

# ENb

East Norwalk Blue

## The Clean Rivers Project, A Review of Imidacloprid Contamination of Local Waterways During the 2024 CT. Growing Season

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Sponsored by the Norwalk River Watershed Association Inc, Pollinator Pathways Inc, and  
Sustainable Connecticut



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**Abstract:**

East Norwalk Blue (ENB) began a survey of local golf courses during Connecticut's seasonal growing period (May through September) under the premise that neonicotinoid pesticides being used at some golf courses could be adding Imidacloprid to surface water pollution of nearby water courses. Water samples by ENB showed results somewhat different than suggested by conventional wisdom, i.e., that surface water runoff from golf courses is polluting local waterways. In over half the properties surveyed ENB research showed surface water arriving at these sites was already polluted with a single neonicotinoid, Imidacloprid (Presley, *et al.*, 2015). Taken at the height of the growing season, only four out of 10 golf courses appeared to be using Imidacloprid on the premises while rivers and brooks approaching these same properties had levels of Imidacloprid already exceeding the long-term chronic levels of 0.010 µg/L (USEPA benchmark 2017) for aquatic insects. In addition to a few golf courses, this survey suggests that other sources in suburban areas outside of farming and coated seeds may be contributing to the presence of Imidacloprid in natural surface waters.

**Introduction:**

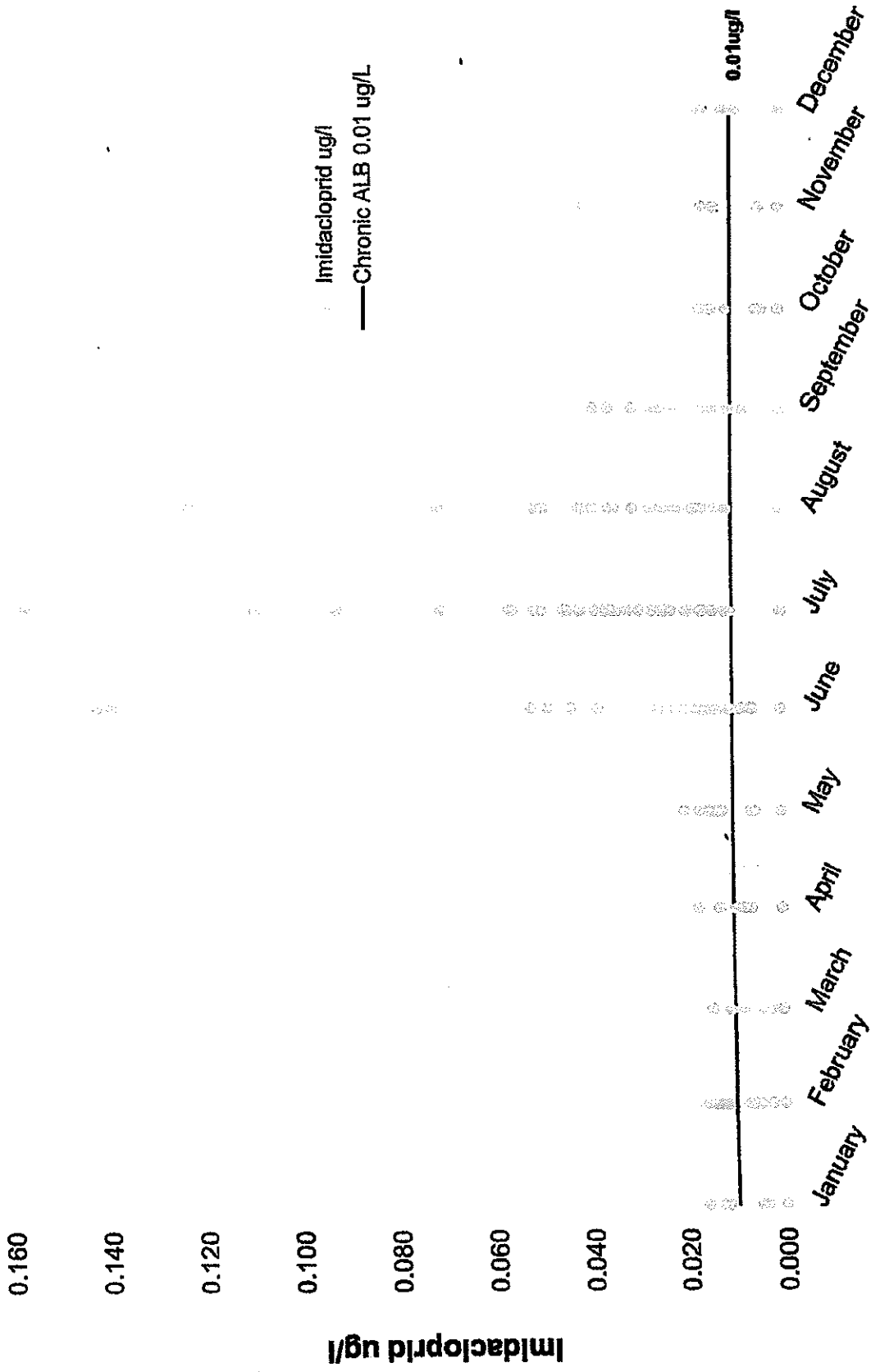
The rising dangers to beneficial insects from the application of neonicotinoid pesticides has progressed beyond the general concern about the decline of honeybees and butterflies to a much broader concern by scientists, as attention turns to aquatic insect populations (Boisvert K. *et al.*, 2015). Neonicotinoids are presently used on some properties where large areas of turf are highly prized and nurtured such as village greens and golf courses. The usual targets for the pesticide are grub worms, although recent data show these applications to be only marginally effective (Clavet *et al.*, 2014).

Based on concerns about the rising levels of Imidacloprid observed by USGS in the Norwalk River (Figure 1), research was undertaken by East Norwalk Blue to look beyond the Norwalk River to other waterways and other possible sources of Imidacloprid infiltrating to rivers and brooks. Ten local golf courses where Imidacloprid may have been used to control grubs in turf during the growing season were chosen at random. Of special concern is that all Imidacloprid levels observed by USGS (Figure 1) during the growing season exceeded the long-term chronic level of 0.010 µg/L (USEPA 2017) for aquatic insects (Presley *et al.*, 2024). Accordingly, a partnership was formed with ENB, the Norwalk River Watershed Association (NRWA), Pollinator Pathways Inc. and Sustainable Connecticut to meet the needs of the project. Laboratory support was provided by the Center for Environmental Sciences and Engineering at the University of Connecticut. Presently, the use of neonicotinoid products on turf is not illegal in Connecticut though a bill is presently before the state legislature to outlaw neonicotinoids for turf applications. Bill HB6916 is in line with similar legislative action already taken by Vermont, Maine and New York.

**Methods:**

Surface water entering the golf course is sampled by ENB and processed at UCONN for Imidacloprid levels and in a similar fashion compared with Imidacloprid levels in surface water leaving the same property. A determination of differences in pesticide concentrations at the two

# Norwalk River Surface Water Data Imidacloprid (2013-2023)



AQL = chronic aquatic life benchmarks for freshwater invertebrate  
 Figure 1. USGS survey records of Imidacloprid concentrations in surface waters of Norwalk River for the period 2013 through 2023.

(CESE)

Imidacloprid. In addition, special attention is also given to the concentration of neonicotinoids in the natural waters arriving at these properties to help identify other possible sources of neonicotinoid infiltration upstream. For the first time, The Center for Environmental Sciences and Engineering Laboratory at UCONN expanded the scope of the sample research to include the analysis of six other neonicotinoid products of: nitenpyram, thiamethoxam, clothianidin, acetamiprid, thiacloprid and fipronil in surface water analysis (Presley *et al.*, 2025). None of these related products were subsequently identified in the 56 samples submitted by ENB except for a trace amount of clothianidin found in a sample from the Woodway Country Club (Presley *et al.*, 2025). The broader neonicotinoid research for seven neonicotinoid products by the UCONN lab served to simplify and limit the focus to Imidacloprid for future surface water testing.

Prior to beginning the research, ENB had to identify a recognized laboratory to process its samples. Christopher Perkins, Lab Director at the UConn Environmental and Engineering Laboratory, agreed to process ENB samples for the duration of the growing season. Designated as The Clean Rivers Project, funding of over \$15,000 was provided by Pollinator Pathways Inc. and Sustainable Connecticut. ENB planned to take all water samples during the Connecticut growing period from May through September 2024 to obtain maximum exposure levels of Imidacloprid. Accordingly, ENB sent its Standard Operating Plan (SOP) to Christopher Perkins (Appendix 2) to review the plan for quality assurance protocols in collecting surface water samples in proximity to the ten golf courses. Sampling techniques and shipping procedures (UPS) were agreed upon as to holding times, sample temperatures and packing samples for shipment. Sampling details, date, time, place and GPS coordinates were recorded by ENB in accord with its SOP and to comply with UConn's Chain of Custody requirements (Appendix 1, Appendix 2). Samples were collected from the surface waters using an ENB-designed stainless-steel sampling platform custom made for ENB to avoid any extraneous contamination from plastics (Appendix 2, Figure 4, Figure 5). Duplicate samples and field trip blanks were collected every day in the field to meet the quality assurance measures contained in ENB's SOP (Appendix 2). Christopher Perkins noted that ENB's sampling SOP was "more than good for this type of work" (Email to R.B. Harris dated 4/19/24). The lab provided ENB with sterile, high-density polyethylene (HDPE) 250 mL bottles for sample collecting, which began on 7/25/24 and ended on 9/27/24.

Water samples were analyzed for neonicotinoid products using a modified United States Geological Survey (USGS) method, which employed graphitized carbon-based solid-phase extraction and high-performance liquid chromatography/mass spectrometry (Furlong, *et.al.* 2001).

#### Results:

A total of 56 surface water samples were collected of which 30 tested positive (54%) for Imidacloprid. All positive samples exceeded the long-term chronic levels of 0.010  $\mu\text{g/L}$  for aquatic insects. Two of the 30 samples exceeded the short-term acute level of 0.385  $\mu\text{g/L}$  for aquatic insects (Presley *et al.*, 2025).

Initial results show four properties with elevated Imidacloprid in surface water (Table 1) discharged from the premises and two others show no increase or a slight decrease in surface water leaving the properties (Table 2). A seventh property could not be properly evaluated because the sampling sites were too far removed from the golf course (Table 2). Five of these seven properties all show incoming surface water to be polluted with varying amounts of Imidacloprid exceeding the long-

Table 2. Location, sampling date and levels of Imidacloprid ( $\mu\text{g/L}$ ) found in surface waters discharged from two golf courses which are equal to or less than Imidacloprid levels in natural ter entering the property suggesting that Imidacloprid is not being used on turf.

Location Detail	Survey Date	Imidacloprid ( $\mu\text{g/L}$ ) in water entering	Imidacloprid ( $\mu\text{g/L}$ ) in water leaving	Delta +/- $\mu\text{g/L}$	Possible use on property	Detail Figure
CT Golf Club	7/25/24	Site distance*	Site distance*	NA	Unknown	6
Woodway	8/14/24	Site 1 (0.163)	Site 3 (0.143)	(-0.020)	Doubtful	7
Brooklawn	9/27/24	Site 1 (0.072)	Site 3 (0.070)	(-0.002)	Doubtful	8

\*Sampling sites 1 and 2 on the Aspetuck River are located too far to the east of the property and Site 4 is located well below (1/2 mile) of the property's discharge point.

The three remaining golf course properties show no trace of Imidacloprid in surface waters entering or in proximity to premises. The Aspetuck Valley Country Club (Figure 9) shows no evidence of Imidacloprid contamination from the Aspetuck River (8/9/24). The Aspetuck River is home to the Aspetuck and Hemlock reservoirs for drinking water and care has been taken over the years to preserve extensive riparian buffers and keep commercial and residential development to a minimum

The Oak Hills Golf Course (Figure 10) receives water from Keeler's Brook, which flows through the property. No detectable amount of Imidacloprid was found in the water at the brook's point of entry, or at its discharge point from the premises on 8/6/24. Keeler's Brook was the only brook investigated by ENB during the summer months where green frogs and numerous aquatic insects were observed.

The marine waters near the Longshore Golf Course on the west and south side (Grey's Creek) of the property were sampled on 7/30/24 and found to be clear of Imidacloprid (Figure 11). Two follow-up, freshwater samples were taken on 8/5/24. The first of these was at the discharge of a drainage creek (Site 5) which serves to relieve the overflow from several ponds on the property. The second sample was at the mouth of a small brook (Site 4) which enters the marine environment (Grey's Creek) at the east end of the property. Both were found to be clear of Imidacloprid (Figure 11). A final sample was taken (8/7/24) from a continuously running, freshwater drainpipe (Site 6). This outlet receives surface water and possibly some ground water from the property and discharges to Grey's Creek on the south side of the golf course. Imidacloprid was not found in that sample (Figure 11).

### Conclusions:

Golf courses are not universally using Imidacloprid on turf. Our survey shows 4 properties out of 10 may be using some amount of the product during the growing season (May through September). The more important finding is that the surface waters from many of the rivers and creeks in proximity to these properties are already carrying Imidacloprid concentrations exceeding the long-term chronic level of  $0.010 \mu\text{g/L}$  prior to entering the golf club properties. Rivers in this category are the Goodwives (Figure 2), the Noroton (Figure 7), the Five Mile south of the New Canaan Golf Course (Figure 4), and the Rooster (Figure 8). Smaller streams include Springdale Brook (Figure 5),

term chronic levels of 0.010 µg/L for aquatic insects (Table 1, Table 2). Two samples from the Goodwives River at the Darien golf course were found to exceed the short-term acute level of 0.385 µg/L for aquatic insects (Table 1). The three remaining golf courses show no evidence of Imidacloprid in surface waters either upon arrival or departure from the properties.

*detectable concentrations*

Evidence of possible Imidacloprid use on golf courses was found in streams discharging from four of the ten properties. The Goodwives River arrival at the Darien golf course exceeded the short-term acute level of 0.010 µg/L for aquatic insects at 0.468 µg/L prior to entry and again at 0.868 µg/L at discharge from the premises (Table 1 & Figure 2). Sasco Brook entering the Patterson Club (Figure 3) and the Noroton River entering the Sterling Farms Golf Course (Figure 5) were already contaminated with Imidacloprid exceeding the long-term chronic levels of 0.010 µg/L for aquatic insects. In contrast to the other three, Five Mile River water entering the New Canaan Golf Club property initially showed no evidence of Imidacloprid (Figure 4). Nevertheless, all four properties showed increased levels of Imidacloprid in surface water discharges from their premises (Table 1).

*upstream*  
*upstream from*

Table 1. Location, date and levels of Imidacloprid (µg/L) found in natural surface waters entering and leaving 4 golf course properties showing possible use of the pesticide in turf maintenance.

*Concentration s*

Location	Survey Date	Imidacloprid (µg/L) in water entering	Imidacloprid (µg/L) in water leaving	Delta +/- µg/L	Possible use on the property	Detail in Figure
Darien Golf Course	8/21/24	Site 1 (0.229)	Site 3 (0.868)	(+0.639)	Probable	2
		Site 2 (0.468)	Site 3 (0.868)	(+0.400)		
Patterson Club	7/24/24	Site 1 (0.080)	Site 5 (0.163)	(+0.083)	Probable	3
New Canaan Golf Course	8/8/24	Site 1 (0.000)	Site 5 (0.075)	(+0.075)	Probable	4
Sterling Golf Course	8/14/24	Site 1 (0.035)	Site 3 (0.090)	(+0.055)	Probable	5

*upstream*     *downstream*

Sampling sites on the Connecticut Golf Course (Figure 6) were located too far from the property lines to provide an accurate assessment of Imidacloprid use on the premises (Figure 6, Table 2). The next two golf courses show Imidacloprid as a component of surface water entering and leaving the Woodway Farm Golf Course (Figure 7) and the Brooklawn Golf Course (Figure 8) with a slight decrease in the pesticide levels at the discharge point for both properties (Table 2). Two of the properties were subject to dry weather (Woodway and Brooklawn) conditions (Appendix 1). In addition, the lack of detailed maps, and the inability of ENB staff to access some private properties were obstacles in all three surveys. Except for the Connecticut Golf Course, the water courses at the Woodway and Brooklawn properties do not show an increase of Imidacloprid levels at their respective discharge sites indicating that Imidacloprid may not be used on either property (Table 2).

*upstream from*

Sasco Brook, (Figure 3) and Horse Tavern and Loudon's brooks (Figure 8). ENB data is dependent on a one-day snapshot of each waterway under specific climate conditions (Appendix 1) and during the height of the growing season indicating that all recorded values may be at the maximum levels in comparison to the rest of the year.

ENB has no knowledge to date that these rivers and brooks have ever been surveyed along their lengths on a seasonal basis to ascertain the concentrations of Imidacloprid especially elevated during the growing season. No scientific assessment known to ENB has been made in these same waterways as to the state of aquatic insect or amphibian populations. Unfortunately, the most fragile insect populations, including species like mayflies, caddisflies and true flies are the most likely to be affected by Imidacloprid (Morrissey C.A., *et al.*, 2015). These same insects are highly sought after as food by amphibians, fish and bird populations. Reduction or loss of this natural food supply immediately has an impact on the animals that depend on it for growth and survival. The ripple effect of this pesticide in our waterways is now highly visible in many areas of Connecticut with the decline of many insect and amphibian species. There is also some preliminary studies that suggest that neonicotinoids may be harmful to marine larvae (Ewere, E.E. *et al.*, 2021)

**Acknowledgements:**

East Norwalk Blue (ENB) thanks Pollinator Pathways Inc. and Sustainable Connecticut for raising over \$15,000 to cover the expense of what is known as the Clean River's Project. The survey would not have been possible without this support and the oversight of Louise Washer from The Norwalk River Watershed Association, Inc. ENB also wishes to thank UCONN's Center for Environmental Services and Engineering for guidance and support. Lab Director Christopher Perkins answered ENB's many questions and processed 56 samples to meet ENB's schedule during the growing season (May through September 2024). Two ENB staff members, Peter Fraboni and Grayson Schottmuller deserve special thanks for their many hours of field work in a difficult environment where adequate maps were hard to find and field work had to be scheduled around private property. This was pioneer work, and an understanding of surface water flow patterns was difficult to ascertain at several locations based on dry weather (Appendix 1).

Sciences

Figure 2. Google map with the location of three ENB surface water test sites for Imidacloprid and results found near the Darien Country Club on 8/21/24. The Goodwives River (Site 1) and a small unnamed creek (Site 2) enter the northern end of the property and the combined waters discharge from the premises to the south (Site 3).



Imidacloprid levels observed at testing sites 2 and 3 on 8/21/24 exceed the short-term acute level for aquatic insects ( $0.385 \mu\text{g/L}$ ). Because surface waters leaving the property at testing Site 3 show Imidacloprid concentrations that are nearly double ( $0.868 \mu\text{g/L}$ ) those levels entering the property at site 2 there is a possibility that Imidacloprid is being used on the premises. While rainfall during the five days prior to testing averaged 0.70 inches, which should have produced normal surface water flow for the sampling day, ENB test results of 8/21 may not show a true picture of seasonality for Imidacloprid applications which usually begin in early May and peak in mid-July (Figure 1). Because surface water samples at Site 2 exceed the short-term acute level of  $0.385 \mu\text{g/L}$  for aquatic insects, further investigation upstream for additional sources of Imidacloprid is indicated.

Table 2. Chart showing town, date, location, waterway and Imidacloprid values ug/L for each sample.

Darien	Country Club of Darien 1	Goodwives River	0.229
8/21/2024	Country Club of Darien 2	Goodwives River	0.468
	Country Club of Darien 3	Goodwives River	0.868