EXHIBIT A

S.S. PAPADOPULOS & ASSOCIATES, INC.
ENVIRONMENTAL & WATER-RESOURCE CONSULTANTS

May 21, 2020

Chase T. Brockstedt
Baird Mandalas Brockstedt, LLC
1413 Savannah Road, Suite 1
Lewes, Delaware 19958

Subject: Mountaire Farms, Millsboro Delaware – Proposed Modification to Spray Irrigation Permit (Docket #2020-P-W-0014)

Dear Mr. Brockstedt:

At your request, we have conducted an initial review of the subject draft spray irrigation permit based on the limited information provided in April 29, 2020 public notice posted online by the Delaware Department of Natural Resources and Environmental Control (DNREC). The proposed modifications to Mountaire's spray irrigation permit do not adequately address surface water impacts from Mountaire's disposal of wastewater via spray irrigation. We have previously addressed the ongoing impacts of Mountaire's spray irrigation and sludge disposal operations on drinking water wells in the attached report.

The proposed permit requires Mountaire to sample surface water from upstream and downstream locations (Part II, Section A.9). It also specifies when and how to collect the samples as well as which constituents to measure. It does not, however, provide any guidelines or limits as to acceptable concentrations or mass loading of nitrates or other parameters in surface water. The excess loading of nitrogen to the groundwater by Mountaire's wastewater spray irrigation operations, both currently and as allowed in the proposed permit, represent a significant continuing negative impact to the adjacent surface waters.

A review of surface water data collected by DNREC and Mountaire clearly indicates an increase in nitrate concentrations from upstream of Mountaire's spray fields to downstream locations. As detailed in our attached report, Mountaire's data from 2017 to 2019 show that nitrate in the upstream sampling point along Swan Creek ("SW-1" in the proposed permit) has averaged 2.7 mg/L, and increased to an average of 14.4 mg/L at the downstream location SW-4. DNREC's surface water monitoring shows a similar increase from upstream to downstream along Swan Creek (see Section 2.5 and Figure 5 of the attached report).

While the proposed permit acknowledges the potential for surface water impact from the spray field operations, there is no mechanism by which to evaluate when such impact is a concern. The state has promulgated a water quality standard of 0.14 mg/L for dissolved inorganic nitrogen (i.e.,

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the sum of dissolved nitrate, nitrite and ammonium) in tidal waters,[1] which applies to the lower reaches of Swan Creek downstream of the surface water monitoring points in the proposed permit. The non-tidal portions of surface water bodies adjacent to Mountaire's spray fields are subject to DNREC's water quality target of 3.0 mg/L total nitrogen (i.e. the sum of nitrate, nitrite ammonium, and organic nitrogen), which was developed through many years of Total Maximum Daily Load modeling efforts for this watershed and others across Delaware.[2]

The proposed permit does address discharges of wastewater to surface water via spills or overland flow (Part III, Section A.4.b; Part IV, Section A.6). It does not, however, consider the potential for discharge of nutrient loading to surface water via groundwater. The Mountaire spray irrigation area ultimately discharges groundwater to the L & T Tax Ditch, Longwood Pond, Swan Creek and Indian River. Under current conditions, groundwater with nitrogen in excess of groundwater standards (10 mg/L) is discharging to these waters. The attached report includes a calculation of the mass of nitrogen discharged along 10,000 feet of Swan Creek's shoreline adjacent to Mountaire's spray fields. Based on an analysis of groundwater flow paths and the 2016 average concentration of 31 mg/L in monitoring wells along Swan Creek, groundwater discharge could account for more than 5,600 pounds of nitrate entering the surface water each year, just from the upper four feet of aquifer. The total amount of nitrate being discharged to the L & T Tax, Longwood Pond, Swan Creek and Indian River is likely much greater but apparently has not been assessed based on the records provided in the public notice for the proposed permit.

Given the proximity of the spray fields to these surface waters (20-200 feet) and the very transmissive aquifer, negative impacts to these waterways from Mountaire's wastewater disposal operations are likely to continue indefinitely. It has not been shown how the proposed 10 mg/L effluent limit will impact surface water. We note that Section 6.2.4 of 7 Del. Admin. C. §7101, the Delaware Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems indicates that a "a Surface Water Assessment Report (SWAR) must be submitted to demonstrate that nutrient performance standards for wastewater are being met at the post treatment location of a large on-site system or through natural attenuation processes prior to reaching the closest receiving surface water body in order to comply with surface water quality standards."

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[1] https://regulations.delaware.gov/AdminCode/title7/7000/7400/7401.pdf

[2] http://www.dnrec.delaware.gov/swc/wa/Documents/TMDL_TechnicalAnalysisDocuments/20_LittleAssawomanBayandTribsTMDLAnalysis.pdf; http://www.dnrec.delaware.gov/swc/wa/Documents/Revised%20TMDL%20Analysis%20for%20C%20and%20D%20Canal%20and%20Lums%20Pond%207-26-2012.pdf

Sincerely,

S. S. PAPADOPULOS & ASSOCIATES, INC.

Harvey Cohen, PhD, PG
Principal Hydrogeologist

Keir Soderberg, PhD
Associate, Senior Geochemist

Attachment:
Supplemental Report of Cohen and Soderberg, April 2020

Supplemental Report

Review and Assessment of Groundwater Conditions in the Vicinity of the Mountaire Farms Poultry Processing Plant, Millsboro, Delaware

Prepared by:

Harvey A. Cohen, Ph.D., P.G.

Keir Soderberg, Ph.D.

S.S. PAPADOPULOS & ASSOCIATES, INC.
Environmental & Water-Resource Consultants

April 28, 2020

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Attachment A Cohen, Harvey and Soderberg, Keir. 2018. Review and Assessment of Groundwater Conditions in the Vicinity of the Mountaire Farms Poultry Processing Plant, Millsboro, Delaware. June 11.

Attachment B Cohen, Harvey, 2018. Letter to Chase Brockstedt re: Consent Decree – Mountaire Poultry Processing Plant, Millsboro, DE. June 27.

Attachment C Cohen, Harvey, 2018. Letter to Chase Brockstedt re: Affidavit of Mark Eisner (Appendix B), C.A. No.: S 18C-06-009 RFS, Mountaire Poultry Processing Plant, Millsboro, DE. October 8.

Attachment D Delaware Department of Natural Resources and Environmental Control (DNREC). 2010a. Memorandum from Blair Venables to Marlene Baust, Regarding: Mountaire Groundwater Data Review. May 12 (Revised June 17).

Attachment E Delaware Department of Natural Resources and Environmental Control (DNREC). 2010b. Letter from Dave J. Schepens to John Wren, Mountaire Farms

of Delaware, Regarding: Non-Compliance Notification: State of Delaware Spray Irrigation Permit LTS 5011-87-09. September 7.

Attachment F Delaware Department of Natural Resources and Environmental Control (DNREC). 2010c. Memorandum from Blair Venables to Marlene Baust, Regarding: Lysimeter Installation and Monitoring Plan for the Mountaire Spray Facility. November 17.

Attachment G Delaware Department of Natural Resources and Environmental Control (DNREC). 2015. Letter from Monica Boyer to Mark Chranowski, Mountaire Farms of Delaware, Inc, Regarding: Mountaire Farms of Delaware, Inc., State of Delaware Spray Irrigation Permit Number LTS-50 11-87-09. 2015 Annual Compliance Inspection Attached. November 30.

Attachment H Delaware Department of Natural Resources and Environmental Control (DNREC). 2016a. Memorandum from Blaire Venables to Marlene Baust, Department of Natural Resources and Environmental Control, Regarding: Mountaire's June 30, 2016 Compliance Monitoring Report (CMR) Addendum 1: Mountaire's Response to DNREC Cited Deficiencies in the Original January 2015 CMR. September 8.

Attachment I United States Environmental Protection Agency (USEPA). 2000. Letter from Rebecca Hanmer, Director, Water Protection Division to Kevin C. Donnelly, Director, Division of Water Resources, Delaware Department of Natural Resources and Environmental Control (DNREC), re: NPDES Draft Permit No. DE 0000086, Mountaire Farms of Delaware, Inc., December 22.

Attachment J Curriculum Vitae for Harvey Cohen and Keir Soderberg

REPORT

Section 1
Introduction

This report addresses the extent of nitrate contamination in groundwater and surface water in the area of Millsboro, Delaware. It specifically addresses the source areas for groundwater contamination associated with the Mountaire chicken processing facility and its waste disposal areas, and the flow paths by which groundwater contamination has and will migrate with groundwater, and to surface water. This report was prepared by Harvey Cohen, PhD, PG and Keir Soderberg, PhD of S.S. Papadopulos & Associates (SSP&A). It is being presented as a supplement to the following previous reports and letters that are attached:

- Cohen, Harvey and Soderberg, Keir. 2018. Review and Assessment of Groundwater Conditions in the Vicinity of the Mountaire Farms Poultry Processing Plant, Millsboro, Delaware. June 11;
- Cohen, Harvey, 2018. Letter to Chase Brockstedt re: Consent Decree – Mountaire Poultry Processing Plant, Millsboro, DE. June 27; and
- Cohen, Harvey, 2018. Letter to Chase Brockstedt re: Affidavit of Mark Eisner (Appendix B), C.A. No.: S 18C-06-009 RFS, Mountaire Poultry Processing Plant, Millsboro, DE. October 8.

The opinions expressed herein are accurate to a reasonable degree of scientific probability. All opinions are based on the information and documents currently available. We reserve the right to supplement the opinions as more information is discovered or becomes available.

Section 2
Mapping of Contaminants and Groundwater Flow Paths

This section addresses the methods used to develop maps relevant to wastewater and sludge from the Mountaire plant applied to the ground surface in the period from 2000 to 2016.

2.1 Mapping of Nitrate in Groundwater

Figure 1 summarizes the data used to illustrate the extent of nitrate contamination in groundwater. The data illustrated on Figure 1 represent the maximum nitrate concentration reported for each well in the time period from 2000 to 2019. The locations shown on this map represent monitoring wells for Mountaire's spray irrigation fields and sludge application fields, as well as residential wells. For the majority of residential wells, there is only a single value available during this time period, and thus the value shown may be on the only available value.[1]

These data were compiled from a variety of sources:

- Quarterly monitoring reports issued by Mountaire (DNREC, 2016b);[2]
- Residential well samples cited in maps and reports issued by Mountaire, DNREC and others; and
- Data collected by Baird Mandalas Brockstedt from more than 200 residential wells in the Millsboro area from November 2017 through September 2019, and analyzed for nitrate by the Delaware Department of Health.

2.2 Mapping of Water Levels

Data on the depth to groundwater were used to create a series of maps of the Columbia Aquifer potentiometric surface for the period from 2001 to 2017. This analysis focused on the interval from ground surface to about 70 feet below ground surface (bgs), the interval in which many residential wells and most Mountaire extraction wells are screened. Four Mountaire monitoring wells screened to depths of up to 130 feet bgs (MW-22, 23, 26 and 27) were excluded from the analyses.

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[1] Information on residential well sampling completed by others is limited, and some of the results, particularly non-detect values, may indicate sampling at locations with nitrate treatment systems or where wells are drawing from deeper formations. As new information becomes available, we may update these maps.

[2] In 2018, SSP&A received an MS Excel-format table of monitoring data that was indicated as compiled by DNREC staff from Mountaire reports for the period from 1987 to 2016. These data included depth to water values and values for various forms of dissolved nitrogen (e.g. nitrate, ammonia, TKN). Data from this compilation was used in development of both the water-level maps and the nitrate maps. Additional data for 2017 to 2019 were also incorporated into the analysis, as available from the EPA FOIA materials.

For this report, the water-level data (generally reported as depth to water) were compiled from sources including DNREC (2016b) and selected Mountaire monitoring reports for spray irrigation fields and sludge application fields. Using information on the top-of casing elevations and ground surface elevations, these data were converted to groundwater elevations. The wells included in this data set include the monitoring wells for Mountaire spray irrigation fields, sludge application fields, and the Inland Bays wastewater treatment facility. No residential wells were used to constrain the potentiometric maps, as these wells are not generally suitable for accurate water-level measurements, and such data were not available.

The water-level data from a given time period were then used to create a separate contour map of the water-level surface specific to that time period. Kriging, a commonly used form of geospatial interpolation, was used to create the water-level maps. These water-level contours were calculated using a form of Kriging known as "Universal Kriging." The Kriging methodology preserves the observed values at each measurement point and interpolates between those points based upon the structure of the input data. To adequately represent the discharge of groundwater to surface water bodies, the groundwater elevation data were supplemented with elevation control points along water bodies including the Indian River, Millsboro Pond, and Swan Creek. In addition, to better estimate the water table in areas with no monitoring wells (e.g. east of Swan Creek), several control points were also added, based upon the water-level mapping completed by the Delaware Geological Survey (2005). The Kriging calculation utilized several line-sink terms to assist in generating the physically correct drawdown shape around gaining streams such as Swan Creek and the Indian River. The actual impact of line sinks on the water-level mapping is scaled by the calculation to best match the actual site data for each time period.

2.3 Particle Tracking

Once the water-level maps were completed, particle tracking was used to estimate the flow paths of hypothetical dimensionless particles in the groundwater. A composite map depicting representative particle tracks helps illustrate the range of groundwater flow paths from each of Mountaire's disposal areas (Figure 2). While not specifically representing nitrate or any other potential contaminant, these flow paths illustrate the path of movement that any dissolved contaminant such as nitrate would move with the groundwater over time. As noted in Cohen and Soderberg (2018), groundwater velocities in the vicinity of the Mountaire property can conservatively be estimated to average 300 to 500 feet per year, with higher velocities in highly transmissive parts of the aquifer. Nitrate, the primary contaminant of concern for residential water users near Mountaire, would travel at the same velocity as the groundwater in which it is found.

Particle tracking was accomplished using the fourth order Runge Kutta (RK4) numerical integration scheme (Press et al., 1996). This tracking approach is based upon that implemented in the program Path3D (Zheng, 1992), which has been demonstrated to provide very similar results to the U.S. Geological Survey particle tracking program MODPATH. For each spray irrigation or sludge application field, theoretical particles were initiated on the perimeter of the source area and allowed to move along the groundwater surface until they reached a discharge boundary such as Swan Creek or Indian River.

The particle tracks described above will vary somewhat, both quarterly and seasonally, depending upon groundwater conditions and the geographic distribution of recharge (spray irrigation) on individual fields.[3] Therefore, as implemented here, no individual set of data will by itself completely describe the flow path of a specific particle over time. Nonetheless, the collective set of particle track maps will describe an envelope in which groundwater and dissolved contamination has moved over the relevant period.

2.4 Synthesis

Using the data illustrated in Figure 1, a contoured map of maximum nitrate in the groundwater was created.[4] For each location, the maximum reported value was plotted at the location of the well. Then, concentration contours were calculated using Kriging. A particular form of Kriging which is well suited to environmental data, "quantile Kriging" (also known as rank transformation Kriging), was applied. Quantile Kriging has been shown to be robust (Reed, et al., 2004) and is particularly well suited to environmental data sets. In quantile Kriging, each value is converted into a rank associated with the cumulative frequency distribution of the data population. Values of rank for grid points between data locations are then calculated from the ranks of the data locations. In a final step, the computed ranks are back-transformed to concentration values from the distribution of the original data population.

Based upon the analysis described in Section 2.3, the envelope of particle tracks originating from areas of Mountaire's spray irrigation and sludge application were then superimposed on the contour map of nitrate contamination. The resulting map illustrates the areas of nitrate contamination at different concentrations that have been and will continue to be impacted by Mountaire's disposal practices (Figure 3). This map includes an area southwest of the spray fields, mainly east of John Williams Highway and encompassing parts of Holly Oak Road, Penrose Lane, and Walt Carmean Lane, labelled "potentially more than 10 mg/L." The nitrate data from residential wells in this area are generally less than 10 mg/L. However, higher concentrations upgradient and downgradient of these wells, and their position within flow paths from both the spray irrigation and sludge application fields indicates that more likely than not, ongoing contributions of nitrate to groundwater from Mountaire puts these wells at risk for higher concentrations. This area also falls within the "Residential Area" defined in the Consent Decree signed December 13, 2019 between DNREC and Mountaire (Figure 1). The Consent Decree's "Residential Area" understates the magnitude of the nitrate problem caused by Mountaire because the number of impacted homes within the "Residential Area" represents only approximately one tenth of the number of impacted homes with nitrate over 5 mg/L in the area defined by the envelope of particle tracks (Figure 3). There are approximately 120 residential wells within the "Residential Area," and approximately 1200 residential wells within the envelope of particle tracks. Of the

[3] Significant mounding of groundwater in the spray irrigation fields can be observed by the increasing water levels in many monitoring wells, and as modeled by He and Andres (2015).

[4] Data from the new wells near Mountaire's temporary sludge storage lagoon, LG-1, LG-2, and LG-3, are not included on Figures 1 or 3, but are discussed in Section 2.5 and shown on Figure 7.

approximately 1080 wells outside of the "Residential Area," 164 have been sampled, 50 with nitrate over 10 mg/L and 57 with nitrate between 5 and 10 mg/L.

2.5 Discharge to Surface Water

Mountaire's Spray Irrigation Permit (No. 359191-04, 2017) allows the discharge of effluent from the Site's wastewater treatment facility onto agricultural fields as a method of wastewater reuse and disposal. Historic and past exceedances of permitted nitrogen discharge limits have contributed to infiltration of excess nitrogen into the subsurface where it migrates with the groundwater, largely in the form of the nitrate ion. In addition, Mountaire discharges this wastewater to the irrigation fields year-round, including times when the ground is frozen or saturated with rainwater, contributing to overland runoff of excess nitrogen to adjacent waterways (e.g., see Bauer, 2020). This is the same condition that the U.S. Environmental Protection Agency was concerned about when it commented on Mountaire's spray irrigation permit as early as December 2000 (Attachment I).

As noted above, and in Cohen and Soderberg (2018; Attachment A), nitrate-impacted groundwater in the vicinity of the Mountaire plant, spray irrigation fields and sludge disposal fields ultimately discharges to surface water. The impacted streams include Indian River, Millsboro Pond, Longwood Pond and the lower reaches of Swan Creek and the L&T Tax Ditch (Figure 4). A number of the spray irrigation fields abut these waterways, with irrigated areas coming within as little as 20 feet of the waterway. For example, irrigated areas in fields WHBJ-5 and WHBJ-6 are within 200 feet of Longwood Pond and Swan Creek, respectively; and the irrigated area of field CB-3A is within 200 feet of Indian River. In addition, the L&T Tax ditch runs along the edge field WHBJ-4, coming within 20 feet of the irrigated area (see Bauer, 2020, Figure 5).[5] Field WBHJ-3 lies on the other side of the L&T Tax Ditch from WHBJ-4 and is within 100 feet of the waterway.

At the average groundwater flow rates cited above (300-500 feet per year), excess nitrogen from edges of the spray irrigation fields can migrate to the L&T Tax Ditch, Longwood Pond, Swan Creek or Indian River within less than a year. Water-level measurements, however, indicate that groundwater gradients between the edges of spray irrigation fields and adjacent water bodies, (e.g. from fields WHBJ-4, WHBJ-6, WHBJ-7, CB-3, CB-3A) are significantly higher than average, and therefore migration rates of over 1,000 feet/year are likely, leading to estimated travel times of two to three months. For nitrogen-laden water discharged via overland flow, transport to these water bodies can occur within a day.

Groundwater samples collected from wells MW-29 and MW-43 have averaged over 20 mg/L of nitrate between 2010 and 2016. This is representative of the groundwater discharging to Swan Creek and the Indian River, respectively, near those locations. For the approximately 10,000 feet of Swan Creek shoreline between MW-31 and Indian River, flow paths for the shallowest groundwater terminate at Swan Creek. If only the upper 4 feet of groundwater water discharge to

[5] Until 2017, Mountaire's annual reports cited an irrigated area of 92.06 acres for WHBJ-4 consistent with the 2003 Vegetative Management Plan (GMB, 2003). For 2017, 2018 and 2019 the irrigated area for WHBJ-4 is listed as 76.84 acres (Mountaire Farms of Delaware, 2017-2019 Annual Spray Operators Reports).

Swan Creek in this zone, it would account for more than 5,600 pounds of nitrate a year entering the surface water, based upon 2016 average concentrations in monitoring wells along the creek. Deeper parts of the aquifer discharge to surface water in the downstream reaches of Swan Creek. A substantial additional amount of Mountaire's nitrate is also discharged to Indian River along a similar length of shoreline between Millsboro Pond and the mouth of Swan Creek.

The ongoing discharge of nitrate from Mountaire's spray fields and sludge disposal areas via groundwater to Swan Creek is consistent with the available surface water nitrate data. DNREC collects water samples from Swan Creek through Delaware's Ambient Surface Water Quality Monitoring Program (DNREC and Environmental Control Watershed Assessment and Management Branch, 2018), with data available from 1998 to 2019 via the USGS/USEPA water quality data portal (https://www.waterqualitydata.us). DNREC data are available from three locations along Swan Creek (Figure 4), with data available from 1998-2019 for the farthest upstream sample location (Swan Creek at Mt Joy Road), 1998-2010 for the next station (Swan Creek at MD Camp Road), and 2000-2002 at the farthest downstream location (Longwood Pond at Rt 24). The DNREC data show a consistent increase from upstream to downstream, with average nitrate values of 2.0, 4.2 and 4.3 mg/L from upstream to downstream (Figure 5). Additional samples were collected by ERM from these three locations on December 5, 2019. The ERM data indicated a three-fold increase in concentration from upstream to downstream, with 3.3, 6.9 and 10.1 mg/L at the three locations. Downstream of Rt 24, the nitrate concentrations in Swan Creek are diluted by tidal flows, but nonetheless the flux of nitrate from Swan Creek contributes to the nitrate in Indian River. In addition, DNREC samples collected from the Indian River at buoy 49 near the mouth of Swan Creek indicate that nitrogen constituents are frequently elevated downstream of Mountaire's discharges.[6] For example, dissolved inorganic nitrogen has exceeded 0.14 mg/L in 85% of DNREC's samples from 2000-2019.[7]

Mountaire has collected surface water samples along Swan Creek as well as the L&T Tax Ditch starting in November 2017 (Figure 6). The nitrate results for Mountaire's surface water samples show a similar increase from upstream of Mountaire's spray fields (SW-1 and SW-2 averaging 2.7 and 0.8 mg/L, respectively) to downstream locations (SW-3, SW-4 and SW-5 averaging 7.3, 14.4 and 8.8 mg/L, respectively). This increase in nitrate from upstream to downstream is evident in both Swan Creek (SW-1 to SW-4) and the L&T Tax ditch (SW-2 to SW-3).

In addition to the above, new shallow wells (LG-1, LG-2 and LG-3, screened from 14 to 34 feet bgs) installed in 2018 indicate high levels of ammonium rather than nitrate in the groundwater near the temporary sludge storage lagoon (Figure 7; see DNREC and Mountaire Farms Inc., 2019; Mountaire Farms of Delaware, 2018-2019). These new wells are located between the lagoon and the tidal portion of Swan Creek, with LG-1 within approximately 100 feet from Swan Creek.

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[6] https://www.waterqualitydata.us/portal/#siteid=21DELAWQ_WQX-306181&mimeType=xlsx

[7] The 0.14 mg/L standard is referenced by DNREC (1998) and the current Delaware Administrative code, which can be found here: https://regulations.delaware.gov/AdminCode/title7/7000/7400/7401.pdf. Total nitrogen at this sampling location typically exceeds 1 mg/L as discussed by the Delaware Center for Inland Bays (2018).

The groundwater flow paths and discharge locations are a function of the area's topography, its subsurface geology, and the impact of human interventions such as pumping wells and the infiltration of spray irrigation water. In the short term, the only way to prevent the ongoing and persistent flow of nitrate-contaminated groundwater from Mountaire's spray fields and sludge disposal areas to Swan Creek and the Indian River would be a physical intervention such as pumping of the groundwater before it reaches the surface water bodies.

Section 3
Lysimeter Data

Mountaire installed suction lysimeters in seven of its spray irrigation fields in 2010 in response to a June 2010 memo from DNREC, and the subsequent Non-Compliance Notification in September 2010 (DNREC, 2010a, 2010b; Attachments D and E). The lysimeters were installed in the vadose zone, 3 to 12 feet bgs (i.e., below the crop root zone), and at least 3 feet above the water table (Figure 7). The goal of these installations was to collect "vadose zone percolate" (DNREC, 2010c; Attachment F). The vadose zone is the unsaturated portion of the subsurface between the ground surface and the water table, and lysimeters are designed to sample vadose zone water (Singh et al., 2017). Lysimeters are intended to provide an understanding of the actual concentration of nitrate in the percolate that is not taken up by the crops and is moving downward towards the groundwater.

Vadose zone water samples were collected quarterly from five of the lysimeters[8] from 2011 through 2019, with each sample representing a snapshot of vadose zone water. The annual average nitrate concentration across all five lysimeters ranged from 27 mg/L to 78 mg/L, with the highest concentration in 2017 (Figure 8). Average nitrate concentrations in the individual lysimeter are shown along with their locations in Figure 9. An original motivation for installing the lysimeters was "to help assess the current impacts that spray irrigation is having on groundwater beneath the facility" (DNREC, 2010a). It is therefore instructive to compare a lysimeter and groundwater monitoring well located within the same field. Figure 10 illustrates that both the vadose zone water and groundwater beneath field WHBJ-7 exceeded 10 mg/l and consistently ranged from 10-50 mg/l which explains why monitoring wells downgradient of the Mountaire spray fields consistently show nitrate levels well above the drinking water standard. DNREC's reviews of Mountaire's spray disposal operation expressed concern about the elevated nitrate levels in Mountaire's lysimeters (DNREC, 2015, 2016a; Attachments G and H).

[8] Seven lysimeters were installed in Mountaire's spray fields in 2010, but LY-1 and LY-3 were not sampled through 2016 ("dry" or suction wasn't working). After some discussion with DNREC in 2016 (see CMR revision page 5 "Item 16"), lysimeters 1, 2 and 3 were replaced in early 2017. This replacement is noted in the 2017 permit (page 15) along with the associated well permit numbers.

Section 4
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FIGURES

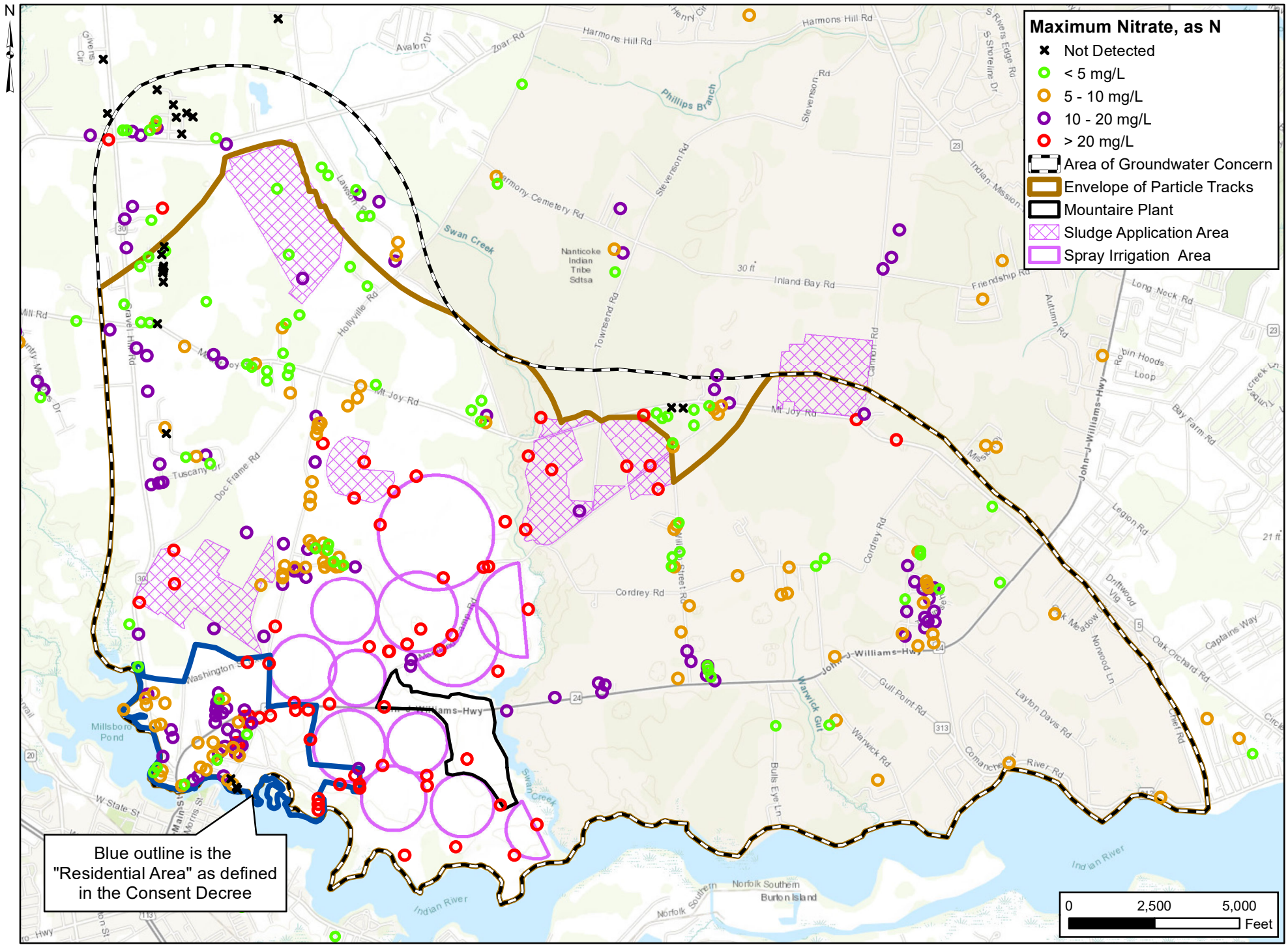

Figure 1 Maximum Nitrate Concentrations in Groundwater 2000 – 2019

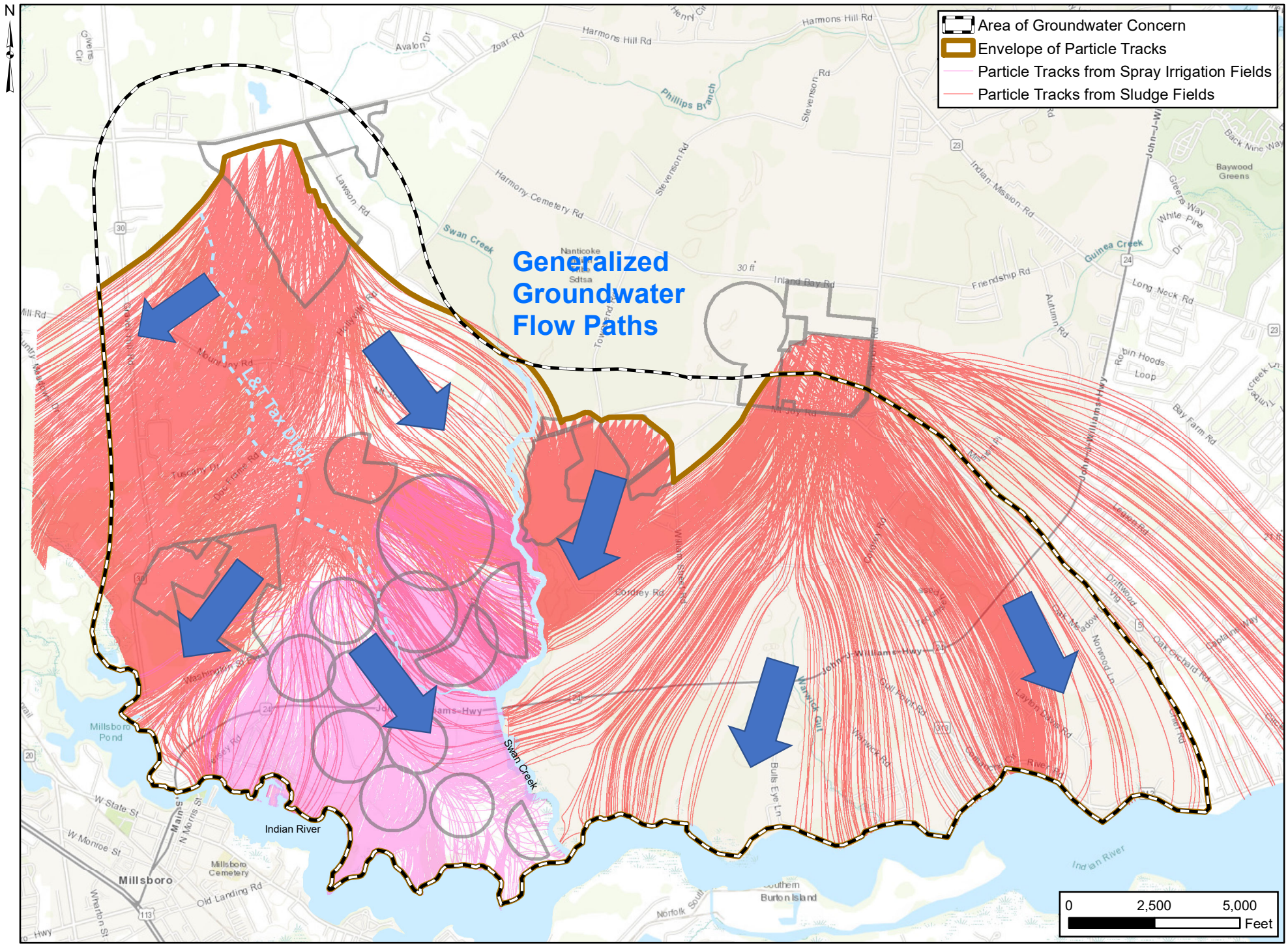

Figure 2 Representative Particle Tracks Based on Groundwater Monitoring Data from 2001 to 2017

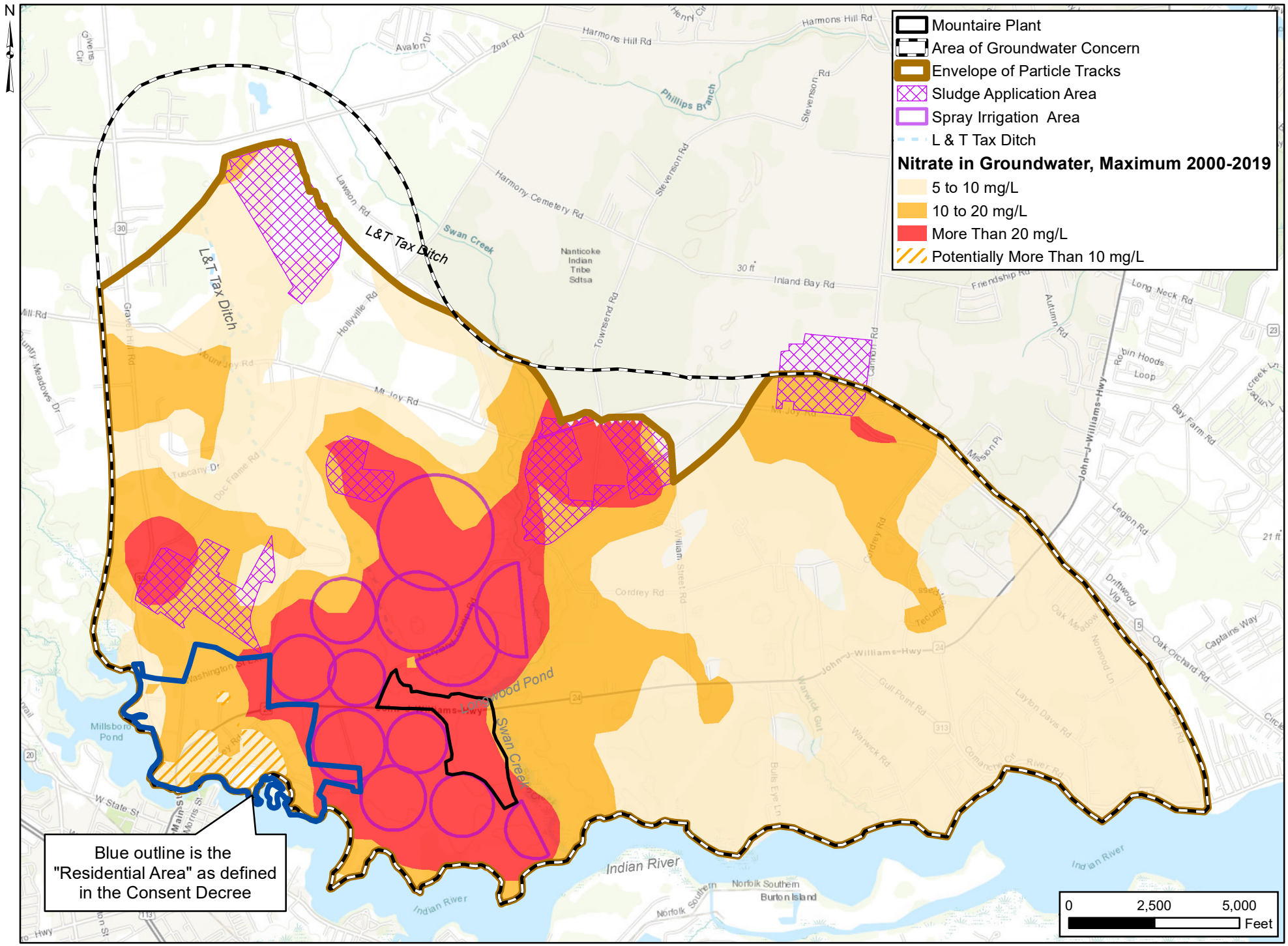

Figure 3 Extent of Nitrate Contamination in Groundwater Impacted by Mountaire Source Areas

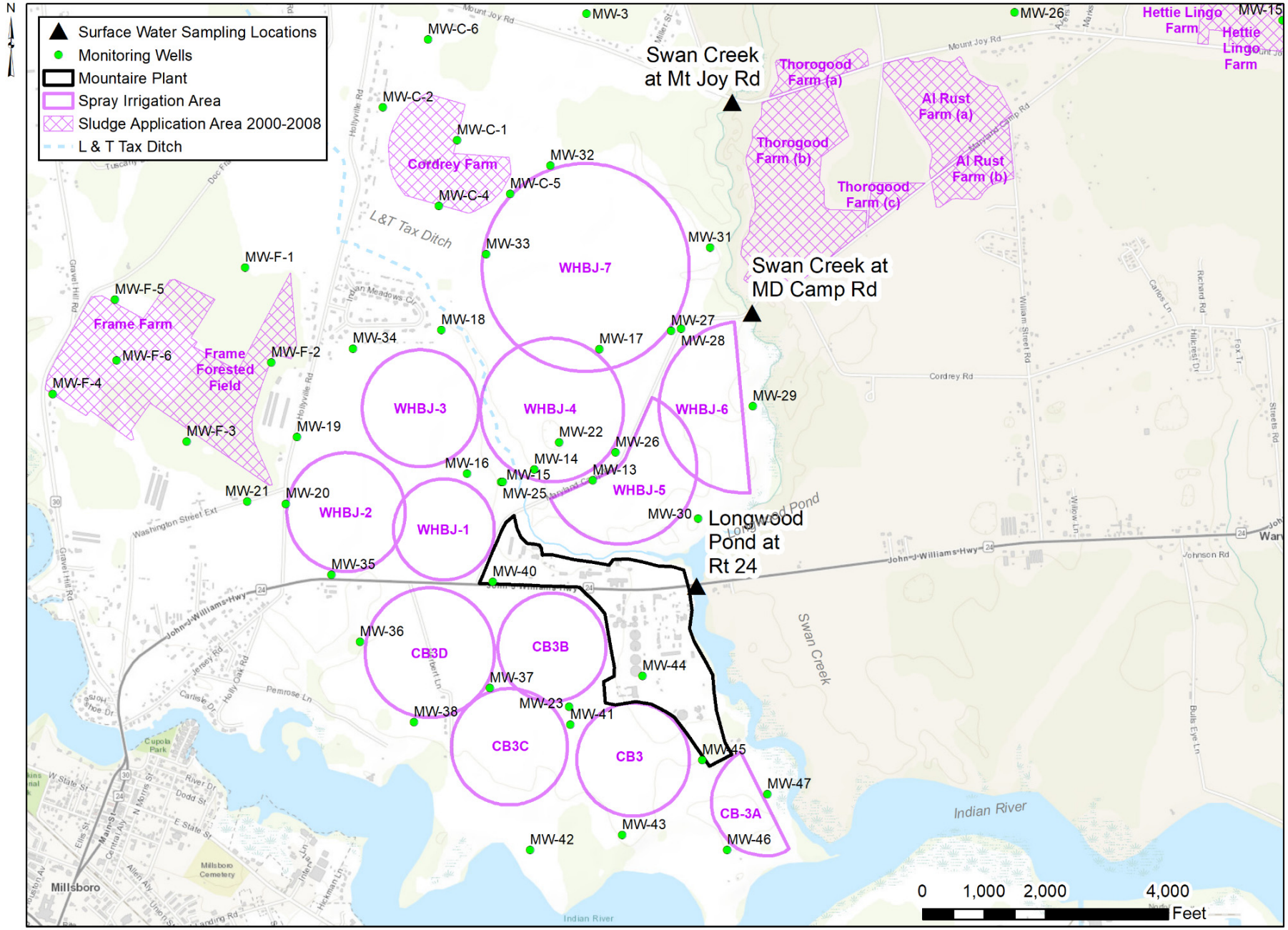

Figure 4 DNREC's Surface Water Sample Locations

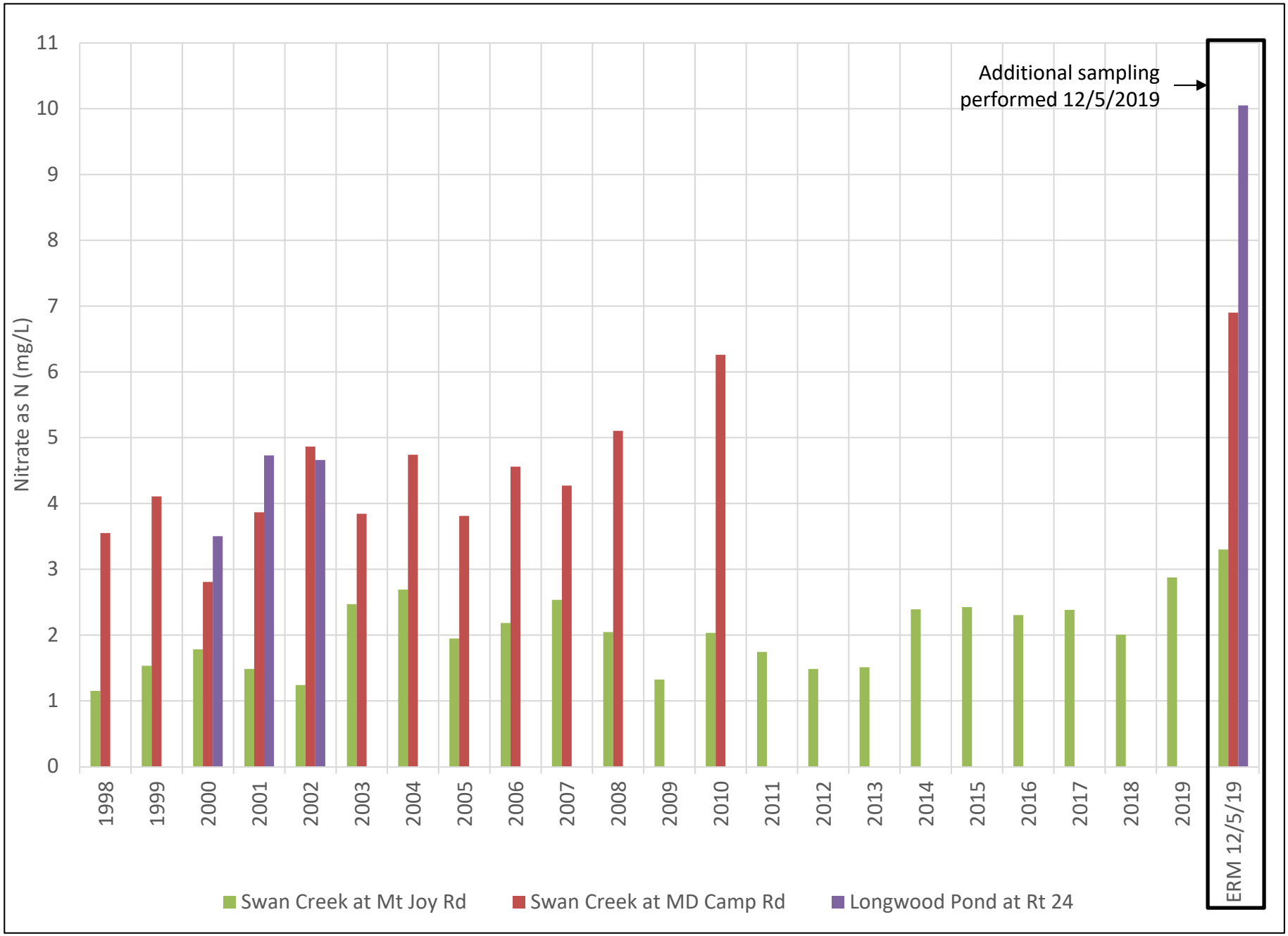

Figure 5 Nitrate Data for Surface Water Samples Along Swan Creek, DNREC and ERM

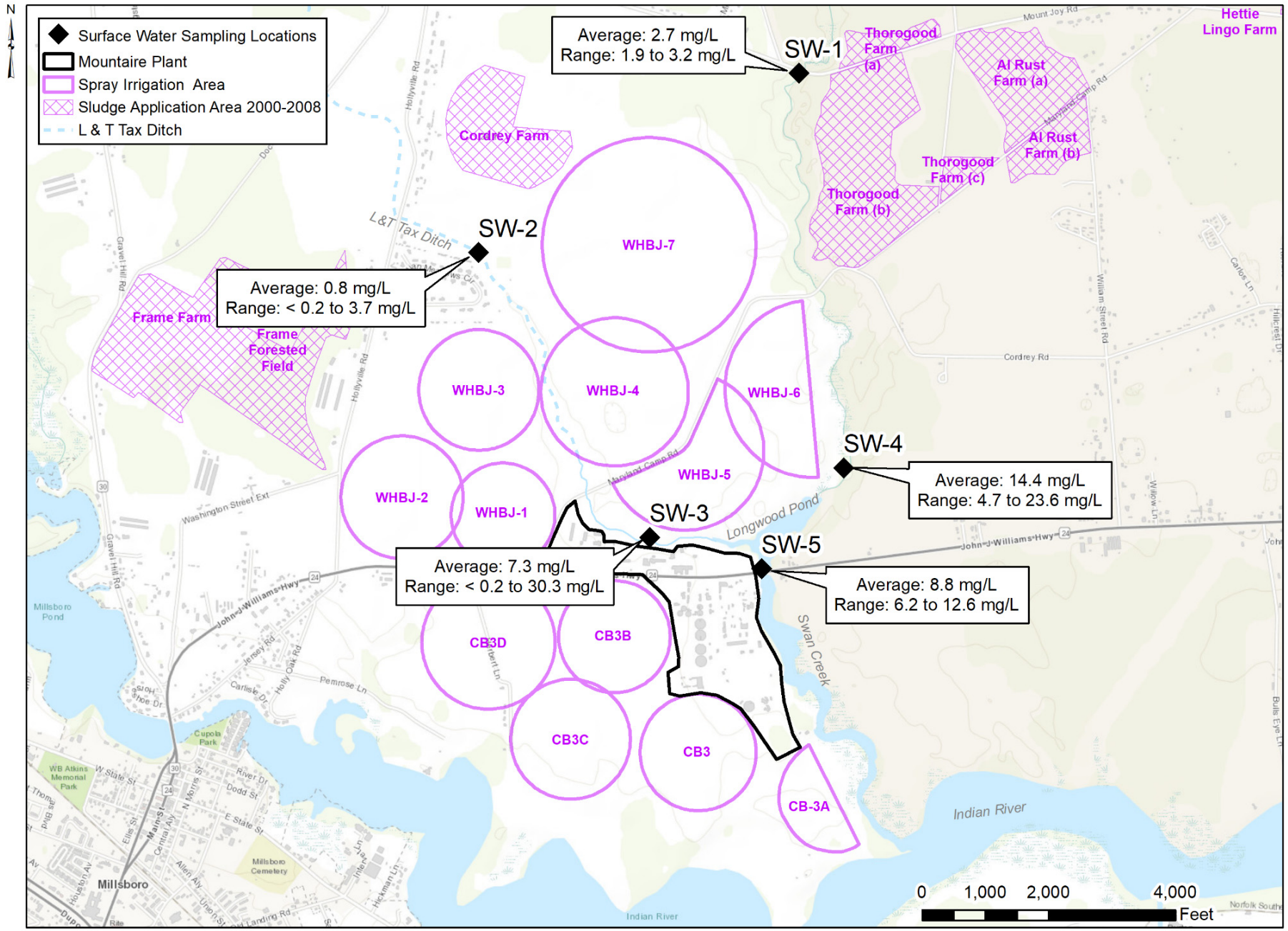

Figure 6 Mountaire's Surface Water Sampling, 2017-2019

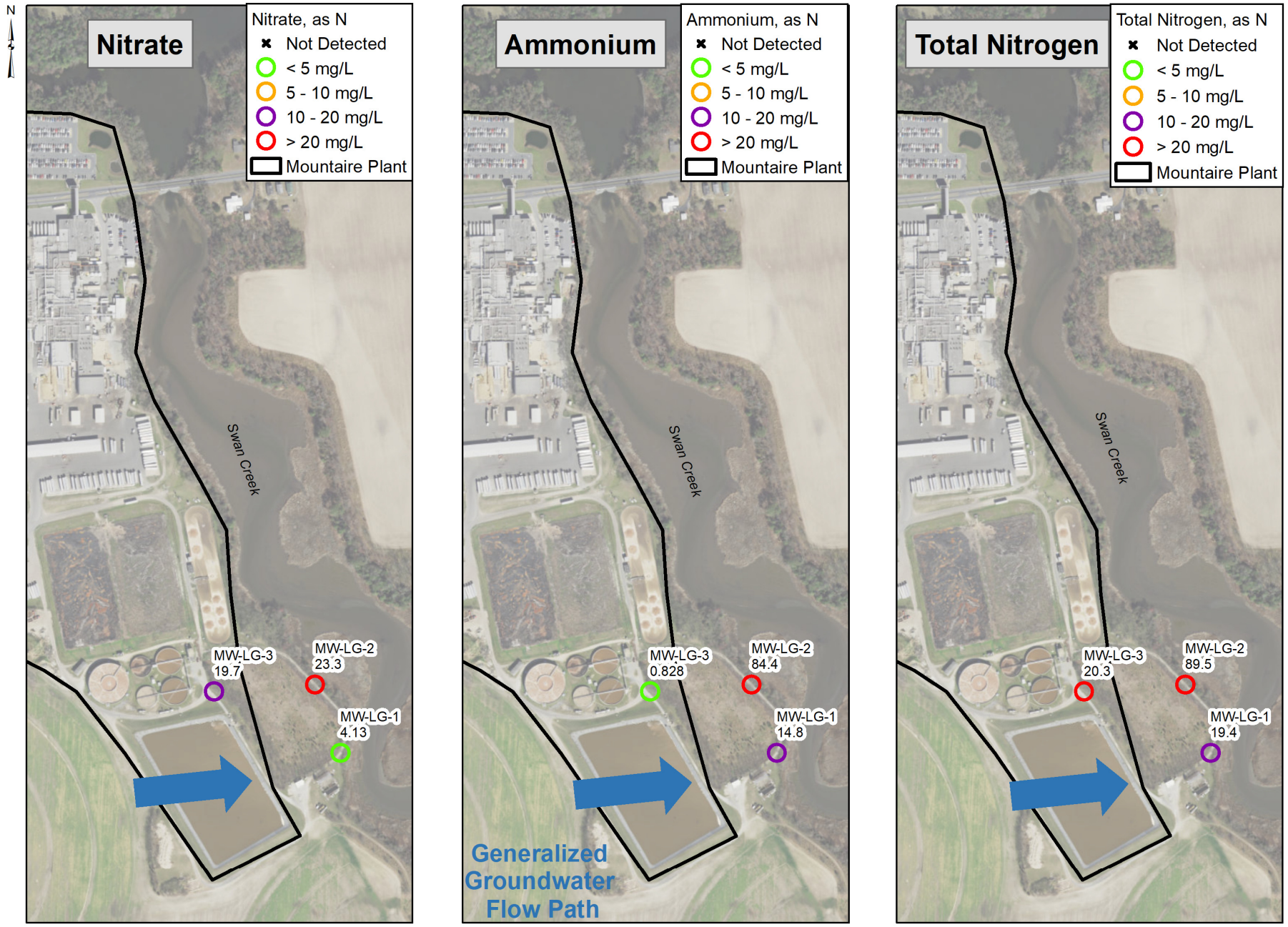

Figure 7 Nitrate, Ammonia, and Total Nitrogen in Groundwater at Lagoon Monitoring Wells, Maximum 2018-2019

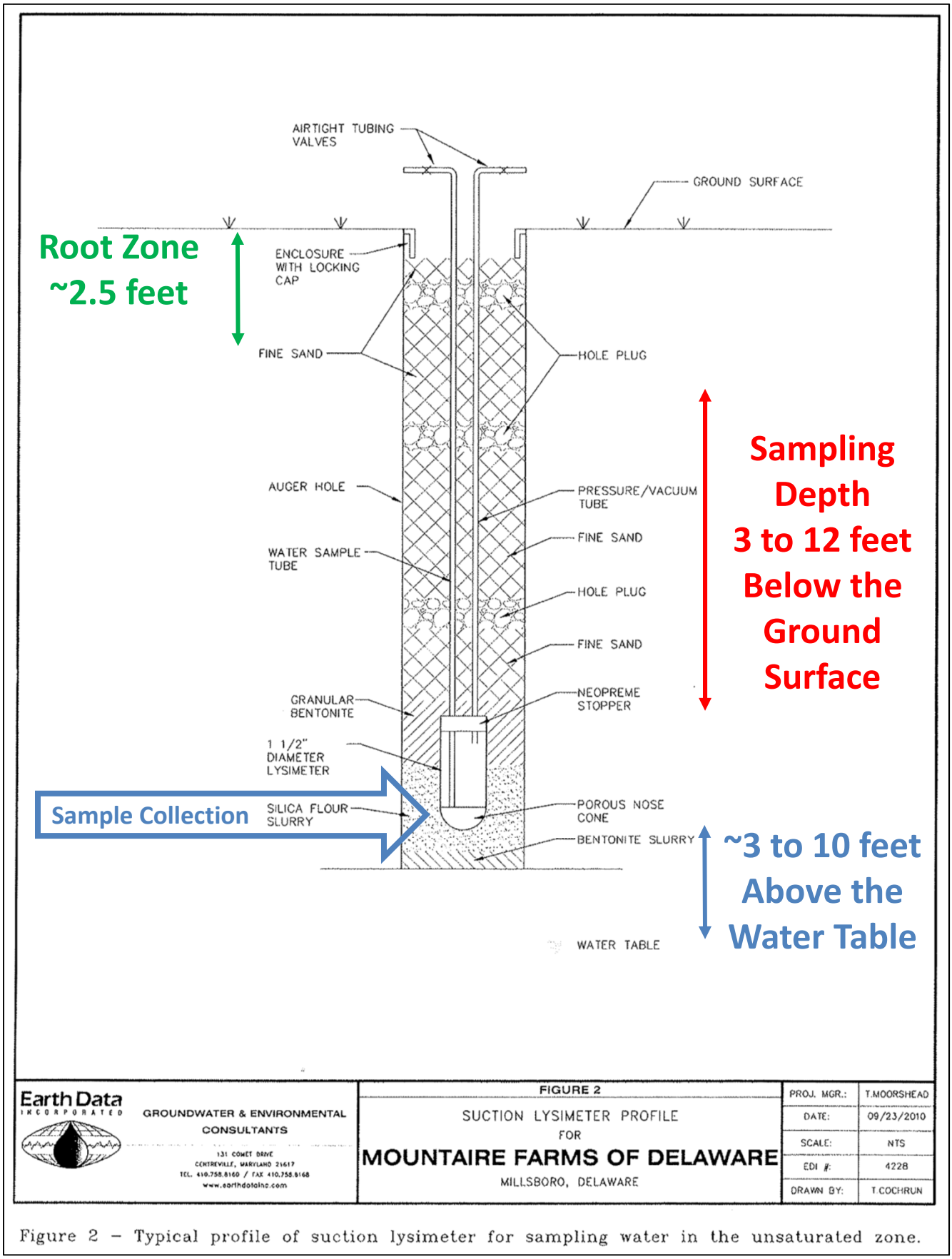

Figure 2 – Typical profile of suction lysimeter for sampling water in the unsaturated zone.

Figure 8 Lysimeter Profile (SSP&A annotations on an attachment to DNREC, 2010c)

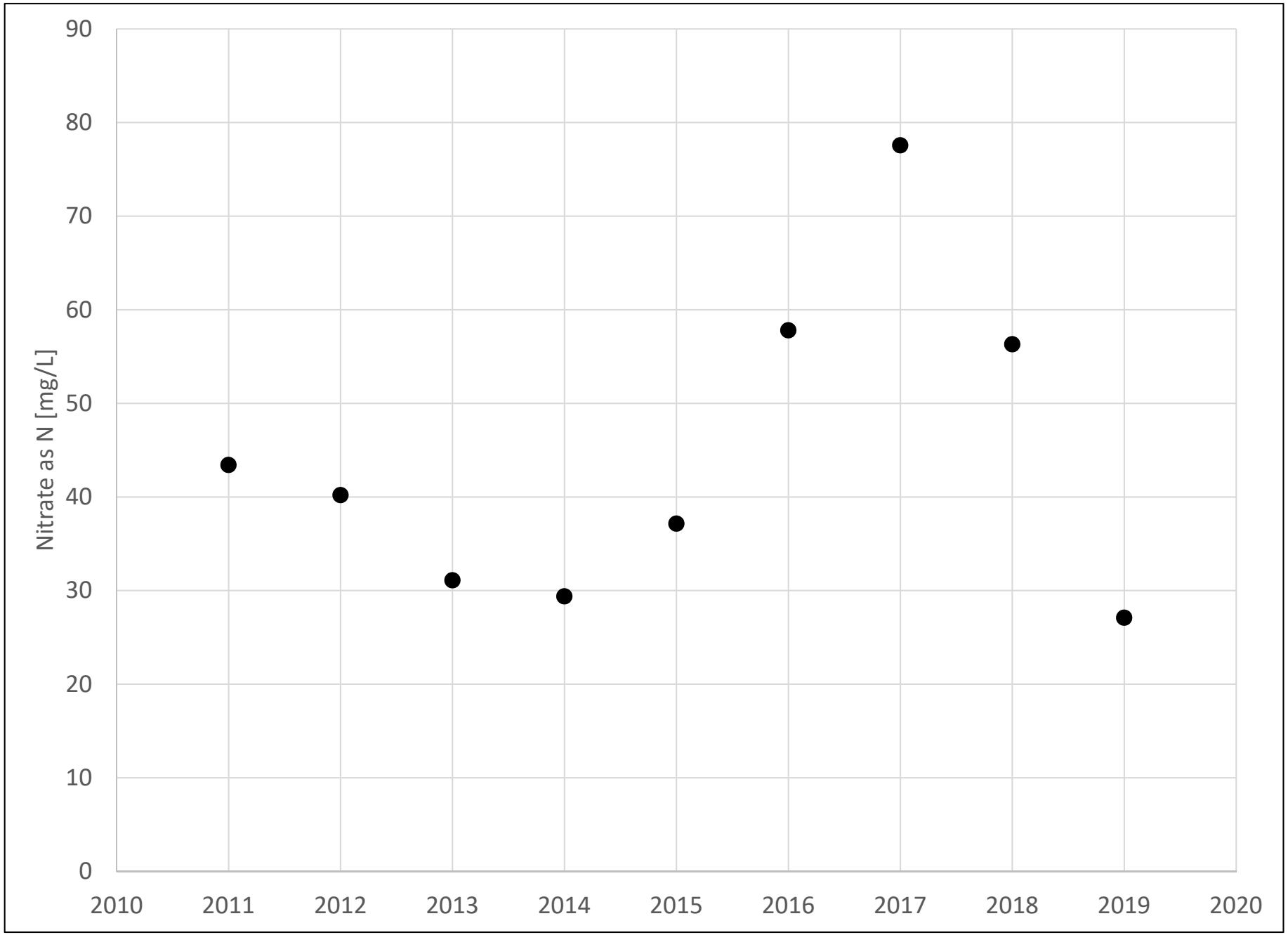

Figure 9 Average Nitrate in Lysimeters by Year

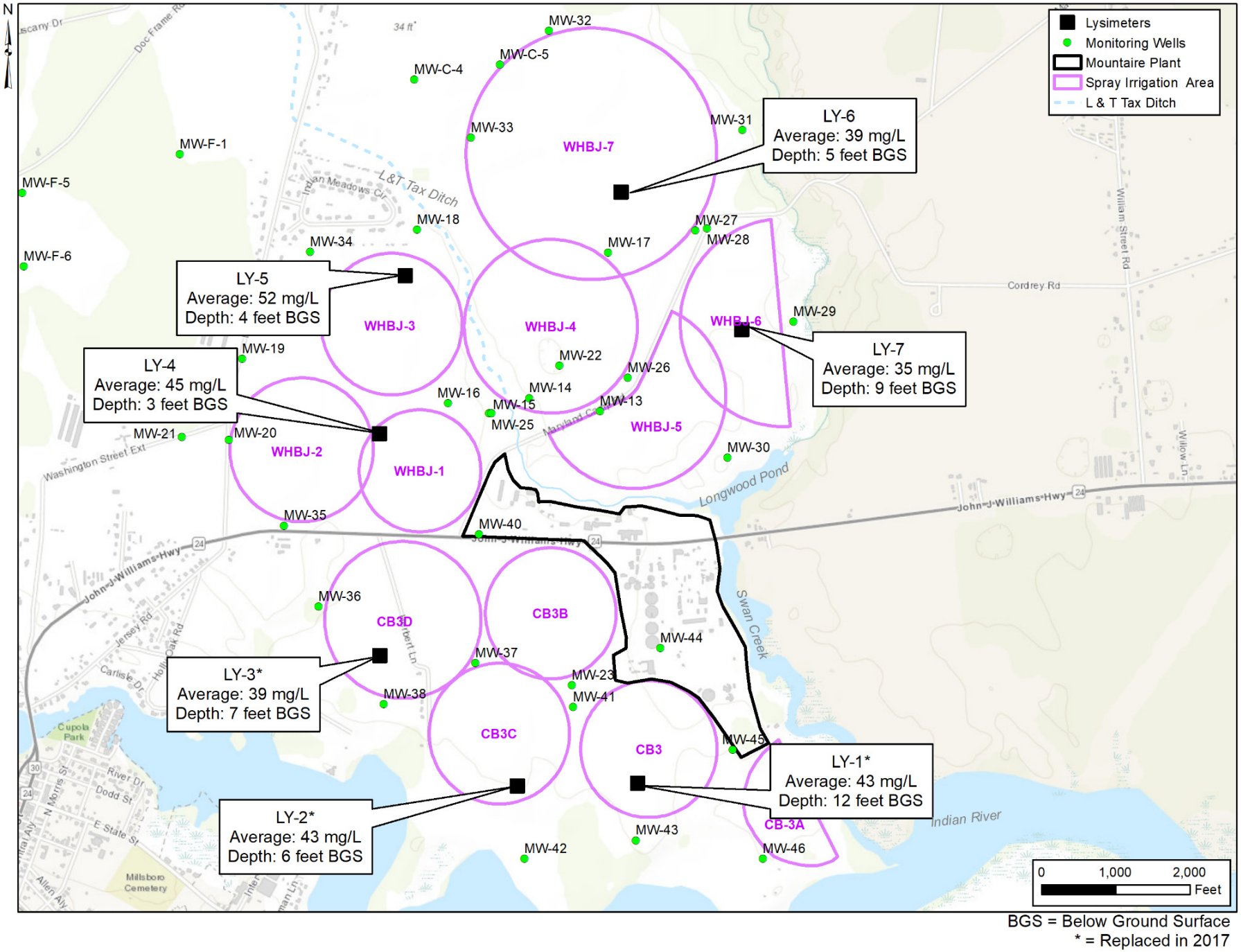

Figure 10 Nitrate in Lysimeters, 2011 - 2019

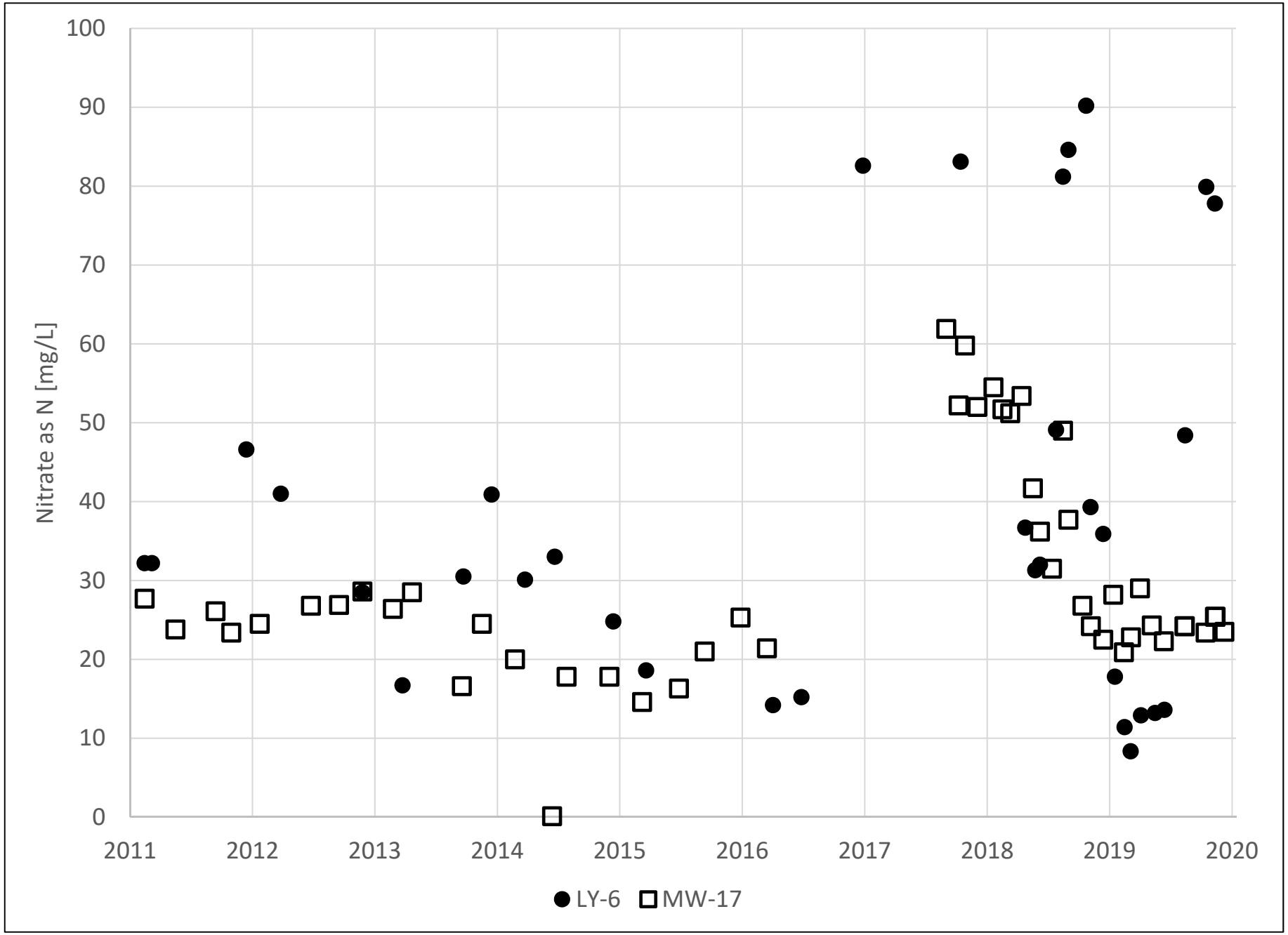

Figure 11 Nitrate Data for Lysimeter 6 and MW-17, Both Within Spray Field WHBJ-7