Active Ingredient Data Package

Metalaxyl & Mefenoxam

Version #4 (May 19, 2015)

Long Island Pesticide Pollution Prevention Strategy
Active Ingredient Assessment

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Bureau of Pest Management
Pesticide Product Registration Section

Contents

Attachments

1.0 Active Ingredient General Information – Metalaxyl & Mefenoxam

1.1 Pesticide Type

Metalaxyl and mefenoxam are types of fungicides that disrupt the synthesis of nucleic acids. Metalaxyl is chemically similar to mefenoxam. Specifically, metalaxyl is a mixture containing equal amounts of the "R" and "S" enantiomers of the compound. The R-enantiomer is more active in controlling plant diseases than either the S-enantiomer or the combination of the two. Mefenoxam, also referred to as metalaxyl-M, contains primarily the R-enantiomer. With the availability of mefenoxam, containing the enrichment of the R-enantiomer, it was possible to reduce the amount of fungicide needed to control diseases. Mefenoxam is more commonly used than metalaxyl in most pesticide products registered in NYS today. As will be discussed later, metalaxyl is only allowed in NYS for seed treatment uses.

Both metalaxyl and mefenoxam target pathogens in the water mold group (oomycete) which rot roots, stems, leaves, and fruits, as well as downy mildews that blight foliage and defoliate plants.

1.2 Primary Pesticide Uses

In 1996, the major manufacturer of metalaxyl (former Ciba-Geigy, currently Syngenta) voluntarily cancelled the registration of metalaxyl products (Attachment 1). At approximately the same time, several products containing mefenoxam were registered. As such, there was a decrease in metalaxyl use in 1996 along with a corresponding increase in the use of mefenoxam. As of 1996, metalaxyl is only used for the treatment of seeds in New York State.

Metalaxyl and mefenoxam are most commonly used with vegetable crops, but are also used with various turf applications and for ornamental products in greenhouses and nurseries. Metalaxyl and mefenoxam have also historically been used to a limited extent for landscape purposes, but only mefenoxam products are registered for this use today.

Metalaxyl is the active ingredient in 38 products registered for use in New York State as a form of seed treatment and mefenoxam is the active ingredient in 45 products registered for use in New York State.

1.3 Registration History

- 1979 Metalaxyl was first registered by the US EPA.
- 1983 Metalaxyl was first used on Long Island.
- 1993 NYS label amended for use of metalaxyl on grapes.
- 1994 The groundwater label advisory for metalaxyl end use products required by US EPA (Attachment 2).
- 1996 Voluntary cancellation of metalaxyl for the end-use product registrations held by Ciba Crop Protection (Attachment 1).
- 1996 Mefenoxam (metalaxyl-M) first registered for use in NYS (Attachment 3).

- 1996 Following the registration of mefenoxam, all soil and foliar applications of metalaxyl were cancelled and only seed treatment allowed.

1.4 Environmental Fate Properties

The table below summarizes some of the environmental fate properties for both metalaxyl and mefenoxam.

Active Ingredient	Adsorption Coefficient (Koc in g/ml)	Half-Life (days)	Aqueous Solubility (mg/l or ppm)	Notes
Metalaxyl	162.3 (K_{foc})	42	7,100	Metalaxyl values derived from PPDB database.
Mefenoxam (Metalaxyl-M)	20 - 790	58.4	26,000	Mefenoxam values derived from 1996 Technical Review

According to the University of Hertfordshire Pesticide Product Database (PPDB at following link: http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/43.htm#none), metalaxyl has a groundwater ubiquity score of 2.91 and is considered to have a high to moderate leachability. Mefenoxam has a groundwater ubiquity score of 1.88 and is considered to have a low leaching potential. The table below summarizes the range in groundwater ubiquity scores along with the corresponding leaching potentials. The groundwater ubiquity score provides a general indication of the potential for leaching to occur. It is based on the properties of the chemical and does not factor in environmental conditions, the field application rate, application timing or product formulation.

Groundwater Ubiquity Score	Leaching Potential
<0.1	Extremely Low
0.1-1.0	Very Low
1.0-2.0	Low
2.0-3.0	Moderate
3.0-4.0	High
>4.0	Very High

The labels for products containing metalaxyl and mefenoxam both contain the EPA groundwater label advisory statement that is required for pesticide products that the EPA determined, based on environmental fate characteristics, may have a tendency to leach from the soil and contaminate underlying groundwater.

N-(2,6-dimethylphenyl)-N-(methoxyacetyl)alanine is a metalaxyl/mefenoxam breakdown product that forms as the parent degrades in a soil medium and also in an anaerobic aquatic environment. N-(2,6-dimethylphenyl)-N-(methoxyacetyl)alanine has a groundwater ubiquity score of 3.83 and is considered to have a high leachability.

1.5 Standards, Criteria, and Guidance

Federal and New York State water quality standards provide a quantitative basis for the implementation of the pollution prevention elements of the Long Island Pesticide Pollution Prevention Strategy (Strategy). These standards have been used all along as benchmarks in water quality monitoring to evaluate the level at which pesticide contamination has been detected and confirmed and are a factor in determining the type of response actions needed. These standards will continue to be used as the critical threshold calling for intervention and action under the Strategy.

Reference points outlined in the Strategy included standards and guidance values. A *standard* is a value that has been promulgated and placed into state or federal regulation. A *guidance value* may be used where a standard for a substance or group of substances has not been promulgated into regulation. Both standards and guidance values are expressed as the maximum allowable concentration in units of micrograms per liter (and parts per billion) unless otherwise indicated.

As summarized in the table below, there are two reference points for mefenoxam (metalaxyl). This includes the NYSDOH 10 NYCRR Part 5 drinking water standard for Unspecified Organic Contaminants ("UOCs") generic Maximum Contaminant Levels (MCLs)[1] and the USEPA Human Health Benchmark for metalaxyl. The USEPA Human Health Benchmarks are established to enable states to determine whether pesticide detections in drinking water or drinking water sources could be a potential health risk. The Human Health Benchmarks are for pesticides for which USEPA has not set a drinking water health advisory or set an enforceable drinking water standard.

Active Ingredient	USEPA SDWA MCL	NYSDOH 10 NYCRR Part 5 UOC MCL	NYSDEC NYCRR Part 703.5	NYSDEC DOW TOGS 1.1.1	USEPA Human Health Benchmark
Mefenoxam	NF	50	NF	NF	519

NF: Value not found in the references.

2.0 Active Ingredient Usage Information

2.1 Amount of Active Ingredient Reported Use in New York State

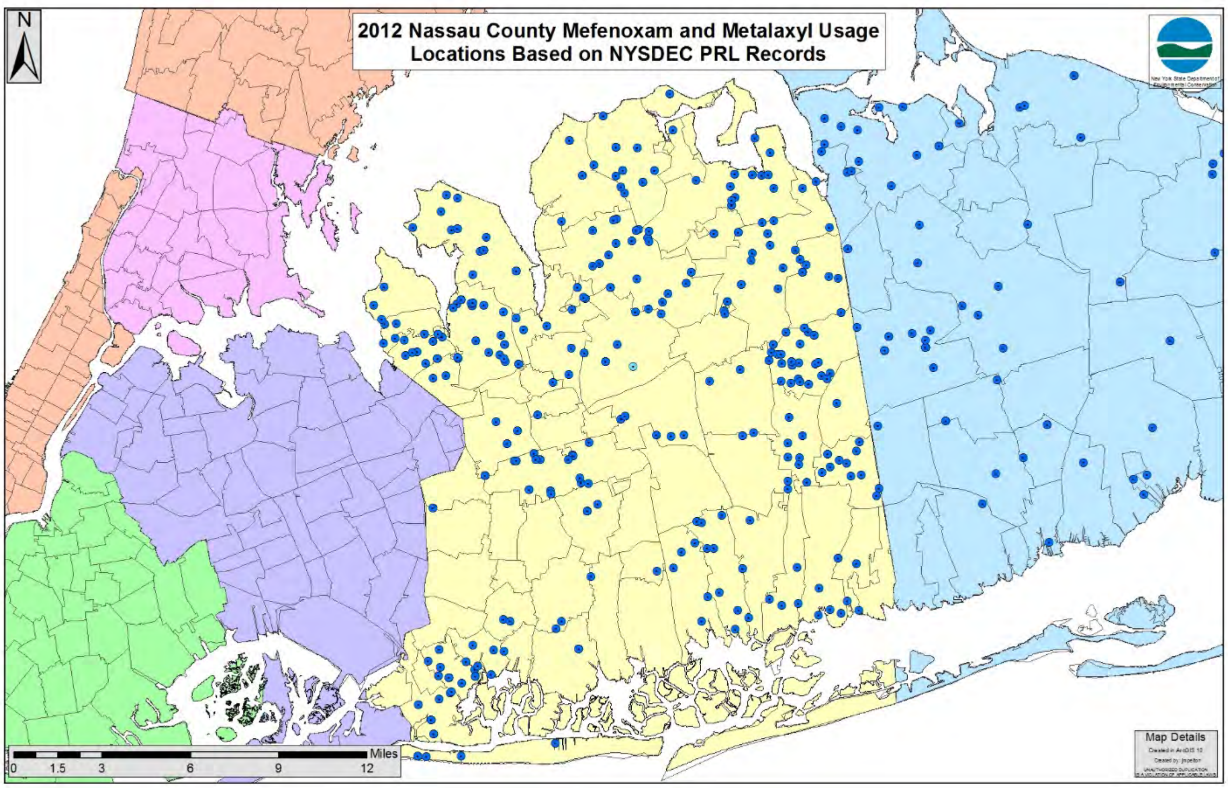
Based on ArcGIS Geocoding of the 2012 pesticide usage data recorded in the Pesticide Reporting Law Annual Data, there were 488 mefenoxam applications in Nassau County and 775 mefenoxam applications in Suffolk County. There was one reported metalaxyl application in central Nassau County and no reported metalaxyl applications in Suffolk County. The figures included below show the locations where mefenoxam was applied in Nassau and Suffolk Counties. As can be seen, mefenoxam applications appear to be uniformly distributed across Nassau County. In Suffolk County, the mefenoxam applications are concentrated in the western portion of the County along with the south and north fork areas. Overall, nearly half of the locations where mefenoxam was applied in Suffolk County occurred in the south fork area.

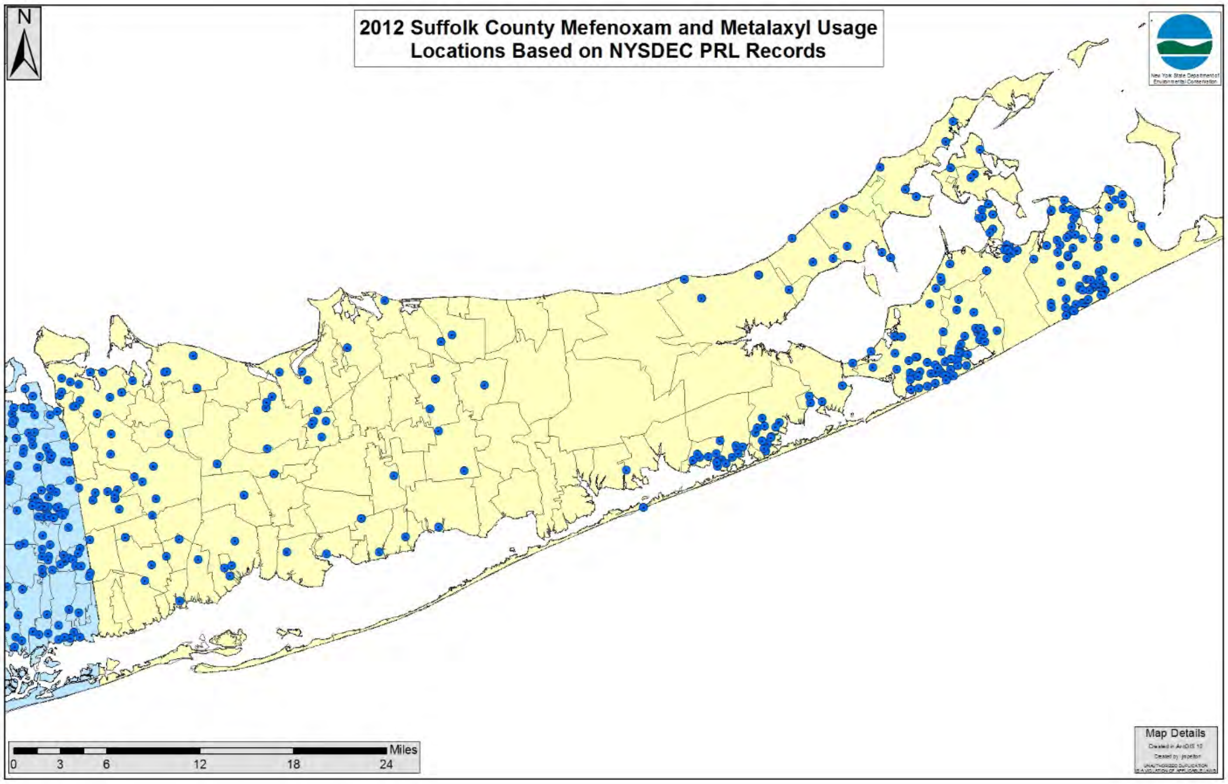
Attachment 4 of this Active Ingredient Data Package for Metalaxyl contains figures illustrating the metalaxyl usage data for 2003, 2006, 2009, and 2012. The table below also summarizes the total

[1] UOCs comprise any organic compound (including pesticides and their degradates) for which the POC designation does not apply, and for which a specific MCL has not been adopted. The UOC standard is 50 ppb for any individual substance in the class. There is also a standard of 100 ppb for "total POCs and UOCs." UOCs, which apply to public water supplies in New York State, are not directly adopted as ambient groundwater standards.

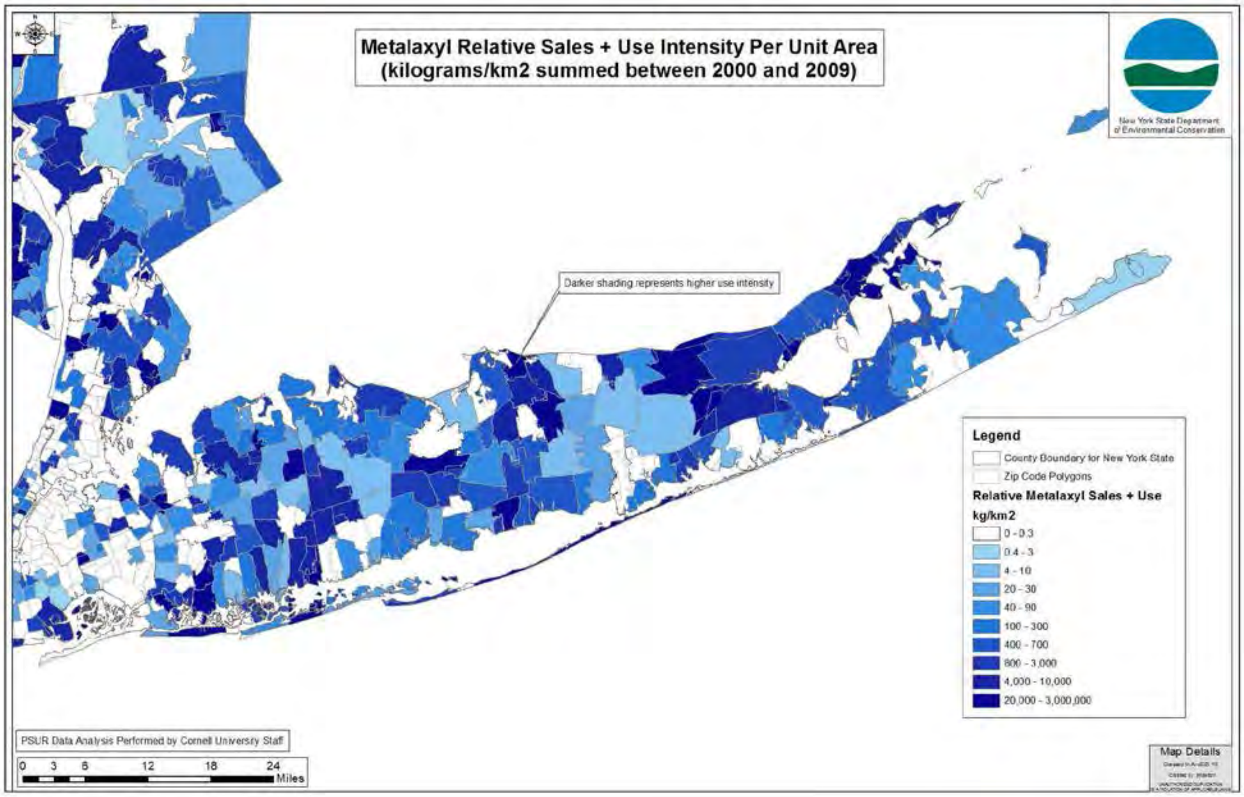
number of metalaxyl and mefenoxam applications that were reported in Nassau and Suffolk Counties in 2003, 2006, 2009, and 2012. As can be seen, the total number of metalaxyl applications has decreased over time while the frequency of mefenoxam applications has increased.

	Annual Number of Reported Applications			
Active Ingredient	**2003**	**2006**	**2009**	**2012**
Metalaxyl	69	14	22	1
Mefenoxam	710	968	1,023	1,288





To supplement the figures showing where the metalaxyl applications occurred for individual years, the following figure illustrates the relative metalaxyl sales plus use data obtained from the Pesticide Sales and Use Reporting (PSUR) Database for the ten year period between 2000 and 2009. The figure is an intensity map that combines reported uses and reported sales for individual zip codes in Nassau and Suffolk Counties. The sales plus use amounts are in kilograms per square kilometer. Darker shading represents a higher use intensity during this time period. No shading is used to indicate that no or very low sales or use data was reported for that zip code. The figure below shows fairly consistent use and sales occurring across the majority of Long Island between 2000 and 2009. Contiguously, the highest combined use and sales were reported in the north fork area however. Very few zip codes across Long Island had no reported sales and use of metalaxyl.



2.2 Overall Number and Type of Products Containing the Active Ingredient

The table below summarizes the registrants that have products containing the active ingredient metalaxyl and mefenoxam registered for use in New York State along with the total number of products for each registrant.

In NYS, there are six basic registrants with a total of 38 registered products that contain the active ingredient metalaxyl and three basic registrants with a total of 45 registered products containing the active ingredient mefenoxam. Some of the products are registered in NYS by supplemental distributors. All of the products allow for use on Long Island. As summarized above, pesticide products containing metalaxyl are only registered in NYS for use as a form of seed treatment.

Registrants with products Containing Metalaxyl (113501) and Mefenoxam (113502) as the Active Ingredient		EPA Company Number of Basic Registrant	Total Number of Products	Products Not Allowed for Use on Long Island	Long Island Use with Label Restriction	Total Number of Products Allowed for Use on Long Island
METALAXYL						
1	BASF CORPORATION	7969	2	0	0	2
2	BAYER CROPSCIENCE LP	264	18	0	0	18
3	LG LIFE SCIENCES LTD	71532	3	0	0	3

Registrants with products Containing Metalaxyl (113501) and Mefenoxam (113502) as the Active Ingredient		EPA Company Number of Basic Registrant	Total Number of Products	Products Not Allowed for Use on Long Island	Long Island Use with Label Restriction	Total Number of Products Allowed for Use on Long Island
4	LOVELAND PRODUCTS, INC.	34704	6	0	0	6
5	NUFARM AMERICAS, INC.	55146	8	0	0	8
6	VALENT U.S.A. CORPORATION	59639	1	0	0	1
		Total:	**38**	**0**	**0**	**38**
MEFENOXAM (METALAXYL-M)						
1	ADAMA	66222	1	0	0	1
2	NUFARM AMERICAS, INC.	55146	1	0	0	1
3	SYNGENTA CROP PROTECTION, LLC	100	43	0	1	43
		Total:	**45**	**0**	**1**	**45**

2.3 Critical Need of Active Ingredient to Meet the Pest Management Need of Agriculture, Industry, Residents, Agencies, and Institutions

Based on the amount of acreage on Long Island that is used for planting of vegetable crops, this represents the largest potential use of metalaxyl and mefenoxam. According to the Cornell Cooperative Extension of Suffolk County (CCE of SC) 2014 Pesticide Usage Report, mefenoxam is currently categorized as having a moderate use rating for mixed vegetables and is considered to have a limited use with cucurbits and potatoes.

Growers of turf and ornamentals in greenhouses and nurseries have also used metalaxyl and mefenoxam to protect crops against root and crown rot diseases in the past, and currently mefenoxam is used for control of both downy mildew (a foliage disease) and root and crown rot diseases. According to the CCE of SC 2014 Pesticide Usage Report, mefenoxam is currently categorized as having a common use rating at greenhouses and a limited use rating at nurseries. Mefenoxam use is considered rare for small fruit, sod, golf course, and turf applications. Even though mefenoxam continues to be used on grapes and at greenhouses, the overall usage has gone down for the period between 2000 and 2010.

To a limited extent, metalaxyl and mefenoxam have also been used for landscape purposes. Since metalaxyl is only allowed for use as a seed treatment, only mefenoxam products are currently registered for landscape use.

The estimated current mefenoxam use rating of moderate is lower than the major use rating for mefenoxam that is estimated during the 1990's. With metalaxyl only being allowed for use on Long Island as a form of seed treatment, it is categorized in the Cornell Cooperative Extension of

Suffolk County Pesticide Usage report as having a moderate use rating since the 2000's. Prior to this, during the 1980's and 1990's, metalaxyl was considered to have a major use rating on Long Island. Overall, the amount of metalaxyl/mefenoxam currently used on Long Island is considerably lower than the maximum amount allowed on product labels. This is because some diseases are not important enough to require treatment, resistance has developed, and there are other less expensive systemic fungicides available.

The following sections are based on the Cornell Cooperative Extension of Suffolk County Metalaxyl (Mefenoxam) 2012 profile and discuss the use of metalaxyl and mefenoxam on vegetable and fruit crops, floral and nursery crops, and turf crops.

Vegetable and Fruit Crops

As previously mentioned, metalaxyl is only registered in NYS for use with seed treatment. The majority of growers on Long Island are purchasing seed that has already been treated with metalaxyl rather than directly applying it to the seeds themselves. For their seed treatment products, Syngenta, one of the primary basic registrants for mefenoxam, provides most of their products containing mefenoxam only to certified seed treatment facilities. Seed treated with metalaxyl is used to control systemic downy mildew, *Pythium* seed rot, *Pythium* damping-off, and early season *Phytophthora* diseases of certain crops.

Although mefenoxam is registered in NYS for use on most vegetable crops, it is used predominantly on pepper, tomato, and potato crops. Mefenoxam continues to be one of the most important and effective fungicides to manage late blight in tomato and potato crops on Long Island. There are other targeted fungicides when applied foliarly can be used as a lower cost alternative to mefenoxam. Two of these alternatives include Ranman (cyazofamid active ingredient) and Revus (mandipropamid active ingredient) and are summarized in the table below.

There are mefenoxam formulations for soil applications and formulations for foliar applications. Due to its excellent systemic activity, uptake by roots results in good distribution of mefenoxam throughout the plant and thus good control. Potato crops are commonly treated with mefenoxam in-furrow at the time of planting for management of pink rot and *Pythium* leak. For the management of *Pythium* leak in potato crops, there are no alternatives to mefenoxam. The application of mefenoxam in-furrow represents a lower use pattern (quantity of mefenoxam used per acre of crop) than a foliar application. Up to two additional applications to foliage can be made at flowering and again two weeks later. The overall utility of mefenoxam for pink rot however, has been affected by the pathogen developing resistance.

Mefenoxam is also a component of the new FarMore™ Technology seed treatment which is being used on cucurbit seed to protect crops from damping-off and *Phytophthora* blight starting early in the season.

Phytophthora blight (crown rot phase) is the target disease for mefenoxam use in pepper crops on Long Island. Although this is a very destructive disease for pepper crops, pathogens have developed resistance making the use of mefenoxam less important for this crop. Some Cornell

University research suggests that half of the isolates of the *Phytophthora* blight pathogen on Long Island have become resistant to mefenoxam. The use of mefenoxam on peppers and other fruiting vegetables is also important for the management of Damping off disease caused by *Pythium*.

Occasionally there are critical needs for mefenoxam to manage late blight in tomato and potato crops on Long Island. Mefenoxam continues to be the most effective fungicide for sensitive strains of this very destructive disease. Some strains of the pathogen that have recently caused tomato crop losses throughout the eastern United States are sensitive to mefenoxam. Procedures have been developed to rapidly (24-48 hours) determine the sensitivity of the pathogen to mefenoxam from a diseased plant sample. One of the worst outbreaks of late blight on Long Island occurred in 2011 and affected tomato as well as potato crops. Impact on conventionally managed crops was minimized because the responsible strain of the pathogen (US-23) was determined to be sensitive to mefenoxam. This allowed growers to obtain control of the late blight outbreak with mefenoxam. Another major late blight outbreak that occurred in 2009 was also caused by a mefenoxam-sensitive pathogen strain (US-22). However, the sensitivity of this strain to mefenoxam was not identified quickly and growers were unable to utilize this information to adjust their fungicide programs. Damping off caused by *Pythium* and root and fruit rot caused by *Phytophthora* are two additional tomato crop diseases that require management on Long Island using mefenoxam.

Because of resistance buildup, the use of mefenoxam to control downy mildew in cucurbit crops has declined on Long Island.

Mefenoxam is registered for use on many fruit crops including apples, peaches, strawberries, brambles and grapes. It is primarily used to manage *Phytophthora* root rot and crown rot and downy mildew. Although infrequently used on Long Island for the control of these diseases, mefenoxam is particularly active on these diseases and is an important pesticide when the weather is ideal for the development of the fungus. For control of downy mildew in grape crops, no more than two applications of mefenoxam per season are recommended, for the purpose of resistance management. Although there are alternatives to control downy mildew on grapes, these alternatives tend to be less cost effective, but may provide rotational options. For strawberry crops, mefenoxam is an important fungicide to include as part of a management program for several diseases (Red stele, vascular collapse, and leather rot).

Floral and Nursery Crops

New York is the sixth largest producer of greenhouse flower crops in the nation, and at least half of these are produced on Long Island. All floral and nursery crops (particularly greenhouse crops of poinsettias and geraniums) are susceptible to root rots caused by *Pythium*, and many greenhouse and nursery crops (particularly rhododendrons, azaleas, boxwoods, pansies, chrysanthemums) are especially sensitive to stem rots and wilts due to *Phytophthora* species. The popular bedding plant impatiens has recently become susceptible to an invasive downy mildew disease. This disease has caused entire beds of impatiens to collapse across Long Island in late summer of 2011. Other important ornamentals that are also threatened by downy mildew diseases include roses, snapdragons, sunflowers, and coleus. Mefenoxam fungicides, in rotation with other active ingredients, are important in controlling the spread of this disease.

Metalaxyl was used by the ornamentals industry for drench applications (those made directly to the root zone) to nursery and greenhouse products until mefenoxam became available in 1996. Changes to the mefenoxam label in recent years have allowed the application of the material as a spray, which many growers prefer to a drench because of its easier application. Most ornamentals usage is either as a spray or a drench, in both nursery and greenhouse settings. Currently, there are no diseases of ornamental crops for which mefenoxam is the only active ingredient available for control. With mefenoxam's ability to effectively protect against very serious plant diseases, its unusually low application rate (0.125-1.25 oz./100 gal), its safety to plants, its long reapplication interval, and its low toxicity (to birds, fish, bees and mammals), mefenoxam is often the best choice for treatment. However, rotation of mefenoxam with other fungicides is important for managing pathogen resistance. Resistance to mefenoxam has been documented in *Pythium* diagnostic clinic isolates from Long Island greenhouses for decades, so growers are careful to rotate among active ingredients and not rely exclusively on mefenoxam. This is especially important for control of downy mildew on some crops because pathogens have the ability to quickly develop resistance to the frequent use of systemic fungicides.

Turf Crops

Mefenoxam is used on turf for control of *Pythium*. The product is used on many golf courses especially during the hottest time of the year when the turf is most susceptible to *Pythium*. Mefenoxam use is limited in sod production but is a very important management tool when *Pythium* periodically becomes a problem in sod. Mefenoxam is important as a turf seed coating and is commonly used in turf grass seed beds.

2.4 Availability of Alternatives

The following sections summarize possible options to maximize the use of mefenoxam with Long Island's vegetable, fruit, floral, nursery, and turf crops while reducing or eliminating the amount that enters the region's groundwater. Section 2.4.1 presents practices or modifications to the way mefenoxam is currently applied, Section 2.4.2 summarizes possible alternative or rotational fungicides that can also be used on Long Island, and Section 2.4.3 presents cultural practices that can be applied to these crops. These options, along with the advantages and disadvantages associated with each, are further summarized in the tables included as Attachment 5. There are three separate tables included in Attachment 5 that summarize possible practices that would apply to major Long Island fruit and vegetable commodities along with possible options for nursery, greenhouse, and turf commodities for both soil and foliar applications.

2.4.1 Active Ingredient Application Modifications

1) Rotation of mefenoxam with other fungicide products with different modes of action. This is a beneficial option for use on most crops where the target remains sensitive to mefenoxam

to reduce the overall amount being applied and to reduce the potential for resistance buildup. Because of mefenoxam's qualities (protective function, inexpensive, safety to plants and handlers, etc.) it tends to be heavily relied upon and even used out of habit. The use of other fungicides in rotation with mefenoxam may reduce this dependency on mefenoxam while at the same time minimizing resistance development.

2) Limiting the use of mefenoxam to a maximum of two applications per year or two per crop cycle will reduce the possibility of over application and the leaching of possible excess to the groundwater system.
3) Improved calibration of application equipment to minimize delivery of excessive fungicide.
4) Use of treated seed to minimize susceptibility to disease and to possibly reduce the need for mefenoxam applications.

2.4.2 *Pesticide Alternatives*

As summarized in the Cornell Cooperative Extension of Suffolk County metalaxyl profile (Attachment 6), other systemic, targeted fungicides in alternation with or possibly in place of mefenoxam can also be used on Long Island. Some of these are listed in the table below. Although some of these products are effective and labeled for late blight in tomato and potato crops they tend to be generally less effective than mefenoxam. The table includes a column summarizing groundwater ubiquity scores (GUS) for each of the active ingredients. With the exception of two active ingredients (fluopicolide and dimethomorph), the possible alternative/rotational fungicides have groundwater ubiquity scores that are at or below the GUS for mefenoxam (approximately 1.88).

Pesticide Product Trade Name	Active Ingredient	Restricted Use Pesticide	Primary Long Island Diseases Managed	Groundwater Ubiquity Score (GUS)	Alternative Uses
Banol Fungicide, Previcur Flex Fungicide, Stellar Fungicide	Propamocarb hydrochloride	Some products are restricted	*Pythium*	1.84 (low leaching potential)	Vegetable and Fruit Crops
Ranman Fungicide, Segway Fungicide	Cyazofamid	Segway products are restricted	*Pythium*, *Phytophthora*, & Downy Mildew	0.87 (very low leachability)	Vegetable and Fruit Crops, Floral, Nursery, and Turf Crops
Adorn Fungicide, Presidio Fungicide, Stellar Fungicide	Fluopicolide	Yes	*Pythium*, *Phytophthora*, & Downy Mildew	3.63 (high leachability)	Vegetable and Fruit Crops, Floral, Nursery, and Turf Crops
Revus Fungicide, Micora Fungicide	Mandipropamid	No	Downy Mildew & *Phytophthora*	1.81 (low leaching potential)	Vegetable and Fruit Crops
Forum Fungicide, Stature SC Fungicide	Dimethomorph	No	Downy Mildew & *Phytophthora*	2.56 (moderate leaching potential)	Vegetable and Fruit Crops, Floral, Nursery, and Turf Crops
Ariston, Curzate, DuPont Tanos	Cymoxanil	No	Downy Mildew & *Phytophthora*	-0.37 (extremely	Vegetable and Fruit Crops

Pesticide Product Trade Name	Active Ingredient	Restricted Use Pesticide	Primary Long Island Diseases Managed	Groundwater Ubiquity Score (GUS)	Alternative Uses
				low leachability)	
Several products (some examples include K-Phite and Magellan)	Phosphite Fungicides	Some are restricted	*Pythium*, *Phytophthora*, & Downy Mildew	Several types of phosphite products	Vegetable and Fruit Crops, Floral, Nursery, and Turf Crops
Several products (some examples include Abound and Heritage)	Strobilurins (e.g. azoxystrobin, pyraclostrobin, etc.)	No	*Pythium*, *Phytophthora*, & Downy Mildew	Varies	Grapes, Floral, Nursery, and Turf Crops
Captan	Captan	No	Downy Mildew	-0.16 (low leachability)	Grapes
Gavel Fungicide, Dithane Fungicide, Elixir Fungicide	Mancozeb	Some are restricted	Downy Mildew	-1 (extremely low leachability)	Grapes
Gavel Fungicide, Zoxium Fungicide	Mancozeb and Zoxamide	Yes	*Phytophthora* & Downy Mildew	-1 (extremely low leachability) and 1.62 (low leachability) respectively	Grapes
Aliette	Fosetyl-Aluminum	No	*Phytophthora* & Downy Mildew	-2.7 (extremely low leachability)	Floral, Nursery, and Turf Crops
Pristine	Pyraclostrobin and Boscalid	No	Downy Mildew	-1 (extremely low leachability) and 1.62 (low leachability) respectively	Grapes, Cucurbits
Banrot, Terrazole, Truban	Etridiazole	Some are restricted	*Pythium* & *Phytophthora*	2.0 (low to moderate leachability)	Floral, Nursery, and Turf Crops

2.4.3 Non-Pesticide Alternatives

In addition to some of the pesticide alternatives summarized above, there are non-pesticide alternatives/practices that can be considered to reduce the overall use of fungicides. Some of these non-pesticide options are summarized below and will also be discussed in Section 5 (Summary of Possible Pollution Prevention Measures) and part of the Attachment 5 matrix.

1) Disinfection practices are important to avoid introducing or spreading of diseases. This includes the removal of plant debris and weeds and the sanitizing of surfaces, containers, and equipment.
2) The use of well drained growing media reduces excess water in the root zone of plants and reduces potential for disease development.

3) In particular for the foliar application of mefenoxam on fruit and vegetable crops, encourage or require use of forecasting models for timing of scouting and management applications.
4) The control, or partial control, of various diseases can be accomplished through the rotation of crops. This disease management practice is typically improved with the use of longer rotational periods. Crop rotation is most commonly applied to vegetable and fruit commodities for the management of soil borne pathogens.
5) The use of resistant plants and cultivars are less susceptible to disease and have the potential to perform with the input of less fungicide.
6) The use of certified, disease-free seed will increase likelihood of higher quality and higher yielding crops with the use of less fungicide. The use of certified seed is of particular importance with potato crops for the control of *Pythium* Leak.
7) Raised beds can be used to avoid poor drainage that may lead to disease development and the need for fungicide treatment. On Long Island, raised beds are most likely to be used for pepper and strawberry crops and in greenhouse and nursery commodities.
8) Avoiding planting in low lying and poorly drained areas minimizes standing water conditions that are likely to lead to root disease.
9) Biological techniques/biocontrols as a form of disease management tend to be the most effective when combined with other management practices. Biocontrols include fungi, bacterium, and viruses and are considered to be less harmful to the environment and applicators.
10) Improve overall health of soil to promote healthy crops and reduce dependency on fungicides. Improving soil health generally includes incorporating a combination of cultivation practices, cash and cover crop rotations, and increasing soil organic matter into disease management practices.
11) Crop management practices including the pruning of crops combined with the proper disposal of vegetation are important in maintaining healthy plants along with removing pathogens and preventing the spread of disease.
12) Practices that provide or enhance air circulation and allow for direct sunlight are important for the drying of crops following irrigation or rain and for minimizing potential for disease development.
13) Improvements to irrigation practices can be applied to reduce the potential for metalaxyl/mefenoxam to leach from the soil column while also influencing conditions that reduce the development and spread of pathogens. Irrigation scheduling should take into consideration application timing (i.e. prior to application and/or immediately after application to soil) as well as crop demand, soil moisture, soil water holding capacity, and forecast weather conditions. Evaluation of the actual irrigation system including emitter type, application efficiency and spacing, as well as evaluation of the system type (drip, sprinkler, or overhead) can increase application efficiency, reduce the risk of off-site movement, and influence conditions that lead to pathogen development. For instance, the use of drip irrigation may limit the spread of pathogens within a field. In certain applications, moisture meters can be used to measure soil water content and determine when irrigation is needed.

2.5 Possible Outcomes Associated with Use Restrictions

As summarized in the Cornell Cooperative Extension of Suffolk County metalaxyl profile (Attachment 6), mefenoxam is an important active ingredient for disease management of several crops on Long Island. This includes potatoes, tomatoes, peppers, floral, nursery, and turf crops. Currently there is no alternative for the control of *Pythium* leak in potato crops and there are no ornamental diseases that can only be controlled by mefenoxam.

Mefenoxam continues to be the most effective fungicide for sensitive pathogen strains. During periods of high disease pressure there is a possibility of negative economic impact if mefenoxam is not available, as there might be crop loss from ineffective control with other fungicides. The lack of mefenoxam as a rotational product for managing resistance development to other fungicides is also a concern and the loss of their efficacy due to resistance will increase the need for mefenoxam.

For vegetables, a major impact would be the loss of the most effective tool for controlling late blight caused by mefenoxam-sensitive pathogens strains in tomato and potato crops. Without mefenoxam, management of late blight would not be as effective and there would be corresponding economic losses.

Although *Phytophthora* blight is also a very destructive disease for pepper growers, pathogens have developed resistance making the use of mefenoxam less important for this crop. The overall extent of resistance on Long Island is not currently known however, so there does continue to be some use of mefenoxam with pepper crops.

In addition to late blight, mefenoxam is also important for the management of *Pythium* leak and pink rot when growing potatoes. The only other products labeled for *Pythium* leak are the phosphoric acid fungicides which provide only suppression and are therefore recommended for mixture with mefenoxam and not as an alternative.

For fruit crops, the loss of mefenoxam would significantly reduce the ability of growers to manage *Phytophthora* root rot (red stele) in strawberries and downy mildew in grapes.

In floral, nursery, and sod crops, loss of mefenoxam would remove an effective fungicide from the rotational programs for control of *Pythium* root rots, *Phytophthora* stem cankers and downy mildew diseases, thus increasing the potential for resistance development in the target pathogens. Over a typical three-month period, several additional applications of alternative materials for *Phytophthora* control would be made, as mefenoxam has a one- to three-month retreatment interval whereas other materials are applied on a 14 or 28 day interval. Use of etridiazole and cyazofamid for *Pythium* control would increase. Production costs would increase for many floral, nursery and sod crops.

2.6 Exposure Potential and Human Health Risk

Exposure to metalaxyl/mefenoxam can occur through diet (crop residues from use in NYS and other areas and drinking water) or occupational use. There are no homeowner use products containing these chemicals registered for use in the state and direct exposure of homeowners to metalaxyl/mefenoxam is not expected.

As previously mentioned, mefenoxam is a refined form of metalaxyl and the U.S. EPA considered them toxicologically equivalent. Metalaxyl/mefenoxam are of low acute toxicity via oral, dermal and inhalation routes of exposure and are not dermal irritants or sensitizers, but are moderate eye irritants. These chemicals did not cause any developmental or reproductive toxicity in laboratory animal studies, but did cause an increase in liver weight (relative to body weight) in chronic feeding studies in laboratory animals. In addition, the U.S. EPA classified metalaxyl/mefenoxam as a Group E–evidence of non-carcinogenicity for humans, based on the available toxicity database.

The U.S. EPA concluded that, based on available data, the chronic dietary risk is minimal from all metalaxyl/mefenoxam uses. In addition, the U.S. EPA did not identify any toxicological endpoints of concern for workers and determined that mixer/loader/applicator and post-application/reentry data are not required to support the reregistration of metalaxyl. Consequently, occupational risk assessments were not conducted by the U.S. EPA for this chemical.

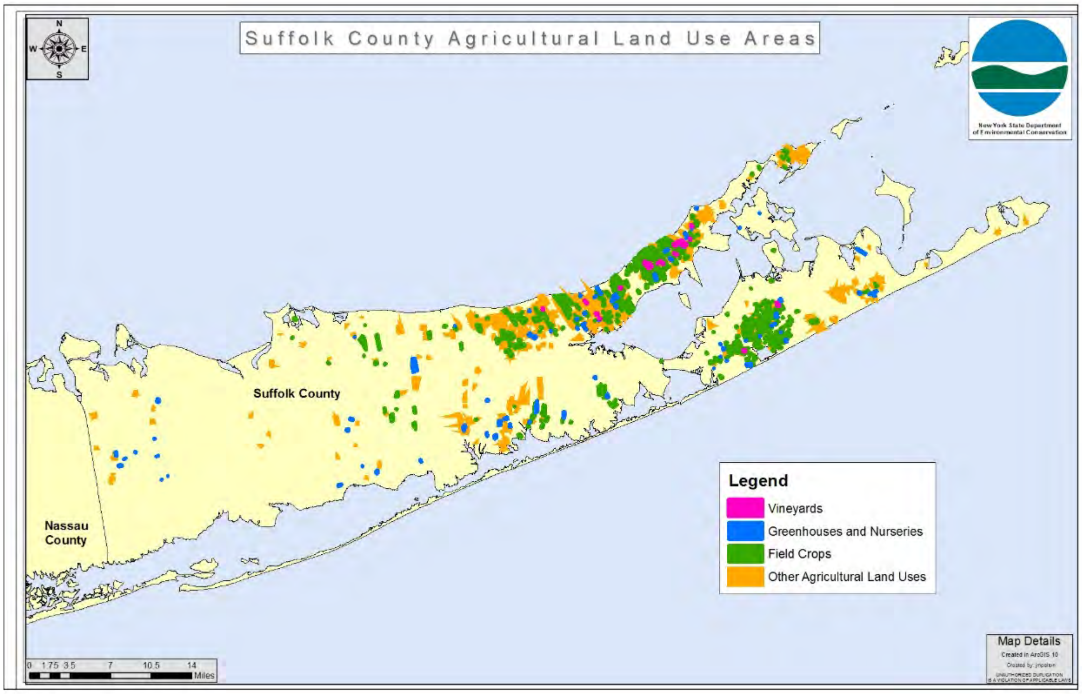
3.0 Land Use Information

The following figures illustrate some of the major agricultural-type land uses that occur in Suffolk County along with figures illustrating the locations and approximate areas of golf courses in both Suffolk and Nassau Counties. Since Nassau County is primarily developed for residential land use (approximately 60%) with a small fraction of agricultural land use, a figure showing Nassau County agricultural uses has not been prepared. The most recent census by the U.S. Department of Agriculture indicates that Nassau County contained approximately 2,682 acres of farmland and 55 farms (23 of which were equine farms) in 2012.

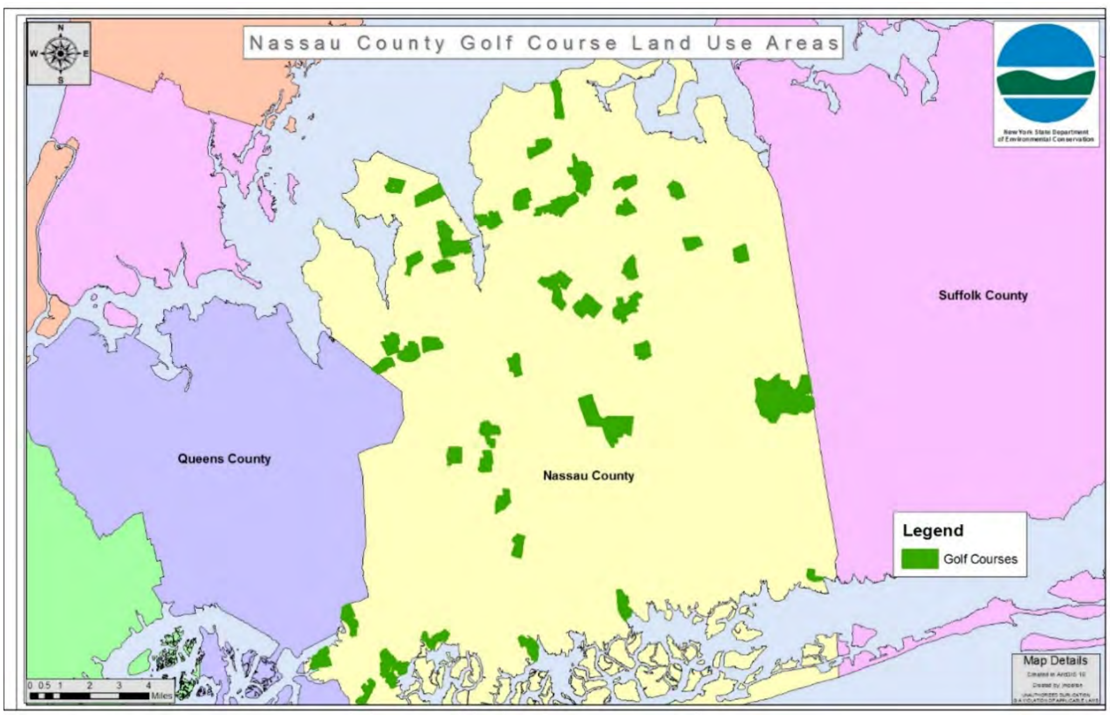
Although the western portion of Suffolk County is primarily used for residential purposes, there are a large number of farms and vineyards to the east and on both the north and south forks of Long Island. This can be seen in the figure below where shading has been used to illustrate the locations and areas of vineyards, greenhouses and nurseries, field crops, and other agricultural land uses in Suffolk County. The land use information is based on the Suffolk County Real Property Tax Service Agency published in August 2014.

According to the most recent census by the U.S. Department of agriculture, Suffolk County contained 35,975 acres of farmland and 604 farms in 2012. Of those numbers, 2,193 acres and 70 farms were dedicated for grape growing; 2,781 acres and 7 farms were dedicated for sod production; 2,605 acres and 72 farms were dedicated for potato growing; and 1,075 acres and 48 farms were dedicated for sweet corn. As can be seen on the figure below, most vineyards are located on the North Fork. Greenhouses and nurseries do not appear to be concentrated in any specific area, but instead are located throughout Suffolk County.

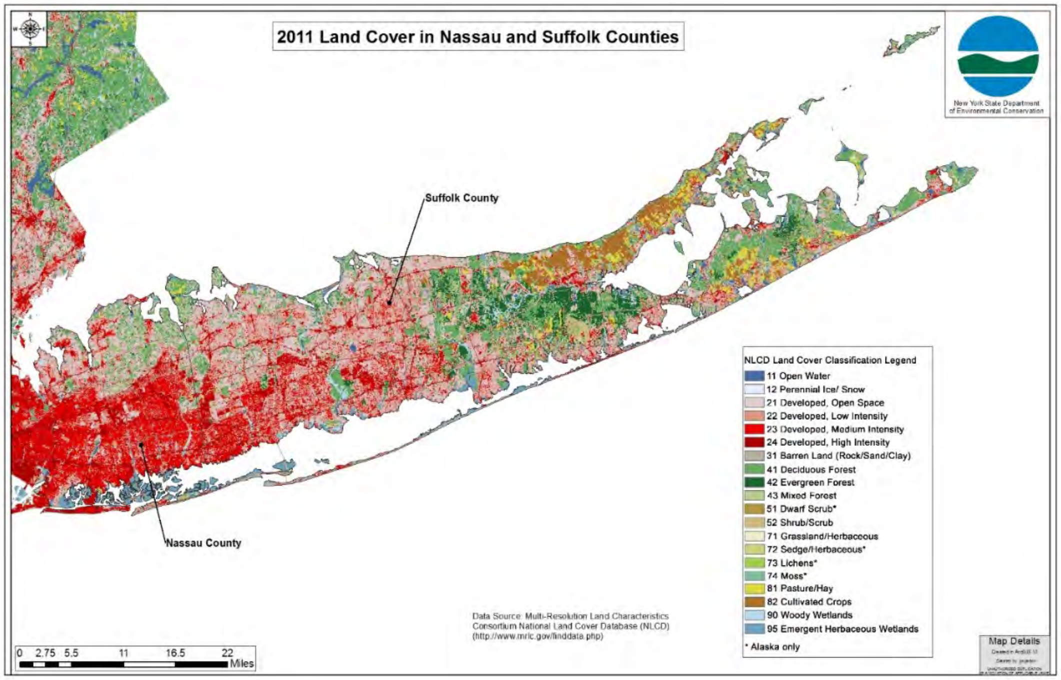
To illustrate the importance of agriculture to the Long Island community, in New York State, Long Island is the top region for the sale of nursery, greenhouse, floriculture and sod products. Suffolk County in particular is also New York's largest pumpkin, tomato and cauliflower producer.



In addition to agricultural type land uses, there is also a large amount of land use on Long Island dedicated to golf courses. The figures below show the locations of golf courses (green shading) in Suffolk County and Nassau County. In total, there are 145 public and private golf courses on Long Island. In Nassau County, approximately 8,321 acres are used for golf course purposes and in Suffolk County, approximately 9,563 acres are used for golf course purposes



The 2011 land cover for both Nassau and Suffolk Counties is shown in the figure below. This is based on the National Land Cover Database and includes 16 land class covers based on Landsat satellite data. The majority of Nassau County and into western Suffolk County contains medium to high intensity development (red hues). Similar to the 2014 Suffolk County land use data shown above, the development intensity decreases eastward in Suffolk County while the amount of agricultural land use (cultivated crops and pasture/hay) increases. The 2011 land cover shows that a higher amount of agricultural land use occurs on the north fork than on the south fork.



4.0 Active Ingredient Analytical Results Summary

4.1 Groundwater Sample Collection History

Groundwater samples are collected annually by Suffolk County Department of Health Services staff from a combination of groundwater monitoring wells, private water supply wells, community water supply wells, and non-community water supply wells. Following collection, samples are submitted to the Suffolk County Public and Environmental Health Laboratory for the analysis of nearly 300 parameters. Most of the groundwater data included as part of this data package was collected between 1997 and 2013.

The table below provides an annual summary of the metalaxyl groundwater sampling data. The table is formatted to summarize groundwater samples collected from the monitoring wells, private wells, and public water supply wells (community and non-community) separately. For each category, the total number of individual locations where metalaxyl was detected relative to the total number of samples collected and analyzed for metalaxyl is provided, along with the annual minimum and maximum concentrations with a comparison to the NYSDOH Maximum Contaminant Level (MCL). The data summarized in the table below is also illustrated graphically as Attachment 7 of the data package. It is important to note that the laboratory analysis does not differentiate between metalaxyl and mefenoxam. As such, all of the laboratory analytical results are reported as metalaxyl and represent a total amount of metalaxyl and/or mefenoxam.

As summarized in the table below, metalaxyl was not detected in groundwater samples at a concentration exceeding the NYSDOH MCL (50 ppb) during the period between 1997 and 2013. Metalaxyl was detected at a maximum concentration of 10.9 ppb in 2007 from a non-community water supply well located in the Town of Laurel. The next highest metalaxyl detection (8.4 ppb) occurred in 2006 in a groundwater sample collected from a monitoring well specifically installed to assess groundwater quality near a greenhouse. Review of more recently collected groundwater data (2011, 2012, and 2013) indicate that metalaxyl was detected at a maximum concentration of 3.2 ppb from a groundwater sample collected from a monitoring well installed in the area of Baiting Hollow. The remaining maximum metalaxyl concentrations in groundwater samples collected from monitoring wells, private wells, and public water supply wells (community and non-community) during 2011, 2012, and 2013 were all below 3 ppb.

The graphical illustrations of the metalaxyl groundwater data includes 25th and 75th percentiles along with averages and minimum and maximum concentrations. For all but five of the years and for all three types of groundwater samples, the 75th percentile is below one ppb. That is, 75 percent of all metalaxyl groundwater detections are below one ppb. The five years with the 75th percentile greater than one ppb were from 2009 and earlier (1998, 2005, 2007, and 2009 (monitoring well and private well groundwater samples)).

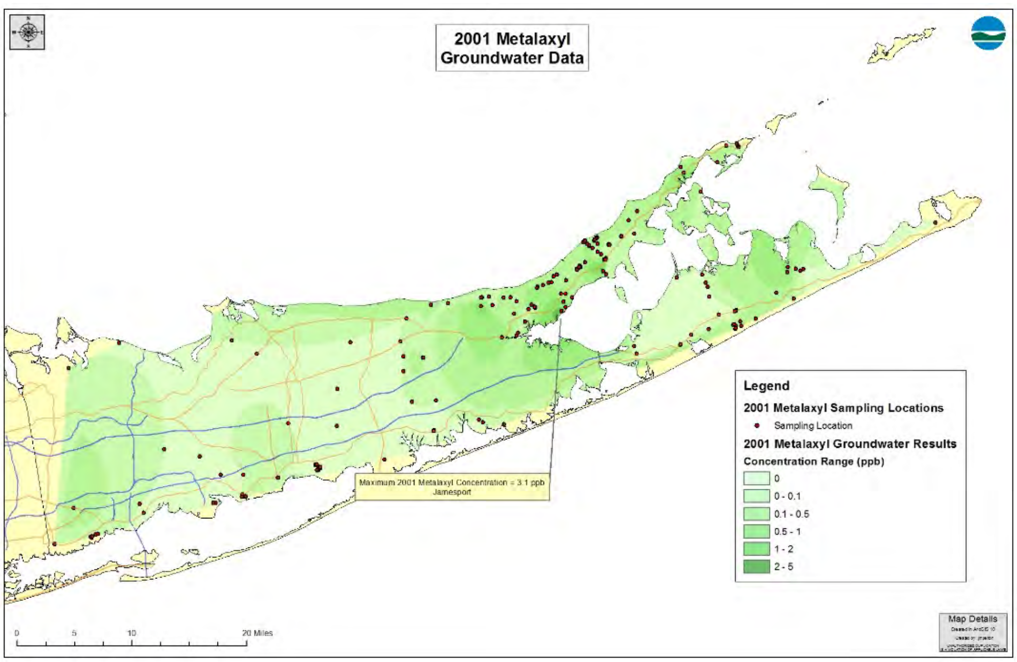
Year	Total Number of Locations with Detections	Total Number of Samples	Percent Detected	Minimum Concentration Detected (ppb)	Maximum Concentration Detected (ppb)	MCL (ppb)	Frequency Exceeding MCL
Groundwater Monitoring and Profile Well Samples							
2001	18	442	4.1%	0.10	3.10	50	0 of 442
2002	22	315	6.9%	0.10	4.55	50	0 of 315
2003	19	243	7.8%	0.10	2.82	50	0 of 243
2004	17	473	3.6%	0.10	1.80	50	0 of 473
2005	31	462	6.7%	0.10	2.70	50	0 of 462
2006	49	592	8.3%	0.10	8.40	50	0 of 592
2007	28	521	5.4%	0.10	3.40	50	0 of 521
2008	59	590	10.0%	0.10	3.40	50	0 of 590
2009	54	506	10.7%	0.10	2.80	50	0 of 506
2010	7	303	2.3%	0.10	1.1	50	0 of 303
2011	10	259	3.9%	0.30	1.50	50	0 of 259
2012	17	502	3.4%	0.25	3.10	50	0 of 502
2013	23	356	6.5%	0.30	3.20	50	0 of 356
Private Well Samples							
1997	2	158	1.3%	0.14	0.38	50	0 of 158

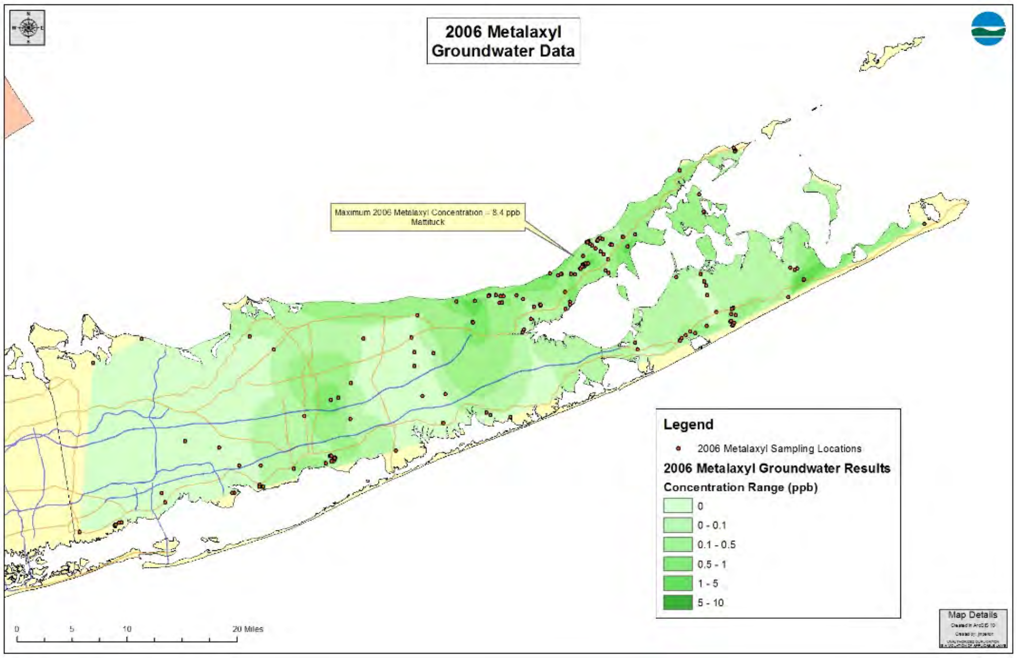
Year	Total Number of Locations with Detections	Total Number of Samples	Percent Detected	Minimum Concentration Detected (ppb)	Maximum Concentration Detected (ppb)	MCL (ppb)	Frequency Exceeding MCL
1998	19	481	3.9%	0.20	3.10	50	0 of 481
1999	20	576	3.5%	0.17	2.60	50	0 of 576
2000	37	712	5.2%	0.20	1.60	50	0 of 712
2001	26	683	3.8%	0.20	2.15	50	0 of 683
2002	25	553	4.5%	0.20	1.82	50	0 of 553
2003	24	589	4.1%	0.20	0.98	50	0 of 589
2004	13	427	3.0%	0.18	3.10	50	0 of 427
2005	14	422	3.3%	0.11	4.30	50	0 of 422
2006	19	575	3.3%	0.20	3.30	50	0 of 575
2007	23	502	4.6%	0.10	4.90	50	0 of 502
2008	33	551	6.0%	0.10	1.90	50	0 of 551
2009	26	527	4.9%	0.10	3.70	50	0 of 527
2010	18	506	3.6%	0.16	2.70	50	0 of 506
2011	20	406	4.9%	0.20	2.20	50	0 of 406
2012	11	237	4.6%	0.20	1.10	50	0 of 237
2013	15	349	2.2%	0.20	2.00	50	0 of 349
Public and Non-Community Water Supply Wells							
1997	1	10	10%	1.2	1.2	50	0 of 10
1998	4	324	1.2%	0.2	0.77	50	0 of 324
1999	4	271	1.5%	0.26	0.8	50	0 of 271
2000	3	269	1.1%	0.2	0.49	50	0 of 269
2001	5	313	1.6%	0.35	1.44	50	0 of 313
2002	11	538	2.0%	0.23	1.95	50	0 of 538
2003	5	705	0.7%	0.26	3.75	50	0 of 705
2004	11	585	1.9%	0.26	2.3	50	0 of 585
2005	10	528	1.9%	0.2	3.4	50	0 of 528
2006	8	551	1.5%	0.3	1.2	50	0 of 551
2007	6	382	1.6%	0.10	10.9	50	0 of 382
2008	38	986	3.9%	0.10	6.40	50	0 of 986
2009	27	927	2.9%	0.10	4.2	50	0 of 927
2010	23	1,015	2.3%	0.20	3.3	50	0 of 1,015
2011	13	976	1.3%	0.20	2.00	50	0 of 976
2012	7	801	0.6%	0.20	2.70	50	0 of 801
2013	11	1,001	1.1%	0.20	2.2	50	0 of 1,001

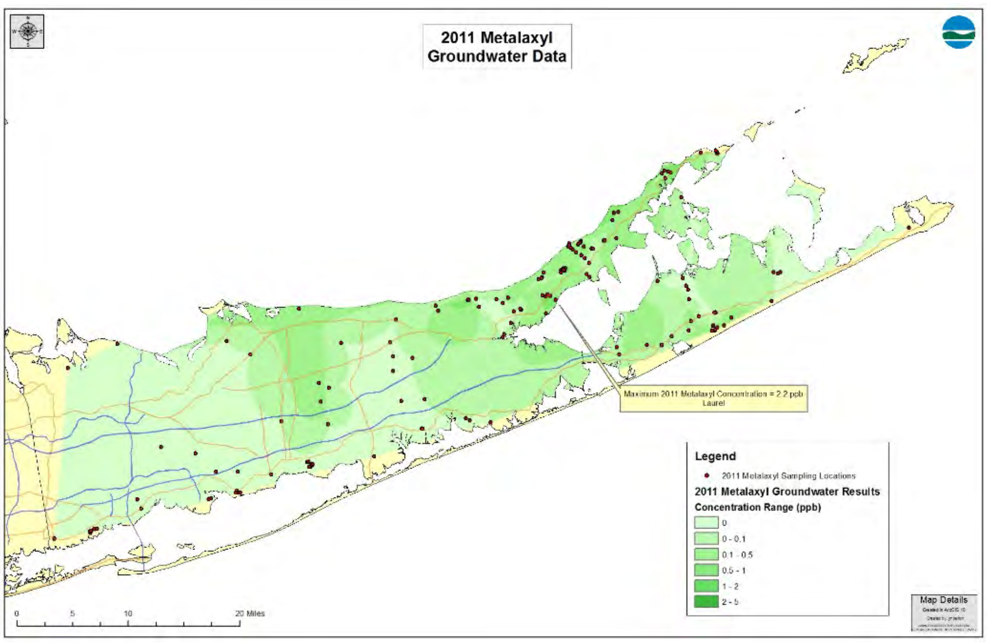
4.2 Groundwater analytical results summary

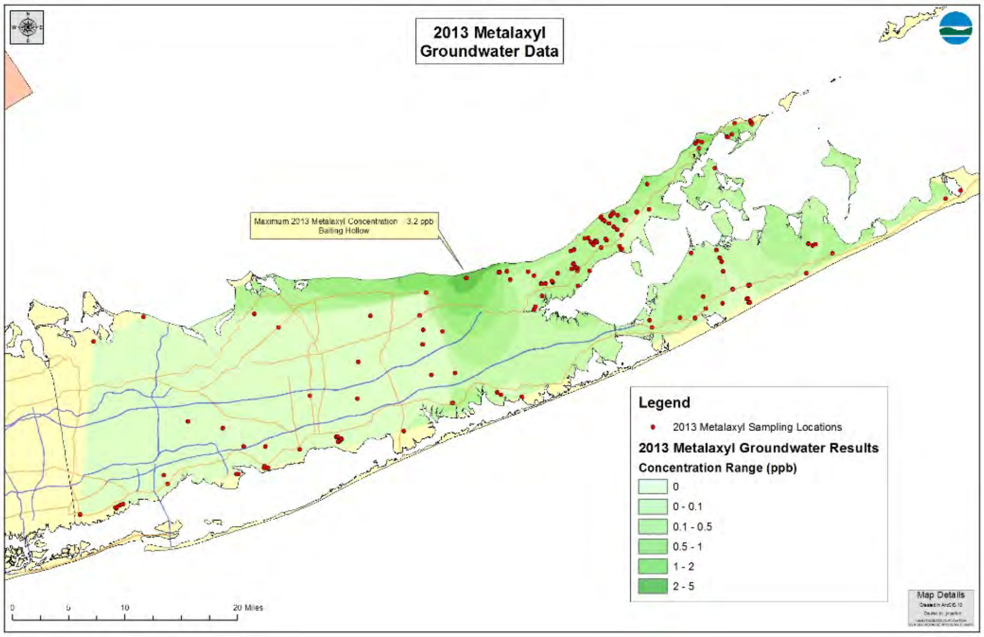
The following four figures were prepared to illustrate the spatial distribution of metalaxyl in Suffolk County groundwater based on 2001, 2006, 2011, and 2013 data. The figures were prepared using groundwater data collected by Suffolk County from a combination of groundwater monitoring wells, private wells, and public wells (community and non-community). The ArcGIS natural neighbor spatial analyst tool was used to complete each of the interpolations. For each figure, an annotation has been added to indicate the area where the highest metalaxyl groundwater concentration occurred.

As summarized in Section 4.1 (Groundwater Sample Collection History) and as shown on the figures, metalaxyl was not detected at a concentration exceeding the NYSDOH MCL (50 ppb). The highest metalaxyl groundwater concentrations consistently occurred in the north fork area and slightly to the west. Review of the 2001, 2003, 2011, and 2013 metalaxyl groundwater figures generally shows a decrease in detections and concentrations along the western portion of Suffolk County with time.

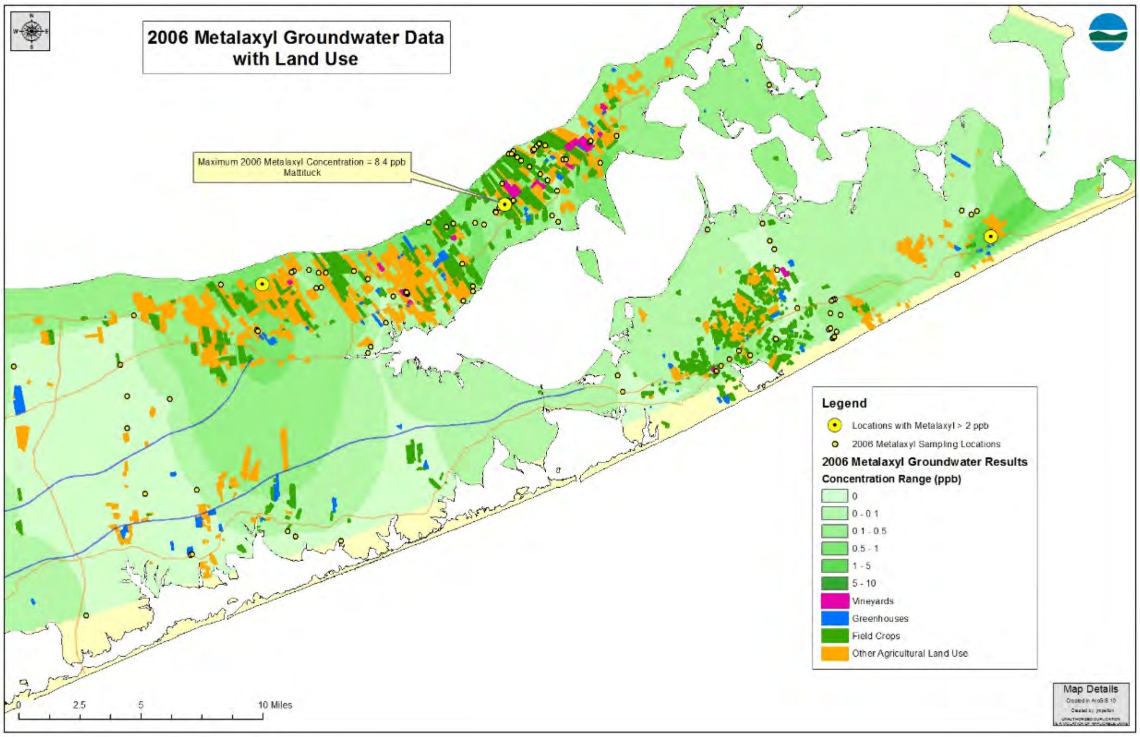



2006 Metalaxyl
Groundwater Data
Maximum 2006 Metalaxyl Concentration = 8.4 ppb
Mattituck
Legend
2006 Metalaxyl Sampling Locations
2006 Metalaxyl Groundwater Results
Concentration Range (ppb)
0
0 - 0.1
0.1 - 0.5
0.5 - 1
1 - 5
5 - 10
0
5
10
20 Miles
Map Details

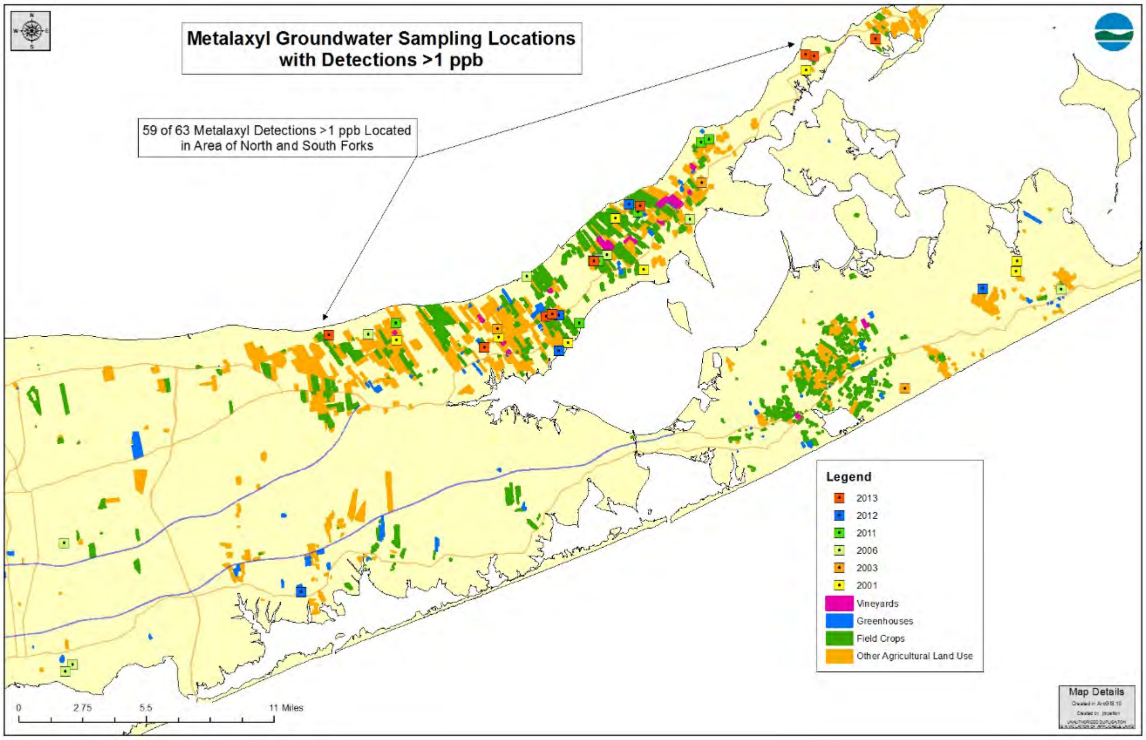

2011 Metalaxyl
Groundwater Data
Maximum 2011 Metalaxyl Concentration = 2.2 ppb
Laurel
Legend
2011 Metalaxyl Sampling Locations
2011 Metalaxyl Groundwater Results
Concentration Range (ppb)
0
0 - 0.1
0.1 - 0.5
0.5 - 1
1 - 2
2 - 5
0
5
10
20 Miles
Map Details



The figure below shows the eastern half of Suffolk County along with the 2006 metalaxyl groundwater data combined with the surrounding agricultural land uses. In 2006, there were five metalaxyl groundwater detections from three locations that were greater than 2 parts per billion (ppb). The three locations are shown on the figure below with slightly larger yellow-filled symbols. The two locations where metalaxyl was detected at a concentration greater than 2 ppb in the north fork area were established as part of groundwater assessments near greenhouse land uses and generally within areas where surrounding land use is for agricultural purposes. The third area along the east-end of the south fork is located near agricultural land use.



Metalaxyl was detected 63 times in groundwater samples collected during the six years (2001, 2003, 2006, 2011, 2012, and 2013) shown in the figure below at a concentration exceeding 1 ppb. Fifty-nine of the detections greater than 1 ppb occurred in the area of the north and south forks where the density of agricultural land use is the highest. In particular, 52 of the 59 of the north and south forks detections occurred in the area of the north fork where the agricultural land use is more widespread and dense. Of the four detections greater than 1 ppb outside of the area of the north and south forks, three of the detections occurred in areas where groundwater investigations have occurred as result of inappropriate applications or where mis-use of the pesticides occurred.



5.0 Summary of Possible Pollution Prevention Measures

As discussed in Section 2.4 (Availability of Alternatives) and summarized in the metalaxyl/mefenoxam alternative tables included as Attachment 5, there are several possible pollution prevention measures/best management practices that can be applied to improve the overall use of metalaxyl/mefenoxam. When applied, these practices have the potential to significantly reduce or eliminate the movement of mefenoxam into groundwater while continuing to allow use of this product on Long Island to meet pest management needs. With a reduction in the amount of metalaxyl needed to control diseases due to the development and availability of mefenoxam in 1996 along with an overall decrease in mefenoxam use for resistance management purposes, emphasis is placed on possible pollution prevention measures for mefenoxam use as a fungicide. The reduced frequency of metalaxyl detections in groundwater combined with less metalaxyl usage support the use of best management practices and/or pollution prevention measures as an approach to address groundwater concerns. The success in reducing and/or eliminating the leaching of metalaxyl/mefenoxam to the groundwater system will not necessarily occur with adoption of an individual practice, but instead will be realized through a combination of the practices identified for this fungicide and implemented as part of an overall disease management program.

As a highly effective pesticide for the control of several important pathogens, mefenoxam is used with many commodities grown on Long Island. Most importantly, mefenoxam is used as a fungicide for the production of vegetable and fruit crops including potatoes, tomatoes, peppers, mixed vegetables, brassicas, cucurbits, grapes, strawberries, apples, stone fruit, and hops. Mefenoxam is also important for controlling disease in ornamental crops grown in both greenhouses and nurseries and for the control of pathogens present in turf and landscaped areas. Mefenoxam can be applied to soil, as a foliar spray, and as a form of seed treatment.

Despite this diversity in mefenoxam use, there are a combination of common practices that can be applied along with commodity-specific practices that can be employed to improve mefenoxam use. Many of the best management practices/pollution prevention measures that have been identified are not only important in eliminating or reducing the potential for this active ingredient to impact groundwater quality, but are also important in maintaining mefenoxam's efficacy.

As summarized below, possible best management practices/pollution prevention measures have been organized into the following three categories. The first category involves practices that can be considered to prevent disease from entering, developing, and spreading within the crop. The second category includes practices to monitor for disease and if present, determine the appropriate management decisions that should be made. Lastly, the third category summarizes practices or modifications to the way mefenoxam is currently applied to make these applications more effective.

Minimizing Conditions Leading to Disease Development

Minimizing conditions that may lead to disease development includes practices to avoid the introduction of pathogens into the crop system along with measures to prevent development and spread of diseases. Although mostly for some of the vegetable and fruit crops, the use of certified, disease free seed and disease free plants can be used to minimize the potential for introducing pathogens to the crop. Both seed and plants should only be acquired from reputable vendors. Sanitation practices in general, are also important in not only preventing the spread of pathogens, but possibly in their elimination. This is particularly important in greenhouse settings where disinfectants should be used to treat surfaces, tools, trays, benches, and containers, etc. and in vegetable and fruit crops where machinery and equipment should be cleaned prior to movement from one field to another.

Improved management of irrigation water, avoiding planting in low lying/poorly drained areas, use of raised beds, and the use of well drained growing media are all approaches to reduce or eliminate soil conditions that favor pathogen development. Not only does an excessive amount of water in soil provide an environment favorable for pathogen development, but it creates conditions that are not healthy for the crops making them more susceptible to disease. Related to excessive soil moisture, too much air moisture and reduced air movement between plants can also create conditions conducive to pathogen development. Ventilation, in particular with greenhouses, and adequate spacing between plants for most crops, promotes air flow thereby reducing the amount of moisture and conditions favorable to pathogens.

Specific to soil borne diseases, crop rotations are important in preventing the accumulation of pathogens and in disrupting pathogen life cycles. This may involve rotating crops at a two to three year frequency. In particular, rotations involving crops that are considered to be non-pathogen host crops significantly reduces the abundance of pathogens.

Reducing the susceptibility of crops to pathogens can be achieved through a combination of techniques to improve the overall quality of soil. Improved soil health not only has the potential for reducing the need for mefenoxam and other fungicides, but a healthier soil, rich in organic matter, also decreases the potential for leaching to occur. Improved soil management practices would combine approaches to increase the amount of soil organic matter with the use of alternate cultivation practices to preserve the existing soil organic matter. Improving soil health is most applicable to the major Long Island vegetable and fruit commodities and to a lesser extent with greenhouse, nursery, and turf commodities. Increasing the amount of soil organic matter can be accomplished by the use of cover crops, through crop rotations, use of wind barriers, carbon-based mulching, and compost applications. Cultivation practices, including reduced tillage and zone tillage techniques can be applied to reduce the loss of organic matter.

Monitoring and Identifying Pathogens Prior to Mefenoxam Usage

Scouting to look for symptoms of plant disease and conditions that may favor disease development is an important component in selecting the most appropriate actions for disease control. Where possible, this includes the accurate identification of the types of pathogens that may be present, determining the overall severity of the disease, and the susceptibility of the pathogen to mefenoxam and other fungicides. The identification and the determination of susceptibility is most applicable for late blight in tomato and potato crops. Routine scouting and improved diagnosis has the potential to allow growers to determine the necessary responses, which may include practices to reduce mefenoxam usage.

To maximize the benefits of monitoring, it can be combined with the use forecasting models. This would include the use of weather information and pest models found on the Network for Environment & Weather Awareness (NEWA). Growers should also be aware of disease information/notices provided by Cornell University, Cornell Cooperative Extension of Suffolk County, and Federal and State agencies.

Possible Practices to Improve Mefenoxam Applications.

It is well established that a single fungicide or fungicides with the same mode of action, should not be used exclusively for disease management because of the likelihood that pathogen resistance will develop. Instead, fungicides with different modes of action should be rotated to minimize the potential for resistant isolates to buildup. Based on this, a best management practice will be developed summarizing fungicides that can be used in rotation with mefenoxam. Overall, through possible disease identification and rotation of fungicides, the BMP will encourage limiting mefenoxam to a maximum of two applications annually. Retaining at least two mefenoxam applications per year is important for resistance management.

As summarized in the Alternative Tables (Attachment 5), there are fungicides that can be rotated or tank mixed with mefenoxam to minimize disease development and to reduce the overall amount of mefenoxam being used. In addition, biological controls are available and becoming increasingly important as part of a disease management program. Although biocontrols are not likely to be effective as a stand-alone practice, when combined with other fungicides and cultural practices, biocontrols can be effective in the control of pathogens. Overall, biological controls also tend to be safer for the environment and for handlers than traditional synthetic fungicides. *Bacillus subtilis* (active ingredient in Cease and Companion), *Streptomyces lydicus*, and *Trichoderma harzianum* (active ingredient in Rootshield and Plantshield) are examples of biological controls used in rotation with mefenoxam for management of *Pythium* in floral, nursery, and turf crops.

For many of the commodities grown on Long Island, the use of resistant plants/cultivars have the potential to reduce the use of mefenoxam. Resistant plants are less susceptible to disease and therefore may generally require less fungicide. It is important however to understand the pathogens that are likely to be problematic in the selection of resistant plants so that this can be factored into the overall disease management program. Resistant plants/cultivars have uses with greenhouse, nursery, landscape, fruit, and vegetable crops (mostly pepper, tomato, and cucurbit crops).

To ensure that the correct mefenoxam rates are being applied, practices involving the proper setup, calibration, and maintenance of spraying equipment are necessary. This involves the use of the correct nozzles and pressures; periodic calibration of sprayers; and performing routine maintenance on nozzles, spray lines, and fittings, etc. Maintaining equipment improves application coverage and also reduces the likelihood that unnecessary and excessive amounts of mefenoxam will be applied.

Education and Outreach

A key component to the implementation of these best management practices and pollution prevention measures is an education and outreach program. A combination of approaches will be used to promote the use and overall benefits of these practices. A factsheet detailing the specific mefenoxam best management practices will be developed and subsequently distributed in hardcopy and also electronically. At a minimum, the factsheet will be available electronically on the Cornell Cooperative Extension of Suffolk County, NYSIPM, the Suffolk County Soil and Water Conservation District, and the Department's Long Island Strategy websites. The factsheet will be the basis for topics to be covered during educational programs offered by Cornell Cooperative Extension of Suffolk County, the Suffolk County Soil and Water Conservation District, and the Department.

Long-Term Monitoring and Measuring Success

To assess the effectiveness of these actions, groundwater samples will be routinely collected and submitted for laboratory analysis from a combination of existing groundwater monitoring locations along with an expanded network of groundwater monitoring wells. Through continued cooperation with the Suffolk County Department of Health Services and Cornell Cooperative Extension of Suffolk County, additional groundwater monitoring wells will be installed downgradient of land uses where mefenoxam applications occur, where usage is expected to continue to occur, and where the selected best management practices will be employed. This will allow the Department to evaluate existing groundwater conditions and the overall results of adopting mitigating measures. Based on monitoring results the Department will determine if additional measures are necessary or if modifications to the adopted practices are warranted.

Recently collected groundwater data shows that the overall frequency of mefenoxam detections has declined along with the maximum detected concentrations. With the promotion and increased implementation of the aforementioned best management practices, it is expected that overall mefenoxam groundwater concentrations and the frequency of detections will continue to decline. The groundwater monitoring program will be an integral part in assessing these short and long-term mefenoxam trends.

With an inherent time lag between implementation of best management practices/pollution prevention measures and a corresponding effect on groundwater quality, progress will also be evaluated by tracking use of the priority BMPs and the educational efforts that will be used to promote their use. An effort to track the implementation of the priority BMPs will be accomplished through the direct interaction with growers and possibly through the use of surveys. Distribution of factsheets, use of Strategy-derived website resources, and participation in educational events will be used to evaluate outreach efforts.

Attachment 1

<u>Notice of Voluntarily Cancellation of Ciba Crop Protection Registrations of Metalaxyl Technical and End-Use Products that Contain Metalaxyl</u>

metalaxyl (Apron, Ridomil, Subdue) Notice of Voluntarily Cancellation 4/96

ENVIRONMENTAL PROTECTION AGENCY
[OPP-66225; FRL 5364-7]

Notice of Voluntarily Cancellation of Ciba Crop Protection Registrations of Metalaxyl Technical and End-Use Products that Contain Metalaxyl

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: EPA is announcing the voluntary cancellation of the registrations of the active ingredient metalaxyl (N-(2,6-dimethylphenyl)-N-(methoxyacetyl) alanine methyl ester) and the end-use product registrations held by Ciba Crop Protection that contain metalaxyl. The cancellation of these metalaxyl registrations was requested by Ciba Crop Protection, who holds the only EPA registration of Metalaxyl Technical. The cancellation of metalaxyl registrations will allow for the full environmental benefit provided by the recent registration of mefenoxam and end-use products containing mefenoxam. Mefenoxam is the R-enantiomer of metalaxy and at half the application rate, and provides the same level of efficacy as metalaxyl. Under an agreement reached with the registrant, metalaxyl products can be sold until December 31, 1998. The registrant has requested that the Agency allow resale and use of the metalaxyl-based end-use products which are in the hands of distributors, dealers and growers by December 31, 1998 until supplies are exhausted.

DATES: Comments associated with this action must be received prior to May 31, 1996. The effective date of the cancellation of the registrations of Metalaxyl Technical and Ciba Crop Protection end-use products containing metalaxyl will be May 31, 1996.

FOR FURTHER INFORMATION CONTACT: By mail: Connie B. Welch, Product Manager 21, Office of Pesticide Programs, Registration Division (7505C), Environmental Protection Agency, 401 M St., SW., Washington, DC 20460. Office location for commercial courier delivery and telephone number: Room 227, Crystal Mall No. 2, 1921 Jefferson Davis Highway, Arlington, VA, (703) 305-6226; e-mail: welch.connie@epamail.epa.gov.

SUPPLEMENTARY INFORMATION:

I. Introduction

Metalaxyl consists of R and S enantiomeric forms at a ration of 1:1; efficacy studies have shown that the R enantiomer provides the majority of the efficacy provided by metalaxyl. Mefenoxam is the R-enantiomer of metalaxyl and provides the same range and level of efficacy as metalaxyl; however, data provided to EPA demonstrates that this efficacy is achieved with half the amount of active ingredient applied per acre required with the use of metalaxyl. On March 6, 1996, EPA granted the conditional time limited registration of the active ingredient mefenoxam and 13 end-use products that contain mefenoxam.

Since metalaxyl is one of the most widely registered and used fungicides in the United States with established tolerances in over 120 crop and livestock commodities and has uses as a seed treatment, as a banded or broadcast soil application, and a foliar spray in combination with protectant type fungicides, EPA feels that a significant reduction in the exposure of the environment to pesticides will be gained with the cancellation of metalaxyl and replacement of these uses with products containing mefenoxam. The cancellation and phase out of products containing metalaxyl will assure that the maximum environmental benefit of mefenoxam registration will be achieved.

Ciba Crop Protection has agreed to end sales of metalaxyl based products by December 31, 1998. Since all registered uses of metalaxyl based products are replaced by the registration of parallel and equivalent mefenoxam based products, there will be no loss of uses and no negative impact of minor crops or US agriculture.

II. Intent to Cancel

The following table list the metalaxyl registrations, listed in sequence by registration number, that will be canceled May 31, 1996.

Table 1. -- Registrations with Pending Requests for Cancellation

Registration No.	Product Name	Chemical Name
000100-00601.......	Metalaxyl Technical	Metalaxyl
000100-00607.......	Ridomil 2E Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00619.......	Subdue 2E Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00626.......	Apron 2E Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00628.......	Ridomil 5G-Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00629.......	Ridomil MZ58 Fungicide	Zinc ion and manganese ethylenebisdithiocarbamate, coordination product N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00639.......	Apron 25W Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester

000100-00658.......	Ridomil/Bravo 81W Fungicide	Tetrachloroisophthalonitrile N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00664.......	Ridomil PC 11-G Granular Fungicide	Pentachloronitrobenzene N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00670.......	Apron + Captan Fungicide Seed Treatment	cis-N-Trichloromethylthio-4-cyclohexene-1,2-dicarboximide N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00676.......	Subdue Granular Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00683.......	Apron + Captan FS Fungicide Seed Treatment	cis-N-Trichloromethylthio-4-cyclohexene-1,2-dicarboximide N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00713.......	Ridomil PC Granular Fungicide	Pentachloronitrobenzene N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester

[[Page 19282]]

000100-00717.......	Subdue II Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00718.......	Subdue & WSP Turf Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00720.......	Ridomil/Copper 70W	Copper hydroxide N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00735.......	Ridomol 50W	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00738.......	Apron 50W Fungicide	N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester

000100-00742.......	Pace Fungicide	Zinc ion and manganese ethylenebisdithiocarbamate, coordination product N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00749.......	Ridomil MZ Fungicide	Zinc ion and manganese ethylenebisdithiocarbamate, coordination product N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester
000100-00767.......	Ridomil MZ 72	Zinc ion and manganese ethylenebisdithiocarbamate, coordination product N-(2,6-Dimethylphenyl)-N-(methoxyacetyl)alanine, methyl ester

Any person adversely affected by this regulation may, within 30 days after publication of this document in the Federal Register, file written objections to the regulation and may also request a hearing on those objections. Objections and hearing requests must be filed with the Hearing Clerk, at the address given above (40 CFR 178.20). A copy of the objections and/or hearing requests filed with the Hearing Clerk should be submitted to the OPP docket for this rulemaking. The objections submitted to this regulation must specify the provisions of the regulation deemed objectionable and the grounds for the objections (40 CFR 178.25). Each objection must be accompanied by the fee prescribed by [(40 CFR 180.33(I))]. If a hearing is requested, the objections must include a statement of the factual issue(s) on which a hearing is requested, the requester's contentions on such issues, and a summary of any evidence relied upon by the objector (40 CFR 178.27).

A request for a hearing will be granted if the Administrator determines that the material submitted shows the following: There is genuine and substantial issue of facts; there is a reasonable possibility that available evidence identified by the requester would, if established, resolve one or more of such issues in favor of the requester, taking into account uncontested claims or facts to the contrary; and resolution of the factual issue(s) in the manner sought by the requester would be adequate to justify the action requested (40 CFR 178.32).

List of Subjects

Environmental protection, Pesticides and pests, Product registrations.

Dated: April 22, 1996.

Stephen L. Johnson,
Director, Registration Division, Office of Pesticide Programs.

[FR Doc. 96-10806 Filed 4-30-96; 8:45 am]
BILLING CODE 6560-50-F

Attachment 2

1994 US EPA Addition of Groundwater Advisory Statement to Metalaxyl Labels

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PREVENTION,
PESTICIDES AND TOXIC
SUBSTANCES

Memorandum

SUBJECT: Amendment to Ground Water Assessment of Metalaxyl for Registration Eligibility Document

FROM: Estella Waldman, Hydrologist
Ground Water Section
Environmental Fate and Ground Water Branch

Elizabeth Behl, Chief
Ground Water Section
Environmental Fate and Ground Water Branch

THRU: Henry M. Jacoby, Chief
Environmental Fate and Ground Water Branch
Environmental Fate and Effects Division (7507C)

TO: Linda Propst
Product Manager #73
Special Review and Reregistration Division (7508W)

Evert Byington, Chief
Science Analysis and Coordination Staff
Environmental Fate and Effects Division (7507C)

This document is presented as an amendment to the original ground-water assessment that was completed for the Registration Eligibility Document (RED). The document was prepared to provide further justification for the recommendations stated in the original RED. Also, one new recommendation has been added in order to be consistent with the regulations considered appropriate for other chemicals.

Recommendations

1. EFGWB recommends that the metalaxyl label be amended to include a ground-water advisory. This advisory should state:

   > "This chemical is known to leach through soil into ground water under certain conditions as a result of agricultural use. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground-water contamination."

2. EFGWB recommends that metalaxyl be considered a Restricted Use compound for ground-water concerns. The triggers for the Restricted Use Rule were developed to indicate the potential for a pesticide to leach to ground water. As illustrated on Figure 1, metalaxyl exceeds all seven of the proposed persistence and mobility triggers for Restricted Use, indicating that it has high potential to move to ground water. Limited monitoring has been conducted for metalaxyl, and few detections have been found in ground water to date. With an extensive monitoring program in metalaxyl use areas, it is likely that metalaxyl would also meet the detections trigger (number 8) for classification as a Restricted Use chemical.

3. EFGWB requests that the registrant propose a level in ground water that, if reached, would be appropriate for some form of regulatory action.

Discussion

In the initial ground-water assessment for the RED, metalaxyl was shown to exhibit the properties and characteristics associated with chemicals that have been detected in ground water. Metalaxyl is a persistent pesticide with an aerobic soil metabolism half-life of approximately six weeks. In addition, metalaxyl is very mobile with Kd values ranging from 0.43 to 1.40 L/kg in three different soils. Considering the nature of the chemical; i.e., highly persistent under certain conditions and very mobile in many soils, there is a strong possibility of movement to ground water, especially in vulnerable areas. This has been confirmed by the detections reported in the "Pesticides in Ground Water Database" (Hoheisel et al., 1992) which indicate that metalaxyl has had an impact on ground-water quality.

Metalaxyl is not oncogenic, mutagenic or teratogenic, its acute toxicity is low, and the risks to nontarget species are also low. Based on our current knowledge about human and ecological endpoints, metalaxyl is not likely to exceed the risk-based levels of concern. However, because the Level of Concern for ground-water quality has been exceeded by metalaxyl, EFGWB recommends several actions. A ground-water label advisory (previously recommended in 1993) should be placed on the metalaxyl label. Metalaxyl should also be considered for classification as a restricted use chemical for ground-water concerns. When compared to several other pesticides that have been recommended for restricted use (Figure 2), metalaxyl (parent) is shown to be extremely mobile and moderately persistent. The degradate of metalaxyl (not illustrated on the figure), is also very mobile and is more persistent than the parent.

EFGWB also recommends that the registrant propose, as a condition of reregistration eligibility, to establish a level of metalaxyl in ground water that would necessitate further regulatory action. If this level were to be detected in ground water, regulatory action would be taken.

FIGURE 1

Physical and Chemical Characteristics of METALAXYL
Relative to EPA Restricted Use Criteria

		CHARACTERISTIC	RESTRICTED USE CRITERIA	REPORTED VALUE
PERSISTENCE	1	Field dissipation half-life	> 3 weeks, or	40 days (≈6 weeks)
	2	Lab-derived aerobic soil metabolism half-life	> 3 weeks, or	40 days (≈6 weeks)
	3	Hydrolysis half-life	< 10% in 30 days, or	≈200 days
	4	Photolysis half-life	< 10% in 30 days, and	≈400 days
MOBILITY	5	Soil adsorption: K_d	≤ 5 ml/g, or	0.43 - 1.40 ml/g
	6	Soil adsorption: K_{oc}	≤ 500 ml/g, or	16
	7	Depth of leaching in field dissipation study	75 cm, and	48 inches (122 cm)
DETECTIONS	8	Number of wells and states with detections	25 wells in 4 or more states, or	17 wells in 2 states
	9	Number of counties with detections > 10% of MCL/HA	3 counties at >40 ppb	0 counties above 40 ppb

Shaded area indicates that parameter exceeds trigger.

Restricted Use requires [(1 or 2 or 3 or 4) and (5 or 6 or 7)] and (8 or 9)

FIGURE 2

Physical and Chemical Characteristics of METALAXYL
Relative to Other Pesticides

	CHARACTERISTIC	Metalaxyl	Alachlor	Acetochlor	Picloram	Tebuthiuron
PERSISTENCE	Field dissipation half-life	40 days	18 days	36 days	278 days	2 years
	Lab-derived aerobic soil metabolism half-life	≈6 weeks	3 weeks	245 days	324 days	35.4 months
	Hydrolysis half-life	≈200 days	stable	stable	stable	>64 days
	Photolysis half-life	≈400 days	NA	stable	>384 hrs	39.7 days
MOBILITY	Soil adsorption: K_d	0.43 - 1.40	0.62 - 8.13	0.81-7.5	0.07-0.98	0.11-1.82
	Soil adsorption: K_{oc}	16 ml/g	190 (est)	74-428	16	4
	Depth of leaching in field dissipation study	48 inches	NA	12 inches	NA	>72 inches

NA = data not available

Attachment 3

1996 NYS Registration of Mefenoxam

Registration of Mefenoxam 9/96

New York State Department of Environmental Conservation
Division of Solid & Hazardous Materials
50 Wolf Road, Albany, New York 12233-7250
Phone 518-457-6934 FAX 518-457-0629

SEP 24, 1996
Mr. Jerry Harrison
Manager State Registrations
Ciba-Geigy Corporation
P. O. Box 18300
Greensboro, NC 27419

Dear Mr. Harrison:

Re: Registration of the New Active Ingredient - Mefenoxam Contained in the Pesticide Products Ridomil Gold EC (EPA Reg. No. 100-801), Ridomil Gold WSP (EPA Reg. No. 100-802), Ridomil Gold Bravo (EPA Reg. No. 100-801, 50534-188), Ridomil Gold PC (EPA Reg No. 100-792), Ridomil Gold GR (EPA Reg. No. 100-798), Ridomil Gold MZ (EPA Reg. No. 100-803); and for Apron XL LS Fungicide (EPA Reg. No. 100-799)

The New York State Department of Environmental Conservation (NYSDEC) has accepted your application for the registration of the new active ingredient, Mefenoxam, contained in the pesticide products Ridomil Gold EC (EPA Reg. No. 100-801), Ridomil Gold WSP (EPA Reg. No. 100-802), Ridomil Gold Bravo (EPA Reg. No. 100-801, 50534-188), Ridomil Gold PC (EPA Reg No. 100-792), Ridomil Gold GR (EPA Reg. No. 100-798), Ridomil Gold MZ (EPA Reg. No. 100-803); and on September 4, 1996 for Apron XL LS Fungicide (EPA Reg. No. 100-799). The Ridomil Gold and Apron products are labeled to control specific fungal diseases on a wide variety of fruits, vegetables, nuts, grain, cotton, tobacco and grasses. Staff combined their review of these products in the interest of efficiency.

The active ingredient mefenoxam [(R)-2-[(2,6-dimethylphenyl)-methoxyacetyl-amino]-propionic acid methyl ester and related compounds] is primarily the R enantiomer of the currently registered compound metalaxyl, which contains both R and S enantiomers in equal proportions. This application was handled as a New Active Ingredient application rather than as a Major Change in Labeling because the new product was assigned a new EPA registration number by the United States Environmental Protection Agency (EPA).

A condition of federal registration for the Ridomil Gold and Apron products requires the registrant to cancel the registration of metalaxyl and its end use products. However, the EPA's final decision on cancellation has not been announced in the Federal Register. If the metalaxyl registrations are canceled, the Federal Register states that EPA will allow sale and use of metalaxyl-containing products until December 31, 1998.

The data package for this product was reviewed by the Division of Fish, Wildlife, & Marine Resources (DFW&MR); our Technical Support & Laboratory Services Section (TS&LS); and the New York State Department of Health (NYSDOH).

The DFW&MR Bureau of Environmental Protection (BEP) in their review did not object to registration. The Ridomil Gold products contain between 0.48 to 46.6% mefenoxam. Apron contains 32.23%. Ridomil is applied at a rate of 2 lbs ai/acre, with a maximum application of 6 Ibs. ai/acre/ season. Apron is applied at a rate of 0.0308 lbs. ai/100 lbs. of seed for sweet corn, peas, sorghum, sunflowers, and turfgrass. With a seeding rate of 120 lbs. seed/acre, sorghum contains 0.37 lbs. of mefenoxam per acre.

According to aquatic and terrestrial models, mefenoxam is not toxic to fish, birds,aquatic invertebrates, or aquatic plants on an acute basis. Toxicity thresholds areexceeded for birds feeding long term on short grass with mefenoxam residues, and for small mammals feeding short and long term on short grass containing these residues.

The maximum application rates used are for avocadoes, which are not grown in New York State. The application rates for crops grown in this State are lower, and would not exceed toxicity thresholds. Mefenoxam, also, has a field dissipation half-life of 35 days and would not be chronically toxic to mammals or birds. Therefore, the pesticide products containing mefenoxam cited in this review will not adversely impact the fish and wildlife resources of New York State.

The New York State Department of Health stated in their review that the toxicity of mefenoxam is similar to that of metalaxyl. These compounds are not highly toxic and the estimated dietary exposure from metalaxyl use does not pose sign)ficant health risks. The reduced application rate of the Ridomil Gold products compared to the metalaxyl products is likely to result in even less dietary exposure as well as reduced worker risks and environmental loading.

There are no chemical-specific federal or State drinking water/groundwater standards for mefenoxam. Based on its chemical structure, mefenoxam falls under the 50 microgram per liter general New York State drinking water standard for an "unspecified organic contaminant" (6NYCRR Part 5 - Public Water Systems).

The TS&LS Section stated in their review that they did not object to the registration of the listed Ridomil Gold products and that they had no objection to registration of Apron XL LS Fungicide as a seed treatment in New York State.

The new active ingredient, mefenoxam, contains a higher ratio of the "R" enantiomer of metalaxyl, the active ingredient in a product line which Ciba has marketed for over 15 years under the trademark Ridomil. Metalaxyl is composed of equal amounts of the two enantiomers described as "R" and "S" enantiomers. Ciba has been successful in separating the two enantiomers and demonstrating that the "R" enantiomer is more active in controlling plant diseases than either the "S" enantiomer or the combination of the two.

Since these new Ridomil Gold and Apron products contain primarily the "R" enantiomeric form of metalaxyl, they can be applied at lower rates without loss of disease control. The net result is reduced amounts of product being applied to the environment. These products have all the favorable characteristics of the Ridomil products but will be used at one-half the rate for current Ridomil products.

Because of the net reduction of impact to the environment from the new products, EPA has designated the Ridomil Gold products as "reduced risk" materials. Some of the studies are not required for reduced risk materials, and EPA Data Evaluation Reviews were not produced by EPA for those studies that were performed. The following data was taken from Ciba-Geigy's summaries of the studies performed as part of the environmental fate review:

Mefenoxam solubility is 26 g/L; the average aerobic metabolism half-life is 58.4 days; the soil photolysis half-life was 358 days; the koc's ranged from 20 to 790 in a sand and from 1299 to 3539 in a silty clay loam; and the column leaching studies ranged from low in a silty clay loam, to high in a sand and in a sandy loam.

While these parameters indicate that this is a fairly persistent, mobile compound, it has been projected that up to 50% less impact to the environment will occur using these new products. Because of this benefit to the environment, the TS&LS has no objections to the registration of these six products.

The major new use pattern in Apron XL LS (EPA Reg. No. 100-799) is as a seed treatment for control of pythium and phythophthora causing damping-off, seed rot, and systemic downy mildew diseases of certain crops. The seed treatment use pattern did not require additional review; therefore, the TS&LS has no objection to the registration of Apron XL LS.

After consideration of the reviews by NYSDOH, DFW&MR, and by TS&LS, the Department accepts for registration Ridomil Gold EC (EPA Reg. No. 100-801), Ridomil Gold WSP (EPA Reg. No. 100-802), Ridomil Gold Bravo (EPA Reg. No. 100-801, 50534- 188), Ridomil Gold PC (EPA Reg No. 100-792), Ridomil Gold GR (EPA Reg. No. 100-798), Ridomil Gold MZ (EPA Reg. No. 100-803); and for Apron XL LS Fungicide (EPA Reg. No. 100-799) for use as labeled to control specific fungal diseases on a wide variety of fruits, vegetables, nuts, grain, cotton, tobacco and grasses in New York State.

Enclosed for your records are the stamped-accepted label and the certificate of registration for the above product.

If you have any questions on this matter, please contact Maureen Serafini, Supervisor of our Pesticide Product Registration Section, at (518) 457-7446.

Sincerely,

Norman H. Nosenchuck, P.E.
Director
Division of Solid & Hazardous Materials

Enclosures
cc: w/enc. - D. Rutz/W. Smith, Cornell University
N. Rudgers, NYS Dept. of Ag. & Mkts.
N. Kim/A. Grey, NYS Dept. of Health

Attachment 4

Metalaxyl/Mefenoxam Usage Figures based on ArcGIS Geocoding of Pesticide Reporting Law Annual Data

Nassau County 2003

Nassau County 2006

Nassau County 2009

Nassau County 2012

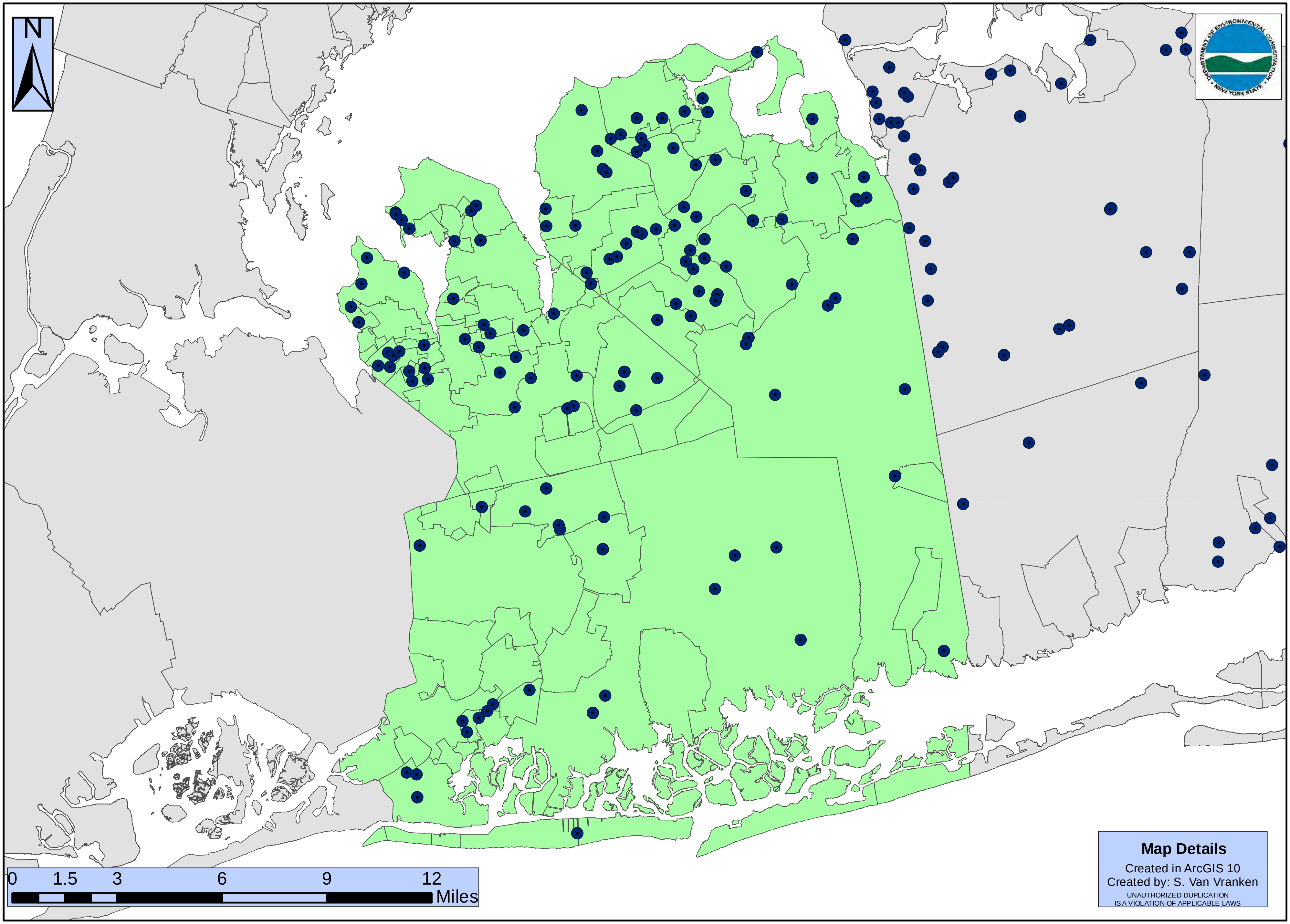
Suffolk County 2003

Suffolk County 2006

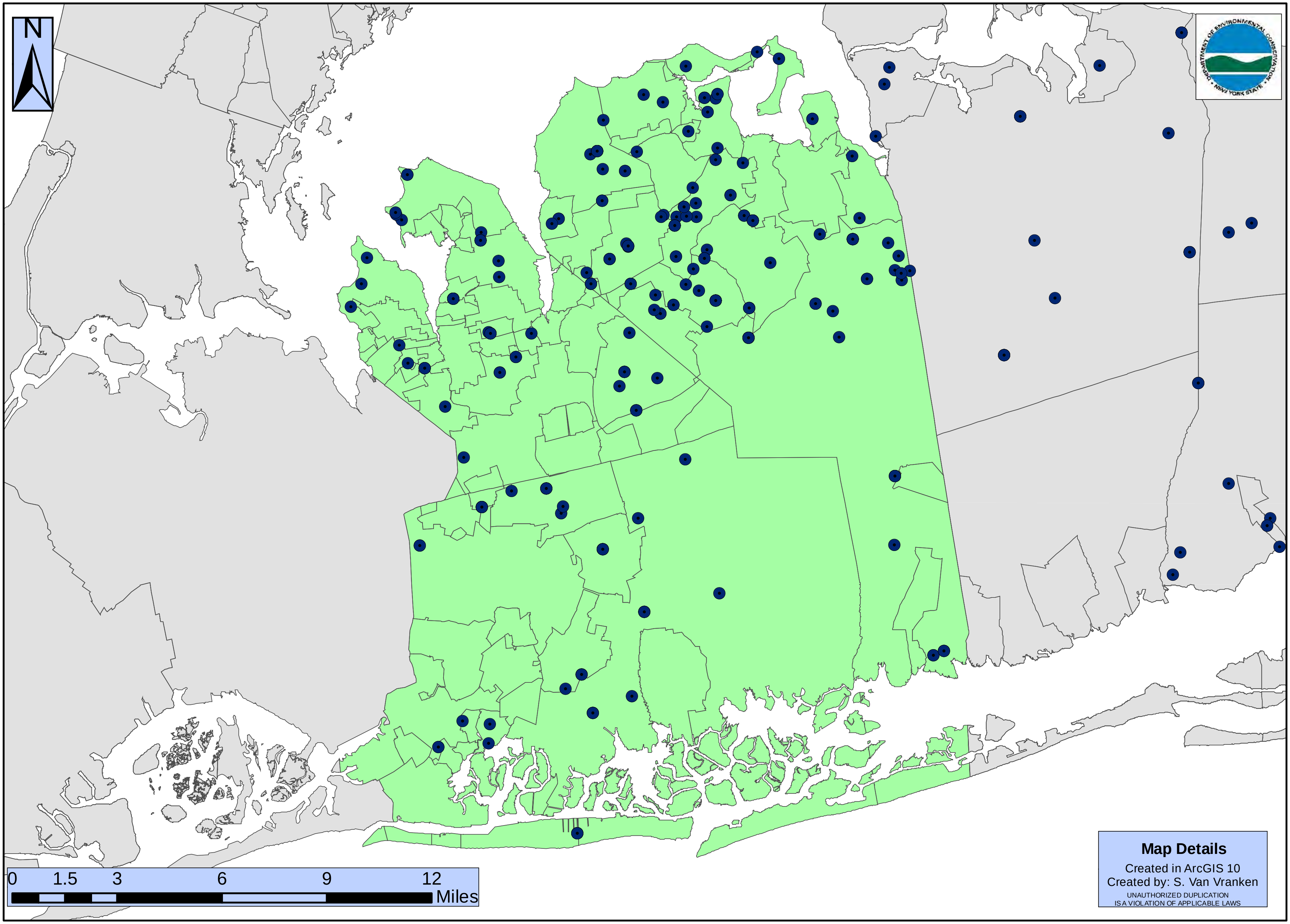
Suffolk County 2009

Suffolk County 2012

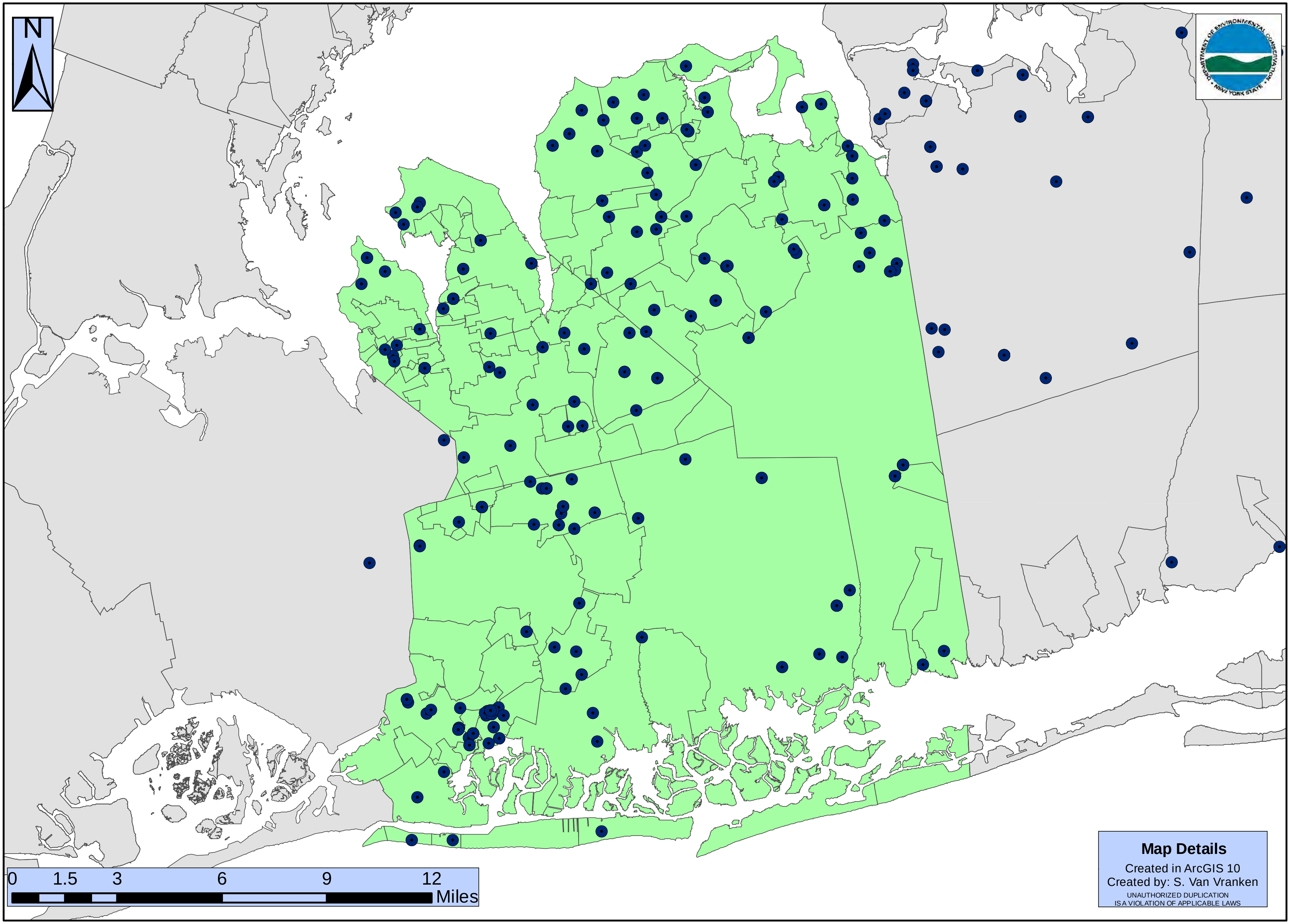
2003 NYSDEC Nassau County Metalaxyl/Mefanoxam Usage Locations



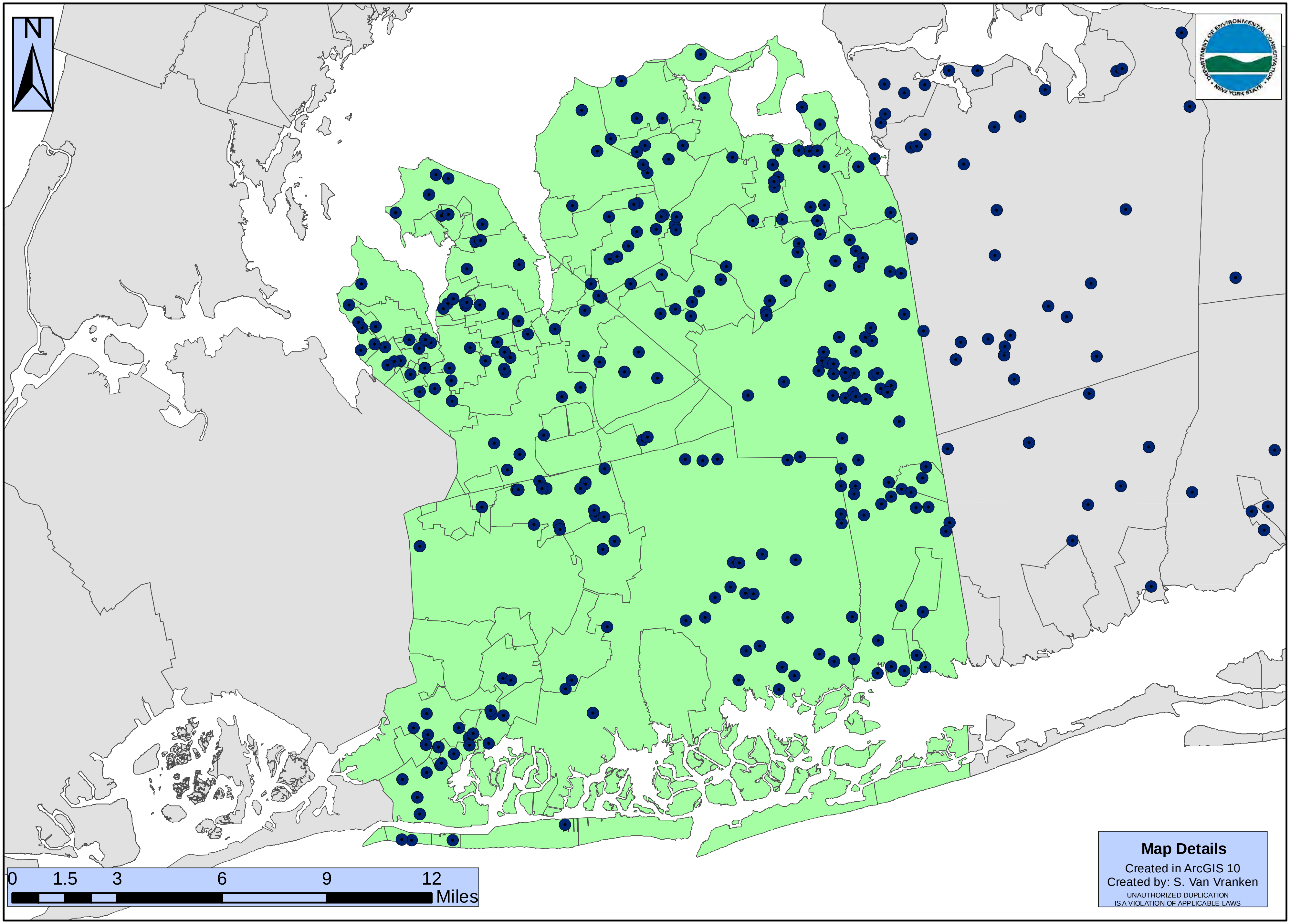
2006 NYSDEC Nassau County Metalaxyl/Mefanoxam Usage Locations



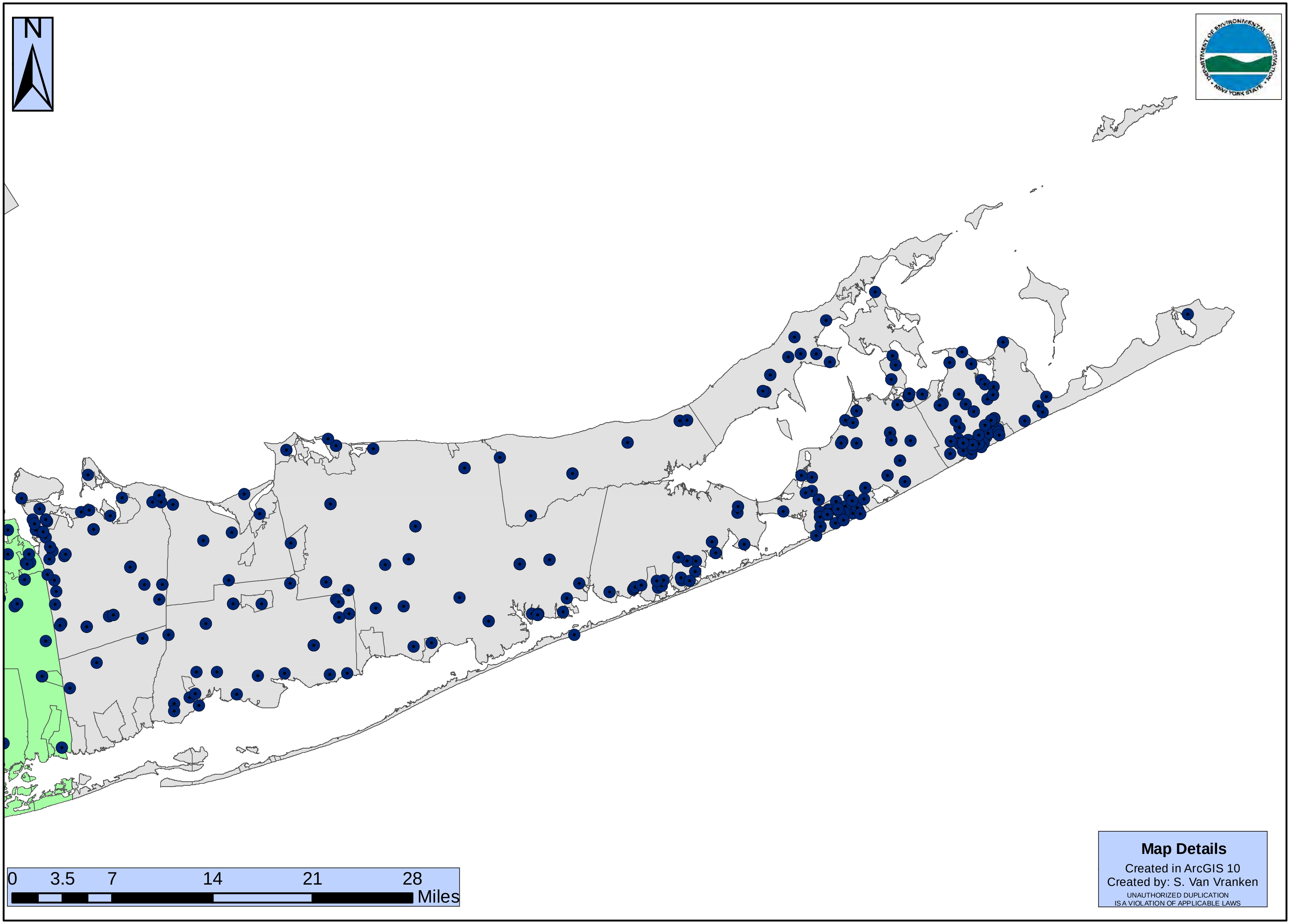
2009 NYSDEC Nassau County Metalaxyl/Mefanoxam Usage Locations



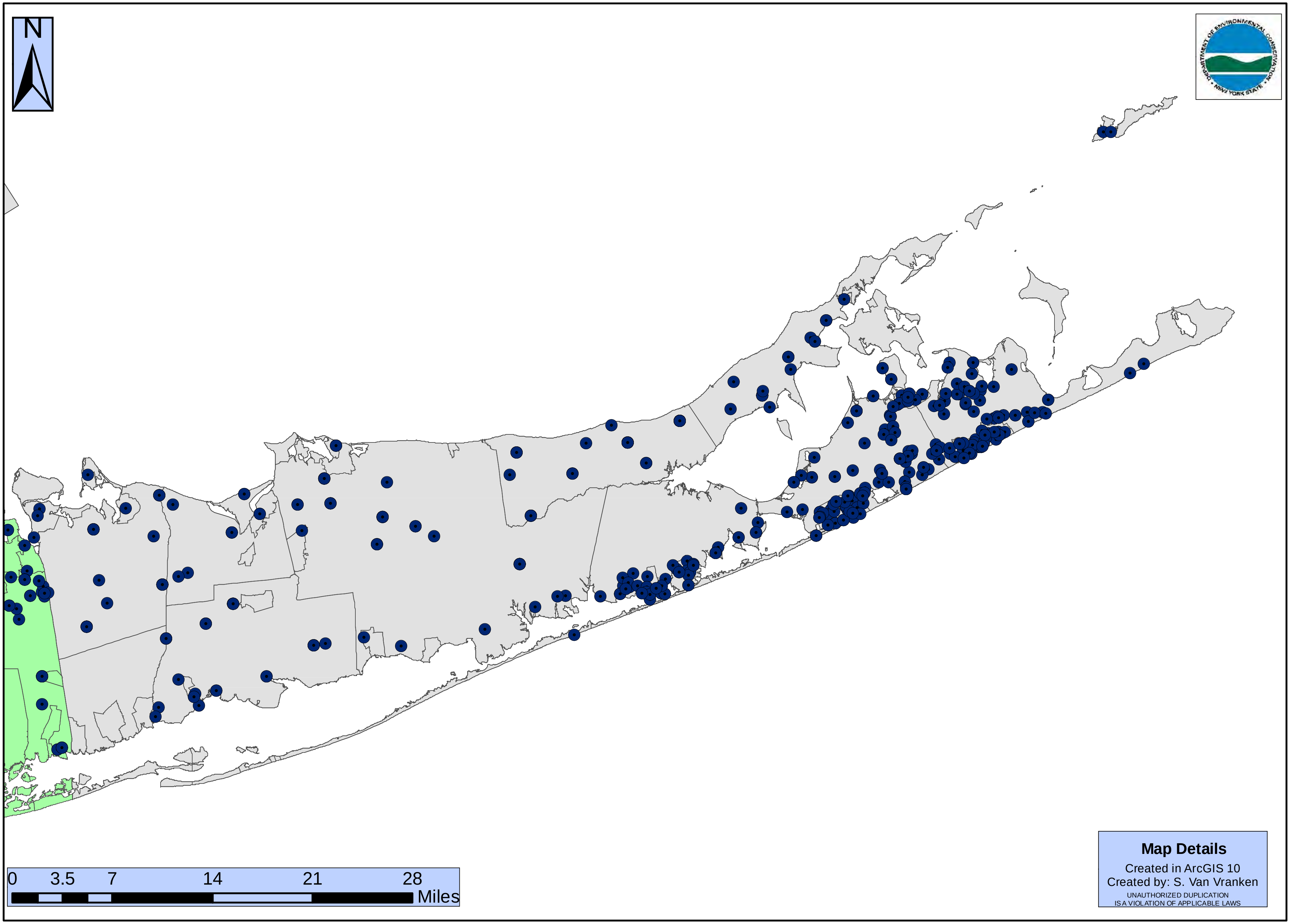
2012 NYSDEC Nassau County Metalaxyl/Mefanoxam Usage Locations



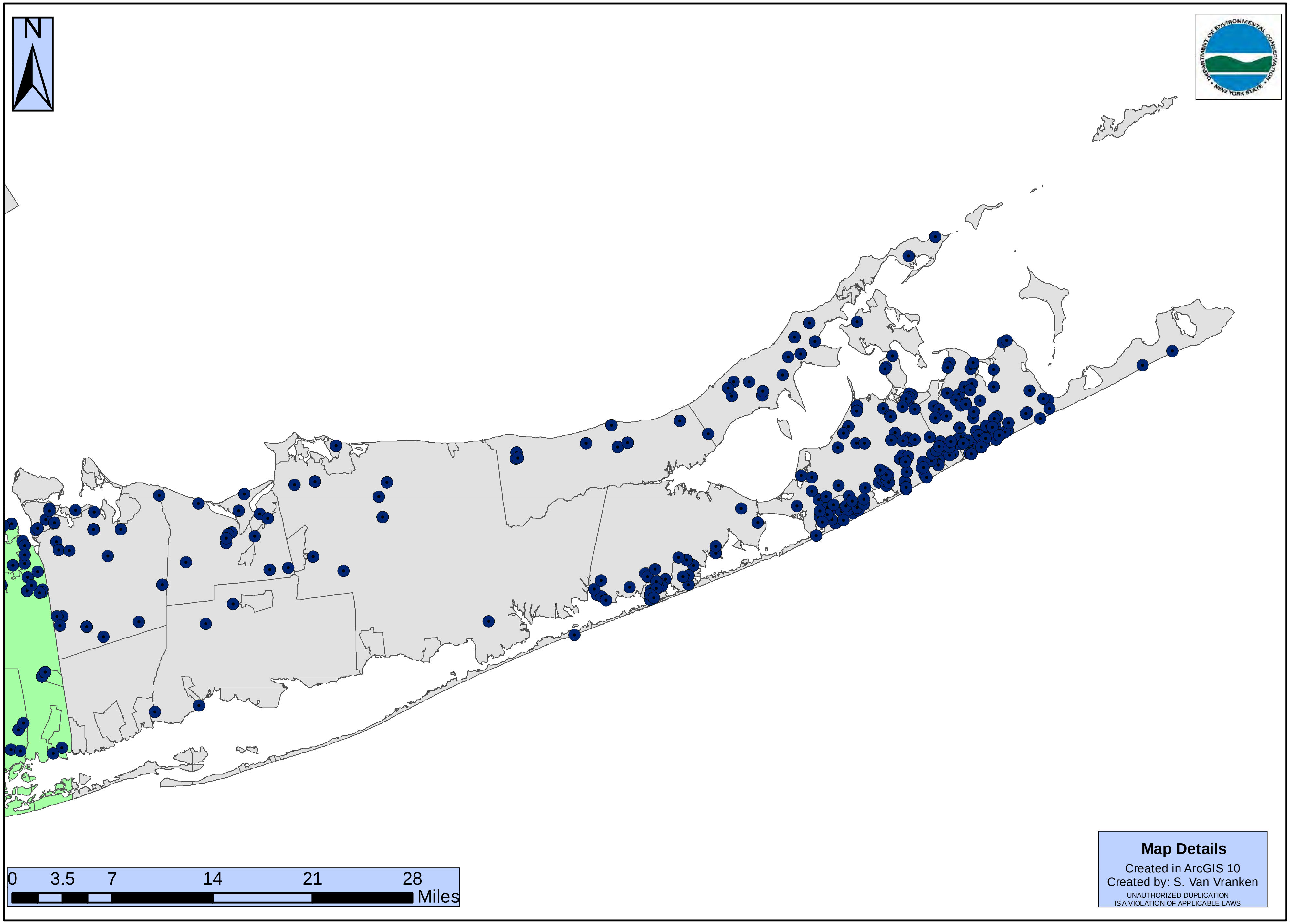
2003 NYSDEC Suffolk County Metalaxyl/Mefanoxam Usage Locations



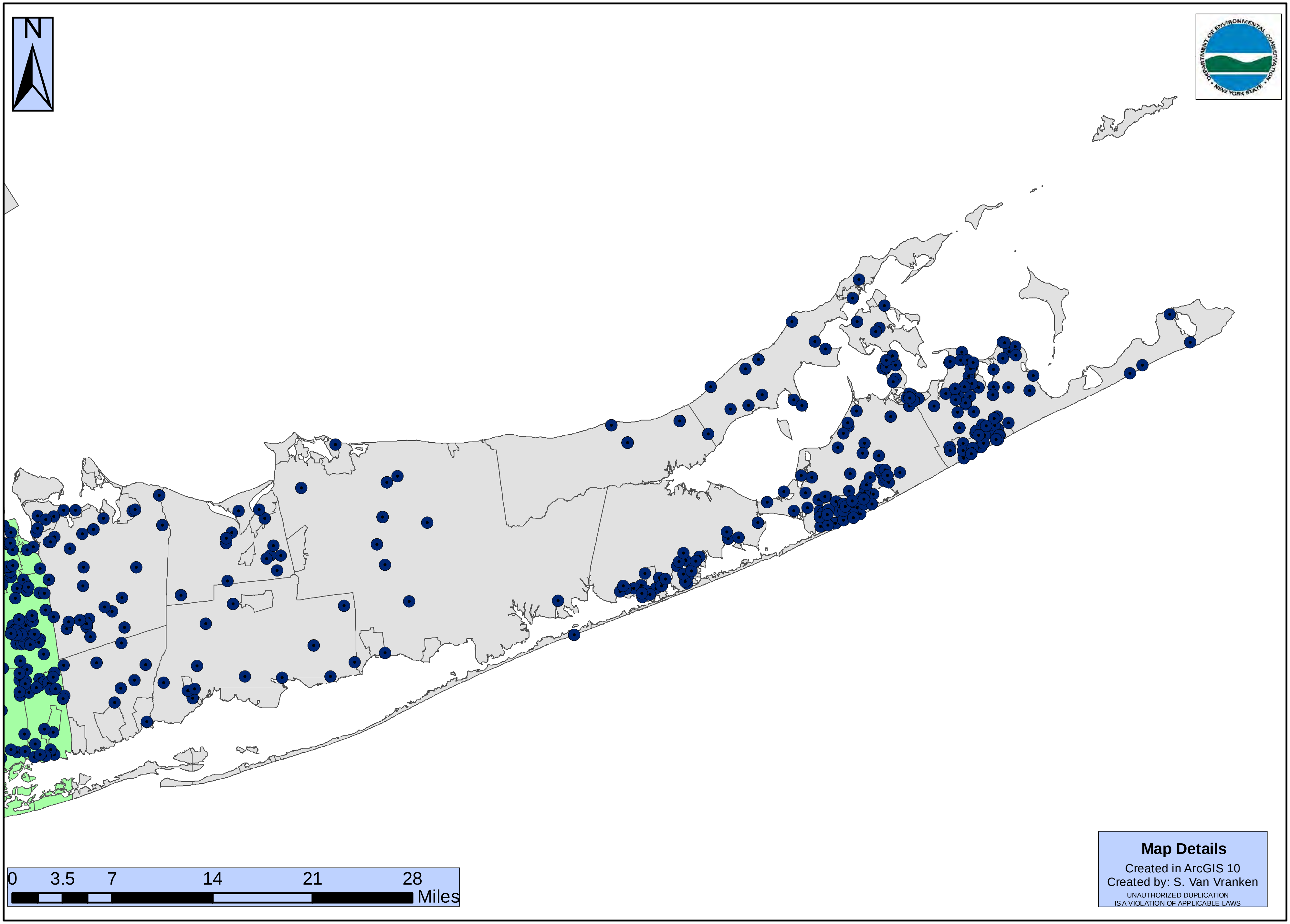
2006 NYSDEC Suffolk County Metalaxyl/Mefanoxam Usage Locations



2009 NYSDEC Suffolk County Metalaxyl/Mefanoxam Usage Locations



2012 NYSDEC Suffolk County Metalaxyl/Mefanoxam Usage Locations



Attachment 5

Summary of Possible Practices to Improve Metalaxyl/Mefenoxam Usage and Reduce or Eliminate Groundwater Contamination

Summary of Possible Practices to Improve Mefenoxam Usage and Reduce or Eliminate Groundwater Contamination

Vegetable and Fruit Crops with Soil and Foliar Applications

Options to Reduce or Increase Effectiveness of Mefenoxam Applications		Major Long Island Vegetable & Fruit Commodities											Advantages	Disadvantages
		Pepper	Tomato	Potato	Mixed Vegetables	Brassicas	Cucurbits	Apples	Stone Fruit	Grapes	Strawberries	Hops		
1) Application Modifications	Rotation of mefenoxam with other fungicides with different modes of action	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	• Reduce potential for resistance buildup. • Has potential to significantly decrease amount of mefenoxam usage.	• Mefenoxam is inherently more effective than other fungicides on sensitive pathogen strains. • Practice is almost exclusively for foliar diseases.
	Limit to a maximum of two (2) annual applications	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	• Reduce potential for resistance buildup. • Has potential to significantly decrease amount of mefenoxam usage.	• During certain times of year or with certain diseases, more than two applications may be necessary.
	Improve calibration of application equipment	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	• Improves delivery of mefonaxam and reduces volumes being applied. • Reduced cost with efficient delivery.	• Increased cost associated with improved application equipment.
	Use of treated seed	✓	✓	✓	✓	✓	✓						• Limits potential for disease development and provides control of the spreading of the disease. • May reduce mefenoxam usage.	• Increased cost associated with purchase of treated seed. • May still require treatment.
2) Fungicides that are Possible Mefenoxam Alternatives or that can be used in Rotation with Mefenoxam	**Possible Fungicide Alternatives that Apply to Foliar and Soil Applications**													
Active Ingredient Name (Product Trade Name and FRAC Code)	Azoxystrobin (Abound, FRAC 11)									✓ (In particular for Downy Mildew)	✓ (In particular for Leather Rot)		• Fungicide recommended as part of a rotational program with mefenoxam for resistance management and to reduce mefenoxam usage.	• Leaching potential (GUS = 2.60) greater than mefenoxam (GUS = 1.88).
	Captan (FRAC M4)									✓ (In particular for Downy Mildew)			• Fungicide recommended as part of a rotational program with mefenoxam for resistance management and to reduce mefenoxam usage. • Leaching potential (GUS = -0.16) lower than mefenoxam (GUS = 1.88).	
	Chlorothalonil (Bravo, FRAC M5)	✓	✓	✓	✓	✓	✓		✓	✓ (In particular for Downy Mildew)			• Leaching potential (GUS = 0.70) lower than mefenoxam (GUS = 1.88). • A protectant fungicide commonly used in rotation with mefenoxam and not as an alternative.	• As a protectant, the fungicide must be present on the vegetation before the disease becomes present and overall efficacy is contingent on contact with the fungus.
	Copper containing fungicides (several products, FRAC M1)	✓	✓	✓	✓		✓			✓ (In particular for Downy Mildew)	✓		• A protectant fungicide commonly used in rotation with mefenoxam and not as an alternative.	• As a protectant, the fungicide must be present on the vegetation before the disease becomes present and overall efficacy is contingent on contact with the fungus.
	Cyazofamid (Ranman, FRAC 21)	✓	✓	✓	✓	✓						✓ (In particular for Downy Mildew)	• Partially systemic fungicide to alternate with mefenoxam or to replace mefenoxam. • Reduces amount of mefenoxam use. • Reduced per acre cost relative to Ridomil Gold Bravo. • Leaching potential (GUS = 0.87) lower than mefenoxam (GUS = 1.88). • Mostly used for foliar purposes, but also used for root rot in carrot, leafy green, tuberous and corm vegetables.	• Can be used for late blight in tomato and potato, but are not as effective as mefenoxam against sensitive strains.
	Fluopicolide (Presidio, FRAC 43)	✓	✓		✓	✓							• Partially systemic fungicide to alternate with mefenoxam or to replace mefenoxam. • Reduces amount of mefenoxam use.	• Can be used for late blight in tomato and potato, but are not as effective as mefenoxam against sensitive strains. • Leaching potential (GUS = 3.63) greater than mefenoxam (GUS = 1.88).
	Mancozeb (Dithane, FRAC M3)			✓	✓		✓			✓ (In particular for Downy Mildew)			• Leaching potential (GUS = -1.0) lower than mefenoxam (GUS = 1.88). • A broad spectrum protectant fungicide commonly used in rotation with mefenoxam and not as an alternative.	• As a protectant, the fungicide must be present on the vegetation before the disease becomes present and overall efficacy is contingent on contact with the fungus.
	Phosphite fungicides or other labeled formulation (an example includes K-Phite, FRAC 33)	✓ (In particular for Pythium Leak)	✓	✓	✓	✓		✓	✓	✓ (In particular for Downy Mildew)	✓	✓ (In particular for Downy Mildew)	• These fungicides are increasingly being recommended for use in combination with the other alternative fungicides rather than in alternation. • Mix with mefenoxam for management of Pythium Leak with tomatoes. • Effective for management of Phytophthora crown rot on apples and stone fruit.	
	Propamocarb hydrochloride (Previcur Flex, FRAC code 28)	✓	✓	✓	✓		✓						• Partially systemic fungicide to alternate with mefenoxam or to replace mefenoxam. • Reduces amount of mefenoxam use. • Out of possible alternatives, Previcur Flex is the only one labeled for root rot.	• Can be used for late blight in tomato and potato, but are not as effective as mefenoxam against sensitive strains. • Leaching potential (GUS = 1.84) generally similar to mefenoxam leaching potential (GUS = 1.88).
	Pyraclostrobin and Boscalid (Pristine, FRAC 7 and 11)									✓ (In particular for Downy Mildew)		✓ (In particular for Downy Mildew)	• Fungicide recommended as part of a rotational program with mefenoxam for resistance management and to reduce mefenoxam usage. • Pyraclostrobin leaching potential (GUS =0.05) lower than mefenoxam (GUS = 1.88).	• Boscalid leaching potential (GUS = 2.56) greater than mefenoxam (GUS = 1.88).
	Possible Fungicide Alternatives that Apply to Foliar Applications													
	Cymoxanil (Curzate and/or Tanos, FRAC 27)	✓	✓	✓	✓							✓ (In particular for Downy Mildew)	• Partially systemic fungicide • Reduced per acre cost relative to Ridomil Gold Bravo. • Leaching potential (GUS = -0.37) lower than mefenoxam (GUS = 1.88).	• Can be used for late blight in tomato and potato, but are not as effective as mefenoxam against sensitive strains.
	Dimethomorph + Ametoctradin (Zampro, FRAC 40 + 45)	✓	✓	✓	✓	✓						✓ (In particular for Downy Mildew)	• Partially systemic fungicide • Reduced per acre cost relative to Ridomil Gold Bravo	• Can be used for late blight in tomato and potato, but are not as effective as mefenoxam against sensitive strains. • Leaching potential (GUS = 2.56) greater than mefenoxam (GUS = 1.88).
	Mandipropamid (Revus, FRAC 40)	✓	✓	✓	✓	✓				✓ (In particular for Downy Mildew)		✓ (In particular for Downy Mildew)	• Partially systemic fungicide • Reduced per acre cost relative to Ridomil Gold Bravo	• Can be used for late blight in tomato and potato, but are not as effective as mefenoxam against sensitive strains. • Leaching potential (GUS = 1.81) generally similar to mefenoxam leaching potential (GUS = 1.88).
	Zoxamide (Zing!, FRAC 22 + M5=chlorothalonil)		✓	✓	✓					✓ (In particular for Downy Mildew)			• Partially systemic fungicide • Reduced per acre cost relative to Ridomil Gold Bravo. • Leaching potential (GUS = 1.62) lower than mefenoxam (GUS = 1.88).	• Can be used for late blight in tomato and potato, but are not as effective as mefenoxam against sensitive strains.

	Options to Reduce or Increase Effectiveness of Mefenoxam Applications	Major Long Island Vegetable & Fruit Commodities											Advantages	Disadvantages
		Pepper	Tomato	Potato	Mixed Vegetables	Brassicas	Cucurbits	Apples	Stone Fruit	Grapes	Strawberries	Hops		
3) Non-Pesticide Cultural Management Practices	**Practices that Apply to both Foliar and Soil Applications**													
	Use of resistant plants/cultivars.	✓	✓				✓	✓			✓		• Plants less prone to disease will perform without as much fungicide input.	• Increased cost associated with purchase of cultivars. • Possibility of incomplete resistance. • Possibility for yield reduction.
	Removal/destruction of infected vegetation.	✓	✓	✓									• May reduce spread of disease and therefore reduce the amount of pesticide usage.	• Possible disposal costs.
	Improved crop management (pruning, leaf/shoot removal, etc.).									✓			Reduces overall risk of disease and improves efficiency of pesticide use.	• Additional labor costs.
	Use of biopesticides.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	• Not as a replacement for mefenoxam, but to supplement in order to reduce the amount of mefenoxam usage.	• Additional costs.
	Improve irrigation practices/develop an irrigation water management plan.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	• Reduced leaching of pesticides. • Reduced water costs. • Improved soil health. • Reduced risk associated with spread of disease.	• May require retrofitting irrigation system to ensure standardized application rates. • Requires monitoring of soil moisture, water holding capacity, crop condition, and weather conditions as well as application timing.
	Practices that Apply Mostly to Foliar Applications													
	Forecasting Models - Encourage use of weather information and pest models found on NEWA for timing of scouting and management applications http://newa.cornell.edu/.		✓ (In particular for Late Blight)	✓ (In particular for Late Blight)				✓	✓	✓ (In particular for Downy Mildew)	✓	✓	• Preventative management to allow for more efficient use of mefenoxam or other fungicides.	• May require training to apply forecast modeling.
	Use of certified seed.			✓									• Reduction in disease susceptibility and reduced need for pesticide usage.	• Increased cost associated with purchase of certified seed.
	Practices that Apply Mostly to Soil Applications													
	Implement sanitation practices to avoid introducing or spread of disease in greenhouse and between fields; clean and disinfect.	✓	✓	✓	✓	✓	✓						• Important IPM component for root disease prevention as fungicides do not protect sufficiently against Pythium and Phytophthora.	• Additional operating costs.
	Crop rotation.			✓ (In particular for Pythium leak)							✓		• May reduce presence of Pythium pathogens in soil leading to disease. • Reduced need for pesticide usage.	• Land area limitations. • Limited impact on some Oomycete pathogens that have broad host ranges.
	Use of raised beds.	✓	✓		✓	✓					✓		• Avoids conditions that lead to disease development. • Reduced need for pesticide usage.	• Increased material costs.
	Avoidance of planting in low lying areas.	✓	✓	✓ (In particular for Pythium leak)	✓	✓	✓	✓	✓	✓	✓	✓	• Reduction in disease susceptibility and reduced need for pesticide usage.	• May require operational expenses to improve drainage.
	Improvements to soil health and quality.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	• May reduce disease susceptibility and therefore reduce the amount of pesticide usage. • May reduce the overall leaching of pesticides from the soil column by increasing water holding capacity and cation exchange capacity. • May reduce off field transport by preventing soil erosion and encouraging water infiltration.	• Possible added cost associated with increasing the soil organic matter. • Is an alternate cropping system that may take time for growers to implement.
	Selection of planting sites with well drained soil.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	• Avoids conditions that lead to disease development. • Reduced need for pesticide usage.	• Land area limitations.

Summary of Possible Practices to Improve Mefenoxam Usage and Reduce or Eliminate Groundwater Contamination

Nursery, Greenhouse, Turf Uses with Soil Applications

Options to Reduce or Increase Effectiveness of Mefenoxam Applications		Floral, Nursery, and Turf Commodities with Soil Applications					Advantages	Disadvantages
		Greenhouse	Nursery	Turf - Sod Production	Turf - Golf Course	Landscapes		
1) Application Modifications	Rotation of mefenoxam with other fungicides with different modes of action.	✓	✓	✓	✓	✓	• Reduce potential for resistance buildup. • Has potential to significantly decrease amount of mefenoxam usage.	• May increase costs depending on fungicides that are used in rotational program.
	Limit to a maximum of two (2) annual applications or two (2) per crop cycle.	✓	✓	✓	✓	✓	• Reduce potential for resistance buildup. • Has potential to significantly decrease amount of mefenoxam usage.	• Greenhouse growers may grow several crops in series so the per crop option may be more appropriate.
	Improve calibration of application equipment	✓	✓	✓	✓	✓	• Improves delivery of mefonaxam and reduces volumes being applied. • Reduced cost if delivery is more efficient.	• Increased cost associated with improved application equipment.
2) Fungicides that are Possible Mefenoxam Alternatives or that can be used in Rotation with Mefenoxam Active Ingredient Name (Product Trade Name and FRAC Code)	Cyazofamid (Segway, FRAC 21)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)		• Alternative to rotate with mefenoxam for management of Pythium (propamocarb + cyazofamid or fluopicolide). • Leaching potential (GUS = 0.87) lower than mefenoxam (GUS = 1.88).	
	Dimethomorph (Stature, FRAC 40)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)		• Alternative to rotate with mefenoxam for management of Phytophthora	• Not effective for management of Pythium. • Leaching potential (GUS = 2.56) greater than mefenoxam (GUS = 1.88). • Same FRAC value (40) as mandipropamid.
	Etridiazole (Truban, Terrazole, Banrot FRAC 14)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)		• Alternative to rotate with mefenoxam for management of Pythium.	• Leaching potential (GUS = 2.0) slightly greater than mefenoxam (GUS = 1.88).
	Fluopicolide (Adorn, FRAC 43)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)		• Alternative to rotate with mefenoxam for management of Pythium (propamocarb + cyazofamid or fluopicolide) or to use in a tank mix (fluopicolide) for downy mildew.	• For downy mildew management, both fluopicolide and mefenoxam must be applied with another effective active ingredient. • Leaching potential (GUS = 3.63) greater than mefenoxam (GUS = 1.88).
	Fosetyl-Aluminum (Aliette, FRAC 33)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)		• Leaching potential (GUS = -2.7) lower than mefenoxam (GUS = 1.88).	
	Mandipropamid (Micora, FRAC 40)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)				• Partially systemic fungicide	• Leaching potential (GUS = 1.81) generally similar to mefenoxam leaching potential (GUS = 1.88). • Same FRAC value (40) as dimethomorph.
	Phosphite fungicides or other labeled formulation (an example includes Magellan, FRAC 33)	✓ (In particular for Downy Mildew & Phytophthora management)	✓ (In particular for Downy Mildew & Phytophthora management)	✓ (In particular for Pythium & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)		• Alternative for very good management of Pythium Blight and Root Rots on Golf Courses	• Not as effective as mefenoxam for management of Pythium in greenhouse/nursery applications unless pathogen is resistant to mefenoxam.
	Propamocarb hydrochloride (Previcur Flex FRAC code 28)			✓ (In particular for Pythium management with turf)	✓ (In particular for Pythium management with turf)		• Alternative to rotate with mefenoxam for management of Pythium (propamocarb + cyazofamid or fluopicolide)	• Leaching potential (GUS = 1.84) generally similar to mefenoxam leaching potential (GUS = 1.88).
	Strobilurins (an example includes Heritage and Compass 0, FRAC 11)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)			
3) Non-Pesticide Cultural Management Practices	Disinfestation practices to avoid introducing or spread of disease.	✓	✓	✓	✓	✓	• Important IPM component for root disease prevention as fungicides do not protect sufficiently against Pythium and Phytophthora.	• Additional operating costs.
	Use of well drained growing media.	✓	✓	✓ (soil)	✓ (soil)	✓ (If plants are in containers)	• Important IPM component for root disease prevention as fungicides do not protect sufficiently against Pythium and Phytophthora.	• Additional operating costs.
	Use of raised beds.	✓	✓			✓	• Less likely to create conditions leading to disease development thereby reducing need for mefenoxam.	• Increased material costs.
	Avoidance of planting in low lying areas.	✓	✓	✓		✓	• Reduction in disease susceptibility and reduced need for pesticide usage.	• May require operational expenses to improve drainage.
	Improve irrigation practices/develop an irrigation water management plan.	✓	✓	✓	✓	✓	• Reduced leaching of pesticides. • Reduced water costs. • Improved soil health. • Reduced spread of disease.	• May require retrofitting irrigation system to ensure standardized application rates. • Requires monitoring of soil moisture, water holding capacity, crop condition, and weather conditions as well as application timing.
	Adequate spacing of plants to promote air movement.	✓					• Minimizes conditions that may lead to disease development.	• Loss of production area with increased spacing.
	Improvements to soil health and quality.	✓	✓	✓	✓	✓	• May reduce disease susceptibility and therefore reduce the amount of pesticide usage. • May reduce the overall leaching of pesticides from the soil column by increasing water holding capacity and cation exchange capacity. • May reduce off field transport by preventing soil erosion and encouraging water infiltration.	• Possible added cost associated with increasing the soil organic matter. • Is an alternate cropping system that may take time for growers to implement.
	Use of biological techniques/biocontrols.	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)		• Not as a replacement for mefenoxam, but to supplement in order to reduce the amount of mefenoxam usage.	• Additional costs.
	Crop rotation.		✓				• May reduce pathogen occurrence thereby reducing the amount of fungicide usage.	• Land area limitations.
	Use of resistant plants/cultivars.	✓	✓			✓	• Plants less prone to disease will perform without as much fungicide input.	• Increased cost associated with purchase of cultivars. • Possibility of incomplete resistance. • Possibility that the resistant cultivars will be less saleable (less popular).

Summary of Possible Practices to Improve Mefenoxam Usage and Reduce or Eliminate Groundwater Contamination

Nursery, Greenhouse, Turf Uses with Foliar Applications

Options to Reduce or Increase Effectiveness of Mefenoxam Applications		Floral, Nursery, and Turf Commodities with Foliar Applications: Greenhouse	Nursery	Turf - Sod Production	Turf - Golf Course	Landscapes	Advantages	Disadvantages
1) Application Modifications	Rotation of mefenoxam with other fungicides with different modes of action.	✓	✓	✓	✓	✓	• Reduce potential for resistance buildup. • Has potential to significantly decrease amount of mefenoxam usage.	• May increase costs depending on fungicides that are used in rotational program.
	Limit to a maximum of two (2) annual applications or two (2) per crop cycle.	✓	✓	✓	✓	✓	• Reduce potential for resistance buildup. • Has potential to significantly decrease amount of mefenoxam usage.	• Greenhouse growers may grow several crops in series so the per crop option may be more appropriate.
	Improve calibration of application equipment	✓	✓	✓	✓	✓	• Improves delivery of mefonaxam and reduces volumes being applied. • Reduced cost if delivery is more efficient.	• Increased cost associated with improved application equipment.
2) Fungicides that are Possible Mefenoxam Alternatives or that can be used in Rotation with Mefenoxam Active Ingredient Name (Product Trade Name and FRAC Code)	Chlorothalonil (Bravo, Daconil, Echo 720, FRAC M5)	✓	✓	✓	✓			
	Copper containing fungicides (several products, FRAC M1)	✓	✓					
	Cyazofamid (Segway, FRAC 21)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)		• Alternative to rotate with mefenoxam for management of Pythium (propamocarb + cyazofamid or fluopicolide). • Leaching potential (GUS = 0.87) lower than mefenoxam (GUS = 1.88).	
	Dimethomorph (Stature, FRAC 40)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)		• Alternative to rotate with mefenoxam for management of Phytophthora	• Not effective for management of Pythium. • Leaching potential (GUS = 2.56) greater than mefenoxam (GUS = 1.88).
	Fluopicolide (Adorn, FRAC 43)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)		• Alternative to rotate with mefenoxam for management of Pythium (propamocarb + cyazofamid or fluopicolide) or to use in a tank mix (fluopicolide) for downy mildew.	• For downy mildew management, both fluopicolide and mefenoxam must be applied with another effective active ingredient. • Leaching potential (GUS = 3.63) greater than mefenoxam (GUS = 1.88).
	Fosetyl-Aluminum (Aliette, FRAC 33)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)	✓	• Leaching potential (GUS = -2.7) lower than mefenoxam (GUS = 1.88).	
	Mancozeb (Dithane, FRAC M3)	✓ (In particular for Downy Mildew management)	✓ (In particular for Downy Mildew management)	✓ (In particular for Downy Mildew management)	✓ (In particular for Downy Mildew management)		• Leaching potential (GUS = -1.0) lower than mefenoxam (GUS = 1.88).	
	Mandipropamid (Micora, FRAC 40)	✓ (In particular for Phytophthora & Downy Mildew management)	✓ (In particular for Phytophthora & Downy Mildew management)				• Partially systemic fungicide	• Leaching potential (GUS = 1.81) generally similar to mefenoxam leaching potential (GUS = 1.88).
	Phosphite fungicides or other labeled formulation (an example includes Magellan, FRAC 33)	✓ (In particular for Downy Mildew & Phytophthora management)	✓ (In particular for Downy Mildew & Phytophthora management)	✓ (In particular for Pythium & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)		• Alternative for very good management of Pythium Blight and Root Rots on Golf Courses	• Not as effective as mefenoxam for management of Pythium in greenhouse/nursery applications unless pathogen is resistant to mefenoxam.
	Propamocarb hydrochloride (Previcur Flex, Banol, FRAC code 28)			✓ (In particular for Pythium management with turf)	✓ (In particular for Pythium management with turf)		• Alternative to rotate with mefenoxam for management of Pythium (propamocarb + cyazofamid or fluopicolide)	• Leaching potential (GUS = 1.84) generally similar to mefenoxam leaching potential (GUS = 1.88).
	Strobilurins (an example includes Heritage, FRAC 11)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium, Phytophthora & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)	✓ (In particular for Pythium & Downy Mildew management)	✓		
3) Non-Pesticide Cultural Management Practices	Disinfestation practices to avoid introducing or spread of disease.	✓	✓	✓	✓	✓	• Important IPM component for root disease prevention as fungicides do not protect sufficiently against Pythium and Phytophthora.	• Additional operating costs.
	Avoidance of planting in low lying areas.	✓	✓	✓		✓	• Reduction in disease susceptibility and reduced need for pesticide usage.	• May require operational expenses to improve drainage.
	Improve irrigation practices/develop an irrigation water management plan.	✓	✓	✓	✓	✓	• Reduced leaching of pesticides. • Reduced water costs. • Improved soil health. • Reduced risk associated with spread of disease.	• May require retrofitting irrigation system to ensure standardized application rates. • Requires monitoring of soil moisture, water holding capacity, crop condition, and weather conditions as well as application timing.
	Use of biological techniques/biocontrols.	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)	✓ (In particular for Pythium management)		• Not as a replacement for mefenoxam, but to supplement in order to reduce the amount of mefenoxam usage.	• Additional costs.
	Crop rotation.		✓				• May reduce pathogen occurrence thereby reducing the amount of fungicide usage.	• Land area limitations.
	Use of resistant plants/cultivars.	✓	✓			✓	• Plants less prone to disease will perform without as much fungicide input.	• Increased cost associated with purchase of cultivars. • Possibility of incomplete resistance. • Possibility for yield reduction.

Attachment 6

Pesticide Use Profile for Metalaxyl (Mefenoxam) on Long Island – A Working Document

Prepared by Cornell Cooperative Extension of Suffolk County

Dated May 4, 2012

Pesticide Use Profile for Metalaxyl (Mefenoxam) on Long Island:

A Working Document

This information is provided at the request of the New York State Department of Environmental Conservation (NYSDEC) to inform decisions concerning future registration and use of this product on Long Island, NY. As part of a complex and dynamic issue, this paper should be used to further a dialogue with NYSDEC and other scientists and is not intended for use by the general public where more detailed information would be necessary. As a working document, it is expected this paper will be modified as additional information becomes available.

1. General use/need

Metalaxyl (N-(2,6-dimethylphenyl)-N-(methoxyacetyl) alanine methyl ester) and mefenoxam are in the acylalanine chemical group of the Phenylamide (PA) fungicides (FRAC Code 4). They have targeted activity for pathogens in the oomycete (water mold) group that includes *Pythium* spp. and *Phytophthora* spp., which rot roots, stems, leaves, and fruits, as well as downy mildews that blight foliage and defoliate plants. Their mode of action affects synthesis of nucleic acids and their target site is RNA polymerase I (Code A1). Metalaxyl is considered a slightly toxic compound, unlikely to cause reproductive effects (EXTOXNET 1996), and products generally bear the signal word CAUTION. It is reported to be practically nontoxic to birds and freshwater fish, and non-toxic to bees (EXTOXNET 1996).

Metalaxyl was registered for use in the USA in 1979. It was first used on Long Island in 1983. Metalaxyl is chemically similar to another fungicide, mefenoxam, which is used rather than metalaxyl in most products registered in NYS today. Metalaxyl is a racemic mixture containing equal amounts of the “R” and “S” enantiomers of the compound. The R-enantiomer is more active in controlling plant diseases than either the S-enantiomer or the combination of the two. Chemists eventually determined how to separate the enantiomers present in metalaxyl, and developed mefenoxam, which contains primarily the R-enantiomer. A synonym for mefenoxam is metalaxyl-M. With mefenoxam it was possible to reduce the amount of fungicide needed to control diseases. EPA designated mefenoxam as a “reduced risk” ingredient because of this net reduction of impact to the environment. Mefenoxam was originally registered by New York State in 1996. Following this registration, all soil and foliar applications of metalaxyl were cancelled, leaving only use as a seed treatment.

As one of the first systemic (redistributing within the plant) fungicides developed, and the first with activity for oomycetes, metalaxyl was part of the revolution in disease management made possible by this movement within the plant plus ability to provide some suppression of new infections. The other fungicides that were being used at the time were protectant, contact fungicides, which are only effective on pathogens that the spray comes in direct contact with before infection. Most notably, metalaxyl enabled unprecedented control of late blight, arguably the most destructive plant disease and the one that caused potato tubers to rot during the famous Irish Potato Famine in the mid-1800s. This disease continues to be an ever-present threat today.

The first use of metalaxyl on Long Island was in 1983 when an emergency exemption was granted to use it to manage late blight. After a few years of metalaxyl use in the USA, the pathogen (*Phytophthora infestans*) developed resistance to it. Metalaxyl and mefenoxam were rendered ineffective against *P. infestans* because this was a qualitative type of resistance (the pathogen was in some cases fully resistant) and this pathogen typically exists in clonal populations (thus entire populations were resistant).

Presently there are 38 products containing mefenoxam and 33 products containing metalaxyl as an ingredient registered for use in New York State. Two products with mefenoxam have been discontinued. All products with metalaxyl are seed treatments, which constitutes a very low quantity of fungicide use. In 2003, 2,732 pounds of mefenoxam were applied in New York State, increasing to 3,158 pounds in 2004 and 4,715 pounds in 2005. On average mefenoxam use amounted to less than 0.02% of New York State's annual pesticide use. The amount of mefenoxam used today on Long Island is substantially less than the maximum allowed on the labels because some diseases are not sufficiently important to warrant treatment, several other pathogens have developed resistance, and fungicides with this active ingredient are more costly than other systemic fungicides developed subsequently.

Based on acreage on Long Island planted to vegetable crops, this is the largest potential use of metalaxyl and mefenoxam. Growers of turf and ornamentals in greenhouses and nurseries have also used metalaxyl and mefenoxam to protect crops against root and crown rot diseases in the past, and currently mefenoxam is used for control of both downy mildew (a foliage disease) and root and crown rots. Metalaxyl and mefenoxam have also been used to a limited extent in landscapes; only mefenoxam products are registered for this use today.

2. <u>Crops/landscape applications</u>

Vegetable and fruit crops

In NYS today, metalaxyl is only registered for use as a seed treatment. It is labeled to control systemic downy mildew, Pythium seed rot, Pythium damping-off, and early season Phytophthora diseases of certain crops. Labeled vegetable crops are beet, carrot, cucumber, spinach, and pod vegetables (peas and beans) for Pythium damping-off. Growers on Long Island are purchasing seed already treated with fungicides rather than making this application themselves. Thiram is the most common fungicide used to treat seed by seed companies.

Fungicides containing mefenoxam are registered for use on most vegetable crops; however, these products are used predominantly on only two crops, pepper and potato. Phytophthora blight is the target disease for mefenoxam use in pepper. There are formulations to apply to soil and formulations to apply to foliage. Due to its excellent systemic activity, uptake by roots results in good distribution of mefenoxam throughout the plant and thus good control. Potato crops are treated with mefenoxam at planting for pink rot and Pythium leak. This application is made at planting in-furrow, which is a lower use pattern (quantity of mefenoxam per acre of crop) than a foliar application. Up to two additional applications to foliage can be made at flowering and two weeks later. Utility of mefenoxam for pink rot has been affected by the pathogen developing resistance. Mefenoxam is also a component of the new FarMore™ Technology seed treatment which is being used on cucurbit seed to protect crops from damping-off and Phytophthora blight starting early in the season.

Occasionally there may be an important need for mefenoxam to manage late blight in tomato and potato on Long Island. It continues to be the most effective fungicide for sensitive strains of this very destructive disease. Some strains of the pathogen that have recently caused tomato crop losses throughout the eastern USA are sensitive to mefenoxam. Procedures have been developed to rapidly (24-48 hrs) determine the sensitivity of the pathogen from a diseased plant sample. One of the worst outbreaks of late blight on Long Island occurred in 2011. Tomatoes as well as potatoes were affected. Impact on conventionally managed crops was minimized because the responsible strain of the pathogen (US-23) was determined to be sensitive to mefenoxam, thus growers were able to obtain control with Ridomil fungicides. A major outbreak in 2009 was also caused by a mefenoxam-sensitive pathogen strain (US-22), but since the sensitivity to mefenoxam was not determined quickly, growers were not able to utilize this information to adjust their fungicide programs.

Mefenoxam is registered for use on many fruit crops including apples, peaches, strawberries, brambles and grapes. It is primarily used to manage Phytophthora root rot and crown rot and downy mildew. Although infrequently used on Long Island for the control of these diseases, mefenoxam is particularly active on these diseases and used especially when the weather is ideal for the development of the fungus. For control of downy mildew in grapes, no more than two applications of mefenoxam per season are recommended, for the purpose of resistance management.

Floral, nursery and turf crops

New York is the sixth largest producer of greenhouse flower crops in the nation, and at least half of these are produced on Long Island. The Long Island nursery industry is also a major contributor to the agricultural value of Suffolk County. All floral and nursery crops (particularly greenhouse crops of poinsettias and geraniums) are susceptible to root rots caused by *Pythium*, and many greenhouse and nursery crops (particularly rhododendrons, azaleas, boxwoods, pansies, chrysanthemums) are especially sensitive to stem rots and wilts due to *Phytophthora* species. The popular bedding plant impatiens has recently come under attack by an invasive downy mildew disease that caused entire beds of impatiens to collapse across Long Island in late summer of 2011. Mefenoxam fungicides, in rotation with other active ingredients, can help to halt the spread of this disease. Other key ornamentals threatened by downy mildew diseases include roses, snapdragons, sunflowers, and coleus.

Metalaxyl was used by the ornamentals industry for drench applications (those made directly to the root zone) to nursery and greenhouse stock until mefenoxam became available in 1996. Changes to the mefenoxam label in recent years have allowed the application of the material as a spray, which many growers prefer to a drench because of its easier application. Current ornamentals usage is as either a spray or a drench, in both nursery and greenhouse. Resistance to mefenoxam has been documented in *Pythium* diagnostic clinic isolates from Long Island greenhouses for decades, so growers are careful to rotate among active ingredients and not rely overmuch on mefenoxam.

Mefenoxam is used on turf for control of Pythium. The product is used on many golf courses especially during the hottest time of the year when the turf is most susceptible to Pythium. Mefenoxam use is limited in sod production but is a very important management tool when, infrequently, Pythium becomes a problem in sod.

3. <u>Alternatives – pesticide and non-pesticide practices</u>

Vegetable and fruit crops

Fungicides containing mefenoxam are being used by growers as a component of integrated pest management programs. Growers use cultural practices to avoid the pathogens (e.g. crop rotation and certified potato seed) and to minimize favorable conditions (e.g. using raised beds for peppers and avoiding planting in low areas). Growers are using other systemic, targeted fungicides in alternation with or in place of mefenoxam. Several systemic fungicides targeting the same type of pathogens as mefenoxam are now registered in New York State. Most are in different chemical groups as indicated by FRAC Code. They are: propamocarb hydrochloride (in the formulated product Previcur Flex; FRAC Code 28), cyazofamid (Ranman; 21), fluopicolide (Presidio; 43), mandipropamid (Revus; 40), dimethomorph (Forum; 40), cymoxanil (Curzate and Tanos; 27), and zoxamide (Gavel; 22). Most of these products are effective and labeled for late blight in tomato and potato; however, none are as effective as mefenoxam against pathogen strains sensitive to this chemistry.

For the control of Phytophthora crown rot (collar rot) on apples and stone fruit growers can control this disease with phosphite fungicides and cultural practices.

Strawberry growers manage Phytophthora root rot (red stele) with the use of resistant cultivars, raised beds and fungicides. Resistant varieties are not resistant to all the races of the red stele fungus, so the disease could still develop if a race to which they are not resistant is present. Mefenoxam is a critical component of the management program. The phosphite products, including fosetyl-Al, and *Streptomyces lydicus* will provide some control of this disease but are not as effective as mefenoxam.

Several products, including Abound, Captan, Sovran, Phostol, Pristine, Revus, and Gavel, are labeled for use on grapes for downy mildew control. These products are recommended as part of a rotational program with mefenoxam. The use of mefenoxam, an extremely active fungicide for this disease, is an especially useful management tool in wet years such as 2011.

Floral, nursery and turf crops

Mefenoxam was once the only root rot protection used in some nursery and greenhouse facilities when the first products containing it were introduced. Today, this active ingredient is used in rotation with other materials that protect against root rot, in order to guard against the development of resistance in the target pathogens. For Pythium management, the other most effective active ingredients used as rotational partners with mefenoxam are etridiazole (in the formulated products Truban, Terrazole, Banrot; FRAC Code 14) and cyazofamid (Segway; 21). For Phytophthora management, the other most effective active ingredients include dimethomorph (Stature; 40), strobilurins [trifloxystrobin (Compass 0; 11), azoxystrobin

(Heritage; 11), pyraclostrobin (Insignia; 11) and pyraclostrobin + boscalid (Pageant; 11)], phosphonates [fosetyl-Al (Aliette, Avalon and Flanker; 33)] and mono- and di-potassium salts of phosphorous acid (Alude, Fosphite, Vital, KPhite, and Rampart; 33)], and fluopicolide (Adorn; 43). Biological controls containing the active ingredients *Bacillus subtilis* (Cease; 44, Companion), *Streptomyces lydicus*, and *Trichoderma harzianum* (RootShield, PlantShield) are also rotational partners for mefenoxam, with better protective effect against Pythium diseases than Phytophthora diseases. Rotations are also required for foliar applications against downy mildew, where materials rotated with mefenoxam would include strobilurins (FRAC Code11), mancozeb (Protect, Dithane; M3), fosetyl-Al, mono- and di-potassium salts of phosphorous acid (33), dimethomorph (40) and fluopicolide (43). Mefenoxam, dimethomorph and mancozeb are the most reliable of these active ingredients for downy mildew control. Biological control materials containing the active ingredients *Bacillus subtilis* (Cease, FRAC Code 44 and Companion) and *Streptomyces lydicus* (Actinovate) are labeled for use against downy mildew but have not been demonstrated to be effective. Integrated pest management is essential for root disease prevention; fungicides alone do not protect sufficiently against Pythium and Phytophthora diseases. Growers of ornamentals also employ careful sanitation practices and use well-drained soilless growing media. Nursery beds are crowned to allow good drainage from plant containers, and weed mats are porous to avoid puddling around containers. Cultural control of downy mildews is more difficult, so disease-resistant varieties are sought. Leaving adequate space between plants for good air movement and timing irrigation to keep plant surfaces as dry as possible are the other important strategies.

There are several alternatives to mefenoxam for control of Pythium in turf. For Pythium management, the other most effective active ingredients are etridiazole (Truban, FRAC Code 14), phosphites (Magellan, 33) propamocarb (Banol, 14) fosetyl-aluminum (Aliette, 33) and cyazofamid (Segway; 21). Cultural controls for *Pythium* include proper drainage and good air circulation. On golf courses, phosphite products have provided very effective control of Pythium blight and root rots.

4. <u>Crops with no/limited alternative</u>

Vegetable and fruit crops

Current uses of mefenoxam on Long Island are important for disease management. There are no alternatives for Pythium leak in potato. Cyazofamid is labeled for pink rot in potato; however, growers often need to manage Pythium leak as well. There are several systemic fungicides with targeted activity for *Phytophthora* species that are labeled for control of late blight and Phytophthora blight; however, these alternatives are not as effective against sensitive strains of the causal pathogens. Resistance in some strains of these pathogens limits the utility of mefenoxam.

Floral, nursery and turf crops

At this time there are no diseases of ornamentals for which mefenoxam is the only chemical control measure available. With its ability to protect effectively against very serious diseases, its unusually low application rate (0.125-1.25 oz/100 gal), its safety to plants, its long reapplication interval, and its low toxicity to birds, fish, bees and mammals, mefenoxam is often the best choice for treatment. However, no producer of crops can work with just a single active ingredient for management of any disease: rotations are important for resistance management Mefenoxam remains an important tool for those needing to grow crops such as geraniums, poinsettias, and rhododendrons that are very prone to root rot. It is even more critical as a treatment in rotation for control of downy mildew on many different crops, because the pathogens that cause these diseases, like the late blight pathogen, are very quick to develop resistance to any systemic fungicide that is applied intensively.

5. <u>Suggested label changes/modifications</u>

Vegetable and fruit crops

No changes are suggested for labels because current product use is low. Current use is very low for metalaxyl because only fungicides used as seed treatments are registered. The quantity of metalaxyl applied per acre of crop when used as a seed treatment is substantially lower than when applied by broadcast to foliage. Growers on Long Island are not using these products themselves. It is possible that some seed for sale at the national level could be pre-treated with metalaxyl; however, mefenoxam is more commonly used. Mefenoxam is in the new FarMore™ Technology.

The amount of mefenoxam used today on Long Island is substantially less than the maximum allowed on the labels because some diseases are not sufficiently important to warrant treatment, several other pathogens are no longer controllable with mefenoxam because they have developed complete resistance, and fungicides with this active ingredient are more costly than other mobile fungicides developed subsequently.

Label changes that have already been made by the manufacturer have reduced allowable use, primarily to aid in resistance management. Consequently, for example, to manage late blight, growers today can only apply products with mefenoxam formulated for use on foliage three times to a crop. Growers who also use other formulations (e.g. mefenoxam applied in-furrow for other potato diseases) can use a maximum of 0.4 lb. a.i./acre/year.

The amount of phenylamide (metalaxyl/mefenoxam) fungicides applied to vegetable and fruit crops on Long Island today is substantially less than in the past for several reasons: 1) metalaxyl use is now limited to seed treatments, 2) mefenoxam used in place of metalaxyl is applied at less than half the amount of active ingredient, 3) label restrictions for resistance management limit use, 4) several pathogens have developed resistance and thus are no longer controllable with these fungicides, 5) other systemic fungicides with targeted activity for the same type of pathogens as mefenoxam fungicides are now available plus they have a lower cost, and 6) acreage planted to vegetable crops, in particular potato, has declined.

Floral, nursery and turf crops

Metalaxyl is no longer needed for floral and nursery crop production; it has been replaced by mefenoxam, which is used at half the application rate recommended for metalaxyl. Mefenoxam is still a critical tool for ornamentals and turf production. Several of the items described for vegetables above apply to ornamental uses of mefenoxam as well: label restrictions for resistance management limit use, many *Pythium* strains have developed resistance and thus are no longer controllable with mefenoxam, other systemic fungicides with targeted activity for the same type of pathogens as mefenoxam fungicides are now available so that mefenoxam is always being applied in rotation rather than repeatedly, in the course of good resistance management.

All crops

As mentioned above, label restrictions for resistance management on many crops limit use and for the same reason many crop guidelines recommend reduction in the number of applications per season. We'd suggest limiting the number of applications to no more than three applications per season.

6. Potential impact if metalaxyl/mefenoxam is prohibited from use on LI

Mefenoxam continues to be the most effective fungicide for sensitive pathogen strains. During periods of high disease pressure there is a possibility of negative economic impact if mefenoxam is not available, as there might be crop loss from ineffective control with other fungicides. Lack of mefenoxam as a rotational product for managing resistance development to other fungicides is also a concern and loss of their efficacy due to resistance will increase the need for mefenoxam.

For vegetables, major impact would be the loss of the most effective tool for two very destructive diseases of important crops on Long Island: Phytophthora blight in pepper and late blight caused by mefenoxam-sensitive pathogens strains in tomato and potato. Management of these diseases would not be as effective without mefenoxam resulting in economic losses.

For fruit crops, the loss of mefenoxam would significantly reduce the ability of growers to manage Phytophthora root rot (red stele) in strawberries and downy mildew in grapes.

In floral, nursery and sod crops, loss of mefenoxam would remove an effective fungicide from the rotational programs for control of Pythium root rots, Phytophthora stem cankers and downy mildew diseases, thus increasing the potential for resistance development in the target pathogens. Over a typical three-month period, several additional applications of alternative materials for Phytophthora control would be made, as mefenoxam has a one- to three-month retreatment interval whereas other materials are applied on a 14- or 28-day interval. Use of etridiazole and cyazofamid for Pythium control would increase. Production costs would increase for many floral, nursery and sod crops.

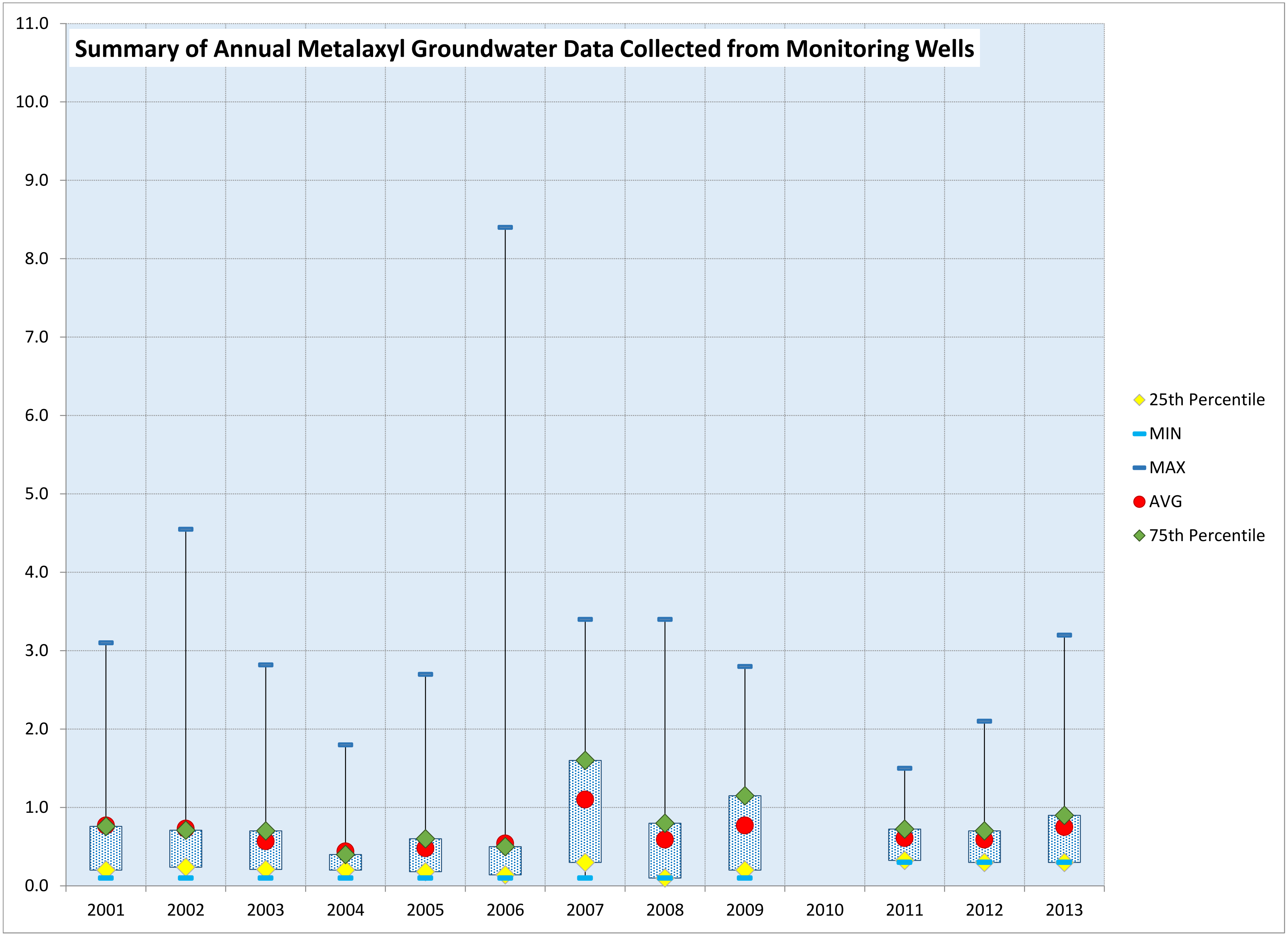
Prepared by Department of Plant Pathology and Plant-Microbe Biology, Cornell University staff at Long Island Horticultural Research & Extension Center and Cornell Cooperative Extension of Suffolk County staff

May 4, 2012

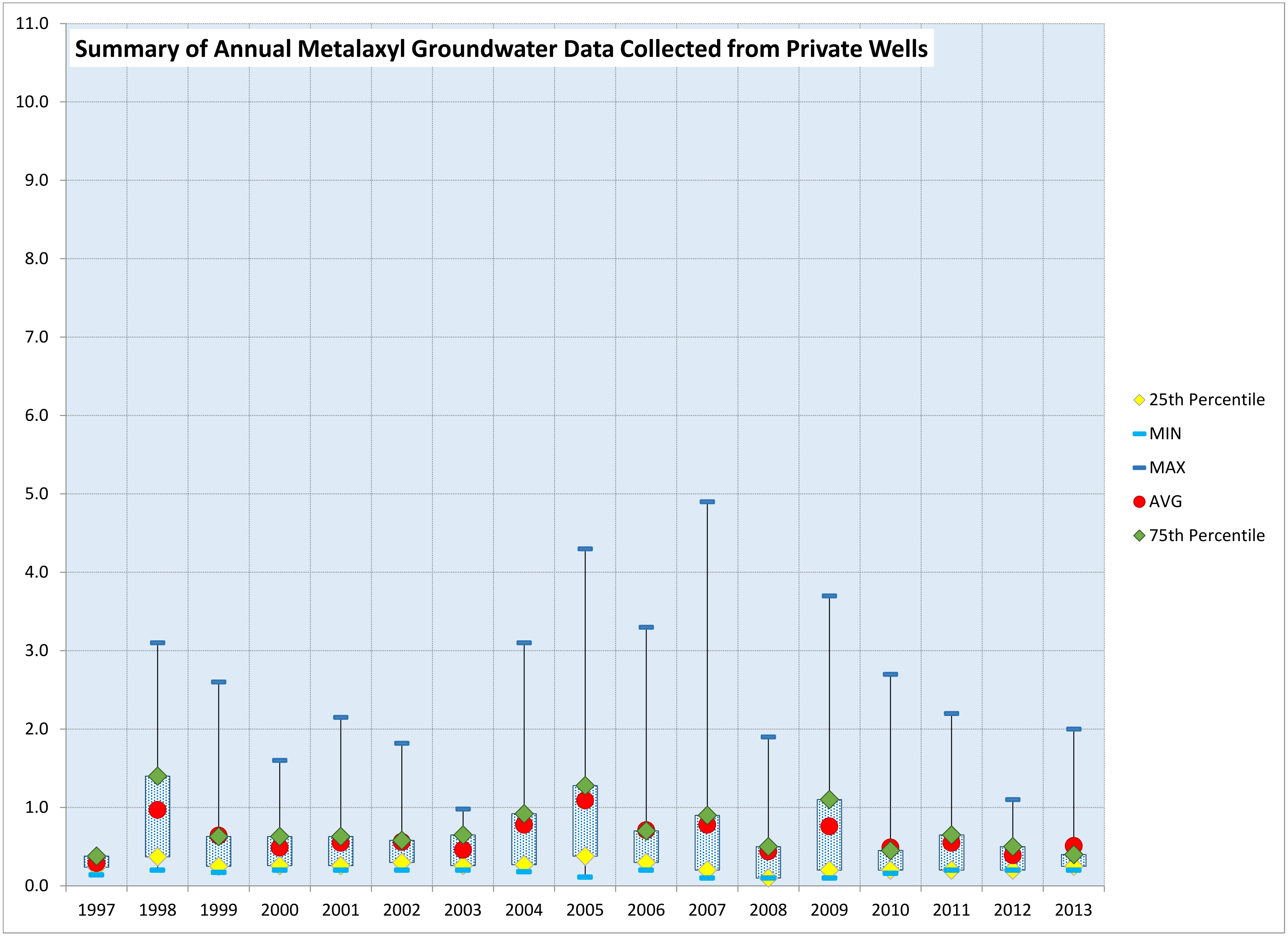
Attachment 7

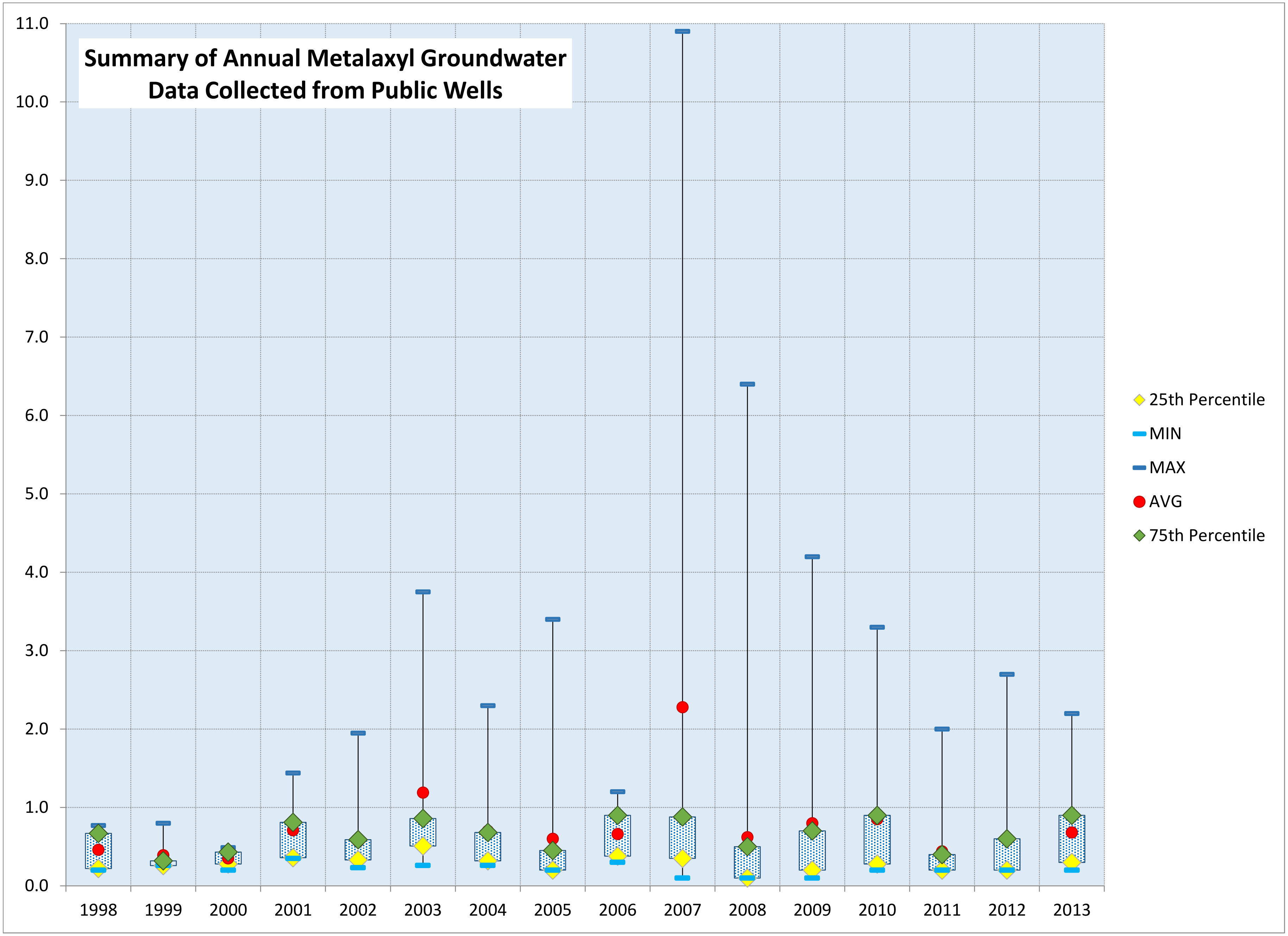
Graphical Summary of Metalaxyl Groundwater Data

- Summary of Annual Metalaxyl Groundwater Data Collected from Monitoring Wells
- Summary of Annual Metalaxyl Groundwater Data Collected from Private Wells
- Summary of Annual Metalaxyl Groundwater Data Collected from Public Wells



Summary of Annual Metalaxyl Groundwater Data Collected from Monitoring Wells
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
25th Percentile
MIN
MAX
AVG
75th Percentile


Summary of Annual Metalaxyl Groundwater Data Collected from Private Wells
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
25th Percentile
MIN
MAX
AVG
75th Percentile



Summary of Annual Metalaxyl Groundwater Data Collected from Public Wells
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
25th Percentile
MIN
MAX
AVG
75th Percentile