform a supplementary WN virus-specific NAT following any positive donor screen test result.

Section B: West Nile Virus Diagnostic Test Criteria:

Probable Case Diagnostic Test Criteria:

AT LEAST ONE of the following:

Detection of flavivirus antibodies in a single serum or CSF sample using a WN virus IgM ELISA[8] without confirmatory neutralization serology (e.g. Plaque Reduction Neutralization Test [PRNT]) **OR**
A 4-fold or greater change in flavivirus HI titres in paired acute and convalescent sera or demonstration of a seroconversion using a WN virus IgG ELISA[8] **OR**
A titre of $\geq$ 1:320 in a single WN virus HI test, or an elevated titre in a WN virus IgG ELISA, with a confirmatory PRNT result **OR** [Note: A confirmatory PRNT or other kind of neutralization assay is not required in a health jurisdiction/authority where cases have already been confirmed in the current year]
Demonstration of Japanese encephalitis (JE) serocomplex-specific genomic sequences in blood by NAT screening on donor blood, by Blood Operators in Canada.

[8] Both CDC and commercial IgM / IgG ELISAs are now available for front line serological testing. Refer to appropriate assay procedures and kit inserts for the interpretation of test results.

Note: WNV IgM antibody may persist for more than a year and the demonstration of IgM antibodies in a patient's serum, particularly in residents of endemic areas, may not be diagnostic of an acute WN viral infection. Seroconversion (by HI, IgG ELISA or PRNT assays) demonstrates a current WNV infection. Therefore, the collection of acute and convalescent sera for serologic analysis is particularly important to rule out diagnostic misinterpretation early in the WNV season (e.g. May, June) and to identify initial cases in a specific jurisdiction. However, it should be noted that seroconversions may not always be documented due to timing of acute sample collection (i.e. titres in acute sera may have already peaked). If static titres are observed in acute and convalescent paired sera, it is still possible the case may represent a recent infection. To help

resolve this, the use of IgG avidity testing[9] may be considered to distinguish between current and past infection. The presence of both IgM antibody and low avidity IgG in a patient's convalescent serum sample are consistent with current cases of viral associated illness. However test results that show the presence of IgM and high avidity IgG are indicative of exposures that have occurred in the previous season. Immunocompromised individuals may not be able to mount an immune response necessary for a serological diagnosis. West Nile virus diagnostic test criteria for these individuals should be discussed with a medical microbiologist.

[9] Early in infection the immune system generates antibodies that bind relatively weakly to viral antigen (low avidity). As the infection proceeds, an increasing percentage of newly generated IgG antibody displays higher binding affinity to virus antigen and thus avidity also rises (Note: avidity is usually measured based upon the ability of IgG to dissociate from antigen preparations after incubation with a solution of urea). As long as high avidity IgG is not yet detected in the serum it can be assumed that the individual was exposed to the viral agent during a recent exposure. With respect to WNV infection it has not been precisely determined when (i.e. post-exposure) high avidity antibodies reach levels in serum that can be accurately detected by serological assays (there may be significant variation depending on the individual). However, it has been shown that greater than 95% of sera collected from individuals exposed to WNV 6-8 months previously will have IgG antibodies that bind strongly to viral antigen and will give high avidity scores using both IFA and ELISA testing formats. **Note: Avidity testing will not replace confirmatory neutralization testing, non-WNV flavivirus IgG antibody (Eg. dengue, SLE, etc.) may bind to the antigen preparations used in avidity assays.**

Confirmed Case Diagnostic Test Criteria:

It is currently recommended that health jurisdictions/authorities use the Confirmed Case Diagnostic Test Criteria to confirm index cases (locally acquired) in their area each year; for subsequent cases, health jurisdictions/authorities could use the Probable Case Diagnostic Test Criteria to classify cases in their area as "confirmed", **for the purposes of surveillance**. Throughout the remainder of the transmission season health jurisdictions/authorities may wish to document PRNT antibody titres to West Nile virus in a proportion of cases, to be determined by that health jurisdiction/authority, in order to rule-out the possibility of concurrent activity by other flaviviruses. [For further information on diagnostic testing algorithms for West Nile virus, see the section entitled Laboratory Specimen Diagnostic Testing Algorithm in Appendix 4 of the National Guidelines for Response to West Nile virus.]

AT LEAST ONE of the following:

A 4-fold or greater change in WN virus neutralizing antibody titres (using a PRNT or other kind of neutralization assay) in paired acute and convalescent sera, or CSF. **OR**
Isolation of WN virus from, or demonstration of WN virus antigen or WN virus-specific genomic sequences in tissue, blood, CSF or other body fluids **OR**

Demonstration of flavivirus antibodies in a single serum or CSF sample using a WN virus IgM ELISA[8, 9], confirmed by the detection of WN virus specific antibodies using a PRNT (acute or convalescent specimen). **OR**
A 4-fold or greater change in flavivirus HI titres in paired acute and convalescent sera or demonstration of a seroconversion using a WN virus IgG ELISA[8, 9] **AND** the detection of WN specific antibodies using a PRNT (acute or convalescent serum sample).

[8] Both CDC and commercial IgM / IgG ELISAs are now available for front line serological testing. Refer to appropriate assay procedures and kit inserts for the interpretation of test results.

Note: WNV IgM antibody may persist for more than a year and the demonstration of IgM antibodies in a patient's serum, particularly in residents of endemic areas, may not be diagnostic of an acute WN viral infection. Seroconversion (by HI, IgG ELISA or PRNT assays) demonstrates a current WNV infection. Therefore, the collection of acute and convalescent sera for serologic analysis is particularly important to rule out diagnostic misinterpretation early in the WNV season (e.g. May, June) and to identify initial cases in a specific jurisdiction. However, it should be noted that seroconversions may not always be documented due to timing of acute sample collection (i.e. titres in acute sera may have already peaked). If static titres are observed in acute and convalescent paired sera, it is still possible the case may represent a recent infection. To help resolve this, the use of IgG avidity testing[9] may be considered to distinguish between current and past infection. The presence of both IgM antibody and low avidity IgG in a patient's convalescent serum sample are consistent with current cases of viral associated illness. However test results that show the presence of IgM and high avidity IgG are indicative of exposures that have occurred in the previous season. Immunocompromised individuals may not be able to mount an immune response necessary for a serological diagnosis. West Nile virus diagnostic test criteria for these individuals should be discussed with a medical microbiologist.

[9] Early in infection the immune system generates antibodies that bind relatively weakly to viral antigen (low avidity). As the infection proceeds, an increasing percentage of newly generated IgG antibody displays higher binding affinity to virus antigen and thus avidity also rises (Note: avidity is usually measured based upon the ability of IgG to dissociate from antigen preparations after incubation with a solution of urea). As long as high avidity IgG is not yet detected in the serum it can be assumed that the individual was exposed to the viral agent during a recent exposure. With respect to WNV infection it has not been precisely determined when (i.e. post-exposure) high avidity antibodies reach levels in serum that can be accurately detected by serological assays (there may be significant variation depending on the individual). However, it has been shown that greater than 95% of sera collected from individuals exposed to WNV 6-8 months previously will have IgG antibodies that bind strongly to viral antigen and will give high avidity scores using both IFA and ELISA testing formats. **Note: Avidity testing will not replace confirmatory neutralization testing, non-WNV flavivirus IgG antibody (Eg. dengue, SLE, etc.) may bind to the antigen preparations used in avidity assays.**

Appendix B

Week Codes - 2007 - West Nile Virus

Week # (Sun to Sat)	**2007**
1	Dec 31 - Jan 6
2	Jan 7 - Jan 13
3	Jan 14 - Jan 20
4	Jan 21 - Jan 27
5	Jan 28 - Feb 3
6	Feb 4 - Feb 10
7	Feb 11 - Feb 17
8	Feb 18 - Feb 24
9	Feb 25 - Mar 3
10	Mar 4 - Mar 10
11	Mar 11 - Mar 17
12	Mar 18 - Mar 24
13	Mar 25 - May 31
14	Apr 1 - Apr 7
15	Apr 8 - Apr 14
16	Apr 15 - Apr 21
17	Apr 22 - Apr 28
18	Apr 29 - May 5
19	May 6 - May 12
20	May 13 - May 19
21	May 20 – May 26
22	May 27 - Jun 2
23	Jun 3 - Jun 9
24	Jun 10 - Jun 16
25	Jun 17 - Jun 23
26	Jun 24 - Jun 30
27	Jul 1 - Jul 7

Week # (Sun to Sat)	**2007**
28	Jul 8 - Jul 14
29	Jul 15 - Jul 21
30	Jul 22 - Jul 28
31	Jul 29 - Aug 4
32	Aug 5 - Aug 11
33	Aug 12 - Aug 18
34	Aug 19 - Aug 25
35	Aug 26 - Sep 1
36	Sep 2 - Sep 8
37	Sep 9 - Sep 15
38	Sep 16 - Sep 22
39	Sep 23 - Sep 29
40	Sep 30 - Oct 6
41	Oct 7 - Oct 13
42	Oct 14 - Oct 20
43	Oct 21 - Oct 27
44	Oct 28 - Nov 3
45	Nov 4 - Nov 10
46	Nov 11 - Nov 17
47	Nov 18 - Nov 24
48	Nov 25 - Dec 1
49	Dec 2 - Dec 8
50	Dec 9 - Dec 15
51	Dec 16 - Dec 22
52	Dec 23 - Dec 29
1	Dec 30 - Jan 5