Active Ingredient Data Package

Imidacloprid

Version #4 (May 20, 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 - Imidacloprid

1.1 Pesticide Type

Imidacloprid is a type of systemic insecticide that works by ingestion and on contact against many kinds of sucking insect pests (aphids, whiteflies, etc.), some beetles (Colorado potato, viburnum leaf), and several other kinds of insects. Imidacloprid is a type of chloro-neonicotinoid.

1.2 Primary Pesticide Uses

Imidacloprid has wide uses in commercial agriculture, horticulture, home garden and other applications as a foliar spray, soil treatment, seed treatment, tree trunk injection and in various specialized delivery systems. It is the only available effective product for control of boxwood and holly leafminers. It is also very effective in controlling white grubs in turf. Numerous imidacloprid products are also registered for flea control on domestic animals, as well as various indoor pest control products. Imidacloprid is the active ingredient in 335 products registered for use in New York State. Of these 335 total products, 252 are allowed for use on Long Island. The use of imidacloprid for soil injections however is prohibited on Long Island.

1.3 Registration History

- 1994 – Imidacloprid first registered by the EPA.
- 1995 - Professional use registered in NYS (five new pesticides) – With condition of groundwater monitoring studies to be conducted (see Attachment 1 for NYS registration decision letter).
- 1996 - Consumer turf use registered in NYS.
- 2003 – Bayer, Cornell University, and NYSDEC developed four (4) Best Management Practices for imidacloprid.
- 2005 – Commercial and agricultural uses classified as NYS Restricted Use and homeowner labels amended to prohibit use on Long Island.
- 2006 – Bayer's patent on imidacloprid expired and many generic products entered the market.
- 2014 – EPA requires new pollinator language to be added to labels of neonicotinoid products including imidacloprid.

1.4 Environmental Fate Properties

Listed below are some of the environmental fate properties of imidacloprid:

Active Ingredient	Koc (g/ml)	Half-Life (days)	Aqueous Solubility (ppm)
Imidacloprid	132-310	48-190 (in soil) 31 (in water)	~600

Because of imidacloprid's environmental fate properties, it is generally expected to have a high potential for leaching from the soil column and contaminating groundwater. According to the University of Hertfordshire Pesticide Product Database, imidacloprid has a groundwater ubiquity score (GUS) of 3.76 and is classified as having a high leachability. The GUS provides a general indication of hazard only. It is based on the physical and chemical properties of the chemical and takes no account of the local environmental conditions, the field application rate, application timing or formulation (http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/397.htm#none). The table below lists leaching potential based upon groundwater ubiquity scores:

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 following compounds are imidacloprid breakdown products that form as the parent degrades in a soil medium. Groundwater ubiquity scores were not available.

- 1-[(6-chloro-3-pyridinyl)methyl]N-nitro-1H-imidazol-2-amine
- 6-chloronicotinic acid
- Imidacloprid Urea

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 Strategy. These standards have been used all along as our 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.

The table below summarizes the standards, criteria and guidance for imidacloprid. 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. 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

[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.

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	NYSDEC NYCRR Part 703.5	NYSDEC DOW TOGS 1.1.1	USEPA Human Health Benchmark
Imidacloprid	NF	50	NF	NF	399

NF: Value not found in the references.

2.0 Active Ingredient Usage Information

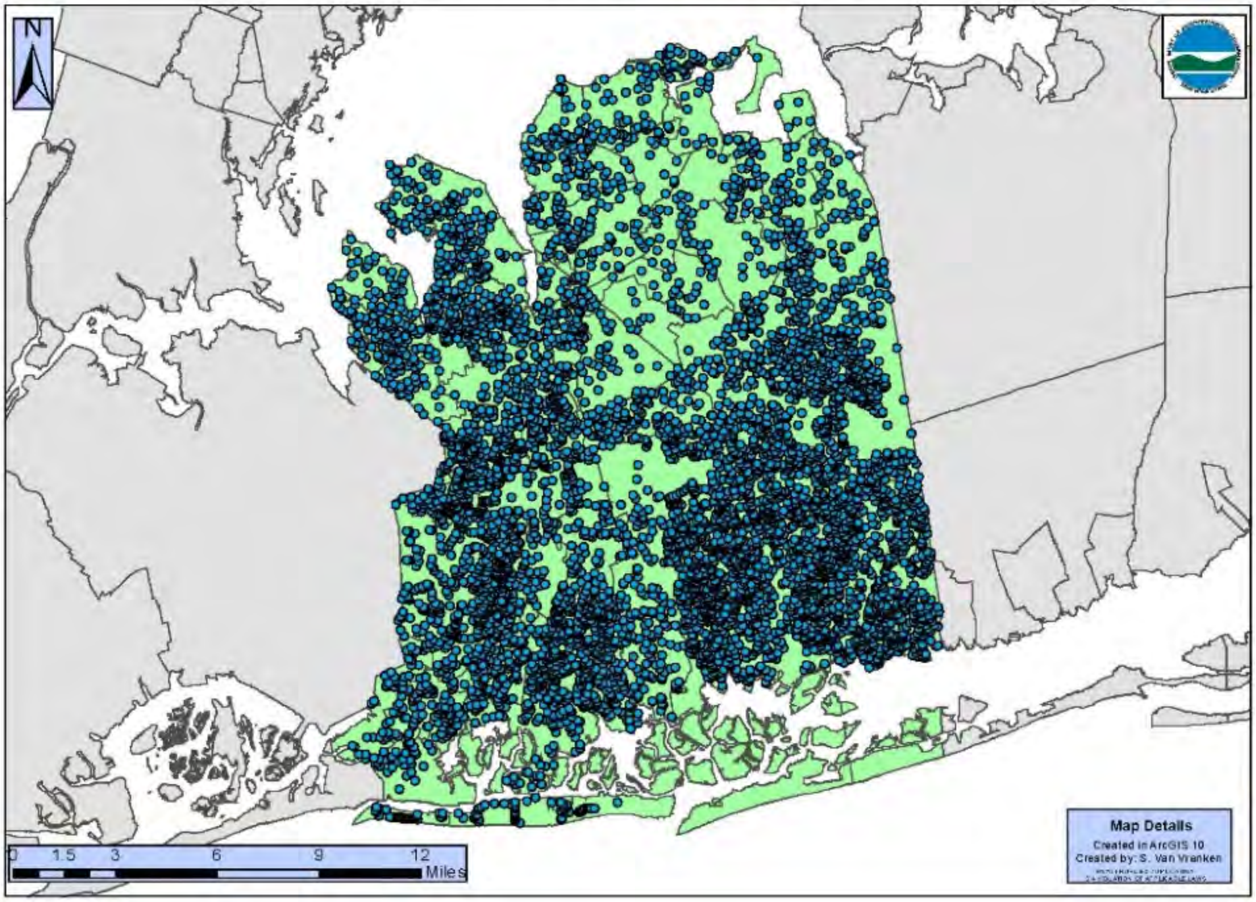
2.1 Amount of Active Ingredient Reported Use in New York State

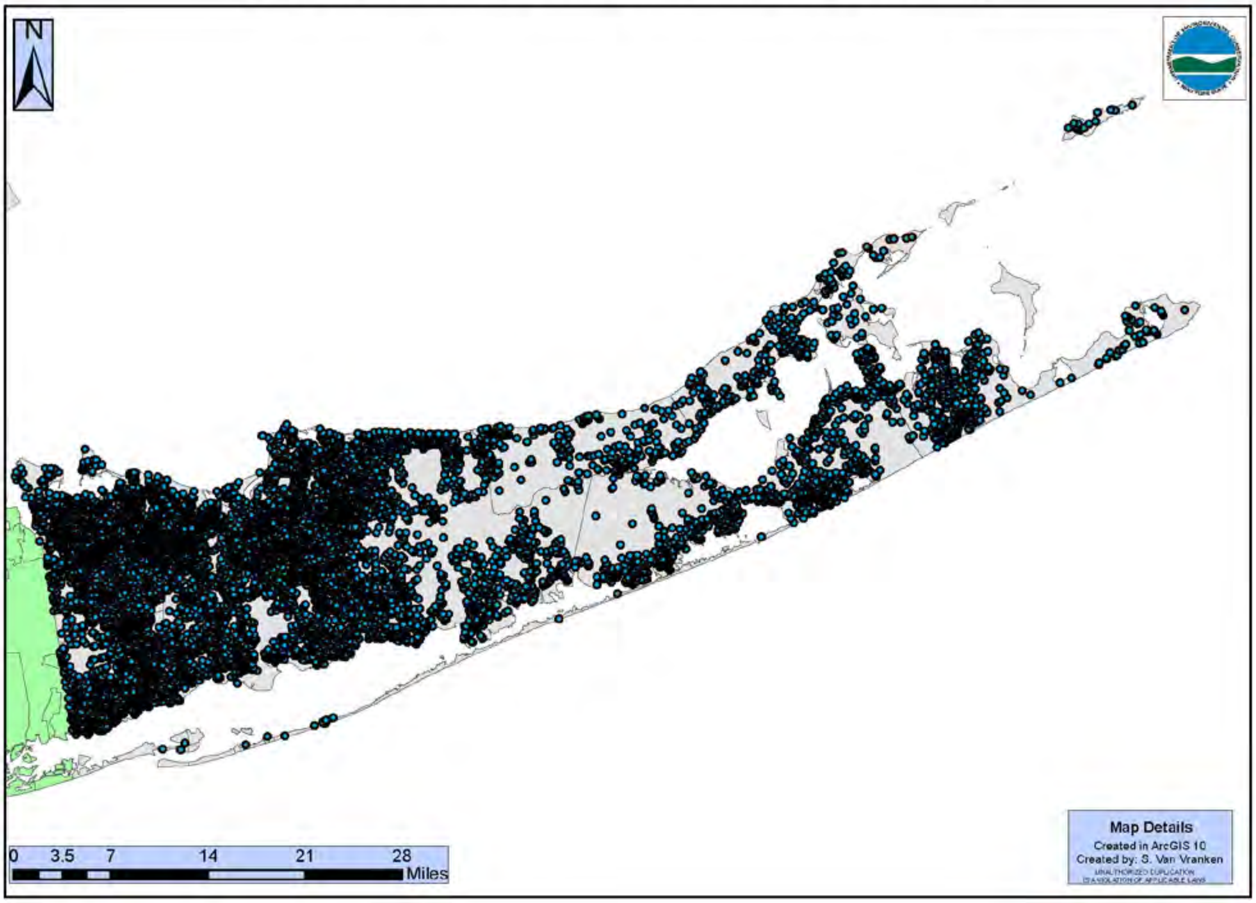
The table below lists the amount of imidacloprid applications reported in the Pesticide Annual Reporting Law every three years from 2003. As indicated in the table below, the amount of imidacloprid applications has increased since 2003.

	Annual Number of Reported Applications			
Active Ingredient	2003	2006	2009	2012
Imidacloprid	39,007	25,715	30,822	46,316

The figures included below, show the locations where imidacloprid was applied in Nassau and Suffolk Counties in 2012. Please refer to Attachment 2 for full page figures of imidacloprid applications from 2003-2012. Overall, the imidacloprid applications appear to be uniformly distributed throughout both counties.

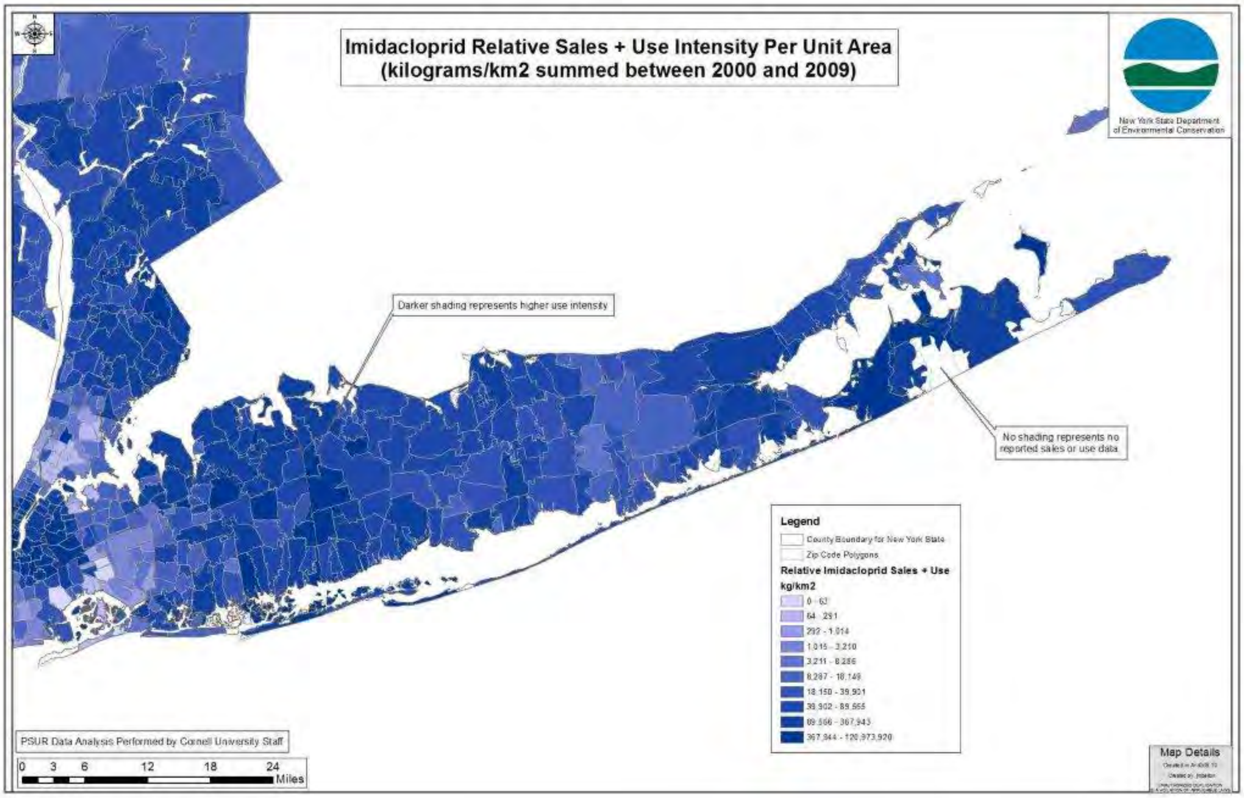
2012 NYSDEC Nassau County Imidacloprid Usage Locations





2012 NYSDEC Suffolk County Imidacloprid Usage Locations

To supplement the figures showing where the imidacloprid applications occurred for individual years, the following figure illustrates the relative imidacloprid 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 sales or use data was reported for that zip code. The figure below shows that imidacloprid is a commonly used pesticide throughout all of Long Island with no specific areas necessarily having a high or low use intensity.



2.2 Overall Number and Type of Products Containing the Active Ingredient

The table below summarizes the primary registrants that have products containing the active ingredient imidacloprid registered for use in New York State along with the total number of products for each registrant. In NYS, there are 37 primary registrants with a total of 335 registered products that contain the active ingredient imidacloprid. In total, 252 of the 335 products are labeled for continued use on Long Island. The table below summarizes the registrant and product details:

Primary Registrants with Products Containing Imidacloprid (129099) as the Active Ingredient		EPA Company Number	Total Number of Products	# of Products Allowed for Use on LI
1	AEROXON, INC.	43419	1	1
2	ALBAUGH INC. LLC	42750	13	11
3	AMTIDE LLC	83851	3	3
4	ANDERSONS LAWN FERTILIZER DIVISION, INC,	9198	2	2
5	ARBORJET, INC.	74578	3	3
6	ARBORSYSTEMS, LLC	69117	2	1
7	ARCH TREATMENT TECHNOLOGIES, INC.	75506	1	1
8	BAYER ADVANCED	72155	21	1
9	BAYER CROPSCIENCE LP	264	19	19
10	BAYER ENVIRONMENTAL SCIENCE	432	75	72
11	BAYER HEALTHCARE, LLC	11556	35	35
12	CHEMINOVA, INC.	67760	3	3
13	CLEARY CHEMICAL	1001	1	1
14	CONTROL SOLUTIONS, INC.	53883	19	3
15	ENSYSTEX III, INC.	82957	1	1
16	ENSYSTEX IV, INC.	83923	2	2
17	FMC CORP, AG PRODUCTS GROUP	279	5	5
18	HELENA CHEMICAL CO.	5905	1	1
19	J.J. MAUGET CO.	7946	3	3

	Primary registrants with products Containing Imidacloprid (129099) as the Active Ingredient	EPA Company Number	Total Number of Products	# of Products Allowed for Use on LI
20	LANXESS CORP.	39967	2	2
21	LOVELAND PRODUCTS, INC.	34704	11	11
22	MAKHTESHIM AGAN OF N. AMERICA	66222	9	9
23	MCLAUGHLIN GORMLEY KING, CO.	1021	4	4
24	NUFARM AMERICAS, INC.	228	63	28
25	ORTHOGROUP	239	1	0
26	PBI-GORDON CORP.	2217	4	0
27	PHOENIX ENVIRONMENTAL CARE, LLC.	81943	2	2
28	PRIME SOURCE, LLC	89442	1	1
29	RAINBOW TREECARE SCIENTIFIC ADVANCEMENTS	74779	2	2
30	ROCKWELL LABS, LTD	73079	2	2
31	ROTAM AGROCHEMICAL CO. LTD.	83100	6	6
32	SCIMETRICS LTD. CORP.	75200	4	4
33	THE SCOTTS CO.	538	1	0
34	SHARDA USA, LLC	83529	3	3
35	UNITED PHOSPHOROUS, INC.	70506	5	5
36	WILLOWOOD, LLC	87290	2	2
37	WINFIELD SOLUTIONS, LLC	1381	3	3
		Total:	335	252

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

According to the Cornell Cooperative Extension of Suffolk County (CCESC) 2014 Pesticide Use Profile Report (Attachment 3), imidacloprid is one of the most commonly used insecticides for pests associated with agricultural production and landscape ornamentals. Though many uses of imidacloprid are shared or supplanted by alternative products, only a few continue to be of value on Long Island. In grapes, imidacloprid is one of only two modes of action for the root form of phylloxera (the pest that almost destroyed the French wine industry). In potatoes and in newly transplanted fruiting vegetables, soil application of imidacloprid remains at least partially effective for control of Colorado potato beetle. In outdoor nurseries (especially smaller nurseries), it is occasionally needed for curative control of oriental beetle as a media drench in container-plant production. In field nurseries and landscapes it is an important product for control of boxwood and holly leafminers, and the most effective, long-residual material for control of viburnum leaf beetle and Japanese beetle adults, when used as a soil application. Particularly for tall trees in landscapes or where sprays are impractical or can't be done due to drift or other issues it has been an important material for soil treatment to control hemlock woolly adelgid, aphids, lacebugs, soft scales and certain other pests. In greenhouses it is still used occasionally in greenhouse-grown vegetable transplants for aphids (spray usually), western flower thrips (spray, for suppression) and fungus gnat larvae (media drench). It is particularly valued for treating plants in hanging baskets early in production, where later overhead foliar sprays are difficult at best. Imidacloprid is very widely used by commercial applicators to control some pests in residential and commercial turfgrass areas, specifically white grubs such as oriental beetle; Dylox (trichlorfon) is the only alternative product available (and the only product for homeowner use on Long Island). Imidacloprid has been widely used in Asian longhorned beetle eradication programs including on Long Island (as a trunk injection only). Note that loss of imidacloprid for some uses, particularly systemic (soil) applications, may result in increased use of or dependence upon other products (including spray applications), such as trichlorfon for white grub control in turfgrass.

The following sections are based on the September 2014 Cornell Cooperative Extension of Suffolk County Use Profile for Imidacloprid on Long Island (Attachment 3) and discuss the specific uses of imidacloprid for:

1) Agricultural Food Crops
2) Nursery and Greenhouse Ornamentals, Vegetable Transplants, and Greenhouse Food Crops
3) Landscape Ornamentals, Turf Grass, and Sod Farms

Agricultural Food Crops

There are very few comparable alternatives to the soil application of imidacloprid available to growers on Long Island. In particular, the soil application of imidacloprid is probably the most important for potato and cucurbit producers on Long Island. The following is a discussion of the primary crops where imidacloprid is used on Long Island and where alternatives are limited. Foliar and soil uses in other crops (e.g. strawberry, grape, herbs, hops, bulb vegetables, bushberry, caneberry) grown on Long Island are of relatively minor importance.

Potato Crops: The soil application at planting is important for the management of Colorado potato beetle, aphids (particularly melon aphid), and potato leafhopper. There is some resistance to imidacloprid in local Colorado potato beetle populations, but at-plant soil application is still practiced, remains at least partially effective for this insect, and provides substantial control of aphids and leafhoppers, both of which can be serious pests each year.

Cucurbits (squash, melon, cucumber, pumpkin): Soil application for management of cucumber beetle is occasionally used, particularly for pumpkin and some other cucurbits to protect young plants at emergence. The Infestation of cucumber beetles can be sudden and severe, especially during early plant growth. Soil or planthouse imidacloprid applications can be used for aphids but tend to be less important.

Brassica Leafy Vegetables (cabbage, broccoli, cauliflower, etc.): Soil application is rarely used on this crop; Admire Pro now has a 2(ee) label for soil application to control swede midge, a newer pest found on Long Island but so far uncommon. 2(ee) refers to limited uses that are not specifically stated on the final pesticide label. Examples include applications at a concentration or frequency less than specified on the labeling and application methods that are not prohibited on the labeling etc.

Fruiting Vegetables (tomato, eggplant, pepper): Soil application is occasionally used for management of Colorado potato beetle to protect newly set transplants (tomato, eggplant). This use was of particular importance to control Colorado potato beetle when potato acreages were higher on Long Island and when it was a more common pest. Colorado potato beetle does remain an occasionally serious pest on eggplant and tomato crops. Planthouse application for aphids is rarely necessary or done.

Leafy Vegetables (lettuce, spinach): Imidacloprid soil applications are rarely used on these leafy vegetable crops.

Nursery and Greenhouse Ornamentals, Vegetable Transplants, and Greenhouse Food Crops
Imidacloprid materials are occasionally used in nursery and greenhouse plant production for foliar application and soil (granular, drench formulations) treatment. Some of the most important uses include:

- Foliar applications for control of aphids in outdoor nurseries (field and container);
- Foliar applications for control of aphids and whiteflies in greenhouses;
- Soil or container media application for oriental beetle larvae (outdoor nursery), fungus gnat larvae (greenhouse and outdoor nursery) and root aphids (occasional in outdoor nurseries or indoor propagation); and

- Foliar, or infrequently field soil treatment, for boxwood leafminer (in nurseries) and flatheaded borers (occasional, bronze birch borer and twolined chestnut borer).

For greenhouse uses, imidacloprid provides nearly season-long control for long-term crops (poinsettia most notably) and a short re-entry interval for media treatment. The availability of imidacloprid has replaced repeat sprays using products with longer re-entry intervals and lower efficacy. There are only limited alternatives to the media or soil application of imidacloprid available for management of oriental beetle grubs, root aphids, whiteflies, hanging basket uses, flatheaded borers, and boxwood leafminer. Media applications of imidacloprid in greenhouse potted plants for whitefly control have decreased due to resistance development in one of the primary target insects (sweetpotato whitefly). Greenhouse whitefly was once common but is now an infrequent greenhouse pest and target of imidacloprid application. There are other pesticide alternatives that are effective for this species. Field soil application to nursery shrubs and trees is not common due to cost but is occasionally done. Applications to grassy areas in field and forest nurseries (a specific use site on labels) are very infrequent if done at all.

Greenhouse Floriculture Crops: Imidacloprid is used as foliar and media treatments for the management of whiteflies (greenhouse and sweetpotato primarily; alternatives have restrictions against application to flowering plants to be grown outdoors or issues with phytotoxicity), mealybugs (citrus, longtailed mainly), leafminers (blotch and serpentine, occasional), and aphids (green peach, melon, foxglove, and other species). Media application for fungus gnat larvae, foliar application for thrips (western flower thrips primarily – suppression or partial control).

Greenhouse-Grown Vegetable Transplants for Sale: Imidacloprid is used as a foliar and soil application for a wide variety of vegetable transplants to control aphids and as a foliar application for control of thrips (western flower thrips primarily – suppression or partial control), and for soil application to control fungus gnats. Imidacloprid is particularly valued for treating greenhouse plants in hanging baskets during early production rather than later in the growing season using overhead foliar sprays. Overhead foliar sprays tend to be difficult to apply.

Greenhouse Food Crops: Imidacloprid is labeled for control of whiteflies and aphids in greenhouse-grown tomatoes and cucumbers for soil application. Although there are relatively few alternatives, this is not a common imidacloprid use on Long Island.

Outdoor Nursery Container Stock: Imidacloprid is used as a media application for black vine weevil and oriental beetle (white grub) larvae, and for leafminers (boxwood, occasional use in nurseries), fungus gnat larvae, and root mealybugs. Media application is also used for the control of Japanese beetle adults on foliage and for flatheaded borers on woody plants (bronze birch, e.g.). Imidacloprid is applied foliarly for control of aphids, adelgids, leaf beetles (occasional), leafhoppers (potato mainly), lacebugs (andromeda, azalea), sawfly larvae, and boxwood leafminer.

Field-Grown Nursery Stock: For field-grown nursery crops, imidacloprid is applied foliarly for control of aphids, adelgids, leaf beetles, leafhoppers (potato), lacebugs (andromeda, azalea), sawfly larvae, boxwood leafminer. Soil applications are used for control of oriental beetle (white grub) larvae, flatheaded borers (bronze birch, twolined chestnut), and boxwood leafminer. Overall, in field nurseries imidacloprid is an important product for management of boxwood, and to a lesser degree holly leafminers. Imidacloprid provides the most effective long-residual control of viburnum leaf beetle and Japanese beetle adults when used as a soil application.

Landscape Ornamentals, Turfgrass and Sod Farms

Imidacloprid has been particularly valued for landscape applications and in some cases has replaced foliar sprays of organophosphate, carbamate and other pesticide products with a soil-applied material. Imidacloprid is effective for common ornamental pests such as Japanese beetle, soft scale insects, hemlock woolly adelgid, boxwood leafminer and lace bugs and with turfgrass pests such as white grubs. The availability of many of the older pesticide products have been lost through the re-registration process and the adoption of the Neighbor Notification law. In the Long Island counties, the Neighbor Notification law requires 48-hour prior notification of neighbors for many pesticides when applied as foliar sprays. In particular, the reduction in pesticide options has increased the interest in systemic products such as imidacloprid.

Imidacloprid formulations for landscape use include many granular materials (many on fertilizer) for control of pests in turfgrass and some for white grubs in landscape plants, tablet formulations for landscape shrubs and trees, trunk injections for landscape trees, and liquid or powder versions used as foliar sprays, trunk sprays (e.g. for hemlock woolly adelgid), or for soil application. Imidacloprid drench applications are permitted on Long Island, but imidacloprid soil injections are prohibited. For large trees, soil applications are important and preferred over foliar sprays due to drift concerns and the occasional difficulty in obtaining adequate coverage with sprays. Arborists also prefer soil application for larger trees and shrubs since this can be applied in the fall when there are fewer conflicting work demands.

Turf and Sod Farms: Imidacloprid is not widely used on sod farms since white grubs are not commonly a problem in sod production because time is needed for populations to move in and become established. In established residential and commercial lawns however, imidacloprid is widely used for control of white grubs (oriental beetle primarily, with other species also seen). The imidacloprid is typically applied in granular formulations using broadcast or drop spreaders and is often part of fertilizer-based formulations. For turf and sod farm uses, imidacloprid is rarely applied as a spray.

Landscape Shrubs and Trees: Some of the most important imidacloprid uses are for residential and commercial landscapes and include:

- A soil or occasionally trunk or foliar application for control of hemlock woolly adelgid,
- A soil application for control of boxwood and holly leafminer and some soft scale insects,

- A soil treatment to provide season-long control of Japanese beetle, some aphids (on large trees or particularly damaging species), lace bugs (e.g. andromeda, sycamore, azalea), flatheaded borers (bronze birch, twolined chestnut), and leaf-feeding beetles (e.g. viburnum leaf beetle – recent Long Island arrival); and
- A trunk injection as part of the USDA Asian Longhorned Beetle programs.

2.4 Availability of Alternatives

The following sections summarize possible options to maximize the use of imidacloprid while reducing or eliminating the amount that enters the subsurface. Section 2.4.1 presents practices or modifications to the way imidacloprid is currently applied, Section 2.4.2 summarizes a few of many possible alternative insecticides, and Section 2.4.3 presents non-pesticide alternatives that can be implemented. These options, along with the advantages and disadvantages associated with each, are further summarized in the tables included as Attachment 4. There are two separate tables included in Attachment 4 that summarize possible practices that apply to major Long Island fruit and vegetable commodities along with possible options for nursery, greenhouse, turf, and ornamental commodities.

2.4.1 Active Ingredient Application Modifications

There are possible modifications to the way imidacloprid is applied to potentially reduce the overall amount of imidacloprid usage. Some of these modifications are summarized below and will also be discussed in Section 5.

1) Reducing insecticide use by precision banded soil applications. This possible alternative is most applicable to vegetable crops and in particular for cucurbits. Evaluations suggest that this approach can provide a reduction up to 84.5% over conventional continuously banded applications;
2) Reducing overall application rates (soil and foliar). Some application improvements may be achieved particularly for soil application by restricting usage rates to the low end of the permitted range and to one application per season per crop regardless of whether the maximum per acre allowance is met;
3) As an approach to improve the delivery of imidacloprid, incorporate the insecticide into drip irrigation and/or chemigation, especially under plastic mulch after the crop has been established;
4) Application of imidacloprid by drop rather than broadcast spreaders for granular materials with runoff warning language added to the label;
5) Treat hot spots only or limit imidacloprid applications to perimeter trap crops;
6) Use of treated seed/seed piece treatment to possibly reduce the need for later imidacloprid applications;
7) Encourage use of imidacloprid only later in the season and not at-plant as a form of soil treatment;
8) Improved calibration of application equipment to minimize delivery of excessive insecticide;
9) Establish agricultural handling facility for mixing of chemicals to avoid loss of pesticide to the subsurface;

10) To reduce the occurrence of soil applications, transplants can be treated in flats;
11) Develop supplemental labels for soil applications; and
12) Establish an irrigation water management plan to optimize the timing of the application to avoid predicted storm/precipitation events and/or light irrigation.

2.4.2 Pesticide Alternatives

Listed in the table below, are possible products that can be used as an alternative to imidacloprid. The table below includes a summary of the Environmental Impact Quotient Field Use Ratings (EIQ FUR) for each of the possible alternative pesticides. The EIQ FUR is a value obtained from published environmental impact information that allows pesticide users to factor in possible environmental effects when comparing commonly used pesticides. The approach is described in a 1992 Cornell University publication titled *A Method to Measure the Environmental Impact of Pesticides*; 1992. The lower the EIQ FUR, the lower the overall estimated environmental impact.

Groundwater ubiquity scores for the respective pesticides are also included in the table below. With the exception of dinotefuron and trichlorfon, each of the active ingredients have groundwater ubiquity scores (GUS) that are below the imidacloprid GUS (3.76).

Included as a separate table (Attachment 5) is a summary of pollinator protection information that coincides with each of the possible pesticide alternatives listed below. With the recent attention that pollinator protection is receiving, this information is provided to allow for further comparisons when evaluating possible alternatives.

Product Name	Active Ingredient	Restricted Use Pesticide	Max. Field Use EIQ	Leaching Potential/GUS	Alternative Uses
TriStar 8.5SL[1], Assail 30SG[2]	Acetamiprid	Yes	3.9[1] 5.2[2]	Very Low/0.94	[1]Greenhouse Crops, Landscape shrubs and Trees, [2]Vegetable and Fruit Crops
Agri-Mek & Others	Abamectin	Yes	0.7	n/a	Vegetable and Fruit Crops and Landscape Shrubs and Trees
Orthene97	Acephate	Yes	24.2	Low/1.14	Vegetable and Fruit Crops, Greenhouse Crops, Landscape Shrubs and Trees
Azatin, Neemix, Aza-Direct, Others	Azadirachtin	No	0.5	Very Low/0.99	Vegetable and Fruit Crops
Botanigard	Beauveria Bassiana GHA	No	n/a	n/a	Greenhouse Crops
Carbaryl, Sevin	Carbaryl	No	156.4	Moderate/2.0	Vegetable and Fruit Crops
Lorsban 75WG	Chlorpyrifos	No	73.7	Very Low/0.15	Vegetable and Fruit Crops
Pylon	Chlorfenapyr	Yes	8	Extremely Low/0.01	Greenhouse Crops
Kryocide, Prokil	Cryolite	No	464.5	n/a	Vegetable and Fruit Crops
Mainspring	Cyantraniliprole	Yes	n/a	Moderate/2.63	Greenhouse and Interior Plantscape Crops
Citation	Cyromazine	No	2.3	Moderate/2.73	Greenhouse and Interior Plantscape Crops
Inject-a-Cide B	Dicrotophos	Yes	n/a	High/3.08	Landscape Shrubs and Trees

Product Name	Active Ingredient	Restricted Use Pesticide	Max. Field Use EIQ	Leaching Potential/GUS	Alternative Uses
Adept	Diflubenzuron	No	10.3	Very Low/0.16	Greenhouse Crops
Dimethoate	Dimethoate	Yes	29.1	Low/1.06	Vegetable and Fruit Crops
Safari	Dinotefuran	Yes	12	Very High/4.95	Greenhouse Crops, Landscape Shrubs and Trees
Tree-Age	Emamectin Benzoate	Yes	n/a	n/a	Landscape Shrubs and Trees
Super Tin	Fentin Hydroxide	Yes	14.6	Very Low/0.72	Vegetable and Fruit Crops
Akari	Fenpyroximate	No	2.9	Low/1.21	Greenhouse Crops
Beleaf	Flonicamid	No	1.2	Low/1.87	Vegetable and Fruit Crops
Avaunt	Indoxacarb	No	3.5	Very Low/0.23	Vegetable and Fruit Crops
Malathion	Malathion	No	97.3	Low/1.28	Vegetable and Fruit Crops
Met 52	Metarhizium Anisopliae Strain 52 Spores	No	n/a	n/a	Nursery (outdoor)
Mesurol	Methiocarb	Yes	66.2	Very Low/0.17	Greenhouse Crops
Rimon	Novaluron	Yes	3.3	Extremely Low/0.03	Vegetable and Fruit Crops
M-Pede	Potassium Laurate	No	n/a	n/a	Vegetable and Fruit Crops, Greenhouse Crops, Landscapes Shrubs and Trees
Preferal	Isaria Fumosorosea	No	n/a	n/a	Greenhouse Crops
Lannate	Methomyl	Yes	19.1	Moderate/2.2	Vegetable and Fruit Crops
Imidan	Phosmet	Yes	132.1	Very Low/0.24	Landscape Shrubs and Trees
Fulfill[1], Endeavor[2]	Pymetrozine	No	3.7[1]	Very Low/0.68	[1]Vegetable and Fruit Crops, [2]Landscape Shrubs and Trees
Baythroid XL, Brigade, Pounce, Others	Pyrethroids	Yes	Various	Various	Vegetable and Fruit Crops, Nursery (outdoor), Landscape Shrubs and Trees
Overture	Pyridalyl	No	n/a	Moderate/2.1	Greenhouse Crops
Esteem[1], Distance[2]	Pyriproxyfen	No	1.6[1] 2.5[2]	Very Low/0.33	[1]Vegetable and Fruit Crops, [2]Greenhouse Crops
Radiant	Spinetoram	No	2.4	Very Low/0.72	Vegetable and Fruit Crops
Entrust	Spinosad	No	2.2	Very Low/0.62	Vegetable and Fruit Crops
Judo	Spiromesifen	No	6.3	Very Low/0.3	Greenhouse Crops
Movento[1], Kontos[2]	Spirotetramat	No	4.9[1] 12.4[2]	Low/1.12	[1]Vegetable and Fruit Crops, [2]Greenhouse Crops
Dylox	Trichlorfon	No	163.4	High/3.77	Turf and Sod Farms

Note – Field Use EIQ values were calculated based on a single application rate

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 insecticides. 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 4 matrix

1) Crop rotation and/or intercropping may reduce pest pressure thereby reducing the amount of imidacloprid required for management of pests;
2) Trench trapping in the spring along field borders adjacent to overwintering sites. This is particularly applicable to potato crops for the control of Colorado potato beetle;

3) Propane flame treatment on field perimeters for newly emerged adults as plants emerge;
4) Use of row covers while plants are young;
5) Use of reflective mulches to deter pests;
6) Post-harvest crop destruction;
7) In particular for greenhouse floriculture crops, isolation of vegetative material relative to seed propagated material and separation of older crops from younger are recommended;
8) Removal and proper disposal of infested plants or stock;
9) Disruption of pest life cycles;
10) Use of sticky traps, particularly for greenhouse crops;
11) 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;
12) Improvements to irrigation practices can be applied to reduce the potential for imidacloprid to leach from the soil column. 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 and reduce the risk of off-site movement;
13) Improvements to soil health to promote healthy crops and reduce dependency on insecticides. Improvements can be achieved through a combination of cultivation practices and measures to increase soil organic matter; and
14) Reduce tillage and timing of tillage to avoid entry under saturated conditions to minimize soil compaction and avoid tillage during pesticide applications.

2.5 Possible Outcomes Associated with Use Restrictions

Based upon the CCESC Pesticide Use Profile and as illustrated in the supporting graphics in this package, Imidacloprid is a widely used, effective insecticide on Long Island. The many uses of imidacloprid are however, shared or supplanted by alternative products. These alternative products may be less effective which, would result in an increase in pesticide usage. Reduction in crop quality may be an outcome associated with imidacloprid use restriction. Crop quality is especially important in ornamental where the whole crop is purchased and the aesthetics are important. Long Island's wine industry relies on imidacloprid to control the pest (phylloxera) that almost destroyed the French wine industry. Specific to turfgrass uses, the possible loss of imidacloprid for some uses, particularly systemic (soil) applications, may result in increased use of or dependence upon other products (including spray applications), such as trichlorfon for white grub control.

2.6 Exposure Potential and Human Health Risk

Exposure to imidacloprid can occur through diet (crop residues from use in NYS and other areas and drinking water), occupational use (mixer/loader/applicator and post-application), and residential use (handler and post-application).

Imidacloprid has low acute toxicity via the dermal and inhalation routes and moderate acute toxicity via the oral route. It is not an eye or dermal irritant or dermal sensitizer. The nervous system is the primary target organ of imidacloprid and nervous system effects (clinical signs of toxicity and changes in Functional Observation Battery (FOB) assessments) were seen in rat acute and subchronic neurotoxicity studies. In addition, imidacloprid caused decreased body weight in reproductive and developmental toxicity studies in laboratory animals, but is not considered teratogenic. The U.S. EPA classified imidacloprid as a Group E−evidence of non-carcinogenicity for humans, by all routes of exposure based upon lack of evidence of carcinogenicity in rats and mice.

The U.S. EPA determined that both acute and chronic dietary exposure estimates to imidacloprid are below the level of concern for the general U.S. and all other population subgroups. Estimated short-term dermal and inhalation risks to residential users exposed to imidacloprid residues during handling, mixing, loading, and applying activities are within the range considered acceptable by the U.S. EPA. In addition, post-application exposure to adults and children/toddlers from the many residential uses of imidacloprid are expected to be minimal. The occupational risks for all agricultural and commercial uses of this chemical were also within the U.S. EPA's acceptable range.

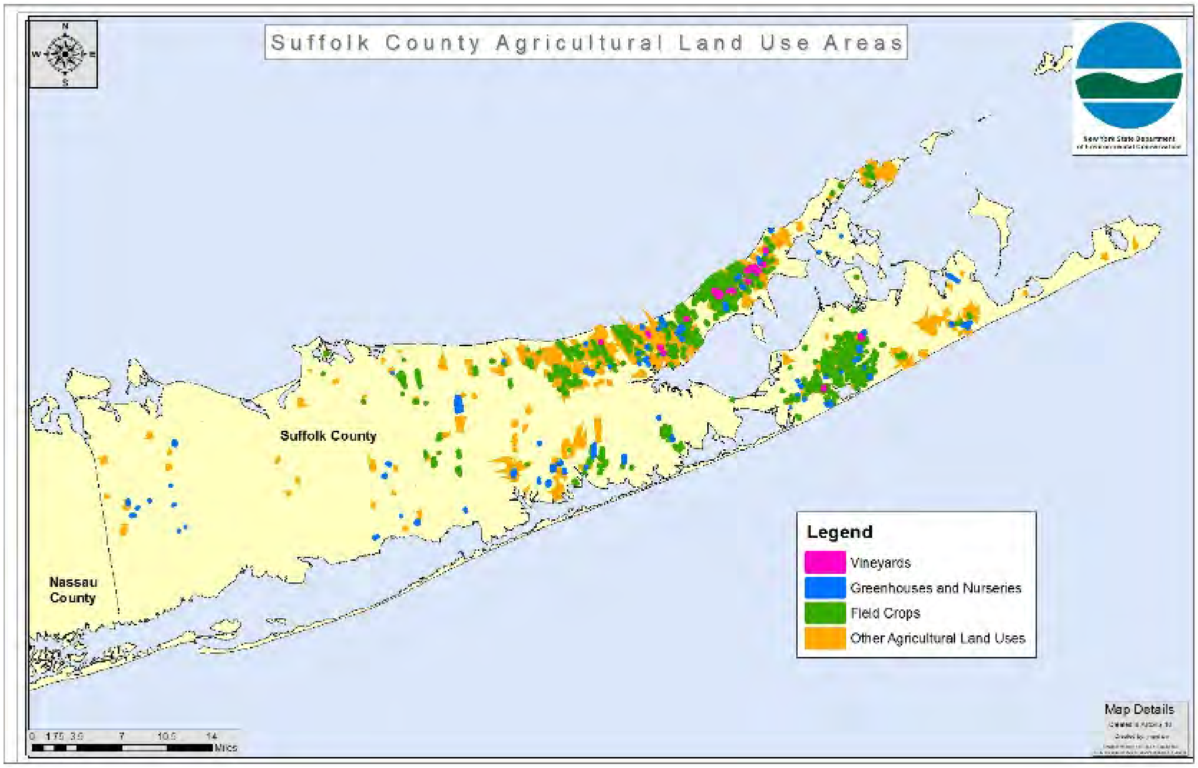
3.0 Land Use Information

The following figure illustrates some of the major agricultural-type land uses that occur in Suffolk County. Since Nassau County is primarily developed for residential land use with a small fraction of agricultural land use, a figure showing Nassau County agricultural uses has not been prepared. According to the most recent census by the U.S. Department of Agriculture, 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 data published in August 2014.

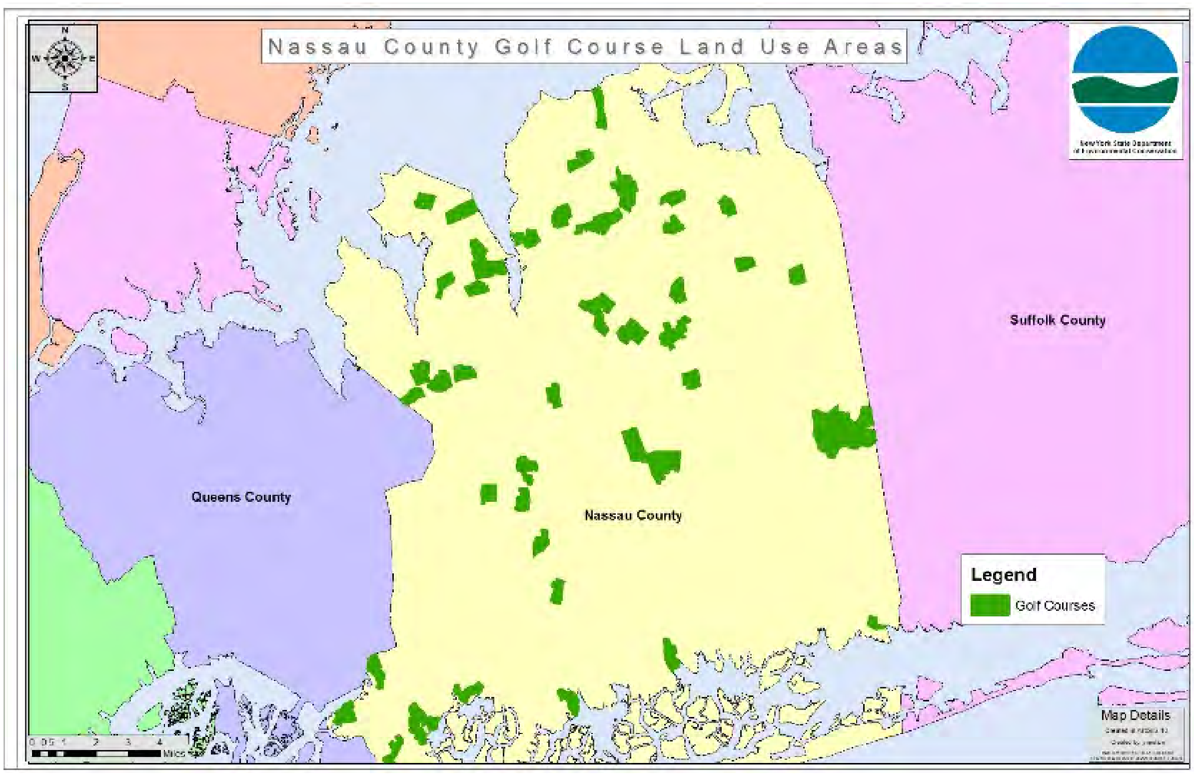
According to the most recent census by the U.S. Department of agriculture, Suffolk County contained 35,975 acres of farmland and 604 farms in 2012. Of those numbers, 2,193 acres and 70 farms were dedicated for grape growing; 2,781 acres and 7 farms were dedicated for sod production; 2,605 acres and 72 farms were dedicated for potato growing; 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.



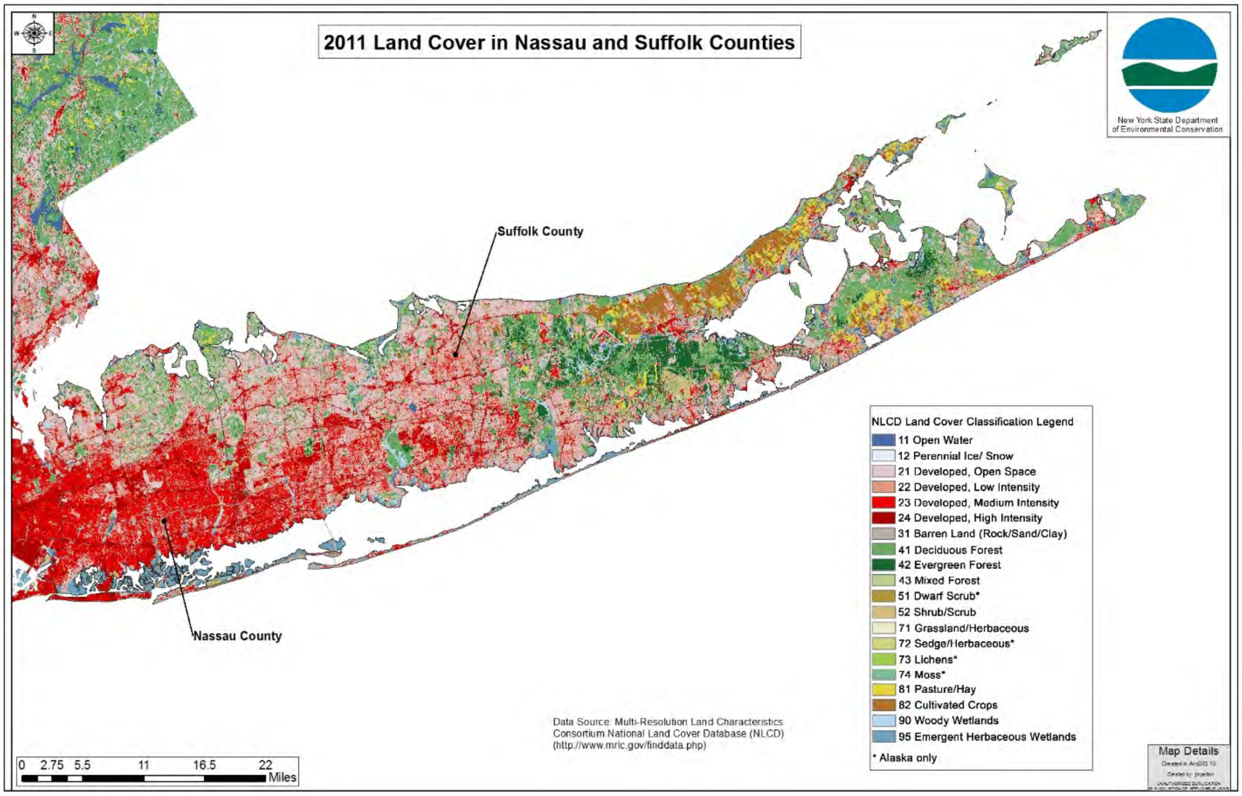
In addition to agricultural type land uses, there is also a large amount of land use on Long Island dedicated to golf courses. The figures below show the locations of golf courses (green shading) in Suffolk County and Nassau County. In total, there are 145 public and private golf courses on Long Island.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

Suffolk County Golf Course Land Use Areas
Suffolk County
Legend
Golf Courses
Map Details



Nassau County Golf Course Land Use Areas
Suffolk County
Queens County
Nassau County
Legend
Golf Courses
Map Details

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. 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 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 2000 and 2013.

The table below provides an annual summary of the imidacloprid 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 imidacloprid was detected relative to the total number of samples collected and analyzed for imidacloprid 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 6 of the data package.

As summarized in the table below, imidacloprid was detected in groundwater samples collected from monitoring wells at concentrations exceeding the NYSDOH MCL (50 ppb) between 2005 and 2009. However, the locations where imidacloprid was detected in groundwater at concentrations exceeding the NYSDOH MCL, were associated with areas where groundwater investigations have occurred as result of inappropriate applications or where misuse of the pesticides occurred. The highest concentration of imidacloprid detected in a private water supply well and a public water supply well was 12.9 ppb in 2011 and 0.5 ppb in 2009, respectively. The graphical illustrations of the imidacloprid groundwater data (Attachment 6) includes the 25th and 75th percentiles along with averages, minimum and maximum concentrations. For all the years of groundwater samples collected from monitoring wells, the 75th percentile is below 10 ppb; from private water supplies, the 75th percentile is below 2 ppb; and from public water supplies, the 75th percentile is below 0.5 ppb.

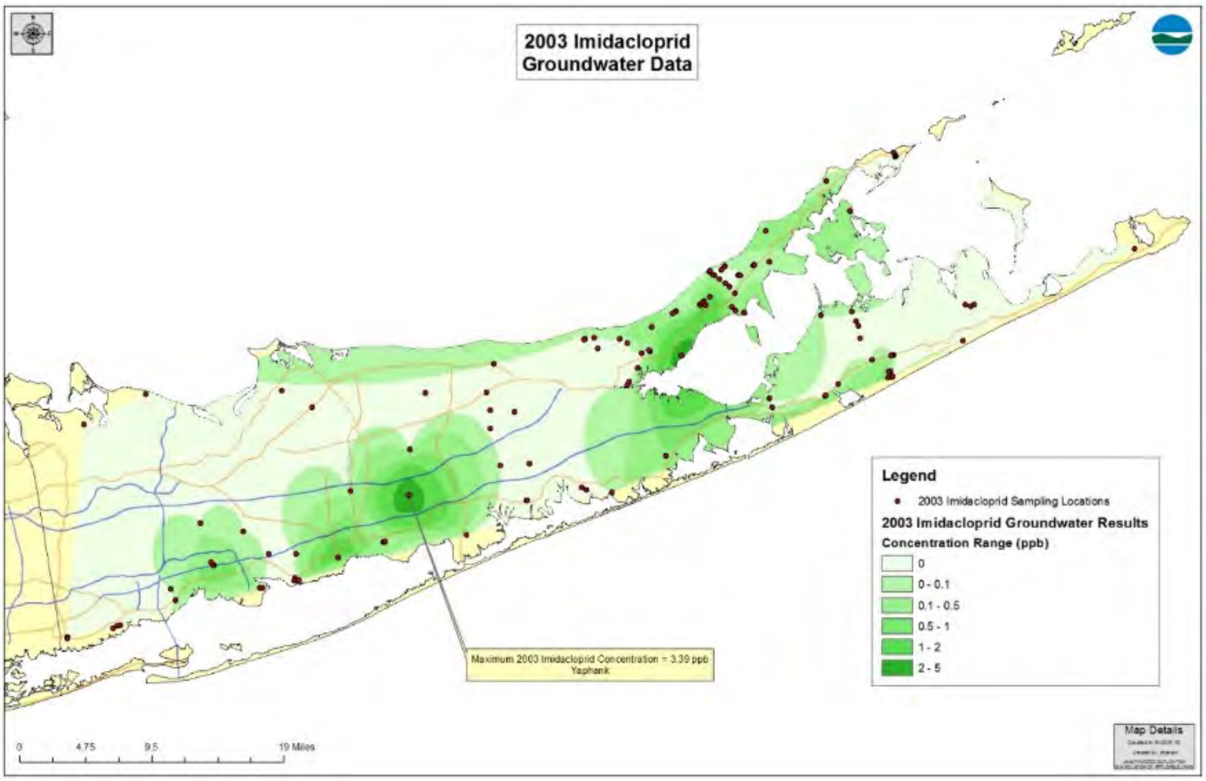
Year	Total Number of Samples	Total Number of Locations w/Detections	Percent Detected	Minimum Concentration Detected (ppb)	Maximum Concentration Detected (ppb)	MCL (ppb)	Frequency Exceeding MCL
Groundwater Monitoring and Profile Well Samples							
2001	442	4	<1.0%	0.24	1.80	50	0 of 442
2002	334	2	<1.0%	0.21	4.46	50	0 of 334
2003	276	11	4.0%	0.20	3.39	50	0 of 276
2004	381	16	4.2%	0.21	21.40	50	0 of 381
2005	412	23	5.6%	0.21	215.00	50	3 of 412
2006	449	55	12.2%	0.20	407.00	50	3 of 449
2007	358	48	13.4%	0.20	84.00	50	3 of 358
2008	590	45	7.6%	0.20	67.70	50	1 of 590
2009	544	51	9.4%	0.20	59.00	50	2 of 544
2010	309	14	4.5%	2.00	2.80	50	0 of 309
2011	259	21	8.1%	0.20	8.60	50	0 of 259
2012	502	32	6.4%	0.30	7.00	50	0 of 502
2013	356	30	8.4%	0.30	6.20	50	0 of 356
Private Well and Non-Community Well Samples							

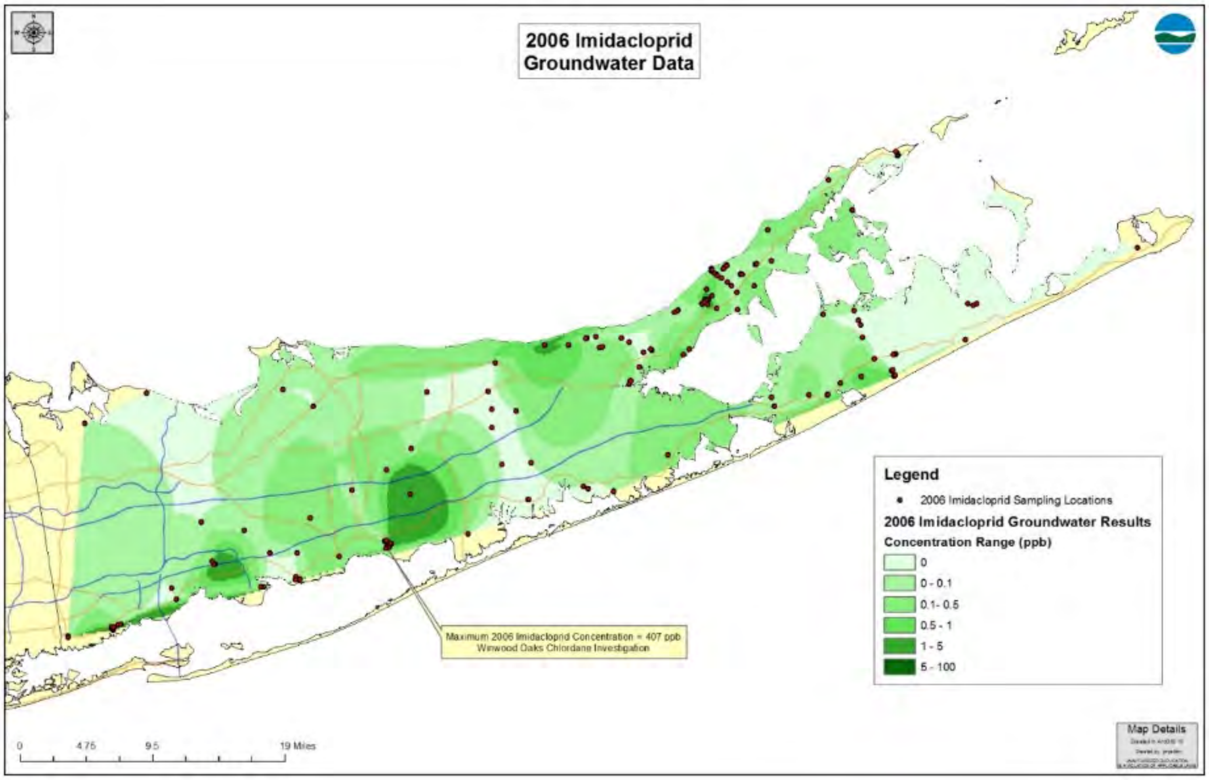
Year	Total Number of Samples	Total Number of Locations w/Detections	Percent Detected	Minimum Concentration Detected (ppb)	Maximum Concentration Detected (ppb)	MCL (ppb)	Frequency Exceeding MCL
2000	686	1	<1.0%	0.42	0.42	50	0 of 686
2001	671	4	<1.0%	0.20	0.82	50	0 of 671
2002	894	12	1.3%	0.22	6.69	50	0 of 894
2003	613	16	2.6%	0.28	2.92	50	0 of 613
2004	509	23	4.5%	0.22	6.10	50	0 of 509
2005	492	28	5.7%	0.21	8.44	50	0 of 492
2006	465	36	7.7%	0.20	4.31	50	0 of 465
2007	584	49	8.4%	0.20	5.50	50	0 of 584
2008	541	27	5.0%	0.20	4.00	50	0 of 541
2009	522	31	6.0%	0.20	1.80	50	0 of 522
2010	502	44	8.8%	0.20	12.90	50	0 of 502
2011	404	38	9.4%	0.20	2.50	50	0 of 404
2012	231	13	5.6%	0.20	1.20	50	0 of 231
2013	347	26	7.5%	0.20	2.80	50	0 of 347
Public Water Supply Wells							
2003	724	1	<1%	0.24	0.24	50	0 of 724
2004	737	2	<1%	0.22	0.36	50	0 of 737
2005	878	5	<1%	0.20	0.40	50	0 of 878
2006	469	6	<1%	0.20	0.28	50	0 of 469
2007	929	7	<1%	0.20	0.40	50	0 of 929
2008	981	6	<1%	0.20	0.40	50	0 of 981
2009	875	4	<1%	0.20	0.50	50	0 of 875
2010	980	7	<1%	0.20	0.30	50	0 of 980
2011	958	3	<1%	0.20	0.60	50	0 of 958
2012	689	3	<1%	0.3	0.50	50	0 of 689
2013	997	4	<1%	0.2	0.30	50	0 of 997

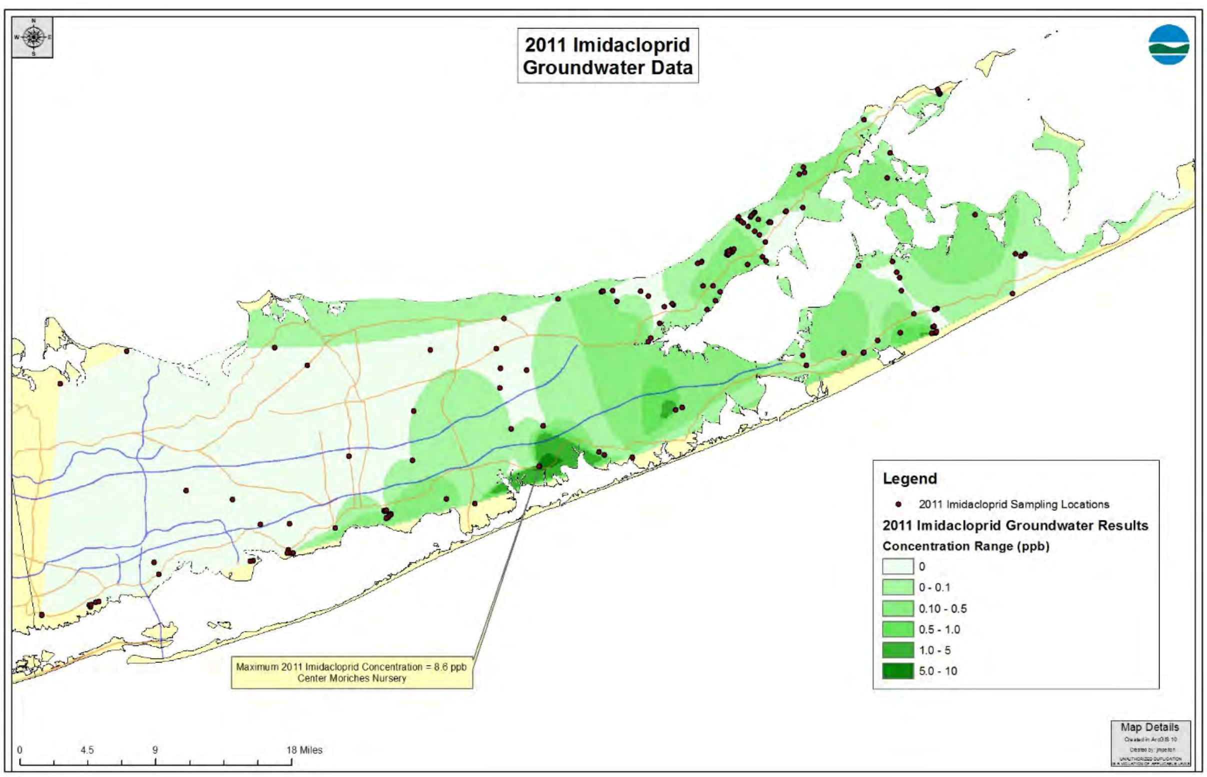
4.2 Groundwater Analytical Results Summary

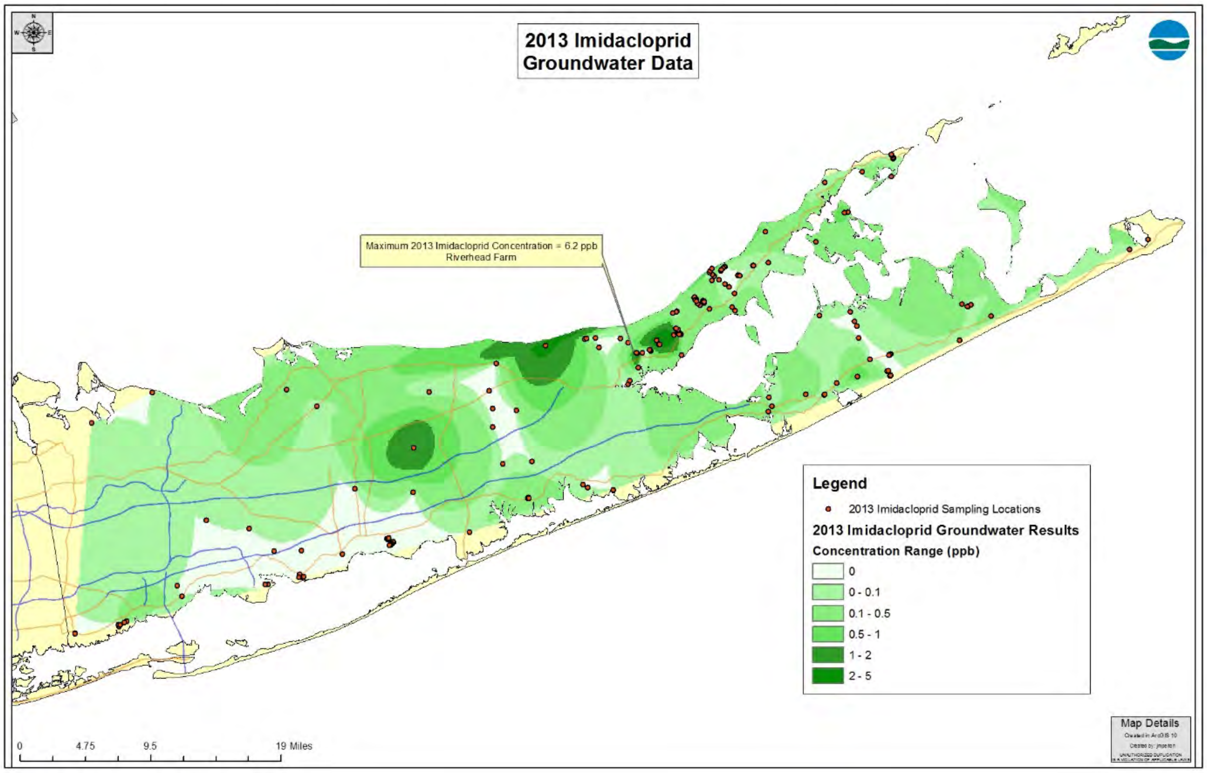
The following four figures were prepared to illustrate the spatial distribution of imidacloprid in Suffolk County groundwater based on 2001, 2006, 2011, and 2013 data. Monitoring wells where imidacloprid was not detected are not shown on the figures. The figures were prepared using groundwater data collected 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 imidacloprid groundwater concentration was detected.

As summarized in Section 4.1 (Groundwater Sample Collection History) and as shown on the figures in Attachment 6, imidacloprid was detected at three locations at concentrations exceeding the NYSDOH MCL of 50 ppb in 2006. Twice at a well associated with the Winwood Oaks chlordane investigation (detections of 407 ppb (30-35' below grade surface) and 386 ppb (20-25' below grade surface)) and once at a well associated with product misuse from a farm in Mattituck (detection 67.4 ppb).




2006 Imidacloprid
Groundwater Data
Maximum 2006 Imidacloprid Concentration = 407 ppb
Winwood Oaks Chlordane Investigation
Legend
2006 Imidacloprid Sampling Locations
2006 Imidacloprid Groundwater Results
Concentration Range (ppb)
0
0 - 0.1
0.1- 0.5
0.5 - 1
1 - 5
5 - 100
0
4.75
9.5
19 Miles
Map Details


2011 Imidacloprid
Groundwater Data
Maximum 2011 Imidacloprid Concentration = 8.6 ppb
Center Moriches Nursery
Legend
2011 Imidacloprid Sampling Locations
2011 Imidacloprid Groundwater Results
Concentration Range (ppb)
0
0 - 0.1
0.10 - 0.5
0.5 - 1.0
1.0 - 5
5.0 - 10
0
4.5
9
18 Miles
Map Details



5.0 Summary of Potential Pollution Prevention Measures

As discussed in Section 2.4 (Availability of Alternatives) and summarized in the Imidacloprid alternative tables included as Attachment 4, there are several possible pollution prevention measures and best management practices that can be applied to improve the overall use of imidacloprid. When applied, these practices have the potential to significantly reduce or eliminate the movement of imidacloprid into groundwater while continuing to allow use of this product on Long Island. The continued need for this insecticide to manage several important pests on Long Island combined with the current imidacloprid groundwater concentrations and detections in the region's groundwater 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 imidacloprid 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 insecticide and implemented as part of an overall pesticide management program.

As a highly effective pesticide for the control of several insects, imidacloprid is used with a diverse array of commodities grown on Long Island. This insecticide has wide uses in commercial agriculture, horticulture, home garden and other applications as a foliar spray, for soil treatment, for trunk injection, as a basal bark spray, and in various specialized delivery systems. Specifically, imidacloprid is used for the production of vegetable and fruit crops including potatoes, tomatoes, cucurbits, brassica leafy vegetables, tomatoes, grapes and leafy vegetables. Imidacloprid is also important for controlling insects in ornamental crops grown in both greenhouses and nurseries and for the control of insects present in turf and landscaped areas (in particular white grubs).

Despite this diversity in imidacloprid use, there are a combination of common practices that can be applied along with commodity-specific practices that can be employed. Many of these best management practices/pollution prevention measures are important in eliminating or reducing the potential for this active ingredient to impact groundwater quality.

Possible Practices to Improve Imidacloprid Applications

It is thought that soil applications are one of the primary uses that allow imidacloprid to more readily leach through the soil column into the underlying groundwater. To reduce the frequency of this use, the development of a supplemental label restricting soil applications could reduce and/or eliminate groundwater contamination. Alternatively, a best management practice can be developed that promotes the use of the lower-end range of imidacloprid application rates and/or that limits the use of imidacloprid to one application per season per crop. Limiting the use of imidacloprid to one application per season may be particularly applicable to turf, sod farm, and landscape uses.

To further minimize soil applications, where possible, imidacloprid can be applied as a foliar spray. A foliar application continues to provide management of pests while providing increased opportunity for pesticide breakdown prior to entry into the soil. Specific soil applications for the control of critical pests will be maintained.

In addition to possibly adjusting application rates, measures can be used to more effectively apply imidacloprid. One measure is to apply imidacloprid with precision banding soil applications. Ohio research (Jasinski et al. 2009. J. Econ Ent. 102(6):2255-64) found a reduction in imidacloprid use by up to 84.5% over a conventional continuously banded application. Banded application techniques are most applicable to vegetable crops, but in particular cucurbits.

The treatment of hot spots where pests are concentrated within a crop combined with the use of trap crops may be an effective approach with some uses to reduce the overall amount of imidacloprid being applied. Trap crops lure pests away from the primary crops and therefore may reduce the amount of insecticide needed for management of the actual cash crop. Additionally, with selection of the correct trap crop/crops, the pests will be concentrated in a small area and can be locally treated instead of applying over the entire cropped area.

With certain uses, the approach used to apply imidacloprid can be modified to improve delivery. In particular, and most applicable to turf uses is the application of granular imidacloprid with a drop spreader rather than a broadcast spreader. This application in combination with the timing of the applications to avoid the loss of imidacloprid through runoff during heavy rain events can reduce and/or eliminate groundwater contamination. Additionally, although not commonly employed for greenhouse crops on Long Island, imidacloprid can be incorporated into irrigation water, including into closed (no runoff) ebb-and-flood sub-irrigation systems. Similarly, insecticides can be applied through drip irrigation to focus the delivery and minimize off-site losses.

To ensure that the correct imidacloprid rates are being applied, practices involving the proper setup, calibration, and maintenance of 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 imidacloprid will be applied.

As summarized in the Section 2.4 and in the Alternative Tables (Attachment 4), there are possible alternative insecticides that can be rotated with or potentially in-place of imidacloprid to reduce the overall amount of imidacloprid being used. In addition, biological controls are available for several of the imidacloprid uses and becoming increasingly important as part of insect management programs. Although biocontrols are not likely to be effective as a stand-alone practice, when combined with insecticides and other cultural practices, biocontrols can be effective in managing pests. Biological controls are particularly important as an alternative for use in greenhouses.

Possible Non-Pesticide Practices for Pest Management

Several non-pesticide alternatives and integrated pest management practices have been identified and will be promoted to further reduce the overall use of imidacloprid. An important practice to implement is the maintenance of a high level of soil organic matter (SOM) to prevent leaching and to enhance the overall quality of soil. Soil organic matter is the primary substrate adsorbing imidacloprid (Lui et. al. 2006). Soil organic matter levels are achieved through a variety of approaches. One approach is the application of cover crops. Not only are cover crops use for soil health purposes, but cover crops are also used to suppress pests. Although a cover crop is unlikely to provide total pest control, it may provide a reduction in the amount of imidacloprid that is needed as well as reduce the off-field runoff by buffering against erosion. Reduced tillage is another practice for increasing the amount of SOM. Reduced tillage preserves soil structure and organic residue while controlling weeds, creating a suitable seedbed and protects soil from erosion.

Introducing permanent infield natural field vegetative strips can provide habitat and refuge for a variety of beneficial insect predators and parasitoids. This practice can help in reducing unwanted pests and in some cases may help maintain pest pressure below action thresholds which otherwise would require targeted insecticide application.

To further improve imidacloprid use, standard best management practices, involving the proper handling and disposal of containers and excess product and the proper transfer of imidacloprid product to application equipment, will be promoted. Also, having a designated agricultural handling facility made up of an impermeable structure on which the mixing of chemicals can be conducted will reduce the risk of unnecessary infiltration of imidacloprid into the subsurface. In the event of a spill, the chemicals are contained and stored on the facility. The installation of this structure is encouraged and funding is available through Suffolk County Soil and Water Conservation District to help offset the costs.

Education and Outreach

There are currently four existing best management practices that were developed by Cornell Cooperative Extension of Suffolk County, Bayer, and the Department. The best management practices were developed for the following four uses: arboriculture, agriculture, greenhouse and nursery, and professional turf. These BMPs were developed in 2004 and will be updated based on the results of this active ingredient assessment.

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 and/or the updated best management practices detailing the specific practices for imidacloprid 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.

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 Cornell Cooperative Extension of Suffolk County, additional groundwater monitoring wells will be installed downgradient of land uses where imidacloprid 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 maximum imidacloprid concentrations has declined over time. With the promotion and increased implementation of the aforementioned best management practices, it is expected that overall imidacloprid 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 imidacloprid 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 Long Island Strategy-derived website resources, and participation in educational events will be used to evaluate outreach efforts.

Attachment 1

<u>1995 NYS Registration of Imidacloprid</u>

Imidacloprid - Pesticide Product Registration 3/95

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-7257
518-457-6934 FAX 518-457-0629

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

March 24, 1995

Dr. Douglas A. Spilker
Regulatory Affairs Specialist
Registrations Department
Bayer Corporation
P. O. Box 4913
Kansas City, MO 64120-0013

Dear Dr. Spilker:

Re: Registration of Five New Pesticide Products Containing the New Active Ingredient Imidacloprid: Merit 75 WSP Insecticide (EPA Reg. No. 3125-439) Merit 75 WP Insecticide (EPA Reg. No. 3125-421) Merit 0.5 G Insecticide (EPA Reg. No. 3125-451) Admire 2 Flowable Insecticide (EPA Reg. No. 3125-422) Provado 1.6 Flowable Insecticide (EPA Reg. No. 3125-457)

Bayer Corporation (formerly known as Miles Inc.) applied for New York State registration for the above-mentioned five products which contain the new active ingredient imidacloprid.

Merit 75 WSP Insecticide (EPA Reg. No. 3125-439) is a 75% active ingredient wettable powder packaged in water soluble packets. Merit 75 WP (EPA Reg. No. 3125-421) is a 75% active ingredient wettable powder. Both products are labeled for foliar and systemic insect control in turfgrass, landscape ornamentals and interior plantscapes and will be used by commercial applicators in commercial settings. Merit 0.5 G Insecticide (EPA Reg. No. 3125-451) is a 0.5°s granular formulation and is labeled for systemic control in turfgrass and landscape ornamentals. Merit 0.5 G Insecticide is. labeled for use by homeowners. Applications for all three Merit products cannot exceed a total of 0.4 lb. of active ingredient per acre per year.

Admire 2 Flowable Insecticide contains two pounds of imidacloprid per gallon and is labeled for control of certain insects infesting cotton and potatoes. Admire 2 Flowable Insecticide is labeled for soil application only. Provado 1.6 Flowable Insecticide contains 1.6 pounds of imidacloprid per gallon and is labeled for control of certain insects infesting apples, cotton and potatoes. Provado 1.6 Flowable Insecticide is labeled for foliar application only.

The maximum amount of imidacloprid that can be applied to potatoes, regardless of formulation or method of application, is 0.31 lb. imidacloprid per acre per season. The maximum amount of imidacloprid that can be applied foliarly to potatoes is 0.2 lb. active ingredient per acre per season.

The amount of imidacloprid that can be applied to apples as a foliar treatment is 0.1 lb. active ingredient per acre per application and cannot exceed a total of 0.5 lb. active ingredient per acre per year.

The product labels for Admire 2 Flowable and Provado 1.6 Flowable contain exposure mitigation measures for endangered species, which are grouped by state and county. The Counties with special restrictions in New York State are Saratoga and Schenectady, and the endangered species of concern for both products is the Karner Blue Butterfly.

The product labels bear statements which restrict the use of Admire 2 Flowable Insecticide and Provado 1.6 Flowable Insecticide on potatoes to soil application only in Saratoga and Schenectady Counties. Therefore, Provado 1.6 Flowable Insecticide, which is labeled for foliar application only, cannot be used on any potatoes in Saratoga or Schenectady County. Provado 1.6 Flowable Insecticide also contains language regarding the timing of applications for apples in Saratoga and Schenectady Counties. Therefore, foliar applications of Provado 1.6 Flowable Insecticide to apples should be avoided during the flowering period, when butterflies may be present.

The New York State Department of Environmental Conservation (the "Department") has completed the review of the information supplied to date in support of the pesticide product registration applications for Merit 75 WSP, Merit 75 WP, Merit 0.5 G, Admire 2 Flowable and Provado 1.6 Flowable which contain the new active ingredient imidacloprid.

The Department has concerns regarding the long-term environmental fate and environmental persistence of the active ingredient imidacloprid when used in vulnerable aquifers. The Department is especially concerned about the use of imidacloprid on Long Island (Nassau and Suffolk Counties) which has been identified as a vulnerable sole-source aquifer. Groundwater monitoring studies to be performed by Bayer Corporation in compliance with United States Environmental Protection Agency ("EPA") requirements may shed some light on the environmental fate of imidacloprid in the future. However, no groundwater data exists within the time frames in which the Department is required to make a registration decision.

Therefore, Bayer Corporation, in correspondence dated March 8, 1995, has agreed to conditions of registration in order for the Department to grant full registration of the five above mentioned imidacloprid containing products and any future imidacloprid containing products. We have been informed by the EPA that additional labels and use patterns for imidacloprid are forthcoming.

Bayer Corporation has agreed to the following:

1. Establish appropriate monitoring wells on Long Island on typical use sites;

2. A total of ten wells will be established, six wells in turf use sites and four wells in potato use sites;

3. Sites are to be mutually acceptable to the Department and Bayer Corporation;

4. Site selection will be determined in 1995 with initial sampling to begin in 1996;

5. Use patterns are to be consistent with the label directions for turf and potatoes;

6. Sampling frequency will be once per year, approximately four to six weeks after application. An initial background sample prior to yearly application and a sample after application will be collected during the first year of sampling;

7. Bayer Corporation will pay for the initial installation of the monitoring wells and sample analyses;

8. The Department intends to take over sampling and analysis within three years;

9. Samples are to be analyzed for parent compound and metabolites, unless Bayer Corporation can demonstrate that the metabolites will not leach to groundwater above 50°s of a calculated standard (reference Chapter I, State Sanitary Code Subpart 5-1, Public Water Systems);

10. The Department intends to develop a Memorandum of Understanding between the Department and the cooperator (landowner), which will release the landowner from any enforcement liability associated with positive detects from analysis of samples collected from these monitoring wells;

11. The cooperators (landowners) must be willing to allow Bayer Corporation and/or Department representatives to enter their property for sample collection from the monitoring wells (notification of sampling will always be provided to the property owner by the Department prior to the sample collection after the Department takes ownership of the monitoring wells) ;

12. Bayer Corporation will provide the Department with the quarterly and final reports of the groundwater studies required by the United States Environmental Protection Agency;

13. Bayer Corporation will provide the Department with a copy of the gas chromatography-mass spectrometry ("GC-MS") analytical method for water when available; and

14. Bayer Corporation will provide the Department with the appropriate analytical standards upon request of the Department.

The Department hereby conditionally registers the five products, Merit 75 WSP (EPA Reg. No. 3125-439), Merit 75 WP (EPA Reg. No. 3125-421), Merit 0.5 G (EPA Reg. No. 3125-451), Admire 2 Flowable (EPA Reg. No. 3125-422) and Provado 1.6 Flowable (EPA Reg. No. 3125-457), as general use pesticide products provided that Bayer Corporation complies with the aforementioned 14 requirements.

The continued registration of all imidacloprid products within New York State will be dependent upon the annual review of groundwater monitoring data collected within the Long Island aquifer. Enclosed are a New York State stamped "ACCEPTED" label for each of the five new pesticide products and a copy of the Certificate of Registration.

Please contact Ms. Maureen Serafini, of my staff, at (518) 457-7446, if you have any questions.

Sincerely,

Norman H. Nosenchuck, P.E.
Director
Division of Hazardous Substances Regulation

Enclosures
cc: w/o enc.
N. Kim - NYS Dept. of Health
A. Grey - NYS Dept. of Health
D. Dodge - NYS Dept. of Agriculture and Markets
D. Rutz - Cornell University
J. Gergela - Long Island Farm Bureau

Attachment 2

Imidacloprid Usage Figures based on ArcGIS Geocoding of Pesticide Reporting Law Annual Data

Nassau County 2003

Nassau County 2006

Nassau County 2009

Nassau County 2012

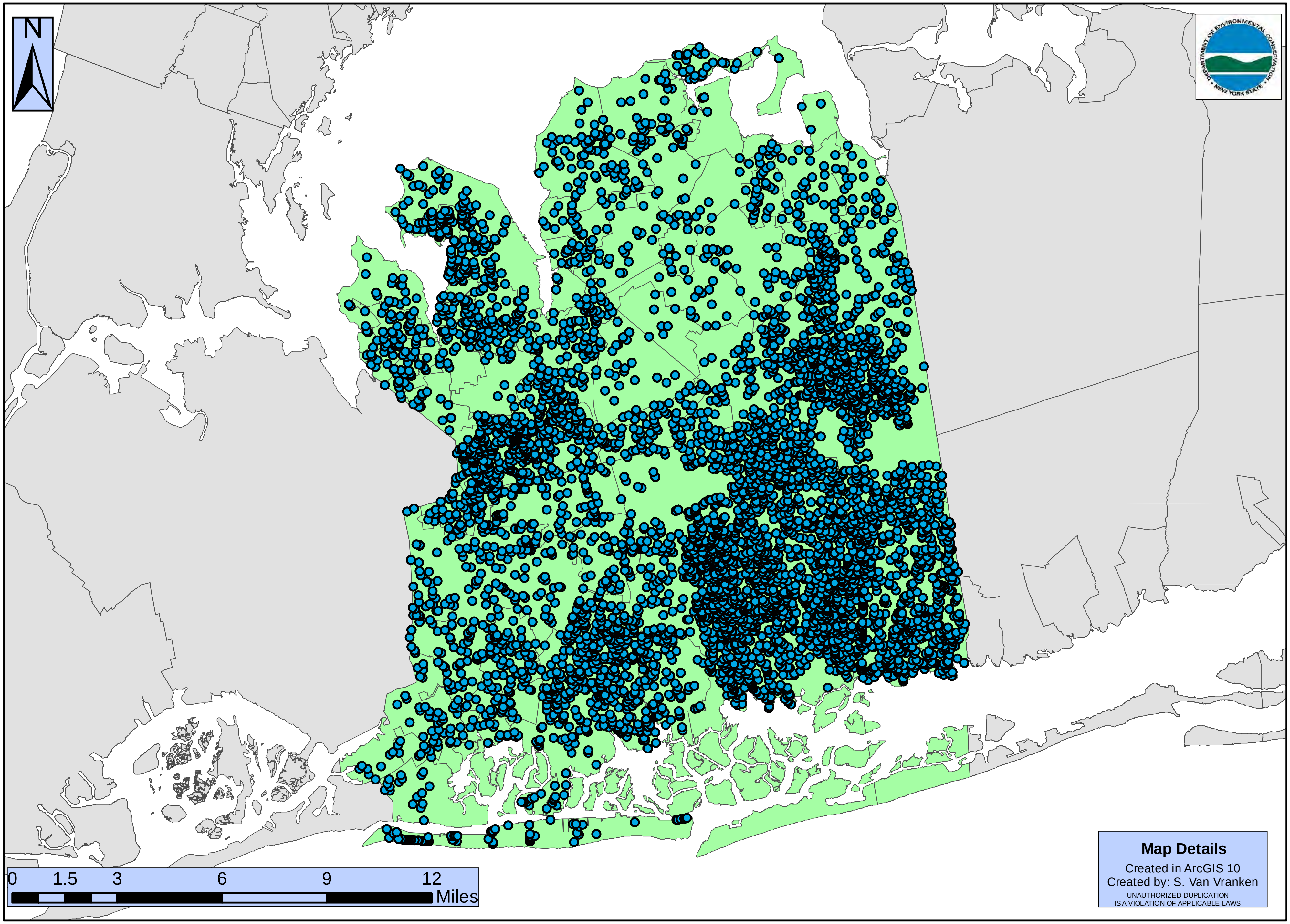
Suffolk County 2003

Suffolk County 2006

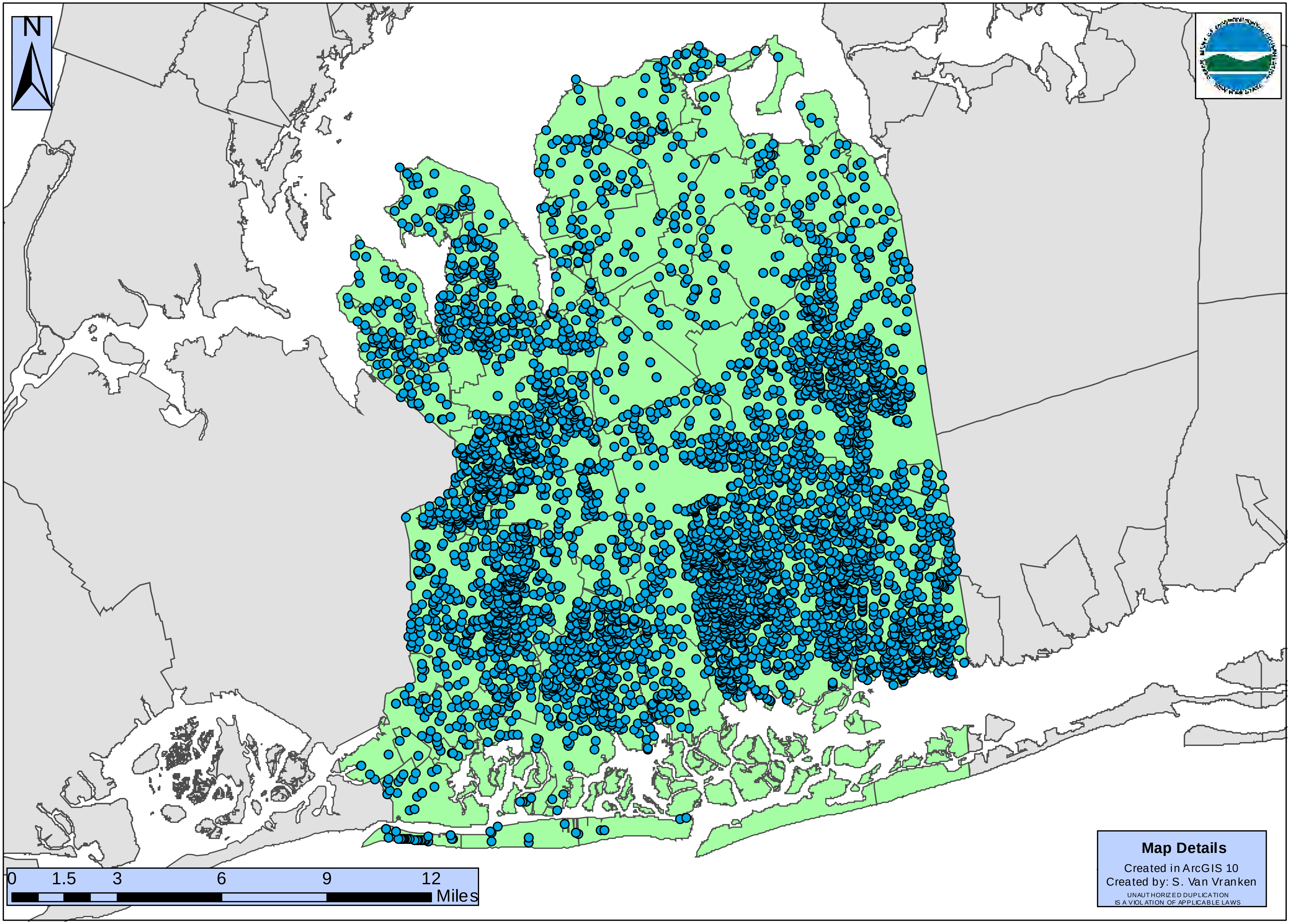
Suffolk County 2009

Suffolk County 2012

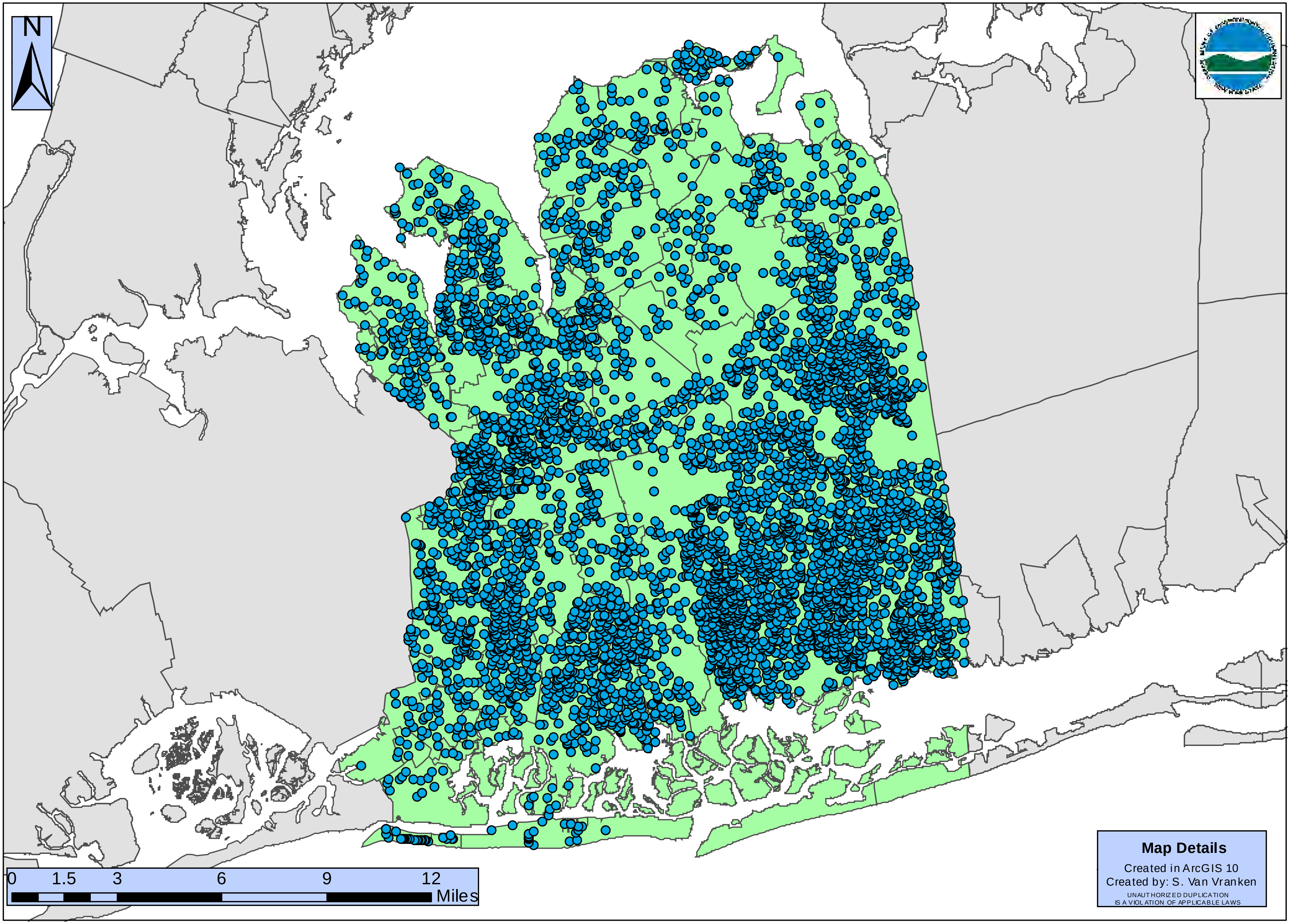
2003 NYSDEC Nassau County Imidacloprid Usage Locations



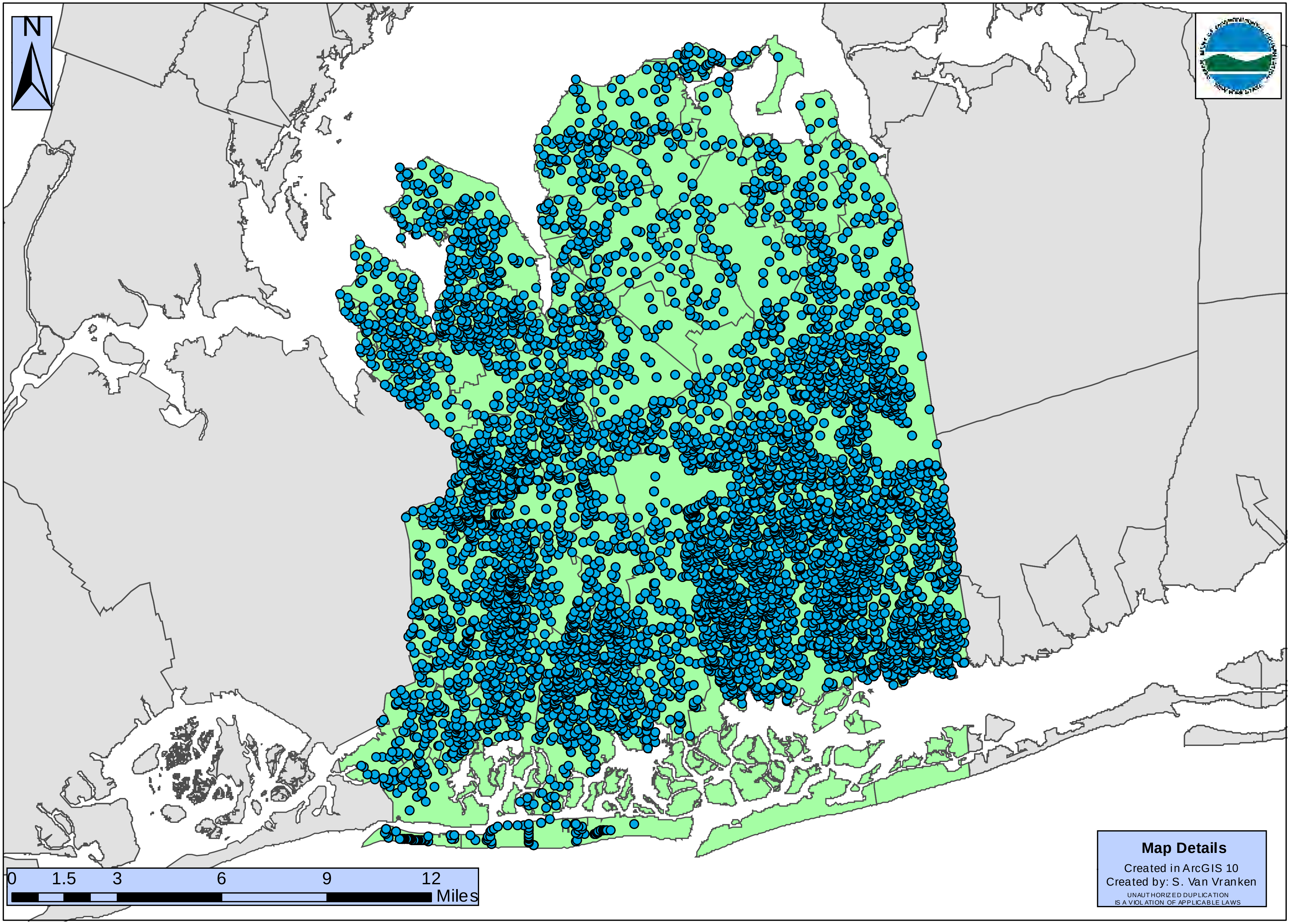
2006 NYSDEC Nassau County Imidacloprid Usage Locations



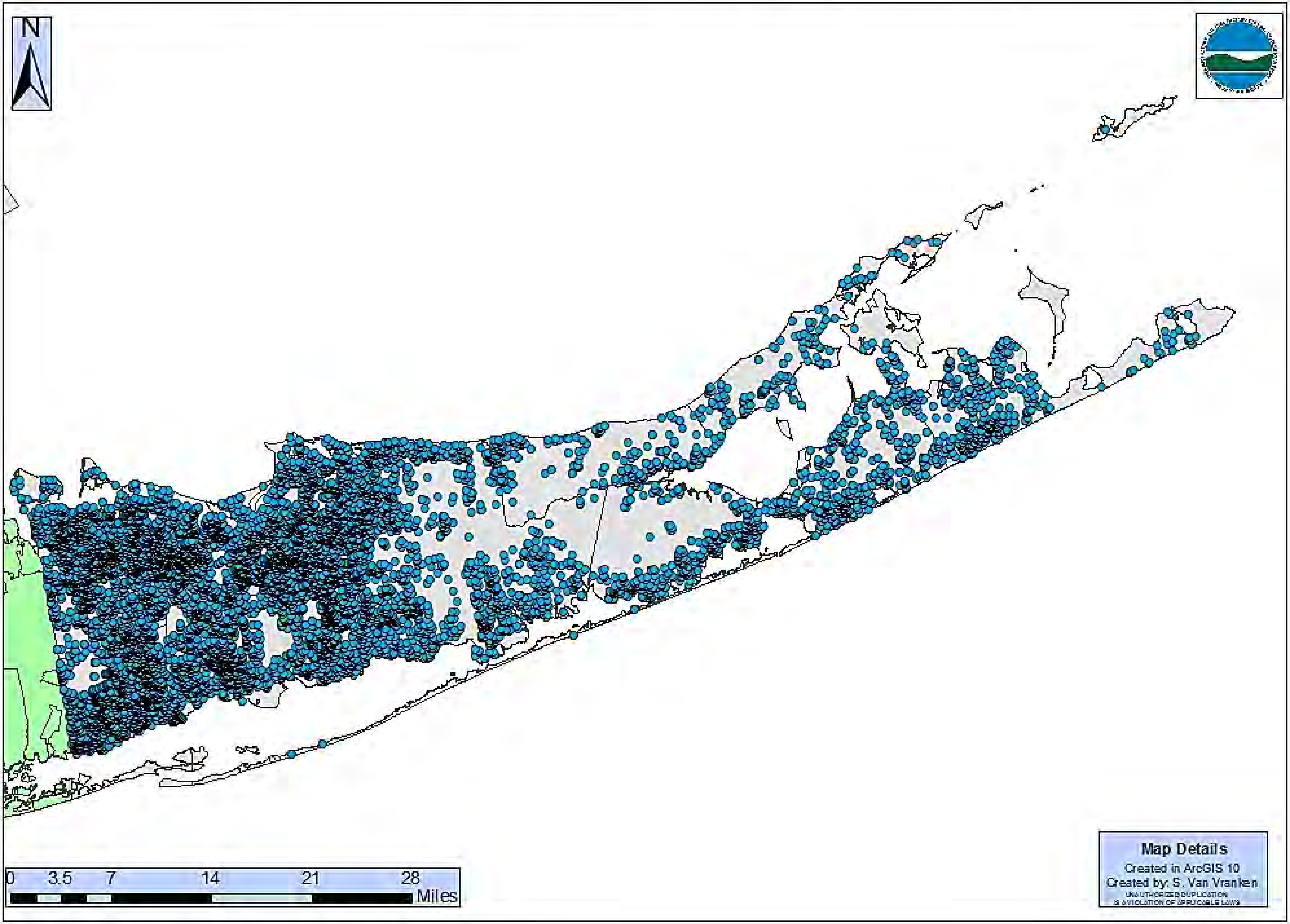
2009 NYSDEC Nassau County Imidacloprid Usage Locations



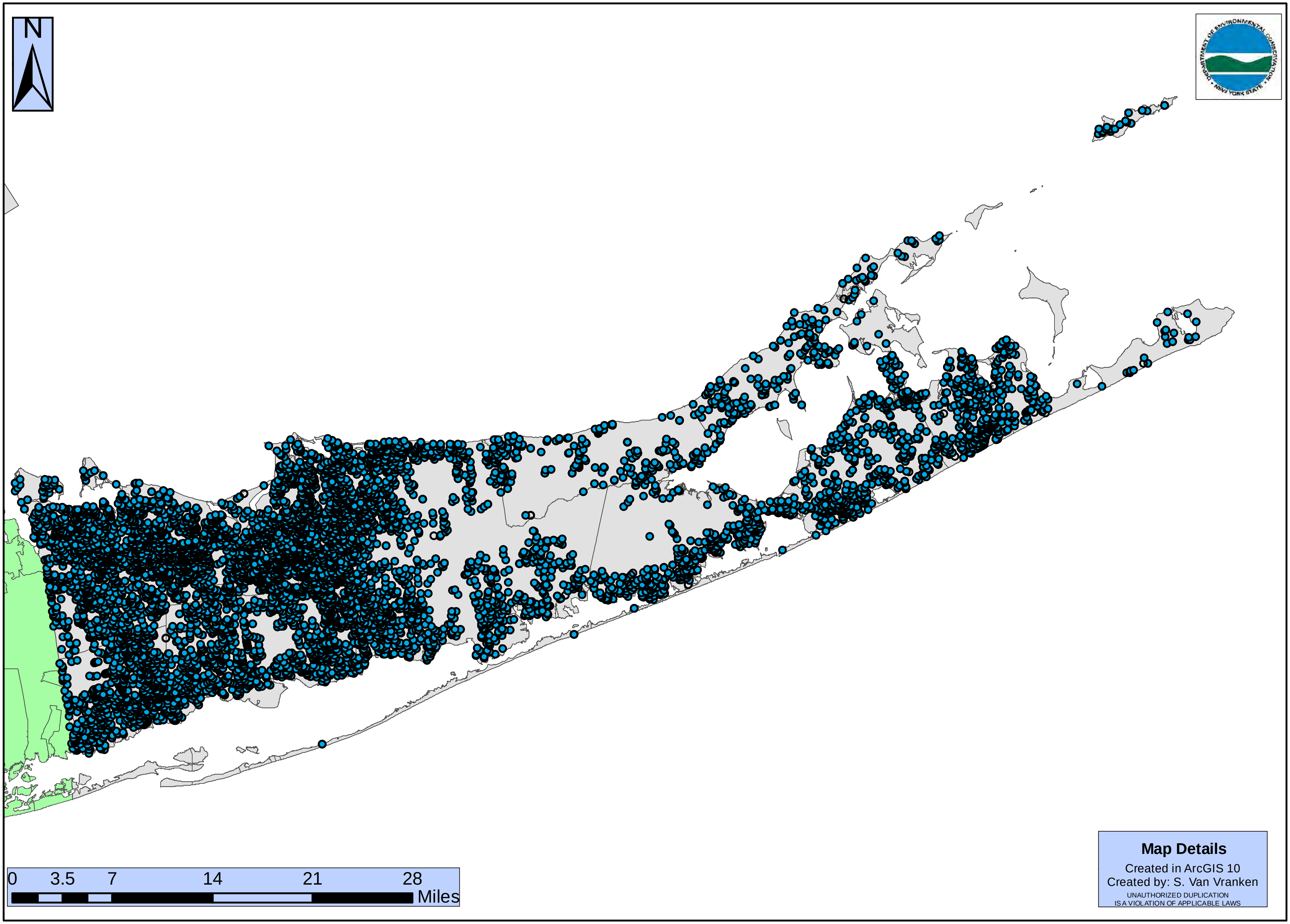
2012 NYSDEC Nassau County Imidacloprid Usage Locations



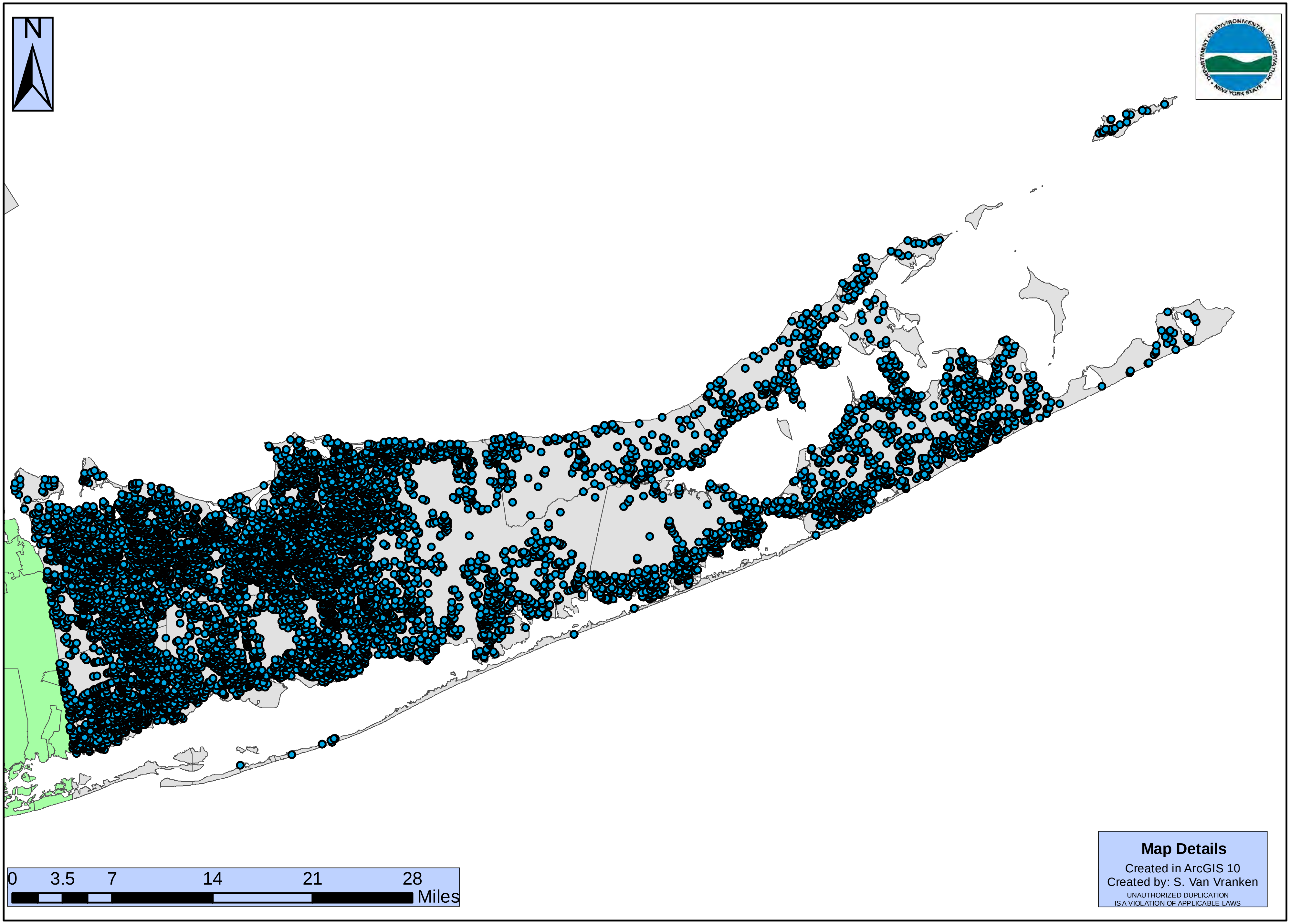
2003 NYSDEC Suffolk County Imidacloprid Usage Locations



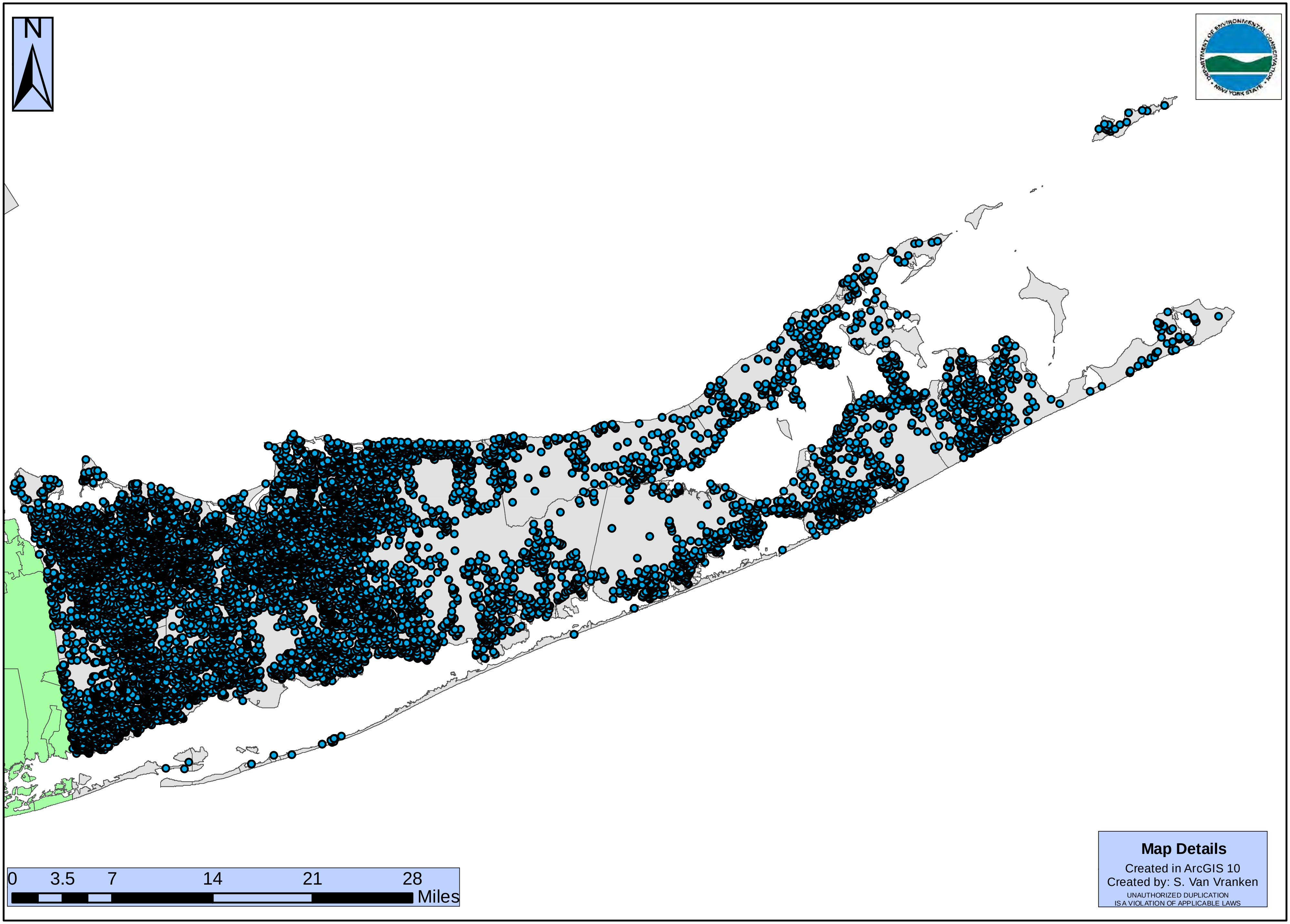
2006 NYSDEC Suffolk County Imidacloprid Usage Locations



2009 NYSDEC Suffolk County Imidacloprid Usage Locations



2012 NYSDEC Suffolk County Imidacloprid Usage Locations



Attachment 3

Pesticide Use Profile for Imidacloprid on Long Island – A Working Document

Prepared by Cornell Cooperative Extension of Suffolk County

Dated September 2, 2014

PESTICIDE USE PROFILE FOR IMIDACLOPRID 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 imidacloprid 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 written with the general public in mind 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 and Need

Imidacloprid (1-[(6-Chloro-3-pyridinyl) methyl]- N-nitro-2-imidazolidinimine) is a chloro-neonicotinoid Group 4A [nicotinic acetylcholine receptor (nAChR) agonist] insecticide that works both on ingestion and on contact against many kinds of sucking insect pests (aphids whiteflies, etc.), some beetles (Colorado potato, viburnum leaf), and several other kinds of pests. It has wide uses in commercial agriculture, horticulture, home garden and other applications as a foliar spray, for soil treatment, for trunk injection, as a basal bark spray, and in various specialized delivery systems. Formulations include wettable powders, liquid flowable, granulars, incorporated into potting media or building materials, as a tablet or fertilizer spike, in seed treatments, in applicator 'pens' or window stickers, and added to baits. Some formulations (*Leverage, *Brigadier, *BiThor, *Swagger) include a second insecticide, usually a pyrethroid (e.g. *cyfluthrin, *bifenthrin), or a fungicide (e.g. metalaxyl, mancozeb, fludioxonil, and/or tebuconazole, for seed treatments). Initially registered in NY State in 1995 as a general-use insecticide, commercial-use imidacloprid products were designated 'restricted use' in New York State on January 1, 2005 under NYSDEC regulations NYCRR Part 326.23 (e) and the majority of home garden products restricted from use on Long Island. Soil injection applications were also prohibited for use in Nassau and Suffolk Counties. Bayer's patent on imidacloprid expired in March 2006; many generic and 'authorized generic' products have now come onto the market. The product has been popular due to its high level of efficacy, relative low mammalian toxicity and comparatively economic pricing and introduction at a time when many older organophosphate, organochlorine and carbamate insecticides were being lost or further restricted due to the EPA re-registration process. Imidacloprid was granted OP Alternative status for uses on leafy petiole and citrus crops on 4/10/2001.

There are currently 353 registrations (PIMS, accessed 9/3/2014) of insecticide products containing imidacloprid in New York State. Some of these registrations are in 'discontinued' status, represent 2ee recommendations extending label uses, or are formulator labels. Many are redundant generics or 'authorized generics'. Most are for commercial agriculture and professional landscape management, including invasive pest control programs (Asian longhorned beetle). This document speaks to those uses in particular. The following kinds of products will not be addressed in this document:
Bait formulations for rodents to assist in control of fleas (e.g. Kaput and Kaput Combo), cockroaches (Invict Gold, Pre-Empt), flies (Bonanza, Maxforce Fly Spot Bait), and ants

(Maxforce Quantum Ant Bait); sprayable insecticide for control of certain indoor pests (crawling insects, bedbugs, ants) (Temprid); products for structural application to control subterranean termites (Premise Foam); spray for control of insects in poultry buildings (Credo D); wood preservatives (Wolman AG Concentrate) or additives for formulation (Preventol TM, Preventol TM Preservative) into end-use products for above and below ground protection of wood, wood composites, plastics, cables, textiles, geotextiles, and termiticidal wall treatments; and seed treatments (Acceleron IX-409, Concur, Nitro Shield, Dyna-Shield Foothold Extra, Dyna-Shield Imidacloprid 5, Senator 600FS, Macho 600ST, Sativa IM RTU, Sativa IM MAX, Latitude); products for manufacturing into end products for use in food crops or ornamental plants; and formulations for veterinary use as dermal application directly on pets (Advantix, Advantage). Imidacloprid is also found in many homeowner-use garden/landscape/houseplant/residence products; the vast majority of these are prohibited for use on Long Island per label, with the exception of Bayer Advanced 2-in-1 Insect Control Plus Fertilizer Plant Spikes, Bayer Systemic Houseplant Insect Control, Bayer Advanced Dual Action Roach Killer Power Pen, and Aeroxon Window Fly Killer.

Imidacloprid per acre use rates vary considerably according to crop or situation, whether used as a spray or systemically, and how calculations are made. Labels typically restrict annual use rates to 0.4 to 0.5 lb imidacloprid/acre/year, though not all labels include such restrictions (e.g. Merit 2.5G, trunk injections). Labels now include required bee hazard language and some (for ornamentals) now include prohibition against application to lindens (*Tilia* spp.). Where used *systemically* (soil/media application, trunk injection) a maximum of one application per crop or year is customary due to expense for material and labor, as well as label limitations and in some cases limited uptake and movement/distribution into mature plants. Plants and crops are not necessarily systemically treated annually or in each growing cycle. In landscapes, for example, professional applicators have found efficacy (based on actual control or on lack of repeat infestation) in trees and shrubs (e.g. hemlock woolly adelgid on hemlock) often lasting beyond one year and in greenhouses preventive application has been done only on specific crops, namely poinsettia for whitefly control and in hanging baskets (annual flowers) where overhead application later is difficult, but due to resistance in sweetpotato whitefly imidacloprid preventive treatments to some crops (poinsettia in particular) are no longer standard practice. *Spray* applications with imidacloprid are occasionally repeated on the same plants for pests such as aphids or leafhoppers.

2. Agricultural Production – food crops, Christmas trees, pulpwood plantations (non-ornamental plants)

Crops with no/limited alternatives for Long Island

Soil application of imidacloprid has few comparable alternatives available to Long Island growers. Following is a discussion of the main crops where imidacloprid has soil uses on Long Island and where alternatives are limited. Foliar and soil uses in other crops (e.g. strawberry, grape, herbs, hops, bulb vegetables, bushberry, caneberry) grown on Long Island are of relatively minor importance.

Potato: soil application at planting is important for Colorado potato beetle (CPB), aphids (particularly melon aphid), and potato leafhopper control. There is resistance to imidacloprid in local Colorado potato beetle populations, but at-plant soil application is still practiced, remains at least partially effective for this insect, and provides substantial control of aphids and leafhoppers, both of which can be serious pests each year.

Cucurbits (squash, melon, cucumber, pumpkin): Soil application for cucumber beetle is occasionally done, particularly for pumpkin and some other cucurbits to protect young plants at emergence. Infestations of cucumber beetle can be sudden and severe especially during early plant growth. Soil or planthouse application can be done for aphids but is less important.

Brassica leafy vegetables (cabbage, broccoli, cauliflower, etc.): soil application is rarely used on this crop; Admire Pro now has a 2(ee) label for soil application to control swede midge, a new pest found on Long Island but so far uncommon.

Fruiting vegetables (tomato, eggplant, pepper): soil application is occasionally used for Colorado potato beetle to protect newly set transplants (tomato, eggplant). The use was of particular importance to control CPB when potato acreages were higher and when it was a more common pest, though it remains an occasionally serious pest on eggplant and tomato. Planthouse application for aphids is rarely necessary or done.

Leafy vegetables (lettuce, spinach): Soil application is rarely used on these crops.

Alternatives – Pesticide and Non-Pesticide Practices

Following is a discussion of the alternatives to imidacloprid foliar application, or to conventional imidacloprid soil application, for insect control in important Long Island food crops. Foliar and soil uses in other crops are of relatively minor importance at this time (e.g. strawberry, grape, herbs, hops, bulb vegetables, bushberry, caneberry). Restricted-use products are designated by an asterisk (*) and cannot be used by unlicensed applicators.

Potato: There is a need for more effective systemic or foliar controls for Colorado potato beetle. All existing treatments for adult CPB in particular are of limited efficacy on Long Island, including imidacloprid. Alternatives to control Colorado potato beetle include foliar applications of Avaunt, Kryocide/Prokil Cryolite, Radiant, Entrust, *Agri-Mek, Assail 30SG, Rimon, or azadirachtin (Azatin, Neemix, etc.) targeting small-stage larvae primarily. Most of these materials have been of relatively low efficacy with some exceptions (assuming careful timing) and Assail would not be an effective option where resistance to imidacloprid is present. Seed-piece treatment with imidacloprid (Tops-MZ-Gaucho, Gaucho-MZ) is an alternative to conventional soil application. Tin-containing fungicide (Super Tin) can suppress CPB feeding and damage, reducing egg laying and survival but is of limited value. There is some varietal resistance in cultivars but these are not suited to Long Island. Other non-chemical controls for CPB include: crop rotation where possible (Long Island growers typically have very limited available land), trench trapping in the spring along field borders adjacent to overwintering sites, and propane flame treatment on field perimeters (or on trap crops planted along edges) for newly emerged adults as plants emerge. For leafhoppers, alternatives include Assail 30SG, carbaryl, pyrethroids (*Baythroid XL/generics, *Warrior II/generics, *Asana XL, *Ambush/generics), *Lannate, Movento, and Dimethoate. Alternatives for aphid control include Assail 30SG, Dimethoate, *Asana XL (potato aphid), Beleaf, Lannate (melon aphid only), and Fulfill. Some varieties show resistance to potato leafhopper but are not suitable for Long Island.

<u>Cucurbits (squash, melon, cucumber, pumpkin):</u> For control of cucumber beetle effective alternatives include Assail 30SG, carbaryl, pyrethroids [*Baythroid XL, *Brigade/generic, *Asana XL (not watermelon), *Danitol, *Pounce/generics], and Lannate (summer squash only). Seed treatment (FarMore DI400) can be used for early-stage control only. Ohio research (Jasinski et al. 2009. J. Econ Ent. 102(6):2255-64) found equivalent (or nearly so) control of striped cucumber beetle in various cucurbits with precision banded soil applications of imidacloprid, reducing imidacloprid up to 84.5% over conventional continuously banded application. Trap crops around field perimeters, periodically treated with insecticide, can help in cucumber beetle control but selected trap plants (Blue Hubbard is suggested) should (but may not) be more attractive than the main crop and this strategy reduces land available for production. Row covers can exclude cucumber beetles while plants are young but are subject to disturbance from wildlife and wind, and must be removed for pollination. There are some differences in attractiveness to beetles among cucurbit crop and cultivars, as well as susceptibility to bacterial wilt caused by a pathogen transmitted by cucumber beetles. Resistance isn't yet sufficient or available among cucurbit crops and cultivars for effective choices to be made in most cases. For aphids, several effective alternatives include Beleaf, Assail 30SG, *Warrior/generics, Fulfill, *Lannate (not pumpkin, summer squash, or winter squash), and Dimethoate (not summer squash, winter squash or pumpkin). Precision-banded application of imidacloprid (noted above) would likely also be effective for aphid control, at least to mid-season. Aphid-transmitted viruses have been a primary problem on some cucurbits, particularly summer squash and cucumber; virus transmission is one reason imidacloprid preventive treatments are used; resistant varieties are available in some cases and often used instead. Reflective mulches can help deter aphids but are difficult for workers to work around.

<u>Brassica leafy vegetables (cabbage, broccoli, cauliflower, etc.):</u> Cabbage and green peach aphid are common aphid species; alternatives for aphid control include Orthene 97/generics (Brussels sprouts and cauliflower, for green peach aphid only), Assail 30SG, Beleaf, *MSR Spray Concentrate (cabbage aphid only, under cancellation), and Fulfill. Little varietal resistance is known; destroying postharvest host crops may help control cabbage aphid. For control of Swede midge, alternatives include Assail 30SG, Lorsban 75WG, *Warrior (but not *Warrior II). Rotation and post-harvest crop destruction are important controls for this pest.

<u>Fruiting vegetables (tomato, eggplant, pepper):</u> For Colorado potato beetle, foliar controls (young larvae only) include *Agri-Mek/generics, Assail 30SG, Radiant, Entrust. As noted earlier under potato, effective treatments are needed for CPB in fruiting vegetables, particularly for the adult stage. Imidacloprid is occasionally used as a foliar spray to control aphids, but effective alternatives for this pest include Assail 30SG, pyrethroids (*Baythroid XL, *Danitol, *Warrior II/generics), Beleaf, Dimethoate, *Lannate, Movento, and Fulfill.

<u>Pome fruit (apple, pear):</u> Imidacloprid is occasionally used as a foliar spray to control green apple & spirea aphids; alternatives include Assail 30SG, pyrethroids (*Asana XL, *Danitol,

*Warrior II), Beleaf, *Lannate, Movento, and M-Pede. Rosy apple aphid is a more damaging pest in apple; alternatives include Assail 30SG, Beleaf, Esteem, *Lannate, Lorsban, and *Warrior II.

Stone fruit (peach, nectarine, plum, etc.): Aphids (green peach mainly) are occasionally a problem in Long Island tree fruit; in peach/nectarine alternatives for foliar application include Assail, Beleaf, *Lannate, and Movento. Black cherry aphid is uncommon (cherry is grown on relatively few acres on Long Island) and alternatives to imidacloprid for control include Assail, *Asana XL, *Baythroid XL, Azatin/Aza-Direct, Beleaf, *Lorsban, Malathion, M-Pede, Movento, and carbaryl.

Leafy vegetables (lettuce, spinach): Aphids are occasionally seen on these crops, infrequently enough to justify preventive soil application. Foliar sprays are occasionally needed; effective alternatives to imidacloprid include Orthene (crisphead lettuce only), Assail 30SG, Dimethoate (lettuce only), Beleaf, *Lannate (lettuce only), *MSR Spray Concentrate (crisphead lettuce, under cancellation), Fulfill, Movento.

Suggested Label Changes/Modifications

Soil application is assumed of greatest interest. Imidacloprid product labels often include a range of soil application rates, with higher rates usually needed for longer residual activity or more difficult-to-control pests. Labels also typically specify a maximum per-acre seasonal use rate. Some mitigation might be realized particularly for soil application by restricting usage rates to the low end of the permitted range and to one application per season per crop regardless of whether the maximum per acre allowance is met. New York State permits use of lower-than-label rates of pesticides in agricultural production, providing such use is not in conflict with label wording. Precision banding for in-furrow field application has been shown to work well in cucurbits but requires some specialized equipment; cost-sharing may be an option if permissible/available. The technology was not yet available when recently reported so would need to be verified. Permitting certain soil applications (e.g. potatoes) with additional restrictions may be considered. Many alternatives to foliar uses were noted above and in most cases there are effective choices, though in some cases timing can be difficult due to weather or other reasons. Lower foliar application rates of imidacloprid would likely work for some pests but not all; 25% of the label rate (Provado 1.6F) has been shown effective against leafhoppers in apples (D. Straub, pers. comm.), but would not also control spotted tentiform leafminer.

3. Agricultural Production – Nursery and Greenhouse Ornamentals, Vegetable Transplants and Greenhouse Food Crops

Crops with no/limited alternatives for Long Island

Imidacloprid materials are occasionally used in nursery and greenhouse plant production for foliar application and soil (granular, drench formulations) treatment. Among the most important uses are foliar applications for aphids (outdoor nursery in field and container, and greenhouse), and whiteflies (greenhouse); soil or container media application for oriental beetle larvae (outdoor nursery), fungus gnat larvae (greenhouse and outdoor nursery) and root aphids (occasional in outdoor nurseries or indoor propagation), foliar or (less often) field soil treatment for boxwood leafminer (in nurseries) and flatheaded borers (occasional, bronze birch borer and twolined chestnut borer). For greenhouses, the nearly season-long control for long-term crops (poinsettia most notably) and the short re-entry interval for media treatment have replaced repeat sprays using products with longer REIs and lower efficacy. Available alternatives to media or soil application of imidacloprid are most limited for oriental beetle grubs, root aphids, whiteflies, hanging basket uses, flatheaded borers, and boxwood leafminer. Media applications of imidacloprid in greenhouse potted plants for whitefly control have decreased due to resistance in a primary target insect, sweetpotato whitefly. Imidacloprid-resistant sweetpotato whitefly (almost entirely in poinsettia) populations appear to be common now. Greenhouse whitefly was once common but is now an infrequent greenhouse pest and target of imidacloprid application; more options are effective for this species. Field soil application to nursery shrubs and trees is not common due to cost but is occasionally done. Applications to grassy areas in field and forest nurseries (a specific use site on labels) are very infrequent if done at all.

Greenhouse floriculture crops: foliar and media treatment for whiteflies (greenhouse and sweetpotato primarily; alternatives have restrictions against application to flowering plants to be grown outdoors or issues with phytotoxicity), mealybugs (citrus, longtailed mainly), leafminers (blotch and serpentine, occasional), and aphids (green peach, melon, foxglove, and other species). Media application for fungus gnat larvae, foliar application for thrips (western flower thrips primarily – suppression or partial control).

Greenhouse-grown vegetable transplants for sale: foliar and soil application for a wide variety of vegetable transplants to control aphids, as a foliar application for thrips (western flower thrips primarily – suppression or partial control), and for soil application to control fungus gnats.

Greenhouse food crops: Imidacloprid is labeled for control of whiteflies and aphids in greenhouse-grown tomatoes and cucumbers for soil application. Though there are relatively few alternatives, this is not a common use on Long Island.

Nursery (outdoor) container stock: Media application for black vine weevil and oriental beetle (white grub) larvae, and for leafminers (boxwood, occasional use in nurseries), fungus gnat larvae, and root mealybugs. Media application for control of Japanese beetle adults on foliage and for flatheaded borers on woody plants (bronze birch, e.g.). Foliar application for control of aphids, adelgids, leaf beetles (occasional), leafhoppers (potato mainly), lacebugs (andromeda, azalea), sawfly larvae, boxwood leafminer.

Nursery stock, field-grown: Foliar application for control of aphids, adelgids, leaf beetles, leafhoppers (potato), lacebugs (andromeda, azalea), sawfly larvae, boxwood leafminer. Soil application for oriental beetle (white grub) larvae, flatheaded borers (bronze birch, twolined chestnut), boxwood leafminer.

Alternatives – Pesticide and Non-Pesticide Practices

Greenhouse floriculture crops: Imidacloprid can be incorporated into irrigation water for greenhouse crops including into closed (no runoff) ebb-and-flood sub-irrigation systems. Though not yet common in practice, some Long Island operations now use this technology. Whiteflies: several foliar insecticides available for whiteflies); SLN's in NY (Judo, Safari) and Kontos as foliar (both) or (Safari and Kontos) media-applied systemic controls. Safari is excluded from use on plants to be grown outdoors that produce pollen and nectar. Some plants are sensitive to Kontos. Biological controls are available and can be effective for whitefly control at comparable or slightly higher cost (esp. parasitoids *Eretmocerus* sp., or for greenhouse whitefly only *Encarsia formosa*) but affected by environmental conditions, quality issues (shipments sometimes have fewer than stated numbers), and less effective if infestations already high and/or antagonistic pesticides (e.g. some fungicides) must also be used. Reduced imidacloprid application rates (media application) may be possible but likely with commensurate decline in efficacy or duration for some pests and possible enhanced development of resistant populations. Crop isolation (older from younger plants, infested from known clean, etc.) can help in management. Mealybugs: imidacloprid has not been highly effective particularly on some species; Safari (media and foliar spray) and TriStar (foliar spray only) would be among several alternatives with Safari showing most consistent results including more difficult species (Madeira mealybug). Biocontrol options are limited to one parasitoid (for citrus mealybug only, mostly unavailable or difficult to obtain) and predator (*Cryptolaemus*), though these are much less effective under winter conditions and present similar issues with pesticide compatibility noted above. Discarding infested plants or stock is done where possible, also avoiding infested benches (where egg masses or lingering mealybugs may remain for some time). Leafminers: Several foliar products labeled and effective except where resistance occurs (a problem with serpentine leafminer in the past); some biocontrols (*Diglyphus*, e.g.) also available are used with some success elsewhere (problem has been minimal on Long Island so no local experience with leafminer biocontrols). Physical removal of infested foliage is possible where infestation is at a low level. Aphids: Many foliar and one systemic (Kontos, some sensitive plants) insecticides available and effective. Several biocontrols also available (*Aphidius* spp., *Aphidoletes*, *Aphelinus*, ladybugs) and can be effective providing environmental conditions not limiting, biocontrol is matched with aphid species, releases are done early and disruptive pesticides are not used. Fungus gnat larvae (root pest) in media: Several other media treatment insecticides available and effective. Biocontrols (nematodes such as *Steinernema feltiae, Heterorhabditis bacteriophora*) can be used but efficacy is unreliable. Thrips (mainly western flower): There is resistance in many western flower thrips populations to some insecticides, most recently to spinosad (Conserve). Relatively few effective choices are available, all are sprays (Overture and *Pylon, both greenhouse use only, *Mesurol (restricted-use)– these three are generally effective; Kontos is only for immature stages, *TriStar 8.5SL and others can also be used but less effective). Biocontrols are also available but not reliably effective for thrips control with usual issues of environment, timing of use, and compatibility with other practices.. Biocontrols generally not as suitable for short-term bedding plant crops (where thrips is a major pest) compared with longer-term crops such as poinsettia. Removal of early blooms (with enclosed adult thrips) during early production, isolation of vegetative- vs seed-propagated material and older crops from younger are recommended. Retrofitting vent screens to exclude thrips from entering the greenhouse is possible but not usually practical and carries significant installation and maintenance costs.

Greenhouse-grown vegetable transplants for sale: Aphids, fungus gnat larvae: *TriStar 8.5SL (for both) or Distance (fungus gnats only) can be used and are effective. Kontos (drench or spray) is labeled for aphids & whiteflies on this crop. Safari also labeled for aphids, whiteflies, fungus gnat larvae but uses not approved in NY for this crop. BotaniGard (biocontrol) spray is partly effective on aphids and whiteflies. Thrips (western flower thrips usually): all products labeled including imidacloprid provide only partial control; there are no highly effective materials for this crop. For thrips and other pests segregating seed-grown plants from older and cutting-grown material helps where possible in larger operations, particularly if older plants known to be infested. Comments on biocontrols above also apply for whiteflies, aphids, fungus gnats, thrips.

Greenhouse food crops: *TriStar 8.5SL label includes control of whiteflies in greenhouse tomatoes. Akari labeled for whitefly suppresson only in cucumber and fruiting vegetables. Exirel (not yet approved in NY) has labeling for whitefly (and thrips suppression) in fruiting vegetables. Distance IGR also has a supplemental label for control of whiteflies in most fruiting vegetables (use not registered in NY). BotaniGard (two formulations), Preferal, and various azadirachtin IGRs can be used to control whiteflies and aphids in many greenhouse vegetable crops but not as effective as imidacloprid. M-Pede and some horticultural oil products can be used to control whiteflies and aphids on greenhouse food crops, though coverage needs to be thorough and they have no residual activity. EPA has determined that outdoor-use products for food crops can be used on greenhouse food crops providing labels do not restrict otherwise, which clears the way for use of some alternative products providing care is taken in calculating rates (this interpretation is apparently being reviewed). Biological control can be effective in greenhouse vegetables for control of aphids (*Aphidius*, *Aphelinus*, *Aphidoletes*, ladybeetles) and whiteflies (*Eretmocerus* spp., *Encarsia formosa*); aforementioned caveats apply.

Nursery (outdoor) container stock: Black vine weevil: media treatment (pre-mix) with Met52 (biocontrol, insect pathogen) has been effective but there are issues with product availability (registered for this use in NY State). Drench treatment with *bifenthrin show some efficacy but variable, best as preventive but there are cost and worker exposure issues. Nematode (*S. feltiae*, *H. bacteriophora*) drenches show variable results and limited to media temperatures above 60F (warmer for *H. bacteriophora*). Oriental beetle (OB): *chlorpyrifos drench or pre-treatment with *bifenthrin can be used preventively but not highly effective on larger larvae and undesirable due to worker exposure issues and cost; chlorpyrifos availability very limited. Mating disruption with OB pheromone appears to be working moderately well to control future infestations and now approved for use in New York State. Generally mating disruption has performed best when used over a large area (5A or more), so efficacy in smaller areas reduced. Beneficial nematodes listed also can be used but efficacy has been poor to limited. Met52 is not effective against this pest. Boxwood leafminer: more common as a pest in field stock but occasional in container plants; some other labeled foliar products but imidacloprid soil or foliar application has been most effective treatment on Long Island (Avid foliar application must be timed for adult activity and can be difficult; results with TriStar foliar application more variable). Some resistant cultivars are known but susceptible ones are widely grown as they are specified or requested. Japanese beetle (adults): foliar insecticides available and effective though mostly less desirable products (pyrethroids, carbaryl, acephate on woody plants); not a common pest in recent years. No non-pesticide alternatives practical or effective for this pest under heavy pressure. Flatheaded borers:

preventive bark sprays with *chlorpyrifos, *permethrin or *bifenthrin can be used. Cultural management probably helps in some cases (e.g. oak, twolined chestnut borer) unless pest pressure high and/or trees recently planted. Resistant birch (*B. nigra* 'Heritage' and others) now grown widely instead of bronze birch borer-susceptible species. Aphids, adelgids, leaf beetles, leafhoppers, lacebugs, sawfly larvae: some foliar insecticide alternatives available/used. Existing natural enemies apparently have some impact but not reliable. Lower label rates of imidacloprid are likely effective for some uses (e.g. leafhoppers as in tree fruit).

Nursery stock, field-grown: Comments above (container stock) for aphids, adelgids, leafhoppers (potato), lacebugs, sawfly larvae, oriental beetle larvae, boxwood leafminer, and flatheaded borers apply. Soil treatment with imidacloprid tends to be uncommon on Long Island for field nursery stock (high cost, difficult application), but has been occasionally done for oriental beetle larvae. Mating disruption (Oriental Beetle MD) for oriental beetle used in container stock has been mostly effective and of reasonable cost; results in field situations (NJ) have been good and would be an alternative. .

Suggested Label Changes/Modifications

Greenhouse floriculture crops: Restricting drench uses to closed irrigation systems is an option particularly if granular broadcast application would also be generally allowed, so that occasional systemic uses are still available even where closed systems are not in place. The label provides for a range of application rates for drench uses – restricting to the lowest rate once per crop is an option. If foliar applications are less likely to pose risks to groundwater these uses might be retained.

Greenhouse-grown vegetable transplants for sale: Use is already very limited in terms of amount of imidacloprid applied. Comments above for floriculture crops also apply.

Greenhouse food crops: Use on Long Island is very limited but might be further restricted to closed systems or other situations where runoff to soil would not occur.

Nursery (outdoor) container stock: Drench uses can be limited to important pests noted and to lowest label use rate (a range of rates is provided for nursery container application). Closed irrigation systems are not found in Long Island nurseries; label language can be added concerning irrigating only lightly within some period following drench application to further reduce risk of runoff. Foliar applications might continue to be allowed if posing minimal risk to groundwater. Imidacloprid is also not widely or preventively used in nursery container production particularly as a drench due to cost for material and labor.

Nursery stock, field-grown: Similar comments under container stock might apply to field uses; there is a similar range of rates for nursery field (soil) application to control white grubs and use might be limited to the lowest rate but efficacy for curative treatment to control late-stage grubs, when control is most used, will be compromised (3^{rd} instar oriental beetle are less sensitive to imidacloprid compared with earlier stages, but as noted preventive treatments for earlier stages are not usually done).

4. **Landscape Ornamentals; Turfgrass and Sod Farms**

Crops with no/limited alternatives for Long Island

Imidacloprid has been particularly valued for landscape application, in some cases replacing foliar sprays of organophosphate, carbamate and other products with a soil-applied material for common pests such as Japanese beetle, soft scale insects, hemlock woolly adelgid, boxwood leafminer and lace bugs or turfgrass pests such as white grubs. The loss of many of these older products through the re-registration process, and the adoption of the Neighbor Notification law in all Long Island counties, which requires 48-hour prior notification of neighbors for many pesticides when applied as foliar sprays, have elevated interest in systemic products (certain spot applications to an area 9 sq. ft. or less are exempt from notification requirements) and in imidacloprid in particular. Imidacloprid formulations for landscape use include many granular materials (many on fertilizer) for control of pests in turfgrass and some for white grubs in landscape plants, tablet formulations for landscape shrubs and trees, trunk injections for landscape trees, and liquid or powder versions used as foliar sprays, trunk sprays (e.g. for hemlock woolly adelgid), or for soil application (drench application permitted on Long Island; imidacloprid soil injections are prohibited). For large trees soil applications are highly favored over foliar sprays due to drift and sometimes to difficulty in obtaining coverage with sprays. Arborists also appreciate soil application for larger trees and shrubs can be done in fall when there are fewer conflicting work demands.

<u>Turf and sod farms:</u> Imidacloprid is not widely used on sod farms, as white grubs are not commonly a problem in sod production (time is needed for populations to move in and establish). In established residential and commercial lawns imidacloprid is widely used for control of white grubs (oriental beetle primarily, with other species also seen) usually in granular formulations applied in broadcast or drop spreaders, often in fertilizer-based formulations, and much less commonly as a spray.

<u>Landscape shrubs and trees:</u> Some of the most important uses are for residential and commercial landscapes as a soil or occasionally trunk or foliar application for control of hemlock woolly adelgid, as a soil application for control of boxwood and holly leafminer and some soft scale insects, as a soil treatment to provide season-long control Japanese beetle, some aphids (on large trees or particularly damaging species), lace bugs (e.g. andromeda, sycamore, azalea), flatheaded borers (bronze birch, twolined chestnut), and leaf-feeding beetles (e.g. viburnum leaf beetle – recent Long Island arrival) and in USDA Asian Longhorned Beetle programs as a trunk injection. It is commonly used as a soil treatment for ash to control emerald ash borer where it is now established (not known on Long Island as of 2014).

Alternatives – Pesticide and Non-Pesticide Practices

<u>Turf and sod farms:</u> Formulations of trichlorfon insecticide (Dylox) can be used to control white grubs in landscape maintenance situations but not sod farms; no other insecticides are available or effective for oriental beetle on Long Island (Acelepryn and related formulations are approved for use in the rest of the state). Milky spore, a biocontrol, is not effective against oriental beetle. Entomopathogenic nematodes can be used but results are highly variable and require special care

in handling and application, the material is expensive and must be checked for viability, and applied when soil temperatures are at least 60F (for *Steinernema*; higher for *Heterorhabditis*).

Landscape shrubs and trees: Hemlock woolly adelgid: Imidacloprid trunk injection or bark application (alternative to foliar or soil application), Safari bark application (SLN label in NY), *TriStar 8.5SL basal bark application or foliar spray, and several other foliar insecticides (horticultural oil, M-Pede,…) are labeled. Boxwood leafminer: Other foliar insecticides are labeled but not generally or consistently effective or timing for adult-stage more difficult (e.g. abamectin and TriStar) and no other systemic (soil) treatments are labeled or available on Long Island. Holly leafminer: Efficacy data on some labeled alternative foliar insecticides is lacking; no other systemic (soil) treatments are labeled. Japanese beetle: several foliar insectides are labeled and effective such as acephate products, Imidan, carbaryl insecticides, and some pyrethroid insecticides but repeat applications are needed during periods of high insect pressure and warm temperatures (recent results with Acelepryn foliar application show season-long control but the product is not approved for use on Long Island). Repeat use of carbaryl or pyrethroids has bene associated with outbreaks of twospotted spider mite. No other systemic (soil) treatments are available for Japanese beetle; Harpoon (under cancellation) is labeled as a trunk injection for this pest on magnolia only. Aphids: many alternative foliar insecticides are labeled including *TriStar, *Endeavor and others. Trunk injection (possibly also trunk spray with 2ee label if approved) with imidacloprid would be an alternative to soil or foliar use. *Bidrin (Inject-a-Cide B) trunk injection can also be used on larger trees but the material is highly toxic. There are no other systemic (soil) treatments for landscape application to control aphids on trees and shrubs; the *TriStar label does not include this pest for bark application. Natural enemies often help keep aphids under control but are not effective in all cases; use of some insecticides (some pyrethroids, e.g.) can inhibit natural enemies. Lace bugs: Imidacloprid trunk injection is an alternative to foliar or soil application for larger trees only (e.g. sycamore lace bug), *Abamectin trunk injection is also an alternative for larger trees. Several other foliar insecticides can be used, but there are no other soil (systemic) insecticides for lace bug control in landscape shrubs and trees. Flatheaded borers: *Tree-äge and bidrin trunk injection for larger trees can be used (note comment on *bidrin above); imidacloprid trunk injection is an alternative to soil treatment. Several insecticides (*bifenthrin, *permethrin) are labeled for bark application as protectants against borer attack. *TriStar 8.5SL can be used as a basal bark treatment or trunk injection though efficacy data are limited. Leaf-feeding beetles: Several foliar insecticides can be used to control various leaf-feeding beetles, but there are no soil-applied systemics for professional landscape use for this group of pests. Asian longhorned beetle: soil applications are not used on Long Island for this pest; use is limited to trunk injection. Other treatments are being explored and some appear to have promise. The Central Islip quarantine was lifted in 2011 and theBrooklyn quarantine may follow, although ALB was recently(2013) discovered in the East Farmingdale/West Babylon area..

Suggested Label Changes/Modifications

Turf and sod farms: Application by drop rather than broadcast spreaders for granular materials with warning language prohibiting runoff, drift or otherwise movement to areas where runoff to drains would be likely could be included. Application might be limited to once per year.

Landscape shrubs and trees: Application might be limited to once per year; uses for critical pests permitted for soil treatment though consideration should be given to flexibility where alternatives don't exist or where new unexpected pests arise. Trunk injection isn't always an alternative and there are concerns for wound healing and secondary infection, or where the injection sites remain apparent over a long period (e.g. on birch).

5. Brief Summary of Critical or Important Uses

Though many uses of imidacloprid are shared or supplanted by alternative products, a few continue to be of value on Long Island. In potatoes and in newly transplanted fruiting vegetables, soil application of imidacloprid remains at least partially effective for control of Colorado potato beetle. In outdoor (especially smaller) nurseries, it is occasionally needed for curative control of oriental beetle as a media drench in container-plant production. In field nurseries and landscapes it is an important product for control of boxwood and (to a minor extent) holly leafminers, and the most effective long-residual material for control of viburnum leaf beetle and Japanese beetle adults, used as a soil application. Particularly for tall trees in landscapes or where sprays are impractical or can't be done due to drift or other issues it has been an important material for soil treatment to control hemlock woolly adelgid, aphids, lacebugs, soft scales and certain other pests. In greenhouses it is still used occasionally in greenhouse-grown vegetable transplants for aphids (spray usually), western flower thrips (spray, for suppression) and fungus gnat larvae (media drench). It is particularly valued for treating plants in hanging baskets early in production, where later overhead foliar sprays are difficult at best . Imidacloprid is very widely used by commercial applicators to control some pests in residential and commercial turfgrass areas, specifically white grubs such as oriental beetle; Dylox (trichlorfon) is the only alternative product available (and the only product for homeowner use on Long Island). Imidacloprid has been widely used in Asian longhorned beetle eradication programs including on Long Island (as a trunk injection only). Note that loss of imidacloprid for some uses, particularly systemic (soil) applications, may result in increased use of or dependence upon other products (including spray applications), such as trichlorfon for white grub control in turfgrass.

Prepared by Entomology Program
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Attachment 4

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

Summary of Possible Practices to Improve Imidacloprid Usage and Reduce or Eliminate Groundwater Contamination
Vegetable and Fruit Crops

Options to Reduce Imidacloprid Usage or Improve Effectiveness of Imidacloprid Applications		Use Patterns								Advantages	Disadvantages
		Fruiting Vegetables	Potato	Cucurbits	Brassica Leafy Vegetables	Leafy Vegetables	Pome Fruit	Stone Fruit	Grapes		
		Primary Target Pests and Usual Application Method (soil and/or foliar)									
		CPB (tomato, eggpl; soil & foliar) Aphids (tomato, pepper, foliar)	CPB, Aphids, PLH (soil, foliar)	Cuke Btl, Aphids (soil only)	Aphids, flea btl (1°foliar, soil uncommon) swede midge not yet	Aphids (1°foliar, soil uncommon)	Aphids incl RAA, LH (foliar), SJS uncommon use (foliar) (soil uncommon)	Aphids, Jap. Btl (foliar) (soil uncommon)	PLH (foliar, uncommon) use (soil not used)		
1) Application Modifications	Precision banded soil applications			✓ (Cuke Btl & aphids)						• Reduced imidacloprid up to 84.5% for control of cucumber beetle	• May require use and purchase of additional or specialized equipment.
	Reduce application rates	✓ (soil and foliar)	✓ (soil and foliar)	✓ (soil)	✓ (mainly if soil)	✓ (mainly if soil)	✓ (mainly if soil, or foliar if for LH)	✓ (soil and foliar)	✓ (foliar)	• Reduces amount of imidacloprid usage. • Reduced cost.	• During certain times of year or with certain diseases, more than one application may be necessary. • Reduced efficacy or residual activity • May increase likelihood for resistance development.
	Treat hot spots only	✓	✓	✓ (Particularly for Striped Cucumber Beetle)	✓	✓	✓	✓		• Reduces amount of imidacloprid usage. • Reduced cost.	• Not generally useful strategy for aphids, leafhoppers
	Use of treated seed/seed piece treatment		✓	✓ (for emergence, cuke btl)						• May reduce the need for soil applications.	• For potatoes, treatment messy and involves additional handling/exposure
	Restricting use to perimeter or trap crops	✓ (CPB)	✓ (CPB)	✓ (Cuke Btl)						• Reduces amount of imidacloprid usage. • May reduce amount of damage to the primary crop.	• Increased cost associated with establishing and maintaining trap crop. • Reduces amount of land available for production. • Proper design and management is required to avoid spread or pests to primary crops.
	Use only later in the season, not at-plant soil treatment	✓ (foliar)	✓ (foliar, or soil at hilling)		✓ (foliar)	✓ (foliar)	✓ (foliar)	✓ (foliar)	✓ (foliar)	• May reduce the need for soil applications, or applied later when roots better developed for interception (potatoes)	• Transplants at planting or emerging plants not protected
	Improve calibration of application equipment	✓	✓	✓	✓	✓	✓	✓	✓	• Reduces amount of imidacloprid usage. • Reduced cost for material • Possibly better efficacy with accurate rate	• Increased cost associated with improved application equipment.
	Establish agricultural handling facility for mixing of chemicals	✓	✓	✓	✓	✓	✓	✓	✓	• Better handling of spills • Reduced risk of environmental contamination	• Cost for facility and maintenance
	Treat transplants in flats	✓ (Aphids)		✓ (Aphids)						• May reduce the need for soil applications.	• Low label rate only for aphids (and whiteflies), not Colorado potato btl
	Have supplemental label for soil applications										
	Guidance on timing of application to maximize quantity staying on target and loss of imidacloprid through runoff and leaching.	✓ (foliar)	✓ (foliar)	✓ (foliar)	✓ (foliar)	✓ (foliar)	✓ (foliar)	✓ (foliar)	✓ (foliar)	• Possibly reduces amount of imidacloprid usage. • Possibly reduces off-site movement of pesticide.	

Summary of Possible Practices to Improve Imidacloprid Usage and Reduce or Eliminate Groundwater Contamination
Vegetable and Fruit Crops

Insecticides that are Possible Alternatives to Imidacloprid or that can be used in Rotation with Imidacloprid

Options to Reduce Imidacloprid Usage or Improve Effectiveness of Imidacloprid Applications	Use Patterns								Advantages	Disadvantages
	Fruiting Vegetables	Potato	Cucurbits	Brassica Leafy Vegetables	Leafy Vegetables	Pome Fruit	Stone Fruit	Grapes		
	Primary Target Pests and Usual Application Method (soil and/or foliar)									
Active Ingredient Name (Product Trade Name)	CPB (tomato, eggpl; soil & foliar) Aphids (tomato, pepper, foliar)	CPB, Aphids, PLH (soil, foliar)	Cuke Btl, Aphids (soil only)	Aphids, flea btl (1°foliar, soil uncommon) swede midge not yet	Aphids (1°foliar, soil uncommon)	Aphids incl RAA, LH (foliar), SJS uncommon use (foliar) (soil uncommon)	Aphids, Jap. Btl (foliar) (soil uncommon)	PLH (foliar, uncommon) use (soil not used)		
Abamectin (Agri-Mek & others)	✓ (CO Potato Beetle)	✓ (CO Potato Beetle)								• Restricted
Acephate (Orthene 97, Acephate, others)				✓ (Aphids, B. sprouts & cauliflower only)	✓ (Aphids - Crisphead Lettuce)				• Leaching potential (GUS = 1.14) lower than imidacloprid (GUS = 3.76)	• Some restricted, 14 DTH on cole crops, possible negative interaction with Sandea (herbicide)
Acetamiprid (Assail 30SG)	✓ (CO Potato Beetle, Aphids)	✓ (CO Potato Beetle, Leafhoppers, Aphids)	✓ (Cucumber Beetle, Aphids)	✓ (Aphids, Swede Midge)	✓ (Aphids)	✓ (Aphids, SJS, LH)	✓ (Aphids, JB)	✓ (LH,JB)	• Reduced-risk for fruiting veg, potato, brassica leafy veg, leafy veg, pome fruit, grapes • Leaching potential (GUS = 0.94) lower than imidacloprid (GUS = 3.76)	• Not effective where resistance to imidacloprid is present
Azadirachtin (Azatin[1], Neemix[2], Aza-Direct[3] Others)	✓ (CO Potato Beetle immature)	✓ ([1, 2]CO Potato Beetle immature)							• Leaching potential (GUS = 0.99) lower than imidacloprid (GUS = 3.76)	• Immature stages only.
Carbaryl, Sevin		✓ (Leafhoppers)	✓ (Cucumber Beetle)	✓ (Flea Beetle)			✓ (Aphids, JB)		• Leaching potential (GUS = 2.0) lower than imidacloprid (GUS = 3.76)	• Use can flare spider mites
Chlorpyrifos (Lorsban 75WG)				✓ (Swede Midge)					• Leaching potential (GUS = 0.15) lower than imidacloprid (GUS = 3.76)	
Cryolite (Kryocide, Prokil Cryolite)	✓ (CO Potato Beetle)	✓ (CO Potato Beetle)								
Dimethoate	✓ (Aphids)	✓ (Leafhoppers, Aphids)	✓ (Aphids - not pumpkin, summer/winter squash)		✓ (Aphids - Leaf lettuce)				• Leaching potential (GUS = 1.06) lower than imidacloprid (GUS = 3.76)	• Restricted, 48 hr REI and long PHI on some crops (lettuce, 14d). • Possible negative interaction with Sandea (herbicide)
Fentin Hydroxide (Super Tin)		✓ (CO Potato Beetle)							• Leaching potential (GUS = 0.72) lower than imidacloprid (GUS = 3.76)	• Restricted
Flonicamid (Beleaf)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)		• Leaching potential (GUS = 1.87) lower than imidacloprid (GUS = 3.76)	
Indoxacarb (Avaunt)		✓ (CO Potato Beetle immature)							• Reduced-risk for potato • Leaching potential (GUS = 0.23) lower than imidacloprid (GUS = 3.76)	
Malathion							✓ (Aphids)		• Leaching potential (GUS = 1.28) lower than imidacloprid (GUS = 3.76)	
Methomyl (Lannate)	✓ (Aphids)	✓ (Leafhoppers, Melon Aphids)	✓ (Cucumber Beetle, melon aphids - cukes, melons, summer squash only)		✓ (Aphids - Lettuce)	✓ (Aphids)	✓ (Aphids)		• Leaching potential (GUS = 2.2) lower than imidacloprid (GUS = 3.76)	• Restricted. 48 hr REI and long PHI on some crops
Novaluron (Rimon)		✓ (CO Potato Beetle immature)							• Effective for immature stages in LI trials • Leaching potential (GUS = 0.03) lower than imidacloprid (GUS = 3.76)	• Timing critical
Potassium Laurate (M-Pede)						✓ (Aphids)	✓ (Aphids)			• Can be phytotoxic, no residual activity (contact only) good coverage critical
Pymetrozine (Fulfill)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)	✓ (Aphids)				•Reduced-risk for fruiting veg, potato cucurbits, brassicas, leafy veg • Leaching potential (GUS = 0.68) lower than imidacloprid (GUS = 3.76)	
Pyrethroids (Baythroid XL[1], Warrior II[2], Asana XL[3], Ambush[4], Brigade[5], Danitol[6], Pounce[7] others)	✓ ([1, 2, 6]Aphids)	✓ ([1, 2, 3, 4]Leafhoppers, [3]Potato Aphids)	✓ ([1, 3, 5, 6, 7]Cucumber Beetle, [8]Aphids)	✓ ([2]Swede Midge, Flea btl)		✓ ([2, 3, 6]Aphids)	✓ ([1, 3]Aphids)	✓ ([6]PLH, JB)		• Restricted. Repeat applications may lead to mite, aphid flaring
Pyriproxyfen (Esteem)						✓ (RAA, SJS)			• Reduced-risk on pome fruit • Leaching potential (GUS = 0.33) lower than imidacloprid (GUS = 3.76)	
Spinetoram (Radiant)	✓ (CO Potato Beetle)	✓ (CO Potato Beetle)							• Reduced-risk on fruiting veg and potato • Leaching potential (GUS = 0.72) lower than imidacloprid (GUS = 3.76)	
Spinosad (Entrust)	✓ (CO Potato Beetle)	✓ (CO Potato Beetle)							• Reduced-risk on fruiting veg and potato • Leaching potential (GUS = 0.62) lower than imidacloprid (GUS = 3.76)	
Spirotetramat (Movento)	✓ (Aphids)	✓ (Aphids)		✓ (Aphids)	✓ (Aphids)	✓ (RAA, SJS)	✓ (Aphids)		• Leaching potential (GUS = 1.12) lower than imidacloprid (GUS = 3.76)	

Summary of Possible Practices to Improve Imidacloprid Usage and Reduce or Eliminate Groundwater Contamination
Vegetable and Fruit Crops

Options to Reduce Imidacloprid Usage or Improve Effectiveness of Imidacloprid Applications		Use Patterns: Fruiting Vegetables	Potato	Cucurbits	Brassica Leafy Vegetables	Leafy Vegetables	Pome Fruit	Stone Fruit	Grapes	Advantages	Disadvantages
	Primary Target Pests and Usual Application Method (soil and/or foliar)	CPB (tomato, eggpl; soil & foliar) Aphids (tomato, pepper, foliar)	CPB, Aphids, PLH (soil, foliar)	Cuke Btl, Aphids (soil only)	Aphids, flea btl (1°foliar, soil uncommon) swede midge not yet	Aphids (1°foliar, soil uncommon)	Aphids incl RAA, LH (foliar), SJS uncommon use (foliar) (soil uncommon)	Aphids, Jap. Btl (foliar) (soil uncommon)	PLH (foliar, uncommon) use (soil not used)		
3) Non-Pesticide Cultural Management Practices	Trench trapping in the spring along field borders adjacent to overwintering sites		✓ (CO Potato Beetle)							• May reduce pest pressure thereby reducing the amount of imidacloprid usage.	• Increased cost associated with maintaining trench trap.
	Propane flame treatment on field perimeters for newly emerged adults as plants emerge		✓ (CO Potato Beetle)							• May reduce the need for pesticides to control insects.	• Commonly requires specialized equipment.
	Crop Rotation		✓ (CO Potato Beetle)		✓					• May reduce pest pressure thereby reducing the amount of imidacloprid usage	• LI growers have limited available land and for pest control considerable distance between crop rotation is necessary
	Intercropping	✓	✓	✓	✓	✓				• May reduce pest pressure thereby reducing the amount of imidacloprid usage	• May not be compatible with production • Additional land, irrigation, maintenance may be needed
	Interseed cover crops	✓	✓	✓	✓	✓	✓	✓	✓	• May improve soil quality and plant health • Possible refuge for pest natural enemies	• Added cost for establishing the cover crop. • May need to control the cover crop so that it does not compete with the target crop. • Additional land, irrigation, maintenance may be needed
	Crop Isolation	✓	✓							• CPB slower to colonize vs unrotated	• Limited land available
	Use of infield vegetative strips	✓	✓	✓	✓	✓	✓	✓	✓	• May provide habitat for insect predators. • Spray interception by ground cover may reduce imidacloprid movement	• Loss of area for direct agricultural use.
	Use of resistant rootstocks								✓ (phylloxera)	• May reduce imidacloprid usage. • Phylloxera not a problem on LI; resistant/tolerant rootstocks usually used	• Selection of the most appropriate rootstock for vineyard.
	Use of Resistant Cultivars									• Where available could reduce need for some insecticides	• Few or no commercial cultivars with insect resistance (some cucurbits resist/less susceptible to cuke beetle)
	Row covers during early stages of plant growth.	✓		✓	✓					• May reduce cucumber beetle pest pressure for cucurbit crops, CPB on tomato/eggplant transplants, flea beetles on cole crops	• Must be removed for pollination. • Increased cost associated with materials and labor for installation. • May be disturbed by wildlife.
	Reflective mulches	✓ (Aphids)		✓ (Aphids)						• May deter aphids for cucurbit crops.	• Reflective mulch makes crop management difficult for workers.
	Use of plastic mulch	✓		✓	✓	✓				• Possible increase in crop yield. • Improved control of pests. • Complements drip irrigation practices. • Reduces between crop row leaching of pesticide.	• Added cost associated with plastic mulch and equipment needed for placement.
	Physical removal of pests, infested foliage/plants	✓ (CO Potato Beetle)	✓ (CO Potato Beetle)							• For small plantings, may be practical and effective	• Labor-intensive and not practical on larger scale
	Post-harvest crop destruction				✓					• May help with cabbage aphid (overwinters on host)	• Late crops may not have sufficient time for cover crop • limited value for most target pests
	Improvements to Soil Health to promote healthy crops and reduce dependency on insecticides. Can be achieved through a combination of cultivation practices and measures to increase soil organic matter	✓	✓	✓	✓	✓	✓	✓	✓	• May reduce the amount of insecticide usage. • May reduce the overall leaching of pesticides from the soil column. • May reduce the amount of soil erosion.	• Possible added cost associated with increasing the soil organic matter. • Actual benefits for pest management not quantified in most cases
	Reduced tillage	✓		✓	✓	✓	✓	✓	✓	• Reduces the amount of soil organic matter that is lost through tillage. • Less tillage preserves soil structure.	• Actual benefits for pest management not quantified in most cases
	Timing of tillage - avoid field entry under saturated conditions to minimize soil compaction and avoid tillage during pesticide applications	✓	✓	✓	✓	✓				• Reduces potential for soil to become compacted. • Reduces potential for pesticide leaching. • Improved soil quality may reduce need for pesticides.	• Possible added cost associated with cultivation.
	Forecasting Models - Encourage or require the use of weather information and pest models found on NEWA for timing of scouting and management applications. http://newa.cornell.edu/										• No models for target pests
	Improve irrigation practices/develop an irrigation water management plan	✓	✓	✓	✓	✓	✓	✓	✓	• Reduces water usage and associated expenses. • Reduces potential for leaching to occur. • Reduces conditions that may lead to disease development.	
	Mating disruption										• Efficacy in smaller areas is reduced • No applications for target pests
	Promote guidance on proper handling of containers and excess product to minimize potential for groundwater contamination.	✓	✓	✓	✓	✓	✓	✓	✓	• Reduces the potential for raw pesticide product to readily enter the subsurface.	• Possible increased operational costs.

Summary of Possible Practices to Improve Imidacloprid Usage and Reduce or Eliminate Groundwater Contamination
Floral, Turf Nursery

Options to Reduce Imidacloprid Usage or Improve Effectiveness of Imidacloprid Applications		Use Patterns						Advantages	Disadvantages
		Greenhouse Floriculture	Greenhouse-grown Vegetable Transplants for Sale	Greenhouse Food Crops	Nursery (outdoor) Container Stock, Field-Grown trees/shrubs (incl Xmas)	Landscape Turf and Sod Farms	Landscape Shrubs and Trees		
		Primary Target Pests and Usual Application Method (soil and/or foliar)							
		Aphids, whiteflies, thrips (suppr), MB, FG larvae foliar (all exc FG) or soil (all exc thrips)	Aphids, FG larvae, thrips (suppr) (foliar), aphids, FG (soil)	Aphids, WF (soil) Tomato, cucumber only not for hydroponic use	Aphids, lacebugs, leaf btls, flatheaded borers, soft scale, leafminers (box esp) (soil, foliar), Jap. Btl adults, FG larvae, BV weevil larvae, white grubs (soil) possibly others	White grubs (soil application)	Adelgids, aphids, leaf-feeding beetles (incl Jap btl), psyllids, soft/armored scales, FH borers		
1) Application Modifications	Precision banded soil applications							• Reduced imidacloprid up to 84.5% for control of cucumber beetle	• Requires specialized equipment
	Reduce application rates	✓ (granular)	✓ (granular)		✓ (granular)	✓	✓ (drench - pests other than borer, grubs, armored scales)	• Lower cost, less material over a given area	• May reduce efficacy and residual control
	Use foliar application instead of soil treatment	✓	✓		✓		✓	• Reduced area use or risk to groundwater movement	• Good for some pests/situations but not others
	Improve calibration of application equipment	✓ (soil)	✓ (soil)	✓ (soil)	✓ (soil)	✓	✓ (drench - pests other than borer, grubs, armored scales)	• More accurate delivery may mean lower cost for material • Usually use less material (lower cost)	• Increased cost associated with improved application equipment.
	Light irrigation to reduce risk of runoff (soil application) or leaching, avoid irrigation immediately following foliar spray (exc. light irrig for turf)	✓	✓	✓ (soil)	✓ (soil)	✓	✓	• More product remains where it can be effective, less off-site movement	
	Treat hot spots only	✓ (soil or foliar)	✓ (soil or foliar)	✓ (soil)	✓ (soil or foliar)		✓ (foliar)	• Less material applied over a given area, lower cost	• Labor required to delimit infestation
	Restricting use to perimeter trap crops								
	Treat transplants in flats or beds rather than at planting in field	✓ (soil or foliar)	✓ (soil or foliar)					• Treatment may be advantage where protection needed only during early establishment	• Less residual control after planting
	Use of Treated Seed								
	Use against the overwintered population and later in the season							• Efficacy may be improved by timing - older trees/larger shrubs best treated in fall or very early spring. • Some pests may be well-controlled with fall application (adelgid, boxwood LM e.g.)	
	Application via drop rather than broadcast spreaders for granular materials with runoff warning language					✓ (granular)			
	Application timing - not to occur prior to predicted storm/precipitation events				✓	✓	✓		
	Establish irrigation water management plan				✓	✓	✓	• Address overwatering in landscapes, nursery container production	
	Establish agricultural handling facility for mixing of chemicals	✓	✓	✓	✓	✓			
	Trunk or bark injection or bark application instead of soil application						✓ (most labeled pests)	• Little/no drift or off-target movement • Basal bark spray for hemlock woolly adelgid; injection products labeled for most pests	• Concerns for wound healing and secondary infection from injection; Injection site remains apparent over a long period on some trees • Some problems with mite outbreaks on systemically treated trees

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Floral, Turf Nursery

Options to Reduce Imidacloprid Usage or Improve Effectiveness of Imidacloprid Applications		Use Patterns: Greenhouse Floriculture	Greenhouse-grown Vegetable Transplants for Sale	Greenhouse Food Crops	Nursery (outdoor) Container Stock, Field-Grown trees/shrubs (incl Xmas)	Landscape Turf and Sod Farms	Landscape Shrubs and Trees	Advantages	Disadvantages
		Primary Target Pests and Usual Application Method (soil and/or foliar): Aphids, whiteflies, thrips (suppr), MB, FG larvae foliar (all exc FG) or soil (all exc thrips)	Aphids, FG larvae, thrips (suppr) (foliar), aphids, FG (soil)	Aphids, WF (soil) Tomato, cucumber only not for hydroponic use	Aphids, lacebugs, leaf btls, flatheaded borers, soft scale, leafminers (box esp) (soil, foliar), Jap. Btl adults, FG larvae, BV weevil larvae, white grubs (soil) possibly others	White grubs (soil application)	Adelgids, aphids, leaf-feeding beetles (incl Jap btl), psyllids, soft/armored scales, FH borers		
used in Rotation with Imidacloprid ... ame)	Abamectin (Avid & others)	✓ (Aphids, thrips (suppr.))			✓ (Boxwood Leafminer)		✓ (Boxwood Leafminer - foliar, Lace Bugs - trunk inj.)		• For box LM timing for adult stage can be difficult • Need high rate for aphid control • Not for ferns, Shasta daisy • Trunk injection not for shrubs
	Acephate (Orthene 97, others)	✓ (Aphids, thrips, certain crops only)			✓ (Jap Btl, aphids - on woody plants & few herbaceous)		✓ (Japanese Beetle)	• Systemic from foliar application • Leaching potential (GUS = 1.14) lower than imidacloprid (GUS = 3.76)	• Phytotoxic to some herbaceous plants/var • Not labeled for most herbaceous plants • Longish REI (24 hr) • Strong odor
	Acetamipirid (TriStar 8.5SL)	✓ (Mealybugs, Thrips - spray; FG larvae- 'sprench')	✓ (Aphids) (FG - drench) certain crops only	✓ (Aphids, WF, thrips) tomatoes only	✓ (Box LM, aphids, Jap Btl, FH borers, scales)		✓ (Hemlock Wooly Adelgid, Boxwood Leafminer, Aphids, Flatwood Borers)	• Low honeybee toxicity (alone) • FH borer and H. woolly adelgid labeling as basal bark spray or trunk injection. HWA also controlled with foliar spray • Leaching potential (GUS = 0.94) lower than imidacloprid (GUS = 3.76)	• Some verbena cultivars sensitive • Restricted
	Azadirachtin (Azatin O, Ornazin, Neemazad , Neemix 4.5, Aza-Direct, AzaGuard, Molt-X)	✓ (Whiteflies, thrips - spray) (FG larvae - drench)	✓ (FG - drench)	✓ (Whiteflies) (FG - drench)				• Labeled for many pests but efficacy variable, includes use as drench for fungus gnat larvae • Leaching potential (GUS = 0.99) lower than imidacloprid (GUS = 3.76)	• Not effective against adult insects
	Bacillus thuringiensis israelensis (Gnatrol)	✓ (FG - 'sprench')	✓ (FG - drench)	✓ (FG - drench)				• Biopesticide, organic-compatible	• Not highly effective, requires frequent repeat application
	Beauveria bassiana (BotaniGard, Mycotrol O)	✓ (Aphids, WF, thrips)	✓ (Aphids, WF, thrips)	✓ (Aphids, WF, thrips)	✓ (Aphids)			• Biological control • No pest resistance • Organic (Mycotrol)	• Not highly effective, better under higher RH but disease risk • ES formulation phytotoxic to tomato
	Carbaryl (Sevin)				✓ (Japanese Beetle, certain aphids, scales)		✓ (Japanese Beetle, scales)	• Effective vs Jap btl adults • Leaching potential (GUS = 2.0) lower than imidacloprid (GUS = 3.76)	• For scales, timed for crawler stage • Use can lead to mite flaring • Toxic to many natural enemies & other non-target spp
	Chlorfenapyr (Pylon)	✓ (Thrips - spray, FG larvae - 'sprench')		✓ (Thrips) fruiting veg only				• Effective vs western flower thrips • Leaching potential (GUS = 0.01) lower than imidacloprid (GUS = 3.76)	• Greenhouse-use only • Restricted • Some plants sensitive
	Chlorpyrifos (DuraGuard ME, Lorsban, Dursban)	✓ (Aphids, MB. Thrips - spray, FG larvae - drench)			✓ (Aphids, Jap beetle, scales - DuraGuard, some plants only) (Flathead Borers - Dursban) (White grubs - Dursban pre-plant incorp for field)	✓ (Sod farms only - Japanese Btl grubs)		• Leaching potential (GUS = 0.15) lower than imidacloprid (GUS = 3.76)	• Restricted • Worker exposure issues • Longish (24 hr) REI for greenhouse use
	Cyromazine (Citation)	✓ (FG larvae - drench)	✓ (FG larvae - drench)					• Leaching potential (GUS = 2.73) lower than imidacloprid (GUS = 3.76)	
	Naled (Dibrom 8E) (fumigant)	✓ (Aphids, WF) not for some roses, mums, poinsettia, few others)							• Restricted • Special re-entry restrictions • Requires use of automatic hot plate
	Dicrotophos (Inject-a-Cide B)						✓ (Aphids, Flathead Borers)	• No drift with trunk injection • Leaching potential (GUS = 3.08) lower than imidacloprid (GUS = 3.76)	• Highly toxic material • Restricted • Requires wounding of tree • Not all trees appropriate for injection
	Diflubenzuron (Adept)	✓ (FG larvae - drench)						• Systemic from foliar application • Leaching potential (GUS = 0.16) lower than imidacloprid (GUS = 3.76)	• Some plants sensitive
	Dimethoate (Dimethoate)				✓ (Aphids, some scales) (certain plants only)			• Systemic from foliar application • Leaching potential (GUS = 1.06) lower than imidacloprid (GUS = 3.76)	• High toxicity OP • Restricted • Long REI (10d) • May affect rooting of cuttings for propagation
	Dinotefuran (Safari)	✓ (Whiteflies, Aphids, MB)			✓ (Hemlock Wooly Adelgid, emerald ash borer/FH borer - basal bark spray)		✓ (Hemlock Wooly Adelgid, emerald ash borer/FH borer - basal bark spray)	• Basal bark spray for HWA and EAB only • Foliar spray or drench very effective vs mealybugs, resistant whiteflies	• Excluded from use on plants to be grown outdoors that produce pollen and nectar • Not quite as effective vs aphids • Restricted • Leaching potential (GUS = 4.95) higher than imidacloprid (GUS = 3.76)
	Emamectin Benzoate (Tree-Age)						✓ (Flathead Borers)		• Restricted

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Floral, Turf Nursery

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	Primary Target Pests and Usual Application Method (soil and/or foliar)	Aphids, whiteflies, thrips (suppr), MB, FG larvae foliar (all exc FG) or soil (all exc thrips)	Aphids, FG larvae, thrips (suppr) (foliar), aphids, FG (soil)	Aphids, WF (soil) Tomato, cucumber only not for hydroponic use	Aphids, lacebugs, leaf btls, flatheaded borers, soft scale, leafminers (box esp) (soil, foliar), Jap. Btl adults, FG larvae, BV weevil larvae, white grubs (soil) possibly others	White grubs (soil application)	Adelgids, aphids, leaf-feeding beetles (incl Jap btl), psyllids, soft/armored scales, FH borers		
Insecticides that are Possible Alternatives to Imidacloprid or that can be	**Active Ingredient Name (Product Trade Na**								
	Fenpyroximate (Akari)	✓ (Whiteflies - suppr, MB)		✓ (Whiteflies) cucumber and fruiting				• Leaching potential (GUS = 1.21) lower than imidacloprid (GUS = 3.76)	
	Flonicamid (Aria- GH/Nursery; Beleaf - GH veg)	✓ (Aphids)		✓ (Greenhouse WF, Aphids) Cucumber& tomato only	✓ (Aphids)			• Soil and foliar use for cucumber, foliar only for tomato and ornamentals • Leaching potential (GUS = 1.87) lower than imidacloprid (GUS = 3.76)	• Not effective for sweet potato whitefly • Restricted • Not for landscape use
	Horticultural Oil (SuffOil-X, Ultra-Pure Oil, Sunspray Ultra-Fine, JMS Stylet Oil)	✓ (Whiteflies, Aphids, MB)		✓ (Whiteflies, Aphids)	✓ (Whiteflies, Aphids, Scales)		✓ (Hemlock Wooly Adelgid, aphids, scales)	• Organic-compatible • No pest resistance	• Label uses vary with product • Risk of phytotoxicity esp with some products and plants • No residual activity, contact only
	Malathion (Prentox Malathion, Malathion 8 Aquamul)			✓ (thrips, Aphids) certain GH veg only	✓ (Aphids, Some scales, lace bugs, Box LM) (certain plants only)		✓ (Aphids, Some scales, lace bugs, Box LM) (certain plants only)	• Leaching potential (GUS = 1.28) lower than imidacloprid (GUS = 3.76)	• Some formulations restricted • Strong odor
	Metarhizium anisopliae (Met52)				✓ (BVW larvae, soil)		✓ (BVW larvae, soil)	• Biological control	• Best pre-mix with media for containers
	Methiocarb (Mesurol)	✓ (Thrips)						• Leaching potential (GUS = 0.17) lower than imidacloprid (GUS = 3.76)	• Long REI (24 hr) for greenhouse use • Restricted-use
	Neem oil (Triact 70)	✓ (Aphids, WF, MB)	✓ (Aphids, WF, MB)		✓ (Aphids, scales)		✓ (Aphids, scales)	• Organic-compatible • Pest resistance unlikely	• Not labeled for pests in residential landscapes • No residual activity, good coverage important (contact only) • Some plant sensitivity
	Novaluron (Pedestal)	✓ (Thrips)						• Leaching potential (GUS = 0.03) lower than imidacloprid (GUS = 3.76)	• For immature stage thrips only. Not for poinsettia
	Phosmet (Imidan)				✓ (Japanese Beetle)		✓ (Japanese Beetle)	• Leaching potential (GUS = 0.24) lower than imidacloprid (GUS = 3.76)	• Restricted-use
	Potassium Laurate (M-Pede)	✓ (Aphid, WF)	✓ (Aphid, whiteflies)	✓ (Whiteflies, Aphids)	✓ (Aphids, scales, lace bugs)		✓ (Aphids, scales, lace bugs, adelgid)	• Organic-compatible	• Contact only, no residual activity • Some plant sensitivity
	Isaria fumosorosea (Preferal)	✓ (Aphids, WF, MB, thrips)	✓ (Aphids, WF, thrips)	✓ (Aphids, Whiteflies)	✓ (Black Vine Weevil - drench for container or field) (Aphids foliar)			• Biological control • No pest resistance • Organic	• Not highly effective but may be better under higher RH though disease risk
	Pymetrozine (Endeavor)	✓ (Aphids)			✓ (Aphids)		✓ (Aphids)	• Reduced Risk • Leaching potential (GUS = 0.68) lower than imidacloprid (GUS = 3.76)	• Restricted-use
	Pyrethroids (Astro, Decathlon, Tame, Talstar S, Scimitar GC, Mavrik AQ, others)	✓ (some Aphids, MB, WF)			✓ (Jap Btl - quarantine, FH borer, BVW adults or some pre-mix with media for larvae, some aphids, lace bugs, scales, some leaf btls, white grubs)		✓ (FH borers, scales some aphids, lace bugs, some leaf btls, BVW adults)	• One product labeled for many pests, inexpensive	• Nearly all restricted-use • Highly toxic to most natural enemies, aquatic life & other non-targets • Not eff. vs all aphids, high rate needed for BVW • For white grubs must be pre-mixed with pot media (not for field use) with worker/handler issues • For scales, timed for crawler stage only • Use can lead to mite or aphid flaring • Not all equally effective, labels and uses vary
	Pyridalyl (Overture)	✓ (Thrips)						• Very effective against western flower thrips • Little or no plant injury	
	Pyriproxyfen (Distance, Fulcrum)	✓ (WF, Aphids - suppr, MB -suppr, FG)		✓ (WF, Aphids - suppr, FG) Most fruiting veg only	✓ (several scales)		✓ (several scales)	• Leaching potential (GUS = 0.33) lower than imidacloprid (GUS = 3.76)	• Not for resistant whiteflies, not highly effective for aphids • For immature scales (crawlers), few species only
	Spinosad (Conserve, Entruist)	✓ (Thrips)						• Entrust for organic use • Reduced-risk • No history of plant injury • Leaching potential (GUS = 0.62) lower than imidacloprid (GUS = 3.76)	• Resistance to spinosad in western flower thrips widespread
	Spiromesifen (Judo)	✓ (Whiteflies)						• Effective even for reisitant white flies • Leaching potential (GUS = 0.3) lower than imidacloprid (GUS = 3.76)	• Greenhouse-use only • Some plants sensitive
	Spirotetramat (Kontos, Movento - Xmas trees)	✓ (Whiteflies, Aphids, Thrips - immature) (foliar and soil)	✓ (Aphids, Whiteflies) (foliar & soil)		✓ (Aphids, Scales) (foliar & soil)			• Both systemic (soil) and foliar uses • Leaching potential (GUS = 1.12) lower than imidacloprid (GUS = 3.76)	• Some plants are sensitive to product
	Trichlorfon (Dylox)					✓ (White Grubs - landscape only)		• Effective even against older grub stages (imidacloprid best preventive or youngest instars)	• Landscape only, not sod farms • Leaching potential (GUS = 3.77) higher than imidacloprid (GUS = 3.76)
	z-tetradec-7-en-one (Oriental Beetle MD)				✓ (oriental beetle grubs	✓ (oriental beetle grubs		• Mating disruption, no insecticide application	• Must be done over large area (5A or more) • Not as effective with very high populations • For container nurseries, must keep containers in 'treatment area' during OB flight period • Efficacy in landscape to be determined, deployment of dispensers may be difficult

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Floral, Turf Nursery

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		Greenhouse Floriculture	Greenhouse-grown Vegetable Transplants for Sale	Greenhouse Food Crops	Nursery (outdoor) Container Stock, Field-Grown trees/shrubs (incl Xmas)	Landscape Turf and Sod Farms	Landscape Shrubs and Trees		
		Primary Target Pests and Usual Application Method (soil and/or foliar)							
		Aphids, whiteflies, thrips (suppr), MB, FG larvae foliar (all exc FG) or soil (all exc thrips)	Aphids, FG larvae, thrips (suppr) (foliar), aphids, FG (soil)	Aphids, WF (soil) Tomato, cucumber only not for hydroponic use	Aphids, lacebugs, leaf btls, flatheaded borers, soft scale, leafminers (box esp) (soil, foliar), Jap. Btl adults, FG larvae, BV weevil larvae, white grubs (soil) possibly others	White grubs (soil application)	Adelgids, aphids, leaf-feeding beetles (incl Jap btl), psyllids, soft/armored scales, FH borers		
3) Non-Pesticide Cultural Management Practices	Biological Controls	✓	✓	✓	✓			• Particularly effective in greenhouse settings for partial control of white fly, aphid, and fungus gnats. Some control of other pests (thrips) • Some biocontrols practical for nursery use e.g. for BVW, lacebugs	• Costly, quality issues, less/not effective if infestations already high • May not work some times of year or on some crops/pests
	Forecasting Models - Encourage or require the use of weather information and pest models found on NEWA for timing of scouting and management applications. http://newa.cornell.edu/				✓			• Some applications for outdoor ornamentals, such as scale insects, lace bugs (use GDD)	
	Crop Rotation	✓	✓	✓	✓			• Rotating crops within spaces or away from infested ones helps reduce pest build-up	• LI growers have limited available land
	Physical removal of infested foliage/plants	✓		✓	✓		✓		• Practical in limited situations
	Avoid infested benches or spaces for new crops	✓						• Mealybugs can move from infested benches onto new crops	
	Retrofitting vent screens/maintain vents and doors.	✓	✓	✓				• Possible reduction in pest population in greenhouse structures for pests entering from outdoors (e.g. thrips)	• Possible increased costs associated with ventilation improvements.
	Use of trapping products (monitoring)	✓	✓	✓	✓			• Traps primarily for detection/timing management decisions • In greenhouse, sticky cards used for fungus gnats, thrips, whiteflies, aphids • In nurseries BVW traps can be used for field detection of adults	• Increased cost associated with insect traps. • Many traps for lepidoptera but imidacloprid not used for this group of insects in general
	Post-harvest crop destruction	✓	✓	✓					
	Crop Isolation	✓	✓	✓	✓			• Grow new crops or very susceptible ones separate from older or infested material	
	Use of Resistant Cultivars				✓	✓	✓	• Tall fescue more tolerant to grub damage • Some boxwoods resistant to leafminer	• Few/no pest-resistant ornamental crops
	Improvements to Soil Health				✓	✓	✓	• Maintaining high levels of soil organic matter (SOM) is critical to prevent leaching. SOM is primary substrate adsorbing imidacloprid	• Increased cost associated with adding nutrient/organic matter to soil.
	Use of plastic mulch							• Possible increase in crop yield. • Improved control of pests. • Complements drip irrigation practices.	• Added cost associated with plastic mulch and equipment needed for placement.
	Improve irrigation practices/develop an irrigation water management plan.	✓	✓	✓	✓	✓	✓	• Reduces water usage and associated expenses. • Reduces potential for leaching to occur. • Reduces conditions that may lead to disease development.	
	Mating disruption				✓	✓		• For oriental beetle in nurseries (container, field). Also approved for landscape but practical use issues • Most mating disruption is for lepidoptera (group mostly not controlled with imidacloprid)	• Best used in over larger area (>5A). Efficacy in smaller areas is reduced
	Promote guidance on proper handling of containers and excess product to minimize potential for groundwater contamination.	✓	✓	✓	✓	✓	✓	• Reduces the potential for raw pesticide product to readily enter the subsurface.	• Possible increased operational costs.

Attachment 5

Summary of Pollinator Protection Information for the Possible Alternative Insecticides

Summary of Pollinator Protection Information from Product Labels for the Possible Alternative Insecticides

Active Ingredient (common/trade name)	Pollinator Label Statements (✓ indicates Yes)
Abamectin (Agri-Mek & others)	✓
Acephate (Orthene 97, Acephate, others)	✓
Acetamiprid (Assail 30SG)	✓
Azadirachtin (Azatin, Neemix, Aza-Direct)	
Bacillus thuringiensis israelensis (Gnatrol)	
Beauveria bassiana (BotaniGard, Mycotrol O)	✓
Carbaryl (Sevin)	✓
Chlorfenapyr (Pylon)	✓
Chlorpyrifos (Lorsban 75WG)	✓
Cryolite (Kryocide, Prokil Cryolite)	
Cyantraniliprole (Mainspring)	✓
Cyromazine (Citation)	
Dicrotophos (Inject-a-Cide B)	
Diflubenzuron (Adept)	
Dimethoate	✓
Dinotefuran (Safari)	✓
Emamectin Benzoate (Tree-Age)	✓
Fenpyroximate (Akari)	
Fentin Hydroxide (Super Tin)	
Flonicamid (Aria, Beleaf)	
Horticultural Oil (SuffOil-X, Ultra-Pure Oil, Sunspray Ultra-	
Imidacloprid (Admire)	✓
Indoxacarb (Avaunt)	✓
Isaria fumosorosea (Preferal)	
Malathion	✓
Metarhizium anisopliae (Met52)	
Methiocarb (Mesurol)	✓
Methomyl (Lannate)	✓
Naled (Dibrom 8E)	✓
Neem oil (Triact 70)	✓
Novaluron (Rimon)	✓
Phosmet (Imidan)	✓
Potassium Laurate (M-Pede)	
Pymetrozine (Endeavor, Fulfill)	
Pyrethroids (Baythroid XL[1], Warrior II[2], Asana XL[3],	✓
Pyridalyl (Overture)	
Pyriproxyfen (Esteem)	
Spinetoram (Radiant)	✓
Spinosad (Entrust)	✓
Spiromesifen (Judo)	
Spirotetramat (Movento)	✓
Trichlorfon (Dylox)	
z-tetradec-7-en-one (Oriental Beetle MD)	

Notes:

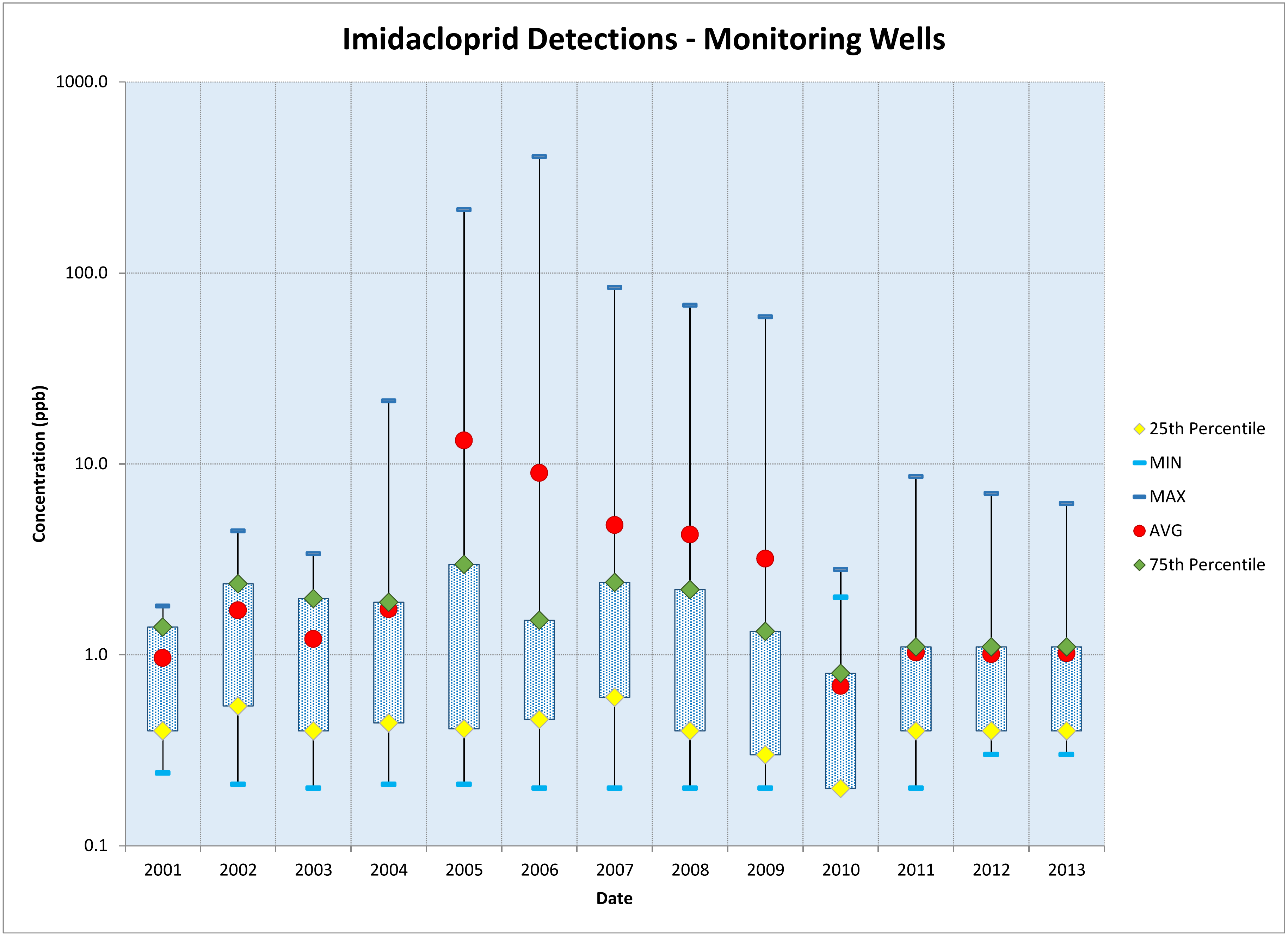
Orange shading indicates EPA bee toxicity statement present on product label.

Green shading indicates statement is not present on label.

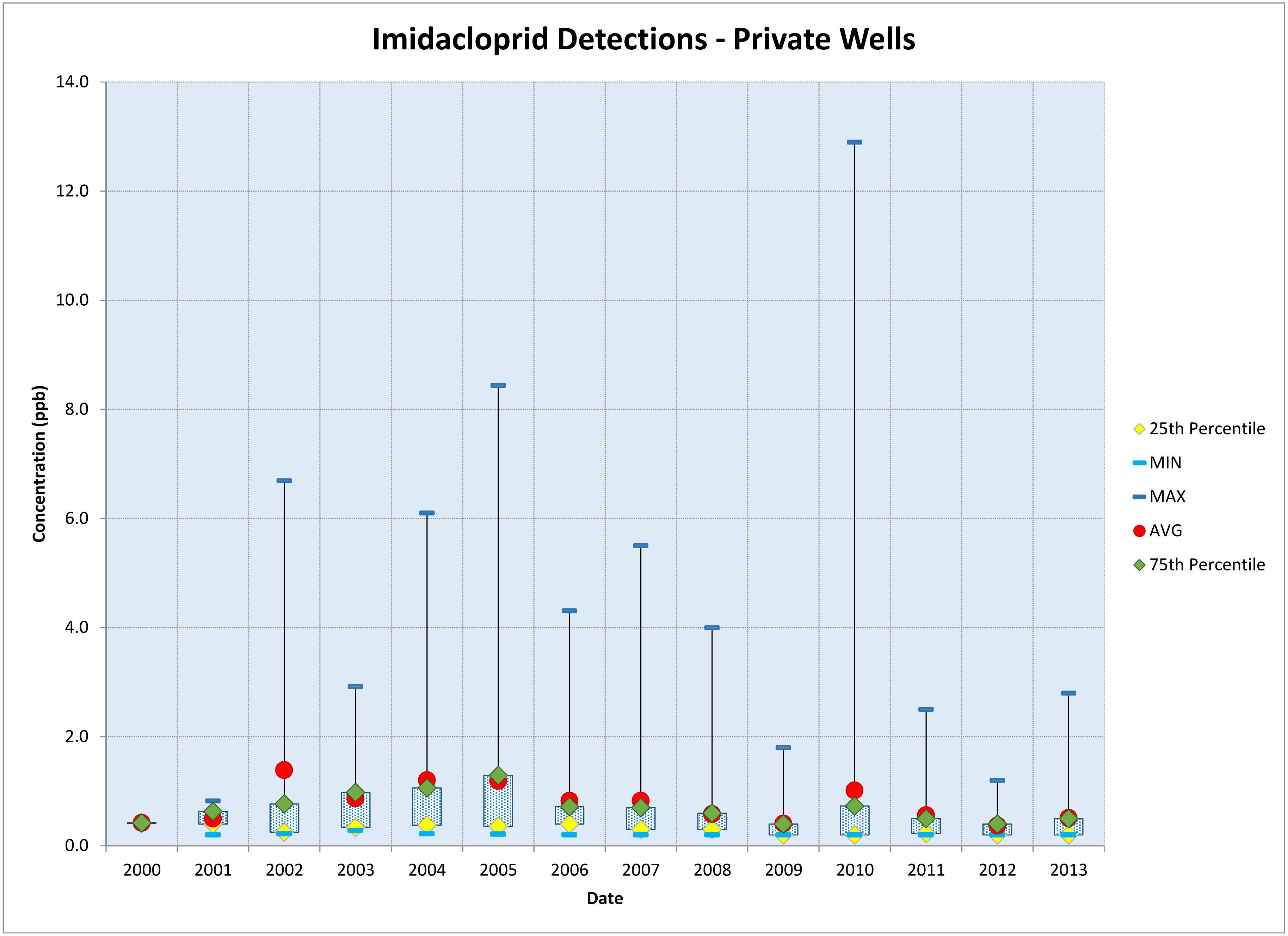
Attachment 6

Graphical Summary of Imidacloprid Groundwater Data

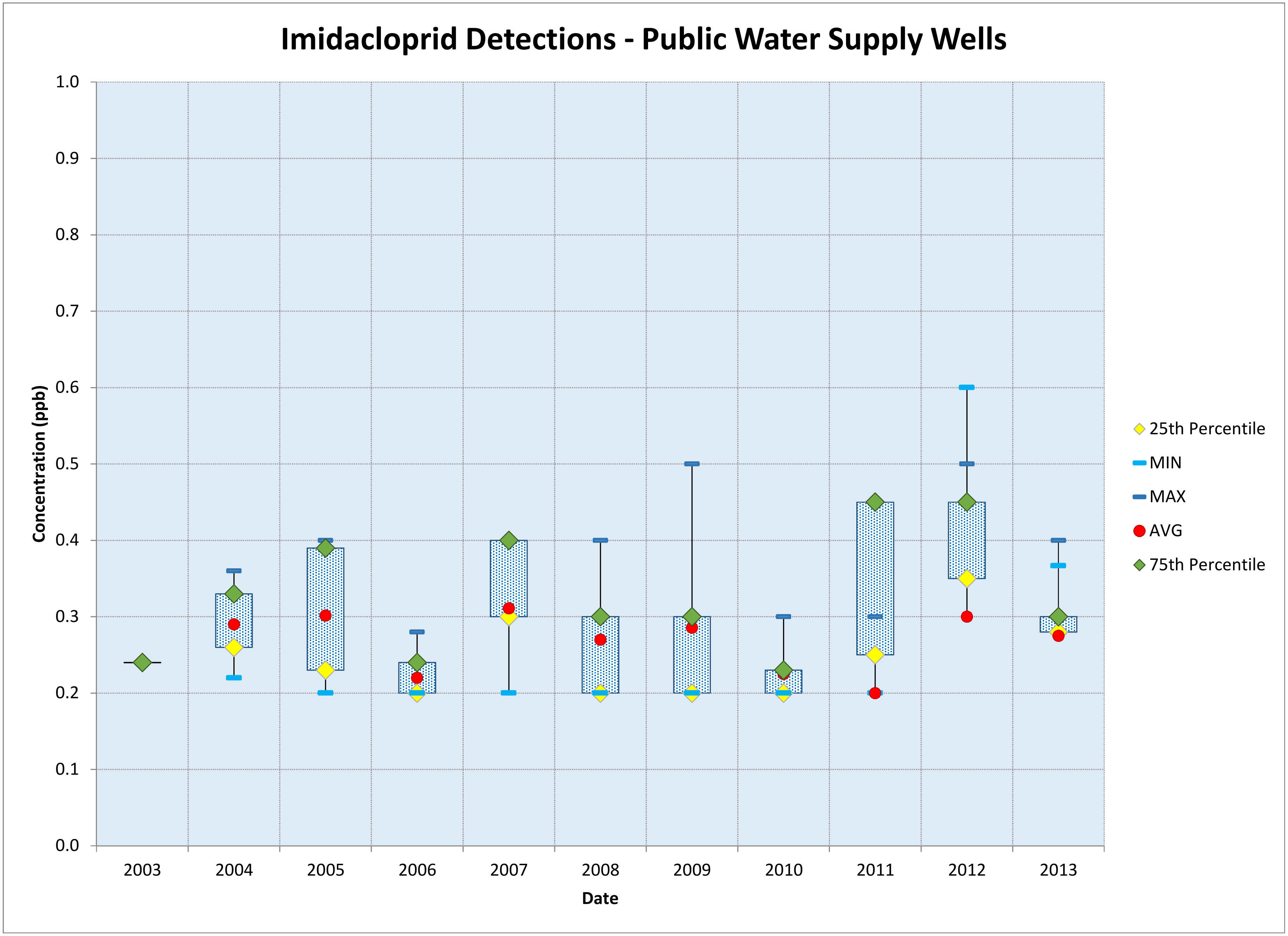
1) Summary of Annual Imidacloprid Groundwater Data Collected from Monitoring Wells
2) Summary of Annual Imidacloprid Groundwater Data Collected from Private Wells
3) Summary of Annual Imidacloprid Groundwater Data Collected from Public Wells



Imidacloprid Detections - Monitoring Wells
Concentration (ppb)
1000.0
100.0
10.0
1.0
0.1
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Date
25th Percentile
MIN
MAX
AVG
75th Percentile



Imidacloprid Detections - Private Wells
Concentration (ppb)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Date
25th Percentile
MIN
MAX
AVG
75th Percentile



Imidacloprid Detections - Public Water Supply Wells
Concentration (ppb)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Date
25th Percentile
MIN
MAX
AVG
75th Percentile