CMMCP AERIAL LARVAL MOSQUITO CONTROL PROGRAM

SPRING 2013

FRANK H. CORNINE III & TIMOTHY D. DESCHAMPS
Central Mass. Mosquito Control Project
111 Otis Street Northborough, MA 01532
(508) 393-3055 • www.cmmcp.org

AERIAL LARVAL MOSQUITO CONTROL PROGRAM – SPRING 2013

FRANK H. CORNINE III & TIMOTHY D. DESCHAMPS
Central Mass. Mosquito Control Project
111 Otis Street Northborough, MA 01532
(508) 393-3055 • www.cmmcp.org • cmmcp@cmmcp.org

ABSTRACT

Inspections by the Central Mass. Mosquito Control Project of early season mosquito habitat indicated that an aerial application of *Bacillus thuringiensis israelensis* was appropriate for certain areas. Towns involved in this application included Billerica, Boxborough, and Chelmsford. The size and composition of these specific targets make them impractical for typical ground treatment, but ideal for aerial applications such as this. This particular application took place over several days in mid-April. Pre- and post application larval surveillance showed an 80.71% overall reduction in the emergence of spring mosquito species at treated monitoring sites, while untreated areas displayed a population growth of over 20.90%.

OBJECTIVE

Snow pack resulting from a traditional New England winter refreshes temporary woodland pools in early spring, which provide ideal habitat for the immature stages of several mosquito species. The service area of the Central Massachusetts Mosquito Control Project is home to two specific species that favor these environments, *Ochlerotatus abserratus* and *Ochlerotatus excrucians*. These two types of mosquitoes are univoltine, meaning they have only one population a year, and do not have multiple generations as many other species. Along with *Oc. abserratus* and *Oc. excrucians*, *Ochlerotatus canadensis* can also develop in these temporary pools, although this species is known to be multivoltine. *Oc. canadensis*, unlike the other two, has been found to harbor West Nile virus and Eastern Equine Encephalitis in addition to other diseases (Andreadis 2005). As these three species are generally the first to emerge in the spring, they constitute the majority of mosquito irritation to humans and livestock at this time of the season. This application, as with past spring aerials, primarily targets these mosquito species while they are immature as to reduce the number of future host-seeking adults. By specifically reducing *Oc. canadensis* and the diseases they may carry, the potential for direct public health impact is also reduced.

METHODS AND MATERIALS

The mosquito control product used in the 2013 spring aerial application was VectoBac G® (EPA Reg. No. 73049-10), with an active component of *Bacillus thuringiensis israelensis* (Bti). This "biopesticide" contains a non-reproducing soil bacterium applied to a granule media and is the same formulation used in the CMMCP ground larvicide program (CMMCP 2013). The success of this specific bacterium strain is derived from target specific toxins it creates. When ingested, these particles interfere with digestion, resulting in larval mortality and a reduction of adult mosquitoes (Extension Toxicology Network 1996). Because ingestion must take place for this strain of Bti to be effective, the targeted immature

mosquitoes must be in the larval stage, preferably before late in the 4th instar stage. During this instar larvae begin to slow their feeding and in preparation for the pupal stage. Once in this life stage, mosquitoes do not feed and therefore cannot be controlled by Bti. An application rate of 5lbs/acre was applied by helicopter, which is well within the recommended application rates for VectoBac G® of 2.5-10lbs/acre (VectoBac G® label).

North Fork Helicopters (Cutchogue, New York) was contracted to perform the aerial application, with CMMCP staff providing support at loading zones. The wetlands selected for this aerial application were chosen by multiple factors, including larval history, mosquito-borne disease potential, current surveillance, and inability for treatment by ground. These targets were generally over 5 acres, depicted through GIS software, and had designations of wooded swamp, deciduous, conifer and mixed, shallow marsh, and shrub swamp, (MassGIS 2007). Similar types of wetlands below 5 acres were to be inspected and treated accordingly during the CMMCP ground larvicide program. The Billerica and Chelmsford portion of the application took place on April 17th, using Warren Farm in Chelmsford as a loading zone. Over the course of the following two days, the Boxborough share of the aerial application was conducted, finishing up on Friday April 19th. The Boxborough application used Minute Man Airfield in Stow as a loading zone. This year 600, 900, and 540 acres were designated for treatment in Billerica, Boxborough, and Chelmsford respectively. In accordance with 333CMR 13.04 (7) (Appendix A), CMMCP placed legal notifications in local newsprint prior to the aerial larvicide. This notification was printed February 6th, 2013 in The Boston Globe, and also posted on the CMMCP website (http://www.cmmcp.org/).

The protocol for this aerial application comes from The Generic Environmental Impact Report (GEIR) and includes direction for recoverable dip stations (RDS) which help in efficacy monitoring (Massachusetts Department of Agricultural Resources 2011). Per this GEIR document, every town in the application receives one treatment RDS for every 250 acres treated as well as one control RDS outside the application areas for comparison. This design allows for comparison between the larval amounts in treatment sites to be to the levels in an untreated control sites. By comparing these numbers, we can gauge the level of success for the application. At each individual RDS, ten larval surveillance positions are flagged and examined both before and after the application. Standard larval surveillance methods are utilized at each position, where the number of larvae and observed instar stage is recorded prior to the application. In addition to these observations, the visible presence or absence of Bti product is also noted in the post-application check. In order to preserve the integrity of the efficacy data, any larvae that are sampled before the application are immediately placed back. However, in order to identify the composition of mosquito species being treated, larvae samples are collected from the surrounding areas.

RESULTS

The Billerica, Boxborough, and Chelmsford treatment RDS indicate that the 2013 spring aerial larvicide had an overall observed larval reduction of 80.71% from pre-application levels. Individually, the Billerica treatment RDS exhibited a 69.71% decrease, the Boxborough treatment RDS an 83.33% decrease, and the Chelmsford treatment RDS showed a 91.24% decrease. Conversely, there was an overall increase of 20.90% from pretreatment levels for the three untreated (control) RDS (Table 1; Figures 1-4).

Table 1: Larval Surveillance of Treatment and Control RDS

Treatment Sites	Pre-application	Post-application	Observed Change
BIL116	87	11	-87.36%
BIL112	29	22	-24.14%
BIL408	59	20	-66.10%
BOX128	12	0	-100.00%
BOX8	25	4	-84.00%
BOX92	49	5	-89.80%
BOX121	22	7	-68.18%
CHM81	37	3	-91.89%
CHM279	32	4	-87.50%
CHM236	68	5	-92.65%
Overall:	420	81	**-80.71%**
Control Sites	**Pre-application**	**Post-application**	**Observed Change**
BIL227	52	80	53.85%
ACT37	78	66	-15.38%
CHM146	47	68	44.68%
Overall:	177	214	**20.90%**

Figure 1: Billerica Treatment RDS Results Pre- and Post Application

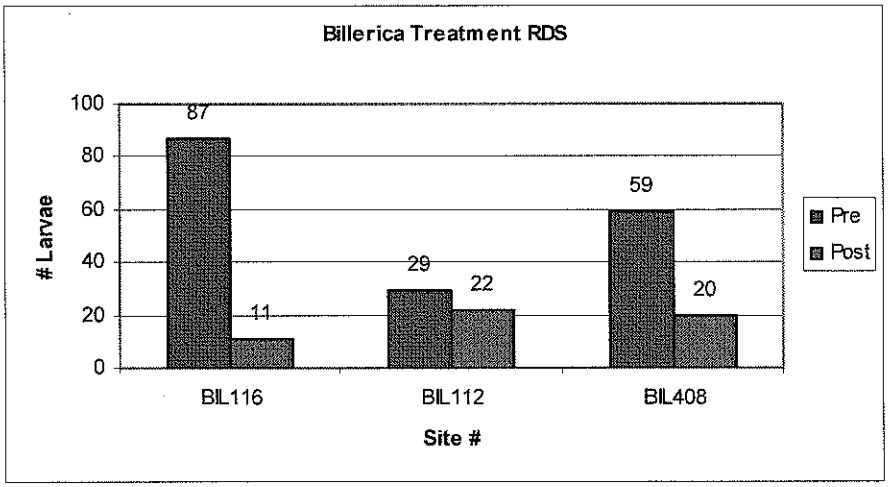


Figure 2: Boxborough Treatment RDS Results Pre- and Post Application

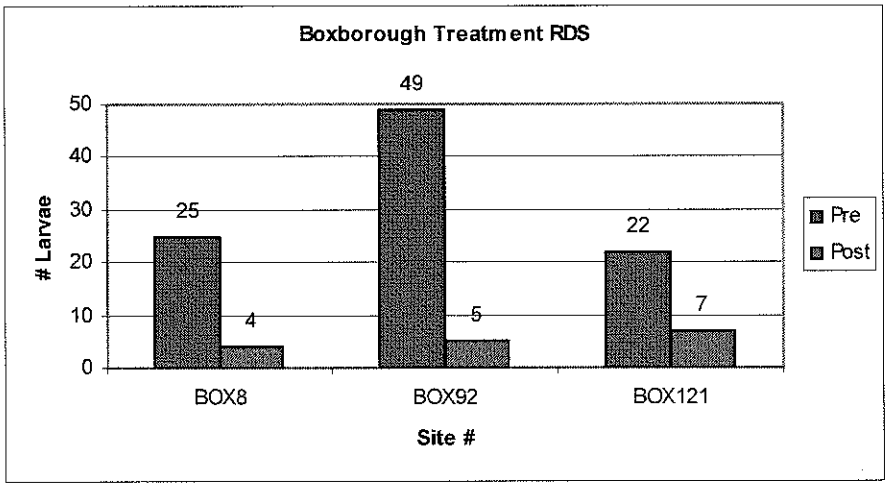


Figure 3: Chelmsford Treatment RDS Results Pre- and Post Application

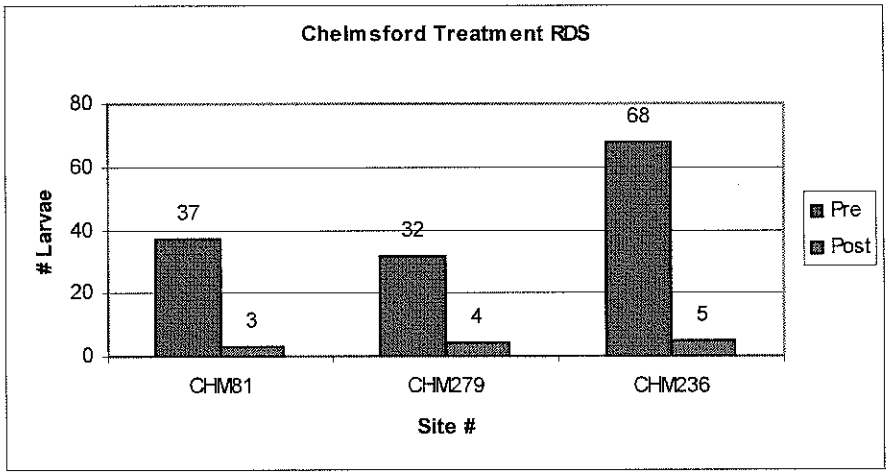
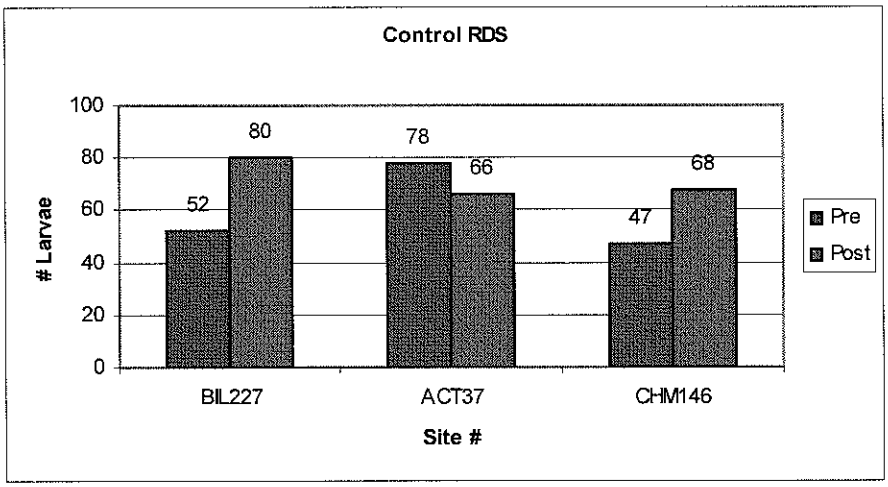


Figure 4: Control RDS Results Pre- and Post Application



DISCUSSION

Resulting in approximately 80.71% overall control, the 2013 CMMCP spring aerial larvicide was considered effective in reducing target mosquito species. This conclusion is reinforced by the 20.90% increase observed in mosquito larvae at untreated control sites. Unlike the extremely dry conditions found during April 2012 which delayed that treatment, this year's application took place in more traditional settings. Larval habitat was present leading up to the aerial due to adequate snowpack, and mosquito larvae were readily found in most instars. Upon observing susceptible mosquito larvae in the larger wetland bodies of Billerica, Boxborough, and Chelmsford, application plans were developed for mid-April. The application for Billerica and Chelmsford was planned for and conducted on April 17th, with Boxborough anticipated for the following day. Due to airspace restrictions interrupting the application, only half of Boxborough was finished on April 18th, with the second half taking place on April 19th.

Most of the treatment RDS had thorough Bti coverage, but there were a few with sporadic product visible around the surveillance flags. Post-application surveillance indicated that product coverage was ideal in Chelmsford, adequate in Boxborough, and slightly more varied in Billerica. This is reflected in the lower than anticipated control rate for Billerica. Although Bti granules might have been somewhat sparse directly at these particular RDS, the majority of all the target wetlands bodies contained sufficient product. Another observation of note was the apparent reduction in larvae following the application for control site ACT37. Field reports show that many of surveillance points had significantly dried up after the initial observations, which made the secondary larvae sampling difficult. This impaired data collection, resulting in a larval "reduction." There were no other reports of drying RDS after initial surveillance.

Of the spring Ochlerotatus species targeted in this application, *Oc. abserratus* and *Oc. excrucians* traditionally emerge first, followed by *Oc. canadensis*. This scenario was present this year as larvae collected prior to the application indicated late instars of *Oc. abserratus* and *Oc. excrucians* and early *Oc. canadensis*, in addition to single specimens of related species. By reducing the local mosquito populations in this aquatic larval stage, the need for adult control later in the season is decreased as a result of this spring aerial application. The associated service requests for adult control will in turn be lowered for the towns involved. Although this program only includes Billerica, Boxborough, and Chelmsford currently, the potential exists for adjacent communities to join this activity to reduce their adult mosquito numbers as well. A thorough review will of this program will be conducted to ensure the success of future applications.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the towns of Billerica, Boxborough, and Chelmsford for participating in this program; North Fork Helicopters for conducting the aerial application; Clarke Mosquito Control Products for supplying the Vectobac G®; Minute Man Airfield, Stow and Warren Farm, Chelmsford for providing loading zones; the CMMCP Commission, and the CMMCP staff for larval monitoring, larval identification, site selection, map development and assisting with the helicopter application.

REFERENCES

Andreadis TG, Thomas MC, Shepard JJ. 2005. Identification guide to the mosquitoes of Connecticut. Bulletin of the Connecticut Agricultural Experiment Station 966:1–173.

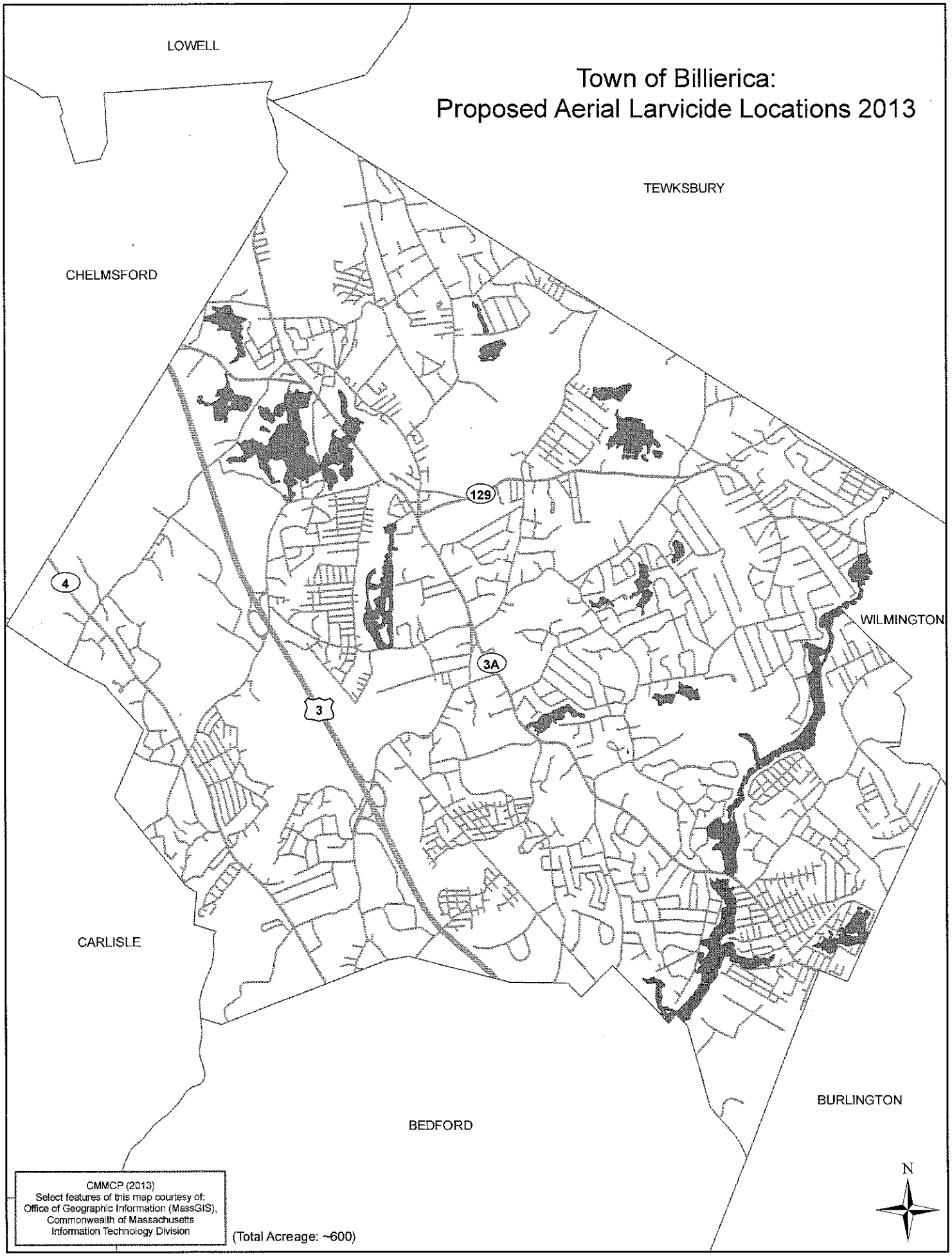
CMMCP [Central Massachusetts Mosquito Control Project]. 2013. *Bti (Bacillus thuringiensis israelensis)*. Northborough, MA: Central Mass. Mosquito Control Project. Available from: http://www.cmmcp.org/bti.htm.

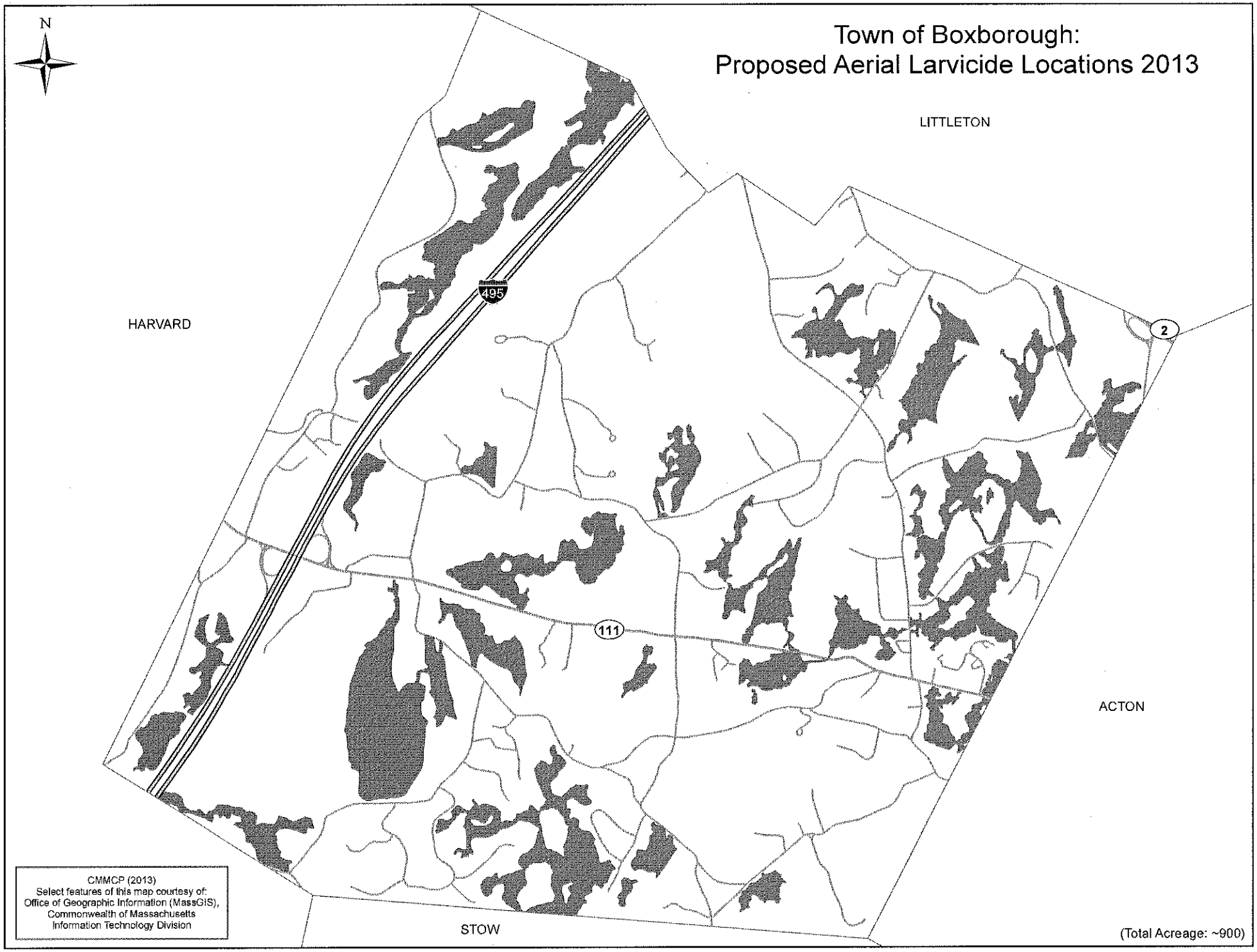
Extension Toxicology Network. 1996. *Bacillus thuringiensis*. Extoxnet. Available from: http://extoxnet.orst.edu/pips/bacillus.htm

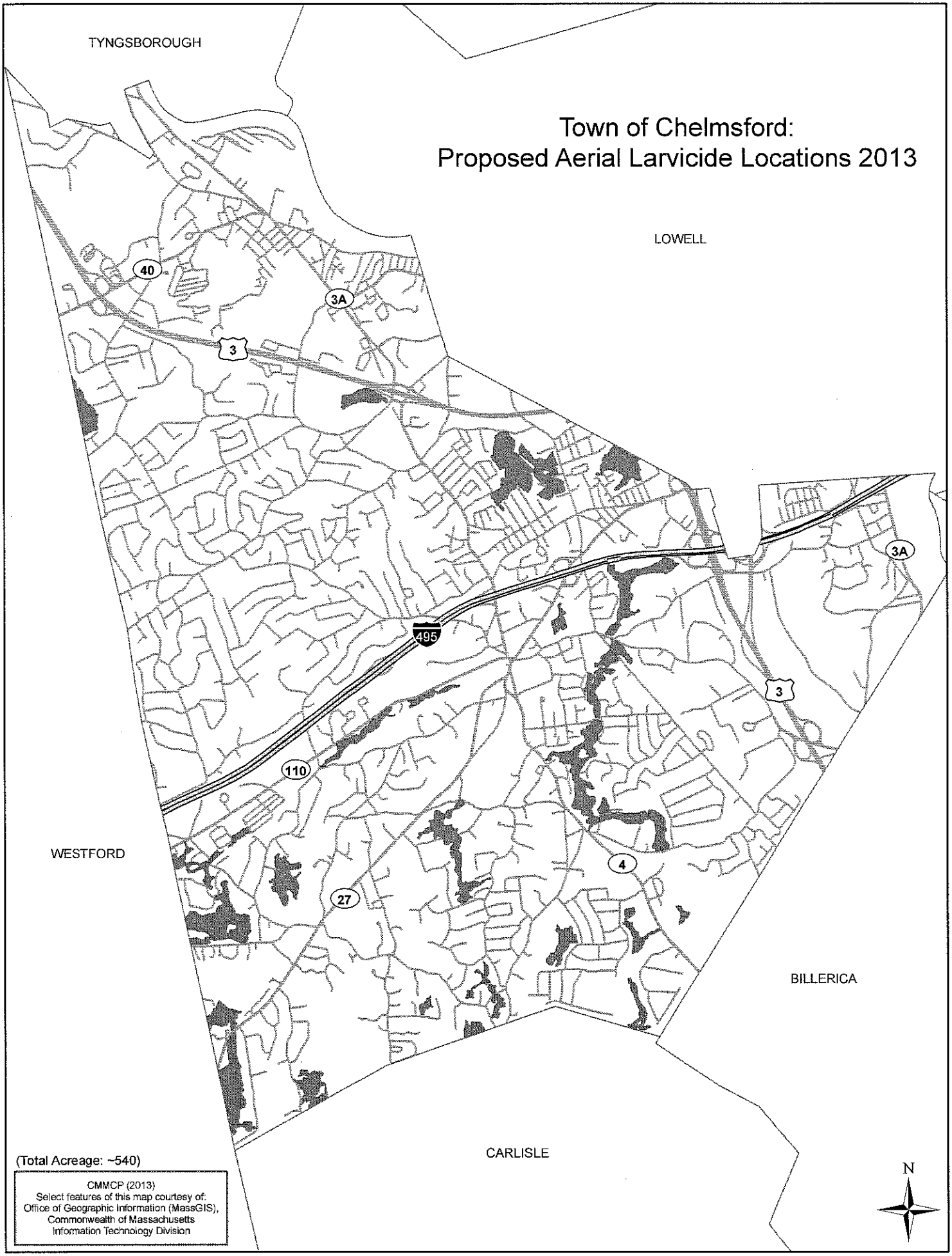
Massachusetts Department of Agricultural Resources. 2011. *Generic Environmental Impact Report (GEIR)*. Massachusetts Department of Agricultural Resources. Available from: http://www.mass.gov/agr/mosquito/geir.htm

MassGIS [Office of Geographic and Environmental Information, Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs]. 2007. *DEP Wetlands (1:12,000)*. MassGIS. Available from http://www.mass.gov/mgis/wetdep.htm

United States Environmental Protection Agency. 1998. *Bacillus thuringiensis subspecies israelensis strain EG2215 (006476) Fact Sheet*. Washington, D.C.: United States Environmental Protection Agency. Available from: http://www.epa.gov/pesticides/biopesticides/ingredients/factsheets/factsheet_006476.htm


Town of Billierica:
Proposed Aerial Larvicide Locations 2013
LOWELL
TEWKSBURY
CHELMSFORD
129
4
3A
3
WILMINGTON
CARLISLE
BEDFORD
BURLINGTON
N
CMMCP (2013)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division
(Total Acreage: ~600)


N
Town of Boxborough:
Proposed Aerial Larvicide Locations 2013
LITTLETON
HARVARD
495
2
111
ACTON
STOW
CMMCP (2013)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division
(Total Acreage: ~900)


TYNGSBOROUGH
Town of Chelmsford:
Proposed Aerial Larvicide Locations 2013
LOWELL
40
3A
3
3A
495
3
110
WESTFORD
4
27
BILLERICA
CARLISLE
(Total Acreage: ~540)
CMMCP (2013)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division
N

Ad Number	2000692062
ID:	Aerial Application
Class:	LEGAL
Begin Date:	2/6/2013
End Date:	2/6/2013

CENTRAL MASS MOSQUITO CONTROL
111 OTIS STREET
NORTHBOROUGH, MA 01532

To place an ad: **617-929-1500**

The Boston Globe

CERTIFIED

Below is your advertisement from THE BOSTON GLOBE, beginning 2/6/2013 and ending 2/6/2013, appearing 1 time(s) in Classification, LEGAL.

Thank you!
Boston Globe Advertising

Legal Notice
- Aerial Application to Control Mosquito Larvae
Per 333CMR 13.04(7), the Central Mass Mosquito Control and North Fork Helicopters will be conducting helicopter applications of the biological larvicide Bti to control mosquito larvae over selected large wetlands in the towns of Boxborough, Billerica and Chelmsford. The applications will be conducted during the daylight hours from March 1 to October 31, 2013 as conditions warrant. The trade name of the product to be used is Vectobac G (EPA Reg. #73049-10). For additional information please contact Tim Deschamps at (508) 393-3055.