

## **LARVAL MOSQUITO REDUCTION**

### **Objective:**

To reduce the abundance of adult mosquitoes of the *Culex* species through the use of Integrated Mosquito Management (IMM) practices.

### **Background:**

All mosquitoes begin their life in water. This offers an opportunity to reduce the number of mosquitoes in an efficient way before the adult mosquitoes emerge and become widely dispersed.

Although approximately forty species of mosquitoes are found in Peel, only a few are important in the transmission of WNV. *Culex pipiens* and *Culex restuans* are the most important mosquito species in the transmission of WNV. They are two of the most common mosquitoes found in urban and suburban areas. They breed quickly and use standing or slow-moving water containing decaying organic materials to lay their eggs. Prime breeding sites include roadside catch basins, ditches, discarded tires left outdoors, poorly maintained bird baths, clogged rain gutters and eaves troughs, puddles in unused swimming and plastic wading pools, containers left outdoors to collect water, and other collections of stagnant water that last for a week or more. Catch basins are an especially important environment since the majority of catch basins inspected in Peel have been found to contain mosquito larvae. This is supported by findings in other nearby jurisdictions.

Breeding of these mosquitoes can be prevented by either eliminating stagnant water (source reduction), changing the environment to be less hospitable for mosquito breeding, or treating the water with larvicide to prevent mosquitoes from developing. Habitat modification can include changing the physical environment or introducing predators. An integrated mosquito management approach is recommended which makes use of a range of larval control strategies as appropriate to the situation.

Where *Culex* mosquito breeding cannot be effectively reduced by other means, larvicides will be employed. The larvicides that will be used in Region of Peel are *Bacillus thuringiensis* var. *israelensis* (Bti) and methoprene (Altosid).

Methoprene is a synthetic insect growth regulator which interferes with the development of mosquito larvae into adults. It has been widely used over a period of many years, and its effectiveness and environmental impact have been extensively studied and documented. It has been investigated and approved by the federal Pest Management Regulatory Agency for mosquito larviciding in Canada. Methoprene has very little non-target species toxicity, and poses no risk to the health of mammals, including humans. It degrades rapidly in water, particularly in the presence of sunlight. In 2003 and 2004, methoprene was the only larvicide which the Ministry of the Environment (MOE) would permit to be

used to treat catch basins. It is expected that catch basin larviciding permits issued by the MOE in 2005 will have a similar requirement. Methoprene has a number of features which makes it the preferred larvicide for catch basins. It is highly effective against the mosquitoes found in catch basins (*Culex pipiens* and *Culex restuans*) and works well in water high in organic material. Sustained release formulations are available so that the application in catch basins will only be necessary every three weeks.

Bti is a biological pesticide which kills mosquito larvae before they develop into adults. Like methoprene, Bti has been extensively used, studied and regulated. It is more selective for mosquito larvae than methoprene, and so has less impact on other insect species. However, it is also less effective and more difficult to use, particularly in catch basins. Bti will be used in surface water breeding sites where impacts on species other than mosquitoes are more of a concern.

The Region of Peel Mosquito Control Task Force has endorsed Integrated Mosquito Management as a guiding principle for the control of mosquitoes in Peel. Based on the importance of *Culex pipiens* and *Culex restuans* in transmission of WNV, the Region of Peel Mosquito Control Task Force has identified the following habitats in Peel (in order of priority from highest to lowest) and recommended control strategies:

<b>Habitat</b>	<b>Recommended Control Strategy</b>
Roadside Catch Basins in urban and suburban areas	Larvicide with methoprene – use other methods for those that drain directly into environmentally sensitive areas
Artificial Containers on Public Property	Reorient existing sanitation by municipal staff and volunteers
Artificial Containers on Private Property	Educational campaign for small breeding sites. Education, enforcement of property standards or public health legislation if necessary for significant breeding sites on residential or commercial/industrial properties
Roadside Ditches	Site by site assessment – physical alteration if feasible or larvicide if significant mosquito breeding site
Storm water management ponds (wet)	Site by site assessment, with habitat modification or larviciding if significant breeding site
Natural Areas <ul style="list-style-type: none"> <li>• Swamps and marshes</li> <li>• Creeks and floodplains</li> </ul>	Site by site assessment, with improvement of natural controls. Bti if mosquito breeding significant and not controlled by other means

## Roadside Catch Basins

Roadside catch basins are the major habitat in urban and suburban areas for *Culex pipiens* and *Culex restuans*, the main vectors of WNV. While each catch basin is small in and of itself, collectively they represent a large area of mosquito breeding habitat, free of natural predators.

To mitigate WNV, Peel Public Health will hire a licensed applicator to treat approximately 75,000 catch basins (roadside storm drains) using the larvicide methoprene with the cooperation of other departments in the Region of Peel, the City of Brampton, the City of Mississauga and the Town of Caledon. Treatment of catch basins is a core part of WNV reduction programs in southern Ontario. Since catch basins are designed to hold water and do so for long periods of time, the only option for reducing mosquito numbers in a large number of catch basins is to larvicide. Methoprene is the recommended agent due to its effectiveness against mosquitoes, low anticipated effects on non-target organisms and the availability of formulations that provide sustained control for at least three weeks. Catch basins which drain directly into environmentally sensitive areas such as Rattray Marsh or Cawthra Park will be treated by a device called a 'Larvasonic®'. The Larvasonic® generates acoustic energy which causes trauma to the internal organs of the larvae resulting in their death. The use of this device is labour intensive and a crew can only treat a few dozen catch basins per day with this unit. It is impractical to use in a region-wide program. Alternatives such as flushing with water or vacuuming catch basins have been found to be ineffective tools for control as larvae are found within a matter of days after a vacuuming or flushing. If other alternatives become available (e.g. *Bacillus sphaericus*), Peel Public Health may use these instead.

Peel Public Health will ensure the catch basin larviciding program is in compliance with Ministry of the Environment regulations and guidelines.

As was done in 2004, the Medical Officer of Health will issue an Order to each local municipality directing them to assist in and facilitate the application of larvicides to catch basins.

## Artificial containers

Artificial containers are objects such as tires, buckets, and unused swimming pools etc. that collect rainwater. Besides other sanitation concerns, they are ideal mosquito breeding sites for certain species due to the lack of predators and may be especially productive when they are in a heavily vegetated area. On public lands there are already programs for waste removal and some volunteer programs exist to clean up parks and ravines. Reorientation of these efforts to emphasize removal of garbage that promotes mosquito breeding may be sufficient to significantly reduce this habitat.

A large percentage of the land area in Peel is privately owned. Prime breeding sites here include discarded tires left outdoors, clogged rain gutters, unused

swimming pools and plastic wading pools and pots and pans containing stagnant water. Every residential and commercial property owner should regularly inspect their property and buildings to determine if conditions are conducive to mosquito breeding and endeavour to eliminate those conditions. The public education campaign in 2005 will continue to highlight the need for Peel property owners to eliminate potential mosquito-breeding sites on private property. Municipal or regional staff will become aware through regular service delivery or by public complaint of significant collections of stagnant water lasting more than a week (e.g. - unused swimming pools, large collections of tires or other refuse). Cleanup will be accomplished through property owner education, or failing that, through enforcement of existing property standards by-laws or public health legislation. If required, Peel Public Health will assess for the presence of mosquito larvae. Small accumulations of stagnant water, such as in a birdbath or children's toys left outside, will be dealt with by education alone.

### **Roadside Ditches**

Peel Public Health found a number of roadside ditches that contained vector mosquito larvae in 2004. Last year roadside ditches received more larvicide treatments than any other surface water breeding site in Peel. The most effective way to prevent breeding is to eliminate the stagnant water through improved grading and drainage. This can be an expensive venture and should only be undertaken if the site is large and likely to be a problem on a continual basis. Municipal roadside ditches that hold water for longer than seven days in the summer months will be referred to the local roads departments for assessment and remediation plans will be considered within existing ditching programs. In the meantime, ditches containing mosquito larvae will be treated with Bti.

### **Storm Water Management Ponds**

Storm water management ponds are highly visible due to their size and location. Larval surveillance in 2002, 2003 and 2004 revealed that these sites do not support significant numbers of mosquito larvae. Last year, larvae were found at least once in 54% of these sites in Caledon but only 9% in Brampton and 12% at Mississauga sites. If larvae were found in ponds that constantly held water, it was generally only in small isolated areas that were surrounded with heavy vegetation. In ponds that were designed to hold water for only short periods of time, larvae were located in recessed areas that did not drain properly. In 2004, only three storm water management ponds had vector mosquito larvae in significant numbers to warrant larviciding (two were in Caledon and one was in Mississauga).

Last year, Peel Public Health stocked a storm water management pond at the Caledon Wellness Centre in Bolton with fathead minnows to reduce mosquito larvae in the pond. In 2003, Peel Public Health staff identified WNV vector larvae in this pond. This resulted in this pond being treated with the biological larvicide Bti on two occasions in 2003.

The Ministry of Natural Resources determined that the fathead minnow is the best species to stock in storm water management ponds. This native species is abundant, widely distributed, an omnivorous feeder and is salt and water temperature tolerant. Fathead minnows have been shown to consume 100-160 mosquito larvae a day in a laboratory environment.

The storm water management pond was stocked in late May with 1,440 fathead minnows. The pond was monitored on a weekly basis. Initial monitoring results revealed that the minnows appeared to be controlling the larvae. In late July, larval surveillance at the pond indicated an increase in the number of mosquito larvae. The increase in larval activity in the pond coincided with a reduction of fathead minnows being observed in the shallow waters. Tests conducted by the Toronto Region Conservation Authority revealed the majority of the adult minnows had died. This can be attributed to low levels of dissolved oxygen in the pond. An overabundance of aquatic vegetation in the pond was the likely cause of the oxygen depletion. In late August, vector mosquito larvae were found at this site and it was larvicided with Bti by Pestalto Environmental Products Inc.

Although this study was unsuccessful, Peel Public Health will consider stocking of fathead minnows in the future if a more suitable site can be located.

As in previous years, storm water management ponds will be monitored for mosquito larvae. If significant mosquito breeding is found at a site despite the use of other measures, the larvicide Bti will be used as part of an integrated mosquito management approach.

### **Natural Areas**

Natural areas such as swamps, marshes, creeks and their floodplains breed mosquitoes of many different species, the majority of which are not responsible for the amplification of WNV in the environment. However, areas where there are temporary pools are believed to be the most important. Areas of open or flowing water do not make good mosquito breeding habitats. Natural areas present special challenges and concerns for mosquito control. Any intervention in these areas must take care not to unnecessarily disrupt the existing ecosystem. And while many mosquitoes are present, many may not be important vectors of WNV. For example, the large number of *Aedes* mosquitoes that emerge in the spring are thought to play little if any role in WNV transmission. Another difficulty is that many areas of stagnant water that produce mosquitoes are present for only a week or so following a rain.

The approach to mosquito control in natural areas in the Region of Peel for 2005 will involve assessment of breeding sites and larval monitoring to determine numbers and species important to WNV transmission. Response will be based on these assessment results and may involve improving natural controls, altering water flows if it does not damage the natural ecosystem and application of Bti if other measures are insufficient to control mosquito breeding. In environmentally

sensitive areas such as Rattray Marsh or Cawthra Woods, Peel Public Health will follow the special process that has been developed by the Ministry of Natural Resources. It involves key provincial and federal agencies to provide recommendations on how to manage each specific site so as to minimize the impacts on rare and sensitive species present there.

**Planned Activities:**

- Public education materials will ask residents and property owners to eliminate mosquito breeding sites on private property.
- Peel Public Health will work with municipal departments and volunteer groups to ensure that existing sanitation and waste removal on public property (including green areas such as parks, cemeteries, golf courses) places emphasis on removing garbage that promotes mosquito breeding (e.g. tires, pails, etc).
- Reports of stagnant water on private property will be assessed as per usual practice by property standards officers. Small sites will be dealt with through education. Significant potential breeding sites which are not cleaned up will be assessed by Peel Public Health for mosquito breeding, and if significant, pursued through local property standards by-laws or public health legislation, as appropriate.
- Peel Public Health will consider stocking another storm water management pond with fathead minnows, if the Ministry of Natural Resources provides assistance in verifying the site is suitable for biological control. Other means of enhancing natural biological controls already present at these sites and other sites will also be investigated.
- Peel Public Health and other agencies will identify areas of stagnant water associated with surface grading problems, road construction, clogged sewers and catch basins and obstructed waterways that are serving as mosquito-breeding habitat. These areas will be assessed on a site specific basis as they are identified and may be treated with larvicide. Remediation will be performed if possible.
- The larvicide methoprene will be applied to approximately 75,000 roadside catch basins in Brampton, Mississauga, and in the towns, villages and rural subdivisions of Caledon. It is anticipated that this will consist of four applications starting in June and ending in late August. In 2004, catch basins in green spaces of municipal parks were included in the larviciding program as were catch basins on properties owned and/or managed by the Region of Peel. Applications will continue to be conducted at these locations in 2005.
- Backyard catch basins will be only be treated upon the request of the homeowner. A consent form must be signed by the home owner prior to

treatment. Methoprene will be the larvicide used to treat backyard catch basins.

- In catch basins draining directly into environmentally sensitive areas the Larvasonic® unit will be used. Peel Public Health may use other methods if available (e.g. *Bacillus sphaericus*) as long as they are found to have a limited impact on the environment.
- Peel Public Health, in collaboration with local conservation authorities and parks departments, will monitor natural areas for mosquito larvae. Where possible, natural controls will be enhanced. Larvicide (Bti) will be applied on a site specific basis if sufficient numbers of mosquitoes implicated in the transmission of WNV are found, in compliance with Ministry of the Environment and Ministry of Natural Resources requirements.