CMMCP AERIAL MOSQUITO LARVAL CONTROL PROGRAM

SPRING 2011

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ABSTRACT

In April 2011, the Central Mass. Mosquito Control Project conducted a spring aerial application of *Bacillus thuringiensis israelensis* in the towns of Billerica, Boxborough, and Chelmsford for selected wetlands which cannot be treated through standard ground larviciding. In conducting pre- and post application larval monitoring, it was found that there was a 90.14% overall reduction in the emergence of spring mosquito species at treated sites. Control sites where no Bti was applied showed an average 48.52% increase in larvae.

OBJECTIVE

As snow melts and the spring rains commence, the dormant eggs of several mosquito species hatch into larvae and develop in the pools created by this localized flooding. Two of these species, *Ochlerotatus abserratus* and *Ochlerotatus excrucians*, are univoltine, meaning they only have one population emergence a year. Their eggs need to go through a freeze-thaw cycle (called cold-conditioning) before they will hatch. Another species that potentially could be found in these pools is *Ochlerotatus canadensis*, which may exhibit some multivoltine behavior by having more than one population emergence per year. This species has also been show to have the capability to transmit both West Nile virus and Eastern Equine Encephalitis in addition to other diseases in the northeast (Andreadis 2005). All combined, these "spring brood" mosquitoes are the primary pestiferous species detected upon emergence to both humans and other mammals during late spring and early summer. The goal of the 2011 spring aerial larvicide program is to reduce the number of "spring brood" mosquito species while in the aquatic larval stage, therefore reducing the number of host-seeking adults who would be capable of negatively impacting residents and livestock in the surrounding areas.

MATERIALS AND METHODS

The product used in the aerial larvicide was *Bacillus thuringiensis israelensis* (Bti), which is the same product used in the CMMCP ground larvicide program (CMMCP 2009). A granular product, VectoBac G® (EPA Reg. No. 73049-10), a "biopesticide," contains a non-reproducing soil bacterium. This bacterium generates target specific toxins which when ingested by the mosquito larvae reduce the likelihood of pupation and later emergence as an adult (Extension Toxicology Network 1996). This Bti product tends to be most effective when used prior to the mosquito larvae reaching the 4th instar. It is at this point that they begin to slow their feeding and begin metamorphosis to the pupal stage. As in previous CMMCP spring aerial applications, an application rate of 5lbs/acre was applied by the helicopter. This rate is well within the recommended application rates for VectoBac G® (2.5-10lbs/acre, VectoBac G® label). North Fork Helicopters (Cutchogue, New York) was again contracted to perform the aerial

application. Their past experience with the CMMCP spring aerial larvicide and their flexibility with the fluid nature of an ideal application timeframe are considered very important to the success of the program.

Targets for the aerial application were based on larval surveillance, past applications, previous mosquito-borne disease activity, and town priority areas. Selected wetland bodies tended to be over 5 acres and categorized as being primarily wooded swamp, deciduous, conifer and mixed; shallow marsh; and shrub swamp, which were determined through the use of GIS layers (MassGIS 2007). Any mosquito larval habitat below the 5 acre threshold were to be inspected during the CMMCP ground larvicide program and treated accordingly.

As previously stated, Bti is more effective if applied while the mosquito larvae are in the earlier instars. The application should be performed prior to the 4th instar, because these younger larvae tend to be the most susceptible. As larvae approach the pupa stage they are less likely to ingest a sufficient amount of the product to be effective. Furthermore, mosquitoes in the pupal stage stop feeding altogether and cannot be controlled by Bti. Because larval stage plays such a crucial role in the effectiveness of this larvicide, the influence by weather is great. A prolonged winter, late snow melt, and below average temperatures can delay larval development, potentially stalling the timing of the application. Conversely, the weather conditions before the 2010 spring aerial application, which including above average temperatures, accelerated larval development and advanced the timing of that particular application.

The Chelmsford portion of the aerial application was conducted on April 21st, while Billerica and Boxborough were treated on the following day, April 22nd. As in previous years, the loading/landing zones were at Warren Farm in Chelmsford for the Billerica and Chelmsford application and at the MinuteMan Airfield in Stow for the Boxborough application. There were slight changes in the acreage designated for the aerial larvicide this year. The town of Billerica requested that 600 acres be treated, while Chelmsford requested 544, and Boxborough 990. This program is the only one at CMMCP that is done with supplemental funds; the towns pays for the helicopter and Bti, CMMCP provides the pre- and post larval monitoring, as well as the labor to assist the helicopter company. 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 14th, 2011 in the Boston Globe (Appendix B), and additionally was also posted on the CMMCP website at (http://www.cmmcp.org/).

Protocol for the monitoring an aerial larvicide event as based on the Generic Environmental Impact Report (GEIR) for mosquito control which outlines directions for the creation of recoverable dip stations (RDS) (Massachusetts Department of Agricultural Resources 2011). Each town receives one treatment RDS for every 250 acres targeted, as well as one untreated control RDS for comparison. This procedure allows for the levels of larvae

in treatment sites to be compared to the levels in an untreated control site. These locations are essential in determining the level of success for the application. Ten marked positions for larval surveillance, both before and after the application, are then established at each RDS. Prior to the application each position is flagged and numbered so that they can be rechecked following the application. The number of larvae present is recorded as well as other larval characteristics, and following the application the presence or absence of Bti product and observed larvae health is additionally noted. Any larvae that are sampled before the application are placed back so the results from the application are not impacted. Larvae samples are collected from the surrounding areas however, to help establish what species were present and controlled during the aerial larvicide.

RESULTS

The results from the treated RDS indicate that for Billerica, Boxborough, and Chelmsford, the 2011 spring aerial larvicide had an overall observed larval reduction of 90.14% from pre-application levels. Following the application, the Billerica treatment RDS exhibited a 96.57% decrease, the Boxborough treatment RDS a 90.70% decrease, and the Chelmsford treatment RDS showed an 81.10% decrease. For the untreated control RDS, Billerica had a slight increase (+10.81%), Boxborough more than doubled (+102.53%), while Chelmsford slightly decreased (-5.66%). When these results were combined it resulted in an overall observed increase of almost 50% (48.52%) for those control RDS where no Bti product was applied (Table 1; Figures 1-4). Larvae samples collected in the areas of the RDS before the application indicate that several species were present including *Aedes cinereus*, *Ochlerotatus abserratus*, and *Ochlerotatus excrucians*.

Table 1: Larval Surveillance of Treatment and Control RDS

Treatment Sites	Pre-application	Post-application	Observed Change
BIL108	45	0	-100.00%
BIL112	58	2	-96.55%
BIL408	72	4	-94.44%
BOX128	13	2	-84.62%
BOX92	12	2	-83.33%
BOX8	18	0	-100.00%
CHM82	38	9	-76.32%
CHM24	38	0	-100.00%
CHM236	51	15	-70.59%
Overall:	345	34	**-90.14%**
Control Sites	**Pre-application**	**Post-application**	**Observed Change**
BIL227	37	41	10.81%
BOX122	20	40	100.00%
ACT37	59	120	103.39%
CHM146	53	50	-5.66%
Overall:	169	251	**48.52%**

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

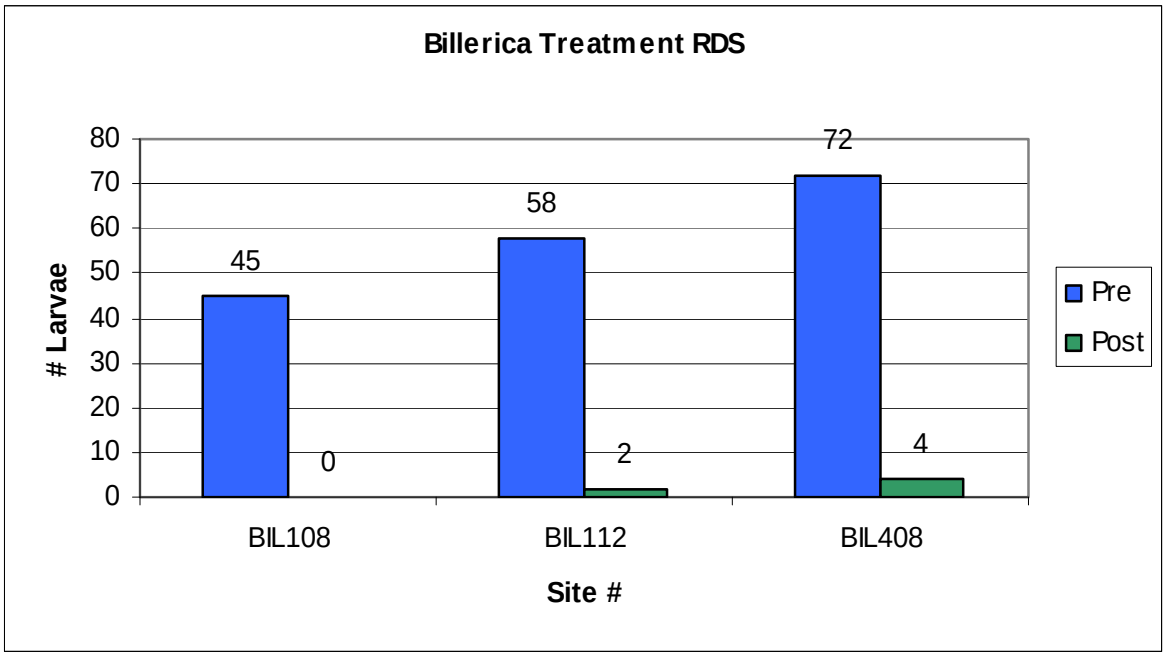


Figure 2: Boxborough Treatment RDS Results Pre- and Post Application

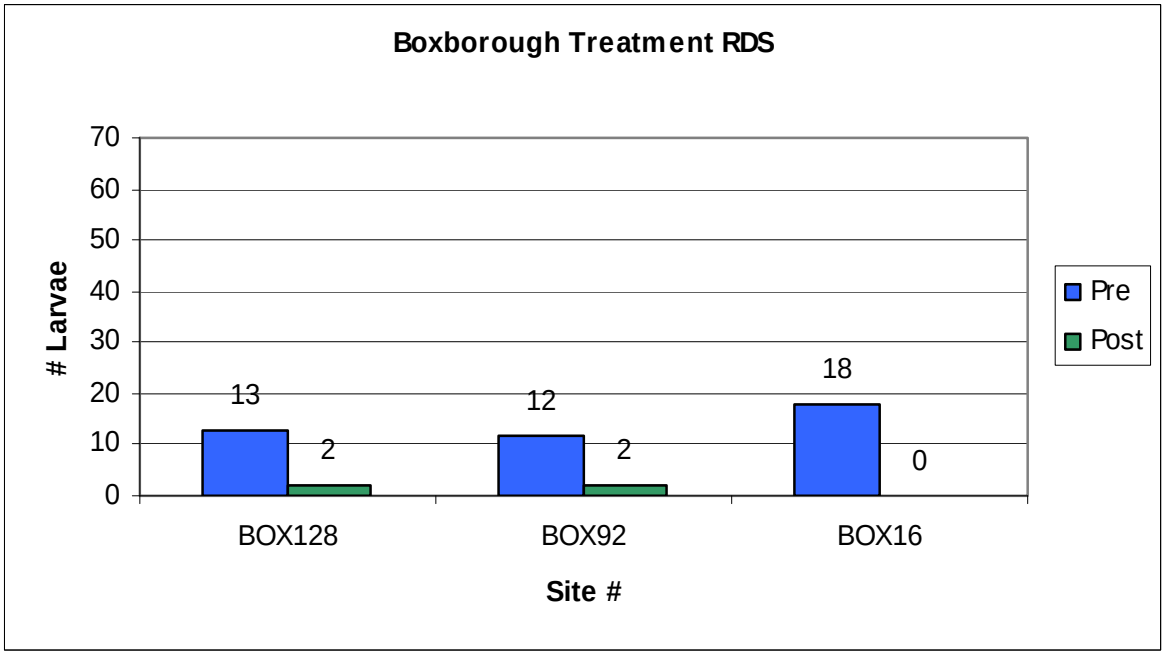


Figure 3: Chelmsford Treatment RDS Results Pre- and Post Application

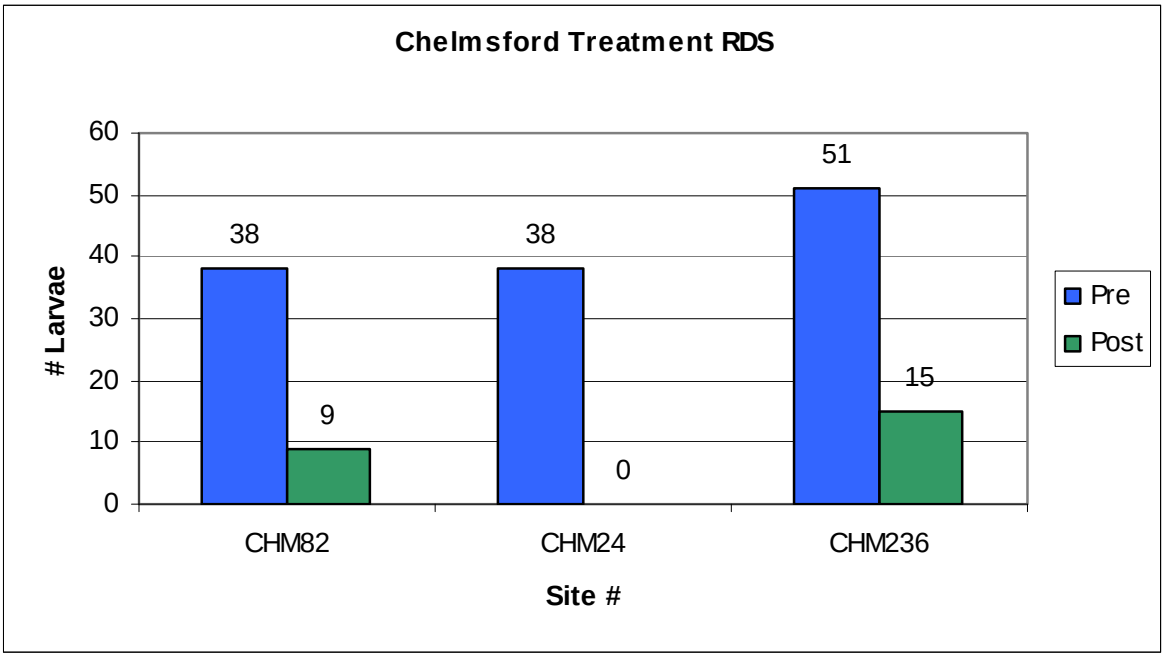
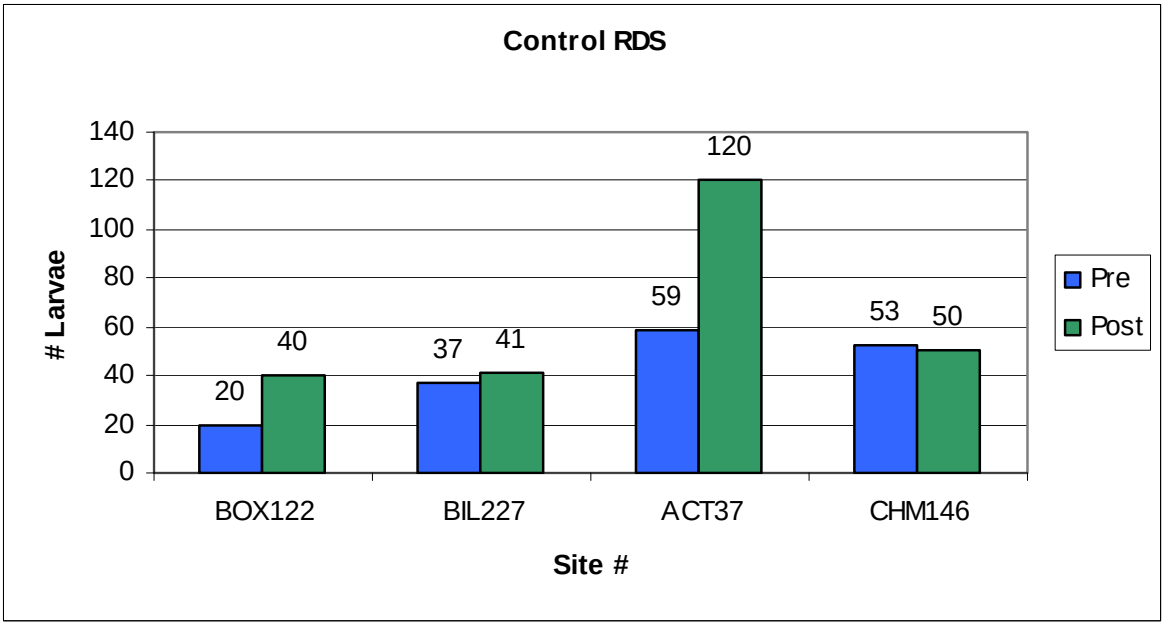


Figure 4: Control RDS Results Pre- and Post Application



DISCUSSION

With approximately 90.14% overall control, the 2011 CMMCP spring aerial larvicide was considered very effective. Larval development was more typical this year compared to the previous year, where advanced stages lead the aerial application to be conducted approximately a week earlier. Pre-application surveillance

indicated that the targeted larvae were within the range of suitable instars. Rain and high winds played a factor in this year's application. The Billerica and Chelmsford portions of the application were to be conducted on April 20th, but due to projected heavy rains were delayed until the 21st. Unfortunately though, only Chelmsford was treated on the 21st, this time limited because of high winds. The result was that the entirety of both Billerica and Boxborough were treated the following day, April 22nd. All of the RDS were checked 24 hours after each application and again once more, to ensure enough time had passed for the Bti product to be fully effective.

Observations showed that one of the RDS did not have Bti visibly present following the application, but at all other treatment RDS there seemed to be ample coverage. Review of the flight data reinforced the notion that this specific RDS was not treated, although the surrounding target areas were. This may have been due to a variety of factors, and will be addressed with the contractor. The timing of the application was proper in that the observed larval stages were within the ideal range, and also several target species were identified prior to the application including *Aedes cinereus*, *Ochlerotatus abserratus*, and *Ochlerotatus excrucians*. No *Oc. canadensis* were found prior to the application, but historically, *Oc. canadensis* begins initial development slightly later than both *Oc. abserratus* and *Oc. excrucians*. The reduction in mosquito larvae from this aerial larvicide will lower the need for wide scale adulticide interventions later. As these "spring brood" species are primarily univoltine, the negative impacts of these early season mosquitoes will be lessened for area residents. There is potential for this program to expand in the future, with neighboring towns joining Billerica, Boxborough, and Chelmsford. This would additionally lessen the need for later adulticide events. All components of this program will be further reviewed to increase the efficacy of future applications.

ACKNOWLEDGEMENTS

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

REFERENCES

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APPENDIX A

(7) Exemptions for Aerial Application of Mosquito Larvicides. Mosquito larvicide applications made by mosquito control programs approved by the State Reclamation and Mosquito Control Board are exempt from 333 CMR 13.04(4) and 333 CMR 13.04(6) if all of the following conditions have been met:

(a) Notice of the proposed application has been published in a newspaper of general circulation in the affected municipality between February 1st and March 1st of the year the application is intended to be made. The notice shall include the following information:

1. Purpose of control program;
2. Method of application;
3. Area of application if known;
4. Name and EPA Registration Number of the pesticide product to be applied; and
5. Phone number of a contact person from whom additional information can be obtained.

Within seven calendar days of publication, a copy of the notice shall be provided to the Department and the Board of Health in the municipality where the application is to be made.

(b) Notice of the proposed application has been provided to the Department and the Board of Health in the municipality where the application is to be made prior to the application. The notice shall include the following information:

1. Purpose of control program;
2. Method of application;
3. Area of application;
4. Date and time of application;
5. Name and EPA Registration Number of the pesticide product to be applied; and
6. Name of the applicator and phone number of a contact person from whom additional information can be obtained.

The full text of these regulations can be found at this link: http://www.mass.gov/agr/legal/regs/pesticides_regulations_list.htm

APPENDIX B

Ad Number 2000458819
ID: Aerial Application to Control Mosquito L
Class: LEGAL
Begin Date: 2/14/2011
End Date: 2/14/2011

CENTRAL MASS MOSQUITO CONTROL
111 OTIS ST
NORTHBOROUGH, MA 01532

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

The Boston Globe

CERTIFIED

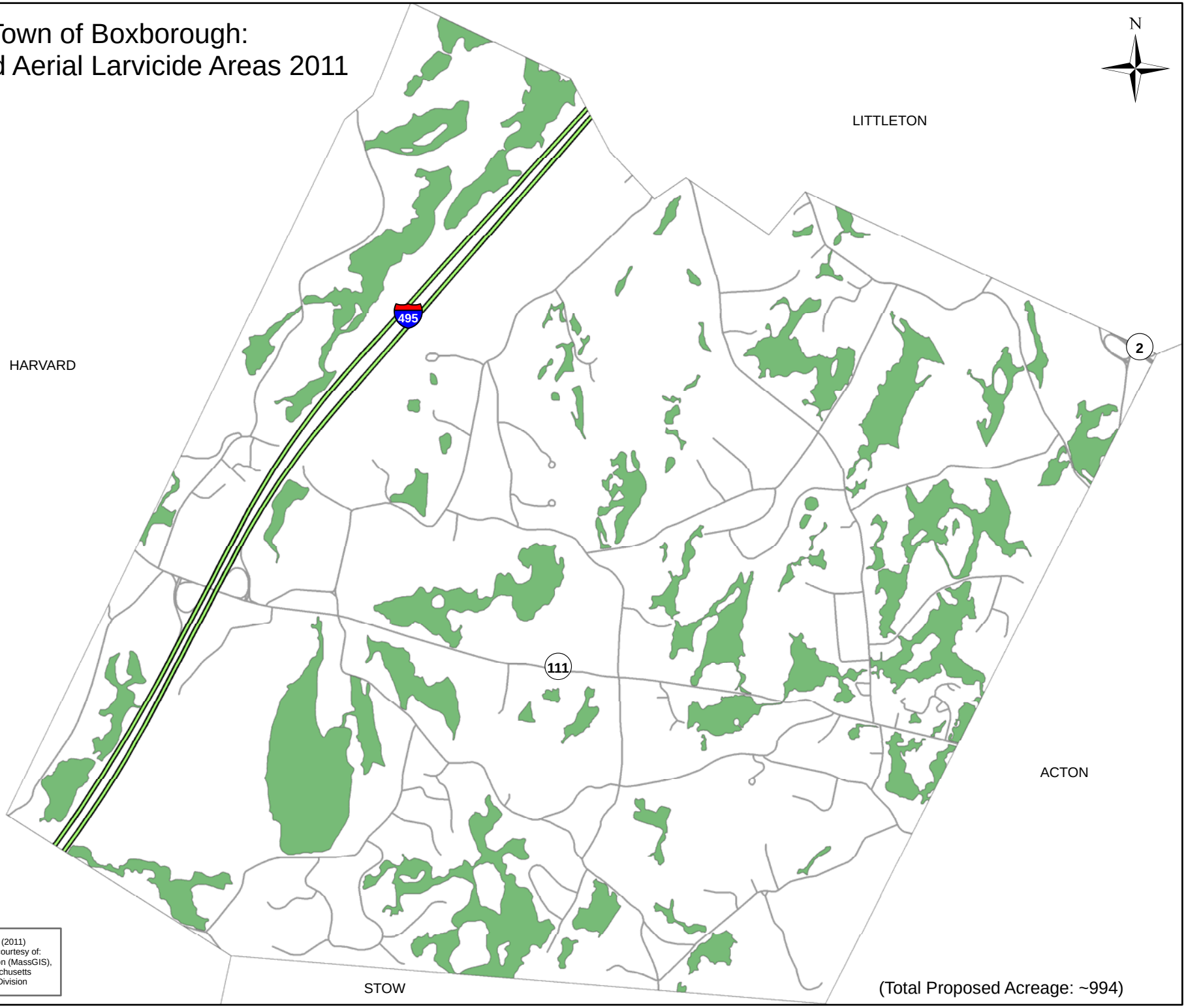
Below is your advertisement from THE BOSTON GLOBE, beginning 2/14/2011 and ending 2/14/2011, appearing 1 time(s) in Classification, LEGAL.

Thank you!
Boston Globe Advertising

Legal Notice-Aerial Application to Control Mosquito Larvae

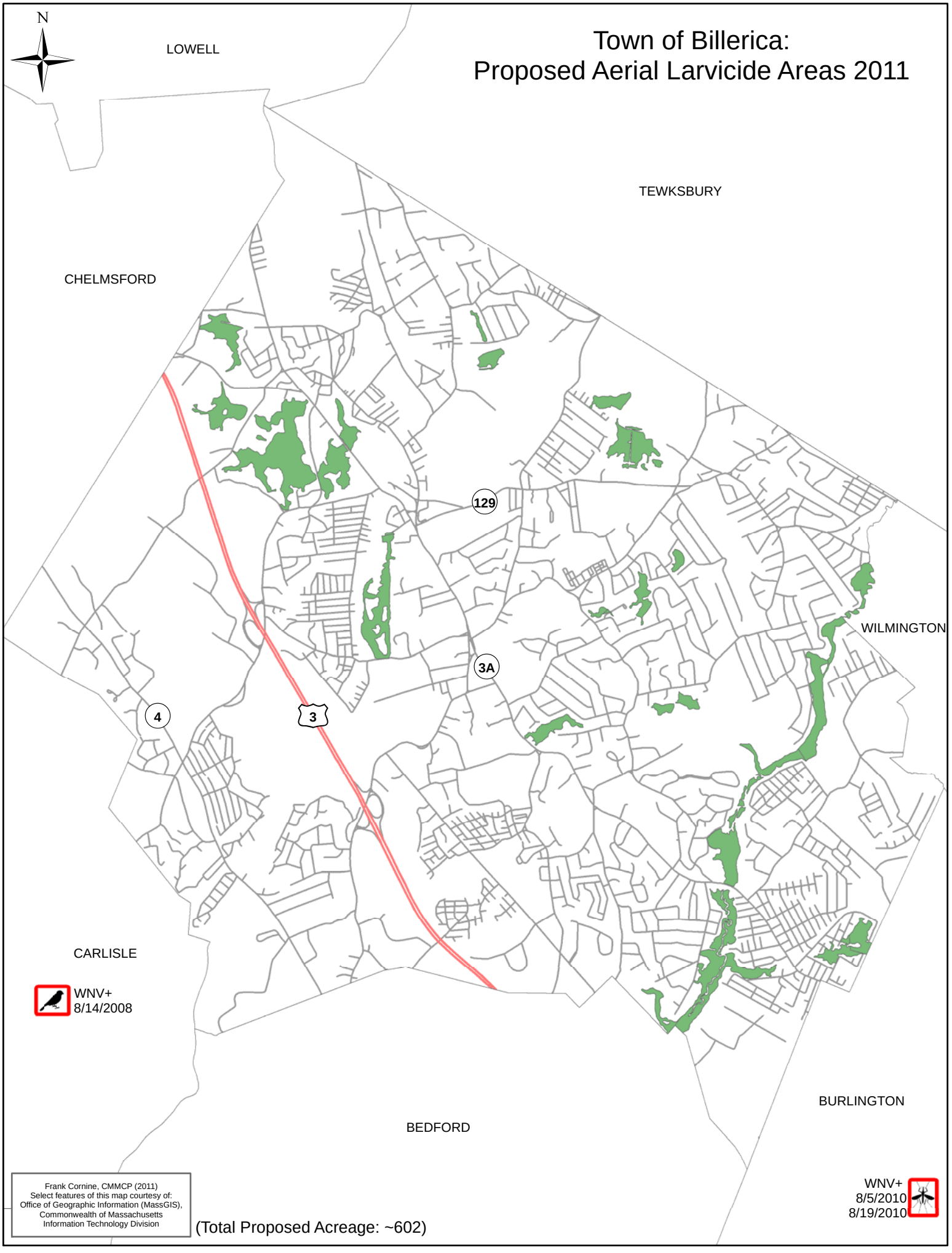
Per 333CMR 13.04(7), the Central Mass. Mosquito Control and North Fork Helicopters will be conducting helicopter applications of the biological larvicide Bti to control mosquito larvae over selected large wetlands in the towns of Boxborough, Billerica and Chelmsford. The applications will be conducted during the daylight hours from March 15 to October 31, 2011 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.

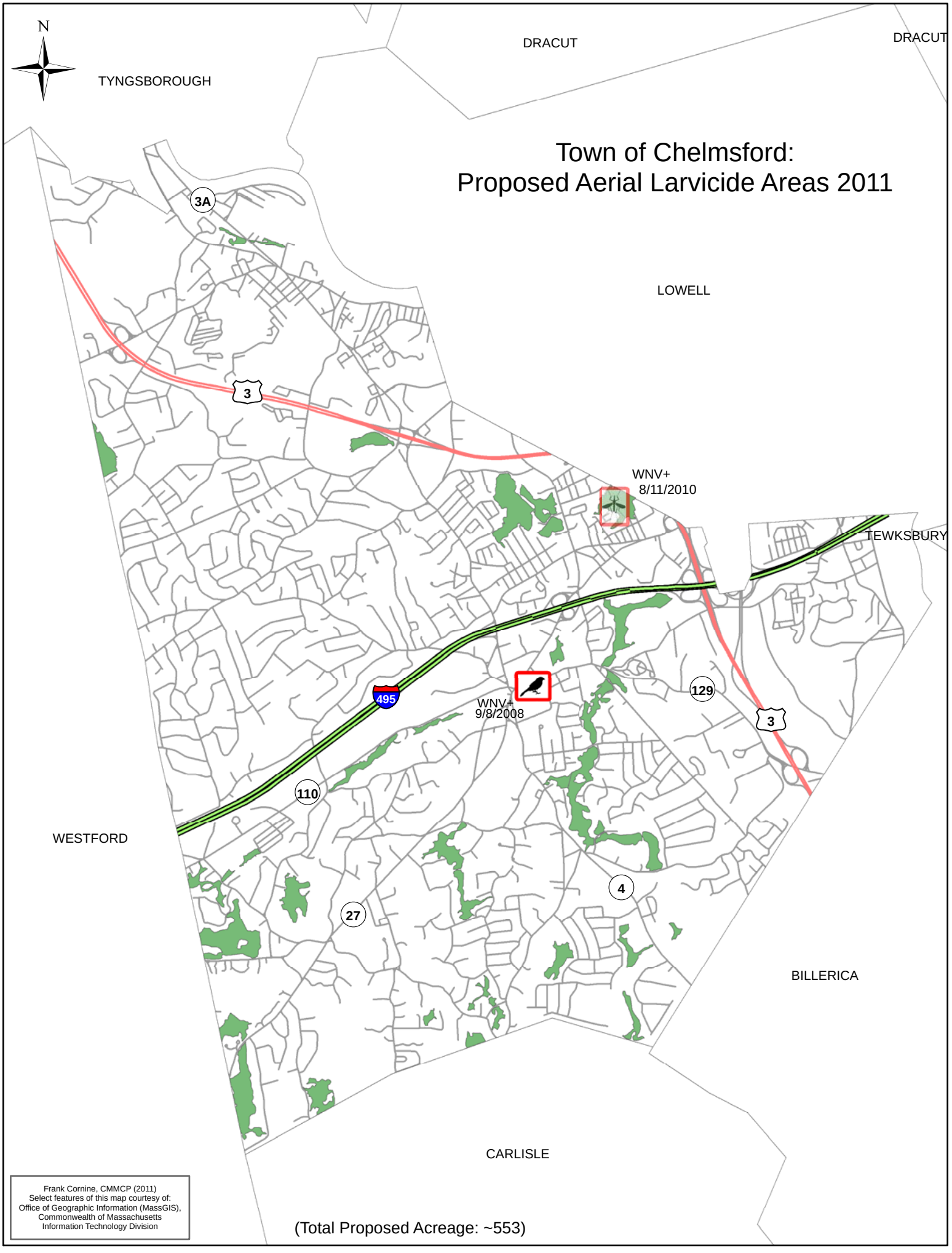
Town of Boxborough:
Proposed Aerial Larvicide Areas 2011



Frank Cornine, CMMCP (2011)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division

(Total Proposed Acreage: ~994)


N
LOWELL
Town of Billerica:
Proposed Aerial Larvicide Areas 2011
TEWKSBURY
CHELMSFORD
129
WILMINGTON
3A
4
3
CARLISLE
WNV+
8/14/2008
BURLINGTON
BEDFORD
Frank Cornine, CMMCP (2011)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division
(Total Proposed Acreage: ~602)
WNV+
8/5/2010
8/19/2010


N
TYNGSBOROUGH
DRACUT
DRACUT
Town of Chelmsford:
Proposed Aerial Larvicide Areas 2011
3A
LOWELL
3
WNV+
8/11/2010
TEWKSBURY
495
WNV+
9/8/2008
129
3
110
WESTFORD
4
27
BILLERICA
CARLISLE
Frank Cornine, CMMCP (2011)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division
(Total Proposed Acreage: ~553)