DRAFT

Lake Bloomington & Evergreen Lake Watershed Plan

McLean & Woodford Counties, Illinois

Funded by:
The City of Bloomington
Illinois Environmental Protection Agency
Illinois Farm Bureau

Prepared by:
Northwater Consulting

With assistance from:
McLean County Soil & Water Conservation District
City of Bloomington

DRAFT: May, 2021

Table of Contents

Figures

Tables

Acronyms

1. ACEP – Agricultural Conservation Easement Program
2. AFT – American Farmland Trust
3. AQI – Aesthetic Quality Index
4. BMP – Best Management Practice
5. CCA – Certified Crop Advisors
6. cfs – Cubic Feet per Second
7. CREP – Conservation Reserve and Enhancement Program
8. CRP – Conservation Reserve Program
9. CSP – Conservation Stewardship Program
10. CWS – Community Water Supply
11. CY – Cubic Yards
12. EL – Evergreen Lake
13. EMC – Event Mean Concentration
14. EQIP – Environmental Quality Incentive Program
15. GIS – Geographic Information System
16. gpm – gallons per minute
17. HUC – Hydrologic Unit Code
18. ICBMP – Illinois Council on Best Management Practices
19. ICGA – Illinois Corn Growers Association
20. IDNR – Illinois Department of Natural Resources
21. IDOA – Illinois Department of Agriculture
22. Illinois EPA – Illinois Environmental Protection Agency
23. IGIG – Illinois Green Infrastructure Grant Program
24. INLRS – Illinois Nutrient Loss Reduction Strategy
25. INSAC – Illinois Nutrient Science Advisory Committee
26. IPCB – Illinois Pollution Control Board
27. ISA – Illinois Stewardship Alliance
28. ISU – Illinois State University
29. ISAP – Illinois Sustainable Ag Partnership
30. ISGS – Illinois State Geologic Survey
31. LB – Lake Bloomington
32. LRR – Lateral Recession Rate
33. MCFB – McLean County Farm Bureau
34. MGD – Million Gallons per Day
35. MRBI – Mississippi River Basin Healthy Watersheds Initiative
36. NCWS – Non-Community Water Supply
37. NFWF – National Fish and Wildlife Foundation
38. NWQI - National Water Quality Initiative
39. NH4 – Ammonia
40. NO2 – Nitrite
41. NO3 – Nitrate
42. NPDES – National Pollutant Discharge Elimination System
43. NPS– Nonpoint Source Pollution
44. NRCS – Natural Resource Conservation Service
45. NTCHS – National Technical Committee for Hydric Soils
46. NVSS – Nonvolatile Suspended Solids
47. NWI – National Wetlands Inventory
48. PCM – Precision Conservation Management
49. RCPP – Regional Conservation Partnership Program
50. SHP – Soil Heath Partnership
51. SRP – Soluble Reactive Phosphorus
52. S.T.A.R. – Saving Tomorrow's Agriculture Resources Program
53. STEPL – Spreadsheet Tool for Estimating Pollutant Loads
54. STP – Stone Toe Protection
55. SSC – Suspended Sediment Concentration
56. SWCD – Soil and Water Conservation District
57. TKN – Total Kjeldahl Nitrogen
58. TMDL – Total Maximum Daily Load
59. TN – Total Nitrogen
60. TNC – The Nature Conservancy
61. TP – Total Phosphorus
62. TSI – Trophic State Index
63. TSP – Technical Service Providers
64. TSS – Total Suspended Solids
65. USDA – U.S. Department of Agriculture
66. USEPA – U.S. Environmental Protection Agency
67. USFWS – U.S. Fish and Wildlife Service
68. USGS – United States Geological Survey
69. USLE – Universal Soil Loss Equation
70. VSS – Volatile Suspended Solids
71. WASCB – Water and Sediment Control Basin

Executive Summary

The Lake Bloomington & Evergreen Lake Watershed

The Lake Bloomington (LB) and Evergreen Lake (EL) Watershed Plan encompasses 69,512 acres from three Hydrologic Unit Code (HUC)-12 watersheds. The plan provides a road map to achieve water quality targets and stakeholder goals established under previous plans; nutrient and sediment water quality goals are in alignment with the Illinois Nutrient Loss Reduction Strategy (INLRS) and the Lake Bloomington and Evergreen Lake Total Maximum Daily Load (TMDL). This plan is intended to be adopted and updated as cost-effective implementation activities continue to achieve the highest load reductions. Priority or critical areas identified should serve as a starting point to guide implementation and outreach efforts by watershed managers and partners.

Public Meeting

Many people and groups in both watersheds have been working diligently to improve water quality in the lakes and protect this important water supply. The City of Bloomington (City) and the McLean County Soil and Water Conservation District (SWCD) have led efforts over the years, supported by local stakeholders such as farmers, lake and community residents, state, local and federal agency staff, and non-profit groups which will support the execution of this plan. Projects underway during plan development include cost-share from the Natural Resources Conservation Service and SWCD for priority Best Management Practices (BMPs), robust water quality monitoring through the City and Illinois State University and in-lake treatments, specifically, shoreline protection. The City also regulates septic systems and conducts related education and outreach. These initiatives and actions have resulted in measurable improvements to water quality, strengthened stakeholder engagement and expanded key partnerships. This lake and watershed track record has laid the critical groundwork needed to accelerate implementation activities detailed in the watershed plan.

Previous stakeholder goals developed by the LB and EL Steering and Technical Committees in 2008 include:

1. Reduce streambank erosion, lakeshore erosion and internal loading.
2. Reduce upland cropland erosion.
3. Reduce erosion from urban areas.
4. Replace failing septic systems.
5. Reduce phosphorus from animal waste and urban runoff.
6. Promote voluntary nutrient management on crop ground, livestock management and tile drainage treatment.
7. Control nuisance wildlife.
8. Conduct water quality monitoring.

This watershed plan includes a detailed assessment of current conditions such as water quality, pollution loading and existing practices, and notable features and attributes including landuse, geology, hydrology, and soils. It is informed by current and historical data and provides strategic recommendations or projects. Table 1 lists lake and watershed key characteristics for both lake watersheds, and a ranking of importance followed by a summary of key recommendations.

Table 1 – Lake & Watershed Key Characteristics & Problem Ranking

Inventory/ Assessment Item	Summary	Ranking
Nutrient & Sediment Loading	In both lake watersheds, nutrient loading from cropland is high and is responsible for the greatest percentage of the nitrogen (93%), phosphorus (67%), and sediment load (76%). Up to 60% of the cropland nitrogen load is estimated as originating from subsurface flow or drain tiles. Nitrogen loading and yield is also measurably higher than in other Illinois watersheds. Agricultural BMPs will be most effective in reducing nutrient and sediment loads, considering cost and feasibility. Further conversion to agriculture is not expected to occur in significant amounts in the future. Prioritized in-field practices, especially those that treat tile water, such as cover crops and nutrient management, will significantly reduce nitrogen loading. Edge-of-field and structural practices (e.g., filter strips, wetlands, and grassed waterways) will address higher-risk areas and further reduce loading, especially for phosphorus and sediment.	**High**
Lake Shoreline Erosion & In-Lake Management Measures	Lake shoreline erosion is responsible for 4% of watershed sediment load and a nominal amount of nutrients. As soil loss from shoreline erosion is quite severe in a small number of areas on Lake Bloomington and a moderate number on Evergreen Lake, selective stabilization will address most of the loading. The City has addressed in-lake nutrient release and loading at key locations. Efforts should shift to reducing external sources and legacy sediment and nutrients through selective dredging in the upper reaches of each lake and construction of in-lake basins or large, anchored floating wetlands to treat watershed sources.	**High**
Chemical Water Quality & Monitoring	Water quality data collected and analyzed indicates sustained high levels of nitrogen. Both lakes have been impaired for nitrates and were addressed in 2006 and 2007 TMDL documents. Chemical water quality, especially nitrogen, is of high concern and a priority in both lake watersheds. An extensive amount of data and a robust monitoring network exists. Moving forward, these efforts should continue in a more coordinated fashion and under a centralized data management system. Opportunities exist for new research on City properties and the current online management system should be utilized by watershed managers and partners to track plan implementation and progress towards water quality targets.	**High**
Gully Erosion	Gully erosion is responsible for a small portion of the watershed sediment (10%), phosphorus (5%) and nitrogen (0.4%) load. Gullies on non-cropland can be addressed through structural practices, while cropland gullies can be addressed though in-field and structural practices. On cropland, a small number of gullies are responsible for a large percentage of the total sediment load. Grassed waterways at these locations are defined as "critical" in Section 9 and should be prioritized.	**Medium**
Tillage & HEL Soils	Mulch and reduced-till systems are common on 69% of all field acres; these acres are responsible for approximately 60% of the cropland sediment and nutrient load. Conventional tillage is low overall but yields the greatest per-acre sediment loads. Highly Erodible (HEL) soils exist on only 3.2% of cropland. Increasing the percentage of no-till in the watershed (currently 20% of fields) and promoting cover crops will measurably reduce sediment and nutrient loading.	**Medium**

Inventory/ Assessment Item	Summary	Ranking
Septic Systems	A combined 1,859 homes with septic systems are in both lake watersheds. Possibly, up to 15%, or 279 systems, of these may be failing. Failing systems are estimated to account for a small portion of the overall nutrient load (0.4% nitrogen and 8% phosphorus). A septic system education program can prevent loading from failing systems in the future.	**Low**
Landuse Change & Urban Areas	The watershed is sparsely populated and there is little evidence that development will increase and lead to major changes even as Bloomington and Normal expand. Much of the tillable acres are already converted to cropland and little to no transition from natural areas is likely. These areas should be conserved. Urban areas contribute little to the overall sediment and nutrient load, however, opportunities do exist for practices such as rain gardens and native buffers.	**Low**
NDPES Dischargers	Three NPDES (National Pollutant Discharge Elimination System) permitted facilities discharge negligible amounts of nutrients and sediment. As these facilities are permitted through the Illinois EPA and United States Environmental Protection Agency (USEPA), they are considered low priority for watershed managers.	**Low**
Streambank Erosion	Streambank erosion is responsible for a low proportion of the watershed's sediment (9%), phosphorus (5%), and nitrogen (0.2%) load. Although it is a natural process, bank erosion can be severe at certain locations, such as forested stream corridors. Due to access constraints and costs associated with stabilization, addressing other sources of sediment and nutrients should be prioritized.	**Low**

Primary Recommendations

1. Conduct targeted outreach and one-on-one communication with producers and landowners identified as having critical areas outlined in Section 9.0. Build consensus and develop a series of large-scale funding initiatives with support from the City of Bloomington.
    a. Establish dedicated funding pot specifically for cover crops, nutrient management, and tile controls.
    b. United States Department of Agriculture – Regional Conservation Partnership Program (RCPP).
        i. Focus on in-field management measures and structural practices to reduce nitrates: cover crops, fall to spring nitrogen application, saturated buffers, and drainage water management.
    c. Illinois EPA Section 319.
        i. Apply to fund structural practices: priority grass waterways and Water and Sediment Control Basins (WASCB), ponds and wetlands, in-lake basin/wetlands.
2. Use the current online watershed management and implementation tracking system to monitor practice adoption, load reductions achieved, and progress made towards meeting water quality targets.
3. Improve upon the structure of existing water quality monitoring efforts and continue to measure progress. Consider a central data management system and better coordination with monitoring partners and researchers.

1.0 Introduction

The focus of this plan is the 43,248-acre Lake Bloomington (LB) and the 26,264-acre Evergreen Lake (EL) watersheds, located mostly in McLean County, Illinois. Three United States Geological Survey (USGS) Hydrologic Unit Code (HUC)-12 subwatersheds make up the project area: Lake Bloomington-Money Creek, Blue Mound-Money Creek, and Evergreen Lake-Sixmile Creek. Both Lake watersheds fall within the Mackinaw River HUC8 basin (07130004), which is tributary to the Illinois River. Figure 1 shows the location of the watersheds and subwatershed boundaries and locations.

This plan characterizes the LB/EL watershed and defines an achievable implementation strategy to address water quality concerns, specifically, nutrients and sediment. It also summarizes and unites ongoing efforts to identify, prioritize and plan new projects, following over two decades of collaborative conservation activities and in-lake management. The plan will, therefore, provide a road map to achieve water quality targets, as well as goals developed by stakeholders during a previous planning process. This plan is intended to be adopted and updated as implementation activities progress to achieve the highest load reductions for the least possible investment.

Both lakes are public drinking water supplies for the City of Bloomington and surrounding communities and have a history of water quality impairments. The importance of sediment and nutrient reduction is critically important to the long-term resiliency of both reservoirs, as well as the recreational benefits they provide. Therefore, nitrogen, phosphorus and sediment reduction are the primary drivers of this plan. Water quality targets of a 40% reduction in nitrogen for both lakes are consistent with existing TMDL plans. A 66% phosphorus reduction target for LB and 82% for EL also aligns with the TMDLs. The 25% sediment reduction is set to match the Illinois Nutrient Loss Reduction Strategy target for phosphorus and reflects a reasonable value based on trends in sediment loading over time. If all recommended projects are implemented and constructed, nitrogen and sediment reduction targets will be exceeded. Due to the extremely low lake phosphorus standard, meeting this target will be more challenging and could require additional measures beyond what is specifically identified in this plan. This plan includes the required Watershed Based Plan components and is organized into the following sections:

- Section 1 – Introduction
- Section 2 – Watershed History
- Section 3 – Watershed Resource Inventory
- Section 4 – Pollutant Loading
- Section 5 – Sources of Watershed Impairments
- Section 6 – Nonpoint Source Management Measures & Load Reductions
- Section 7 – Cost Estimates
- Section 8 – Water Quality Targets
- Section 9 – Critical Areas
- Section 10 – Technical & Financial Assistance
- Section 11 – Implementation Milestones, Objectives & Schedule
- Section 12 – Information & Education
- Section 13 –Monitoring & Tracking Strategy

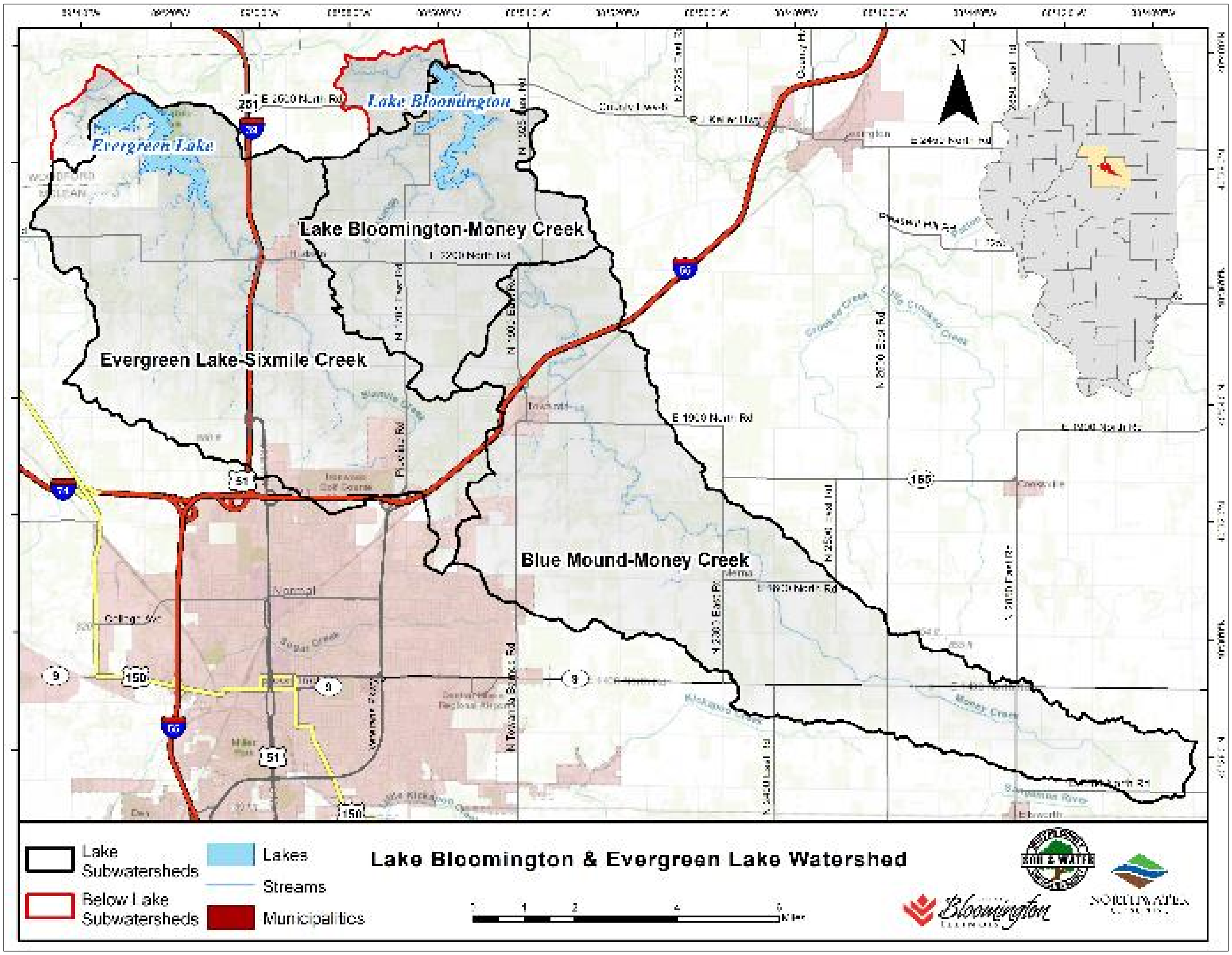


Figure 1 – LB/EL Watershed

2.0 Lake & Watershed History

Lake Bloomington was constructed in 1929 by impounding Money Creek and is a water supply source for domestic, commercial, industrial, and agricultural purposes. It is also used for recreation and serves as a selling point for the residential developments that sprang up along its shores. Evergreen Lake, located west of Lake Bloomington, serves as a supplemental water source (ISWS, 1994).

The City of Bloomington relies on EL and LB for its community drinking water supply. Together, these two reservoirs have an estimated capacity of 22,900 acre−feet. Raw water is treated at the LB Water Treatment Plant and then delivered to customers in Bloomington, Towanda, Hudson, and Bloomington Township. Average water use is 11.5 million gallons per day (mgd) (Wittman Hydro Planning Associates, 2010). Bloomington's top 50 largest water customers use an average of 5,620,369 cubic feet of water each year or just over 42 million gallons. These water users include businesses such as Cargill, State Farm, and Bridgestone Tire.

2.1 Lake Bloomington

Lake Bloomington is surrounded by over 200 residential properties and is a popular local recreational resource. Lake capacity was increased in 1957 by raising the dam 5 ft and it is estimated that 0.4% of the lake's capacity is lost each year due to sedimentation. Hudson, Towanda, Bloomington Township (TWP) West Phase, Bloomington TWP Crestewicke, Meadows, and Hilltop MHPs are consumers of water taken from Lake Bloomington (Tetra Tech, Inc., 2006).

Lake Bloomington and its watershed have been the subject of numerous studies, initiatives and planning efforts over the years. The City of Bloomington, the McLean County Soil and Water Conservation District (SWCD), the McLean County Natural Resource Conservation Service (NRCS) and many others, such as Illinois State University (ISU) and The Nature Conservancy (TNC), have actively worked to promote and install conservation practices, conduct water quality monitoring, perform education and outreach, and improve conditions in the lake.

As described in subsequent sections, a TMDL plan was approved in 2007 in response to nitrogen and phosphorus impairments and a watershed plan was initiated in 2006 and completed in 2008. During the 2006 watershed planning process, agency and stakeholder committees were formed and the public was engaged to help identify concerns and develop reasonable solutions. Concerns identified for LB include:

- Inconsistent water supply to the City and volume loss.
- High nitrates, phosphorus, algae, and sedimentation.
- Urban development and septic systems.
- Impacts to recreation and wildlife habitat.
- Gaps in scientific data.
- Awareness and knowledge of issues and incentives to implement strategies.

Many, but not all these concerns, persist today. For example, high nitrates, phosphorus and sedimentation are still an issue, however, data indicates that nitrate is of higher importance. Urban development does not appear to have expanded rapidly since the 2008 plan and future projections indicate a similar pattern. Despite the high number of septic systems, other pollution sources exceed impacts to water quality far more. Rather than there being significant gaps in scientific data, substantial data exists and is being collected; this issue now is with management and use of that information.

The previous watershed plan also outlines a series of goals to address concerns. These goals were organized to address nitrate/nitrite, phosphorus levels and sedimentation:

1. Riparian areas:
    a. Stabilize eroding streambanks.
    b. Control lake shoreline erosion.
    c. Internal lake nutrient loading.
2. Urban Areas:
    a. Develop construction erosion and sedimentation controls.
    b. Reduce urban lawn fertilizer application.
    c. Inspect and replace inadequate septic systems.

3. Agriculture:
    a. Promote voluntary nutrient management plans.
    b. Reduce delivery of sediment from cropland.
    c. Develop livestock management plans.
    d. Manage tile drainage.

Based on current conditions, inventories and analysis completed to support this plan, focus should remain on those agricultural goals to achieve the greatest "bang-for-the-buck."

2.2 Evergreen Lake

Water is drawn from EL when its water quality is better than that of LB. The City has increased the capacity of its reservoirs over time. In 1995, 37% more capacity (approximately 1.23 billion gallons) was added by raising the spillway by 5 ft. The City also constructed a pumping station in 1992 to draw water from the Mackinaw River to supplement the reservoir system under certain conditions.

As with LB, EL and its watershed have been the subject of numerous studies, initiatives and planning efforts. A TMDL plan was approved in 2006 in response to Total Suspended Solids (TSS) and phosphorus impairments. Ultimately, the TMDL was finalized for phosphorus. A watershed plan was initiated in 2006 and completed in 2008. During the 2006 watershed planning process, agency and stakeholder committees were formed and the public was engaged to help identify concerns and develop reasonable solutions. Problem statements articulated for EL included:

- Excessive phosphorus loading from sedimentation and animal waste, including livestock.
- Upland and streambank erosion.
- Increased flows and nutrient loading from urban areas and lack of monitoring.

Many, but not all these concerns, persist today. For example, urban development does not appear to have expanded rapidly since the 2008 plan and this trend is expected to continue. Some monitoring of urban runoff has occurred, however, the data was unusable. Streambank erosion is still occurring but efforts to stabilize critical stream segments, combined with conversion of stream channels to subsurface drains, have significantly reduced contributions from bank erosion. Apart from a few locations, livestock animal waste does not appear to be a major source of phosphorus.

The previous watershed plan also outlines a series of goals to address problem statements. These goals were organized to address phosphorus and include:

1. Stabilize eroding streambanks.
2. Control lake shoreline erosion.
3. Reduce internal lake nutrient loading and resuspension of sediment.
4. Control nuisance wildlife, such as Canada Geese and carp.
5. Reduce delivery of sediment from cropland.
6. Reduce livestock waste.
7. Reduce phosphorus loading from urban runoff and sheet flow.
8. Establish an urban runoff monitoring program.

Based on current conditions, inventories and analysis completed to support this plan, focus should remain on those agricultural-related goals and in-lake management measures, such as strategic shoreline erosion control to achieve the greatest "bang-for-the-buck."

2.3 Relationship to Other Plans, Studies, & Initiatives

Both lakes and watersheds have been the subject of frequent research, planning, and implementation. This section summarizes those activities and reports to date and their relationship to the current plan. A concerted effort was made to secure all relevant documents/studies and recognize previous initiatives and projects that have helped to generate improvements to water quality and engaged stakeholders. Those relevant to and utilized by this plan are presented in Table 2.

Table 2 - Relevant Reports, Plans, Initiatives, & Studies

Work Product	Year	Notes/Relevance
Lake Bloomington Watershed, Watershed Plan Environmental Assessment – United States Department of Agriculture	1991	Assessment of in-lake structures to reduce sediment loading. Report used to justify and support current plan recommendations for in-lake structures.
Water Quality Characteristics of Lake Bloomington and Evergreen Lake – Illinois State Water Survey	1994	Evaluation of reservoir chemical and biological characteristics to determine changes in lake water quality prior to and following installation of a floating pump. Used to evaluate historical water quality and in-lake measures.
Aeration/Destratification in Lake Evergreen, McLean County, Illinois – Illinois State Water Survey	1998	An evaluation of the efficiency of an aeration system installed in Evergreen Lake to improve water quality. The system was determined to be effective. The study was used to inform current estimates of in-lake nutrient loading and to estimate load reductions associated with installing additional aeration units.
Evergreen Lake Watershed TMDL Report – CDM Smith	2006	Total phosphorus TMDL. An 82% reduction in internal and external load is needed for the lake to meet the State's 0.05mg/L phosphorus standard. The TMDL report was used to set water quality targets, perform a water quality trends analysis and guide current modeling.
Lake Bloomington Watershed TMDL Report – Tetra Tech	2007	Total phosphorus and nitrate TMDL. An 66% reduction in phosphorus load is needed for the lake to meet the State's 0.05mg/L phosphorus standard. A 34% reduction in nitrate load is needed to meet the State's drinking water standard of 10 mg/L. The TMDL report was used to set water quality targets, perform a water quality trends analysis and guide current modeling.
Lake Bloomington Watershed Plan – Lake Bloomington Watershed Planning Committee	2008	Previous 9-element watershed plan. Baseline for current effort. Foundation for stakeholder goals and objectives, watershed history, trends, and practice recommendations.
Evergreen Lake Watershed Management Plan – Evergreen Lake Watershed Planning Committee	2008	Previous 9-element watershed plan. Baseline for current effort. Foundation for stakeholder goals and objectives, watershed history, trends, and practice recommendations.

Work Product	Year	Notes/Relevance
Interim Water Supply Plan – Wittman Hydro Planning Associates	2010	Report assessing water supply resiliency. Provides recommendations for water conservation and management. Report used as a source of background information.
Water Tour Opinions: A Social Assessment of the Lake Bloomington and Lake Evergreen Watersheds – Illinois State University	2014	A study and report documenting attitudes towards water resources. Results are based on interviews and focus groups, and intended to guide outreach and education to the non-agricultural community. Some findings used to reinforce plan recommendations.
Bundling in-field and off-field nutrient practices to reduce nutrient export, improve drinking water quality, and address hypoxia in the Gulf of Mexico – The Nature Conservancy	2017	A Conservation Innovation Grant (CIG) funded project to develop and evaluate in-field and edge-of-field conservation practices. Included transition from fall to spring fertilizer application, wetland restoration, tile mapping, outreach, and a GIS analysis of potential project locations. To support this plan, project maps were used to help identify tiled fields for modeling purposes, restored wetlands were incorporated into the plan and nutrient loading model and potential project locations were evaluated and a subsection included are recommended BMPs. This report also helped to inform the Education & Outreach component of the plan.
Riparian Areas Inventory Summary; Riparian Areas Maintenance - Cardno	2018	Town of Normal inventory of urban detention/retention basins. Outlines current conditions of structures and remedial actions. Inventory used to guide detention basin inventory section of this plan.

In 2005, Sand County Foundation established a pilot program in the LB watershed with the City, the Council on Best Management Practices, University of Illinois, Illinois Department of Agriculture, NRCS, and others to implement conservation practices to see if (1) water quality could be significantly affected, (2) farmers would participate on a broad basis, and (3) lessons could be learned and utilized elsewhere. Key to the strategy was to give farmers a variety of choices on conservation practices, including enhanced conservation planning, cover crops, bioreactors, drainage management, nutrient inhibitors, split and spring application, etc. The incentives were carefully structured to encourage producer implementation and assessment of economic viability on their operation and to foster long-term adoption. Over time, approximately 15,500 acres, or 50% of the eligible land, were enrolled in one or more practice. Significant reductions in nitrogen and phosphorus discharge were achieved, and farmers adopted systems that strengthened the economic viability of their operations. The demonstration was so successful that the City expanded this program to EL and granted it its own funding mechanism.

3.0 Watershed Resource Inventory

3.1 Location & Watershed Boundaries

Figure 1 shows the location of both lakes and their respective watersheds. The three relevant HUC12 subwatersheds are within the Mackinaw River HUC8 basin (07130004) and tributary to the Illinois River. This plan encompasses the watershed areas of LB and EL upstream of their dams.

- The 43,248-acre LB watershed is located entirely in McLean County and includes the two HUC12 subwatersheds:
    - Lake Bloomington-Money Creek.
    - Blue Mound-Money Creek.
- The 26,264-acre EL watershed is mostly in McLean County with a small portion in Woodford County (4%, 1,152 aces). It includes one HUC12 subwatershed:
    - Evergreen Lake-Sixmile Creek.

3.2 Water Quality Standards & Impairments

3.2.1 Standards

What are Standards?

Water quality standards are laws or regulations established to enhance water quality and protect public health and welfare. Standards consist of criteria necessary to support and protect a specific "designated use" of a waterbody and an antidegradation policy. Examples of designated uses are primary contact, fish consumption, aesthetic quality, protection of aquatic life, and public and food processing water supply. Criteria are expressed numerically for standards with a numeric limit (e.g., 10% of samples over a time period cannot exceed the standard expressed as a concentration), or as narrative description for qualitative standards without a numeric limit (e.g., increased algae growth not meeting aesthetic standards). Antidegradation policies are adopted so that water quality improvements are conserved, maintained, and protected (CDM Smith, 2014). Waterbodies are considered impaired when they exceed these standards, meeting the criteria to be defined as impaired. Section 303(d) of the 1972 Clean Water Act requires the States to define impaired waters and identify them on the 303(d) list. When no numeric or narrative criteria is set for a parameter, guidelines are described for a specific use.

Relevant Standards & Water Quality Parameters

Water quality standards relevant to this plan are phosphorus, total suspended solids (TSS), and nitrogen. The 2007 LB TMDL recommended reductions of 66% for phosphorus and 34% for nitrate to meet Illinois standards. The 2006 EL TMDL recommends an 82% reduction in phosphorus. The TMDLs did not directly address TSS which can reduce lake storage capacity and affect habitat. Phosphorus loading is also linked to sediment yields in agricultural watersheds. Other impairments, such as mercury, are related to fish tissue analysis and are outside of the scope of this plan.

The ILNRS calls for a 15% reduction in nitrogen, while the Gulf Hypoxia Action Plan (2008) calls for a 45% reduction to address and reduce the hypoxic zone and achieve plan goals. Each parameter and associated standards are discussed below.

Phosphorus is a major cellular component of organisms. Phosphorus can be found in dissolved and sediment-bound forms but is often “locked up” as components in aquatic biota, primarily algae. Major sources in the watershed likely include fertilizers and, to a lesser extent, human and animal waste. In freshwater systems, phosphorus occurs naturally in smaller concentrations than nitrogen, making it the limiting nutrient in these freshwater aquatic systems. Increased nutrient concentrations (especially phosphorus) in a waterbody stimulates algae growth, which can lead to large populations, forming a bloom that can be harmful to water quality and aquatic life. Dissolved phosphorus is especially important because it is readily usable by algae and other plants. The two common forms are:

- **Soluble reactive phosphorus (SRP)** –dissolved phosphorus readily usable by algae. SRP is often found in very low concentrations in phosphorus-limited systems where the nutrient is tied up in the algae and cycled very rapidly. Sources include fertilizers, animal wastes, and septic systems.

- **Total phosphorus (TP)** – includes dissolved and particulate forms. According to Illinois water quality standards, total phosphorus must not be greater than 0.05 mg/L in lakes greater than 20 acres in size; streams may not exceed 0.05 mg/L at the point of entry into a lake. The Illinois Nutrient Science Advisory Committee (INSAC) recommends a 0.1 mg/L standard for non-wadable rivers and 0.113 mg/L for wadable streams for the northern ecoregion of Illinois (INSAC 2018).

Nitrogen The various forms of nitrogen differ in respect to lake health and standards. Inorganic forms of are readily available by algae for growth. Other forms of nitrogen, and in high concentrations, can be toxic to fish and other aquatic organisms. Excess nitrogen also aids in excessive algal growth and blooms. The four common forms are:

- **Nitrite (NO2)** – an inorganic form, is an intermediate oxidation state of nitrogen, both in the oxidation of ammonia to nitrate and in the reduction of nitrate.

- **Nitrate (NO3)** – an inorganic form, generally occurs in trace quantities in natural or unimpacted surface water systems but may attain high levels in some groundwater. Nitrate travels easily through soil carried by water into surface waterbodies and groundwater. The current standard of 10 mg/L for nitrate-nitrogen (nitrogen from nitrate) in drinking water is specifically designated to protect human health.

- **Ammonia (NH4)** – is present naturally in surface waters. Bacteria produce ammonia as they decompose dead plant and animal matter. In Illinois, the total ammonia general use standard is 15 mg/L.

- **Organic nitrogen (TKN)** – is defined functionally as organically bound nitrogen in the tri-negative oxidation state. Organic nitrogen includes nitrogen found in plants and animal materials, which includes such natural materials as proteins and peptides, nucleic acids and urea. In the analytical procedures, Total Kjeldahl Nitrogen (TKN) determines both organic nitrogen and ammonia. Raw sewage will typically contain more than 20 mg/L.

- **Total nitrogen (TN)** is the sum of TKN (ammonia, organic and reduced nitrogen) and nitrate-nitrite for the purposes of this report. INSAC recommends 3.8 mg/L as the TN criteria for wadable streams in the northern ecoregion (INSAC 2018).

Total Suspended Solids (TSS) TSS refers to the portion of total solids suspended in water as retained by a filter. It varies temporally in both rivers and lakes, typically increasing from erosion during runoff events, lake turnover, biological processes, and human disturbances.

Total Suspended Solids can be differentiated between volatile suspended solids (VSS), organic materials such as algae and decomposing organic matter, and nonvolatile suspended solids (NVSS), which include non-organic “mineral” substances (IEPA, 2016).

As there is no regulatory standard for TSS in streams, a guideline of 116 mg/L has been applied as an indicator of conditions to support aquatic life use (ALUS), as described in the 2003 TMDLs for Rayse Creek and the East Fork Kaskaskia River. In lakes, the Aesthetic Quality Index (AQI) is a point system used to rank the lake quality based on physical and chemical water quality indicators. Three evaluation factors are used in establishing the number of AQI points; the higher AQI scores indicate increased impairment (IEPA, 2018):

1. Median Trophic State Index (TSI): May–October and calculated from water quality data (total phosphorus, chlorophyll a, and Secchi disk transparency)
2. Macrophyte Coverage: Average percentage of lake surface area covered by macrophytes during peak growing season.
3. Nonvolatile Suspended Solids (NVSS) concentration: Median lake surface NVSS concentration for samples collected at 1 ft depth.

Although NVSS is only one of three evaluation criteria for determining the AQI score, NVSS concentrations are heavily weighted as the highest score is achieved when NVSS concentrations are greater than or equal to 15 mg/L. The previous Illinois EPA guideline for listing TSS for aquatic life in lakes is a NVSS greater than 12 mg/L. As VSS and NVSS data are insufficient to support the water quality analysis for this watershed, this analysis will compare TSS to the 15 mg/L standard as a proxy.

3.2.2 Impairments

Current impairments on the 2018 303(d) list are shown in Figure 2 and Table 3. Lake Bloomington, EL and their tributary streams make the list and are impaired for phosphorus, sediment, mercury and habitat alterations. The impairments have persisted through time, however, Money Creek was recently added as an impaired waterbody in 2018 (Table 4).

Water quality impairments documented in the watershed date back to at least the early 1990s. Table 4 outlines the history of regulatory impairments.

Table 3 – 2018 303(d) Impaired Waterbodies

Assessment ID	Waterbody	Size (ac or mi)	Designated Use	Cause
RDO	Lake Bloomington	635 ac	Fish Consumption, Aesthetic Quality	Mercury, TSS, total phosphorus
DKP-02	Money Creek	28 mi	Aquatic Life	Loss of instream cover
DKN-01	Sixmile Creek	10 mi	Aquatic Life	Alteration in stream-side or littoral vegetative covers, other flow regime alterations, dissolved oxygen, sedimentation/siltation, loss of instream cover
SDA	Evergreen Lake	700 ac	Fish Consumption, Aesthetic Quality	Mercury, TSS, total phosphorus

Table 4 – Historical Impairments on 2004-2016 IEPA 303(d) List

Assessment ID	Waterbody	Impairment/ Impairment Cause
2004		
RDO	Lake Bloomington	Total phosphorus, nitrate, TSS, excessive algal growth
DKN-01	Sixmile Creek	Habitat Assessment (streams)
SDA	Evergreen Lake	Total phosphorus, TSS
2006		
RDO	Lake Bloomington	Total phosphorus, nitrogen, nitrate, TSS
2008		
RDO	Lake Bloomington	Mercury, nitrogen, nitrate, TSS, total phosphorus, aquatic algae
DKN-01	Sixmile Creek	Alteration in stream-side or littoral vegetative covers, other flow regime alterations, dissolved oxygen, sedimentation/siltation
SDA	Evergreen Lake	Mercury, TSS, total phosphorus
2010		
RDO	Lake Bloomington	Mercury, nitrogen, nitrate, TSS, total phosphorus, aquatic algae
DKN-01	Sixmile Creek	Alteration in stream-side or littoral vegetative covers, other flow regime alterations, dissolved oxygen, sedimentation/siltation
SDA	Evergreen Lake	Mercury, TSS, total phosphorus
2012		
RDO	Lake Bloomington	Mercury, manganese, total dissolved solids, TSS, total phosphorus, aquatic algae
DKN-01	Sixmile Creek	Alteration in stream-side or littoral vegetative covers, other flow regime alterations, dissolved oxygen, sedimentation/siltation
SDA	Evergreen Lake	Mercury, manganese, TSS, total phosphorus
2014		
RDO	Lake Bloomington	Mercury, total dissolved solids, TSS, total phosphorus, aquatic algae
DKN-01	Sixmile Creek	Alteration in stream-side or littoral vegetative covers, other flow regime alterations, dissolved oxygen, sedimentation/siltation, loss of instream cover

Assessment ID	Waterbody	Impairment/ Impairment Cause
SDA	Evergreen Lake	Mercury, TSS, total phosphorus
2016		
RDO	Lake Bloomington	Mercury, total dissolved solids, TSS, total phosphorus, aquatic algae
DKN-01	Sixmile Creek	Alteration in stream-side or littoral vegetative covers, other flow regime alterations, dissolved oxygen, sedimentation/siltation, loss of instream cover
SDA	Evergreen Lake	Mercury, TSS, total phosphorus

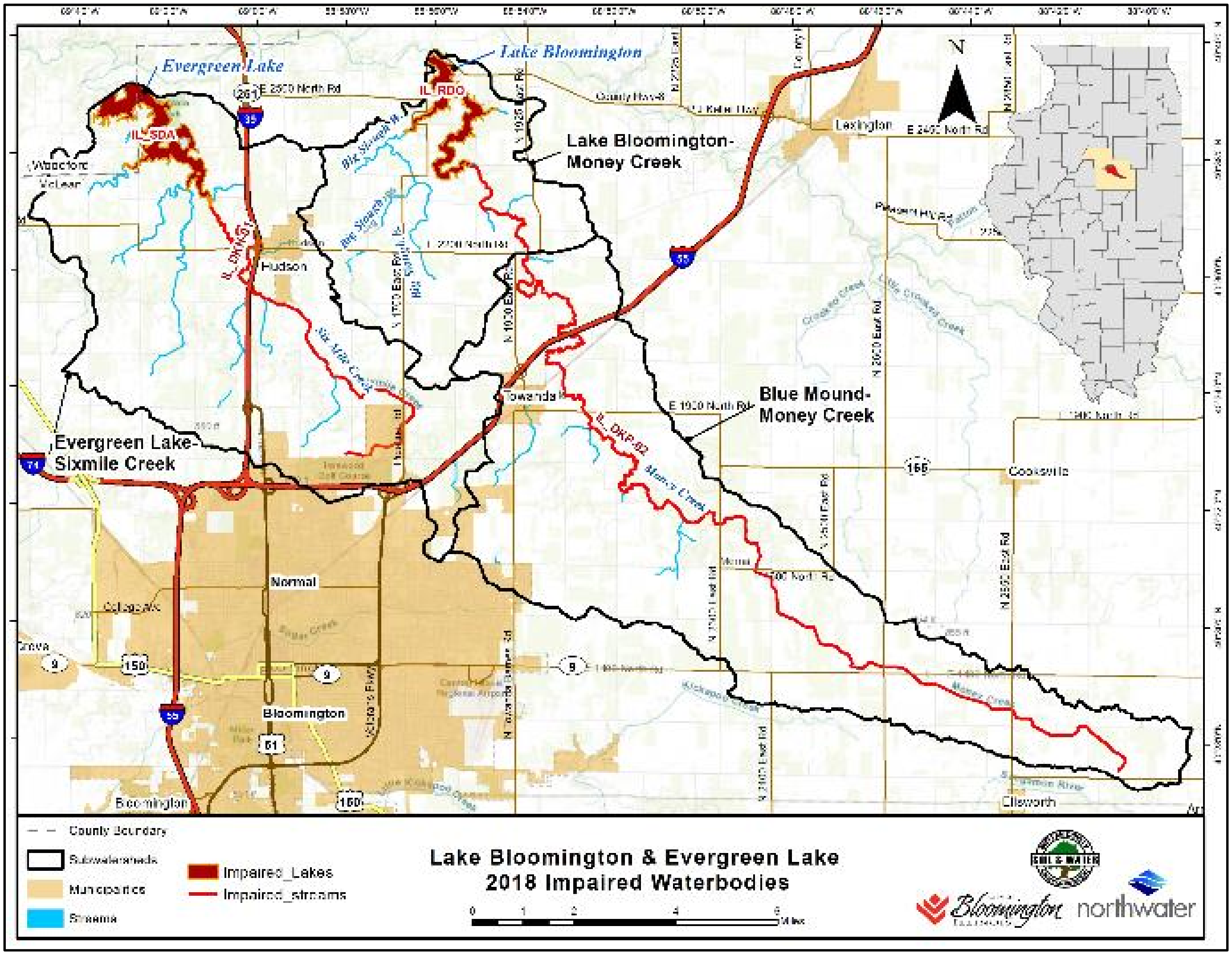


Figure 2 – 2018 Impaired Waterbodies

3.3 Water Quality Data

As described in the previous section, waterbodies have had a wide range of impairments, including phosphorus, TSS, dissolved oxygen, nitrate, mercury, algal growth, and habitat loss.

Data was made available from the City of Bloomington, ISU and the Illinois EPA. All three entities have been actively monitoring the lakes and their tributaries. Details of the water quality stations and locations are included in Table 5 and Figure 3 and Figure 4. Only data more recent than 2004 were included in presentation and analysis. There have been many different and often unaligned data collection campaigns in the watershed. Stations in close proximity were synthesized together to support cohesive analysis and allowed for time-series plots for LB, EL, and their respective tributaries. The temporal data range for the lake and river stations are 2004-2019 and 2009-2019, respectively.

Table 5 –Water Quality Sampling Sites - 2004–2019

Station Code	Latitude (dd)	Longitude (dd)	Waterbody	Range of Data	Parameters & Other Notes
DKP-02	40.59410	-88.88875	Money Creek	(Bi-weekly) August 2009 to October 2019	NO3-N, TP, TSS, Flow. Station was moved 2.3 miles in the southeast in May 2013 from the bridge on Country Rd 2200 N to the bridge on N1975 East Rd.
DKN-1	40.60627	-89.00264	Sixmile Creek	(Bi-weekly) August 2009 to December 2019	NO3-N, TP, TSS, Flow.
RDO*	40.65945	-88.93347	Lake Bloomington	(Weekly) January 2005 to December 2019	NO3-N, TP, TSS, VSS
RDO_SP*	40.66148	-88.93499	Lake Bloomington at Spillway	(Weekly) January 2005 to December 2018	NO3-N, TP, TSS, VSS
RDO-1*	40.66008	-88.93488	Lake Bloomington	April to October From 2004 to 2019	NO3-N, TP, TSS, VSS
RDO-2	40.65135	-88.92772	Lake Bloomington		NO3-N, TP, TSS, VSS
RDO-3	40.63894	-88.92437	Lake Bloomington		NO3-N, TP, TSS, VSS
RDO-4	40.64552	-88.93477	Lake Bloomington		NO3-N, TP, TSS, VSS
SDA**	40.64796	-89.05507	Evergreen Lake	(Weekly) January 2005 to December 2019	NO3-N, TP, TSS, VSS
SDA_SP**	40.64962	-89.05542	Evergreen Lake at Spillway	(Weekly) January 2005 to December 2018	NO3-N, TP, TSS, VSS
SDA-1**	40.64877	-89.05465	Evergreen Lake		NO3-N, TP, TSS, VSS

Station Code	Latitude (dd)	Longitude (dd)	Waterbody	Range of Data	Parameters & Other Notes
SDA-2	40.63972	-89.03850	Evergreen Lake	June to October from 2004 to 2012 AND May to October 2019	NO3-N, TP, TSS, VSS
SDA-3	40.63353	-89.03058	Evergreen Lake		NO3-N, TP, TSS, VSS
SDA-4	40.64938	-89.04137	Evergreen Lake		NO3-N, TP, TSS, VSS

* Stations considered as same location because of proximity, named RDO further in the report.

** Stations considered as same location because of proximity, named SDA further in the report.

City Wetland Monitoring Site

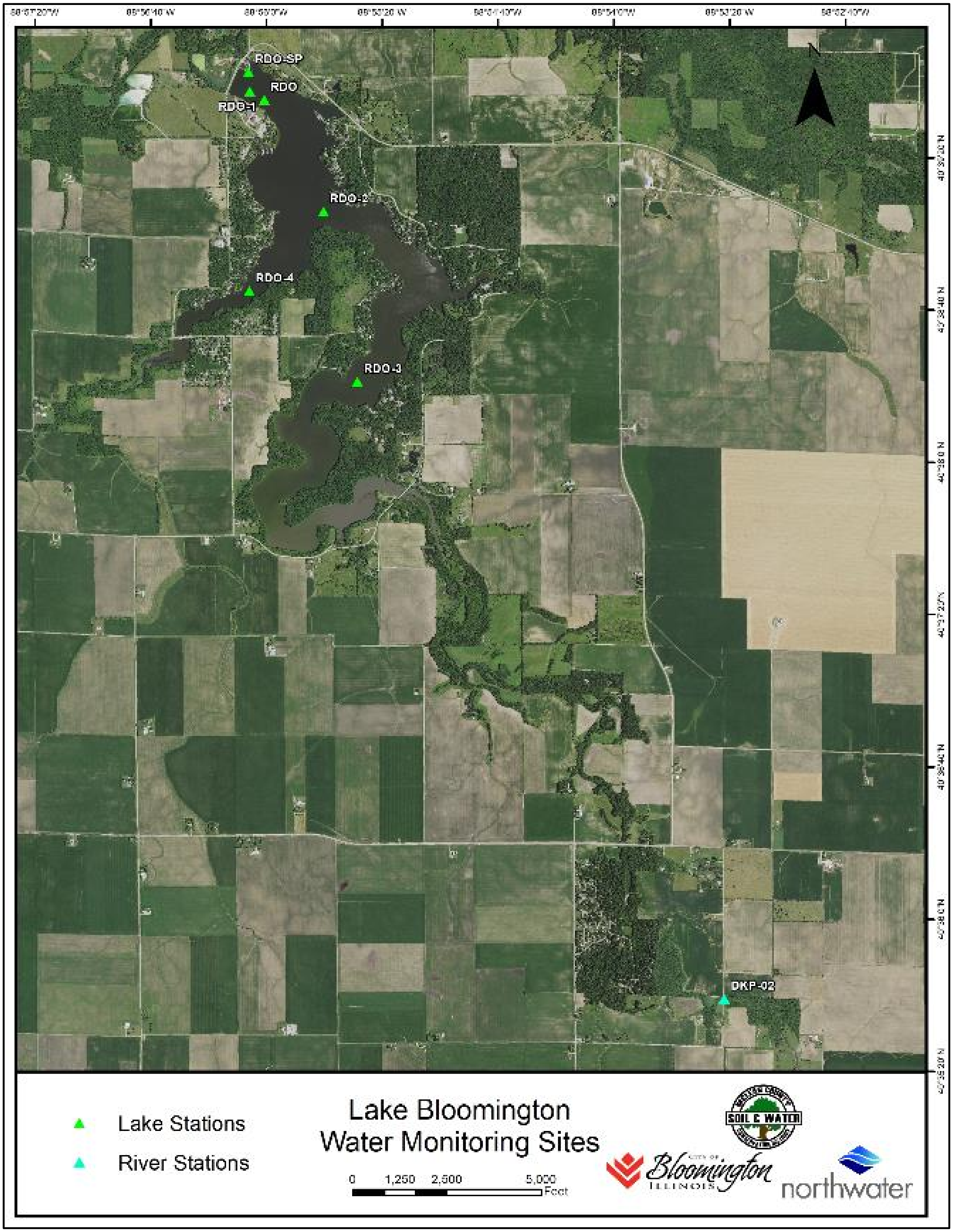


Figure 3 – Water Quality Sampling Stations – Lake Bloomington 2004–2019

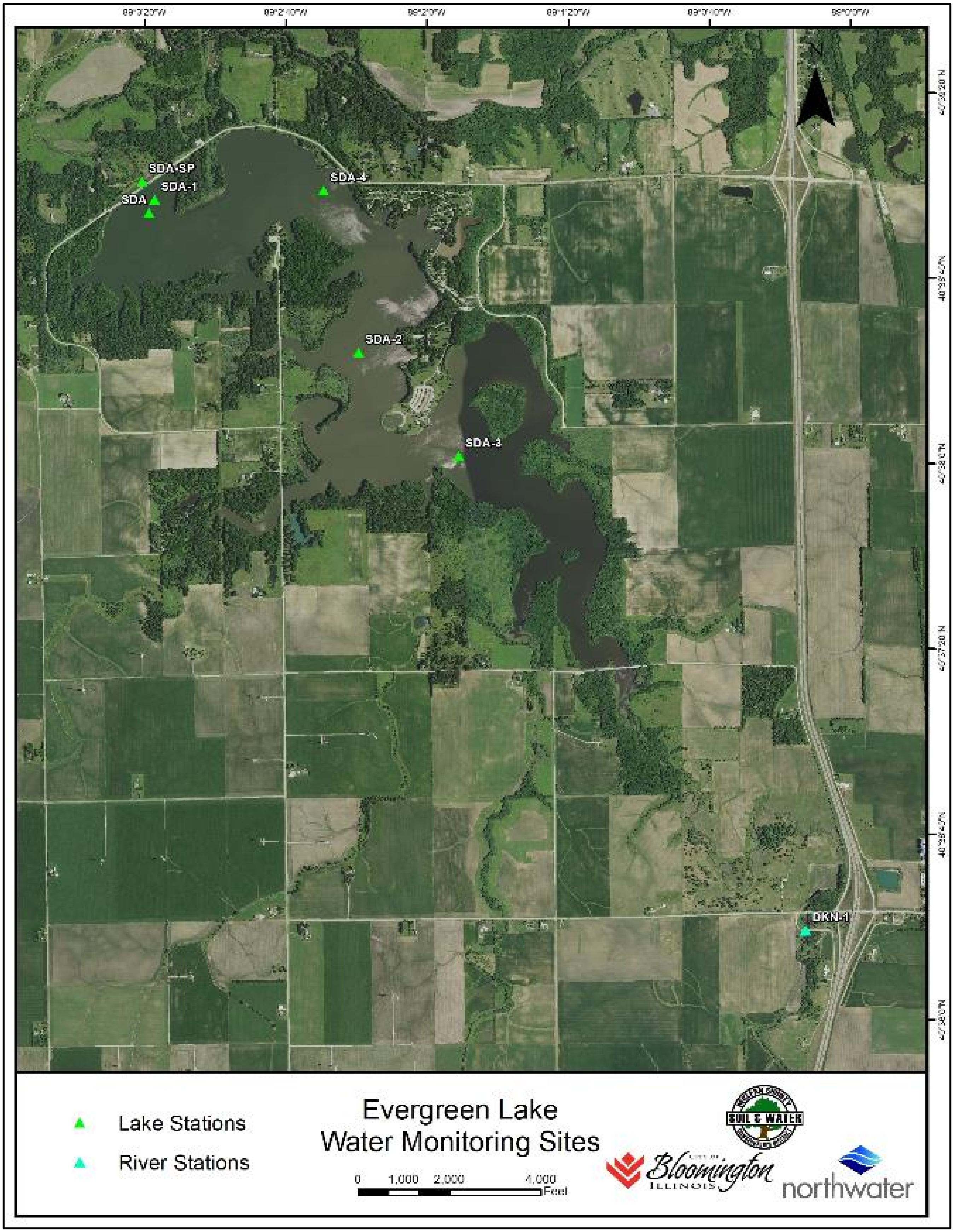


Figure 4 – Water Quality Sampling Stations – Evergreen Lake 2009–2019

3.3.1 Total Phosphorus

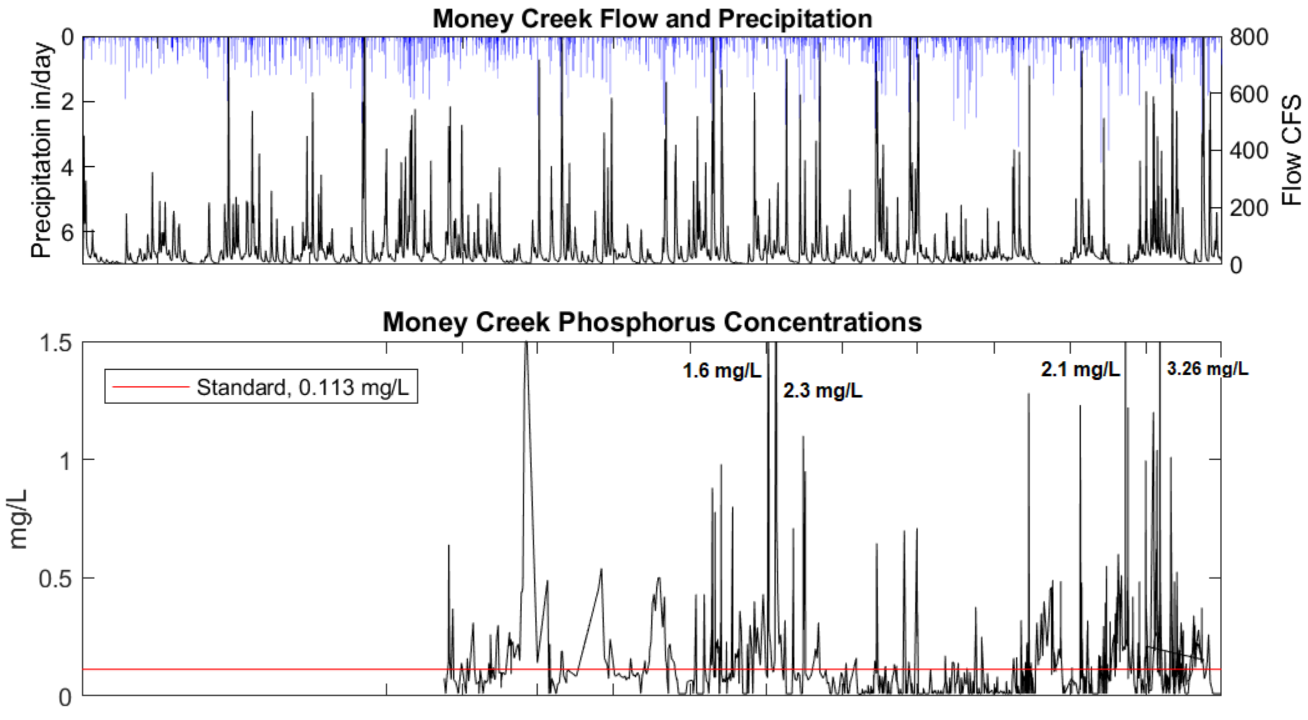
Streams

Money and Sixmile Creek have regularly exceeded the INSAC guideline 0.113 mg/L for TP. Based on analysis of the data from 2009-2019, 35% and 50% of samples exceeded the guideline, respectively (Table 6). Figure 5 plots TP in Money Creek and Sixmile Creek alongside precipitation and Money Creek flow for reference. Total Phosphorus concentrations from 2015 to the end of 2019 seem to reflect the timing of agricultural activities and seasonal changes, with higher concentrations from the spring to fall. Also, periods with higher TP seem to be related to low flows; this is particularly visible during the years 2014, 2017, 2018, and 2019. Total Phosphorus was higher from 2009-2015 and 2017-2019. This two-year gap seems to be related to a period of drought and low flow. The particularly high concentrations measured in 2018 and 2019 indicate an increasing trend.

Table 6 – Summary Statistics TP Concentrations in Streams 2009 - 2019

Station Code	Waterbody	Drainage Area (acres)	Count	Mean (mg/L)	Median (mg/L)	95%* percentile (mg/L)	Max (mg/L)	Exceeded INSAC Recommendation	
								Count	Percent
DKP-02	Money Creek	26,880	1,274	0.20	0.12	0.65	3.3	632	50%
DKN-1	Sixmile Creek	11,520	1,318	0.16	0.08	0.53	5.0	459	35%

**95% of the concentrations are lower*



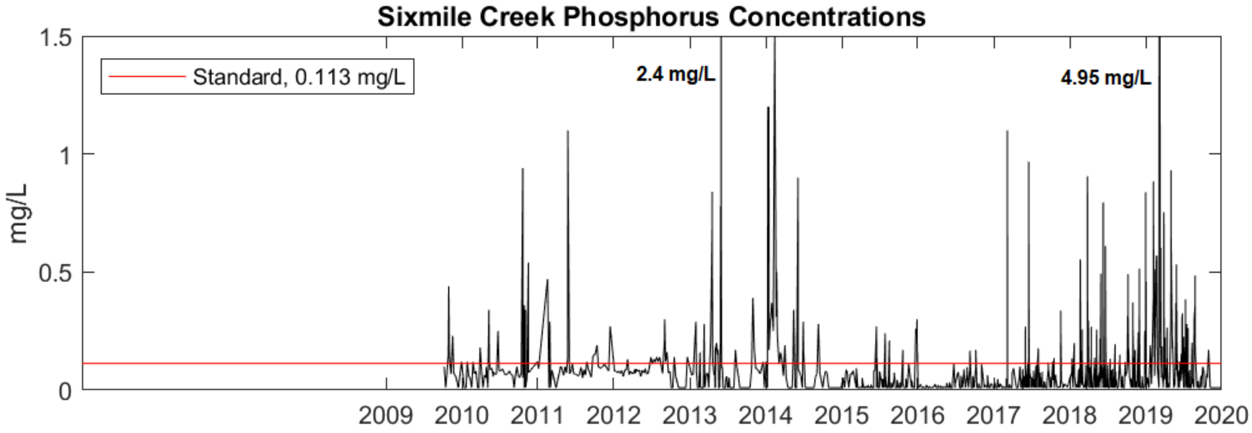


Figure 5 – Flow, Precipitation & Total Phosphorus Concentrations in Money Creek & Sixmile Creek

Lakes

Total Phosphorus concentrations in LB and EL routinely exceed the water quality standard of 0.05 mg/L (Table 7 and Figure 6). Average concentrations were higher prior to 2016 in both lakes. Concentrations were lower in 2016 and 2017, similar to the streams and likely due to lower precipitation and drought conditions during that period. Concentrations increased again in 2018 and 2019 in both lakes (Figure 6).

Table 7 illustrates statistics from over 1,000 measurements collected at each lake between 2004 and 2019. It is important to note that many lab results had reporting limits higher than the 0.05 mg/L standard. These samples were assumed to have a value below the standard for this analysis. Based on the 95th percentile, LB has higher TP concentrations with a range between 0.18 and 0.45 mg/L, and EL values are between 0.1 and 0.16 mg/L. All locations have median values equal or above the standard. These consistently high concentrations demonstrate the challenges associated with meeting the low 0.05 mg/L threshold despite progress made in the watershed and lakes to reduce phosphorus loads.

Table 7 – Summary Statistics of TP Concentrations in Lakes - 2004 – 2019

Waterbody	Station Code	Date Range	Count	Number Exceeded	Percent Exceeded	Mean (mg/L)	Median (mg/L)	95th Percentile	Max (mg/L)
Lake Bloomington	RDO*	2005 - 2019	817	581	71%	0.12	0.08	0.45	2.00
	RDO-2	2005 - 2019	231	184	80%	0.17	0.09	0.44	5.20
	RDO-3	2005 - 2019	145	121	83%	0.15	0.09	0.21	3.90
	RDO-4	2005 - 2019	107	89	83%	0.16	0.07	0.18	4.00
Evergreen Lake	SDA**	2005 - 2019	826	437	53%	0.07	0.05	0.16	2.70
	SDA-2	2005 - 2019	127	77	61%	0.08	0.06	0.10	4.00
	SDA-3	2005 - 2019	134	94	70%	0.07	0.08	0.14	0.19
	SDA-4	2005 - 2019	257	129	50%	0.06	0.05	0.13	0.77

**Combination of the data from the station RDO, RDO-1 and the spillway location*
*** Combination of data from the station SDA, SDA-1 and the spillway location*

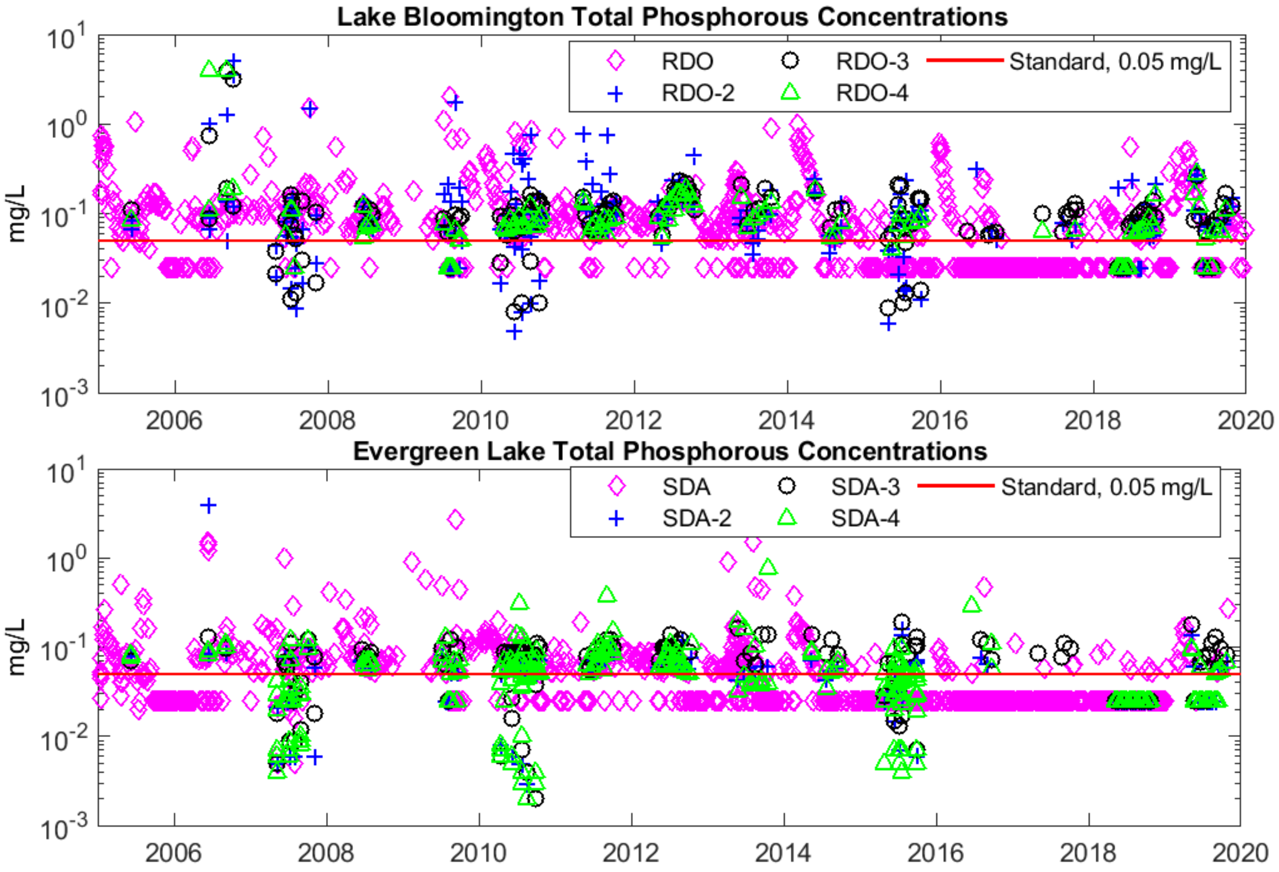


Figure 6 –Total Phosphorus Concentrations in Lake Bloomington & Evergreen Lake

3.3.2 Nitrogen

Streams

Nitrate is the primary nitrogen species for which data is available, with over 1,000 samples from each tributary. The nitrate concentrations were compared against the 10 mg/L drinking water standard and the 3.98 mg/L INSAC TN criteria in Table 8. These data bring insights into the nitrogen loading dynamics in the watershed, and the high concentrations demonstrate the need for further watershed management to improve the health and function of the lakes and manage water treatment costs.

Most *nitrite* data available for the streams falls below lab detection limits, and there is limited data for TKN and ammonia. The analysis assumes that nitrate is the primary component of TN when screening against the INSAC criteria. Most nitrogen data were reported as 'nitrate as N'.

Money and Sixmile Creek exceed the INSAC guideline of 3.98 mg/L most of the time; 74% and 71% of samples exceeded the guideline, respectively. The two creeks also exceeded the drinking water standards for 43% and 19% of samples, respectively. Figure 7 plots NO3-N in Money and Sixmile Creeks alongside precipitation and Money Creek flow for reference. The year of 2013 was exceptional for both streams with an extended period of concentrations above 10 mg/L. This was a statistically high year of flow and precipitation preceded by a year of lower rainfall. High concentrations correlate with larger runoff events and during the spring period when agricultural practices are commencing. Low concentrations occur during lower flows typically from late summer through winter.

During low-flow periods, especially in the summer, dissolved oxygen typically decreases which may favor denitrification processes. From 2014 through 2017, NO3-N was elevated for an extended period more so than other years. This correlates with higher flows for those years, which indicates that more runoff was conveying more NO3-N at the same time. Denitrification processes were likely not as prevalent due to the higher flows.

These data bring insights into the nitrogen loading dynamics in the watershed, and the high concentrations demonstrate the need for further watershed management.

Table 8 – Summary Statistics NO3-N Concentrations in Streams - 2009 - 2019

Station Code	Waterbody	Drainage Area (acres)	Count	Mean (mg/L)	Median (mg/L)	95th percentile (mg/L)	Max (mg/L)	Exceed INSAC		Exceed WQ std.	
								#	%	#	%
DKP-02	Money Creek	26,880	1,174	8.1	9.2	15	22	866	74%	505	43%
DKN-1	Sixmile Creek	11,520	1,346	6.5	6.8	13	23	958	71%	257	19%

The INSAC guideline is for total nitrogen. This table is based on nitrate concentrations and should be considered conservative in that regard as nitrite, TKN and ammonia are not accounted for.

Lake Bloomington

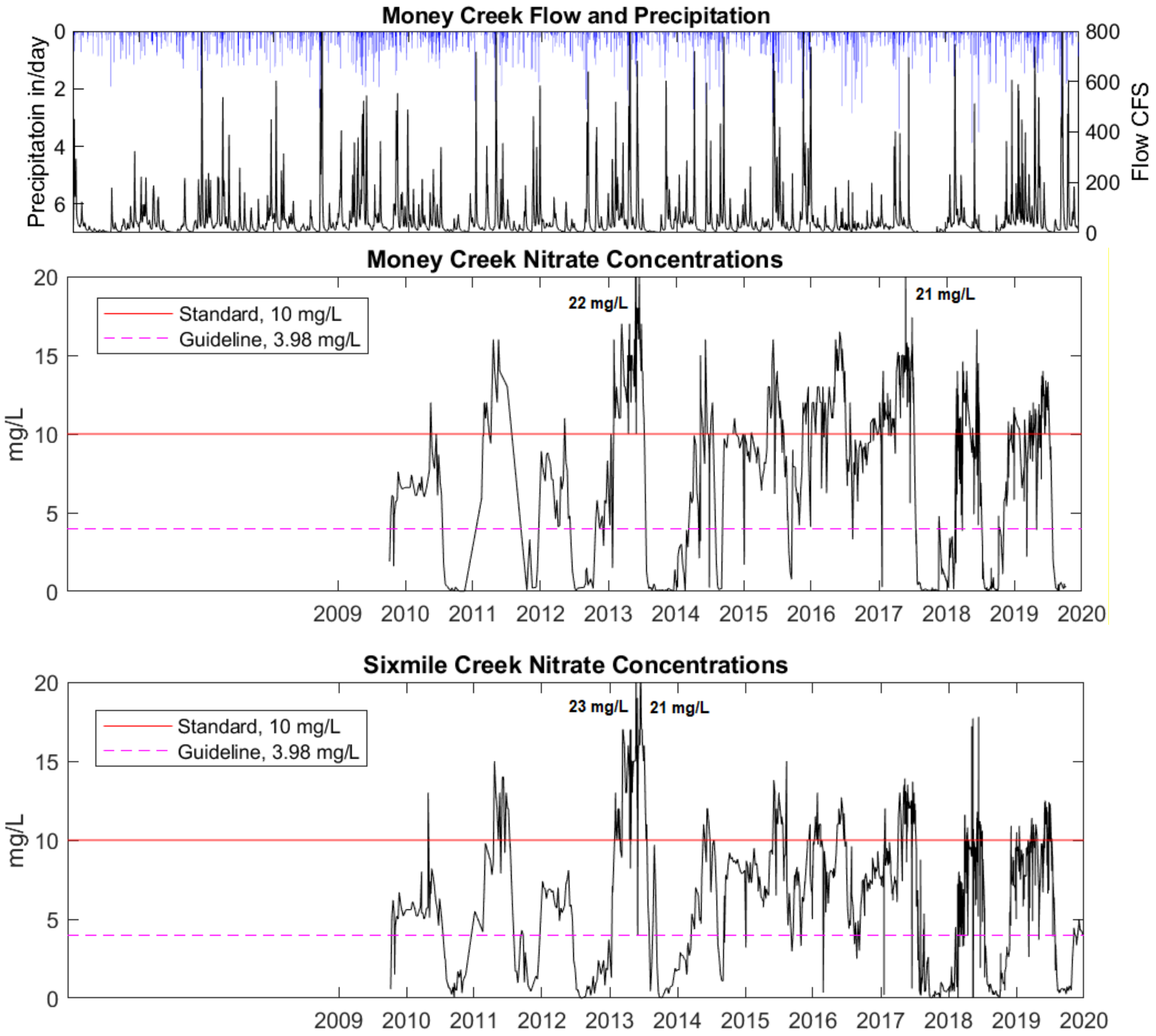


Figure 7 – Flow, Precipitation & Nitrate Concentrations in Money Creek & Sixmile Creek

Lakes

Table 9 and Figure 8 present statistics based on over 1,000 samples from each lake. Concentrations in the lakes do not exceed the 10 mg/L standard often; 7.6% of samples in LB and less than 1% in EL. There is a direct correlation between the values measured at the Money and Sixmile Creeks and their respective lakes. At LB, concentrations typically exceed the drinking water standard for a short period in the spring. Evergreen Lake only once had exceedances of the standard at station SDA-3 (2013) but does experience a seasonal spike. When Money Creek concentrations are on the order of 15 mg/L, values measured in LB are close to or exceed 10 mg/L. In 2009 and 2012, Money Creek had much lower concentrations, and LB had values much lower than the standard, with a maximum of 5 mg/L. Tributary nitrogen concentrations appear to have a strong effect on measured values in the lakes. When concentrations fall below 10 mg/L in the streams, so do the lakes where exceedances in the drinking water standard are muted. The predictable seasonal increases in nitrate should focus on addressing nutrient export during the spring and early summer. Evergreen Lake appears to have better buffering and perhaps more efficient denitrification than LB as there is a greater differentiation between tributary and lake concentrations.

Table 9 – Summary Statistics of NO3-N Concentrations in Lakes - 2005 - 2019

Waterbody	Station Code	Date Range	Count	Number Exceeded	% Exceeded	Mean (mg/L)	Median (mg/L)	95th percentile (mg/L)	Min (mg/L)	Max (mg/L)
Lake Bloomington	RDO*	2005-2019	910	69	7.6%	4.4	3.9	11	0.01	14
	RDO-2	2005-2019	293	11	3.8%	4.1	3.5	10	0.02	13
	RDO-3	2005-2019	156	13	8.3%	4.4	3.8	11.7	0.02	16
	RDO-4	2005-2019	123	9	7.3%	4.5	4.1	11	0.03	13
Evergreen Lake	SDA**	2005-2019	971	0	0%	2.4	1.8	6.6	0.02	9.4
	SDA-2	2005-2019	156	0	0%	2.5	2.0	6.2	0.02	8.4
	SDA-3	2005-2019	126	2	1.6%	2.7	2.1	7.9	0.02	10.2
	SDA-4	2005-2019	254	0	0%	2.2	1.6	5.9	0.02	8.9

For data reported as nitrate + nitrite, it was assumed that nitrite was negligible. This allowed for a more complete temporal plot to be developed.

**Combination of the data from RDO, RDO Spillway and RDO-1*

*** Combination of the data from SDA, SDA Spillway and SDA-1*

Stream Restoration Site – Evergreen Lake Watershed

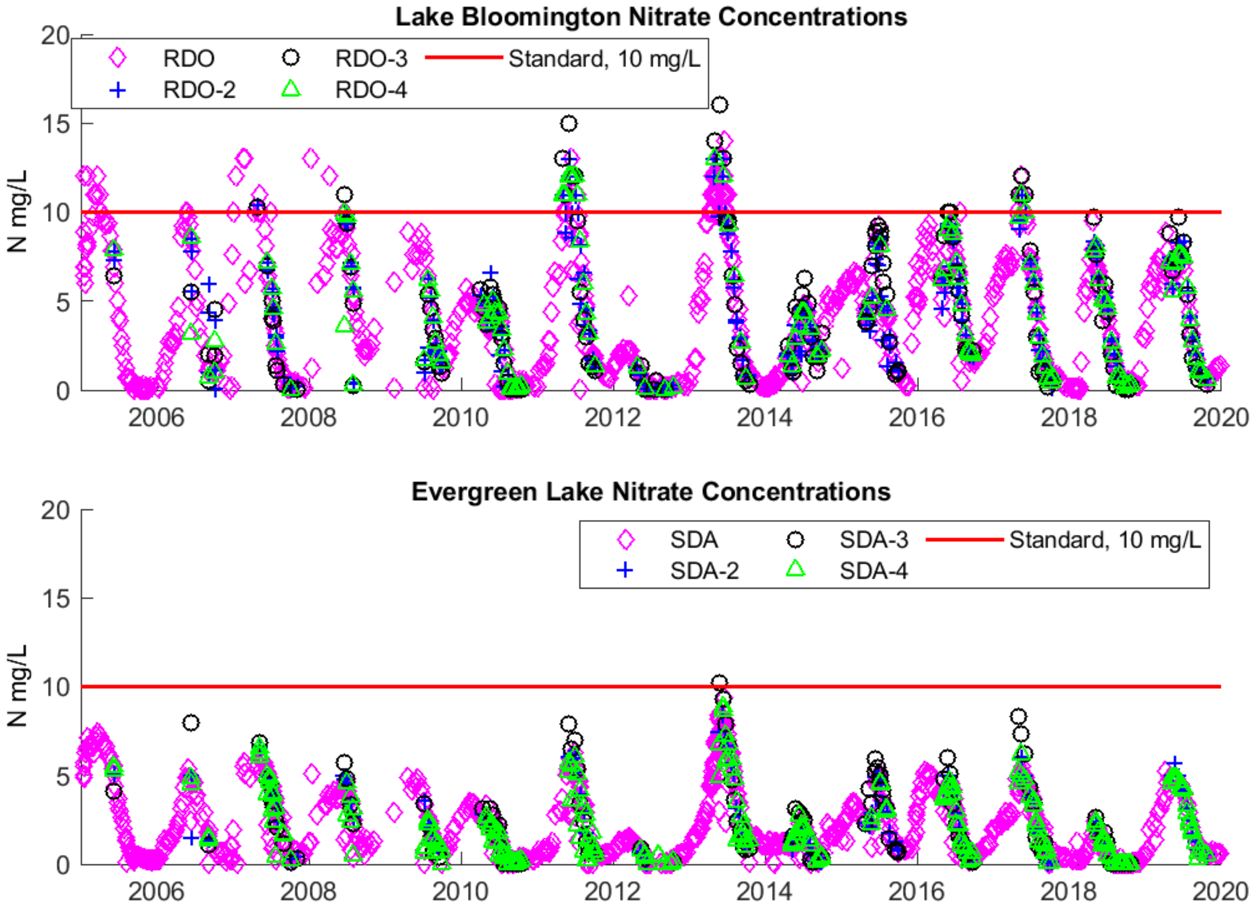


Figure 8 – Nitrate Concentrations in Lake Bloomington & Evergreen Lake

3.3.3 Total Suspended Solids

Streams

Money and Sixmile Creeks exceed the 116 mg/L guideline only during large storm events (Table 10 and Figure 9). There is a wide range of TSS concentrations directly correlated to flow - between 0.6 and 325 mg/L. Results indicate that large portions of the total sediment load occur from a few storm events each year. Sixmile Creek exceeds the TSS guideline more frequently than Money Creek.

Table 10 – Summary Statistics of TSS in Streams 2009 – 2019

Station Code	Waterbody	Drainage Area (acres)	Count	Mean (mg/L)	Median (mg/L)	Min (mg/L)	95% Percentile	Max (mg/L)	Exceeded IEPA Guideline	
									Count	Percent
DKP-02	Money Creek	26,880	665	27	17	<4	82	310	16	2%
DKN-1	Sixmile Creek	11,520	666	26	11	0.63	100	325	27	4%

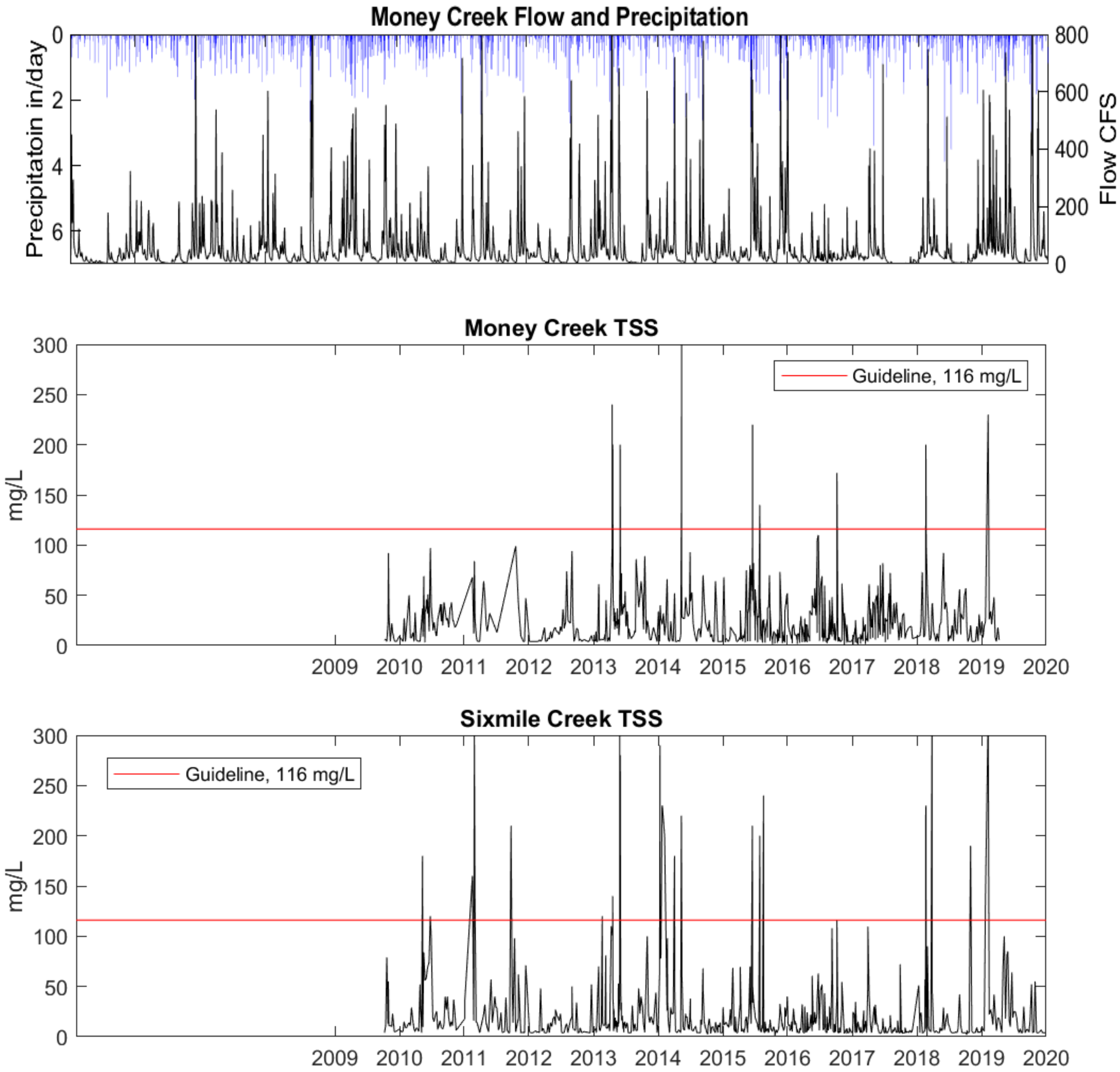


Figure 9 – Flow, Precipitation & TSS Concentrations Money Creek & Sixmile Creek

Lakes

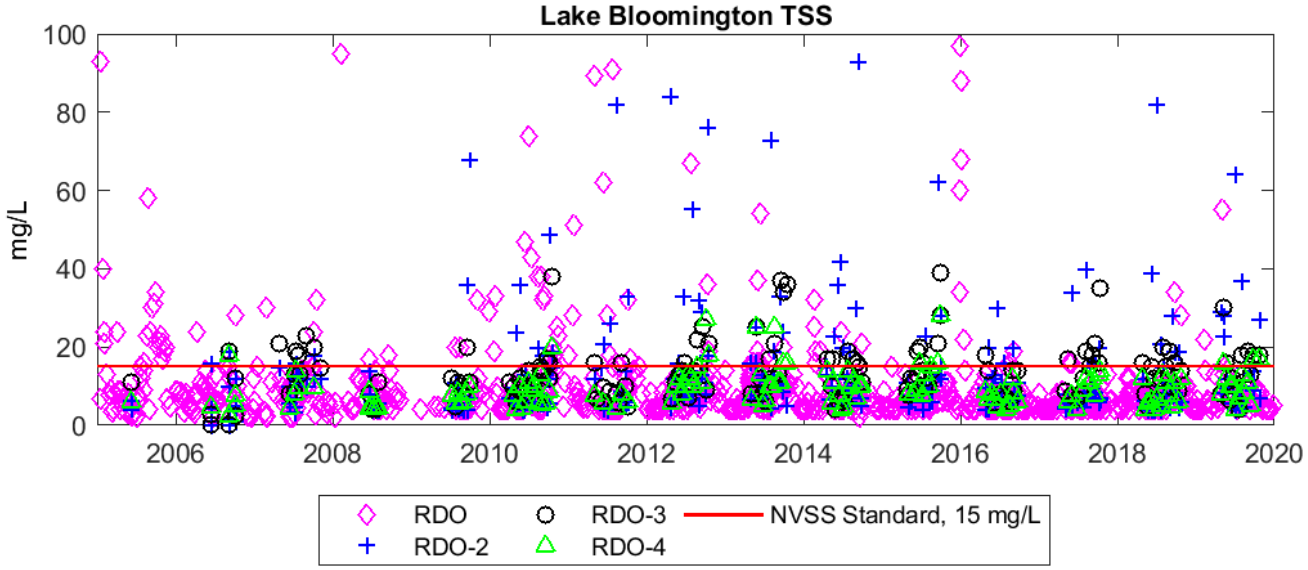
There are no lake guidelines or standards regarding TSS, so the AQI NVSS limit is applied for reference purposes in Table 11 and Figure 10 . Analysis of over 1,000 samples from 2005 - 2019 indicates TSS only exceeds the limit during storm events. The lowest TSS concentrations are typically found at lake spillway monitoring locations. Overall LB exceeds TSS limits more frequently than EL. There appears to be a long-term trend of decreasing TSS concentrations in both lakes, more so in LB (Figure 10).

Table 11 – Summary Statistics of TSS Concentrations in Lakes

Waterbody	Station Code	Date Range	Total Samples	Mean (mg/L)	Median (mg/L)	95th Percentile (mg/L)	Max (mg/L)	Min (mg/L)	Samples Exceeding AQI Limit	
									Count	Percent
Lake Bloomington	RDO*	2005-2019	698	8.9	6.4	22	97	<2	68	10%
	RDO-2	2004-2019	171	14.3	9.6	49.5	93	0.058	42	25%
	RDO-3	2004-2019	106	13.5	12	27.3	39	<0.05	39	37%
	RDO-4	2004-2019	85	10.1	9.2	19.6	28	2.4	14	16%
Evergreen Lake	SDA**	2005-2019	664	5.7	4	10	87	1.1	16	2%
	SDA-2	2004-2019	87	8.8	7.2	17.4	36	3.2	7	8%
	SDA-3	2004-2019	94	14.8	12	29.4	43	<4	38	40%
	SDA-4	2004-2019	157	10.6	8	26.4	94	<2	25	16%

**Combination of the data from RDO, RDO Spillway and RDO-1*

*** Combination of the data from SDA, SDA Spillway and SDA-1*



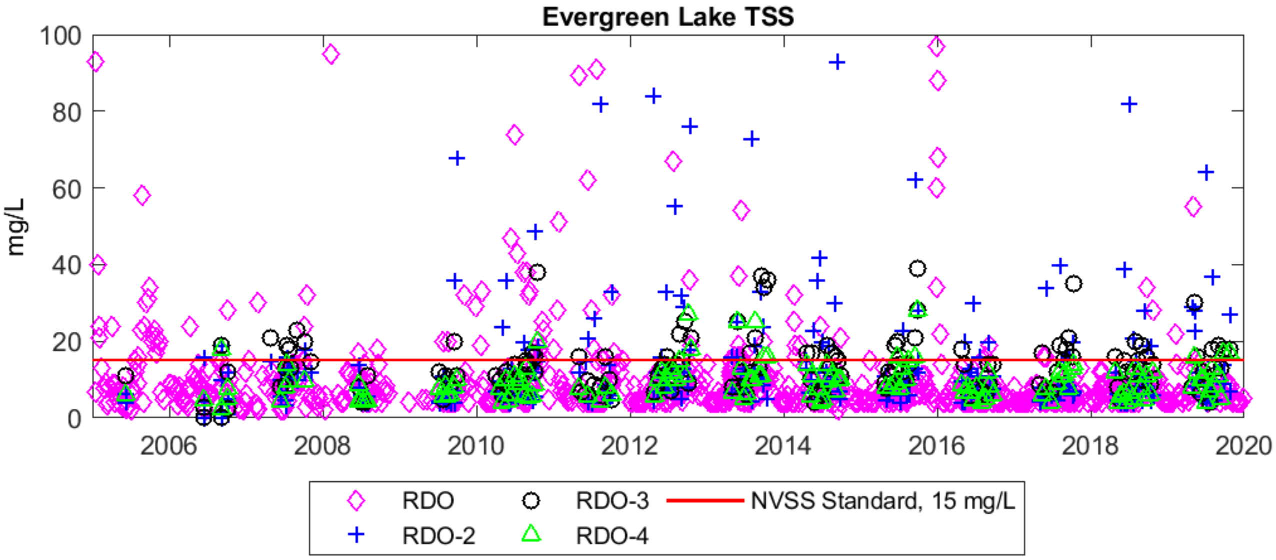


Figure 10 – TSS Concentrations in Lake Bloomington & Evergreen Lake

3.3.4 Volatile Suspended Solids

Volatile suspended solids data are presented in Table 12 and Figure 11. Spillway monitoring sites at both lakes show similar results or a median concentration of 4 mg/L. Lake Bloomington has slightly higher VSS statistically than EL, with values decreasing towards the spillways. The VSS values tend to spike in correlation with TSS and precipitation events. The non-volatile proportion of TSS is the more dominant component of TSS affecting both lakes.

Table 12 – Summary Statistics of VSS Concentrations in Lakes

Waterbody	Station Code	Date Range	Total Samples	Mean (mg/L)	Median (mg/L)	95th Percentile (mg/L)	Max (mg/L)	Min (mg/L)
Lake Bloomington	RDO*	2005-2019	820	5.0	4	8.8	37	<2
	RDO-2	2005-2019	243	7.8	5.9	21	70	0.089
	RDO-3	2005-2019	144	7.6	7	14.3	28	<1.9
	RDO-4	2005-2019	121	6.0	5.2	11	14	<0.05
Lake Evergreen	SDA**	2005-2019	772	4.4	4	7.6	83	1.1
	SDA-2	2005-2019	112	6.2	5.2	10	35	1
	SDA-3	2005-2019	151	7.0	6	13	30	1.5
	SDA-4	2005-2019	213	6.4	5.2	12	33	<2

**Combination of the data from RDO, RDO Spillway and RDO-1*

*** Combination of the data from SDA, SDA Spillway and SDA-1*

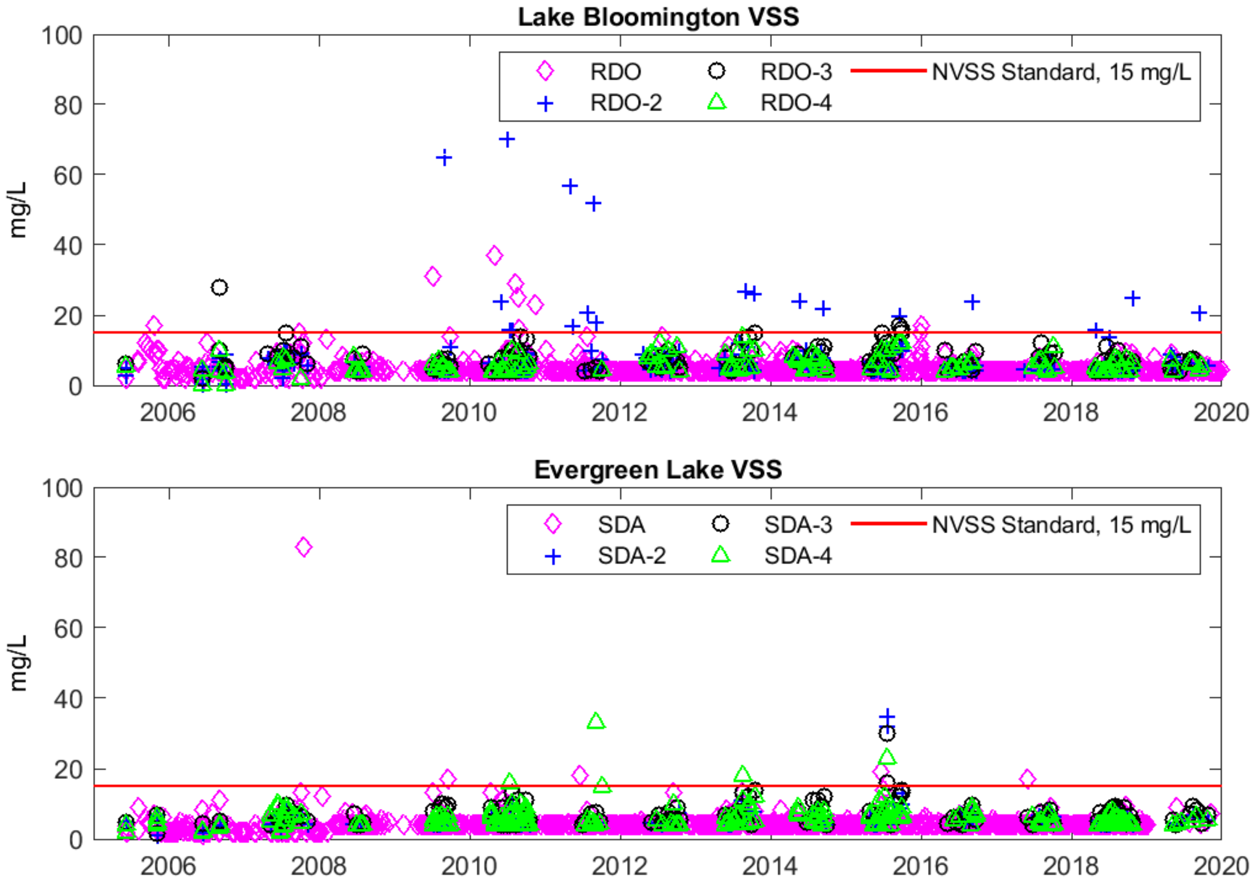


Figure 11 – VSS Concentrations in Lake Bloomington & Evergreen Lake

3.4 Nutrient & Sediment Yields

Concentration data combined with flow are used to generate annual estimates of nitrogen, phosphorus and sediment yields.

3.4.1 Water Yield

Mean annual water yield was estimated for the Sixmile and Money Creek stations based on available datasets. The results of three methods are presented in Table 13. Mean water yield estimates range from 15 to 24 cubic feet per second (cfs) for Sixmile Creek and 34 to 53 cfs for Money Creek.

1. The first method used Money Creek flow data to calibrate a rain-flow model (GR4J) and produce a continuous daily flow dataset and flow duration curve (Figure 12). The GR4J model is a catchment water balance model that relates runoff to rainfall and evapotranspiration using daily data. The hydrograph and duration curve for Sixmile Creek was generated from Money Creek results by applying a watershed area ratio method. This was done because stage data from Sixmile Creek was inconsistent and could not be correlated with a single stage-discharge relationship.

2. The second method applied a flow duration curve of historical flow from Money Creek using a period of 1958 to 1983. The watershed area ratio method was then applied to Sixmile Creek.
3. The third method applied a 0.36 runoff ratio to a mean annual precipitation value of 39 inches/year based on results from a nearby study of the Iroquois watershed.

Table 13 – Mean Average Water Yields - Money Creek & Sixmile Creek

Stream	Method 1* (cfs)	Method 2** (cfs)	Method 3 ***(cfs)
Sixmile	24	15	19
Money	53	34	44

Modeled data from 2000 to 2019

***USGS data from 1958 to 1983*

**** Runoff ratio of 0.36*

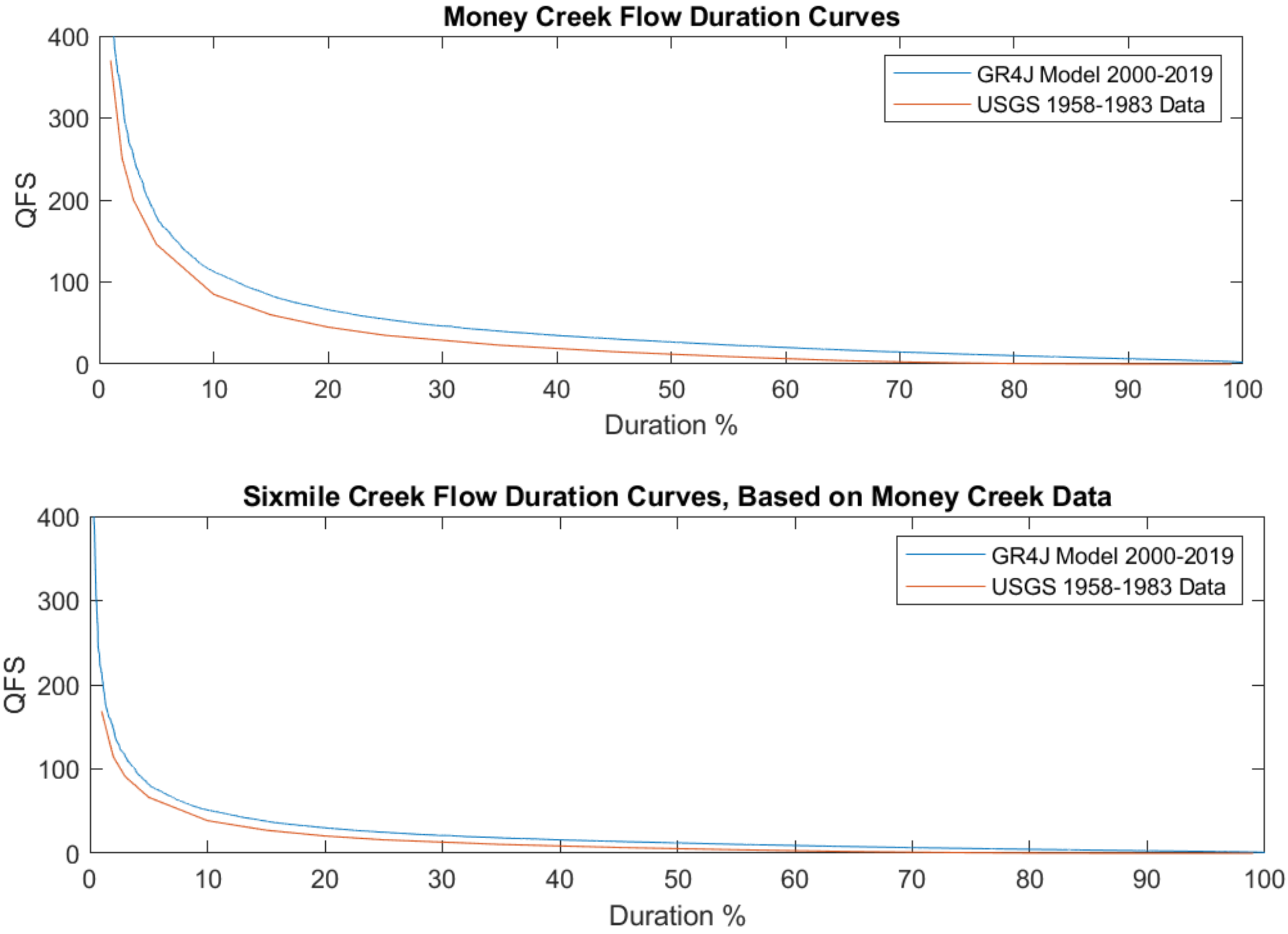


Figure 12 - Flow Duration Curves for Money Creek & Sixmile Creek

3.4.2 Nitrate Yields

Mean annual nitrate yields were estimated using the load duration method (Table 14 and Figure 13) and a basic mean concentration method applying water yields presented in the previous section (Table 15). Results generated from this method are higher primarily because a greater water yield was applied. Analysis of the various methods to estimate nitrate yields indicate a range of 16.3 to 34.6 lbs/ac/yr for Sixmile Creek and 20.3 to 39 lbs/ac/yr for Money.

Table 14 – Estimated Nitrate Yields Based on Load Duration Method

Watershed	Estimated Mean Annual NO3 Yield	
	lbs/year	lbs/ac/yr
Sixmile Creek	398,292	34.6
Evergreen Lake	-	34.6
Money Creek	1,049,268	39
Lake Bloomington	-	39

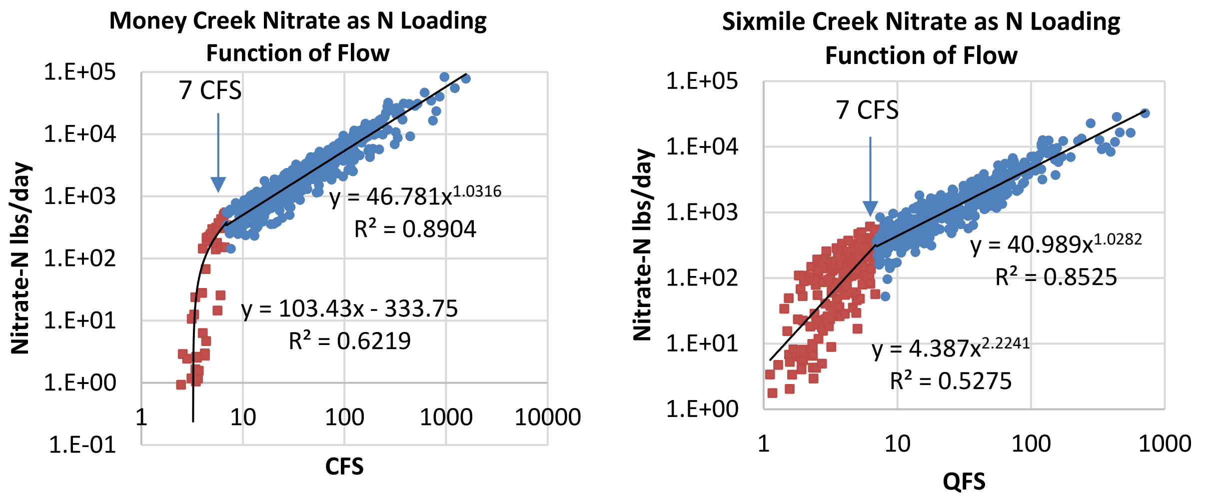


Figure 13 - Relationship between Nitrate Loading & Flow

Table 15 - Nitrate Yield Estimates based on Mean Concentration Methods

Watershed	Mean NO3 Concentration mg/L	Estimated Mean Annual NO3 Yield					
		Water Yield Method 1		Water Yield Method 2		Water Yield Method 3	
		lbs/year	lbs/ac/yr	lbs/year	lbs/ac/yr	lbs/year	lbs/ac/yr
Sixmile Creek	6.5	307,946	26.7	187,338	16.3	240,503	20.9
Evergreen Lake		-	26.7	-	16.3	--	20.9
Money Creek	8.1	842,742	31.4	544,722	20.3	699,309	26
Lake Bloomington		-	31.4	-	20.3		26

3.4.3 Phosphorus Yields

Mean annual phosphorus yields were estimated using the same methods as nitrate (Table 16, Figure 14 and Table 17). Sixmile Creek ranges from 0.4 to 0.7 lbs/ac/yr and Money Creek from 0.5 to 0.8.

Table 16 – Estimated Phosphorus Yields based on Load Duration Method

Watershed	Estimated Mean Annual Phosphorus Yield	
	lbs/year	lbs/ac/yr
Sixmile Creek	5,620	0.49
Evergreen Lake	-	-
Money Creek	13,879	0.52
Lake Bloomington	-	-

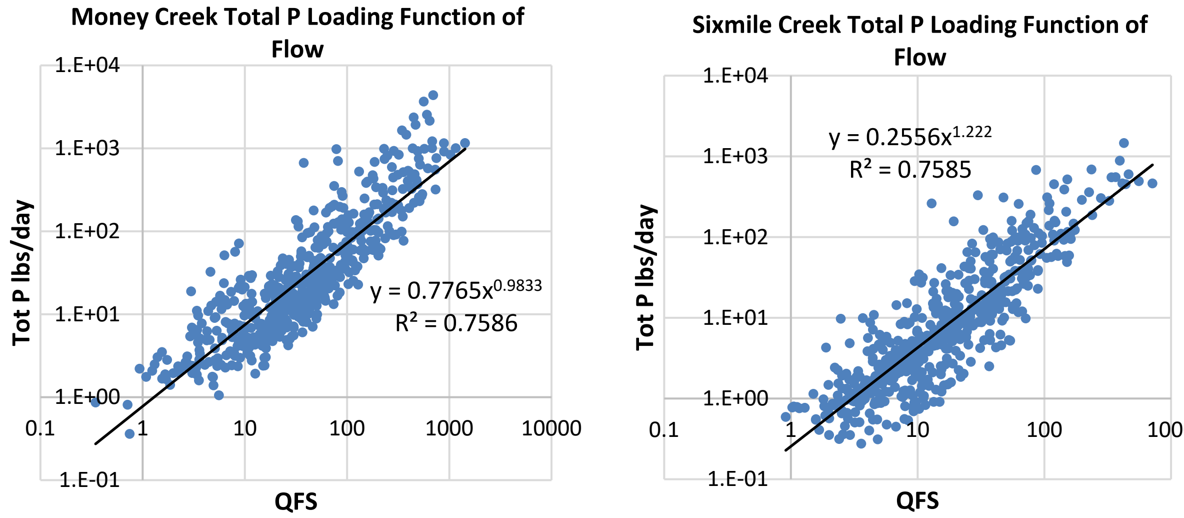


Figure 14 - Relationship between Phosphorus Loading & Flow

Table 17 - Phosphorus Yield Estimates based on Mean Concentration Methods

Watershed	Mean Concentration (mg/L)	Estimated Mean Annual Phosphorus Yield					
		Water Yield Method 1		**Water Yield Method 2**		**Water Yield Method 3**	
		lbs/year	lbs/ac/yr	lbs/year	lbs/ac/yr	lbs/year	lbs/ac/yr
Sixmile Creek	0.16	7,580	0.7	4,611	0.4	5,920	0.5
Evergreen Lake		-	0.7	-	0.4	-	0.5
Money Creek	0.2	20,808	0.8	13,450	0.5	17,267	0.6
Lake Bloomington		-	0.8	-	0.5	-	0.6

3.4.4 Sediment Yield

Total suspended sediment yield estimates also utilized the same methods used for nutrients and are similar for both watersheds. Yields range from 65 to 107 lbs/ac/yr for Sixmile Creek and 68 to 105 for Money Creek (Table 18, Table 19 and Figure 15). This data, however, is not representative of the true sediment load. This is because sediment is largely flow dependent and insufficient data is collected across higher or extreme flow events. Collection methods did not apply depth integrated sampling, resulting in an underestimation of concentrations during storm events. Further, Suspended Sediment Concentration (SSC) analysis should be performed as it is a more appropriate measure than TSS for calculating yield and bedload measurements should be made to account for the larger soil particles not entrained in the water column where TSS measurements are typically taken. Enhancements to sediment monitoring methods are necessary to develop more accurate estimates of yield.

Table 18 - TSS Yield Estimate based on Load Duration Method

Watershed	TSS Yield (modeled flow)	
	lbs/year	lbs/ac/yr
Sixmile Creek	1,114,453	96.7
Evergreen Lake	-	-
Money Creek	2,696,348	100.3
Lake Bloomington	-	-

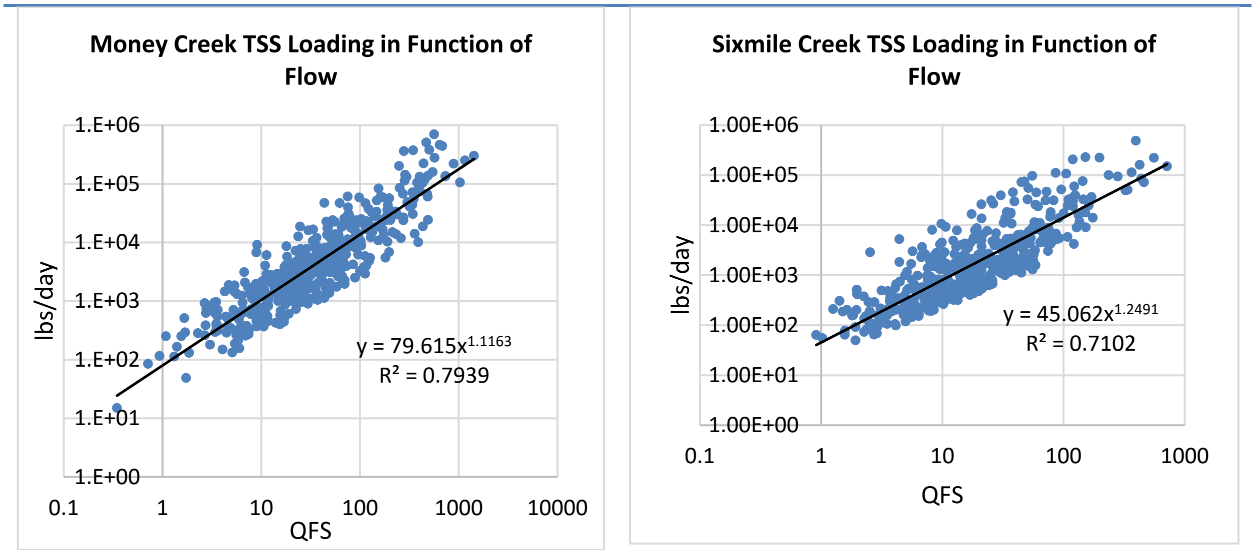


Figure 15 - Relationship Between TSS Loading & Flow

Table 19 - TSS Loading Estimates based on Mean Concentration Methods

Watershed	Mean concentration (mg/L)	Estimated Mean Annual TSS Yield					
		Water Yield Method 1		Water Yield Method 2		Water Yield Method 3	
		lbs/year	lbs/ac/yr	lbs/year	lbs/ac/yr	lbs/year	lbs/ac/yr
Sixmile Creek	26	1,231,785	106.9	749,353	65.0	962,012	83.5
Evergreen Lake		-	-	-	-	-	-
Money Creek	27.2	2,829,947	105.3	1,829,190	68.1	2,348,296	87.4
Lake Bloomington		-	-	-	-	-	-

3.5 Aquatic Resources

Water quality can be evaluated using biological indicators such as fish and bugs or macroinvertebrates. In Illinois, aquatic life use assessments in streams are typically based on the interpretation of biological information, physicochemical water data, and physical-habitat information from the Intensive Basin Survey, Ambient Water Quality Monitoring Network, or Facility-Related Stream Survey programs. The primary biological measures used are the fish Index of Biotic Integrity (fIBI), the macroinvertebrate Index of Biotic Integrity (mIBI) and the Macroinvertebrate Biotic Index (MBI) (IEPA BOW, 2012).

Available data from the Illinois EPA indicates that biological sampling was performed on Money Creek (DKP-02) and Sixmile Creek (DKN-02) in 2005 and 2010. Low IBI and mIBI scores indicate more impaired conditions; the inverse is true for MBI scores where a higher score indicates poorer conditions.

Table 20 and Table 21 present fIBI, mIBI, and MBI scores for those years where scores have been provided by the Illinois EPA. Most recent fish quality scores indicate fair (moderately impaired) conditions in both Money and Sixmile Creek. The trend from 2005 to 2010 shows a substantial improvement in Sixmile.

Table 20 –2005 & 2010 fIBI Scores

fIBI Score / Trend Rating	DKP-02 (Money Creek)	DKN-02 (Sixmile Creek)
2005	26	12
Rating	Fair/ Moderate Impairment	Severe/Poor Impairment
2010	27 ↑	21↑
Rating	Fair/ Moderate Impairment	Fair/ Moderate Impairment

↓= Worsening Trend →= No Changes ↑= Improving Trend

In terms of macroinvertebrate quality, results between 2005 and 2010 indicate good quality in Money Creek (DKP-02) and fair to good conditions in Sixmile (DKN-02). Overall, macroinvertebrate biological indicators show that conditions improved for Money Creek and worsened slightly in Sixmile.

Table 21 –2005 & 2010 MBI & mIBI scores

Station	2005		2010	
	MBI	mIBI Score	MBI	mIBI Score
DKP-02	6	82	5.4↑	91.8 ↑
Rating	Fair/ Moderate Impairment	Good / No Impairment	Good / No Impairment	Good / No Impairment
DKN-02	6	82	8.2↓	45.9 ↓
Rating	Fair/ Moderate Impairment	Good / No Impairment	Fair/ Moderate Impairment	Good / No Impairment

↓= Worsening Trend →= No Changes ↑= Improving Trend

Surveys of freshwater mussels have also been conducted in both lake watersheds including a recent 2017 study performed by the Illinois Natural History Survey and funded by TNC. Fourteen species of mussels have been recorded from the Money Creek watershed, and six species of mussels have been recorded from the Sixmile Creek watershed. Between 1987 and 2013, Money Creek was surveyed for freshwater mussels at three locations and included identification of the state threatened Slippershell (Alasmidonta viridis). Sixmile Creek was surveyed in 2005 and 2010 at Co. Rd. 2000N bridge and is the only previous survey location on the creek upstream of EL. Four species were recorded live and shells of two additional species were encountered during those surveys (Vinsel, R.M. and A.P. Stodola. 2017).

The 2017 Money Creek effort resulted in a total of 13 native species of freshwater mussels, one invasive bivalve species, and four families of freshwater gastropods. The most commonly encountered species, and the only species found in the tributaries, was the Cylindrical Papershell (Anodontoides ferussacinaus), with collections at six sites. The most abundant species across all sites was the Wabash Pigtoe (Fusconaia flava). The Illinois threatened Slippershell Mussel was the only species encountered that is listed at the state or federal level. Twenty-three individuals representing ten species of freshwater mussels were observed in the Sixmile Creek watershed. Five species were found alive, the remainder were represented only by shell material. The most commonly encountered mussel species were Giant Floater (Pyganodon grandis) and Pondhorn (Uniomerus tetralasmus) (Vinsel, R.M. and A.P. Stodola. 2017).

3.6 Watershed Jurisdictions & Demographics

Both the LB and EL watersheds are located almost entirely within McLean County; 98% or 68,367 acres. Only 2%, or 1,145 acres, lie within Woodford County. (Table 22, Figure 16). There are 4 incorporated municipalities: Bloomington, Normal, Hudson, and Towanda. While Bloomington is large, the watershed only occupies 280 acres of land within the City. The town of Normal is similar as only 2,307 acres of its near 12,000 total acres are within the watershed. Bloomington and part of Normal fall within the Blue Mound-Money Creek subwatershed. The remainder of Normal falls within the Evergreen Lake-Sixmile Creek subwatershed. The Village of Hudson and a very small portion of Towanda also fall within the EL watershed. Hudson occupies 564 acres and Towanda, 485 acres.

3.6.1 Watershed Jurisdictions & Jurisdictional Responsibilities

Figure 16 depicts most jurisdictional entities and jurisdictional areas. Both LB and EL are water supplies for the City of Bloomington and surrounding communities; the City is the primary entity responsible for the management and improvement of the lakes. Bloomington maintains leases on a total of 223 parcels, or 83 acres, adjacent to LB and owns 27 parcels, or 1,107 acres, in the Lake Bloomington-Money Creek subwatershed and 32 parcels, or 3,104 acres, in EL.

Drainage districts maintain responsibility within certain portions of the watershed. Drainage districts are local bodies formed for the purpose of draining, ditching, and improving land for agricultural and sanitary purposes. They are authorized to build and maintain drains and levees, to sue all necessary private land within their corporate bodies for that purpose, and to tax land within their boundaries, as necessary. Drainage districts exist within the watershed and cover 2,600 acres, primarily within the EL watershed – 1,859 acres or 72%.

The LB/EL watershed spans 12 different townships. Towanda occupies 17,012 acres and Hudson 18,545 acres. Table 22 lists townships by subwatershed.

Table 22 – Townships by Subwatershed

Subwatershed	HUC12 Code	Township Name	Area (acres)
Blue Mound-Money Creek	71300040201	Blue Mound	4,049
		Dawson	4,587
		Money Creek	3,550
		Old Town	288
		Towanda	16,033
		Bloomington City	280
		Normal	25
		Arrowsmith	1,586
Lake Bloomington-Money Creek	71300040202	Money Creek	5,200
		Towanda	6
		Hudson	7,324
		Normal	320
Evergreen Lake-Sixmile Creek	71300040502	Kansas	1,148
		Dry Grove	760
		Towanda	973
		White Oak	3,189
		Hudson	11,221
		Normal	8,973

No state of federal properties exist in the watershed. McLean County owns and operates Comlara Park located on EL. Three Nature Preserves are owned by the Parklands Foundation. In the LB watershed, this includes the 42 Moon Preserve within the inner loop of LB and the 38-acre Breen Champion Federal Preserve. The 50-acre McClure Preserve, acquired in 2008, is in the EL watershed and adjoins the northwestern border of Comlara Park. The Indian Creek Homeowners Association, located two miles north of Towanda, contains approximately 20 acres of common ground managed by residents as a private nature area with hiking trails (LBWPC, 2008).

A series of Homeowner associations also maintain limited jurisdictional responsibilities in the watershed, including the Lake Bloomington Homeowners Association. The Illinois EPA Bureau of Water regulates wastewater and stormwater discharges to streams, rivers, and lakes through the National Pollutant Discharge Elimination System (NPDES). Two NPDES permits exist within the EL watershed and one in LB (Section 3.17.1).

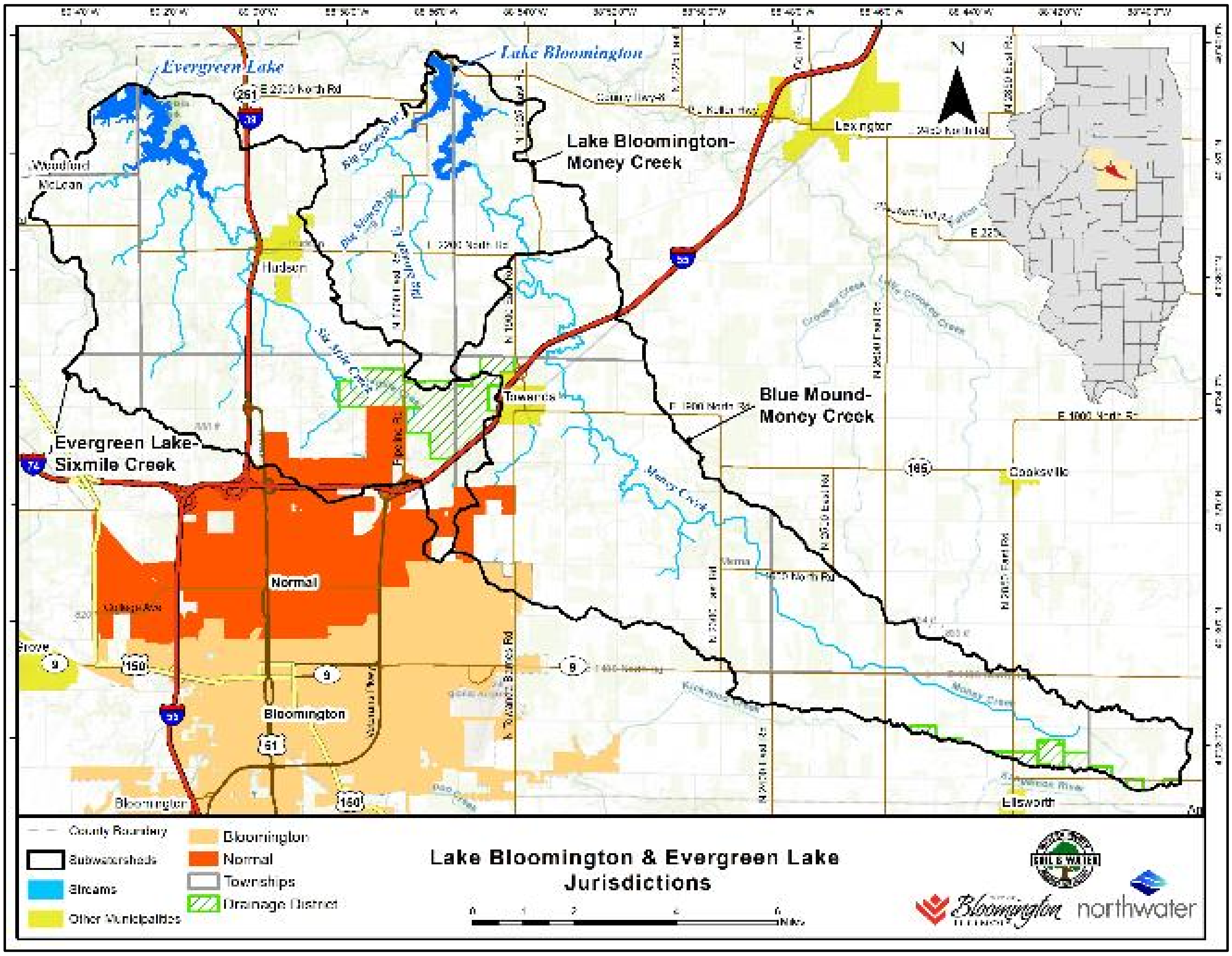


Figure 16 – Jurisdictional Boundaries

3.6.2 Demographics

According to the United States Census Bureau 2018 census, total population of the counties encompassing the watershed is 172,828 with 13% above the age of 65. Bloomington and Normal are the largest cities with populations of 77,955 and 54,808, respectively. Most of the urban population, however, is not within the watershed. The estimated population within the watershed is 15,733 based on the 2010 census. Table 23 illustrates the breakdown by subwatershed. Most of the watershed area is rural and lies north of the two cities (Figure 17).

Table 23 - Subwatershed Population & Housing Units

Subwatershed	HUC12 Code	2010 Population	Number of Housing Units
Blue Mound-Money Creek	71300040201	5,218	1,833
Lake Bloomington-Money Creek	71300040202	1,143	577
Evergreen Lake-Sixmile Creek	71300040502	9,372	3,484
Grand Total		**15,733**	**5,894**

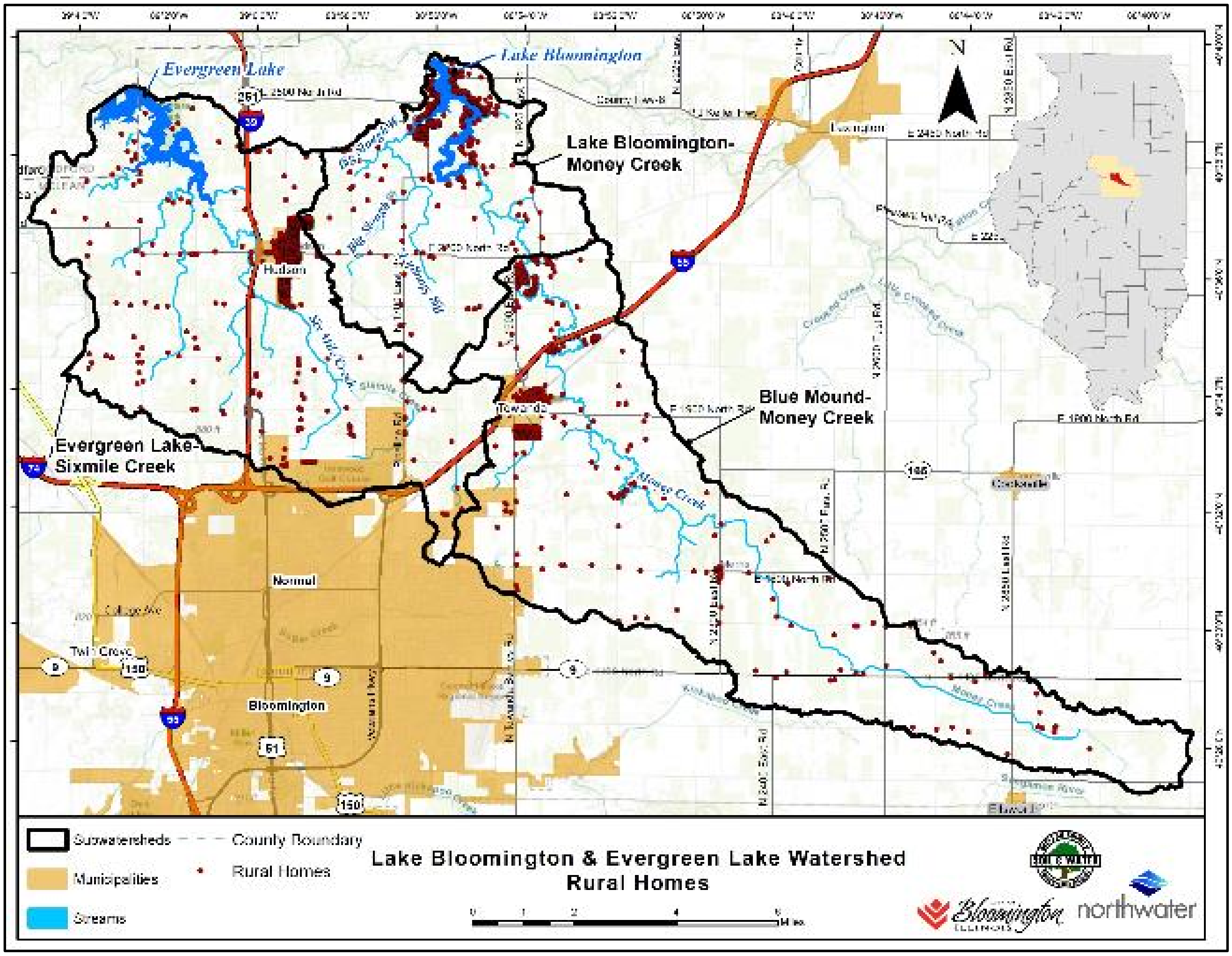


Figure 17 – Rural Homes

3.7 Geology, Hydrogeology, & Topography

This section includes information on surficial geology and hydrogeology, in addition to wells, surface elevation, and slope.

3.7.1 Geology

The LB and EL watershed is located along the west-central portion of the Bloomington Ridged Plain region of Illinois. Surficial materials and hydrology of the watershed have been fundamentally shaped by glacial processes of deposition and erosion. The watershed is primarily covered with loess, a fine-grained windblown glacial deposit which is highly erodible on steeper slopes. Beneath this veneer of loess is typically a silty or clayey glacial till with variable thickness and composition (Table 24). The spatial extents and statistics of each surficial deposit type are illustrated in Figure 18.

Surficial geology was adapted from Illinois State Geologic Survey (ISGS) 1995 Stack-Unit mapping of the top 15 meters of earth materials. Drift thickness varies from over 100 ft in the central portion to over 400 ft in a band running northeast-southwest through the northwest end of the watershed. This zone of thick drift material corresponds to the Danvers buried bedrock valley. The unconsolidated deposits are primarily underlain by the Pennsylvanian-aged Shelburn and Patoka formations consisting of limestone, shale, coal, and sandstone. In the southeast portion of the watershed, the Bond formation shales and limestones overly the Shelburn-Patoka.

The widespread veneer of highly erodible and fine-grained glacial loess is a major potential source of sediment in the watershed.

Table 24 – Surficial Geology of Lake Bloomington & Evergreen Lake Watershed

Surficial Geology	Description[1]	Area (acres)	Percent of Watershed
Alluvium	Thin Cahokia alluvium underlain by thick silty and clayey sequences of Wedron till.	1,537	2.21%
Loess	Thin Richmond loess underlain by thick silty and clayey sequences of Wedron till.	59,817	86.1%
	Thin Richmond loess underlain by thick silty and clayey sequences of Wedron till with discontinuous layers of sand and gravel.	3,439	4.95%
Outwash	Thin Henry formation sands and gravels underlain by thick silty and clayey sequences of Wedron till.	207	0.30%
Till	Thick sequences of silty and clayey Wedron till.	4,512	6.49%

[1] Adapted from Illinois State Geological Survey *Stack-Unit Mapping of Geologic Materials in Illinois to a Depth of 15 meters*

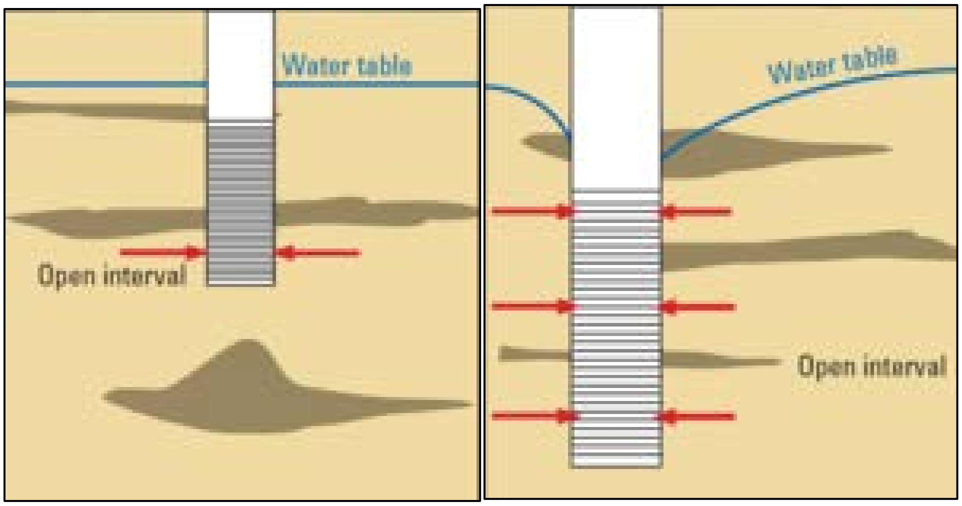
3.7.2 Hydrogeology

There are estimated to be at least 251 private water wells within the LB/EL watershed based on the ISGS wells and borings database. There are 3 Community Water Supply (CWS) and 11 Non-Community Water Supply (NCWS) wells recorded in the state database. Based on the available dataset of private wells, average depth is 166 ft with a minimum of 25 ft and a maximum of 345 ft. An inferred average depth to water-bearing units of 144 ft was calculated based on the 195 wells which denoted depth to top of screened interval. Well yield or pumping rate data was available for 154, indicating an average yield of 19 gpm, however, some wells yield in excess of 100 gpm. Table 25 provides depth, completion and yield information for available water wells grouped by subwatershed.

Wells are primarily completed in the unconsolidated gravels, sands and clays of the till and outwash formations; only three reported producing from bedrock units. Illinois State Geologic Survey mapping for major sand and gravel aquifers indicates that a tongue of the highly productive Mahomet sand and gravel aquifer extends into the northwest portion of the aquifer, while high yielding bedrock aquifers may be accessible within 500 ft drilling depth along the north-central portion of the area.

Table 25 – Water Wells

Subwatershed	Total Depth (ft)			Top of water bearing unit (fbgs)			Water bearing interval thickness (ft)			Well yield (gpm)			Average drift thickness (ft)
	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	
Blue Mound-Money Creek	145	32	293	119	10	249	11	1	149	18	4	100	175
Lake Bloomington-Money Creek	156	25	327	123	13	292	11	1	57	19	1	60	295
Evergreen Lake-Sixmile Creek	201	46	345	189	10	335	22	2	276	19	2	175	295
Total	**166**	**25**	**345**	**144**	**10**	**335**	**15**	**1**	**276**	**19**	**1**	**175**	**244**



Diagrams of a Domestic Well (left) and Public-Supply Well (right)

Credit: USGS 2014

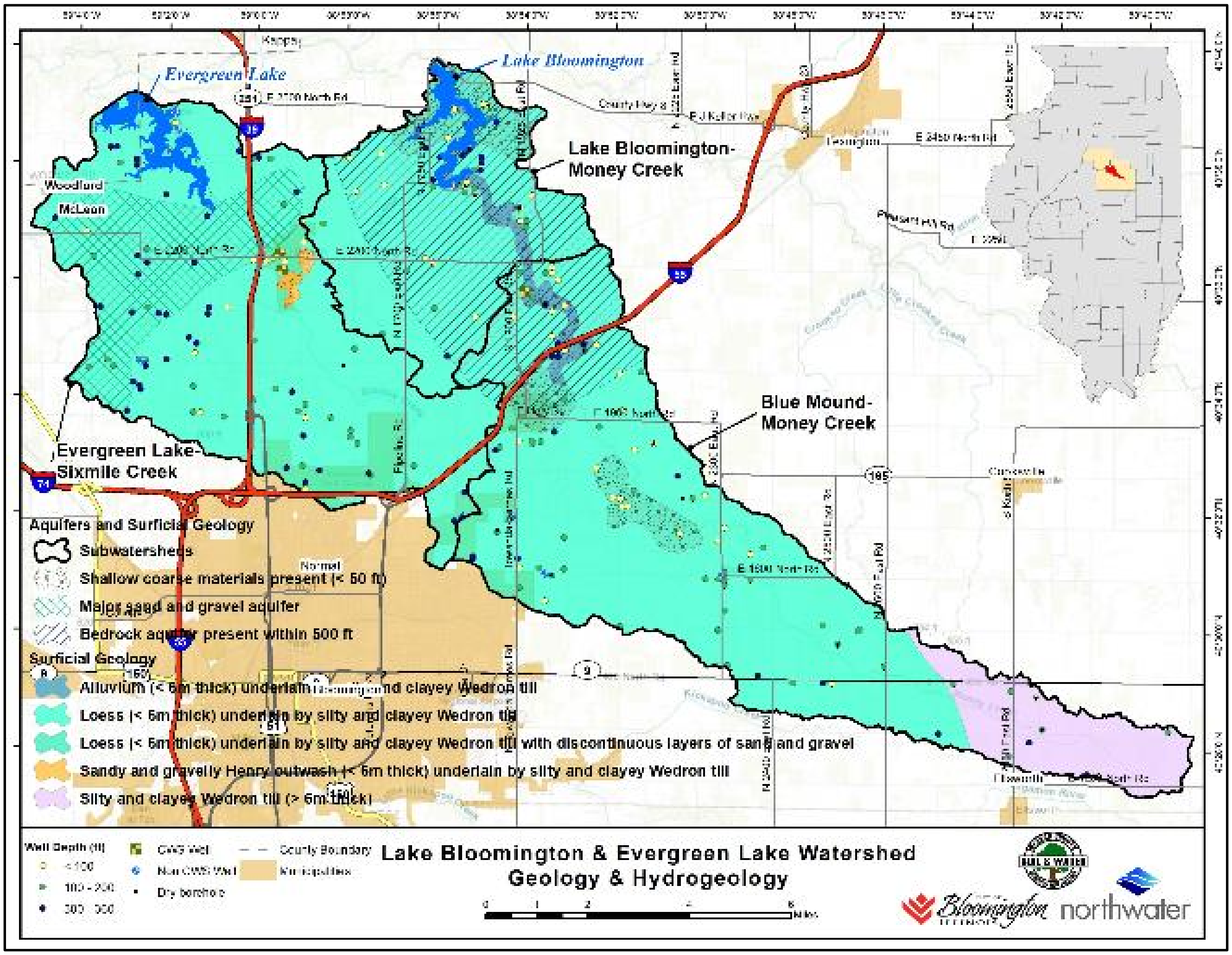


Figure 18 – Geology & Wells

3.7.3 Topography & Relief

Elevation statistics by subwatershed are found in Table 26 and watershed elevation is shown in Figure 19. For both EL and LB, elevation ranges from about 686 to 905 feet above sea level (fasl). Most of the combined LB and EL watershed is at 788 fasl or lower, with an average of about 786 fasl. The lowest elevations can be found within both lakes and their immediate tributaries. The Lake Bloomington-Money Creek subwatershed has the lowest average elevation (757 fasl), while Blue Mound-Money Creek has the highest (814 fasl).

Slope statistics by subwatershed are found in Table 27 and watershed slopes are shown in Figure 20. Average slope in the combined LB and EL watershed is 3.6% (2.1°) and the maximum is 280% (70°). Headwaters and upland areas are flatter, transitioning to steeper slopes adjacent to stream corridors and major waterbodies.

Table 26 – Elevation by Subwatershed in Feet Above Sea Level

Subwatershed	HUC12 Code	Average Elevation (fasl)	Minimum Elevation (fasl)	Maximum Elevation (fasl)
Blue Mound-Money Creek	71300040201	814	727	905
Lake Bloomington-Money Creek	71300040202	757	702	808
Evergreen Lake-Sixmile Creek	71300040502	789	686	887
Watershed Average		**794**	**705**	**867**

Table 27 – Slope by Subwatershed in Percent

Subwatershed	HUC12 Code	Average Slope (%)	Maximum Slope (%)
Blue Mound-Money Creek	71300040201	3.2	236
Lake Bloomington-Money Creek	71300040202	3.5	229
Evergreen Lake-Sixmile Creek	71300040502	4.1	280
Watershed Average		**3.6**	**248**

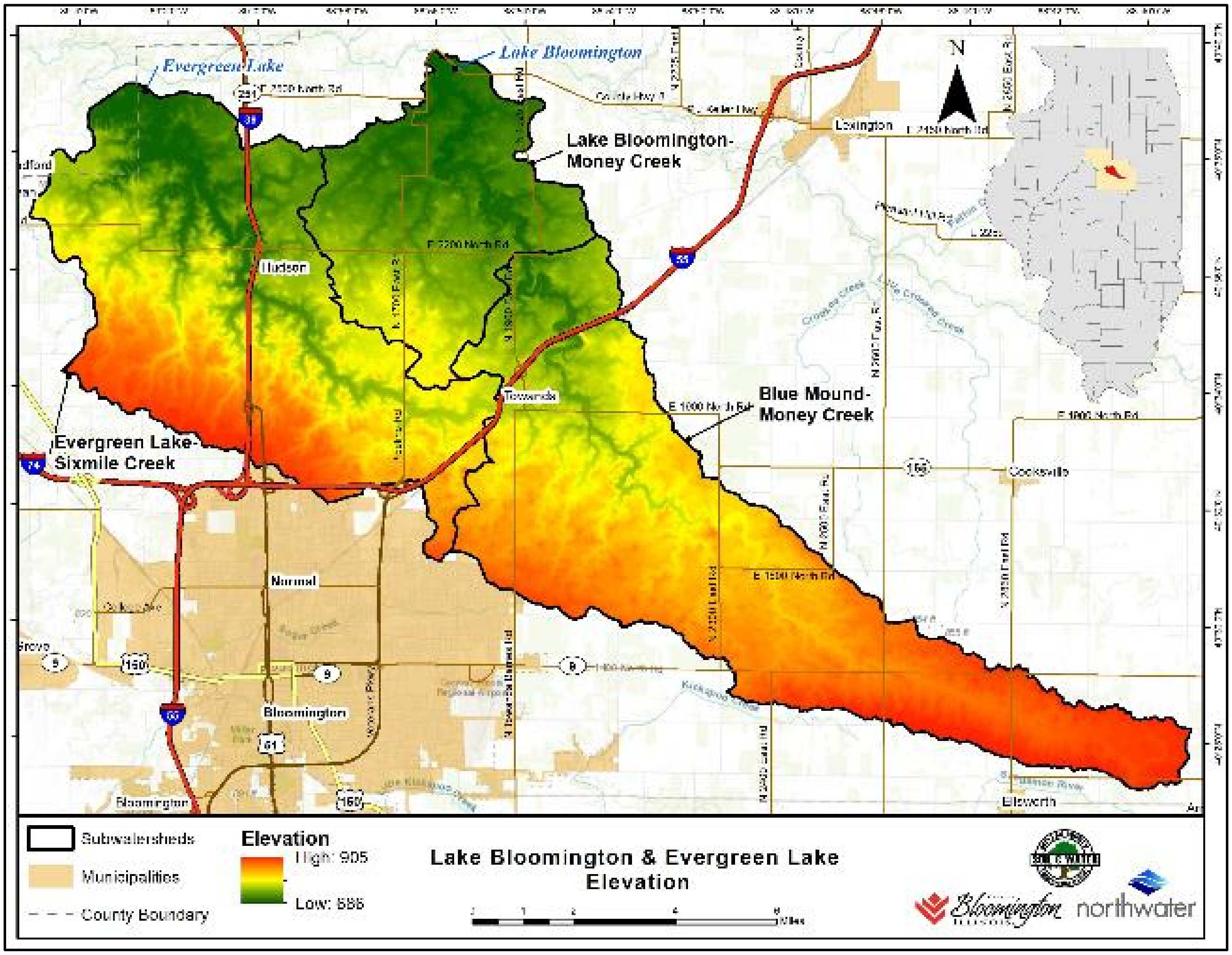


Figure 19 – Surface Elevation in Feet

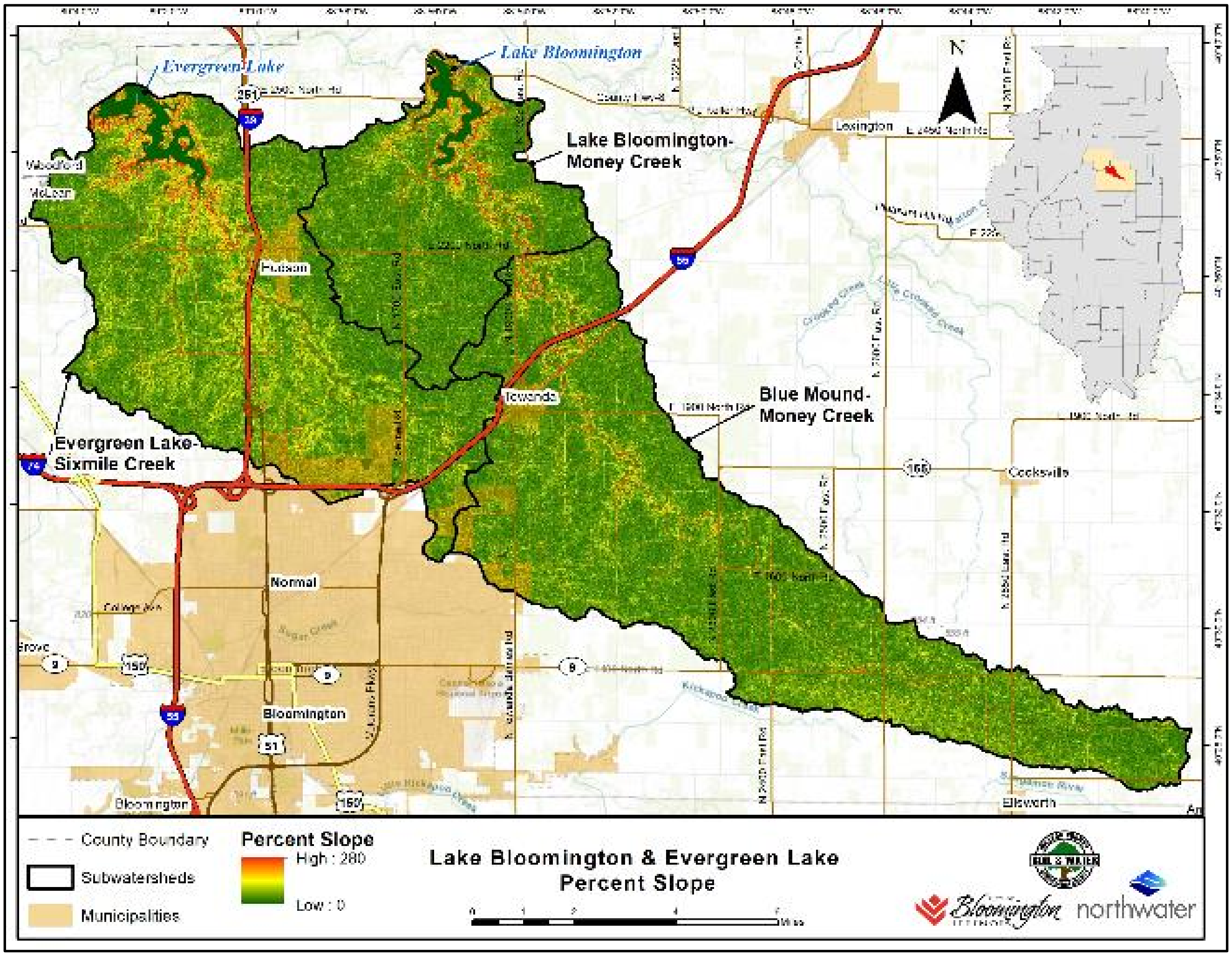


Figure 20 – Surface Slope in Percent

3.8 Climate

The State Climatologist Office for Illinois provides data from weather stations found across the state. Thirty-year normals for the watershed were acquired from a weather station in Normal, IL. The data consists of averages summarized from 1981-2010 and are shown in Table 28. Temperatures are measured in degrees Fahrenheit and the precipitation in inches.

Average annual temperature is 50.5° F. May through August experience monthly average temperatures greater than 70° F; the lowest average temperatures are in January (23.9° F). The highest average maximum is 85.4° F in July and the average minimum is in January (14.8° F). In general, the minimum and maximums follow the same monthly trends as average temperatures.

Average annual precipitation for the 30-year time span is 39.3 in. The month with the highest level of precipitation is May with a mean of 4.6 in. The lowest average monthly rainfall occurs in February (1.9 in). The wettest month of the year is May where the average annual precipitation is 4.6 in. July also sees a large amount with an average of 4.2 in. Average precipitation levels of this time frame follow an identical trend to the averages in recent years past.

Table 28 - Climate Normals (1981-2010)

Month	Maximum Temp (F)	Minimum Temp (F)	Mean Temp (F)	Mean Precipitation (in.)
January	32.9	14.8	23.9	2.1
February	37.6	18.3	27.9	1.9
March	49.4	27.1	38.2	2.7
April	62.3	37.8	50.0	3.7
May	73.1	49.1	61.1	4.6
June	82.8	59.9	71.4	3.9
July	85.4	63.3	74.4	4.2
August	84.0	61.0	72.5	3.8
September	77.7	52.5	65.1	3.1
October	65.0	41.2	53.1	3.3
November	50.2	30.8	40.5	3.3
December	36.3	19.3	27.8	2.7
Average	**54.4**	**39.6**	**50.5**	**3.3 (39.3 Total)**

Data was also acquired from the PRISM climate group to summarized averages from the last 15 years (January 2005-May 2020). The PRISM climate group is a part of the Northwest Alliance for Computational Science and Engineering based at Oregon State University and supported by the USDA Risk Management Agency. Temperatures are presented in degrees Fahrenheit and the precipitation in inches (Table 29).

The average annual temperature is 51.2° F. June through August experience monthly averages greater than 70° F; the lowest average temperatures are in January (24.8° F). The highest average maximum is 85.2° F in July and the average minimum is in January (16.4° F).

Average levels of this time frame follow an identical trend to those from a period of 1981-2010. In general, minimum and average temperatures follow the same monthly trends as average values from the period of 1981-2010. However, the average maximum temperature has risen by 7 degrees from when comparing 1981-2010 to the last 15 years.

The average annual precipitation for the most recent 15 years is 39.9 in. The month with the highest level is June with an average of 4.53 in. The lowest average monthly rainfall occurs in February (2.1 in). The wettest months of the year are May and June when the average annual precipitation exceeds 4 in.

Table 29 - Monthly Climate, 2005–2020

Month	Average Precipitation (in.)	Minimum Temp. (° F)	Average Temp. (° F)	Maximum Temp. (° F)
January	2.48	16.4	24.8	33.2
February	2.14	17.8	27.0	36.2
March	2.69	29.3	39.5	49.9
April	3.83	39.8	51.4	62.9
May	4.38	51.9	62.9	73.9
June	4.53	61.5	72.3	83.2
July	3.71	64.1	74.7	85.2
August	3.49	62.3	73.1	84.0
September	3.69	55.4	67.3	79.3
October	3.72	43.1	54.3	65.4
November	2.49	30.9	40.6	50.2
December	2.75	21.8	29.7	37.6
Average	**39.9 (annual total)**	**40.9**	**51.2**	**61.5**

3.9 Landuse

To characterize watershed landuse and nonpoint source (NPS) pollution, a custom Geographic Information System (GIS) landuse layer was developed from 2017 aerial imagery and verified to the extent possible through field surveys. Table 30 lists the results of classification for LB, Table 31 for EL and Figure 21 shows distribution in the watershed.

The predominant landuse in both lake watersheds is row crop agriculture which makes up 84% (36,126 acres) of the total LB watershed area and 74% (19,463 acres) of the EL watershed. The Blue Mound-Money Creek subwatershed contains almost 10% more crop area than Lake Bloomington-Money Creek. Crops are primarily a corn-soy bean rotation.

Grasslands and open space are the second and third most dominant categories in Blue Mound-Money Creek. Forest and open water pond/reservoir combined account for 12.5% of the Lake Bloomington-Money creek subwatershed. In EL, grasslands and open space combined cover 11.6%, or 3,059 acres, followed by forest at 4.3% or 1,142 acres.

A total of six small livestock confinement operations are in the LB watershed, all in the Blue Mound – Money Creek subwatershed. If still in operation, these operations are believed to be non-discharging; no additional information is available. A combined 577 acres of pasture and small, open livestock feed areas exist, 418 acres in LB (1%) and 159 acres in EL (0.6%). Animal units were quantified in 2021. Inventory data indicates a total of 358 cattle and 123 swine, horses, sheep and goats combined in LB and 67 cattle, 3 horses, 5 goats, and 15 chickens in EL. Total livestock numbers have declined from surveys completed in 2008 and 2014.

Table 30 – Blue-Mound-Money Creek / Lake Bloomington-Money Creek Landuse Categories & Area

Landuse Category	Area (ac)	Percent Total Area	Landuse Category	Area (ac)	Percent Total Area
Blue Mound-Money Creek (71300040201)			**Lake Bloomington-Money Creek (71300040202)**		
Row Crops	26,213	86%	Row Crops	9,913	77%
Open Space	1,156	3.8%	Forest	999	7.8%
Grasslands	1,123	3.7%	Open Water Pond/Reservoir	605	4.7%
Forest	432	1.4%	Open Space	474	3.7%
Roads	399	1.3%	Grasslands	471	3.7%
Pasture	360	1.2%	Roads	141	1.1%
Urban Residential	233	0.77%	Rural Residential	66	0.52%
Open Water Stream	91	0.30%	Pasture	45	0.35%
Parks & Recreation	81	0.27%	Open Water Stream	34	0.27%
Farm Building	63	0.21%	Orchard	26	0.20%
Rural Residential	54	0.18%	Farm Building	21	0.16%
Open Water Pond/Reservoir	45	0.15%	Utility	15	0.12%
Institutional	41	0.13%	Parks & Recreation	13	0.10%
Industrial	25	0.08%	Wetland	11	0.08%
Railroad	18	0.06%	Livestock Feed Area	5.0	0.04%
Wetland	17	0.06%	Campgrounds	3.2	0.02%
Confinement	12	0.04%	Commercial	2.5	0.02%
Livestock Feed Area	8.1	0.03%	Cemetery	2.0	0.02%
Commercial	8.0	0.03%	Warehouse	1.6	0.01%
Cemetery	6.8	0.02%	Wind Farm	1.6	0.01%
Utility	5.6	0.02%	-	-	-
Wind Farm	3.9	0.01%	-	-	-
Warehouse	2.4	0.01%	-	-	-

Table 31 - Evergreen Lake-Sixmile Creek Landuse Categories & Area

Landuse Category	Area (ac)	Percent Total Area
Evergreen Lake-Sixmile Creek (71300040502)		
Row Crops	19,463	74%
Grasslands	1,603	6.1%
Open Space	1,456	5.5%
Forest	1,142	4.3%
Open Water Pond/Reservoir	929	3.5%
Roads	498	1.9%
Urban Residential	283	1.1%
Pasture	157	0.60%
Golf Course	122	0.46%
Warehouse	108	0.41%
Rural Residential	103	0.39%

Landuse Category	Area (ac)	Percent Total Area
Parks & Recreation	81	0.31%
Open Water Stream	75	0.29%
Commercial	52	0.20%
Farm Building	36	0.14%
Institutional	35	0.13%
Mobile Homes	26	0.10%
Industrial	25	0.10%
Campgrounds	19	0.07%
Wetland	17	0.06%
Utility	12	0.05%
Wind Farm	7.0	0.03%
Railroad	6.4	0.02%
Cemetery	5.6	0.02%
Livestock Feed Area	2.0	0.01%

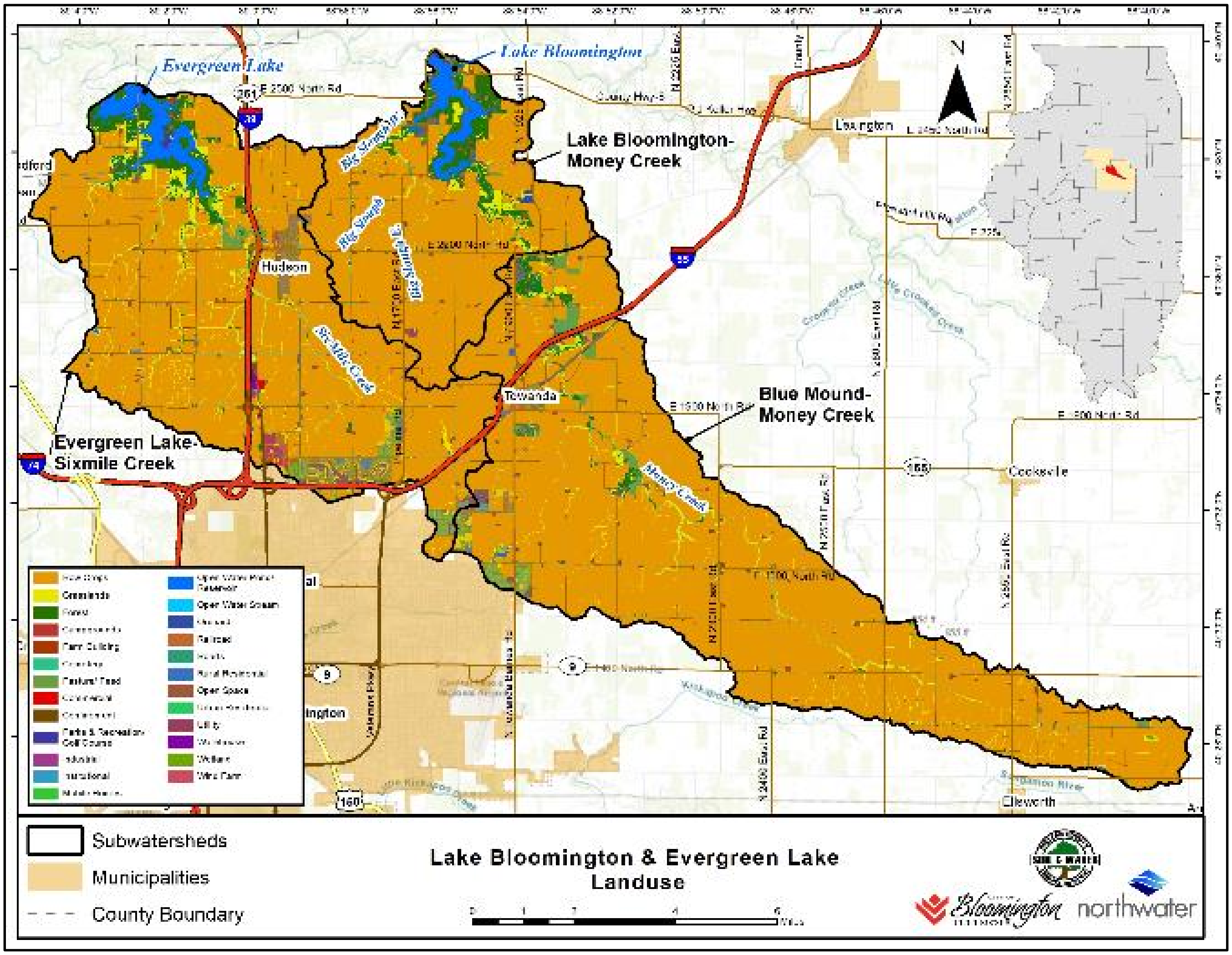


Figure 21 – Landuse

3.9.1 Landuse Change

Little future change in development is expected throughout the watershed with some exceptions. Growth priorities for the Town of Normal, as described in the Comprehensive Plan 2040, have been established and fall within headwater areas of the EL watershed and, to a lesser extent, the western edge of Blue Mound-Money Creek in the LB watershed. Growth priorities are broken into 4 tiers. Tier 1 is the highest priority and has development/redevelopment potential resulting from access to infrastructure. Tier 2 is immediately adjacent to incorporated areas and infrastructure where development will require some investment. Tier 3 is the lowest priority and can only be served with major infrastructure investments. Tier 4 has the potential for development with major investments, however, these areas are not anticipated to be developed between now and 2040.

As noted in Table 32, a total of 2,939 acres are defined as "future" growth areas beyond 2040 with the vast majority (2,729) within the EL watershed. Highest priority growth areas, or Tier 1, total 211 acres in EL and 40 in LB. Almost the entire extent of growth is expected to occur within areas currently being cropped.

Table 32 - Projected Development Priorities

Growth Tier	Acres	Percentage Subwatershed	Notes
Evergreen Lake-Sixmile Creek (71300040502)			
1	211	0.8%	Areas currently crop ground
2	108	0.4%	Areas currently crop ground
3	176	0.6%	Areas currently crop ground
4	2,729	10%	Areas mostly crop ground
Blue Mound-Money Creek (71300040201)			
1	40	0.1%	Areas crop ground or adjacent to developed areas
3	697	2%	Areas crop ground and adjacent to developed areas
4	210	0.7%	Areas currently crop ground

3.10 Soils

Based on soils data from the NRCS National Cooperative Soil Survey, 87 types exist in the combined LB and EL watershed (Table 33, Figure 22). Sable silty clay loam is the dominant soil, accounting for about 22% of the entire watershed, or 27,978 acres. Ipava silt loam is also prevalent and accounts for 18% (12,801 acres). These two types are also most common within each subwatershed – combined, 6,229 acres, or 48% of Lake Bloomington-Money Creek, 12,734 acres, or 42% of Blue Mound-Money Creek, and 8,819 acres, or 34% of Evergreen Lake-Sixmile Creek. Fifteen other soil types combined account for 46% of the total LB and EL watershed area, while the remaining 71 together account for 14%.

The NRCS gives official soil series descriptions (NRCS 2018b). Sable silty clay loam consists of very deep, poorly drained, moderately permeable soils. They are formed in nearly level broad summits of moraines and stream terraces, with slopes ranging from 0 to 2 percent. The Ipava series consists of very deep, somewhat poorly drained soils formed in loess on uplands and have slopes ranging from 0 to 5 percent.

Table 33 - Soil Types & Extent

Soil Type	Acres	Percent of Watershed
Sable silty clay loam, 0 to 2 percent slopes	14,981	21.6%
Ipava silt loam, 0 to 2 percent slopes	12,801	18.4%
Catlin silt loam, 2 to 5 percent slopes, eroded	5,848	8.4%
Saybrook silt loam, 2 to 5 percent slopes, eroded	4,748	6.8%
Osco silt loam, 2 to 5 percent slopes	3,891	5.6%
Drummer and Elpaso silty clay loams, 0 to 2 percent slopes	3,048	4.4%
Catlin silt loam, 2 to 5 percent slopes	2,659	3.8%
Flanagan silt loam, 0 to 2 percent slopes	1,785	2.6%
Sawmill silty clay loam, 0 to 2 percent slopes, occasionally flooded	1,626	2.3%
Radford silt loam, 0 to 2 percent slopes, occasionally flooded	1,418	2.0%
Water	1,417	2.0%
Elkhart silt loam, 2 to 5 percent slopes, eroded	1,149	1.7%
Osco silt loam, 2 to 5 percent slopes, eroded	1,085	1.6%
Arrowsmith silt loam, 0 to 2 percent slopes	977	1.4%
Wyanet silt loam, 2 to 5 percent slopes, eroded	880	1.3%
Saybrook silt loam, 5 to 10 percent slopes, eroded	782	1.1%
La Rose silt loam, 5 to 10 percent slopes, eroded	708	1.0%
71 Other Soil Types (less than 10,000 acres and less than 14% of watershed)	9,708	14%

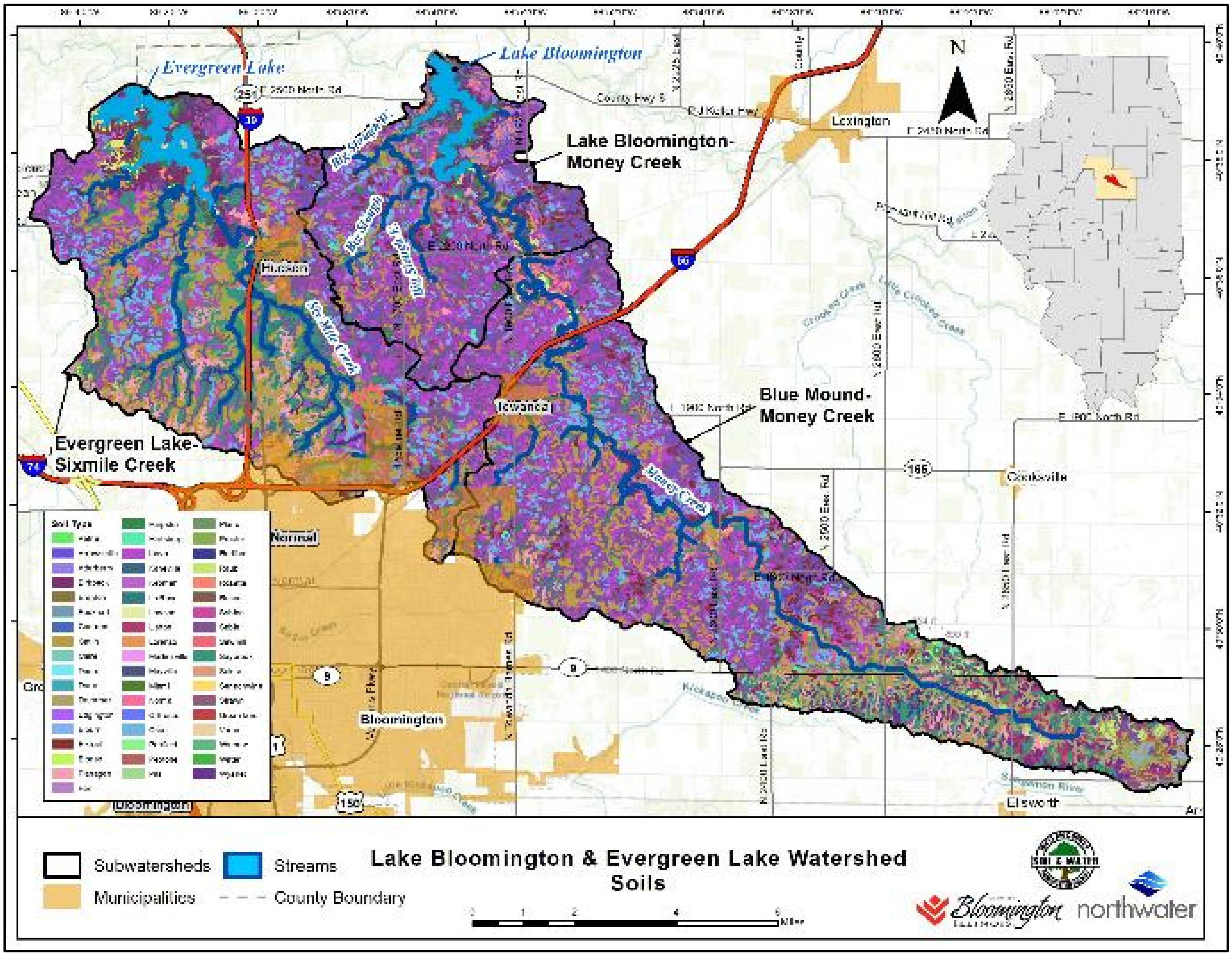


Figure 22 – Soils

3.10.1 Highly Erodible Soils

As defined by the NRCS, a highly erodible soil (HEL), or soil map unit, has a maximum potential for erosion that is greater than eight times the tolerable erosion rate. The maximum erosion potential is calculated without consideration to crop management or conservation practices, which can markedly lower the actual erosion rate on a given field.

The location and extent of HEL soils were identified using the USDA-NRCS SSURGO database and county frozen soils lists. About 3,871 acres of HEL exist, representing only 5.6% of the total LB and EL watershed area (Table 34, Figure 23). These soils are generally located immediately adjacent to streams and in steep forested or grassed areas. The Evergreen Lake-Sixmile Creek subwatershed contains the highest percentage (10%), whereas Lake Bloomington-Money Creek contains the least (1%). A small percentage are being cropped as described next in Section 3.9.2.

Table 34 – HEL Soils

Subwatershed	HUC 12 Code	Subwatershed Area	Acres HEL	Percentage of Subwatershed
Blue Mound-Money Creek	71300040201	30,398	550	1.8%
Lake Bloomington-Money Creek	71300040202	12,850	675	1%
Evergreen Lake-Sixmile Creek	71300040502	26,264	2,646	10%
Grand Total		**69,512**	**3,871**	**5.6%**

3.10.2 Cropped Highly Erodible Soils

If a producer has a field identified as HEL and wishes to participate in a voluntary NRCS cost-share program, that producer is required to maintain a conservation system of practices that maintains erosion rates at a substantial reduction of soil loss. Fields that are determined not to be HEL are not required to maintain a conservation system to reduce erosion.

Of the 55,637 acres of cropland, 3.2%, or 1,187 acres (2.6% of the watershed), are considered HEL and could be targeted for erosion control measures (Table 35 and Figure 23). Evergreen Lake – Sixmile Creek has the highest portion of HEL cropland (4.8%). The Lake Bloomington watershed has the lowest with both Money Creek subwatersheds at 1.3%. Cropped HEL soils and tillage practices are further discussed in Section 5.0.

Table 35 – Cropland HEL Soils

Subwatershed	HUC 12 Code	Subwatershed Area	Cropland Area	HEL Cropland Area	% of Subwatershed as Cropped HEL	% of Cropland as HEL
Blue Mound-Money Creek	71300040201	30,398	26,213	400	1.3%	1.5%
Lake Bloomington-Money Creek	71300040202	12,850	9,913	164	1.3%	1.7%
Evergreen Lake-Sixmile Creek	71300040502	26,264	19,463	1,253	4.8%	6.4%
Grand Total		**69,512**	**55,590**	**1,187**	**2.6%**	**3.2%**

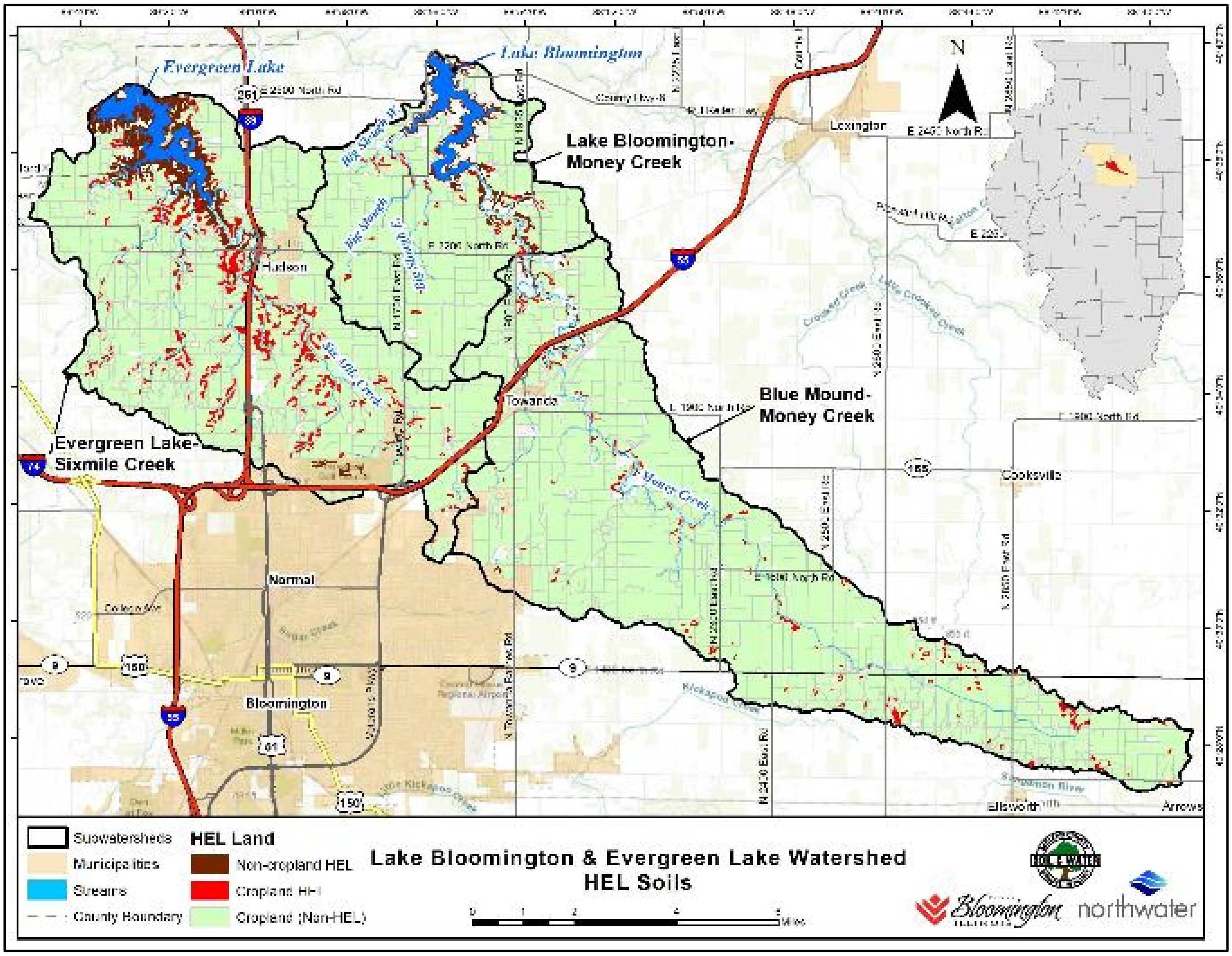


Figure 23 – HEL Soils

3.10.3 Hydric Soils

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation (NRCS, 2018). Table 36 describes the total area of hydric soils by subwatershed and Figure 24 depicts their location. As an indicator of the potential for wetland development, understanding where hydric soils are located can inform wetland restoration and creation activities.

Hydric soils are scattered throughout the watershed and are an indicator of former wetlands and potential areas for wetland development. These soils are typically wet and will flood if overland or tile drainage is not present. There are 9 different hydric soils within the watershed totaling 20,793 acres (Table 36), located primarily in flat areas around the periphery of the watershed, adjacent to subwatershed boundaries and along tributaries (Figure 24). Sable silty clay loam is the dominant hydric soil. The Blue

Mound - Money Creek subwatershed contains the highest percentage, or 34%; Evergreen Lake – Sixmile Creek contains the smallest percentage, or 24%.

Table 36 – Hydric Soils

Subwatershed	HUC12 Code	Subwatershed Area (acres)	Acres Hydric Soils	Percentage of Subwatershed
Blue Mound-Money Creek	71300040201	30,398	10,434	34%
Lake Bloomington-Money Creek	71300040202	12,850	4,076	32%
Evergreen Lake-Sixmile Creek	71300040502	26,264	6,283	24%
Grand Total		**69,512**	**20,793**	**30%**

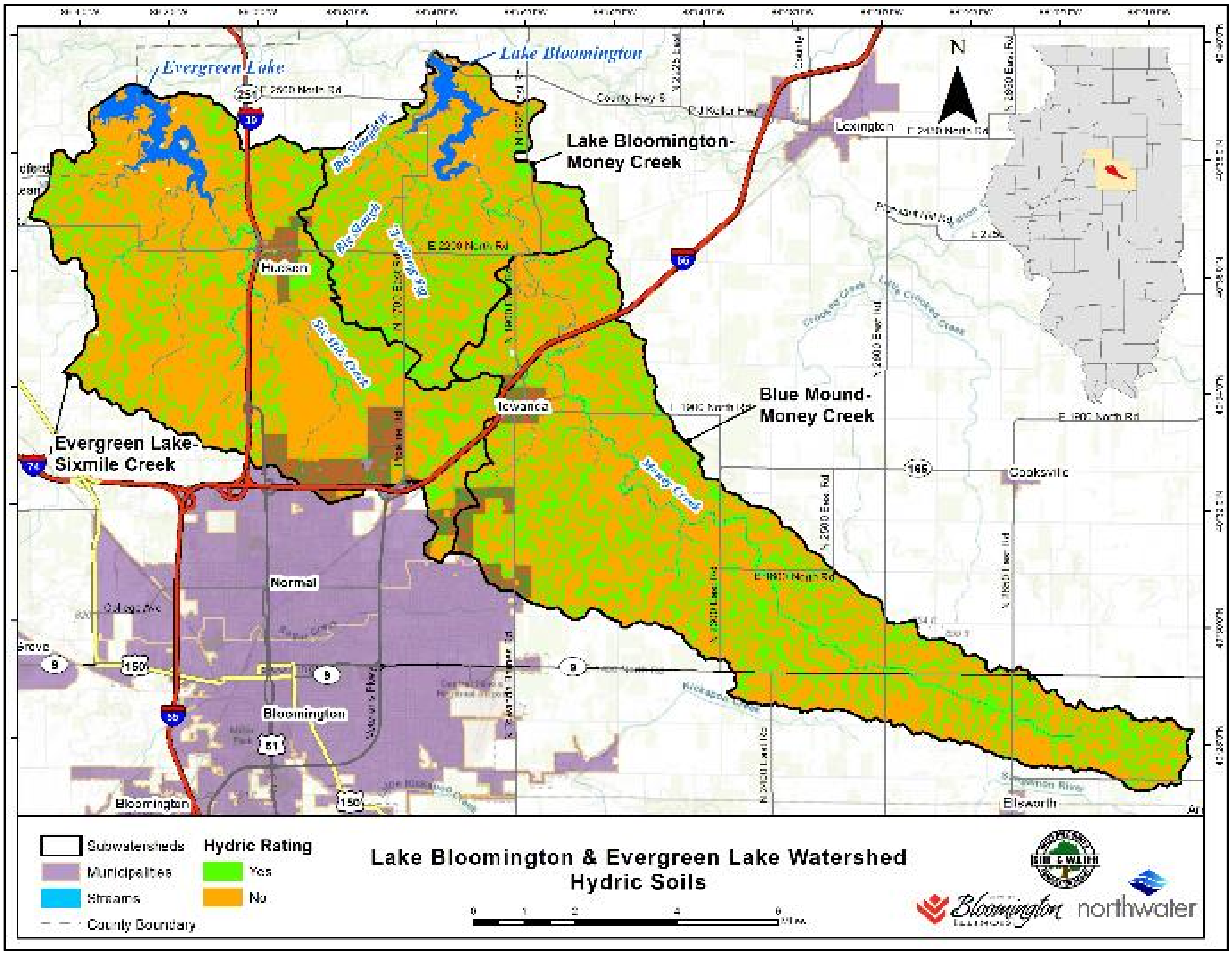


Figure 24 – Hydric Soils

3.10.4 Hydrologic Soil Groups

The NRCS has four hydrologic soil groups based on infiltration capacity and runoff potential. Group A has the greatest infiltration capacity and least runoff potential, while D has the least infiltration capacity and greatest runoff potential. A hydrologic soil group is determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity and depth to an impermeable layer or to a water table (USDA, 2007). Certain wet soils are tabulated as D based solely on the presence of a water table within 24 inches of the surface, even though the saturated hydraulic conductivity may be favorable for water transmission. When adequately drained to a seasonal water table at least 24 inches below surface, dual hydrologic groups (A/D, B/D, C/D) are given, based on their saturated hydraulic conductivity and the water table depth when drained. The first letter applies to the drained condition and the second to the undrained condition (USDA, 2007). This section applies datasets disseminated by the USDA National Cooperative Soil Survey.

Figure 25 and Table 37 illustrate the hydrologic soil groups and statistics for the watershed. The dominant group is B/D, which accounts for 34% of watershed soils and has low-moderate rates of runoff. Group C soils encompass 30% of the watershed and have higher runoff potential.

The Blue Mound – Money Creek subwatershed has the greatest proportion of B/D soils. Higher runoff potential is present on crop ground, as 45% (25,039 acres) are B or B/D groups, and 54% (30,280 acres) are C or C/D.

Table 37 – Hydrologic Soil Groups

Subwatershed	HUC12 Code	Subwatershed Area (acres)	Hydrologic Groupings and Total Area (acres)					
			B	B/D	C	C/D	D	Unclassified
Blue Mound-Money Creek	71300040201	30,398	2,786	11,488	8,162	7,879	62	21
Lake Bloomington-Money Creek	71300040202	12,850	1,287	4,946	2,972	2,989	49	607
Evergreen Lake-Sixmile Creek	71300040502	26,264	2,325	7,496	10,008	5,401	222	811
Grand Total		**69,512**	**6,397**	**23,930**	**21,142**	**16,270**	**334**	**1,439**
Total Percent			**9.2%**	**34%**	**30%**	**23%**	**0.5%**	**2.1%**

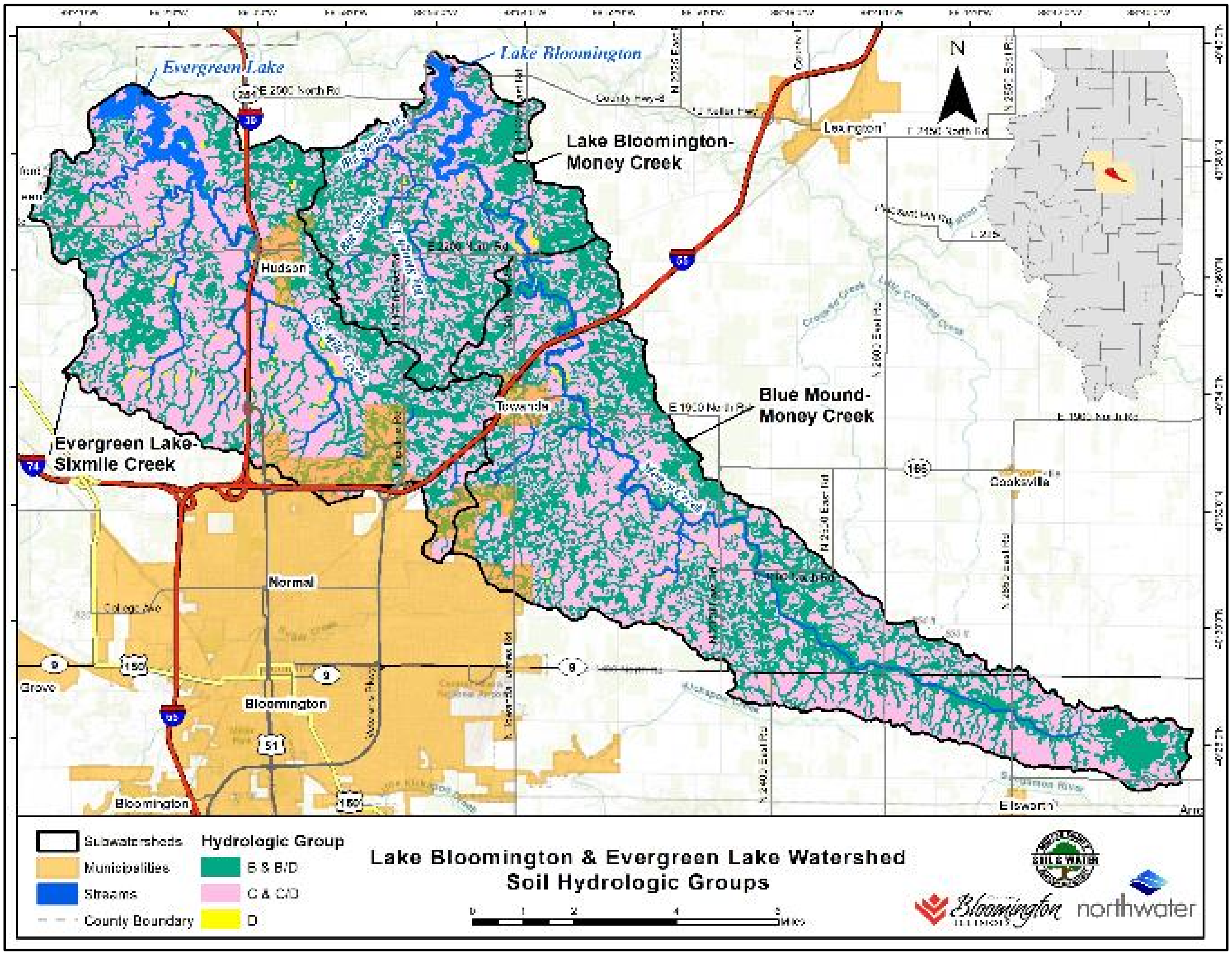


Figure 25 – Soil Hydrologic Groups

3.10.5 Septic System Suitability

Not all soil types support septic systems and improper construction can lead to failure and leaching of wastewater into groundwater and surrounding waterways. Soil data was analyzed by subwatershed for the ability to support septic systems.

Results show that 90%, or 62,232 acres (Table 38), of the watershed contain soils classified as "very limited" with respect to septic suitability. This does not indicate that soils are unsuitable for septic systems, but special consideration is required when establishing systems within most of the watershed. A total of 1,610 homes/buildings believed to have septic systems are located on soils classified as very limited. Figure 26 illustrates the extent of limiting soils for septic fields along with the location of homes/buildings.

Table 38 – Soil Septic System Suitability, Total Area & Home/Building Count

Subwatershed	HUC12 Code	Total Area (acres)	Total Homes on Septic	“Very Limited”		“Somewhat Limited”		“Not Rated”	
				Area (acres)	Septic Systems	Area (acres)	Septic Systems	Area (acres)	Septic Systems
Blue Mound-Money Creek	71300040201	30,398	567	27,967	483	2,411	83	21	1
Lake Bloomington-Money Creek	71300040202	12,850	505	11,028	407	1,216	98	607	0
Evergreen Lake-Sixmile Creek	71300040502	26,264	787	23,237	720	2,215	67	811	0
Grand Total		**69,512**	**1,859**	**62,232**	**1,610**	**5,841**	**248**	**1,439**	**1**

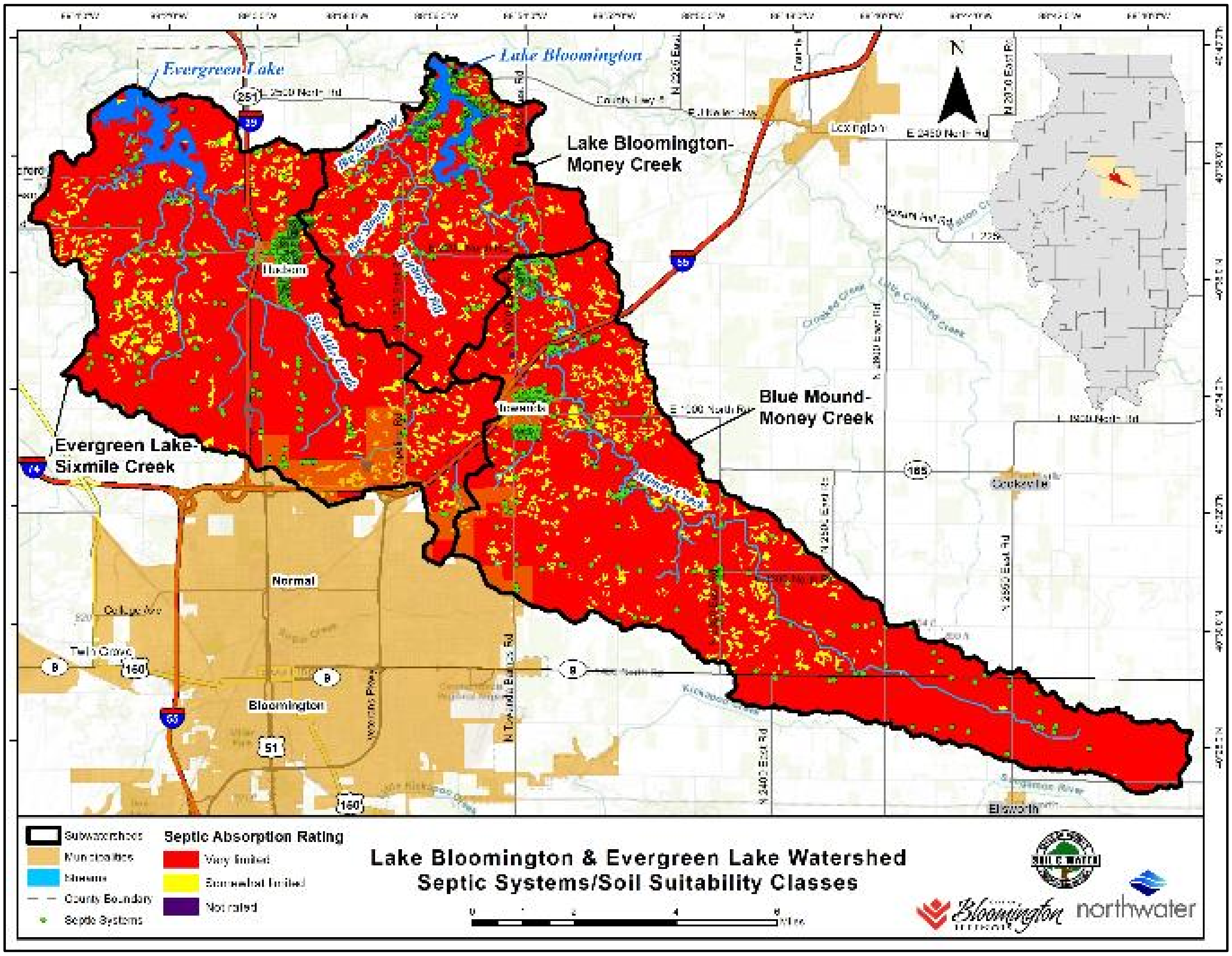


Figure 26 – Soil Septic Suitability

3.11 Tillage


Conventional Tillage

According to a 2019 Illinois Department of Agriculture (IDOA) tillage transect survey completed by the McLean County SWCD for the LB and EL watershed, approximately 55.6% of the corn, none of the soybean acreage in EL and 45% of corn and 7% of the soybean acres in LB use conventional tillage methods, which leave little or no residue on the surface. In LB, an additional 23% of corn acres and 5% of soybean acres use reduced-till, which can decrease soil loss by 30% compared to conventional tillage. The remaining 32% of corn and 89% of soybean acres are mulch-till or no-till (2% no-till corn and 40% no-till beans). In EL, 17% of corn acres and 8.7% of soybean acres use reduced-till, and 22% of corn and 54% of beans use mulch-till. No-till is found on 5.6% of corn and 37% of the bean acreage. Mulch-till leaves 30% residue of the previous year's crop and can reduce soil loss by 75%.

A more detailed field-based assessment of tillage practices was performed in the spring of 2020 to better characterize current conditions. Table 39 and Figure 27 show the acres of tillage types and distribution in the watershed; pollution loading by tillage is discussed in more detail in Section 5.0. Tillage is grouped into 7 categories: conventional, reduced-till, mulch-till, strip-till, no-till, hay, and cover crop.

Results show that mulch-till and no-till make up the largest portions of the LB and EL watershed (55% and 20%, respectively), followed by reduced-till (14%). Conventional and strip-till account for 7% and 1%, respectively; cover crops are used on 1,182 acres or 2% of all cropland. No-till is most prevalent in the Blue Mound-Money Creek (34%) subwatershed, mulch-till in LB-Money Creek (75%), reduced-till in Blue Mound-Money Creek (16%), and conventional tillage and cover crops in EL (9% and 3%).

Table 39 – Tillage Types, Acres & Percent of Cropland

Subwatershed/ HUC12 Code	Conventional		Cover Crops		Mulch-Till		No-Till		Reduced-Till		Strip-Till		Hay	
	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%
Blue Mound - Money Creek 71300040201	1,721	7%	507	2%	9,922	38%	9,025	34%	4,296	16%	701	3%	42	0.2%
Lake Bloomington - Money Creek 71300040202	217	2%	160	2%	7,406	75%	630	6%	1,501	15%	0	0%	0	0%
Evergreen Lake - Sixmile Creek 71300040502	1,843	9%	515	3%	13,377	69%	1,482	8%	2,186	11%	0	0%	59	0.3%
Grand Total	**3,781**	**7%**	**1,182**	**2%**	**30,705**	**55%**	**11,138**	**20%**	**7,982**	**14%**	**701**	**1%**	**101**	**0.2%**

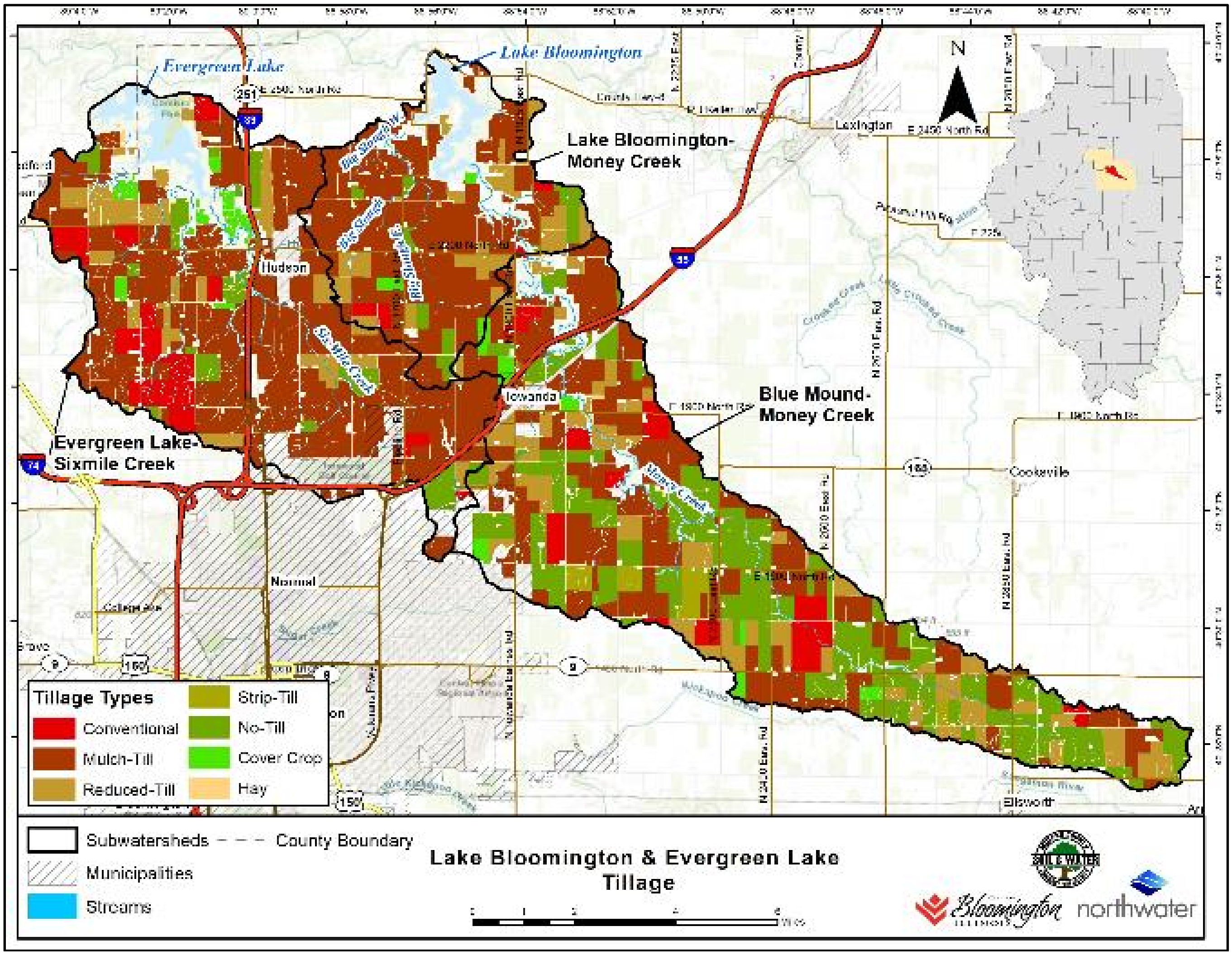


Figure 27 – Tillage Types

3.12 Existing Conservation Practices

Existing management practices within the watershed are extensive and include saturated buffers, grass riparian buffers, grass waterways, ponds and basins, terraces, water and sediment control basins (WASCB), wetlands, streambank stabilization, and nutrient management. Table 40 below shows the total number or extent of each management practice; Figure 28 shows existing practices. The greatest number of WASCBs and terraces are in the Blue Mound-Money Creek subwatershed. Wetlands, riparian buffers, and grass waterways are least prevalent in Lake Bloomington-Money Creek. Nutrient management plans cover the greatest acreage in Blue Mound-Money Creek and saturated buffers and streambank stabilization practices are concentrated in EL. In addition to the listed practices, other relevant work has included lake shoreline stabilization, septic system management, in-lake aeration to address phosphorus and a social survey to document attitudes towards water resources, as well as numerous education and outreach events.

With relatively large reductions still required to meet water quality goals stated in this plan, substantial opportunities exist to install new practices. This is especially true where nutrient loading is the greatest or where pollutants may bypass existing BMPs, such as tile water bypassing a filter strip. It is important to note that each practice varies in its ability to effectively remove pollutants, however, these practices are providing benefits to water quality and have been accounted for in the watershed pollutant loading estimates. Historical efforts to address water quality cannot be understated. The practices listed below reflect years of hard work by the McLean County SWCD and NRCS, the City of Bloomington, private landowners, and others.

Table 40 – Existing Conservation Practices

Subwatershed	HUC12 Code	Best Management Practice	Count / Extent
Blue Mound-Money Creek	71300040201	Grass Riparian Buffer	294 (acres)
		Field Border	6 (acres)
		Grass Waterway	256 (acres)
		Pond/Wet Basin	45 (acres)
		Dry Detention Basin	2
		Terrace	44
		WASCB	18
		Wetland	17 (acres)
		Nutrient Management Plan	1,180 (acres)
Lake Bloomington - Money Creek	71300040201	Grass Riparian Buffer	68 (acres)
		Field Border	4 (acres)
		Grass Waterway	30 (acres)
		Pond/Wet Basin	14 (acres)
		Terrace	0
		WASCB	2
		Wetland	11 (acres)
		Nutrient Management Plan	37 (acres)
		Lake Shoreline Stabilization	27,538 (ft)[1]
		Lake Aerator/Circulator	1
Evergreen Lake - Sixmile Creek	71300040502	Grass Riparian Buffer	255 (acres)
		Field Border	29 (acres)
		Grass Waterway	336 (acres)
		Pond/Wet Basin	93 (acres)
		Dry Detention Basin	1
		Saturated Buffer	2
		Streambank Stabilization	4
		Terrace	24
		WASCB	19
		Wetland	17 (acres)
		Nutrient Management Plan	292 (acres)
		Lake Shoreline Stabilization	14,187 (ft)
		Lake Aerator/Circulator	1

Calculation of grass riparian buffers are an estimation and include grassed areas within 35 feet of a flowing stream. [1] *includes seawall*

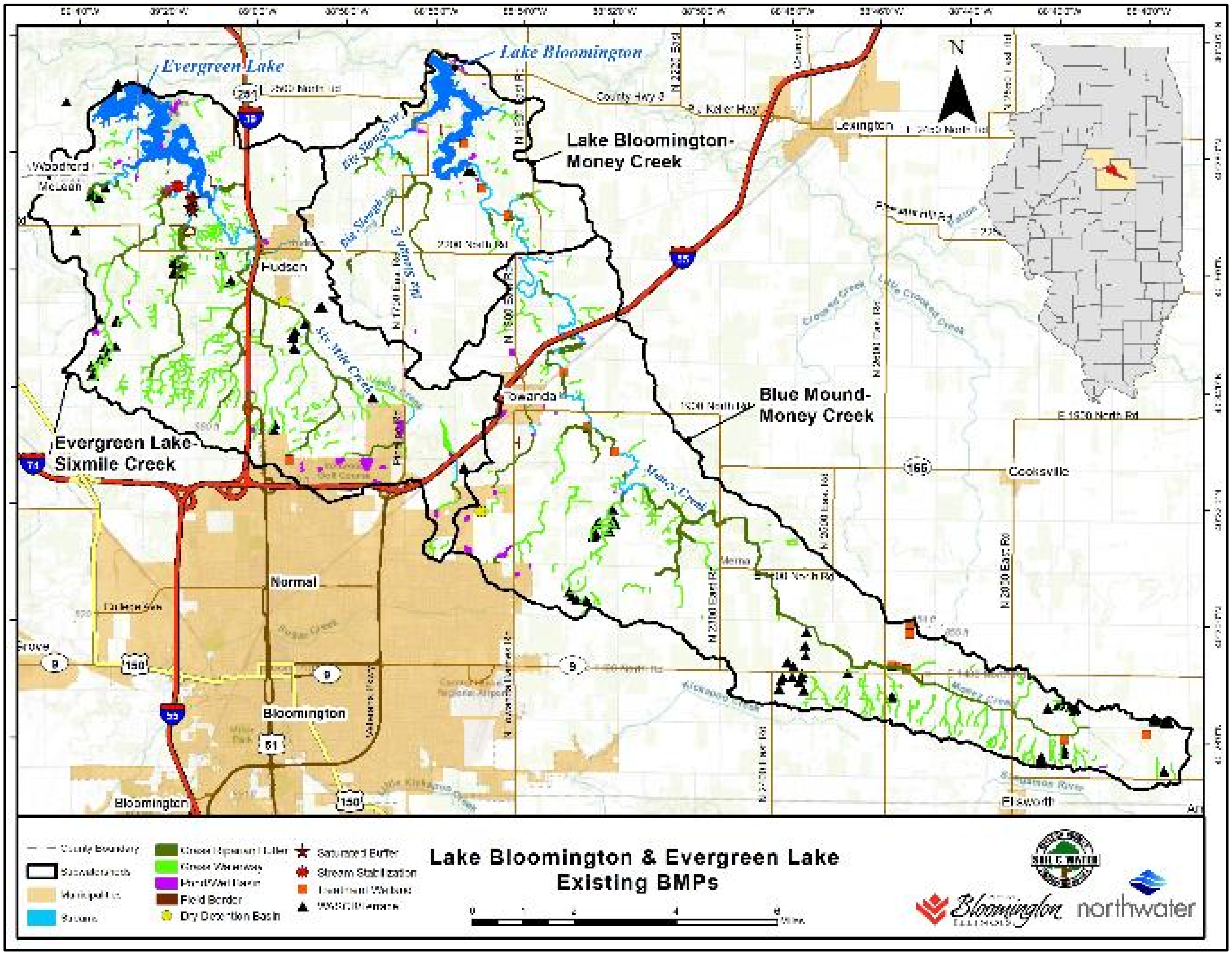


Figure 28 – Existing BMPs

Erosion Control Structure in Watershed

3.13 Hydrology & Drainage System

In the past, three USGS stream gauging stations operated in the LB watershed. The City of Bloomington currently monitors streamflow at stations on Money and Sixmile Creek. Due to a relatively short period of flow records, USGS StreamStats was used to retrieve peak flow data (Table 41).

Table 41 – Lake Bloomington & Evergreen Lake Primary Tributary Peak Flow Data

Stream	HUC12	Peak Flow Data (ft^3/s) by Recurrence Level Interval (yrs)				Drainage Area (mi^2)	Stream Slope (ft/mi)
		2 yrs	5 yrs	10 yrs	500 yrs		
Sixmile Creek (at Evergreen Lake)	71300040502	1,010	1,800	2,400	5,920	23.5	8.4
Money Creek (at Lake Bloomington)	71300040202	1,350	2,400	3,170	7,660	50.4	5.4
Money Creek (Blue Mound Subwatershed)	71300040201	1,310	2,320	3,060	7,440	46.2	5.7

3.13.1 Streams

Due to limitations with the accuracy of the National Hydrography Dataset (NHD), the custom landuse layer was used to better represent the actual wetted extent of streams in the watershed; Table 42 shows perennial open water tributary stream length. Results show a total of 75 miles of streams; major named tributaries include: Money Creek, Sixmile Creek, and Big Slough East, West and 2 (Figure 29). Money Creek, which drains to LB, is 28.4 miles long while Sixmile Creek is 9.3 and tributary to EL. The Big Slough system, also in the LB watershed, is 7.3 miles; all other unnamed tributaries total 30.3 miles. Although accuracy is limited, the NHD indicates all perennial, intermittent or ephemeral tributaries, forested gullies, and subsurface drainage ways totaling 187 miles (Table 43). Named streams captured in the NHD show Money Creek at 33 miles in length, Sixmile at 15 miles and Big Slough at 5.8.

Ponds and reservoirs total 1,579 acres, or 2.2% of the LB and EL watersheds (Table 42). They range in size from 590 acres (LB) to less than an acre. Evergreen Lake is approximately 840 acres in size and the largest body of water in the combined watershed. The drainage system is depicted in Figure 29.

Table 42 – Open Water Perennial Streams & Tributaries

Tributary Name	Length (ft)	Length (mi)
Money Creek	149,763	28.4
Sixmile Creek	49,111	9.3
Big Slough East	20,238	3.8
Big Slough West	9,083	1.7
Big Slough 2	9,266	1.8
Unnamed Tributary	160,154	30.3
Grand Total	**397,615**	**75**

Table 43 – Surface Water Inventory by Subwatershed

Subwatershed	HUC12 Code	Perennial Streams (mi)	NHD Waters* (mi)	Ponds and Lakes (ac)
Blue Mound-Money Creek	71300040201	32.6	75	45
Lake Bloomington - Money Creek	71300040202	12.6	32.2	605
Evergreen Lake - Sixmile Creek	71300040502	30	79.5	929
Grand Total	–	**75**	**187**	**1,579**

** = all NHD water sources including perennial streams, intermittent or ephemeral tributaries, forested gullies and subsurface drainageways*

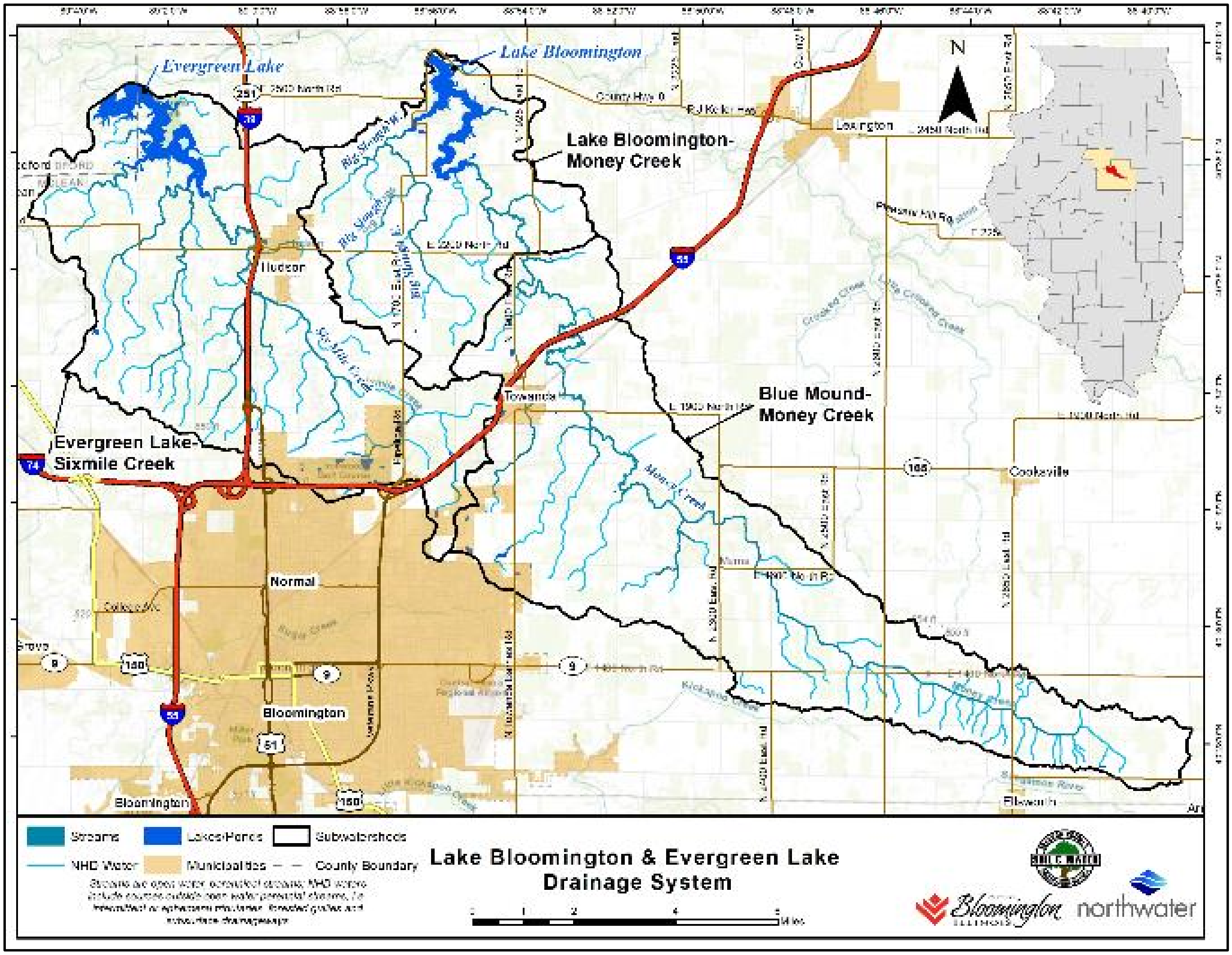


Figure 29 – Drainage System

3.13.2 Tile Drainage

Tile drainage in the watershed is believed to be high. Methods used to identify and estimate tile drainage included direct observations performed during a watershed windshield survey, knowledge of local agency staff and analysis of soils, elevation, imagery, past research, and landuse.

It is estimated that 1,363 fields, or 52,567 acres in the watershed, are likely tile drained. This corresponds to 95% of all cropland or 76% of the watershed. The Blue Mound-Money Creek subwatershed likely has the greatest total and percent area tiled, 24,596 acres or 81%. Evergreen Lake-Sixmile Creek has the lowest overall percent area tiles, or 70%, and Lake Bloomington-Money Creek the lowest total area, or 9,636 acres. As a percentage of total cropland acreage, Lake Bloomington-Money Creek likely has the highest, or 97%. Table 44 shows estimated tiled area by subwatershed.

Table 44 – Tile Drained Cropland

Subwatershed	HUC12 Code	Subwatershed Area (ac)	Cropped Area (ac)	Tiled Area (ac)	Percent Cropped Area Tiled (%)	Percent Subwatershed Area Tiled (%)
Blue Mound-Money Creek	71300040202	30,398	26,213	24,596	94%	81%
Lake Bloomington - Money Creek	71300040305	12,850	9,913	9,636	97%	75%
Evergreen Lake - Sixmile Creek	71300040502	26,264	19,463	18,335	94%	70%
Grand Total		**69,512**	**55,589**	**52,567**	**95%**	**76%**

3.13.3 Stream Channelization

Stream channelization is the engineering of a river or stream by modifying channel cross section profiles into smooth and uniform trapezoidal or rectangular forms, and can include activities such as straightening, widening or deepening the channel, clearing riparian and aquatic vegetation, and bank reinforcement. Typically, this causes increased volume and/or velocity of the water which disrupts stream equilibrium, causing conditions such as channel downcutting and bank erosion (known as the Channel Evolution Model; Simon 1989). Aerial imagery from 2017 was evaluated to determine the extent of open water stream channelization (Table 45 and Figure 30).

Channelized Stream

Results indicate that channelization is high. Out of a total of 75 stream miles, 45% (34 miles) are channelized. The Lake Bloomington-Money Creek subwatershed contains the highest percentage or more than half of all stream miles. Lake Bloomington contains a higher percentage of channelized stream miles than EL.

Table 45 – Length of Channelized Streams

Subwatershed	HUC12 Code	Total (ft)	Total (mi)	Channelized (ft)	Channelized (mi)	% Stream Length Channelized
Blue Mound-Money Creek	71300040201	172,859	32.7	80,379	15.2	47%
Lake Bloomington-Money Creek	71300040202	66,510	12.6	34,103	6.5	51%
Evergreen Lake-Sixmile Creek	71300040502	158,949	30.1	65,020	12.3	41%
Grand Total		398,319	75.4	179,502	34	45%

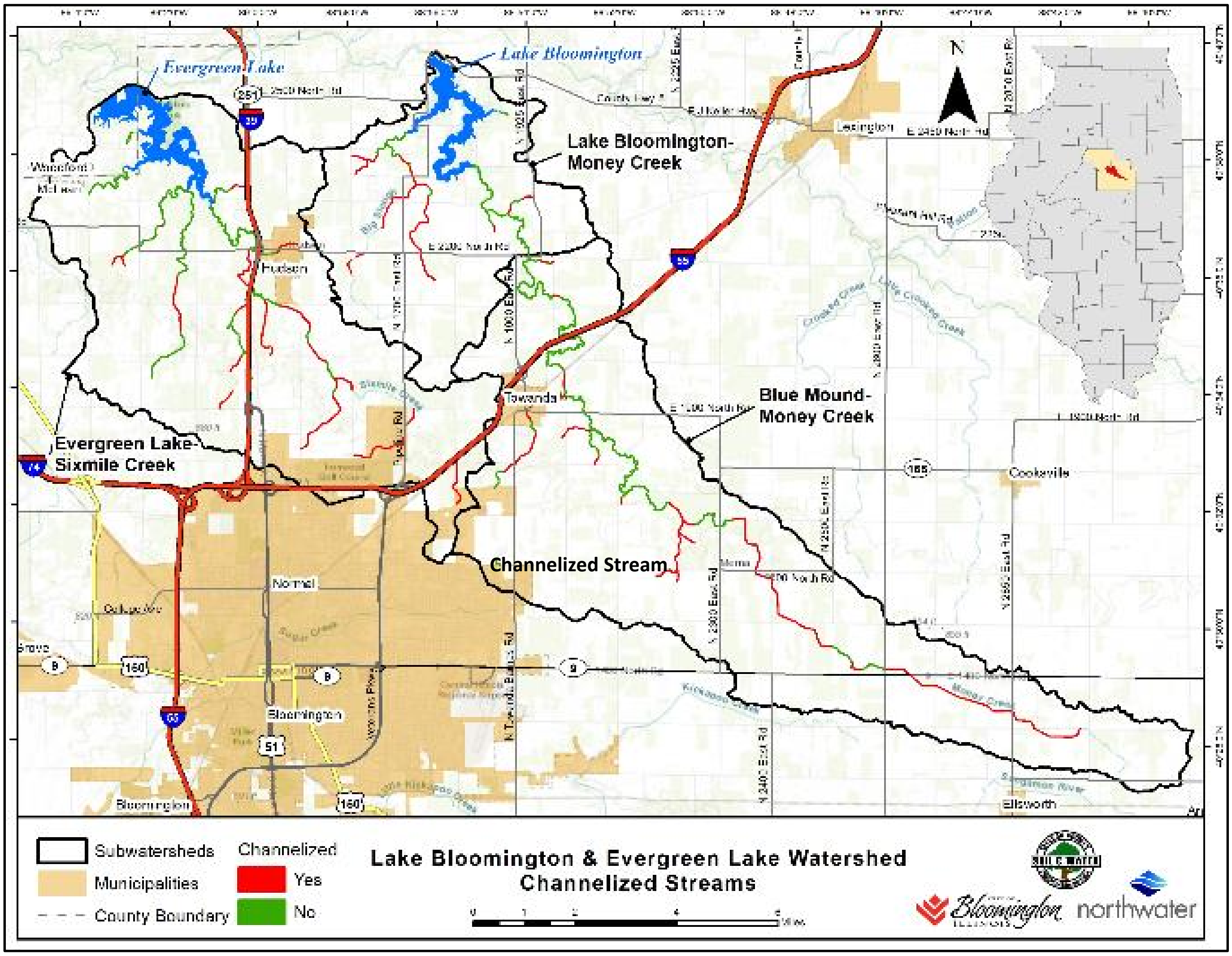


Figure 30 – Channelized Streams

3.13.4 Riparian Areas & Buffers

Riparian and buffer areas exist adjacent to streams and lakes in the watershed. A field assessment, combined with analysis of recent aerial imagery, was used to determine the adequacy and relative extent of natural stream and lake buffers.

Methods – A buffer quality ranking system was developed and applied to individual stream reaches. Stream reaches were organized into a sequential numbering system based on breaks at road crossings. Two categories of buffer quality include:

1. Adequate – greater than or equal to 35 ft of un-impacted riparian or buffer area, either forest grass, or wetland.
2. Inadequate – less than 35 ft riparian or buffer area impacted or degraded. Inadequate include row crops, moderately to highly overgrazed pasture, roads, buildings, and urban open space.

Existing literature was reviewed to determine the minimum adequate buffer width; 35 ft was selected based on the following references:

1. The USDA-NRCS requires a minimum of a 20-foot buffer to be eligible for the Conservation Reserve Program (NRCS, 2010).
2. A study performed in Kansas determined that buffers between 27 and 53 feet significantly removed nitrogen, phosphorus, and suspended solids from entering the stream (Mankin, et al. 2007).

Stream Buffers

Streams are generally well buffered or approximately 69% of all stream miles (Table 46). Although most are well buffered, areas exist where improvements can be made. Buffers can be expanded on over 46 miles (31%), mostly located in the headwaters of both lake watersheds (Figure 31). Evergreen Lake-Sixmile Creek has the highest percentage (70%) of adequately buffered stream miles, while Lake Bloomington-Money Creek has the lowest, or 65%. Adequate buffer percentage in the LB watershed is lower than EL.

Buffer type varies with grassland accounting for 43% of all stream miles combined for each lake watershed. Forest makes up 23%, row crops 22%, and pasture 6.6%; the nine other categories combined make up roughly another 5%.

Table 46 – Stream Buffer Adequacy

Subwatershed	HUC12 Code	Total (ft)	Total (mi)	Inadequate (mi)	Adequate (mi)	Inadequate (%)	Adequate (%)
Blue Mound-Money Creek	071300040201	339,500	64	20	44	31%	69%
Lake Bloomington-Money Creek	071300040202	129,942	25	8.7	16	35%	65%
Evergreen Lake-Sixmile Creek	071300040502	319,591	58	17	41	30%	70%
Grand Total		**789,033**	**147**	**46**	**101**	**31%**	**69%**

Table 47 – Stream Buffer Landuse Categories

Buffer Type	Total Miles	% of Stream Length
Grasslands	63	43%
Forest	34	23%
Row Crops	33	22%
Pasture	9.7	6.6%
Urban Open Space	4.8	3.3%
Wetland	1.3	0.88%
Roads	0.48	0.33%
Urban Residential	0.10	0.07%
Rural Residential	0.05	0.04%
Warehouse	0.05	0.03%
Open Water Pond/Reservoir	0.04	0.03%
Farm Building	0.02	0.01%
Railroad	0.01	0.01%
Grand Total	**147**	**100%**

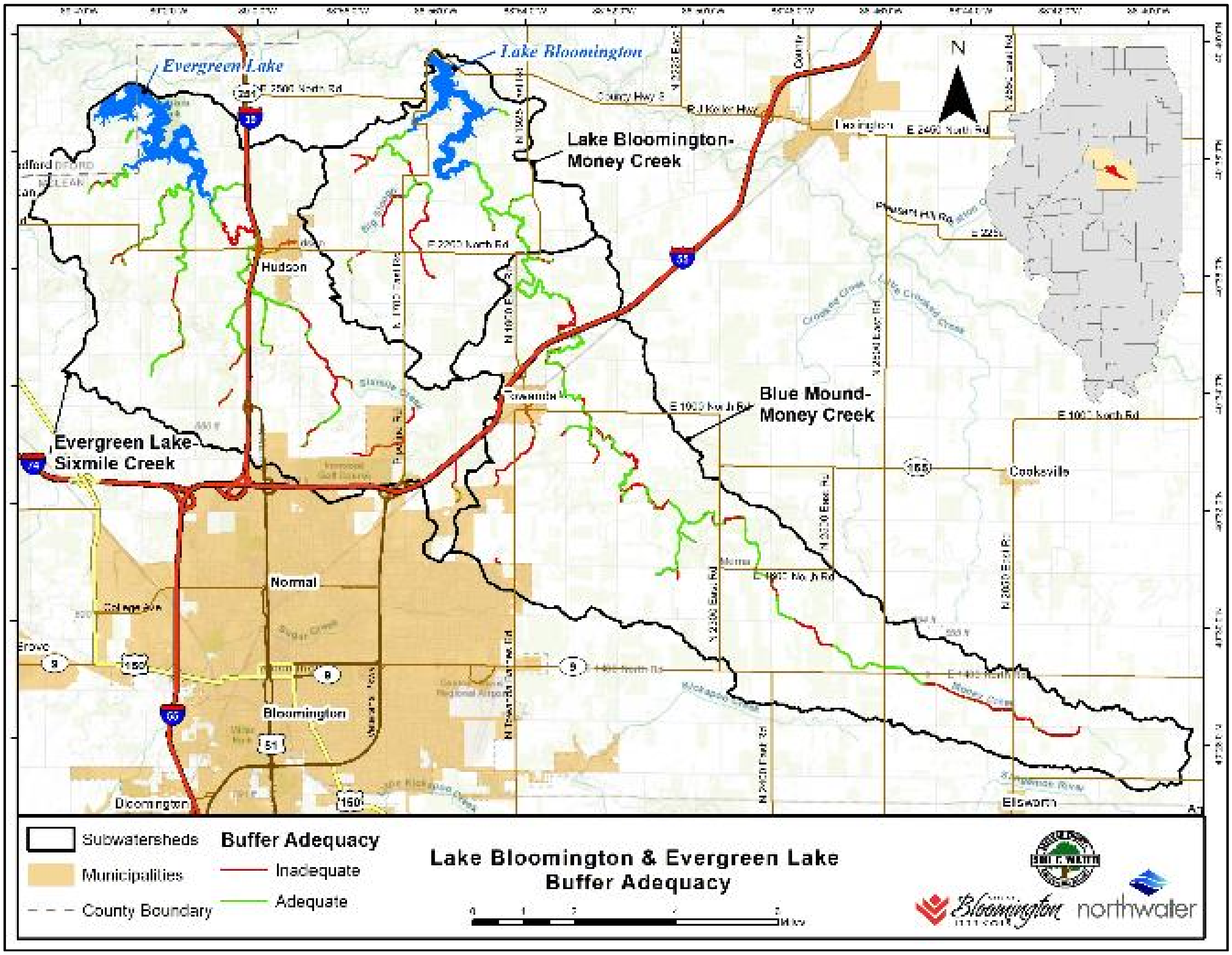


Figure 31 – Stream Buffers

Lake Buffers

Lakes are generally well buffered and contain large, contiguous riparian areas. Analysis shows that for both lakes combined, 84% (32 mi) of shoreline is adequately buffered (Table 48). Forested areas account for 78%, grassland 7% and urban open space 6% (Table 49).

Evergreen Lake has the greatest percentage of well-buffered shoreline with 91% while LB has 79%, or 13 miles. In LB, most of the inadequate buffer zones are at the northern end of the lake.

Table 48 – Lake Buffer Adequacy

Lake Name	Total (ft)	Total (mi)	Inadequate (mi)	Adequate (mi)	Inadequate (%)	Adequate (%)
Lake Bloomington	91,000	17	3.6	13	21%	79%
Evergreen Lake	108,156	21	1.8	19	9%	91%
Grand Total	**199,156**	**38**	**5.4**	**32**	**14%**	**86%**

Table 49 – Lake Buffer Landuse Categories

Buffer Type	Total Miles	% of Shoreline Length
Forest	30	78%
Grasslands	2.6	7%
Urban Open Space	2.4	6%
Parks & Recreation	1.3	3%
Roads	0.91	2%
Rural Residential	0.62	2%
Campgrounds	0.09	0.2%
Open Water Stream	0.08	0.2%
Utility	0.04	0.1%
Wetland	0.04	0.1%
Commercial	0.01	0.03%
Grand Total	**38**	**100%**

3.13.5 Wetlands


Restored Wetland

Wetlands provide numerous valuable functions that are necessary for the health of a watershed. They play a critical role in protecting and moderating water quality through a combination of filtering and stabilizing processes. Wetlands remove pollutants through absorption, assimilation, and denitrification. This effective treatment of nutrients and physical stabilization leads to an increase in overall water quality. In addition, wetlands can increase stormwater detention capacity and attenuation, and moderate high flows. These benefits help to reduce flooding and erosion. Wetlands also facilitate groundwater recharge by allowing water to seep slowly into the ground, thus replenishing underlying aquifers. Groundwater recharge is also valuable to wildlife and stream biota during the summer months when precipitation is low, and the base flow of rivers/streams draw on the surrounding groundwater table.

Excluding stream, ponds, and lakes, the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) indicates there is a total of 255 acres (0.4%) of wetlands within the combined LB and EL watershed. These are categorized as freshwater emergent and forested shrub wetlands. Results are shown in Table 50 and Figure 32.

Considering the outdated nature of the NWI dataset, an analysis of open water and forested wetlands was performed using 2017 and 2019 aerial imagery to better understand their current extent. Results show only 163 acres (0.2%) of wetlands in the combined LB and EL watershed; 45 of the 163 acres can be considered emergent or open water. Comparing to NWI data indicates up to 54 acres of previously delineated wetlands in the LB watershed and 38 acres in EL may have been drained or modified; therefore, opportunities exist to restore these areas.

Table 50 – Wetlands

Subwatershed	HUC12 Code	Current Wetlands			NWI Wetlands		
		Area (acres)	% Total	% Difference From NWI	Emergent (acres)	Forested/Shrub (acres)	Total (acres)
Blue Mound-Money Creek	071300040201	79	48%	14%	24	67	91
Lake Bloomington-Money Creek	071300040202	58	36%	53%	21	79	100
Evergreen Lake-Sixmile Creek	071300040502	26	16%	84%	47	17	64
Grand Total		**163**	**100%**	**44%**	**92**	**163**	**255**

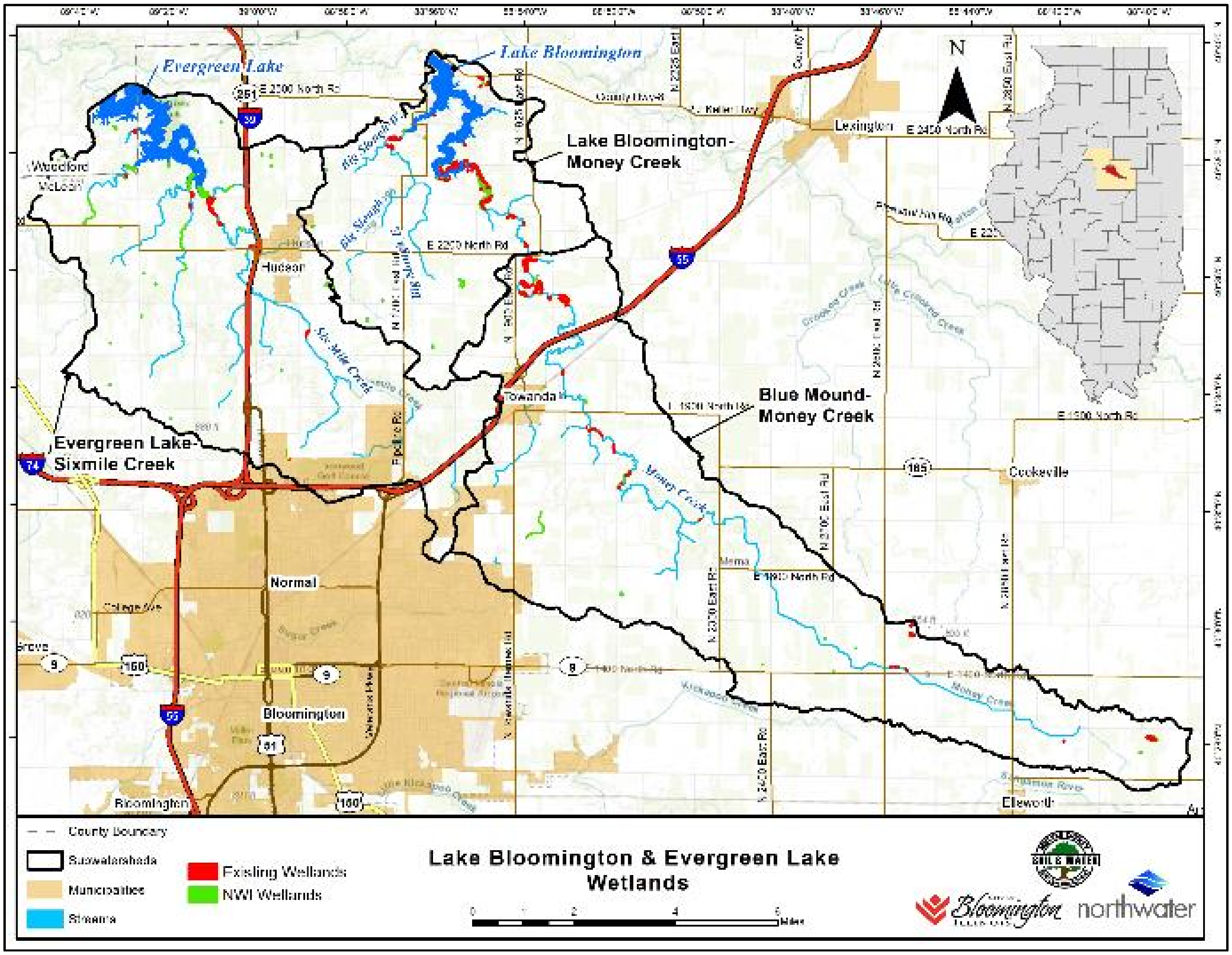


Figure 32 – Wetlands

3.13.6 Floodplain

A review and analysis of the most recent Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps (DFIRM) indicates there are 4,302 acres of 100-year floodplain within the combined LB and EL watershed, or 6% of the total area (Table 51, Figure 33). The LB watershed contains more 100-year floodplain than EL. Flood hazard areas on the Flood Insurance Rate Map are identified as a Special Flood Hazard Areas (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year but are broken up into different zones based on severity of flood hazard risk. The 1-percent annual chance flood is also referred to as the base flood, or 100-year flood (FEMA 2018). The Blue Mound-Money Creek subwatershed contains the greatest area in the 100-year floodplain or 1,660 acres and Lake Bloomington-Money Creek the highest percentage or 8%.

Table 51 – 100-Year Floodplain

Subwatershed	HUC12 Code	Area (ac)	Percent Area of Subwatershed
Blue Mound-Money Creek	71300040201	1,660	5%
Lake Bloomington-Money Creek	71300040202	1,004	8%
Evergreen Lake-Sixmile Creek	71300040502	1,638	6%
Grand Total		**4,302**	**6%**

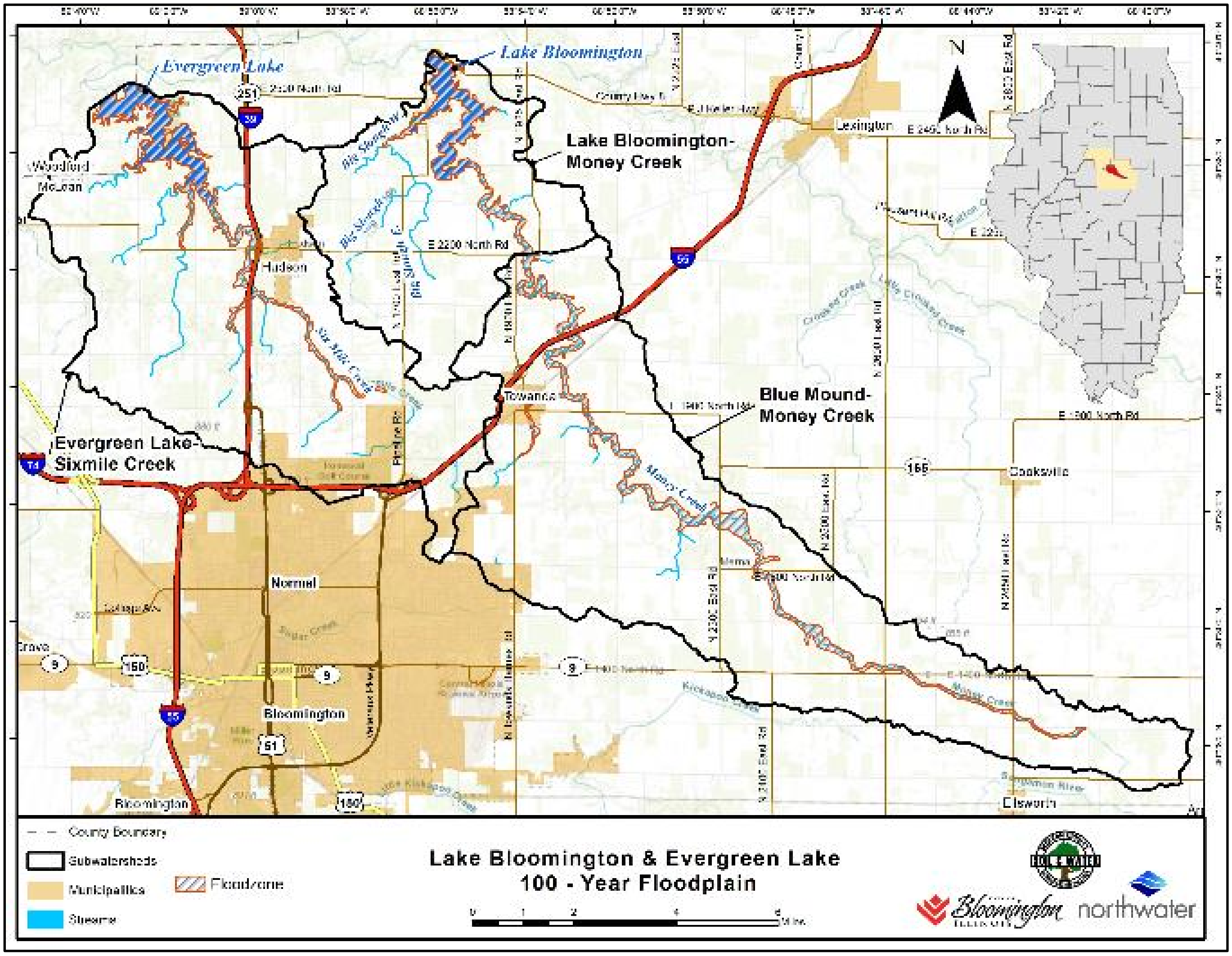


Figure 33 – 100-Year Floodplain

3.14 Lake Shoreline & Streambank Erosion

Lake shoreline and streambank erosion is a source of sediment and nutrients. An evaluation of the extent and severity of these sources was performed to quantify sediment, nitrogen and phosphorus loading. Streambank erosion was evaluated through observations during a windshield survey and 2005 and 2006 assessment reports prepared by Stream Technical Resource Evaluation And Management Service (STREAMS). The 2005 and 2006 assessments were performed on almost all tributaries draining to LB and EL. For information collected during the windshield survey, data was captured with a GPS receiver at each road crossing to estimate average eroding bank height and annual recession rates. Results were extrapolated upstream and downstream from each crossing to the next observation point. Data was transferred into GIS to create a map layer representing supplemental estimates of annual soil loss from streambank erosion. This data was combined with the 2005 and 2006 assessment and corrected for recent streambank stabilization projects to generate estimates for all stream throughout the watershed.

For shorelines, both LB and EL were assessed in the spring of 2020 by boat. Erosion rates and bank heights were estimated and marked with a GPS receiver and transferred into a series of line files used to quantify soil loss and nutrient loading.

Annual sediment, nitrogen and phosphorus loads were calculated using equations below and adjusted to account for the trapping efficiency of BMPs. Eroding bank height, bank length and lateral recession rates (LRR) estimated in the field were transferred to GIS. Lake bank soil nutrient concentrations were estimated from soil cores obtained from representative areas within each lake. Soil nutrient concentrations for streambanks were derived from measured values from similar watersheds. The following equations were used to estimate total annual loads:

$$\boldsymbol{Sy = L \times LRR \times H \times yd \times SDR \times STF}$$

Sy – sediment yield in tons/yr
L – eroding bank length in feet
LRR – estimated lateral recession rate in feet per year
H – eroding bank height in feet
γd – Soil dry weight density (tons/ft^3)
SDR – Sediment Delivery Rate (1); not used for lake banks
STF – Sediment Transport Factor (0.24-0.75); not used for lake banks

$$\boldsymbol{TN = \left[Sy \times \frac{2000\ lbs}{1.0\ ton}\right] \times\ Nc\ x\ Cf}$$

TN – Total nitrogen load from lake banks and streambanks in lbs/yr
Sy – Sediment yield in tons/yr
Nc – Nitrogen concentration in soil (0.000643 lbs/lb)
Cf – Correction factor, 1.0

$$\boldsymbol{TP = \left[Sy \times \frac{2000\ lbs}{1.0\ ton}\right] \times\ Pc\ x\ Cf}$$

TP – Total nitrogen load from lake banks and streambanks in lbs/yr
Sy – Sediment yield in tons/yr
Pc – Phosphorus concentration in soil (0.00304 lbs/lb)
Cf – Correction factor, 1.0

3.14.1 Streambank Erosion

Streambank erosion is a natural process but the rate at which it occurs is often increased by anthropogenic (human) activities such as urbanization and agriculture. Bank erosion is typically a result of streambed incision and channel widening. Field observations indicate that the severity of streambank erosion is variable but overall, low. Consistent with the 2005 and 2006 STREAMS reports, most of the bank erosion in LB is generated from Money Creek (now 88%). Unlike Sixmile Creek above EL, Money Creek above LB does not show significant signs of downcutting. Therefore, the primary source of streambank erosion comes from lateral bank migration alone. Sediment delivery to LB from streambank erosion is significantly less than that found in EL where over 90% of the sediment is generated within four miles of the lake and channel incision is the primary factor (STREAMS, 2005). In the last decade and a half, several streams have been converted to subsurface drainage. Work by the City and SWCD to stabilize more severely eroding stream segments in EL have led to lower overall sediment and nutrient loading.

Results indicate that bank erosion now is responsible for delivering 1,828 tons of sediment, 2,350 lbs of nitrogen, and 1,111 lbs of phosphorus annually to EL. This represents a 14% reduction in sediment delivery since the assessment performed in 2005. In the LB watershed, streambank erosion is responsible for 1,288 tons of sediment, 1,656 lbs of nitrogen, and 783 lbs of phosphorus. This only slightly higher than the 2006 estimate of 1,260 tons. The Evergreen Lake – Sixmile Creek subwatershed has the highest total streambank sediment and nutrient load despite having less stream miles than the Lake Bloomington-Money Creek subwatershed. Fifty-six percent of the total sediment load is from within EL and yield (lbs/ft) is also highest in this subwatershed.

Table 52 – Streambank Erosion & Loading

Stream	Stream Miles	Sediment Load (tons/yr)	Sediment Load (lbs/ft)	Nitrogen Load (lbs/yr)	Phosphorus load (lbs/yr)
Lake Bloomington-Money Creek					
Money Creek	3.4	129	14	166	78
Big Slough East	3.8	80	7.9	102	48
Big Slough West	1.7	11	2.4	14	6.7
Big Slough 2	1.8	10	2.2	13	6.3
Unnamed Tributaries	1.8	26	5.3	33	16
Subtotal	**12.6**	**256**	**6.4 (avg)**	**329**	**155**
Blue Mound-Money Creek					
Money Creek	25	1,009	15.3	1,297	614
Unnamed Tributaries	7.7	23	1.1	30	14
Subtotal	**32.7**	**1,032**	**8.2 (avg)**	**1,327**	**628**
Evergreen Lake-Sixmile Creek					
Sixmile Creek	9.3	513	21	660	312
Unnamed Tributaries	21	1,315	24	1,691	799
Subtotal	**30.1**	**1,828**	**22 (avg)**	**2,350**	**1,111**
Grand Total	**75**	**3,115**	**93**	**4,006**	**1,894**

3.14.2 Lake Shoreline Erosion

A total of 91,000 feet, or 17 miles of shoreline, was evaluated in LB and 108,156 feet, or 20.5 miles in EL. Total annual sediment from both lakes combined is 1,315 tons. Annual nitrogen loading is 1,010 lbs and phosphorus is 683 lbs (Table 53). Overall, shoreline erosion is low and most of the total sediment and nutrient load is originating from a very small percentage of banks (Figure 34 and Figure 35).

Table 53 – Lake Shoreline Erosion & Pollutant Loading

Lake Name	Bank Length (ft)	Average Eroding Bank Height (ft)	Average LRR (ft/yr)	Sediment Load (tons/yr)	Nitrogen Load (lbs/yr)	Phosphorus Load (lbs/yr)
Lake Bloomington	91,000	1.1	0.07	437	308	227
Evergreen Lake	108,156	1.5	0.1	878	702	456
Total	**199,156**	**1.3 (avg)**	**0.09 (avg)**	**1,315**	**1,010**	**683**

Lake Bloomington

The vast majority of shoreline in LB is stabilized and eroding at very low rates. Seawalls and rock stabilization are common. Only 4% of banks, or roughly 3,500 feet, are eroding at excessive rates or considered “very severe.” Annual sediment loading from lake bank erosion is estimated to be 437 tons, nitrogen 308 lbs, and phosphorus 227 lbs. Average eroding bank height is 1.1 ft and average LRR is 0.07 ft/yr or low.

Evergreen Lake

Most of EL shorelines are eroding at low rates with low eroding bank heights. Only 5% of banks, or roughly 5,500 feet, are eroding at excessive rates or considered “very severe.” Bank stabilization measures and natural and stable banks are common. Annual sediment loading from lake bank erosion is estimated to be 878 tons, nitrogen 702 lbs, and phosphorus 456 lbs. Average eroding bank height is 1.1 ft and average LRR is 0.1 ft/yr or low-moderate.

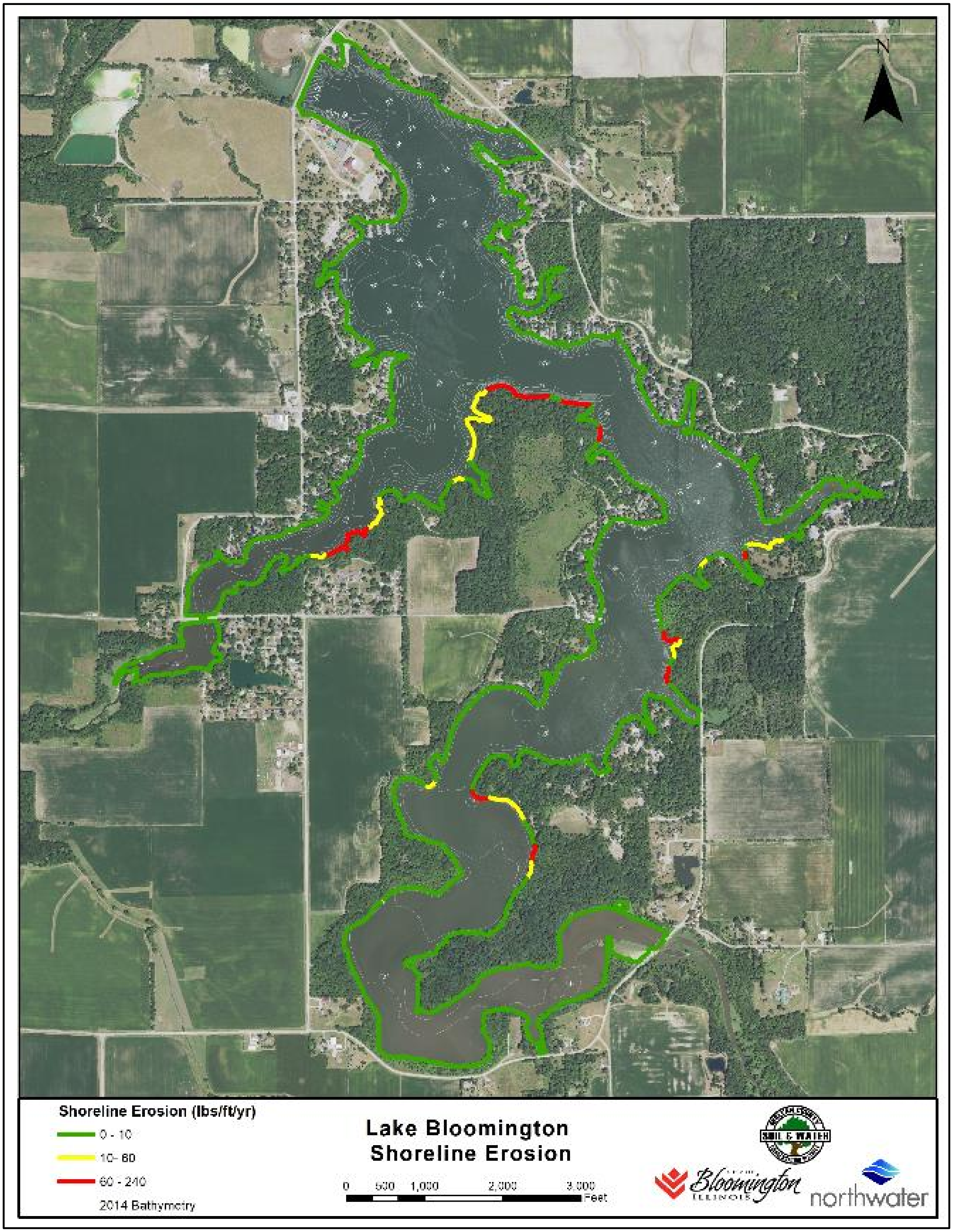


Figure 34 - Lake Bloomington Shoreline Erosion

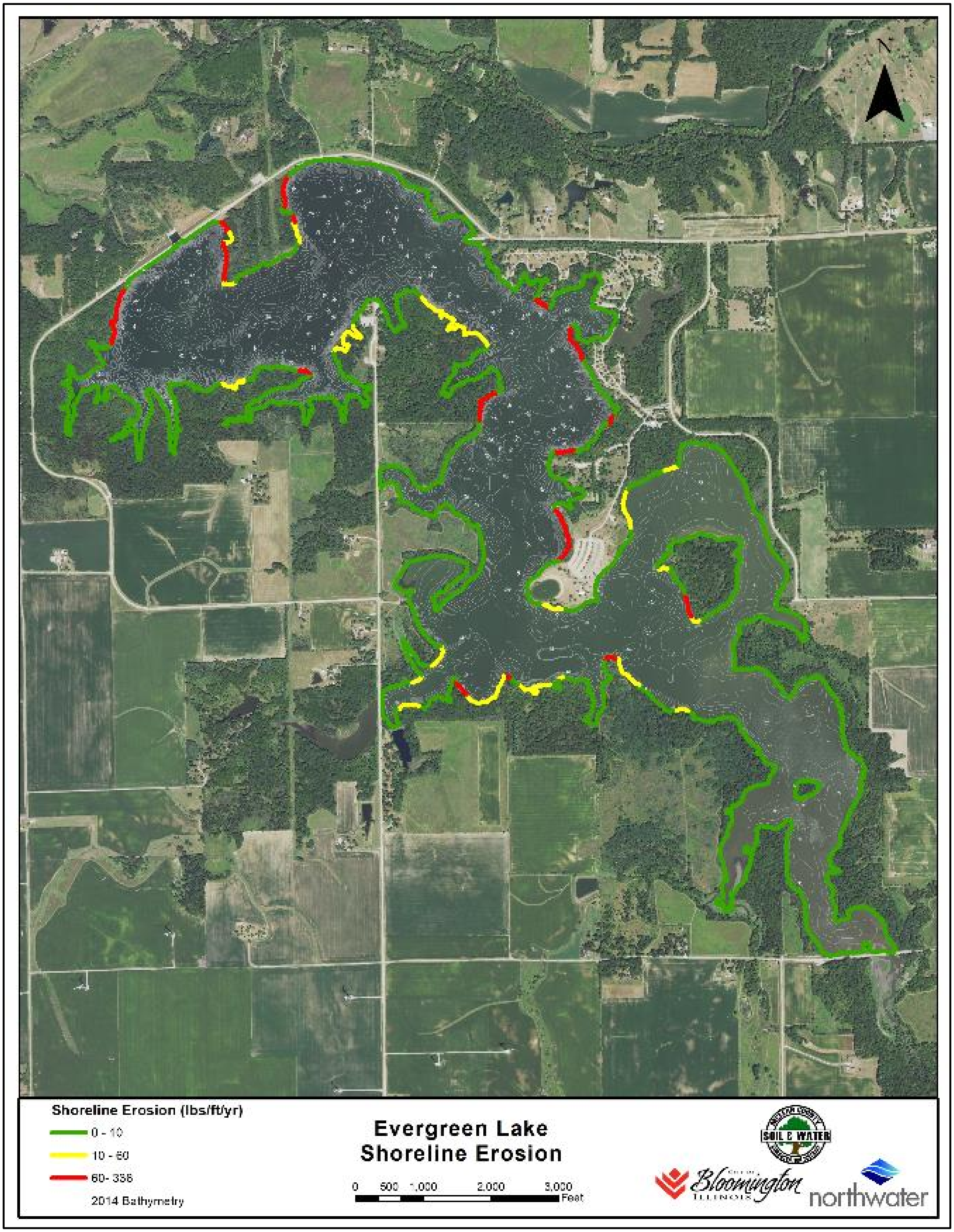


Figure 35 - Evergreen Lake Shoreline Erosion

3.15 Gully Erosion

Gully erosion is the removal of soil along drainage lines by surface water runoff. Once started, gullies will continue to move by headward erosion or by slumping of the side walls unless steps are taken to stabilize the disturbance. Gully erosion occurs when water is channeled across unprotected land and washes away the soil along the drainage lines. Under natural conditions, run-off is moderated by vegetation which generally holds the soil together, protecting it from excessive run-off and direct rainfall. To repair gullies, the object is to divert and modify the flow of water moving into and through the gully so that scouring is reduced, sediment accumulates, and vegetation can establish. Stabilizing the gully head is important to prevent damaging water flow and headward erosion. In most cases, gullies can be prevented by good land management practices (Water Resources Solutions, 2014).

Gully erosion was evaluated during a watershed windshield survey and estimated using GIS. Results presented in this section represents both ephemeral (those that form each year) and permanent (those that receive intermittent streamflow and expand over time such as a forested ditch or channel). For those ephemeral gullies not visible from a road or observed during the windshield survey, GIS was used to estimate their location and extent. Gullies were delineated in GIS using aerial imagery and high-resolution elevation data, and a conservative average estimated width, depth, and years eroding were applied. For gullies observed in the field, dimensions were directly measured and transferred to GIS for analysis.

Total net erosion in tons/year and estimates of nitrogen and phosphorus loading were calculated using the equations below. A distance-based delivery ratio was applied to account for distance to a receiving waterbody. Sediment trapping efficiency was accounted for if the gully drained to a reservoir or other BMP. Soil nutrient concentrations were obtained from measured data in similar watersheds and STEPL. The following equations were applied to estimate gully erosion and nutrient yields:

$$\boldsymbol{Sy} = \left\{\frac{\boldsymbol{L} \times \boldsymbol{W} \times \boldsymbol{H}}{\boldsymbol{Y}} \times \boldsymbol{\gamma d}\right\} \boldsymbol{DPS}^{0.2069}$$

Sy – sediment yield in tons/yr
L – gully length in feet
W – gully width in feet
D -gully depth in feet
Y – years eroding
γd – Soil dry weight density (tons/ft^3)
DPS$^{0.2069}$- Distance to lake or perennial stream or waterbody in feet, delivery ratio

$$\boldsymbol{TN} = \left[\boldsymbol{Sy} \times \frac{\mathbf{2000}\ \boldsymbol{lbs}}{\mathbf{1.0}\ \boldsymbol{ton}}\right] \times \boldsymbol{Nc\ x\ Cf}$$

TN – Total nitrogen load from gully in lbs/yr
Sy – Sediment yield in tons/yr
Nc – Nitrogen concentration in soil (lbs/lb)
Cf – Correction factor, 1.0

$$\boldsymbol{TP} = \left[\boldsymbol{Sy} \times \frac{\mathbf{2000}\ \boldsymbol{lbs}}{\mathbf{1.0}\ \boldsymbol{ton}}\right] \times \boldsymbol{Pc\ x\ Cf}$$

TP – Total nitrogen load from gully in lbs/yr
Sy – Sediment yield in tons/yr
Pc – Phosphorus concentration in soil (lbs/lb)
Cf – Correction factor, 1.0

Gully Erosion

Gully erosion in the watersheds occurs primarily at ephemeral water courses adjacent to major perennial drainage ways. It is also evident on crop ground especially on long slopes where subsurface drainage is occurring. Conservation practices observed in the watershed, such as WASCBs or grassed waterways and other grade control structures, have been implemented to address this specific type of erosion.

Results indicate that there are 68 miles of eroding gullies, with an average depth of 0.8 ft and an average width of 1.3 ft (Table 54 and Figure 36). Gullies are responsible for the annual delivery of 3,520 tons of sediment, 1,914 lbs of phosphorus and 7,037 lbs of nitrogen. Broken down by lake, annual sediment delivery is 2,387 tons sediment, 1,293 lbs phosphorus, 4,765 lbs of nitrogen for Bloomington and 1,133 tons sediment, 621 lbs phosphorus, and 2,272 nitrogen for Evergreen. Approximately 68% of the entire sediment load is within the LB watershed.

The highest sediment and nutrient loads from gully erosion are originating from the Blue Mound-Money Creek subwatershed. This subwatershed accounts for 53% of the sediment and phosphorus and 54% of the gully nitrogen load. The Lake Bloomington-Money Creek subwatershed has the lowest total length and least sediment and nutrient loading of all subwatersheds.

Table 54 – Gully Erosion & Pollutant Loading

Subwatershed	HUC12 Code	Gully Length (ft)	Gully Length (mi)	Average Gully Width (ft)	Average Gully Depth (ft)	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (tons/yr)
Blue Mound-Money Creek	71300040201	157,609	30	1.1	0.6	3,827	1,016	1,877
Lake Bloomington-Money Creek	71300040202	58,546	11	2	1.4	938	277	510
Evergreen Lake-Sixmile Creek	71300040502	144,717	27	1.1	0.7	2,272	621	1,133
Grand Total		**360,872**	**68**	**1.3 (avg)**	**0.8 (avg)**	**7,037**	**1,914**	**3,520**

An analysis by landuse indicates that 92% of the total nitrogen, 90% of the total phosphorus and 90% of the total sediment load from gully erosion is originating from crop ground. Grasslands are responsible for 5% and forested areas 3% of the total sediment load.

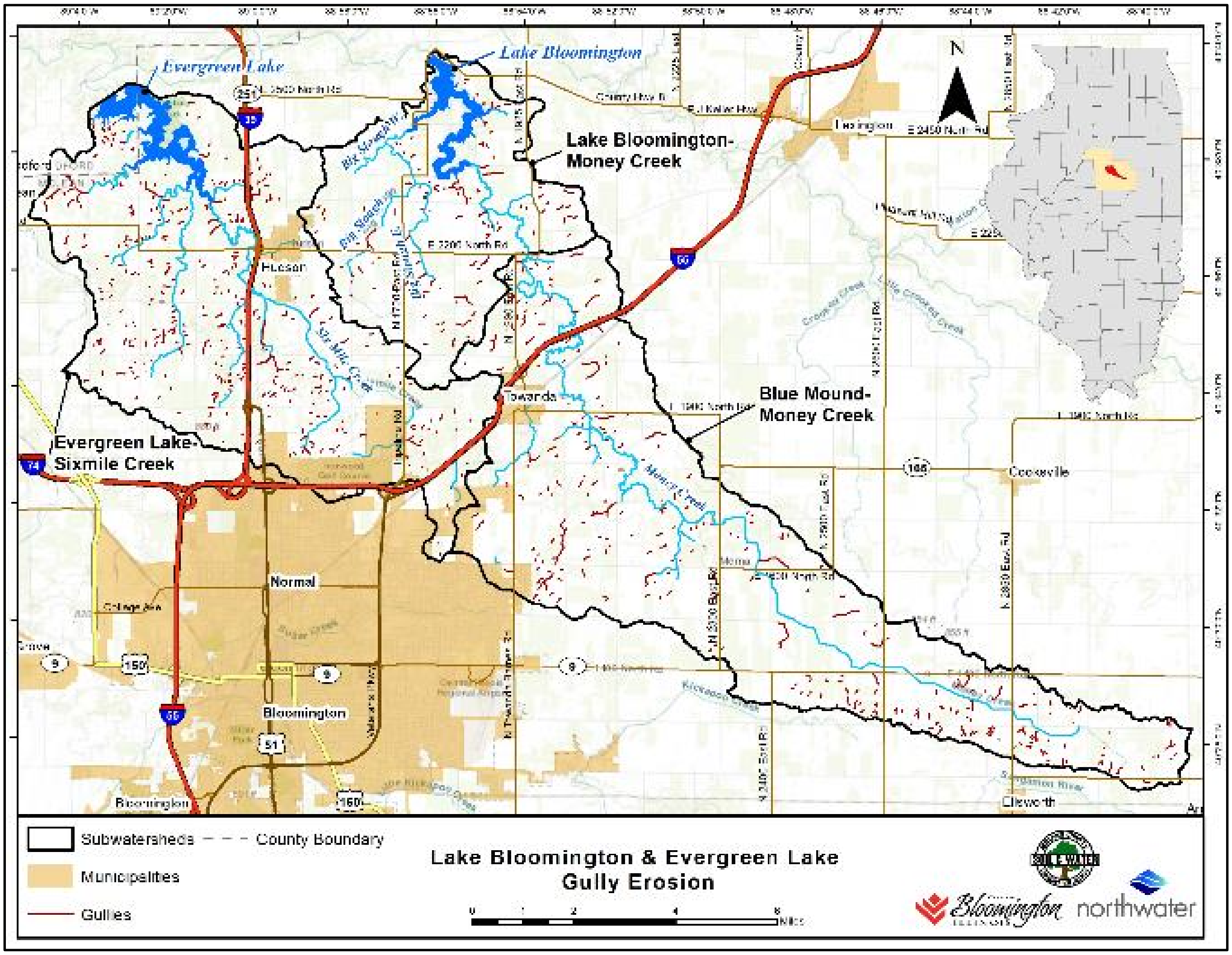


Figure 36 – Gully Erosion

3.16 Sheet & Rill Erosion

Through rain and shallow water flows, sheet erosion removes the thin layer of topsoil. When sheet flows begin to concentrate on the surface through increased water flow and velocity, rill erosion occurs. Rill erosion scours the land even more, carrying off rich nutrients and adding to the turbidity and sedimentation of waterways. The extent of sheet and rill erosion in the watershed was calculated using the Universal Soil Loss Equation (USLE), which is widely used to estimate rates caused by rainfall and associated overland flow. This method relies on soil properties, precipitation, slope, cover types and conservation practices (if applicable). A map-based USLE model was developed for all cropped soils within the watershed and used to quantify sediment loading from agricultural ground and identify locations with the potential for excessive erosion.

For both lakes combined, analysis shows sheet and rill erosion from cropland is responsible for the annual delivery of 26,801 tons of sediment and an average 0.48 tons/ac/yr delivered to the lakes (Table 55).

Modeled results indicate that the majority of sheet and rill erosion is originating from mulch-tilled fields and from tilled HEL soils (Section 5) and those fields closest to a stream or other waterbody.

Lake Bloomington receives the majority of the total watershed sediment load from crop ground, or 63%, but yields less than EL, or 0.47 tons/ac versus 0.51 tons/ac. The Blue Mound-Money Creek subwatershed contributes the highest total amount of sediment from sheet and rill erosion (11,912 tons/yr), while Lake Bloomington-Money Creek contributes the least, or 4,931 tons/yr. Tillage methods that, on average, deliver greater than 1 ton/ac/yr represent 4% of all cropland and are responsible for the annual delivery of 11% of the entire cropland sediment load. Although conventional tilled fields yield the greatest per acre, mulch-till is responsible for 58% of the total delivered sediment in both watersheds combined (Table 56), primarily due to higher overall acreage.

Table 55 – Sheet & Rill Erosion Loading

Subwatershed	HUC12 Code	Cropland Area (acres)	Sediment Load (tons/yr)	Sediment Load (tons/ac/yr)
Blue Mound-Money Creek	71300040201	26,213	11,912	0.45
Lake Bloomington-Money Creek	71300040202	9,913	4,931	0.50
Evergreen Lake-Sixmile Creek	71300040502	19,463	9,958	0.51
Grand Total		**55,590**	**26,802**	**0.48**

Table 56 – Sheet & Rill Erosion Loading by Tillage Type

Tillage Type	Total Area (ac)	% Cropland area (acres)	Sediment Load (tons/yr)	Sediment Load (tons/ac/yr)	% of Total Sediment Load from Sheet & Rill Erosion
Conventional	3,781	7%	3,375	0.89	13%
Mulch-Till	30,706	55%	15,453	0.50	58%
Reduced-Till	7,982	14%	4,701	0.59	18%
Strip-Till	701	1%	171	0.24	1%
No-Till	11,138	20%	2,980	0.27	11%
Cover Crop	1,182	2%	119	0.10	0.4%
Hay	101	0%	3	0.03	0.01%
Grand Total	**55,590**	**100%**	**26,802**	**0.38 (avg)**	**100%**

3.17 Lake Sedimentation

Lake sediment sampling and analysis was performed to determine the feasibility of sediment removal and installation of in-lake structures at major tributaries entering LB and EL. In the summer of 2020, Northwater Consulting, Berrini & Associates, LLC, and City staff collected sediment core samples and completed a series of water and sediment depth measurements throughout the shallow upper end of each lake. This section of the plan includes:

1. A summary of sediment survey results that include estimates of sediment volume, lake cross-sections and the loss of water depth in each lake.
2. An analysis and interpretation of sediment chemistry.
3. A summary of potential dredging and in-lake sediment and nutrient control structure options, along with recommendations and estimates of probable cost.

3.17.1 Sediment & Water Depth

Existing water depth and sediment measurements were completed in the upper ends of LB and EL in July 2020 (Figure 37). Existing water depth and total depth measurements were obtained by determining the depth to the top of the soft sediment using a one-inch diameter aluminum range pole with a 6" diameter disk attached to the end. A separate range pole was then pushed through the soft sediment until the underlying hard bottom was reached to measure the total original lake depth and to determine the thickness of sediment. Both measuring poles were marked with 0.1 ft and 1.0 ft gradation markings for field accuracy.

Measurements were obtained along designated transect lines crossing each lake, and the locations of each measured point were then recorded using a hand-held Trimble GPS receiver with sub-meter accuracy. The data was processed and then plotted as cross-sections so that a profile view of the existing sediment and the original lake bottom could be developed. Grid maps depicting sediment thickness were created by extrapolating measured points (Figure 38 and Figure 39). The average end-area-method was applied to each of the cross sections to calculate quantity of accumulated sediment, the remaining water volume, and estimated percent volume loss of each lake segment within the study area.

In addition, a total of 3 sediment core samples were obtained from each lake and analyzed for various physical and chemical characteristics such as particle size, total solids, percent solids, organic content, ammonia nitrogen, total metals, Polychlorinated Biphenyls (PCBs), pesticides and settleability. Additional discussion is provided below, and detailed results are presented in Appendix A.

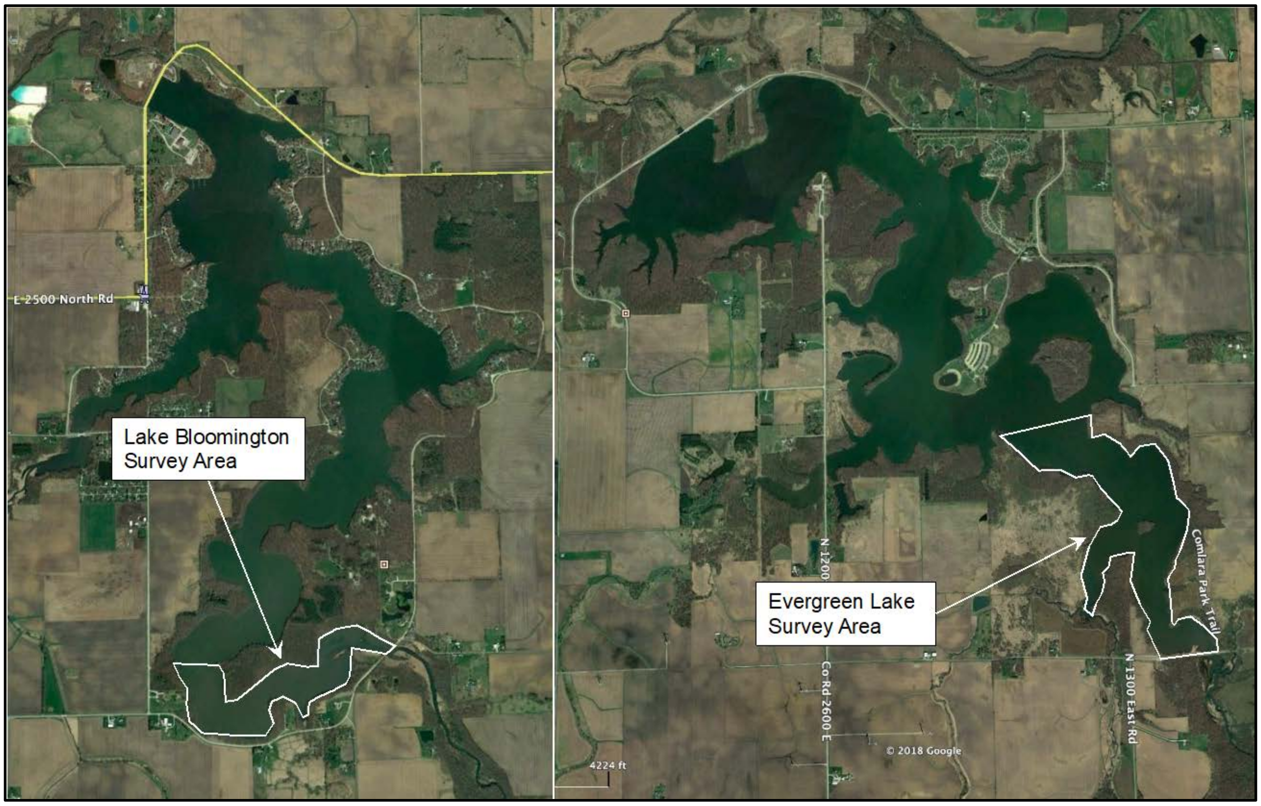


Figure 37 - Sediment Survey Study Area

Results are presented in Table 57, which indicate that approximately 93,060 cubic yards of sediment has been deposited within the upper end of LB and approximately 307,462 cubic yards within the upper end of EL. These sediment volumes represent an approximate 36% and 29 % water volume loss respectively within the surveyed areas.

Table 57 - Sediment Survey Volume Summary

Transect	Original (CY)	Sediment (CY)	Percent Volume Loss
		Lake Bloomington	
BG	3,357	1,216	36%
BF	17,725	6,841	39%
BE	37,578	15,995	43%
BD	37,651	15,742	42%
BC	33,462	12,056	36%
BB	70,317	21,984	31%
BA	72,902	19,226	26%
Total	**272,992**	**93,060**	**36%**
		Evergreen Lake	
EJ	4,294	1,988	46%
EI	17,174	8,435	49%
EH	26,596	10,903	41%
EG	70,048	22,299	32%

Transect	Original (CY)	Sediment (CY)	Percent Volume Loss
EF	147,439	42,140	29%
EE	220,860	51,601	23%
EC	258,594	48,323	19%
EB	242,278	34,704	14%
EA	382,818	44,172	12%
EM	6,488	1,881	29%
EL	41,432	14,768	36%
EK	55,979	18,301	33%
ED	44,771	7,947	18%
Total	**1,518,772**	**307,462**	**29%**

Lake Bloomington

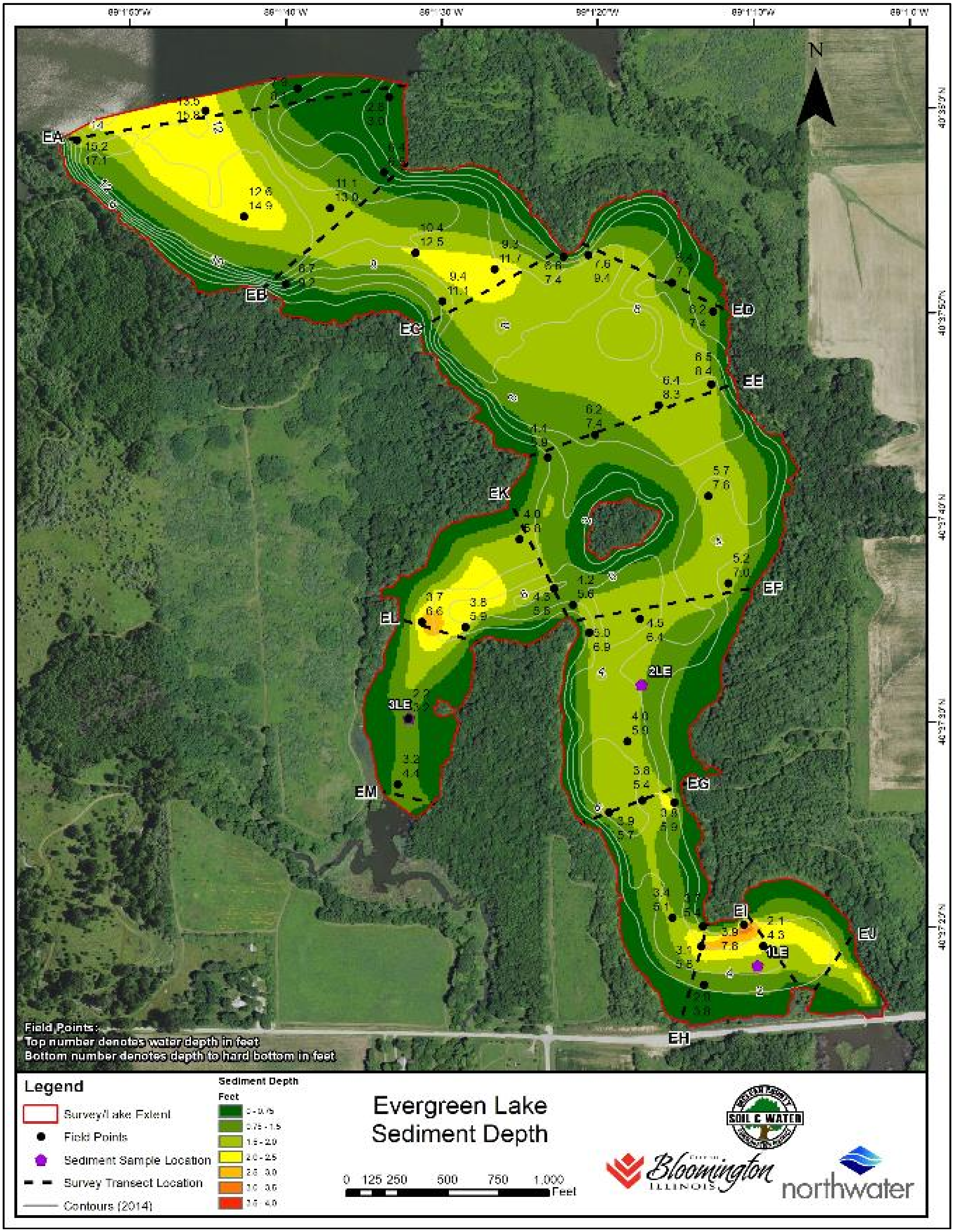


Figure 38 - Evergreen Lake Sediment Depth

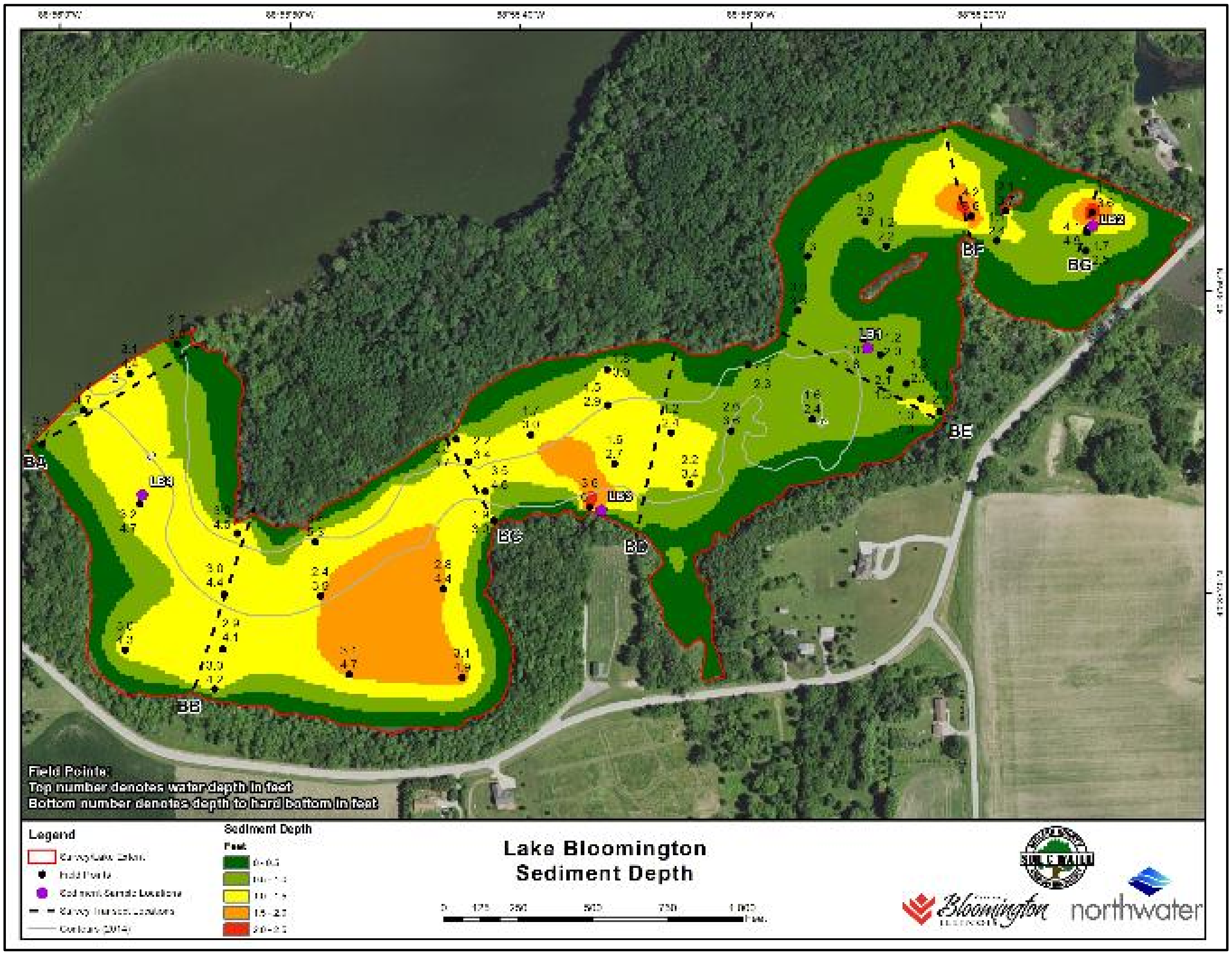


Figure 39 - Lake Bloomington Sediment Depth

Select cross section views of each survey transect are provided for reference (Figure 40 and Figure 41). All cross-sections are provided in Appendix A. The total volume loss for LB ranged from 36% - 43% for the furthest upstream area from the road bridge to Transect BC. Existing water depths were generally shallow and ranged from 1 - 4 ft with sediment deposition ranging from 1 - 2 ft and average thickness being closer to 1 ft. Although BA was the final transect, an additional measurement was obtained approximately 1,800 feet downstream (north) near the midpoint of both shorelines and found that the water depth was 5.7 ft with a hard underlying lake bottom depth of 7.4 and 1.7 ft of sediment.

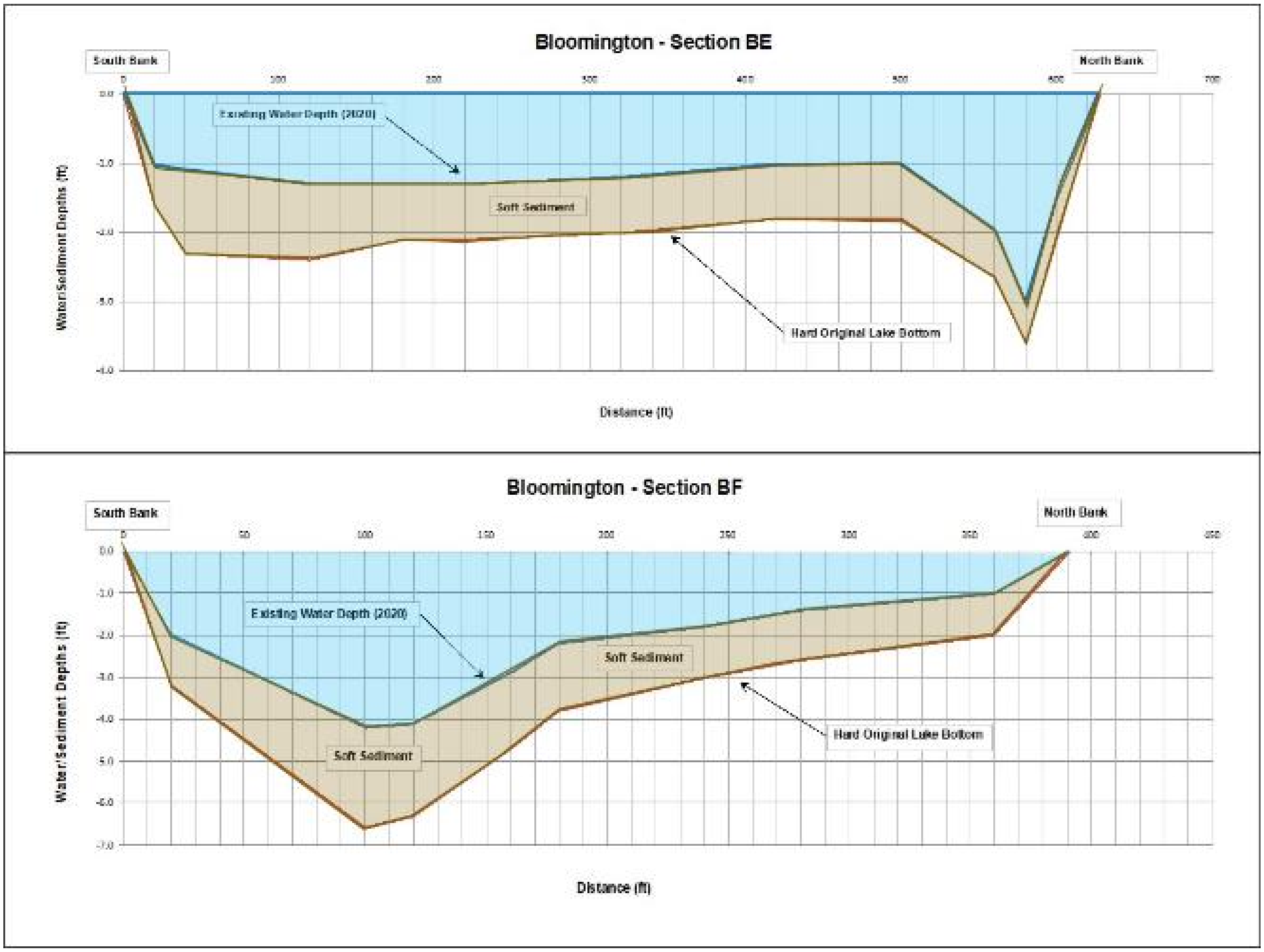


Figure 40 - Lake Bloomington Cross-Section - BE & BF

The total estimated volume loss for EL ranged from 41% - 49% between the Inlet and Transect EH and rapidly decreased to 32% between Transects EH and EG and 29% between Transects EG and EF. The volume losses within the remaining survey area from Transect EF to EA ranged from 23% - 12%. The southwest cove inlet included volumes losses ranging from 29% - 36% from the inlet to Transect EK. Existing water depths throughout the surveyed area generally ranged from 2 - 4 ft throughout the upper end of the lake to the south of Transects EF and EK. Water depths increased to the north of Transect EE and ranged from 6 ft to a maximum depth of 15 ft at Transect EA. Sediment deposition ranged from 1 - 3 ft upstream (south) of Transect EE and from 1 - 2 ft in the deeper water north towards Transect EA.

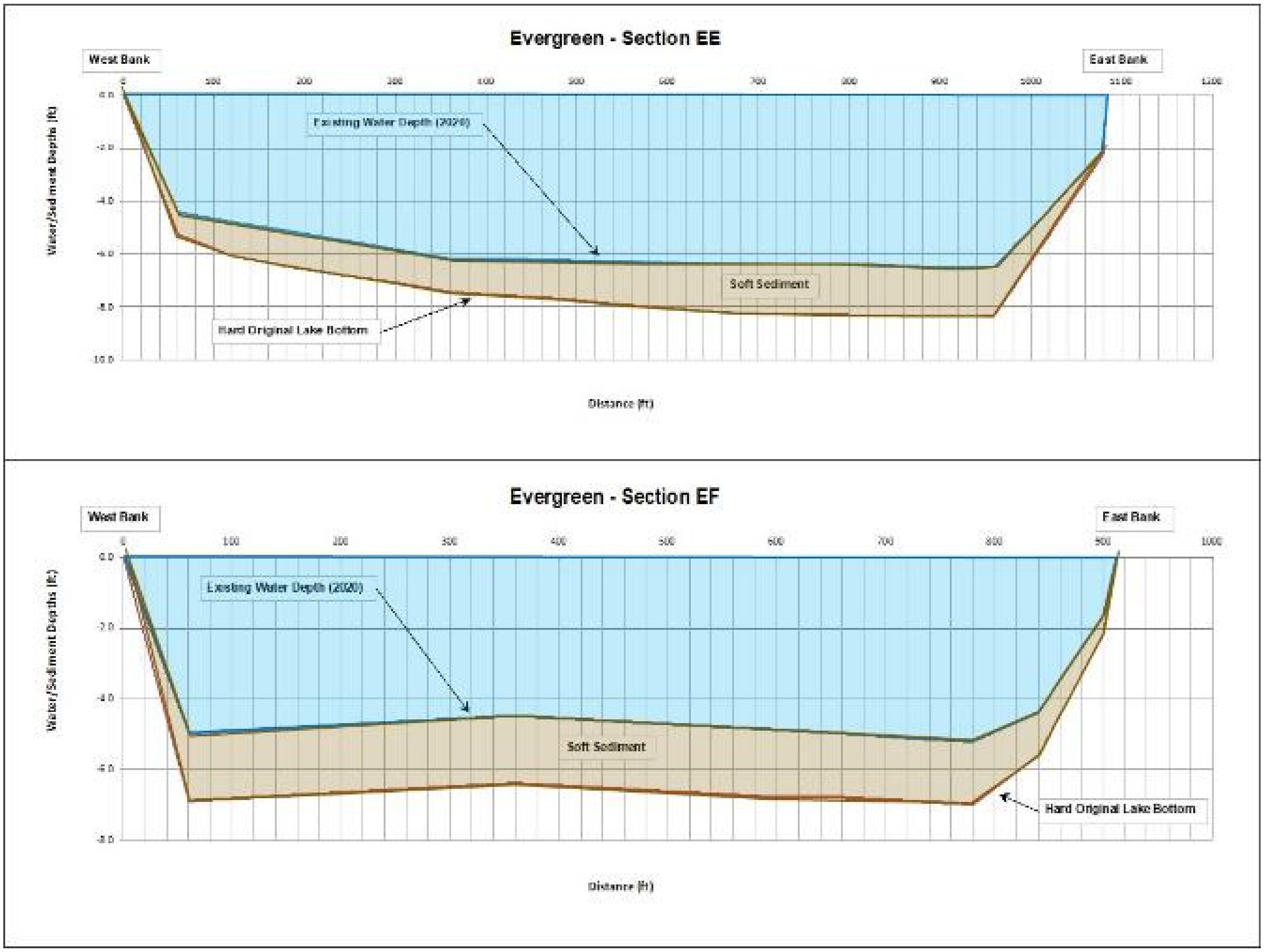


Figure 41 - Evergreen Lake Cross-Section - EE & EF

3.17.2 Lake Sediment Chemistry

Sediment core samples were obtained by City staff using a Wildco Hand Corer with a 20" sampling tube from three representative locations distributed throughout the upper end of each lake. This was done to evaluate chemical and physical properties of the in-situ sediment for future permitting and design considerations. A fourth core sample was obtained from LB because one core (LB2) located near the road bridge inlet point contained mostly gravelly material, likely deposited during higher flow storm events.

The sediment core analysis included: particle size to #230 sieve, total solids (%), total organic content (%), Polychlorinated Biphenyls (PCBs), Pesticides and Total Metals analyzed as a solid in mg/kg. In addition to the physical and chemical characterization described above, a 4-hour supernatant test for lead, zinc, ammonia-nitrogen, total suspended solids (TSS) and total volatile solids (TVS) and a 24-hour supernatant test for TSS and ammonia-nitrogen was completed for future permitting considerations in the event hydraulic dredging is executed. Concentrations of chemical parameters can be classified as low to normal based on the Illinois EPA Classification of Lake Sediment (Appendix A). The results indicate that no restrictions are anticipated for the removal and placement of the sediment on upland locations. PCBs and pesticides were all below the laboratory detection limits, and all metals were well below "Illinois Pollution Control Board (IPCB) TACO Tier 1 Soil Remediation Objectives for Residential Properties" and "Illinois EPA Maximum Allowable Concentrations for Clean Fill". The complete laboratory report is included in Appendix A.

The concentration of TSS after 24 hours was evaluated to determine estimated retention time requirements for designing a facility to store and dewater dredged sediment. The results of this analysis showed that after 24 hours of settling, TSS concentration ranged from 11 mg/L - 29 mg/L. The Illinois EPA standard for effluent discharge is 15 mg/L. If faster settling times are required due to limited land area and available retention time, an environmentally safe polymer or flocculent can be added to ensure that clear effluent water can be achieved prior to discharge from a dewatering facility. In addition, ammonia-nitrogen concentrations observed from the 4-hour supernatant analysis ranged from 0.21 - 2.3 mg/L, which are below the regulated standard of 2.5 mg/L for effluent. Historical sediment data obtained from the EPA STORET database indicated that TP concentrations in the upper end of each lake ranged from 490 to 610 mg/kg, which falls within the normal range for Illinois lake sediment (Mitzelfelt, IEPA, 1996).

3.17.3 Lake Sedimentation Summary

The entire LB survey area from the inlet to Transect BA is very shallow and the estimated 93,060 CY of soft, phosphorus-rich sediment restricts access in some locations and likely becomes re-mobilized by boat propellers, wind waves and high flow conditions. However, it is important to note that the upper end of LB has a very gradual slope and the depth to hard underlying lake bottom only ranges from 3 - 5 ft.

Transect BA is the furthest downstream cross-section and has existing water depths that range from 2.5 - 3.5 ft and original hard lake bottom depths that range from 3 - 4.7 ft. Therefore, the soft sediment thickness at the deepest, most downstream portion of the survey ranged from 0.5 - 1.2 ft.

Evergreen Lake was observed to have the most significant relative impact from the lake Inlet point at the road bridge through Transect EE where approximately 172,316 cubic yards of sediment were observed in water depths that were less than 6 ft. Volume losses due to sediment deposition are greater in EL.

Removing accumulated sediment within the shallow upstream areas of both lakes is strongly recommended to increase water holding capacity, improve recreational access, and reduce internal nutrient recycling due to soft sediment re-mobilization in shallow areas. Targeted sediment removal would also increase the effectiveness, longevity, and trapping capability of any sediment and nutrient control basin project that may be implemented in the future. Furthermore, removal will increase lake water volume by approximately 19 million gallons for LB and 35 million gallons for EL.

Specific recommendations for management of sediment and other practices in the upper reaches of both lakes is provided in Section 6.

3.18 Point Source Pollution & Septic Systems

Point source pollution in the watershed comes from NPDES permitted dischargers. Septic systems, although typically considered to be a nonpoint source issue, exist in the watershed and may be contributing to nutrient loading in certain areas. Failing septic systems can leach wastewater into groundwater and surrounding waterways. Point source pollution is defined by the United States Environmental Protection Agency (USEPA) as “any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack” (Hill 1997). The NPDES, a provision of the Clean Water Act, prohibits point source discharge of pollutants into waters of the U.S. unless a permit is issued by the USEPA or a state or tribal government. Individual permits are specific to individual facilities (e.g., water or wastewater treatment facilities) and general permits are for a group of facilities in a geographical area. Permits describe the allowed discharge of pollutant concentrations (mg/L) and loads (lbs/day). Permitted discharges contribute only a small portion of annual point source pollution. This can be expected, as there are many more people dependent on septic systems.

3.18.1 NPDES Dischargers

The LB/EL watershed contains three facilities permitted to discharge. Two are located within EL: a HOA facility in Hudson and the Comlara Park facility on the lake. Only 1 facility is in the LB watershed: East Bay Camp and Retreat at the lake. Sediment and nutrient loading were calculated using permit data from the USEPA, the 2008 LB TMDL and from NPDES permit documents.

Permitted NPDES dischargers account for a total of 0.14 tons/yr sediment, 61 lbs/yr phosphorus, and 324 lbs/yr nitrogen (Table 58). The Evergreen Lake-Sixmile Creek subwatershed is the highest contributor of nitrogen (195 lbs/yr), phosphorous (42 lbs/yr) and sediment (0.11 tons/yr).

Table 58 – NPDES Facilities & Pollutant Loading

Subwatershed Name	Subwatershed Number	NPDES Permit Number	Facility Name	Nitrogen Load (lbs/yr)	Phosphorous Load (lbs/yr)	Sediment Load (tons/ yr)	Average Daily Flow (MGD)
Lake Bloomington-Money Creek	71300040202	IL0025666	East Bay Camp and Retreat	129	19	0.035	0.006
Lake Bloomington-Money Creek Subwatershed Total				*129*	*19*	*0.035*	*0.006*
Evergreen Lake-Sixmile Creek	71300040502	IL0036391	McLean County Parks and Recreation	24	23	0.058	0.001
		IL0074365	Prairie View Homeowners Association	171	19	0.05	0.008
Evergreen Lake- Sixmile Creek Subwatershed Total				*195*	*42*	*0.11*	*0.004*
Grand Total				**324**	**61**	**0.14**	**0.015**

3.18.2 Septic Systems

Outside of Normal, septic systems provide treatment of wastewater from individual properties and structures. The City of Bloomington regulates systems surrounding LB and has focused recent attention to those that are aging. Current regulations and actions include:

1. When a house is sold and the lease is presented to the City Council for approval, each septic system must be evaluated by a McLean County licensed septic evaluator.
2. Once the City receives the evaluation and the McLean County Health Department letter, a determination is made as to whether repairs are needed or if a new system will be required before the lease is transferred.
3. As of 2021, 6 complete septic systems have been replaced following this procedure. Over 15 have been repaired prior to lease transfer.
4. Each new tenant is required to agree to have their septic tank pumped and system evaluated once every 3 years with records to be stored at the City. This is included in the lease as an addendum and is enforceable. Failure to comply could result in the termination of the lease with the City.
5. The City and the Lake Bloomington Association have partnered to purchase and distribute chlorine tabs for sand filters as well as spent considerable time on educational outreach to all tenants about the importance of proper septic system care.

Despite efforts by the City, failing septic systems can be an active source of pollutants. Faulty or leaking septic systems are sources of bacteria, nitrogen, and phosphorus. Typical national septic system failure rates are 10-20% but vary widely depending on the local definition of failure; no failure rates are reported specifically for Illinois (USEPA, 2002). Therefore, a 15% failure rate was used for analysis.

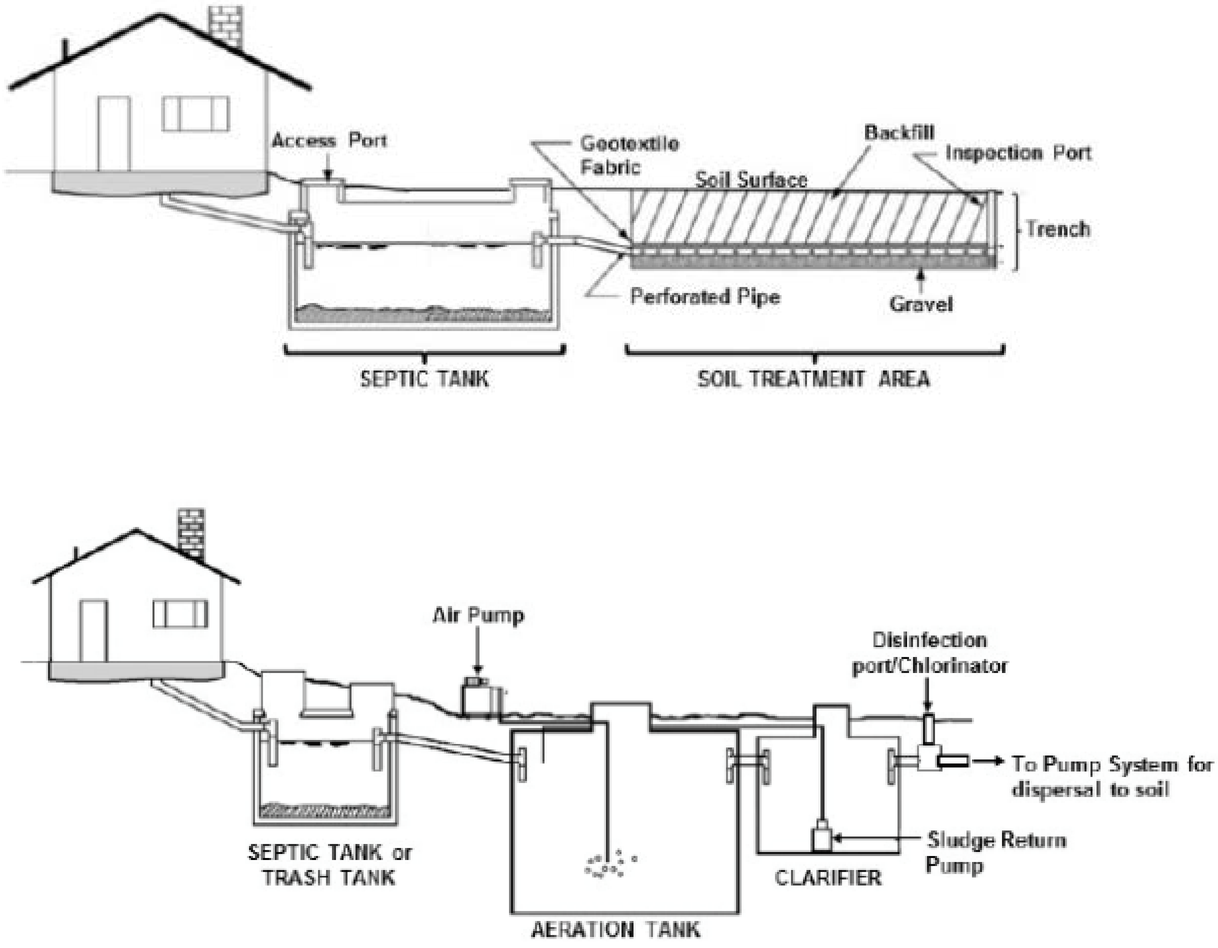
Every home and structure in the watershed outside municipal sewer boundaries were located and mapped using GIS to estimate the number of individual structures using septic systems (Figure 42). This data was then compared to parcels with known septic systems provided by the McLean County Health Department and reconciled to get a more accurate count. Corresponding nitrogen and phosphorus loads were then estimated using the STEPL.

Assuming a rate of 15%, it is possible that 279 structures have failing septic systems (Table 59). Due to the planning nature of this analysis, the exact number systems are unknown. Potentially failing systems contribute an estimated 3,415 lbs/yr of phosphorus and 8,717 lbs/yr of nitrogen. For the purposes of this report, it is assumed that these loadings do make it to waterways, however, loading is a function of location to a waterway, and it is possible that some portion of septic water may be absorbed or filtered prior. The greatest number of potential failing systems (118) and, ultimately, loading is in the Evergreen Lake – Sixmile Creek subwatershed; Lake Bloomington – Money Creek contains the least (76). Nutrient loading is higher overall in the LB watershed compared to EL.

Septic systems range from 26 to 9,653 ft from a receiving stream or lake/pond. Average distance is 1,122 ft and the median is 766 ft. Approximately 50% of all systems are at or less than 766 ft from a receiving waterbody. Lake Bloomington-Money Creek contains the greatest percentage at or lower than the median distance, or 77% of all systems.

Table 59 – Potentially Failing Septic Systems Nutrient Loading

Subwatershed	HUC12 Code	Septic System Count	Failing Septic Systems Count	Nitrogen Load (lbs/yr)	Phosphorus Load (lbs/yr)
Blue Mound-Money Creek	71300040201	567	85	2,663	1,044
Lake Bloomington-Money Creek	71300040202	505	76	2,355	922
Evergreen Lake-Sixmile Creek	71300040502	787	118	3,699	1,449
Grand Total		**1,859**	**279**	**8,717**	**3,415**



Septic Systems: Conventional (above) and Aerobic Treatment (below)
Credit: OSU 2017

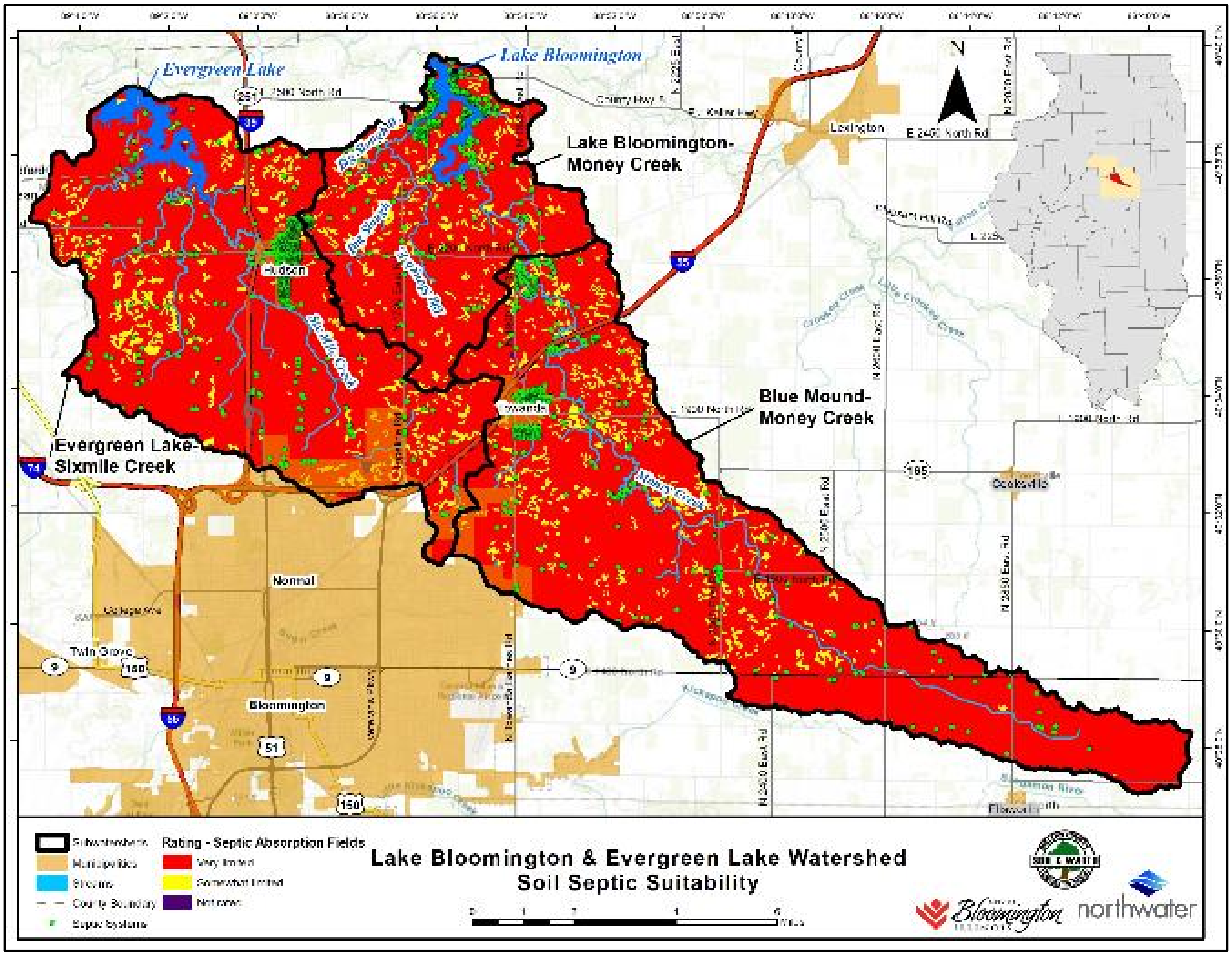


Figure 42 – Homes with Septic Systems & Soil Suitability Classes

3.19 Urban Detention Basin Inventory

Detention basins are part of designed drainage systems and stormwater infrastructure and are hydrologically connected to natural waterways (e.g., rivers, streams, lakes, and wetlands) through storm sewers, drainage ditches, and other basins. Detention basins can be wet (ponds), onstream, or dry and are specifically designed to reduce peak runoff discharges and pollutants from developed areas. Wet basins contain a perennial pool of water that control storm water quantity and quality by retaining water, and remove sediment and pollutants through physical, biological, and chemical processes such as sedimentation and biological uptake. Generally, wet basins control stormwater quantity and quality better than other types. Dry basins temporarily store stormwater before discharging and dry up between large rainstorms or snow melt events; these provide more retention benefits than water quality. Onstream, or online basins, are directly connected to a natural waterway either by inflow, outflow, or both. Regulations discourage or prohibit the construction of stormwater detention facilities in wetlands.

In October 2019, a survey was conducted in the LB and EL watersheds. Basins were identified through remote sensing of aerial and satellite imagery. A total of 22 were assessed (Figure 43) and evaluated for maintenance and design needs, potential safety problems, shoreline erosion and retrofit opportunities, and then ranked as low, medium, or high priority for action. Low priority basins had either no or minor maintenance needs; medium priority required maintenance but are still functioning to improve water quality; and high priority basins require maintenance and have enough structural issues that they are failing to provide their designed water quality benefit.

Inventory methods were similar to those performed by Cardno in 2018 for Normal. The 2018 report entitled "Riparian Areas Inventory Summary; Riparian Areas Maintenance" categorized basin quality, needs and recommended actions. This report was used to select high priority projects for further investigation and applicability to this watershed plan.

Fourteen wet and 8 dry basins were inventoried. The survey identified:

- 3 wet basins have compromised structures from bank erosion or sedimentation.
- 6 of 14 wet basins will benefit from 4,692 ft of shoreline stabilization, or 19% of all shoreline.
- Sediment removal is recommended for up to 4 wet basins.
- Large amounts of algal growth were observed at 7 wet basins, potentially due to excessive nutrients.
- 2 dry basins are recommended to be converted to wet, and 1 dry to a wetland.
- Aerator installation is recommended at up to 7 wet basins to address internal nutrient release.
- Invasive species removal and control of Amur Honeysuckle (*Lonicera maackii*), common reed (*Phragmites australis*), autumn olive (*Elaeagnus umbellate*), Canada thistle (*Cirsium arvense*), wild parsnip (*Pastinaca sativa*), and crown vetch (*Securigera varia*) is recommended at up to 7 basins.
- Wildlife management of Canada geese (*Branta canadensis*) is recommended at 2 basins.
- Native buffers are recommended at up to 20 basins to provide filtration, water quality, shoreline stabilization and habitat benefits, and to deter Canada geese.

The Blue Mound-Money Creek subwatershed contains 5 dry and 6 wet basins, and the Evergreen Lake-Sixmile Creek subwatershed contains 3 dry and 8 wet; none are located within the Lake Bloomington-Money Creek subwatershed. Feasible project recommendations and expected load reductions are described in Section 6. Projects were prioritized and selected based on their impacts to water quality. Actions without measurable or expected sediment or nutrient reductions are not further detailed in this plan, such as invasive species removal or wildlife management. The 2018 Cardno report referenced above can be used to direct future activities not specifically detailed herein.

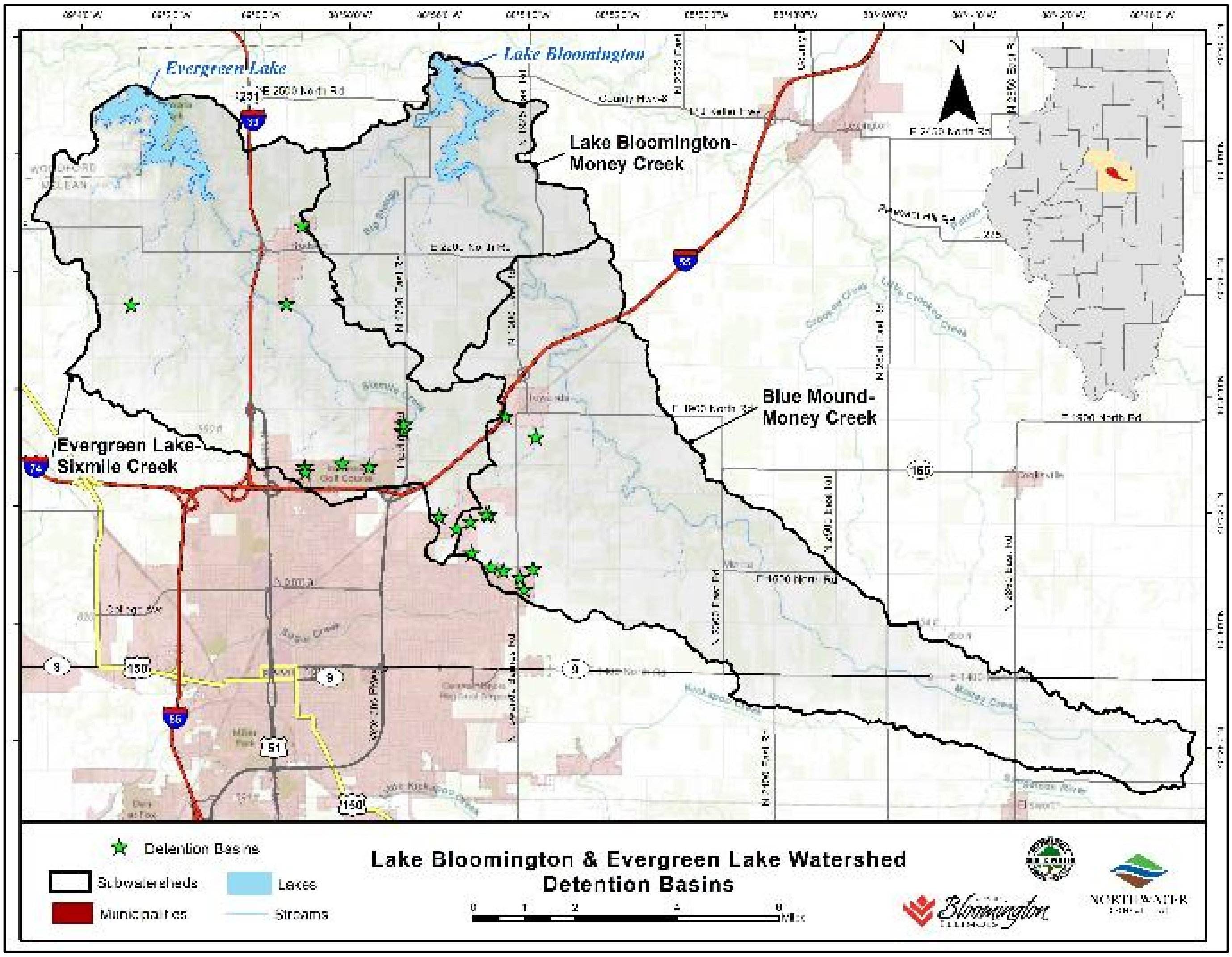


Figure 43 - Detention Basin Inventory Locations

Wet Basin - Normal

4.0 Pollutant Loading

4.1 Introduction

A watershed survey was completed to gain an understanding of conditions and features and to collect field-specific data. This included: tillage practices, cover types, existing project (BMP) locations and site suitability, and sources of sediment and gully erosion. This survey, combined with interpretation of aerial imagery, resulted in the identification of site-specific BMP locations. Drainage areas were then delineated for each site.

A spatially explicit GIS-based pollution loading model (SWAMM) was developed to estimate loading from direct runoff and tile or subsurface flow. The model simulated surface runoff and loading using the curve number approach, local precipitation, the USLE, and Event Mean Concentrations (EMCs) specific to landuse and soil types. In addition, field survey data was incorporated, such as tillage practices and existing BMPs. The model accounts for subsurface tile flow by allocating a percentage of annual rainfall. It was calibrated using measured water quality and streamflow data.

4.2 Pollutant Loading

Pollutant load estimates are presented in this section and are provided for septic systems, NPDES dischargers, surface runoff and tile flow, gully erosion, internal lake loading, and streambank and lake shoreline erosion. Gully and streambank erosion were observed in the field to the extent it was visible. Lake shoreline erosion was directly assessed for LB and EL. Loading from septic systems was estimated based on those homes not connected to a wastewater treatment system, and NPDES discharge data was acquired from the USEPA. Results from the GIS-based direct surface runoff and tile flow pollution load model are illustrated in Figure 44, Figure 45, and Figure 46. Loading from direct, surface runoff and tile accounts for what is contributed from overland flow and tiles. Internal nutrient loading, due to release of sediment-bound phosphorus and ammonia-nitrogen, were estimated based on various methods developed by Nurnberg (1984, 1988, 2009, 2013).

As presented in Table 60, total annual loading for both lake watersheds from all sources is 1,960,104 lbs of nitrogen, 40,696 lbs of phosphorus, and 35,334 tons of sediment. Direct runoff and tile flow combined are responsible for 99% of the nitrogen load, 78% of the phosphorus, and 77% of the sediment load. Loading from tile flow alone is likely responsible for approximately 60% of the total nitrogen and 8% of the total phosphorus load. All other sources combined - failing septic systems, point source discharges, lake shoreline, internal lake loading, streambank erosion, and gully erosion- account for 1% of the nitrogen, 22% of the phosphorus, and 23% of the sediment load. At 62% of the combined land area, the LB watershed accounts for 63% of the annual nitrogen, and 60% of the annual phosphorus and sediment load.

Table 60 – Pollution Loading Summary

Pollution Source	Nitrogen Load (lbs/yr)	Phosphorus Load (lbs/yr)	Sediment Load (tons/yr)	Nitrogen Load (% total)	Phosphorus Load (% total)	Sediment Load (% total)
Lake Bloomington – Blue Mound-Money Creek (HUC 71300040201)						
Surface Runoff & Tile Flow	892,831	13,530	12,110	46%	33%	34%
Streambank Erosion	1,327	628	1,032	0.1%	1.5%	2.9%
Gully Erosion	3,827	1,016	1,877	0.2%	2.5%	5.3%
Septic Systems	2,663	1,044	0	0.1%	2.6%	0%
Subtotal	**900,648**	**16,218**	**15,019**	**46%**	**40%**	**42%**
Lake Bloomington – Money Creek (HUC 071300040202)						
Surface Runoff & Tile Flow	337,898	6,028	5,036	17%	15%	14%
Streambank Erosion	329	155	256	0.02%	0.38%	0.72%
Gully Erosion	938	277	510	0.05%	0.68%	1.4%
Lake Shoreline Erosion	308	227	437	0.02%	0.56%	1.2%
Septic Systems	2,355	922	0	0.12%	2.3%	0%
NPDES Discharge	129	19	0.035	0.01%	0.05%	0.0001%
Internal Lake Loading	709	415	0	0.04%	1.0%	0%
Subtotal	**342,666**	**8,403**	**6,239**	**17%**	**20%**	**18%**
Evergreen Lake – Evergreen Lake-Sixmile Creek (HUC 71300040502)						
Surface Runoff & Tile Flow	706,271	12,051	10,237	36%	30%	29%
Streambank Erosion	2,350	1,111	1,828	0.12%	2.7%	5.2%
Gully Erosion	2,272	621	1,133	0.12%	1.5%	3.2%
Lake Shoreline Erosion	702	456	878	0.04%	1.1%	2.5%
Septic Systems	3,699	1,449	0	0.19%	3.6%	0%
NPDES Discharge	195	42	0.11	0.01%	0.1%	0.0003%
Internal Lake Loading	1,301	705	0	0.07%	1.7%	0%
Subtotal	**716,790**	**16,435**	**14,076**	**37%**	**40%**	**40%**
Grand Total	**1,960,104**	**40,696**	**35,334**	**100%**	**100%**	**100%**

Modeled pollution loading from surface runoff and subsurface tile flow is reported in Table 61, and depicted in Figure 44, Figure 45, and Figure 46. Per-acre results are calculated by dividing the total annual load of a given landuse category by the total number of acres. Results show that streams have the highest per-acre nitrogen load. This is due to consistently high measured concentrations and rapid delivery. Crop ground is responsible for the second greatest per-acre nitrogen load, followed by livestock feed areas. As with nitrogen, streams deliver the highest per-acre phosphorus and sediment loads. Livestock feed areas have the second highest per-acre phosphorus loads, or 2.2 lbs/ac. Row crops follow streams to contribute the second highest per-acre tonnage of sediment.

Cropland delivers 1,820,652 lbs/yr of nitrogen, or 33 lbs/ac/yr; 27,351 lbs/yr of phosphorus, or 0.49 lbs/ac/yr; 26,802 tons, or 0.48 tons/ac/yr of sediment. It is important to note that these results represent delivered loads for all fields in the watershed combined. Individual fields deliver soil and nutrients at different rates based on tillage practices, soil and slope characteristics, proximity to a waterbody, and whether a BMP is in place.

Modeled per-acre nitrogen delivery rates from cropland range from 1.3 lbs/ac/yr to as high as 70 lbs/ac/yr. Phosphorus delivery rates range from 0.04 lbs/ac/yr – 2.1 lbs/ac/yr and sediment delivery rates range from 0.01 tons/ac/yr to 2.7 tons/ac/yr. Per-acre nitrogen loading is greatest in the Evergreen Lake-Sixmile Creek subwatershed (34 lbs/ac/yr) and least in Lake Bloomington – Money Creek (31 lbs/ac/yr).

Other landuse categories, such pasture and roads, are also relatively high per-acre contributors of nutrients and sediment. Although forest, grasslands, urban open space, and residential areas have low per-acre values compared to other categories, the watershed contains a higher percentage and, therefore, cumulative loading is higher.

Table 61 – Pollution Loading from Surface & Subsurface Runoff by Landuse

Landuse Category	Area (acres)	Nitrogen Load		Phosphorus Load		Sediment Load	
		lbs/yr	lbs/ac/yr	lbs/yr	lbs/ac/yr	tons/yr	tons/ac/yr
Row Crops	55,589	1,820,652	33	27,351	0.49	26,802	0.48
Grasslands	3,197	7,132	2.2	133	0.04	34	0.01
Urban Open Space	3,086	11,327	3.7	380	0.12	44	0.01
Forest	2,573	5,824	2.3	142	0.06	49	0.02
Open Water Pond/Reservoir	1,579	43,650	28	1,371	0.87	63	0.04
Roads	1,039	9,972	10	512	0.49	103	0.10
Pasture	562	9,923	18	307	0.55	48	0.09
Urban Residential	516	3,686	7.1	169	0.33	24	0.05
Rural Residential	223	1,769	7.9	96	0.43	22	0.10
Open Water Stream	201	16,295	81	837	4.2	146	0.73
Parks & Recreation	175	628	3.6	31	0.18	1.3	0.008
Golf Course	122	563	4.6	24	0.19	1.4	0.01
Farm Building	120	1,516	13	42	0.35	9.2	0.08
Warehouse	112	820	7.3	50	0.44	10	0.09
Institutional	76	689	9.1	30	0.40	6.1	0.08
Commercial	63	506	8.1	26	0.41	5.1	0.08
Industrial	50	373	7.5	21	0.42	5.1	0.10
Wetland	45	87	1.9	0	0.01	0.03	0.001
Utility	33	204	6.2	10	0.31	1.9	0.06
Orchard	26	97	3.8	4	0.14	0.6	0.02
Mobile Homes	26	205	8.0	9	0.33	1.6	0.06
Railroad	24	111	4.6	8	0.33	2.1	0.09
Campgrounds	22	149	6.7	6	0.25	1.4	0.062
Feed Area	15	446	30	33	2.2	1.9	0.13
Cemetery	14	71	4.9	3	0.18	0.3	0.02
Wind Farm	12	25	2.0	2	0.14	0.2	0.02
Confinement	12	281	23	13	1.1	0.9	0.07
Grand Total	**69,512**	**1,937,000**	**28 av.**	**31,608**	**0.45 av.**	**27,384**	**0.39 av.**

Table 62 compares the loadings originating from direct runoff with the combined LB and EL watershed load from all sources. Row crops are the greatest contributor, responsible for 93% of the total nitrogen, 67% of total phosphorus, and 76% of the total sediment load. Open water/ponds, streams and urban open space are the next three highest contributors of surface runoff nitrogen loads, at 2.2%, 0.83% and 0.58%, respectively. Open water/ponds, streams and roads contribute, 3.4%, 2.1% and 1.3% of total phosphorus, respectively. Roads deliver relatively high per-acre and total sediment loads or 0.29%; this is primarily a function of higher runoff rates and less infiltration, and the fact they cover a relatively large percent of the area.

Table 62 – Loading from Surface & Subsurface Runoff by Landuse as Percentage of Watershed Load

Landuse Category	Area (acres)	Nitrogen Load		Phosphorus Load		Sediment Load	
		lbs/yr	% Total Watershed Load	lbs/yr	% Total Watershed Load (LB&EL)	tons/yr	% Total Watershed Load (LB&EL)
Row Crops	55,589	1,820,652	93%	27,351	67%	26,802	76%
Grasslands	3,197	7,132	0.36%	133	0.33%	34	0.10%
Urban Open Space	3,086	11,327	0.58%	380	0.93%	44	0.12%
Forest	2,573	5,824	0.30%	142	0.35%	49	0.14%
Open Water Pond/Reservoir	1,579	43,650	2.2%	1,371	3.4%	63	0.18%
Roads	1,039	9,972	0.51%	512	1.3%	103	0.29%
Pasture	562	9,923	0.51%	307	0.76%	48	0.14%
Urban Residential	516	3,686	0.19%	169	0.41%	24	0.07%
Rural Residential	223	1,769	0.09%	96	0.24%	22	0.06%
Open Water Stream	201	16,295	0.83%	837	2.1%	146	0.41%
Parks & Recreation	175	628	0.03%	31	0.08%	1.3	0.004%
Golf Course	122	563	0.03%	24	0.06%	1.4	0.004%
Farm Building	120	1,516	0.08%	42	0.10%	9.2	0.03%
Warehouse	112	820	0.04%	50	0.12%	10	0.03%
Institutional	76	689	0.04%	30	0.07%	6.1	0.02%
Commercial	63	506	0.03%	26	0.06%	5.1	0.01%
Industrial	50	373	0.02%	21	0.05%	5.1	0.01%
Wetland	45	87	0.004%	0	0.001%	0.03	0.0001%
Utility	33	204	0.01%	10	0.03%	1.9	0.006%
Orchard	26	97	0.005%	4	0.01%	0.6	0.002%
Mobile Homes	26	205	0.01%	9	0.02%	1.6	0.005%
Railroad	24	111	0.01%	8	0.02%	2.1	0.01%
Campgrounds	22	149	0.01%	6	0.01%	1.4	0.004%
Feed Area	15	446	0.02%	33	0.08%	1.9	0.01%
Cemetery	14	71	0.004%	3	0.01%	0.3	0.001%
Wind Farm	12	25	0.001%	2	0.004%	0.2	0.001%
Confinement	12	281	0.01%	13	0.03%	0.9	0.003%
Grand Total	**69,512**	**1,937,000**	**98.8%**	**31,608**	**77.7%**	**27,384**	**77.5%**

Note: Percentages do not add up to 100% because direct runoff is not the only source of loading in the watershed. Streambank erosion, lake shoreline erosion, gully erosion, septic systems, internal lake loading and NPDES dischargers are responsible for the remaining percentage.

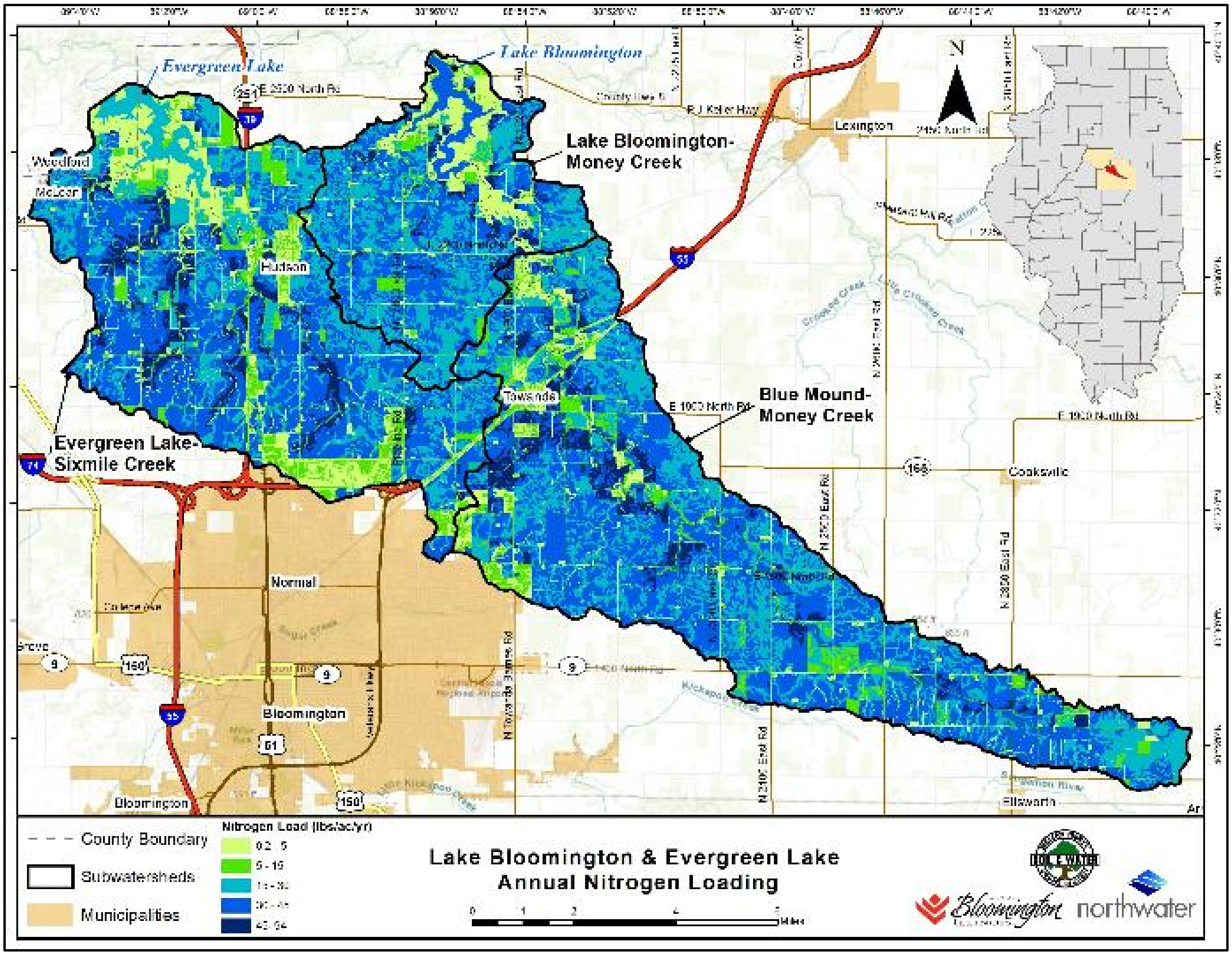


Figure 44 – Annual Nitrogen Loading Per Acre from Direct Surface & Subsurface Runoff

Channelized Stream

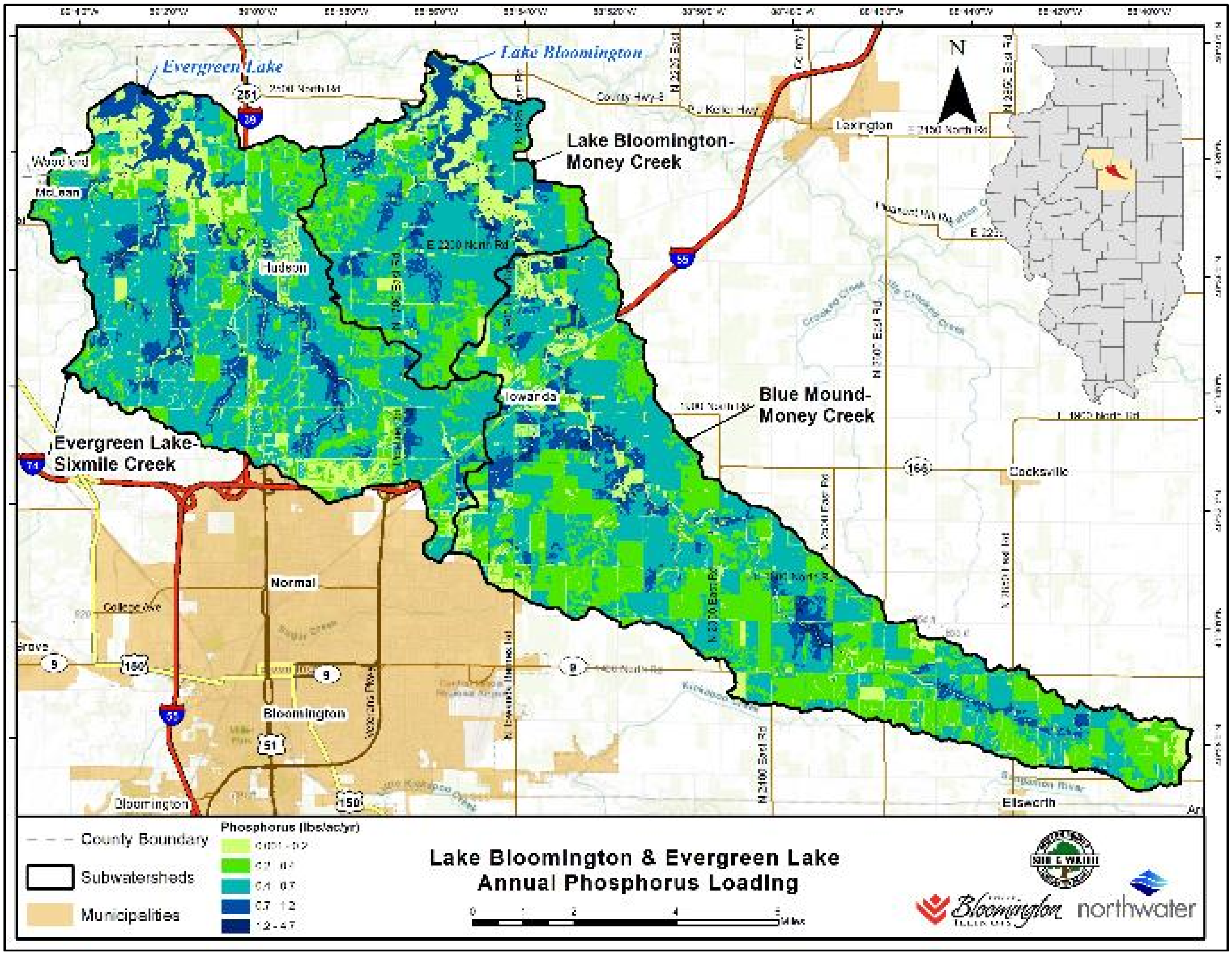


Figure 45 – Annual Phosphorus Loading Per Acre from Direct Surface & Subsurface Runoff

Treatment Wetland in Watershed

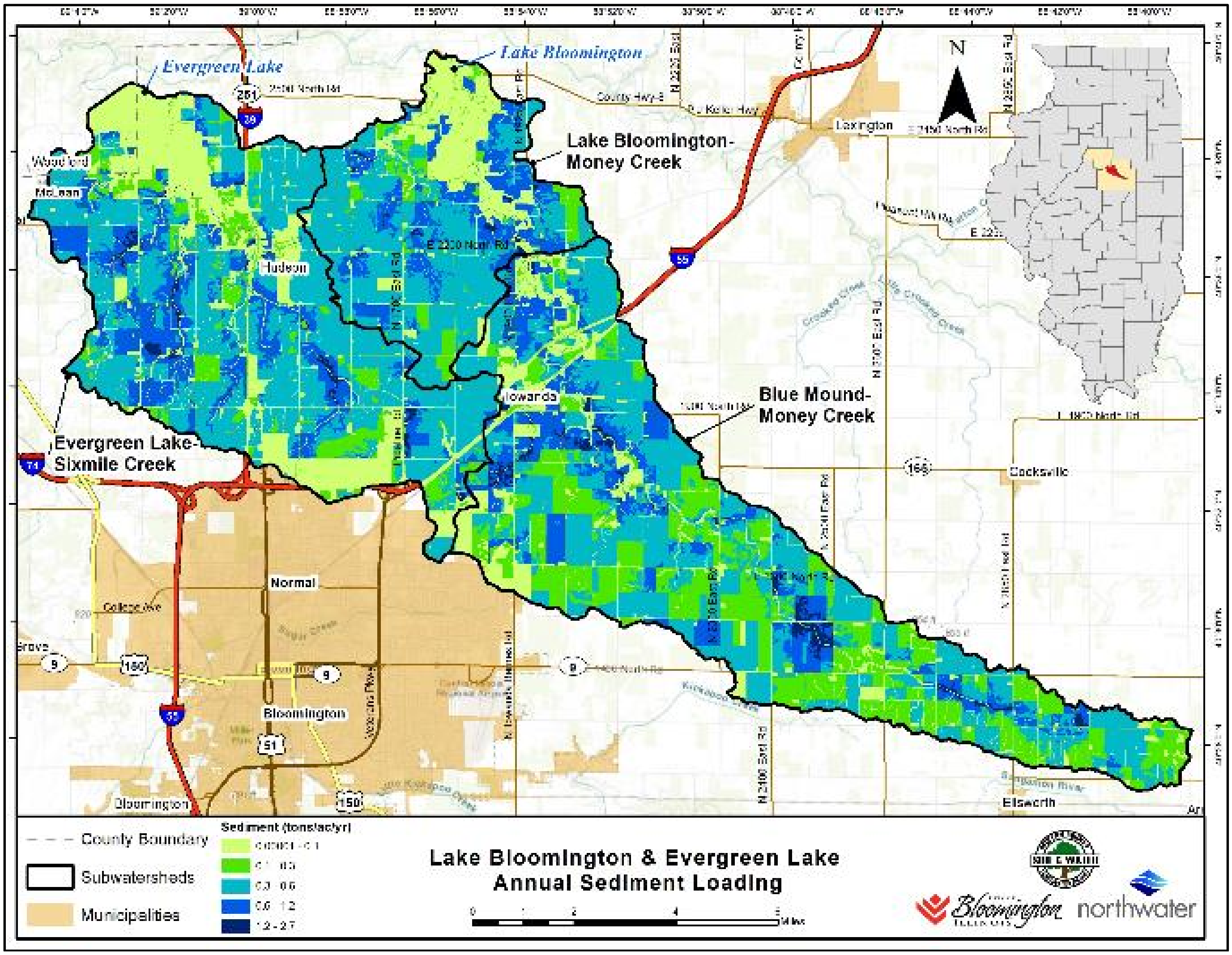


Figure 46 – Annual Sediment Loading Per Acre from Direct Surface Runoff

4.1.1 In-Lake Loading

Internal phosphorus and ammonia-nitrogen loading rates were calculated based on the extent and duration of anoxic conditions in the lakes using historical data from before and after commissioning of in-lake circulators. Rates were estimated using the method of Nürnberg (1984) where the total loading is equal to the anoxic area multiplied by the anoxic time multiplied by the release rate.

For this analysis, the release rate for phosphorus was calculated several ways (Nürnberg 1984, 1988, 2013) and an average used. For LB, average release rate is 8.8 mg/m^2/day and 8.1 mg/m^2/day for EL. For both lakes, an average ammonia-nitrogen release rate of 15 mg/m^2/day was used based on Beutel's (2006) analysis of eutrophic lakes. It is important to note that there is a wide range of sediment release rates for both phosphorus and ammonia nitrogen reported in the literature. Further sampling and laboratory sediment analysis would be necessary to refine estimates.

Anoxic area was calculated on a monthly basis by analysis of historical dissolved oxygen data at various depths across the lakes compared to lake bathymetry; the average anoxic area is presented in Table 63 along with the typical period of anoxia.

There was substantially less dissolved oxygen data for the period prior to the circulator installation in 1996 than for post. However, there is sufficient data to assess potential changes to internal loading due to the oxygenating effect of the circulators and in-lake sediment dynamics. The analysis indicates that both lakes had a reduction in the anoxic lake-bed area of approximately 65%, which translates to phosphorus and ammonia-nitrogen internal loading reductions of over 61% for LB and 64% for EL. The current internal load for LB is estimated to be 415 lbs/yr of phosphorus and 709 lbs/yr of nitrogen. The current internal load for EL is estimated to be 705 lbs/yr of phosphorus and 1,301 lbs/yr of nitrogen.

Table 63 – Internal Phosphorus & Nitrogen Loading

Lake	Circulator	Average Anoxic Area (acres)	Anoxic Months	Phosphorus Loading (lbs/yr)	Nitrogen Loading (lbs/y)	Reduction with Circulator		
						Phosphorus lbs/yr	Nitrogen lbs/yr	Percent
Lake Bloomington	Pre-circulator	122	June-September	1,055	1,804	641	1,095	61%
	Circulator installed	43	June-October	415	709			
Evergreen Lake	Pre-circulator	222	June-September	1,965	3,628	1,261	2,327	64%
	Circulator installed	79	June-September	705	1,301			

Evergreen Lake

5.0 Sources of Watershed Impairments

Cropland Surface Erosion

Watershed impairments originate from either NPS or point source pollution. A description of point source pollution is given in Section 3.15.1. Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source." Unlike pollution from point sources such as industrial and sewage treatment plants, NPS pollution comes from many diffuse sources and is caused by rainfall or snowmelt moving over and through the ground. The runoff picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters (USEPA 2018).

In the LB and EL watershed, sources of sediment and nutrients are thought to be originating from cropland and, to a lesser extent, livestock, gullies, streambank, and lake shoreline erosion. Leaking or improperly maintained septic systems may also be a source of nutrients. Permitted point source discharges exist in the watershed, however, their contributions to water quality impairments are negligible.

The following section provides pollutant source descriptions identified at the significant subcategory level, along with estimates to the extent they are present. The section looks at the greatest contributions and spatial extent of loading by each major source.

5.1 Nitrogen & Phosphorus

The primary source of nitrogen in the combined LB and EL watershed is tile flow and surface runoff from cropland. Tile nitrogen is responsible for 58% and surface runoff 35% of the total nitrogen load. The primary source of phosphorus is surface runoff from cropland which is responsible for 59% of the total load; an additional 8% is believed to be originating from tile flow (Table 64). Secondary sources include eroding gullies (agricultural and non-agricultural), surface runoff from livestock, stream and lake bank erosion, internal lake loading, and septic systems.

Table 64 – Nutrient Loading from all Sources

Pollutant Source	Nitrogen Load (lbs/yr)	Phosphorus Load (lbs/yr)	Nitrogen Load (% total)	Phosphorus Load (% total)
Tile Flow: Cropland	1,140,202	3,265	58%	8%
Surface Runoff: Cropland	680,450	24,087	35%	59%
Surface Runoff: Livestock	10,369	340	0.53%	0.84%
Surface Runoff: Non-Crop/Livestock	105,979	3,917	5.4%	9.6%
Gully Erosion (cropland)	6,493	1,730	0.33%	4.3%
Gully Erosion (non-cropland)	544	184	0.03%	0.45%
Internal Lake Loading	2,010	1,120	0.1%	2.8%
Streambank Erosion	4,006	1,894	0.2%	4.7%
Lake Shoreline Erosion	1,010	683	0.05%	1.7%
Septic Systems	8,717	3,415	0.44%	8.4%
NPDES Discharges (point source)	324	61	0.02%	0.15%
Grand Total	**1,960,104**	**40,696**	**100%**	**100%**

5.1.1 Cropland

The amount of nutrients originating from cropland depends on a whole host of complex factors and conditions including, but not limed to, weather, soil chemistry, nutrient application rates and timing, subsurface drainage or tiling, tillage practices, proximity to a receiving waterbody, or the presence or absence of conservation practices. To better understand the extent of nutrient loading from cropland, an analysis was performed on available and known watershed data. This includes an investigation of modeled loading from surface runoff versus tile flow, and tillage types.

Nitrogen – Excessive loading is a challenge for the City and adds complexities and cost to their water treatment process and ability to meet the 10 mg/L drinking water standard. It is believed that most of the nitrogen load is tile flow from cropland and, to a lesser extent, surface runoff. Supported by regular stream and lake monitoring, modeling indicates that the LB watershed is responsible for 59% of the combined cropland loading of both lakes. Despite a lower total load, the EL watershed has a greater yield at 33.8 lbs/ac/yr versus 32.2 lbs/ac/yr for LB. Blue Mound – Money Creek subwatershed crop ground delivers the greatest percentage (44%) of the combined LB/EL watershed nitrogen load. Blue Mound – Money Creek also delivers approximately three-quarters of the total nitrogen load entering LB from cropland (Table 65).

Phosphorus – Increased concentrations in a waterbody stimulates algae growth, which can lead to large populations, forming a bloom that can be harmful to water quality and aquatic life. These conditions occur in both lakes and prompted the City to take steps to mitigate those conditions, such as investments in aeration at its water intake and predictive monitoring. Measured data indicates that watershed phosphorus loadings and lake concentrations continue to be high when compared against the state lake standard. It is believed that much of the phosphorus load is from surface runoff and more closely tied to soil erosion. Modeling shows that the LB watershed is responsible for 63% of the combined cropland load of both lakes. Despite a lower total, the EL watershed has a greater yield at 0.52 lbs/ac/yr versus 0.48 lbs/ac/yr for LB. Blue Mound – Money Creek subwatershed crop ground delivers the greatest percentage (45%) of the combined LB/EL watershed phosphorus load. Within LB, the Lake Bloomington – Money

Creek subwatershed yields more than Blue Mound – Money Creek, or 0.5 lbs/ac/yr versus 0.47 lbs/ac/yr but delivers only 29% of the total entering LB from cropland.

Tiling

Nitrogen - Subsurface tile systems in agricultural landscapes can be a major source of surface water nitrate loads. In the combined LB and EL watershed, tile flow is believed to be responsible for 58% of the annual cropland load versus 35% for surface runoff. Tile yield averages 20.5 lbs/ac/yr; the EL watershed yields 20.9 lbs/ac/yr, slightly higher than that of LB at 20.3 lbs/ac/yr (Table 65).

Table 65 - Annual Crop Ground Nitrogen Loading - Tile Flow & Surface Runoff

Subwatershed	HUC12 Code	Crop Acres	Annual Surface Runoff Nitrogen – Total Load (lbs) / Per Acre	Annual Tile Nitrogen – Total Load (lbs) / Per Acre	% Total LB & EL Load - Surface	% Total LB & EL Load Tile
Lake Bloomington						
Blue Mound – Money Creek	71300040202	26,213	311,671 / 11.9	547,109 / 20.9	16%	28%
Lake Bloomington – Money Creek	71300040305	9,913	117,126 / 11.8	185,754 / 18.7	6%	9%
Subtotal		**36,126**	**428,797 / 11.9**	**732,863 / 20.3**	**22%**	**37%**
Evergreen Lake						
Evergreen Lake – Sixmile Creek	71300040503	19,463	251,653 / 12.9	407,340 / 20.9	13%	21%
Subtotal		**19,463**	**251,653 / 12.9**	**407,340 / 20.9**	**13%**	**21%**
Grand Total		**55,589**	**680,450 / 12.2**	**1,140,203 / 20.5**	**35%**	**58%**

Phosphorus – loading from subsurface tile flow is believed to be relatively low, accounting for 3,265 lbs/yr for both lakes. This represents 12% of the total LB and EL cropland load. Average tile yield for each subwatershed is 0.06 lbs/ac/yr compared to 0.4 lbs/ac/yr for surface runoff.

Tillage

Conventional till has the highest annual yield or per-acre loading of nutrients, followed by reduced-till. Although mulch-till yields less nutrients per acre, it covers the majority of crop ground in the combined LB/EL watershed and, therefore, contributes about 57% of the nitrogen and 58% of total phosphorus from cropland (Table 66). No-till is responsible for 17% of the nitrogen and 14% of the phosphorus and covers 20% of the combined watershed. Annual per-acre loadings from conventional, mulch, and reduced-till range 4.6–70 lbs/ac for nitrogen and 0.1–2.1 lbs/ac for phosphorus. In contrast, annual per-acre loading from cover crops, no-till, strip-till, and hay range 1.3–51 lbs/ac for nitrogen and 0.04–1 lbs/ac for phosphorus.

Table 66 – Cropland Nutrient Loading by Tillage Type

Tillage Type	Area (% cropland)	Nitrogen Load (lbs/yr)	Phosphorus Load (lbs/yr)	Nitrogen Load (% crop)	Phosphorus Load (% crop)	Nitrogen Load per Acre (lbs/ac/yr)	Phosphorus Load per Acre (lbs/ac/yr)
Conventional	7%	137,690	2,567	7.6%	6.8%	36	0.68
Reduced-Till	14%	277,162	4,499	15%	16%	35	0.56
Mulch-Till	55%	1,046,478	15,866	57%	58%	34	0.52
Strip-Till	1%	22,771	215	1.3%	0.78%	32	0.31
No-Till	20%	318,184	3,958	17%	14%	29	0.36
Cover Crop	2%	17,933	237	1%	0.9%	15	0.2
Hay	0.2%	433	9.5	0.02%	0.03%	4.3	0.09

In the LB watershed, 50% of the nitrogen and 51% of the phosphorus load is originating from mulch-till fields compared to 70% and 69% in EL. Mulch-till fields in EL deliver approximately one-quarter of the entire LB and EL cropland nutrient load combined. No-till fields contribute almost 3 times more nitrogen and phosphorus in LB than in EL.

5.1.2 Livestock, Gullies, Lake Shorelines, Streambanks, & Septic Systems

Surface runoff from non-cropland is the second highest source of nitrogen (6%) and phosphorus (10%) for LB and EL combined (Table 64). Of this, a small number of livestock operations exist and are relatively high yielding sources of nutrients that can be addressed to generate water quality benefits. Septic systems, if failing, contribute nutrients. Gully, streambank and lake shoreline erosion are relatively minor sources and more relevant in terms of sediment.

Livestock – the 577 acres of pasture and livestock feed areas contribute 7,916 lbs/yr of nitrogen and 276 lbs/yr of phosphorus in LB and 2,453 lbs/yr of nitrogen and 64 lbs/yr of phosphorus in the EL watershed. This amounts to 0.53% of the annual nitrogen and 0.84% of the phosphorus for both lakes combined.

Septic systems - Potentially failing septic systems may contribute 0.44% of the nitrogen and 8.4% of the total combined LB and EL annual phosphorus load. The LB watershed receives 58% of the total nutrient load from septic systems.

Streambank Erosion - Streambank erosion delivers 4.7% of the combined LB and EL phosphorus and only 0.2% of the total annual nitrogen. Streambank erosion is more prevalent in EL which receives 59% of the total nutrient load from streambanks.

Gully Erosion - Gully erosion delivers only 0.36% of the combined LB and EL nitrogen and 4.7% of the total annual phosphorus; gullies on cropland deliver a much greater portion. Gully erosion is more prevalent in LB which receives 68% of the total nutrient load from gullies.

Lake Shoreline Erosion – Lake bank erosion delivers only 0.05% of the combined LB and EL nitrogen and 1.7% of the total annual phosphorus. Lake shoreline erosion is more prevalent in EL which receives 70% of the total nitrogen and 67% of the total phosphorus load from bank erosion.

Internal Lake Nutrient Release – Internal lake loading contributes 0.1% of the combined LB and EL nitrogen and 2.8% of the annual phosphorus. Nutrient release is roughly 15% higher in EL than LB. This source of nutrient loads has been significantly reduced with the addition of aerators.

5.2 Sediment

The primary source of sedimentation in the watershed is cropland sheet and rill erosion, responsible for 76% of the entire sediment load (Table 67). Secondary sources include eroding gullies (primarily agricultural), surface runoff from non-croplands, and stream and lake bank erosion. Point sources contribute a negligible amount of sediment.

Table 67 – Sediment Loading from all Sources

Pollutant Source	Sediment Load (tons/yr)	Sediment Load (% total)
Surface erosion: Cropland Sheet & Rill	26,802	76%
Surface erosion: Non-Cropland	583	1.6%
Gully Erosion (cropland)	3,166	9%
Gully Erosion (non-cropland)	354	1%
Streambank Erosion	3,116	9%
Lake Shoreline Erosion	1,315	3.7%
NPDES Discharges (point source)	0.18	0.005%
Grand Total	**35,335**	**100%**

5.2.1 Cropland

The amount of sediment originating from cropland depends on tillage practices, proximity to a receiving waterbody, the presence or absence of conservation practices, and land slope. To better understand the extent of sediment loading from cropland, an analysis was performed to investigate the total and per-acre loading by tillage practices and soil HEL designation. Results are presented in Table 68 and Table 69.

Tillage

Mulch-till fields contribute 52% of the annual cropland sediment to LB and 67% to EL. This represents 44% of the total cumulative load for each lake and 52% of all sediment originating only from crop ground. Conventional tillage yields the highest per-acre, or 0.98 tons/ac/yr in LB and 0.8 tons/ac/yr in EL. Despite only accounting for 6.8% of all cropland acres in the combined LB and EL watershed, conventional tillage delivers 13% of the entire sediment load originating from farm ground in LB, with only 5.4% of crop acres. In EL, 15% comes from 9.5% of the acreage. Reduced-till and mulch-till is also responsible for a relatively high percentage of the sediment load compared to total area in LB (Table 68). Cover crops and no-till combined are only responsible for 16% of the loading in LB (despite a relatively high number of acres) and 5% in EL. Annual per-acre sediment yields from conventional, mulch and reduced-till range from 0.04–2.7 tons/ac, while cover crops, no-till, and strip-till are 0.01–0.1 tons/ac.

Table 68 – Cropland Sediment Loading by Tillage Type

Tillage Type	Area (ac)	% Crop Land	Sediment Load (tons/yr)	Sediment Load (tons/ac/yr)	% Crop Sediment load
Lake Bloomington					
Mulch-Till	17,329	48%	8,732	0.50	52%
Reduced-Till	5,796	16%	3,415	0.59	20%
Conventional	1,938	5.4%	1,906	0.98	11%
No-Till	9,655	27%	2,559	0.26	15%
Strip-Till	701	1.9%	171	0.24	1.0%
Cover Crop	667	1.9%	58	0.09	0.35%
Hay	42	0.12%	2	0.04	0.01%
Subtotal	**36,127**	**100%**	**16,843**	**0.47**	**100%**
Evergreen Lake					
Mulch-Till	13,377	69%	6,721	0.50	67%
Reduced-Till	2,186	11%	1,286	0.59	13%
Conventional	1,843	9.5%	1,468	0.80	15%
No-Till	1,482	7.6%	422	0.28	4.2%
Cover Crop	515	2.7%	60	0.12	0.61%
Hay	59	0.3%	2	0.03	0.02%
Subtotal	**19,463**	**100%**	**9,958**	**0.51**	**100%**
Grand Total	**55,590**	**-**	**26,802**	**0.48**	-

Cropped HEL Soils

An analysis was performed to better understand the extent of sediment loading from sheet and rill erosion based on HEL soils and tillage. Results are presented in Table 69.

Although HEL soils make up only 3.3% of combined LB and EL watershed cropland area, they account for 1,025 tons, or 3.8% of cropland sediment load, and 3% of the entire sediment load. On average, cropped HEL soils deliver sediment at rates 18% higher than non-HEL. Cropped HEL are more prevalent in EL and responsible for a much higher percentage of overall cropland sediment load in EL (6.9%) versus only 1.8% in LB.

Mulch-till fields contribute 0.7% of the annual HEL cropland sediment to LB and 4.8% to EL. Conventional tillage of HEL yields the highest per-acre, or 1.23 tons/ac/yr in LB and 0.98 tons/ac/yr in EL. In LB, most cropped HEL are being no-tilled; a comparable area of mulch-till contributes more than twice the sediment. In both watersheds, cover crops planted on HEL soils lose far less soil, per acre, on an annual basis. Yield from all tillage types in EL is higher than LB.

Table 69 – Cropland Sediment Loading by HEL Soils & Tillage Type

Tillage Type	Area (ac)	% Crop HEL	Sediment load (tons/yr	Sediment load (tons/ac/yr)	% Total Cropland Sediment load
Lake Bloomington					
Mulch-Till	184	33%	117	0.64	0.69%
Reduced-Till	105	19%	67	0.63	0.39%
Conventional	61	11%	75	1.23	0.44%
Strip-Till	2	0.30%	0.4	0.21	0.002%
No-Till	204	36%	55	0.27	0.32%
Cover Crop	5	0.93%	0.26	0.05	0.002%
Hay	4	0.65%	0.17	0.05	0.001%
Subtotal	**564**	**100%**	**315**	**0.56**	**1.8%**
Evergreen Lake					
Mulch-Till	792	63%	496	0.63	4.8%
Reduced-Till	152	12%	107	0.70	1.0%
Conventional	55	4.4%	54	0.98	0.53%
No-Till	135	11%	41	0.30	0.40%
Cover Crop	94	8%	13	0.13	0.12%
Hay	26	2%	0.8	0.03	0.01%
Subtotal	**1,253**	**100%**	**710**	**0.57**	**6.9%**
Grand total	**1,817**	**-**	**1,025**	**0.56**	-

5.2.2 Gullies, Lake Shorelines, & Streambanks

Gully erosion from crop ground and streambank erosion are the next most significant sources of sediment, followed by lake shoreline erosion.

Gully Erosion - Gully erosion on crop ground delivers 9% of the total LB and EL sediment and is more prevalent in LB which receives 2,201 tons/yr, or 70%, and approximately 10% of its load versus 8% for EL. The Blue Mound – Money Creek subwatershed delivers 1,838 tons/yr, or 84% of the total LB gully load and 58% of sediment from all cropped gullies.

Streambank Erosion - Streambank erosion delivers 9% of the total LB and EL watershed sediment load and is more extensive in EL, accounting for 1,828 tons/yr, or 59% and approximately 13% of its sediment versus 6% for LB.

Lake Shoreline Erosion – Lake bank erosion delivers 3.7% of the total LB and EL watershed sediment and is more extensive in EL, accounting for 878 tons/yr, or 67%, and approximately 6% of its sediment versus 2% for LB.

6.0 Nonpoint Source Management Measures & Load Reductions

This section details recommended BMPs for the watershed, their quantities and expected annual pollution load reductions. Although reductions presented below include nitrogen, phosphorus and sediment, special attention is given to nitrogen. As this is the most common water quality impairment in both lake watersheds, practices that address nitrogen loading should receive priority.

BMPs can be described as a practice or procedure to prevent or reduce water pollution and address stakeholder concerns. They typically include treatment requirements, operating procedures, and practices to control surface runoff and mitigate pollution loading. This section describes all BMPs needed to achieve measurable reductions in nitrogen, phosphorus and sediment.

Expected reductions are calculated using average pollutant reduction efficiency percentages based on the Illinois Nutrient Loss Reduction Strategy, existing literature, and local expertise. Ranges of efficiencies used can be found in Table 70 and Table 71. It should be noted that addressing nutrient and sediment loading will take a substantial amount of effort and resources. Water quality improvements will not happen overnight, and time will be needed to realize results. Years of work by the City, the McLean County SWCD and others have generated many positive water quality benefits, especially with respect to sediment and phosphorus. Building off these efforts will help to accelerate improvements.

Table 70 – Pollutant Reduction Efficiency Ranges by BMP for Surface Runoff

BMP	Nitrogen Reduction (%)	Phosphorus Reduction (%)	Sediment Reduction (%)
WASCB/Terrace[1]	20%	60%	70%
Grade Control Structure/Riffle[1]	0-20%	0-30%	0–40%
Detention Basin/Pond/Sediment Basin	15–35%	30–60%	40–90%
Grassed Waterway[1, 2]	10–30%	8–25%	12–40%
Filter Strip/Native Prairie Buffer	10%	30-40%	45-65%
Field Border	8-10%	25-40%	30-65%
Conservation Cover - Conversion to Permanent Grasses	90%	80%	90%
Livestock Stream Fencing & Pasture Management	50%	55%	60%
Livestock Feed Area Treatment System	84%	83%	79%
Wetland Creation & Restoration	10–50%	12–90%	17–75%
No-Till/Strip-Till	10%	50%	70%
Cover Crop	30%	30%	40%
Deep Placement P Fertilizer	0%	20%	0%
Streambank Stabilization/Riffle	75-100%	75-100%	75-100%

BMP	Nitrogen Reduction (%)	Phosphorus Reduction (%)	Sediment Reduction (%)
In-Lake Basin/Floating Treatment Wetlands	25-35%	20-40%	25-45%
Urban Rain Garden	40-50%	45-55%	50-65%
Urban Native Prairie Buffer	5%	30%	35%
Urban Detention Basin Sediment Removal[3]	10%	25%	50%
Pond Aerator	50%	50%	0%
Shoreline Stabilization	100%	100%	100%

[1] = Controls 100% of gully erosion. [2] = Reduction percentage includes maintenance of existing structures. [3] = Percent reductions reflect enhanced efficiency following dredging

Table 71 – Pollutant Reduction Efficiency Ranges by BMP for Subsurface Runoff

BMP	Nitrogen Reduction (%)	Phosphorus Reduction (%)
Bioreactor	40%	5%
Drainage Water Management	40%	10%
Detention Basin/Pond[1]	18–35%	30–60%
Saturated Buffer	55%	25%
Conservation Cover - Conversion to Permanent Grasses	90%	80%
In-Lake Basin/Floating Treatment Wetlands[1]	25-35%	20-30%
Wetland Creation & Restoration[1]	10–50%	12-90%
Cover Crop	38%	10%
Nutrient Management – Spring Split Application of Nitrogen	20%	0%

[1] = Assumes tile flow is routed through BMP

6.1 Best Management Practices & Expected Load Reductions

Load reductions were calculated for each recommended BMP using the GIS-based loading model. Where applicable, a drainage area was delineated for each individual practice. Therefore, expected load reductions are spatially explicit and represent delivered pollutants. This section is organized into practices associated with agricultural ground, urban residential areas and in-lake and land directly adjacent to each reservoir. Agriculture subsections cover structural versus in-field practices.

Table 72 and Table 73 list all proposed BMPs, quantities, area treated, and expected annual reductions. Locations are shown in Figure 47, Figure 48, Figure 49, Figure 50, Figure 51, and Figure 52. The largest total expected reductions can be achieved from cover crops, nutrient management, and a select number of structural practices. These practices will require willing landowners to implement and large investments by the City and other partners. Further information on BMP costs, reductions, critical practices, technical and financial assistance and implementation goals can be found in Sections 7–11. Individual BMP load reductions and details are contained in the online management described in Section 13.1.

Table 72 – Recommended BMPs & Load Reduction Summary – Lake Bloomington

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)
Lake Bloomington – Blue Mound-Money Creek (HUC 71300040201)						
In-Field Practices	Cover Crop	25,436 (ac)	25,436	297,408	3,309	4,718
	No-Till/Strip-Till	7,503 (ac)	7,503	10,781	2,018	3,560
	Nutrient Management – Deep Placement P	24,793 (ac)	24,793	0	2,027	0
	Nutrient Management – Split Application N	23,245 (ac)	23,245	104,368	0	0
In-Field Practices Subtotal		***n/a***	***80,977***	***412,557***	***7,354***	***8,278***
Structural, In-Lake, and Urban Practices	Conservation Cover	24 (#), 47 (ac)	52	1,158	24	28
	Ponds/Sediment Basin	1 (# ponds) / 1 (# sediment basin)	437	3,026	163	241
	Urban Detention Basin	1 (#)	39	63	3.9	0.6
	Field Border	73 (#), 129 (ac)	3,565	3,599	482	856
	Filter Strip	48 (#), 112 (ac)	2,263	4,006	569	1,081
	Grade Control	1 (# locations), 1 (structures)	15	9	2.1	4.4
	Grassed Waterway	28 (#), 63 (ac)	6,050	16,421	1,017	1,928
	WASCB	15 (# locations), 61 (basins)	208	788	130	209
	Wetland, Constructed/Restored	20 (#), 72 (ac)	4,532	39,018	706	1,007
	Drainage Water Management	16 (# locations)	2,038	15,279	11	0
	Saturated Buffer	13 (# locations), 172,900 (ft tile)	1,897	22,791	29	0
	Bioreactor	11 (# locations), 15 (structures)	654	5,804	2	0
	Pasture Management (Livestock Fencing / Crossings)	2 (# locations), 14,025 (ft fence), 6 (crossings), 2 water systems	165	2,090	80	38
	Urban Basin Aerator	3 (# locations), 6 (# units)	12	177	4	0
	Urban Native Buffer	5 (# locations), (5.4 ac)	30	10	1.9	0.3
	Sediment Removal - Urban Detention Basin	2 (# locations), 14,900 (CY)	12	19	1.3	0.2
	Streambed & Bank Stabilization	3 (# locations), 3,700 (ft STP), 12 (riffles)	n/a	231	109	180
	Urban Basin Shoreline Stabilization	3 (# locations), 2,467 (ft)	n/a	2.1	1.4	1.4
Structural Practices Subtotal		*n/a*	*21,969*	*114,491*	*3,337*	*5,575*
Grand Total		**n/a**	**102,946**	**527,048**	**10,691**	**13,853**

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)
Lake Bloomington – Money Creek (HUC 071300040202)						
In-Field Practices	Cover Crop	9,673 (ac)	9,673	104,505	1,367	1,950
	No-Till/Strip-Till	3,174 (ac)	3,174	4,369	833	1,364
	Nutrient Management – Deep Placement P	9,796 (ac)	9,796	0	873	0
	Nutrient Management – Split Application N	9,543 (ac)	9,543	36,795	0	0
In-Field Practices Subtotal		***n/a***	***32,186***	***145,669***	***3,073***	***3,314***
Structural, In-Lake, and Urban Practices	Conservation Cover	17 (#), 34 (ac)	39	925	22	27
	Ponds	2 (#)	133	1,176	51	69
	Urban Detention Basin	1 (#)	18	37	2.4	0.5
	Field Border	27 (#), 50 (ac)	2,124	2,027	284	451
	Filter Strip	22 (#), 46 (ac)	945	1,531	233	403
	Grade Control	1 (# locations), 6 (structures)	126	290	17	27
	Grassed Waterway	5 (#), 11 (ac)	2,565	4,195	218	390
	Wetland, Constructed/Restored	11 (#) / 37 (ac)	3,728	26,354	458	610
	Saturated Buffer	4 (# locations), 51,800 (ft tile)	367	3,793	5.2	0
	Bioreactor	3 (# locations), 6 (structures)	255	2,094	0.8	0
	Pasture Management (Livestock Fencing / Crossings)	1 (# locations), 2,710 (ft fence), 1 (crossings)	83	558	18	15
	Livestock Feed Area Management System	1 (# locations), 1,500 (ft diversion), 2 (basin structures)	8	127	9.5	0.3
	Urban Rain Garden	8 (# locations), 11 (gardens)	4.7	13	0.5	0.2
	Urban Native Buffer	2 (# locations), (0.4 ac)	3.1	1.9	0.2	0.1
	Lake Shoreline Stabilization	18 (# locations), 5,722 (ft)	n/a	250	184	354
	In-Lake Basin / Floating Wetland	1 (# locations), 380 (ft), 1 (ac)	34,313	253,874	4,372	5,409
	Lake Dredging	1 (# locations), 93,060 (CY)	35	-	-	-
Structural Practices Subtotal		***n/a***	***44,747***	***297,246***	***5,876***	***7,756***
Grand Total		**n/a**	**76,933**	**442,915**	**8,949**	**11,070**
Grand Total Lake Bloomington		**n/a**	**179,879**	**969,963**	**19,640**	**24,923**

Table 73 – Recommended BMPs & Load Reduction Summary – Evergreen Lake (HUC 071300040503)

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)
In-Field Practices	Cover Crop	18,653 (ac)	18,653	225,830	2,754	3,926
	No-Till/Strip-Till	10,524 (ac)	10,524	15,065	2,715	4,336
	Nutrient Management – Deep Placement P	18,904 (ac)	18,904	0	1,747	0
	Nutrient Management – Split Application N	17,842 (ac)	17,842	79,668	0	0
In-Field Practices Subtotal		***n/a***	***65,923***	***320,563***	***7,216***	***8,262***
Structural, In-Lake, and Urban Practices	Conservation Cover	37 (#), 66 (ac)	176	2,126	60	80
	Ponds	1 (#)	39	270	11	11
	Urban Detention Basin	3 (#)	486	1747	168	63
	Field Border	50 (#), 102 (ac)	2,458	2,660	387	700
	Filter Strip	45 (#), 86 (ac)	1,444	2,892	415	754
	Grassed Waterway	17 (#), 26 (ac)	2,202	6,259	390	695
	WASCB	5 (# locations), 11 (basins)	21	107	15	23
	Wetland, Constructed/Restored	17 (#) / 42 (ac)	2,817	18,946	328	366
	Drainage Water Management	27 (# locations)	1,958	17,760	13	0
	Saturated Buffer	24 (# locations), 218,300 (ft tile)	2,169	28,534	37	0
	Bioreactor	21 (# locations), 26 (structures)	935	8,003	2.8	0
	Urban Basin Aerator	1 (# locations), 2 (# units)	23	161	6.1	0
	Urban Native Buffer	7 (# locations), (8.3 ac)	67	27	5.2	0.9
	Sediment Removal - Urban Detention Basin	1 (# locations), 14,800 (CY)	3	3.9	0.3	0.02
	Streambed Stabilization	1 (# locations), 2 (riffles)	n/a	20	9.4	16
	Urban Basin Shoreline Stabilization	1 (# locations), 1,773 (ft)	n/a	6.4	3.5	3.1
	Lake Shoreline Stabilization	28 (# locations), 11,171 (ft)	n/a	613	399	767
	In-Lake Basin / Floating Wetland	2 (# locations), 1,130 (ft), 2.1 (ac)	21,601	156,745	3,681	3,404
	Lake Dredging	1 (# locations), 172,316 (CY)	106	-	-	-
Structural Practices Subtotal		***n/a***	***36,505***	***246,880***	***5,931***	***6,883***
Grand Total Evergreen Lake		**n/a**	**102,428**	**567,443**	**13,147**	**15,145**

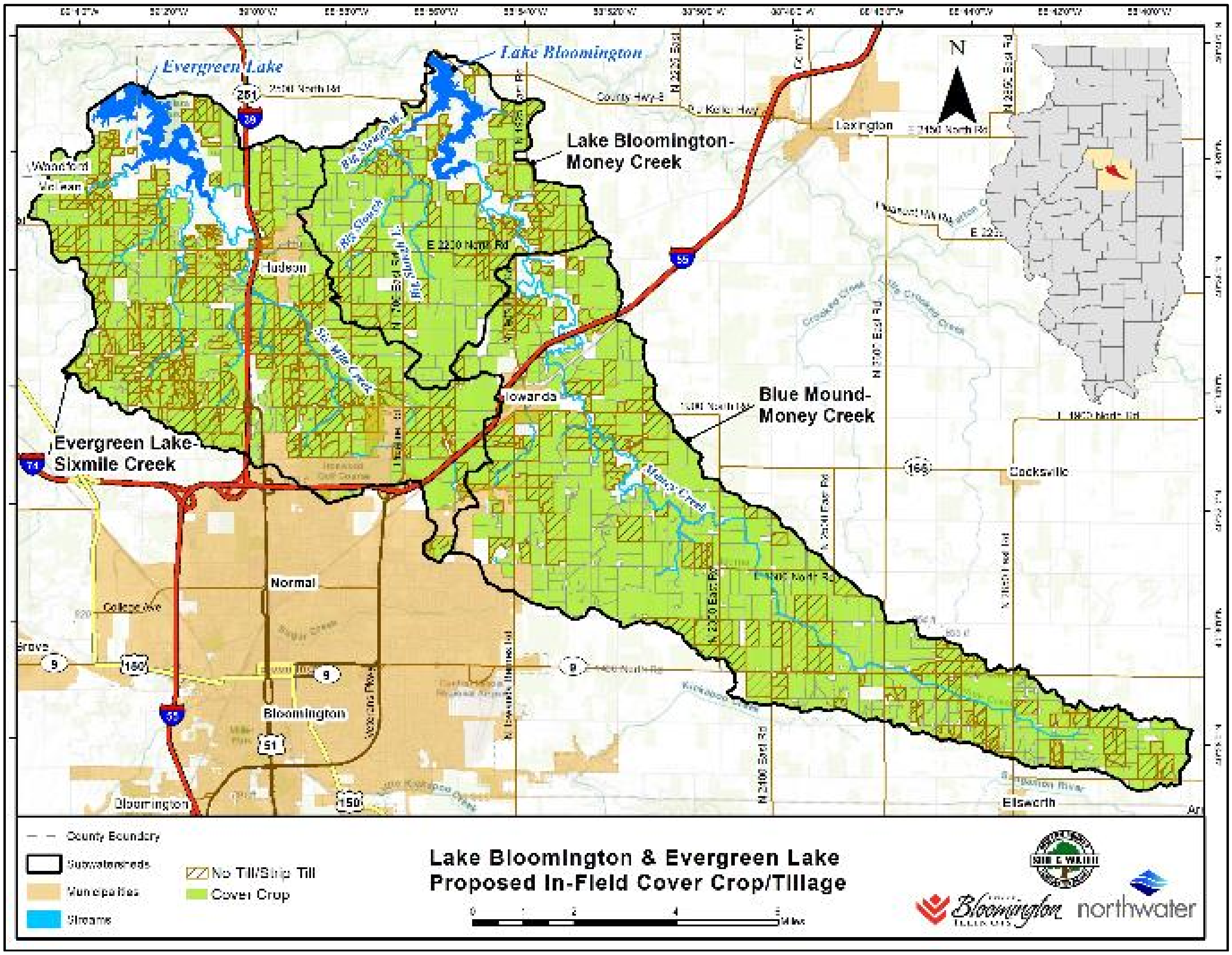


Figure 47 – Proposed BMPs – In-Field Cover Crop/Tillage

No-Till in the Watershed

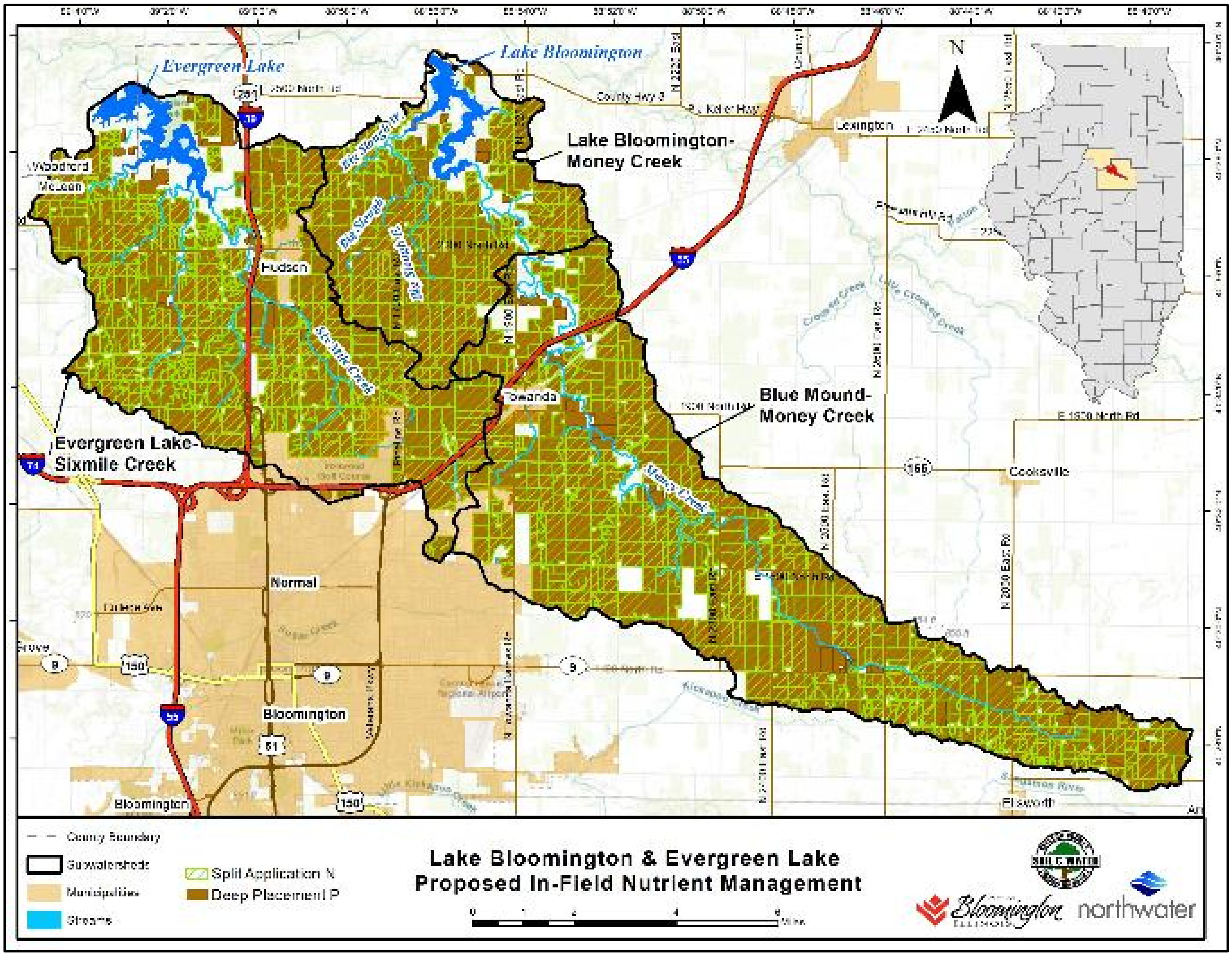


Figure 48 – Proposed BMPs - In-Field Nutrient Management

Drainage Ditch in the Watershed

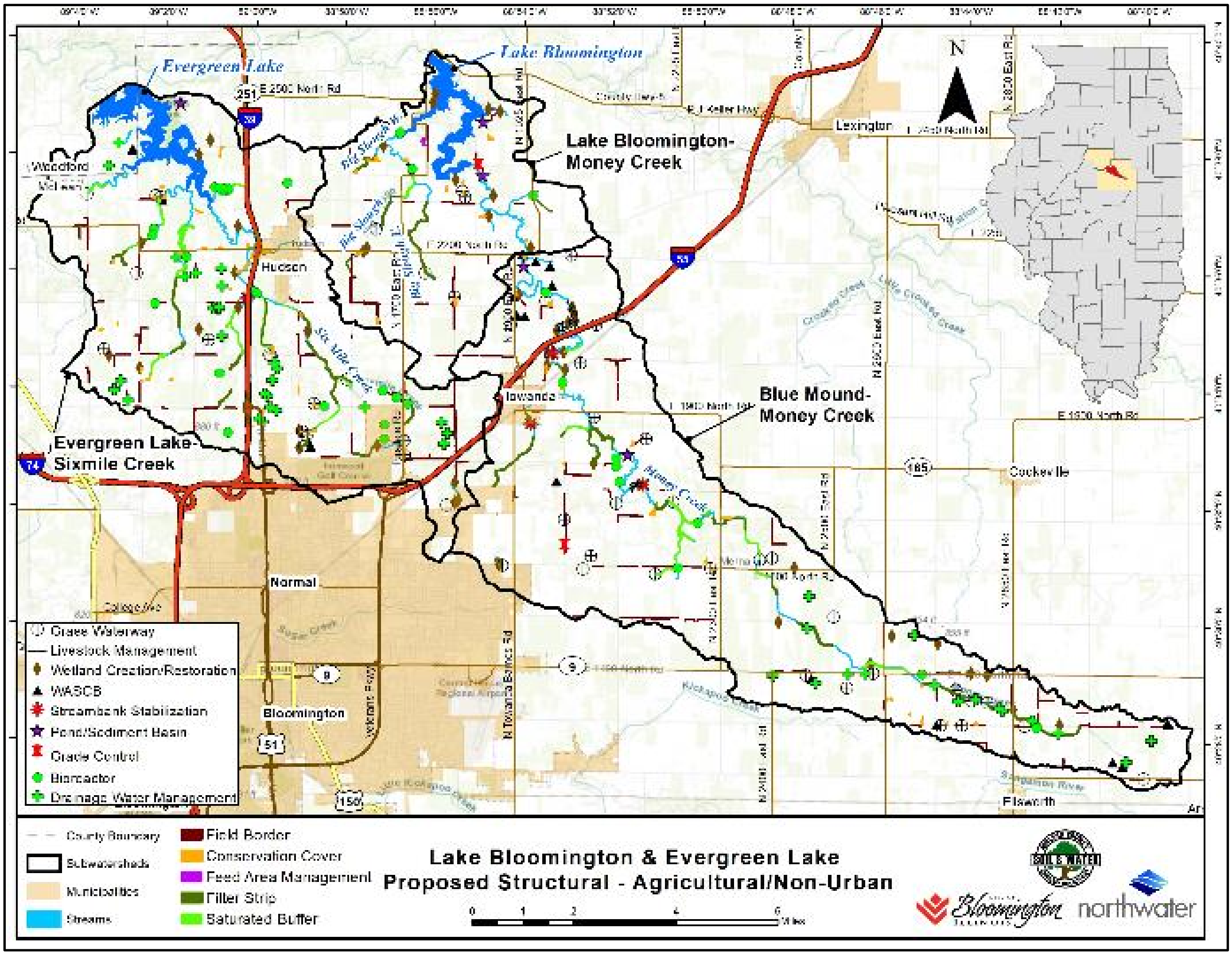


Figure 49 – Proposed Structural BMPs – Agricultural/Non-Urban

Grass Waterway in the Watershed

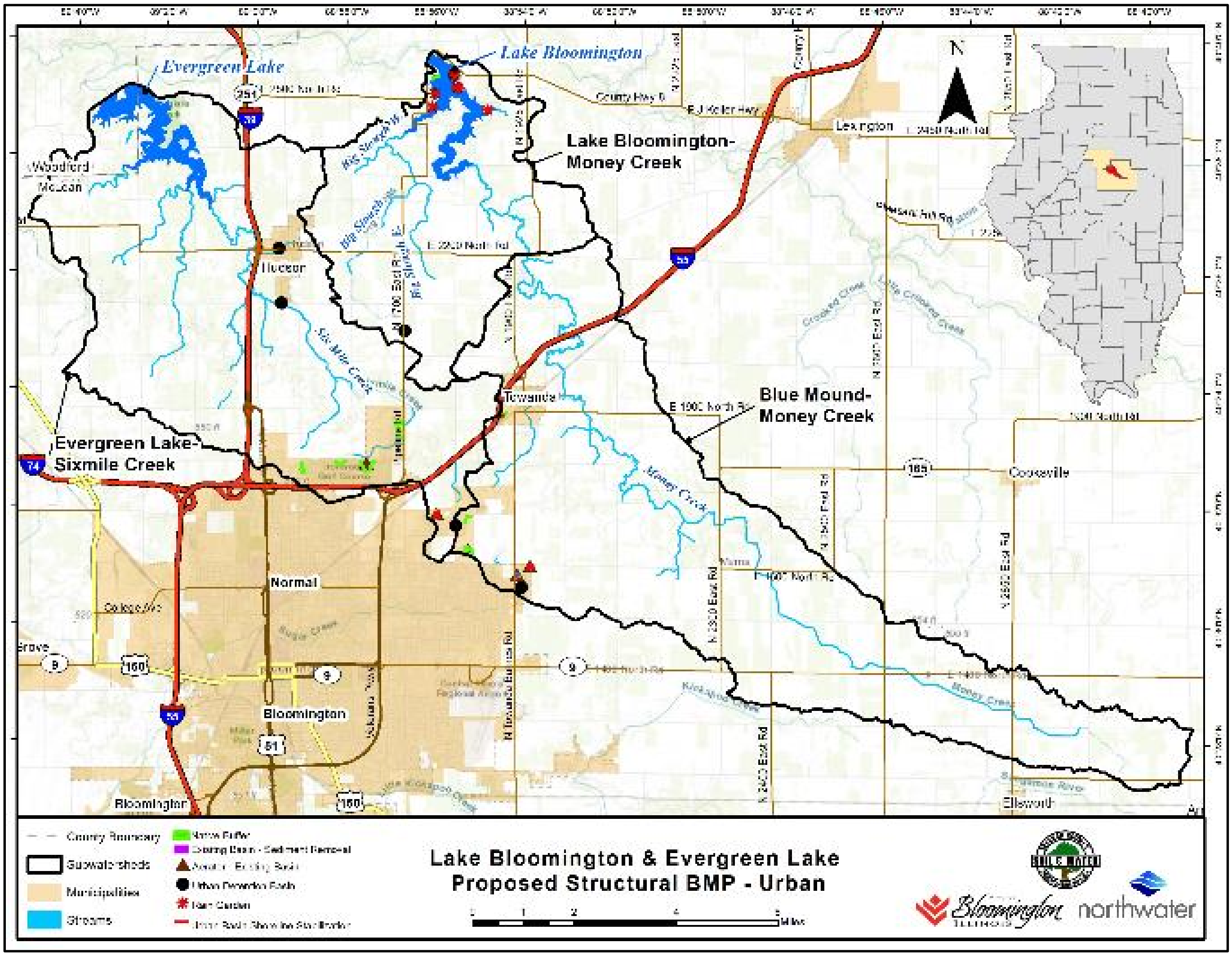


Figure 50 – Proposed Structural BMPs – Urban

Urban Detention Basin in the Watershed

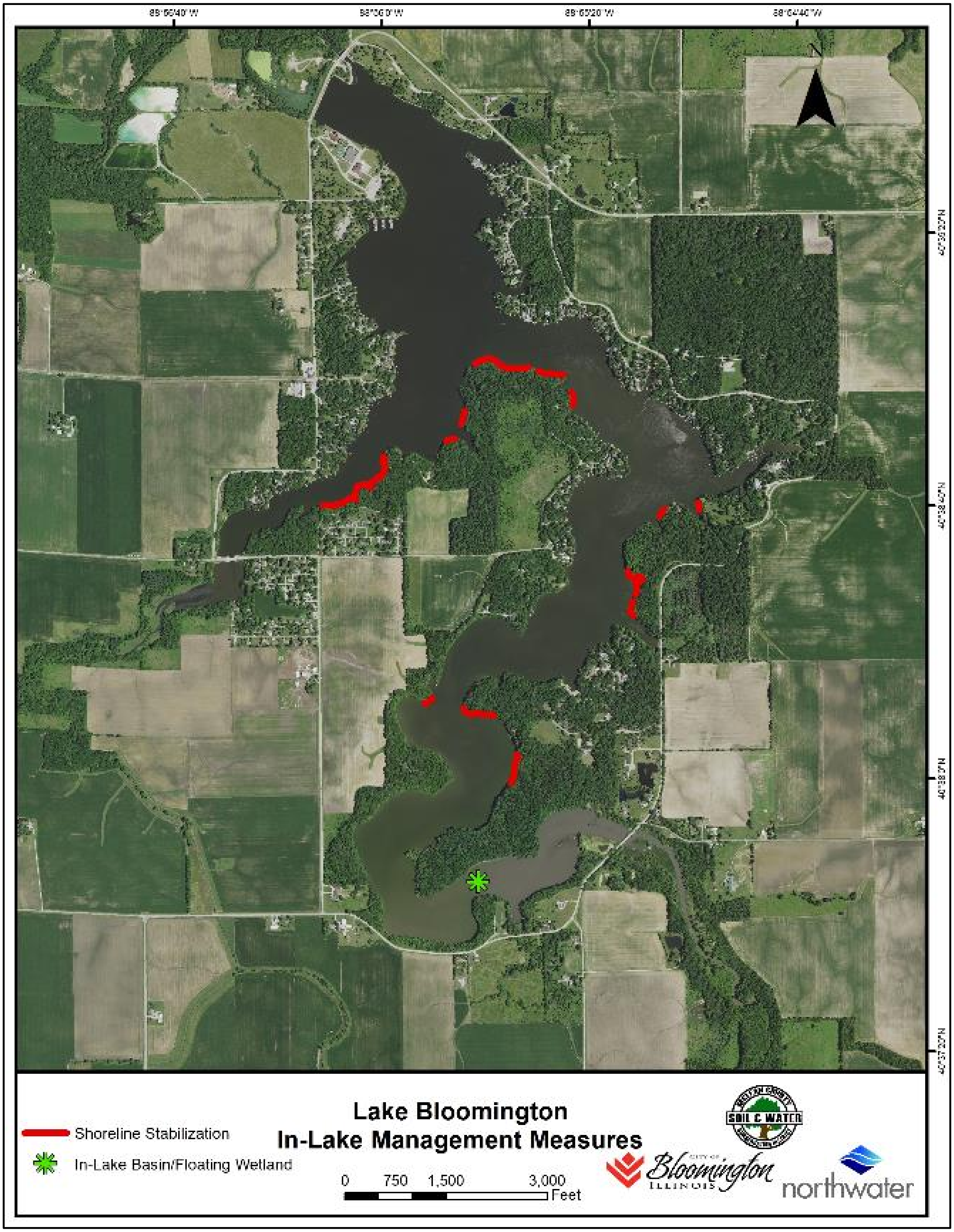


Figure 51 – Proposed In-Lake Management Measures – Lake Bloomington

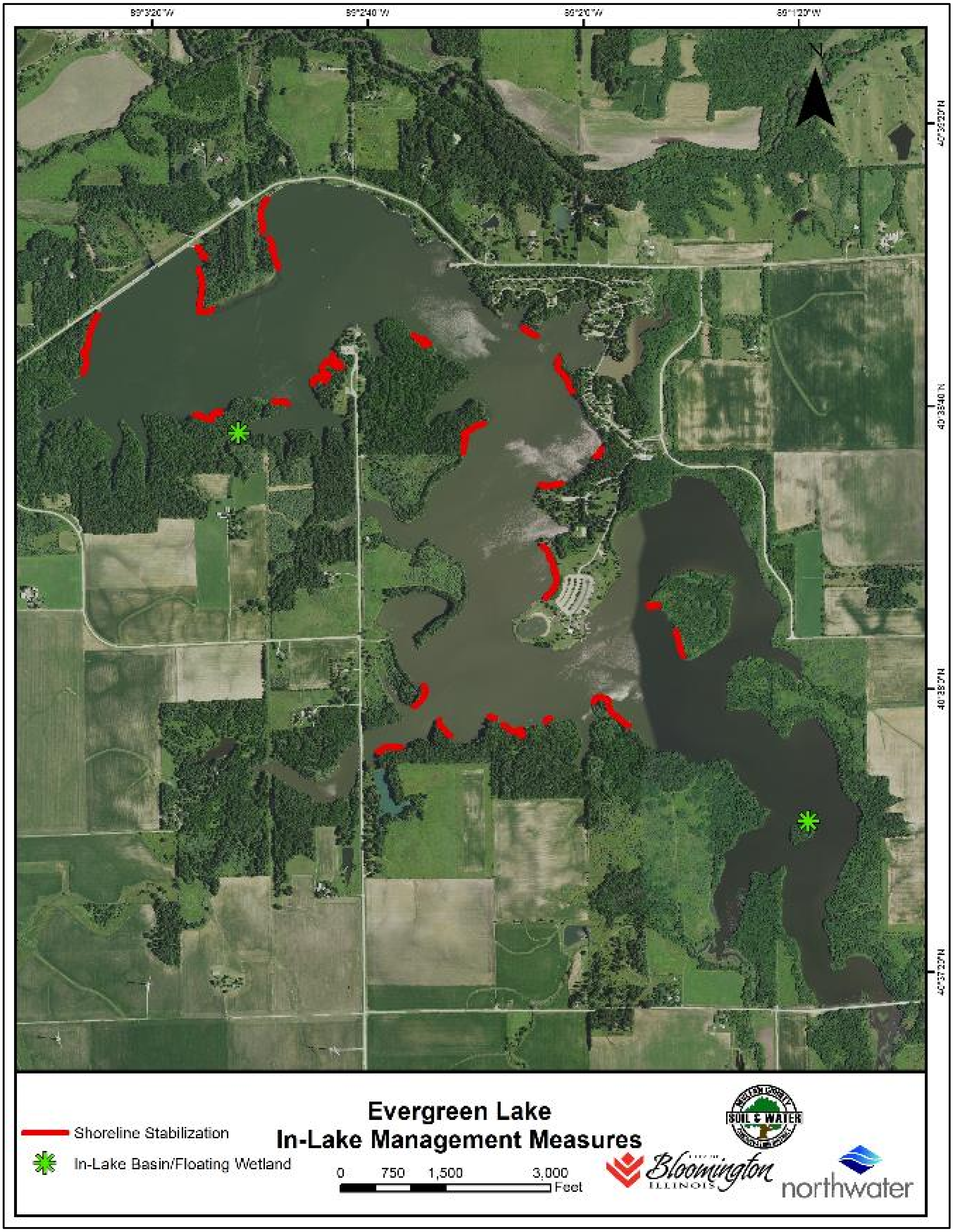


Figure 52 – Proposed In-Lake Management Measures – Evergreen Lake

6.1.1 Agricultural - In-Field BMP Summary

In-field management measures are critical to achieving water quality targets. These measures focus on nutrient and sediment loading coming from cropland.

Cover Crops

A cover crop is a temporary vegetative cover that is grown to provide protection for the soil and improve soil conditions. Cover crops can be applied over a broad area in the watershed and are key to addressing nitrogen.

All fields greater than 5 acres not currently in cover crops were selected and are proposed for 755 fields in LB (35,109 ac) and 438 fields (18,653 ac) in EL for a total of 53,762 acres. If all acres are planted, the following annual load reductions are expected:

Lake Bloomington (35,109 ac):

- 401,913 lbs nitrogen
- 4,676 lbs phosphorus
- 6,668 tons sediment

Evergreen Lake (18,653 ac):

- 225,830 lbs nitrogen
- 2,754 lbs phosphorus
- 3,926 tons sediment

Cover Crop

No-Till or Strip-Till

No-till can be defined as farming where the soil is left relatively undisturbed from harvest to planting. During the planting operation, a narrow seedbed is prepared, or holes are drilled in which seeds are planted. A switch from conventional tillage to no-till is often a prerequisite for the installation of cover crops. Strip-till is a good alternative to no-till, especially for those producers that are not willing to move to no-till. Strip-till is a minimum tillage system that combines the soil drying and warming benefits of conventional tillage with the soil-protecting advantages of no-till by disturbing only the portion of the soil that is to contain the seed row.

No-till or strip-till is proposed for fields greater than 5 acres in size where conventional or reduced tillage is employed and where HEL soils exist are being mulch-tilled. In LB, 227 fields are recommended (10,677 ac). In EL, 240 fields are recommended (10,524 ac), for a total of 21,201 acres. If all acres are treated, the following annual reductions are expected:

Lake Bloomington (10,677 ac):

- 15,150 lbs nitrogen
- 2,851 lbs phosphorus
- 4,924 tons sediment

Evergreen Lake (10,524 ac):

- 15,065 lbs nitrogen
- 2,715 lbs phosphorus
- 4,336 tons sediment

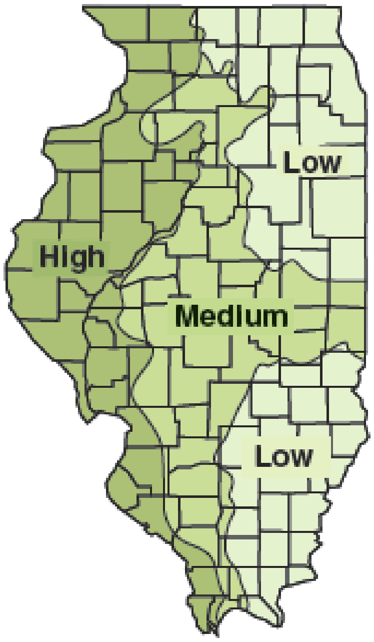
No-Till

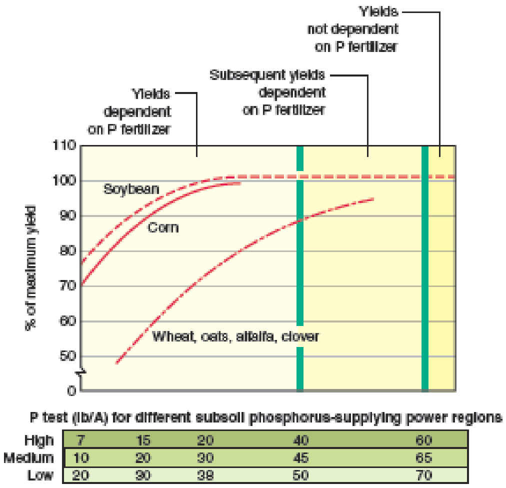
Nutrient Management

Nutrient management is the practice of using nutrients essential for plant growth, such as nitrogen and phosphorus fertilizers, in proper quantities and at appropriate times for optimal economic and environmental benefits. Nutrient management is a non-structural practice that can be applied to all fields in the watershed, primarily to address nitrogen; it is well-suited to the flat topography and productive nature of soils in the watershed although, if a field is being farmed, nutrient management should be practiced regardless of these factors. The nutrient management system now being promoted by the Illinois Council on Best Management Practices (ICBMP) utilizes the approach commonly called the "4Rs":

- Right Source: Matches fertilizer type to crop needs.
- Right Rate: Matches amount of fertilizer to crop needs.
- Right Time: Makes nutrients available when crops need them.
- Right Place: Keeps nutrients where crops can use them.

Promoting smart soil testing is also important as the spatial variability of available nutrients in a field makes soil sampling the most common and greatest source of error in a soil test (University of Illinois 2012). Proper soil testing is the foundation of good nutrient management as it relates to nitrogen and phosphorus.





As described in Chapter 8 of the Illinois Agronomy Handbook, regional differences in P-supplying power shown in the adjacent figure were broadly defined primarily by parent material and degree of weathering factors. Within a region, variability in parent material, degree of weathering, native vegetation, and natural drainage cause differences in the soil's P-supplying power. For example, soils developed under forest cover appear to have more available subsoil P than those developed under grass.

Minimum soil test levels required to produce optimal crop yields vary depending on the crop to be grown and the soil's P-supplying power (see adjacent figure). Near maximal yields of corn and soybeans are obtained when levels of available P are maintained at 30, 40, and 45 lbs/ac for soils in the high, medium, and low P-supplying regions, respectively. Since these are minimal values, to ensure soil P availability will not restrict crop yield, it is recommended that soil test results be built up to 40, 45, and 50 lbs/ac for soils in the high, medium, and low P-supplying regions, respectively. This is a practical approach because P is not easily lost from the soil, other than through crop removal or soil erosion.

Several methods described in Chapter 8 of the Illinois Agronomy Handbook can be used to manage crop nutrient loss: variable rate technology (VRT) and deep fertilizer placement. VRT can improve the efficacy of fertilization and promote more environmentally sound placement compared to single-rate applications derived from the conventional practice of collecting a composite soil sample to represent a large area of the field. Research has shown that this technology often reduces the amount of fertilizer applied over an entire field. However, one of the drawbacks of this placement method is the expense associated with these technologies. Also, VRT can only be as accurate as the soil test information used to guide the application rate (University of Illinois 2012).

Shifting the fall application of nitrogen fertilizer to split applications in the spring can reduce tile nitrate losses by 20% (David, 2018). Split applying nitrogen involves two or more fertilizer applications during the growing season rather than providing all of the crop's nitrogen requirements with a single treatment. This makes nutrient uptake more efficient and reduces the risk of denitrification, leaching or volatilization.

Deep fertilizer placement is where any combination of nitrogen, phosphorus, and potassium can be injected at a depth of 4 to 8 inches. Subsurface applications may be beneficial (if the subsurface band application does not create a channel for water and soil movement) when the potential for surface water runoff is high (University of Illinois 2012).

Deep Placement – P Fertilizer

Fields greater than 5 acres in size and without a known nutrient management plan were selected for the deep placement of phosphorus fertilizer. If applied to all 759 fields in LB (34,588 ac) and all 459 (18,904 ac) in EL, expected annual load reductions are:

Lake Bloomington (34,588 ac):

- 2,900 lbs phosphorus

Evergreen Lake (18,904 ac):

- 1,747 lbs phosphorus

Split Application – Nitrogen Fertilizer

Fields greater than 5 acres in size without a known nutrient management plan and expected to be tiled were selected for split application of nitrogen fertilizer. If applied to all 693 fields (32,788 ac) in LB and all 417 (17,842 ac) in EL, expected annual load reductions are:

Lake Bloomington (32,788 ac):

- 141,163 lbs nitrogen

Evergreen Lake (17,842 ac):

- 79,668 lbs nitrogen

6.1.2 Structural BMP Summary

This section provides a brief description of each structural BMP and their expected load reductions. Practices are primarily for agricultural areas but do include locations in residential zones or forested areas. For example, several wetlands are recommended in developed drainages surrounding LB and ponds are often sited in forested draws.

Water and Sediment Control Basins (WASCB)

Earth embankment and/or channel constructed across a slope to intercept runoff water and trap soil. WASCBs are often constructed to mitigate gully erosion where concentrated flow is occurring and where drainage areas are relatively small. Multiple basins are often placed along a flow line or at each site depending on drainage area and cropping systems. Locations to apply these practices are somewhat limited in the watershed.

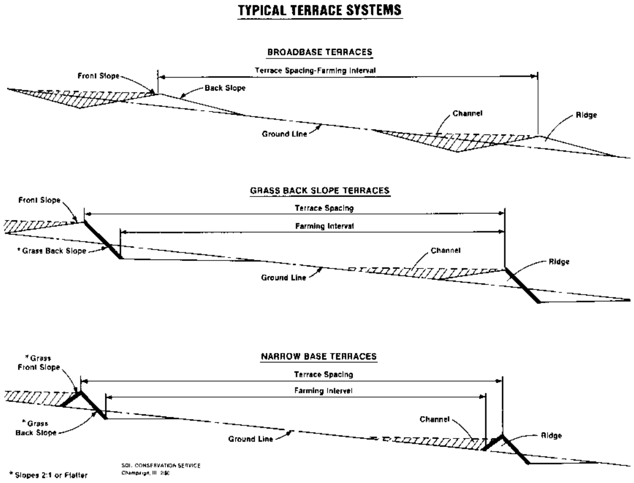
WASCBs are recommended at 20 locations, 5 in EL and 15 in LB, for a total of 72 individual basins and 10,800 feet (150-foot average per WASCB). Eleven individual WASCBs are in EL and 61 in LB. If all practices are installed, a total of 229 acres will be treated. Expected annual load reductions (including gully stabilization) will total:

Lake Bloomington (61 WASCBs):

- 788 lbs nitrogen
- 130 lbs phosphorus
- 209 tons sediment

Evergreen Lake (11 WASCBs):

- 107 lbs nitrogen
- 15 lbs phosphorus
- 23 tons sediment



NRCS Detail – Terrace/WASCB

Grassed Waterways

A grass waterway is a grassed strip in a field that acts as an outlet for water to control silt, filter nutrients and limit gully formation. Grassed waterways are applicable in areas with very large drainage areas and low-moderate slopes. These practices are well suited to the watershed.

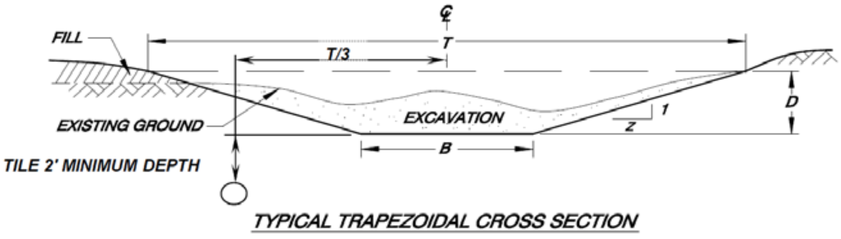
Grassed waterways are recommended at 50 locations, 17 in EL (26 ac) and 33 in LB (75 ac). Nine recommended waterways include maintenance of existing structures, such as widening, shaping and re-seeding: 5 sites, or 6.9 ac in EL and 4 sites, or 5.2 ac in LB. If all are installed, a total of 10,817 acres will be treated. Expected annual load reductions (including gully stabilization) are:

Lake Bloomington (75 ac):

- 20,616 lbs nitrogen
- 1,235 lbs phosphorus
- 2,319 tons sediment

Evergreen Lake (26 ac):

- 6,259 lbs nitrogen
- 390 lbs phosphorus
- 695 tons sediment



NRCS Grassed Waterway Detail

Constructed Wetlands/Wetland Restoration

A constructed wetland is a shallow water area built by creating an earth embankment or excavation area. Constructed wetlands can include a water control structure and are designed to mimic natural hydrology, store sediment and filter nutrients. Wetland restoration, on the other hand, aims to improve existing structures or features by expanding their footprint. Wetlands have been identified in areas where hydric soils support their establishment, where local topography does not allow for the construction of a pond, and where no substantial area of cropland is needed to be removed from production. Local watershed studies have shown that wetlands are reasonably efficient at treating nitrogen, especially from tile flow.

Wetlands are recommended at 48 locations, 31 (109 ac) in LB and 17 in EL (42 ac). Of the total, restoration or expansion of existing wetlands are recommended at 2 locations (6 ac) in EL. If all wetlands are implemented, they will treat 11,077 acres and the annual expected load reductions (including gully stabilization) are:

Constructed Wetland

Lake Bloomington (109 ac):

- 65,372 lbs nitrogen
- 1,164 lbs phosphorus
- 1,617 tons sediment

Evergreen Lake (42 ac):

- 18,946 lbs nitrogen
- 328 lbs phosphorus
- 366 tons sediment

Saturated Buffers

A saturated buffer is a BMP in which drainage water is diverted as shallow groundwater flow through a grass buffer specifically for nitrate removal. A saturated buffer system can treat approximately 40 acres and consists of a control structure for diversion of drainage water from the outlet to lateral distribution lines that runs parallel to the buffer. Areas adjacent to a stable stream segment or existing grass buffer where adequate slope and ideal soil characteristics are likely to exist were chosen; in several cases, planting of stream buffers is needed. Pollutant removal from surface runoff is included in the expected load reduction calculations if new grass buffers are installed, otherwise, saturated buffers only treat subsurface flow.

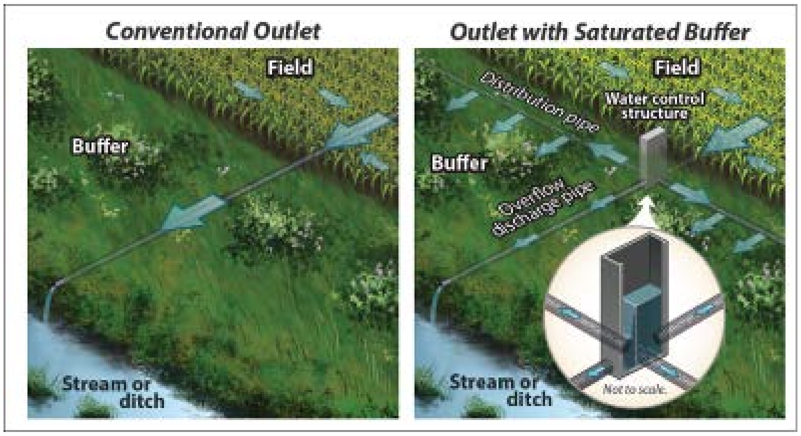
A total of 41 systems or sites are recommended, 17 in LB and 24 in EL; this represents a treatment area of 4,433 acres and over 400,000 ft of tile. Annual expected load reductions if all sites are implemented total:

Lake Bloomington (17 systems):

- 26,584 lbs nitrogen
- 34 lbs phosphorus

Evergreen Lake (24 systems):

- 28,534 lbs nitrogen
- 37 lbs phosphorus



Saturated Buffer - *Credit: USDA*

Denitrifying Bioreactor

A denitrifying bioreactor is a structure containing a carbon source, installed to reduce the concentration of nitrate nitrogen in subsurface agricultural drainage flow via enhanced denitrification. One bioreactor system will treat approximately 50 acres. Locations were identified by direct observation during the watershed windshield survey, by interpretation of aerial imagery and soils, and from recommendations provided by TNC.

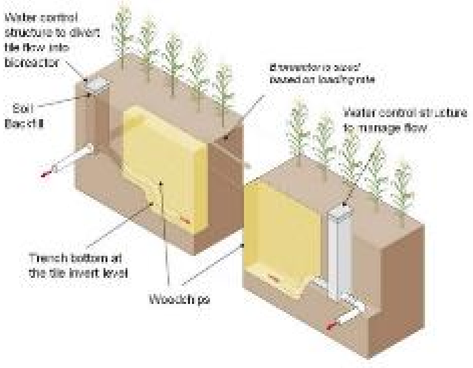
Forty-seven bioreactors at 35 locations, 26 in EL (21 locations) and 21 in LB (14 locations) can likely be applied effectively and will treat 1,844 acres. Annual load reductions expected if all bioreactors are implemented total:

Lake Bloomington (21 systems):

- 7,898 lbs nitrogen
- 2.8 lbs phosphorus

Evergreen Lake (26 systems):

- 8,003 lbs nitrogen
- 2.8 lbs phosphorus



Bioreactor

Drainage Water Management

Drainage water management (DWM), also known as controlled drainage, is the practice of managing water table depths in such a way that nutrient transport from agricultural tile drains is reduced during the fallow season and plant water availability is maintained during the growing season. Sites were selected by direct observation during the watershed windshield survey, by interpretation of aerial imagery and soils, and from recommendations provided by TNC. A total of 43 locations, 16 in LB and 27 in EL, are recommended to treat a total of 3,996 acres. Annual expected load reductions if all sites are treated total:

Lake Bloomington (16 systems):

- 15,279 lbs nitrogen
- 11 lbs phosphorus

Evergreen Lake (27 systems):

- 17,760 lbs nitrogen
- 13 lbs phosphorus

Water Control Structure

Filter Strips, Field Borders, & Conservation Cover

A filter strip is a band of grass or other permanent vegetation used to reduce sediment, nutrients, pesticides, and other contaminants. Only those areas directly adjacent to an openly flowing ditch or stream where existing buffer areas are either inadequate or nonexistent were selected for the placement of filter strips. Field borders are like filter strips but are located along field edges or adjacent to timbered areas; they can range in width from 30 – 120 feet. Conservation cover plantings consist of removing land from production and planting native vegetation. This practice is recommended on sites that are expected to have high erosion rates.

Field borders are recommended at 150 locations for a total of 280 acres, 100 locations in LB (179 ac) and 50 (102 ac) in EL. If all borders are planted, they will treat 8,148 acres. Expected annual load reductions (including gully stabilization) are:

Lake Bloomington (179 ac):

- 5,626 lbs nitrogen
- 766 lbs phosphorus
- 1,307 tons sediment

Evergreen Lake (102 ac):

- 2,660 lbs of nitrogen
- 387 lbs of phosphorus
- 700 tons of sediment

Field Border

Filter strips are recommended at 115 locations for a total of 244 acres, 70 locations (158 ac) in LB and 45 (86 ac) in EL. If all strips are planted, they will treat 4,651 acres. Expected annual load reductions (including gully stabilization) are:

Lake Bloomington (158 ac):

- 5,537 lbs nitrogen
- 802 lbs phosphorus
- 1,484 tons sediment

Evergreen Lake (86 ac):

- 2,892 lbs nitrogen
- 415 lbs phosphorus
- 754 tons sediment

Conservation cover plantings are recommended at 78 locations totaling 147 acres of planting, 41 locations (81 ac) in LB and 37 (66 ac) in EL. The treated area is 267 ac. If all are planted, expected annual load reductions (including gully stabilization) are:

Lake Bloomington (81 ac):

- 2,083 lbs nitrogen
- 46 lbs phosphorus
- 55 tons sediment

Evergreen Lake (66 ac):

- 2,126 lbs nitrogen
- 60 lbs phosphorus
- 80 tons sediment

Grade Control Structures

A grade control structure consists of a constructed berm or a rock/modular block structure (NRCS detail provided below) designed to address gully erosion and control vertical downcutting. Grade control structures are recommended at locations where slopes are very steep and gully erosion is considered very severe; areas where other practices are just not feasible. Rock riffles are also possible at locations where grade control is required and can be used in place of the practices below; rock riffles are described in the streambank stabilization section.

Grade Control Structure

Grade control structures are only recommended in LB at 2 locations for a total of 7 individual structures. If all are installed, they will treat a total of 141 acres. Expected annual load reductions (including gully stabilization) are:

- 299 lbs nitrogen
- 19 lbs phosphorus
- 31 tons sediment

Streambank Stabilization: Stone-Toe Protection & Riffle

Streambank stabilization consists of both the placement of rock riffles and the installation of stone-toe protection (STP) to stabilize eroding streambanks and control stream grade, if necessary. Stream channel incision or deepening can lead to bank erosion and, oftentimes, grade control or rock riffles are needed in combination with STP. Fourteen stream riffles and 3,700 ft of STP are recommended at 3 locations, 2 in LB and 1 in EL (only riffles). Locations were selected based on sediment load, accessibility and cost effectiveness.

Riffle

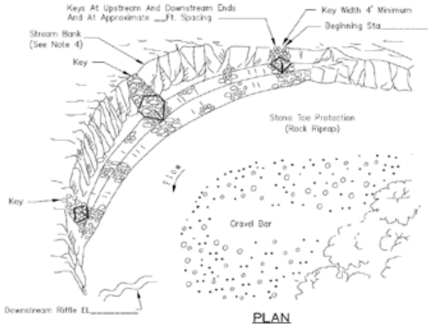
If all sites are addressed, annual expected load reductions are:

Lake Bloomington (2 sites):

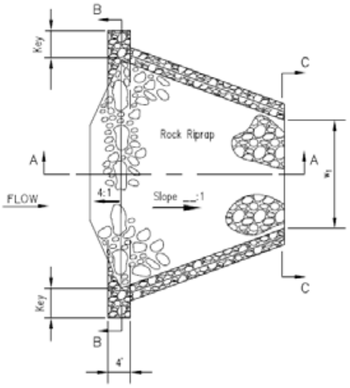
- 231 lbs nitrogen
- 109 lbs phosphorus
- 180 tons sediment

Evergreen Lake (1 site):

- 20 lbs nitrogen
- 9.4 lbs phosphorus
- 16 tons sediment



NRCS STP Detail



NRCS Riffle Detail

Ponds / Sediment Basins

A pond is water impoundment made by constructing an earthen dam. A sediment basin is similar but designed to trap sediment and only hold water for a limited period of time. Similar to a WASCB, a sediment basin will treat a large drainage area. A total of 5 ponds and 1 sediment basin are recommended to treat 608 acres, 3 ponds and 1 sediment basin in LB and 1 pond in EL. These structures will trap sediment and nutrients from runoff and will control gully erosion in steep forested draws.

If all ponds and the sediment basin are installed, annual expected load reductions (including gully stabilization) are:

Lake Bloomington (4 sites):

- 4,202 lbs nitrogen
- 214 lbs phosphorus
- 310 tons sediment

Evergreen Lake (1 site):

- 270 lbs nitrogen
- 11 lbs phosphorus
- 11 tons sediment

Pond

Pasture Management & Stream Fencing

Pasture management consists of stream fencing to exclude livestock from the stream, appropriate stream crossings for cattle use and an alternate water supply (if needed). Stream fencing is placed back from the stream edge to allow for a vegetated buffer to filter runoff.

Stream fencing is recommended at 3 pasture locations in the LB watershed; each location but one includes stream crossings. A total of 16,735 ft of fence is recommended.

If each system is installed, 173 acres would be treated. Expected annual load reductions in LB are:

- 2,648 lbs nitrogen
- 98 lbs phosphorus
- 53 tons sediment

Stream Fencing

Livestock Feed Area Treatment System

Once a site has been identified in the watershed, an integrated system can be constructed to manage livestock waste. The feed area system includes three individual practices working in series; a settling basin to capture solids, a rock spreader and vegetated swale for initial waste treatment and, finally, a treatment wetland to capture and treat the remaining waste.

One system in the LB watershed is recommended to treat 8 ac. If this system is implemented, the following annual load reductions are expected:

- 127 lbs nitrogen
- 9.5 lbs phosphorus
- 0.3 tons sediment

Waste Containment Area

6.1.3 In-Lake Management Measures

In-lake management measures are those practices or actions that can be implemented to address nutrient and sediment loads generated within each lake or from the entire watershed. In-lake dams and floating wetlands, shoreline stabilization, and maintenance dredging are recommended. Other measures, such as aeration or alum treatments to prevent internal nutrient release, are not included. Aerators are in place and operating at critical locations and internal nutrient release is now low compared to other sources.

Selective Dredging

Removing accumulated sediment within the shallow upstream areas of both lakes is recommended to improve access and to reduce internal nutrient recycling due to soft sediment re-mobilization. Targeted removal will increase the effectiveness, longevity, and trapping capability of any sediment and nutrient control infrastructure project that may be implemented in the future. It will also add water volume capacity, especially during drought or critical periods between precipitation events. Up to 93,060 CY of sediment removal is recommended for LB and 172,316 for EL. If the maximum dredging quantities are achieved, expected reductions are:

1. **Lake Bloomington**
    - 55,278 lbs phosphorus
    - 50,252 tons deposited sediment
2. **Evergreen Lake**
    - 102,356 lbs phosphorus
    - 93,051 tons deposited sediment

Reductions are not included in the summary tables and totals. The sediment and phosphorus is deposited and although available for resuspension and a potential internal loading source, removal does not necessarily reflect a reduction to the lakes for the purposes of this plan.

In-lake Basin/Floating Wetland System

In-lake sediment and nutrient control basins, consisting of either a free-floating sediment control boom or curtain, a floating wetland, or a low-head dam structure, could be constructed to trap and treat nutrients and reduce flow velocities and allow sediment to be deposited within the upper end of each lake. The exact positioning and location would be determined through further hydraulic and engineering design studies.

Floating Treatment Wetland Examples (www.martinecosystems.com)

Low-flow/in-lake dam; Otter Lake, Illinois

Since an in-lake structure would temporarily increase the upstream lake elevation by several feet, the final design would need to control the maximum water surface elevation to reduce flooding potential and impacts to properties and structures. Low flows pass through an opening within the dam structure, which could allow small boats to pass upstream. Larger flows would be temporarily impounded allowing sediment and nutrients to be deposited and retained. With a floating wetland system, flooding potential is mitigated as the wetlands are anchored and will adjust as water levels rise and fall.

Primary sediment and nutrient control basin/floating wetland structure locations for each lake are illustrated below. A third location is recommended in EL for a small tributary immediately south of the spillway. On LB, the narrow constriction in the lake appears feasible since the distance from shoreline to shoreline is only 380 ft and hard lake bottom depths range from 3 - 4.5 ft. The primary structure location for EL is approximately 2,700 ft downstream of the E 2300 N Rd bridge. The structure could be installed in two separate segments that tie into the island for a total structure length of approximately 1,000 feet. However, due to the overall length at this location, a smaller structure could be considered further upstream where the overall length would be about 460 ft with slightly shallower bottom depths.

Proposed Structure Locations

Further evaluation is needed to determine and select the most cost-effective location and design for any in-lake structure or barrier. The overall size and capacity of the basin, in addition to lake use requirements and upstream flooding considerations, are all important factors that can impact design complexity, construction cost and nutrient trapping efficiency.

One location is recommended on LB to treat 34,313 ac and is approximately 380 ft in length or 1 ac in size for a floating wetland system. Two locations are recommended on EL, for a total of 1,130 ft or 2.1 ac for a floating wetland system. If selective dredging is performed alongside the installation of an in-lake basin structure or floating wetland systems, annual expected load reductions are:

Lake Bloomington:	**Evergreen Lake:**
• 253,874 lbs nitrogen	• 156,745 lbs nitrogen
• 4,372 lbs phosphorus	• 3,681 lbs phosphorus
• 5,409 tons sediment	• 3,404 tons sediment

Lake Shoreline Stabilization

Stabilizing sections of shoreline to reduce in-lake sediment delivery should be targeted to those areas with the highest rates of erosion. This can be accomplished by installing rip-rap or another form of armoring at the base of each bank. Shoreline stabilization is recommended at 18 locations, or 5,722 ft in LB and 28 locations, or 11,171 ft in EL. These areas are presented in Figure 51 and Figure 52. Annual load reductions expected if all sites are implemented total:

Lake Bloomington:

- 250 lbs nitrogen
- 184 lbs phosphorus
- 354 tons sediment

Evergreen Lake:

- 613 lbs nitrogen
- 399 lbs phosphorus
- 767 tons sediment

Stabilized Shoreline – Lake Bloomington

6.1.4 Urban BMPs – Residential areas

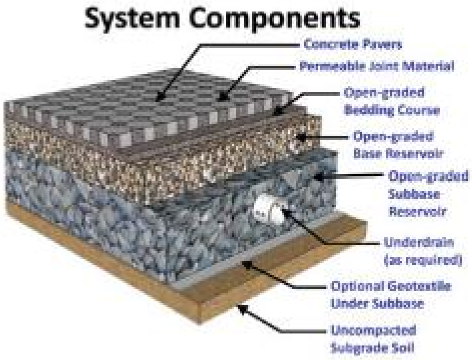
Urban BMPs are those specific to residential areas or within city limits. This includes rain gardens and rain barrels, naturalized urban detention basins, sediment removal from existing basins, shoreline stabilization of existing basins, native buffers, and septic systems. Wetlands located in residential areas are summarized in the previous section.

Residential Rain Gardens

Rain gardens are recommended in residential areas surrounding LB where interested homeowners exist. A rain garden is a planted depression that allows rainwater runoff from impervious urban areas, including roofs, driveways, walkways, parking lots, and compacted lawn areas, the opportunity to be absorbed.

Eleven rain gardens are recommended around LB at 8 locations to treat 4.7 acres. Annual load reductions expected if all are installed are:

- 13 lbs nitrogen
- 0.5 lbs phosphorus
- 0.2 tons sediment



Urban Detention, Aeration, Sediment Removal, & Shoreline Stabilization

Naturalized detention basins are designed to provide greater water quality and habitat benefits relative to standard dry-bottom (turfgrass) detention basins. They are stormwater control facilities that are planted with native vegetation to help improve stormwater quality. Aerators installed in existing basins promote mixing and reduce algal blooms and the internal release of nutrients from deposited sediment. Shoreline stabilization in existing basins is also needed in more severe areas to limit bank erosion and selective dredging is recommended to remove a source of nutrients and increase storage capacity.

Naturalized Detention Basin

Naturalized detention basins - a total of 5 are recommended, 2 in LB and 3 in EL to treat 543 acres. If implemented, annual expected load reductions are: 1,857 lbs nitrogen, 174 lbs phosphorus, and 64 tons sediment. The most critical locations are in EL.

Aerators - 6 are recommended within 3 existing basins in LB and 2 in one basin in EL. If installed, these aerators could be expected to reduce annual nutrient loading by 338 lbs of nitrogen and 10 lbs of phosphorus. The most critical locations are in EL.

Sediment removal - dredging a total of 29,700 CY of sediment from 2 basins in LB and 1 in EL is expected to reduce nitrogen loading by 23 lbs/yr, phosphorus by 1.6 lbs/y, and sediment by 0.2 tons/yr. The most critical locations are in LB.

Shoreline stabilization - at 3 existing basins in LB 1 location in EL for a total of 4,240 ft is expected to reduce nitrogen loading by 8.5 lbs/yr, phosphorus by 4.9 lbs/yr, and sediment by 4.5 tons/yr. The most critical shorelines are in the EL watershed.

Native Prairie Buffers

Native vegetative buffers as shown in the photo above can help to filter sediment and nutrients more efficiently, provide habitat where little exists and are aesthetically pleasing. Native buffers have been identified where interest lies and where previous urban detention basin assessments have recommended them. A total of 6 ac at 7 locations is proposed in LB and 8.3 ac at 7 locations in EL to treat 100 combined acres. Annual load reductions expected are:

Lake Bloomington (6 ac):

- 12 lbs nitrogen
- 2.2 lbs phosphorus
- 0.4 tons sediment

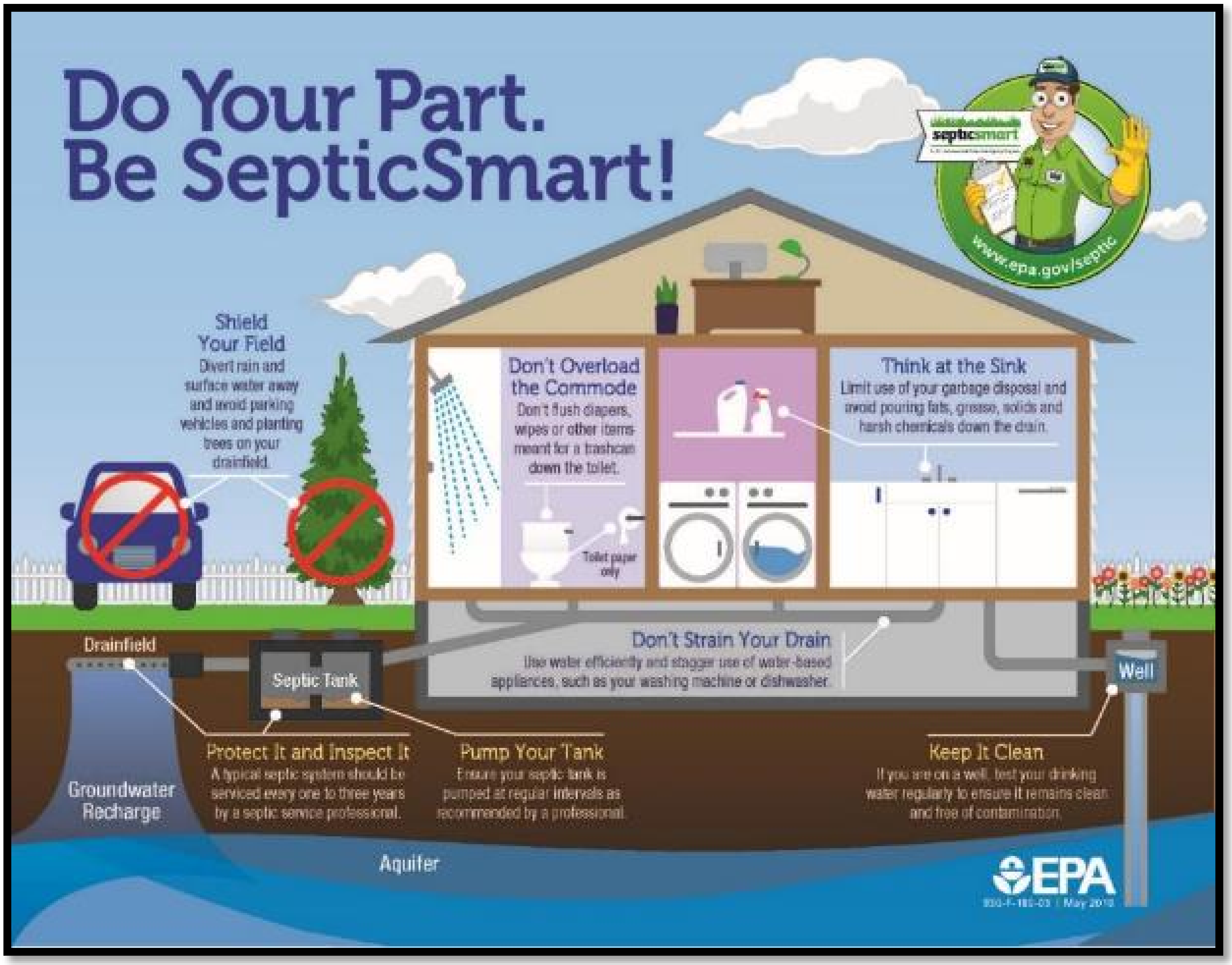
Evergreen Lake (8.3 ac):

- 27 lbs nitrogen
- 5.2 lbs phosphorus
- 0.9 tons sediment

Septic Systems

Failing septic systems are likely a source of nutrients to both lakes. It is not known which specific systems are failing and, therefore, actions taken by stakeholders and watershed managers to address them should focus on education programs. The EPA, for example, has implemented a SepticSmart program (https://www.epa.gov/septic) consisting of tips for maintenance and educational materials that can be distributed or promoted to those homes in the watershed that are not on sewers.

Reducing the number of failing systems will benefit water quality, however, the cost of connecting all residences to a sewer network far outweighs the water quality benefits. As previously noted, the City and the Lake Bloomington Association have partnered to purchase and distribute chlorine tabs for tenants for sand filters, as well as spent considerable time in educational outreach to all tenants about the importance of proper septic system care.



Septic Smart Brochure: *Credit: EPA*

6.1.5 City-Owned BMP Summary

Practices specific to City-owned property are summarized in Table 74. This includes ponds, wetlands, in-lake measures and sediment removal, grade control, a rain garden, a bioreactor, shoreline stabilization, and native buffers. If implemented, these practices will reduce 21% of the combined LB/EL watershed nitrogen load, 22% of the phosphorus and 29% of the sediment. The majority of the water quality benefits are achieved with the proposed in-lake structures.

Table 74 - City of Bloomington Owned BMP Summary

BMP	Watershed	Quantity	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)
Native Buffer	Lake Bloomington	1.4 (ac)	4.2	0.66	0.18
In-Lake Floating Treatment Wetland/Basin (includes dredging)	Lake Bloomington (1) / Evergreen Lake (2)	3.1 (ac)	410,618	8,053	8,814
Aeration	Lake Bloomington	2 (#)	50	1.2	0
Bioreactor	Lake Bloomington	1 (#)	528	0.2	0
Rain Garden	Lake Bloomington	1 (#)	0.04	0.001	0.0004
Pond	Lake Bloomington (2) / Evergreen Lake (1)	3 (#)	1,445	62	80
Wetland Creation	Lake Bloomington (4) / Evergreen Lake (1)	14 (ac)	4,195	113	123
Urban Detention Basin Sediment Removal	Lake Bloomington	13,300 (CY)	15	1	0.2
Lake Bloomington Shoreline Stabilization	Lake Bloomington	5,722 (ft)	250	184	354
Evergreen Lake Shoreline Stabilization	Evergreen Lake	11,171 (ft)	613	399	767
Urban Detention Basin Shoreline Stabilization	Lake Bloomington	1,329 (ft)	0.6	0.8	0.4
Grand Total			**417,719**	**8,814**	**10,139**

7.0 Cost Estimates

BMP costs were calculated based on professional judgment and expertise, cost-share rates provided by the NRCS and SWCD, and unit costs used in other watershed plans. Many of the estimates are based on field visits and known quantities for a given practice. Costs should be considered as estimates only and revisited during implementation, as required. Totals include costs for some level of planning and/or engineering. Maintenance costs are not included.

7.1 Unit Costs

Unit cost estimates and assumptions are as follows:

1. Filter strips and field borders are estimated at $200/ac. Costs include land preparation, materials and seeding. Estimates do not include any annual rental payments or land acquisition costs. Native buffers planted in urban areas are estimated at $800/ac.
2. Grass conversion/planting includes land prep and seeding and is estimated at $500/ac.
3. Riffles are estimated as $8,000 each.
4. Streambank (STP) stabilization assumes $72/ft and lake shoreline stabilization $90/ft, including engineering and permitting.
5. Livestock stream fencing is estimated as $1.60 per foot. Each system that includes a stream crossing estimated at $5,000 each. Watering systems are estimated at $40,000 each.
6. A Livestock waste or feed area system is based on professional judgment at a cost of $60,000 per facility.
7. Grade control structures are estimated at $6,000 each.
8. Grass waterways assume $3,700 per acre plus an estimated cost of $2.50 per ft of tile.
9. WASCBs costs are estimated at a base cost of $2,100 per basin (av. of 700 yd^3 soil), in addition to an estimated $3.50 per ft of tile.
10. Terraces are estimated at a base cost of $2.56 per foot, plus an additional cost of $3.50 per ft of tile.
11. Wetlands are based on a unit cost of $20,000 per acre plus $3,000 for a water control structure and tile.
12. Urban detention basins are estimated at an average cost of $80,000 per basin.
13. Residential rain gardens are estimated at $4,500 each and based on professional judgment.
14. Ponds are an average cost of $50,000 each (av. 10,000 yd^3 soil). Cost can range depending on the size of the berm and primary spillway pipe, the extent of clearing needed, and size of rock at outfall structures.
15. Pond aerators assume an installation and material cost of $4,000 per unit.
16. Nutrient management practices cost $18.40 per acre for 1 year including soil testing plus a nutrient management plan at $10/ac up to a maximum of $1,200.
17. Drainage Water Management is estimated to cost $161.60 per acre for installation to retrofit an existing tile system, using the estimates obtained from the Agricultural Watershed Institute in Macon County.

18. Bioreactors cost an estimated $53.21 per cubic yard to install, including labor and materials. Based on a surface area of 20' x 50' and a 4' depth, the cost is $8,000 for a system sized to treat 50 acres.
19. Saturated buffers assume total tile length of 3 times the buffer length plus a water control structure. Tile cost is estimated at $2.10 per ft. Water control structures are $3,000 each.
20. No-Till and strip-till assume $16.41/ac for 1 year.
21. Cover crops assume $68.43/ac for 1 year of non-winter terminating crop.

In-Lake Structures & Dredging

The following summary provides opinions of probable cost for select dredging and in-lake basins/dam or floating wetland systems. It is important to note that the opinions of cost only include capital construction costs. Future operation and maintenance costs (i.e., debris, vegetation and sediment removal) are excluded.

For preliminary planning purposes, a dredging project that ranges in size from 93,060 cubic yards (LB) to 172,316 cubic yards (EL) would cost from $10 to $12 per cubic yard plus engineering, permitting and contingency. Therefore, a preliminary budget estimate for selective dredging in the upper ends of LB would range from $1.3 to $1.5 million and from $2.4 to $2.8 million for EL.

If an in-lake structure is assumed to have a total average height of 6-8 ft and is constructed of embankment and/or riprap fill and stable armoring, cost can be estimated by linear ft. The total length of the LB structure is 380 ft and the primary option noted for EL is 1,000. At an average height of 6 ft, other similar designs have ranged from $1,500 to $2,000 per ft, including engineering, permitting, contingency, and construction. Therefore, the LB structure could cost from $570,000 to $760,000 and the EL option from $1.5 to $2.0 million. A 1991 environmental assessment prepared by the USDA indicated a total cost of $1,902,200 for 11 ft structures on LB and EL. Accounting for inflation, current estimates are within a reasonable range assuming no major mitigation or land acquisition is needed.

Floating wetland systems can cost approximately $1,000,000 per acre for materials and anchoring. Assuming a 1 ac system on LB and a 1.9 and 0.2 ac system on EL, unit costs are similar to a permanent structure. Permitting and engineering costs associated with floating wetland systems are assumed to be lower than those of a constructed dam.

Costs assume dredging is completed prior to construction of any in-lake structure to ensure load reductions are maximized. A 10% contingency has been added.

7.2 Total Cost

Table 75 below provides a detailed breakdown of cost estimates for each BMP type and the cost per unit of loading reduced. The total cost of implementing all BMPs is estimated to be **$25,164,647**. Average cost per pound of nitrogen removed is $2,270; average cost per pound of phosphorus removed is $12,998, and the average cost for a ton of sediment removed is $30,878. It should be noted that these average costs include practices with exceptionally high values and, therefore, skew the averages.

Per pound of nitrogen reduction, filter strips and cover crops are the most effective practices, followed by field borders, nutrient management, conservation cover, grass waterways, drainage water management, and in-lake structures. Filter strips, field borders and conversion to no-till or strip-till are the most cost effective for phosphorus reduction, followed by grass waterways and nutrient management. Field borders, filter strips and no-till/strip-till are the most cost effective for reducing sediment delivery to the lakes.

In addition to the costs presented in this section for BMP implementation, there will be costs associated with outreach and addressing septic systems through education campaigns. It is estimated that costs for education and outreach could range from $30,000 – $70,000 per year, including staff time to contact and educate landowners, organize workshops, and develop grant applications.

Table 75 – BMP Cost Summary by BMP Type

	TYPE	Quantity	Total Cost (USD)	Cost/lb Nitrogen Reduction	Cost/lb Phosphorus Reduction	Cost/ton Sediment Reduction
In-Field Practices	Cover Crop	53,762 (ac)	$3,678,998	$5.86	$495.16	$347.29
	No-Till/Strip-Till	21,201 (ac)	$347,895	$11.50	$62.50	$37.57
	Nutrient Management – Deep Placement P	53,493 (ac)	$1,506,483	n/a	$324.18	n/a
	Nutrient Management - Split Application N	50,630 (ac)	$1,425,181	$6.45	n/a	n/a
In-Field Practices Subtotal / Av.		***n/a***	***$6,958,557***	***$7.93***	***$293.95***	***$192.43***
Structural, In-Lake, and Urban Practices	Conservation Cover	78 (#), 147 (ac)	$95,200	$22.62	$895.58	$702.58
	Ponds/ Sediment Basin	4 (# ponds) / 1 (# sediment basin)	$325,000	$72.80	$1,441.69	$731.14
	Urban Detention Basin	5 (#)	$560,000	$303.31	$3,210.27	$8,704.03
	Field Border	150 (#) / 281 (ac)	$56,086	$6.77	$48.63	$29.94
	Filter Strip	115 (#) / 244 (ac)	$48,700	$5.78	$40.00	$21.77
	Grade Control	2 (# locations) / 7 (structures)	$42,000	$140.40	$2,230.48	$1,348.75
	Grassed Waterway	50 (#) / 100 (ac)	$572,380	$21.30	$352.41	$189.95
	WASCB	20 (# locations) / 72 (basins)	$210,210	$895.00	$1,457.16	$906.16
	Wetland, Constructed/Restored	48 (#) / 151 (ac)	$3,177,200	$37.68	$2,129.62	$1,601.81

	TYPE	Quantity	Total Cost (USD)	Cost/lb Nitrogen Reduction	Cost/lb Phosphorus Reduction	Cost/ton Sediment Reduction
	Drainage Water Management	43 (# locations) / 443,000 (ft tile)	$645,795	$19.55	$27,171.92	n/a
	Saturated Buffer	41 (# locations)	$1,278,300	$23.19	$17,853.35	n/a
	Bioreactor	35 (# locations) / 47 (structures)	$372,000	$23.39	$66,192.17	n/a
	Pasture Management (Livestock Fencing / Crossings)	3 (# locations) / 16,735 (ft fence) / 7 (crossings) / 2 (water systems)	$146,797	$55.44	$1,506.69	$2,747.46
	Livestock Feed Area Management System	1 (# locations) / 2,750 (ft diversion) / 2 (basin structures)	$60,000	$471.30	$6,335.80	$193,548.40
	Urban Rain Garden	8 (# locations) / 11 (gardens)	$47,000	$3,712.48	$90,909.10	$278,106.51
	Urban Basin Aerator	4 (# locations) / 8 (# units)	$40,000	$109.81	$3,571.43	n/a
	Urban Native Buffer	14 (# locations) / 14 (ac)	$11,264	$291.13	$1,543.01	$8,282.35
	Sediment Removal – Urban Detention Basin	3 (# locations) / 29,700 (CY)	$427,680	$18,774.36	$256,710.68	$1,626,159.70
	Streambed and Bank Stabilization	4 (# locations) / 3,700 (ft STP) / 14 (riffles)	$378,400	$1,506.94	$3,190.83	$1,939.52
	Urban Basin Shoreline Stabilization	4 (# locations), 4,240 (ft)	$381,689	$44,957.48	$77,421.70	$85,198.44
	Lake Shoreline Stabilization	46 (# locations) / 16,893 (ft)	$1,520,389	$1,761.87	$2,610.07	$1,357.22
	In-Lake Basin / Floating Wetland[1]	3 (# locations) / 1,510 (ft) / 3.1 (ac)	$7,810,000	$19.02	$969.86	$886.10
Structural Practices Subtotal / Av.[2]		***n/a***	***$18,206,090***	***$2,593***	***$14,813***	***$34,488***
Grand Total		**n/a**	**$25,164,647**	**$2,270**	**$12,998**	**$30,878**

[1] – Includes cost of dredging [2] – average values exclude urban basin sediment removal

8.0 Water Quality Targets

This section describes water quality targets and those implementation actions required to meet them. The primary constituent of concern in both the LB and EL watershed is nitrogen. A 40% nitrogen reduction target was selected for both watersheds using the EL TMDL. The TMDL called for a 38% reduction and 40% was set to account for a slight trend in increasing nitrate concentrations since the TMDL was completed. Also utilizing the TMDLs, a 66% phosphorus reduction target is set for LB and an 82% for EL. A sediment reduction target of 25% is established, aligning with the INLRS target for phosphorus and reasonably considering low overall watershed sediment loads. Table 75 and Table 76 compare BMPs to targets for each lake.

Results indicate that widespread and overlapping in-field and structural BMP implementation, combined with in-lake management measures, will meet, or exceed targets. The exception of EL where an additional 2%-32% phosphorus reduction is needed. It should be noted that reductions do not account for the cumulative effect of upstream practices and, therefore, the total reductions achieved will likely be somewhat lower if all recommended practices are considered as a “system”; it is estimated that this situation could reduce reduction estimates by up to 30%. Despite this, it is still reasonable to assume that targets can be met or exceeded apart from phosphorus. Attainment of the phosphorus target will not be easy considering the low water quality standard of 0.05 mg/L and the fact that a substantial amount of legacy in-lake phosphorus will need to be removed and relatively large sections of the watershed will need to be converted from current uses to grassland. Although not included in the total reduction estimates, some dredging is recommended for the upper reaches of both lakes and will eliminate a substantial source of available phosphorus and help to achieve targets.

Cover crops, conversion to no-till or strip-till and the two primary in-lake structures (combined with selective dredging) will likely provide the greatest potential for reductions. Combined, in-field practices will achieve slightly greater reductions in both sediment and nutrients compared to structural practices; (Table 76 and Table 77). In-field management is less costly on an annual basis but requires a long-term commitment and landowner buy-in to ensure benefits are realized over multiple years.

The importance of lake and watershed management is even more important today as the City considers large investments in water treatment and supply infrastructure as detailed in a recently commissioned Master Plan. The plan lists 5 nitrate control strategies ranging in cost from $10 to $35 million. The highest capital cost option is to upgrade the water treatment plant with an Ion Exchange system. The lowest cost and recommended option is to blend surface water with groundwater by adding additional wells and infrastructure. On the other hand, this watershed plan details actions designed to reduce nutrient concentrations to levels that could eliminate or reduce the need for additional water treatment controls. Furthermore, focusing on source water or watershed protection will provide additional benefits, such as improved recreational opportunities. Considerations for the lake and watershed approach include:

1. Future savings of costly infrastructure and water treatment plant upgrades. Dollars spent in the watershed will yield substantial reductions in nutrient and sediment loads, potentially at a lower cost.

2. Leveraging of funds. Watershed improvements are eligible for a wide array of state and federal funding where relatively small investments from the City can generate substantial amounts of funding.
3. Recreational and quality of life benefits. Improving lake water quality will attract visitors who then invest in the local economy. An increase in use fees collected by the City will follow and lake residents may start to benefit from higher property values over time.

Table 76 – Lake Bloomington Water Quality Targets & Load Reductions

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (% Total Load)	Phosphorus Reduction (% Total Load)	Sediment Reduction (% Total Load)
Lake Bloomington – Blue Mound-Money Creek (HUC 71300040201)						
In-Field Practices	Cover Crop	25,436 (ac)	25,436	24%	13%	22%
	No-Till/Strip-Till	7,503 (ac)	7,503	0.87%	8.2%	17%
	Nutrient Management – Deep Placement P	24,793 (ac)	24,793	0%	8.2%	0%
	Nutrient Management – Split Application N	23,245 (ac)	23,245	8.4%	0%	0%
In-Field Practices Subtotal		***n/a***	***80,977***	**33%**	**30%**	**39%**
Structural, In-Lake, and Urban Practices	Conservation Cover	24 (#), 47 (ac)	52	0.09%	0.10%	0.13%
	Ponds/Sediment Basin	1 (# ponds) / 1 (# sediment basin)	437	0.24%	0.66%	1.1%
	Urban Detention Basin	1 (#)	39	0.01%	0.02%	0.003%
	Field Border	73 (#), 129 (ac)	3,565	0.29%	2.0%	4.0%
	Filter Strip	48 (#), 112 (ac)	2,263	0.32%	2.3%	5.1%
	Grade Control	1 (# locations), 1 (structures)	15	0.001%	0.01%	0.02%
	Grassed Waterway	28 (#), 63 (ac)	6,050	1.3%	4.1%	9.1%
	WASCB	15 (# locations), 61 (basins)	208	0.06%	0.53%	0.98%
	Wetland, Constructed/Restored	20 (#), 72 (ac)	4,532	3.1%	2.9%	4.7%
	Drainage Water Management	16 (# locations)	2,038	1.2%	0.04%	0%
	Saturated Buffer	13 (# locations), 172,900 (ft tile)	1,897	1.8%	0.12%	0%
	Bioreactor	11 (# locations), 15 (structures)	654	0.47%	0.01%	0%
	Pasture Management (Livestock Fencing / Crossings)	2 (# locations), 14,025 (ft fence), 6 (crossings), 2 water systems	165	0.17%	0.32%	0.18%
	Urban Basin Aerator	3 (# locations), 6 (# units)	12	0.01%	0.02%	0%
	Urban Native Buffer	5 (# locations), (5.4 ac)	30	0.001%	0.01%	0.001%

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (% Total Load)	Phosphorus Reduction (% Total Load)	Sediment Reduction (% Total Load)
	Sediment Removal - Urban Detention Basin	2 (# locations), 14,900 (CY)	12	0.002%	0.01%	0.001%
	Streambed & Bank Stabilization	3 (# locations), 3,700 (ft STP), 12 (riffles)	n/a	0.02%	0.44%	0.85%
	Urban Basin Shoreline Stabilization	3 (# locations), 2,467 (ft)	n/a	0.0002%	0.01%	0.01%
Structural Practices Subtotal		***n/a***	***21,969***	**9.2%**	**14%**	**26%**
Grand Total		**n/a**	**102,946**	**42%**	**43%**	**65%**
Lake Bloomington – Money Creek (HUC 071300040202)						
In-Field Practices	Cover Crop	9,673 (ac)	9,673	8.4%	5.6%	9.2%
	No-Till/Strip-Till	3,174 (ac)	3,174	0.35%	3.4%	6.4%
	Nutrient Management – Deep Placement P	9,796 (ac)	9,796	0%	3.5%	0%
	Nutrient Management – Split Application N	9,543 (ac)	9,543	3.0%	0%	0%
In-Field Practices Subtotal		***n/a***	***32,186***	12%	12%	16%
Structural, In-Lake, and Urban Practices	Conservation Cover	17 (#), 34 (ac)	39	0.07%	0.09%	0.13%
	Ponds	2 (#)	133	0.09%	0.21%	0.32%
	Urban Detention Basin	1 (#)	18	0.003%	0.01%	0.00%
	Field Border	27 (#), 50 (ac)	2,124	0.16%	1.2%	2.1%
	Filter Strip	22 (#), 46 (ac)	945	0.12%	0.95%	1.9%
	Grade Control	1 (# locations), 6 (structures)	126	0.02%	0.07%	0.13%
	Grassed Waterway	5 (#), 11 (ac)	2,565	0.34%	0.89%	1.8%
	Wetland, Constructed/Restored	11 (#) / 37 (ac)	3,728	2.1%	1.9%	2.9%
	Saturated Buffer	4 (# locations), 51,800 (ft tile)	367	0.31%	0.02%	0%
	Bioreactor	3 (# locations), 6 (structures)	255	0.17%	0.003%	0%
	Pasture Management (Livestock Fencing / Crossings)	1 (# locations), 2,710 (ft fence), 1 (crossings)	83	0.04%	0.07%	0.07%
	Livestock Feed Area Management System	1 (# locations), 1,500 (ft diversion), 2 (basin structures)	8	0.01%	0.04%	0.001%
	Urban Rain Garden	8 (# locations), 11 (gardens)	4.7	0.001%	0.002%	0.001%
	Urban Native Buffer	2 (# locations), (0.4 ac)	3.1	0.0002%	0.001%	0.0005%
	Lake Shoreline Stabilization	18 (# locations), 5,722 (ft)	n/a	0.02%	0.75%	1.7%

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (% Total Load)	Phosphorus Reduction (% Total Load)	Sediment Reduction (% Total Load)
	In-Lake Basin / Floating Wetland	1 (# locations), 380 (ft), 1 (ac)	34,313	20%	18%	25%
	Lake Dredging	1 (# locations), 93,060 (CY)	35	n/a	n/a	n/a
Structural Practices Subtotal		***n/a***	***44,747***	***24%***	***24%***	***36%***
Grand Total		**n/a**	**76,933**	**36%**	**36%**	**52%**
Grand Total Lake Bloomington		**n/a**	**179,879**	**48% - 78% (target met)[1]**	**50% - 80% (target likely met)[1]**	**100% (target exceeded)[1,2]**
[1] – A range is provided to account for the cumulative effects of BMPs implemented as a "system" [2] - Summed total sediment reductions are 117% of the total load when considered individually						

Table 77 – Evergreen Lake Water Quality Targets & Load Reductions - HUC 071300040503

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (% Total Load)	Phosphorus Reduction (% Total Load)	Sediment Reduction (% Total Load)
In-Field Practices	Cover Crop	18,653 (ac)	18,653	32%	17%	28%
	No-Till/Strip-Till	10,524 (ac)	10,524	2.1%	17%	31%
	Nutrient Management – Deep Placement P	18,904 (ac)	18,904	0%	11%	0%
	Nutrient Management – Split Application N	17,842 (ac)	17,842	11%	0%	0%
In-Field Practices Subtotal		***n/a***	***65,923***	***45%***	***44%***	***59%***
Structural, In-Lake, and Urban Practices	Conservation Cover	37 (#), 66 (ac)	176	0.30%	0.37%	0.57%
	Ponds	1 (#)	39	0.04%	0.07%	0.08%
	Urban Detention Basin	3 (#)	486	0.24%	1.0%	0.45%
	Field Border	50 (#), 102 (ac)	2,458	0.37%	2.4%	5.0%
	Filter Strip	45 (#), 86 (ac)	1,444	0.40%	2.5%	5.4%
	Grassed Waterway	17 (#), 26 (ac)	2,202	0.87%	2.4%	4.9%
	WASCB	5 (# locations), 11 (basins)	21	0.01%	0.09%	0.16%
	Wetland, Constructed/Restored	17 (#) / 42 (ac)	2,817	2.6%	2.0%	2.6%
	Drainage Water Management	27 (# locations)	1,958	2.5%	0.08%	0%
	Saturated Buffer	24 (# locations), 218,300 (ft tile)	2,169	4.0%	0.23%	0%
	Bioreactor	21 (# locations), 26 (structures)	935	1.1%	0.02%	0%
	Urban Basin Aerator	1 (# locations), 2 (# units)	23	0.02%	0.04%	0%
	Urban Native Buffer	7 (# locations), (8.3 ac)	67	0.004%	0.03%	0.01%

BMP Class	BMP	Quantity	Area Treated (ac)	Nitrogen Reduction (% Total Load)	Phosphorus Reduction (% Total Load)	Sediment Reduction (% Total Load)
	Sediment Removal - Urban Detention Basin	1 (# locations), 14,800 (CY)	3	0.001%	0.002%	0.0001%
	Streambed Stabilization	1 (# locations), 2 (riffles)	n/a	0.003%	0.06%	0.11%
	Urban Basin Shoreline Stabilization	1 (# locations), 1,773 (ft)	n/a	0.001%	0.02%	0.02%
	Lake Shoreline Stabilization	28 (# locations), 11,171 (ft)	n/a	0.09%	2.4%	5.4%
	In-Lake Basin / Floating Wetland	2 (# locations), 1.130 (ft), 2.1 (ac)	21,601	22%	22%	24%
	Lake Dredging	1 (# locations), 172,316 (CY)	106	n/a	n/a	n/a
Structural Practices Subtotal		***n/a***	***36,505***	***34%***	***36%***	***49%***
Grand Total Evergreen Lake		**n/a**	**102,428**	**49% - 79% (target exceeded)[1]**	**50% - 80% (target not met)[1]**	**60% - 93% (target exceeded)[1]**

[1] – A range is provided to account for the cumulative effects of BMPs implemented as a "system"

9.0 Critical Areas

Critical areas are those BMP locations throughout the watershed where implementation activities should be prioritized. This includes locations targeted for in-field and structural practices. In-field management practices will provide the greatest "bang-for-the-buck" and benefit to water quality. They will improve soil structure and health, and overall farm profitability. Structural practices, although more costly upfront, will prove benefits over multiple years and address locations where other measures are infeasible. Critical areas focus on maximizing reductions primarily in nitrogen. Critical areas that address phosphorus also maximize sediment reductions.

9.1 Lake Management

Lake management practices can be implemented to generate substantial reductions in sediment and nutrients and address both in-lake and external sources (Figure 53). These practices fall under the sole jurisdiction of the City of Bloomington. Critical lake management areas are:

Shoreline stabilization are those segments that cost less than $1,000 per ton of sediment reduced. This includes 3 segments in LB and 8 segments in EL. In LB, critical lake banks represent only 23% of those recommended and will address over 44% of the total expected reductions. In EL, critical banks represent only 35% of those recommended and will address 65% of the total expected reductions from this practice.

1. Lake Bloomington: 1,329 ft will achieve annual reductions of 157 tons of sediment, 111 lbs of nitrogen, and 82 lbs of phosphorus.

2. Evergreen Lake: 3,937 ft will achieve annual reductions of 497 tons of sediment, 398 lbs of nitrogen, and 259 lbs of phosphorus.

In-lake structures or floating wetlands - combined with selective dredging, are considered critical given the ability to treat a large watershed area. Additionally, the volume of recommended sediment removal is equal to almost half of the annual water consumption from Bloomington's top 50 water customers. Sediment and, more importantly, sediment-bound phosphorus is available for transport to deeper areas of the lake where it can be released in dissolved form, increase concentrations in the water column and stimulate algal blooms.

1. Lake Bloomington annual reductions: 253,874 lbs nitrogen, 4,372 lbs phosphorus, and 5,409 tons of sediment. Selective dredging will remove 55,278 lbs of legacy phosphorus and 50,252 tons of sediment.
2. Evergreen Lake annual reductions: 156,435 lbs of nitrogen, 3,673 lbs of phosphorus, and 3,395 tons of sediment. Selective dredging will remove 102,356 lbs of legacy phosphorus and 93,051 tons of sediment.

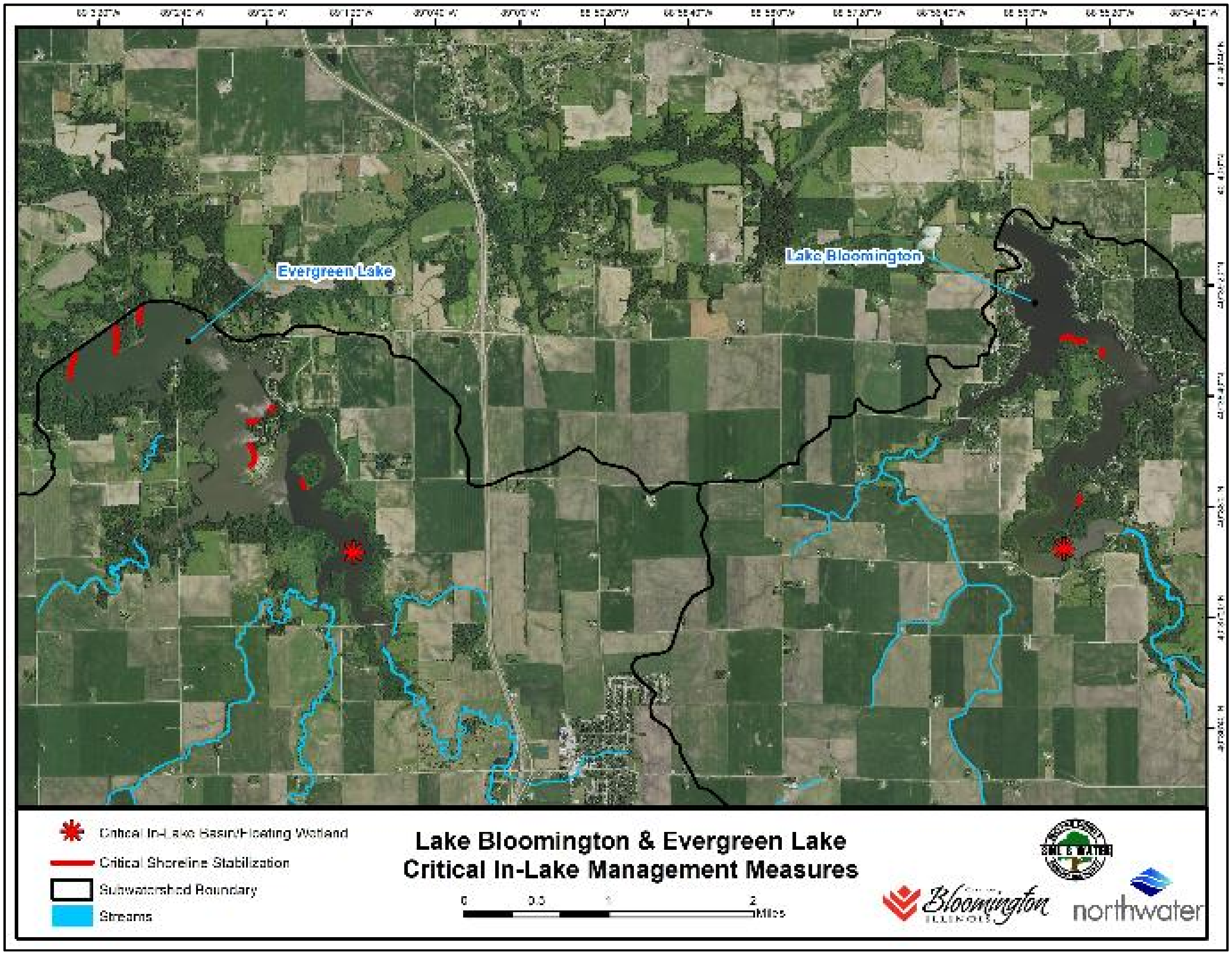


Figure 53 - Critical Areas – In-Lake Management Measures

9.2 In-Field Management Measures

In-field practices recommended are nutrient management, no-till/strip-till, and cover crops. Critical areas are primarily based on expected sediment and nutrient load reductions. Specific selection criteria are provided by management practice type and are discussed in the following subsections.

9.2.1 Nutrient Management

Critical areas for nutrient management were selected based on the practices with the highest per-acre reductions. As listed in Table 78 and depicted in Figure 54, critical areas for nutrient management practices are expected to achieve 52% of the total nitrogen and 39% of the total phosphorus reductions associated with these practices, while only encompassing 36% of the total recommended acres.

Deep placement of phosphorus fertilizer – fields larger than 5 acres in size that are expected to generate annual phosphorus reductions greater than 0.1 lbs/ac were selected. This represents a total of 14,057 acres or 347 fields: 196 fields or 8,334 acres in LB and 5,723 acres or 151 fields in EL.

Split application of nitrogen fertilizer - fields larger than 5 acres in size that are expected to generate annual nitrogen reductions greater than 4.5 lbs/ac were selected. This represents a total of 23,173 acres or 487 fields: 262 fields or 13,310 acres in LB and 9,863 acres or 225 fields in EL.

Table 78 - Critical Areas - Nutrient Management

Critical Practice	Quantity	Total Nitrogen Reduction (lbs/yr)	Total Phosphorus Reduction (lbs/yr)	Percent of Total Practice Load Reduction Nitrogen	Percent of Total Practice Load Reduction Phosphorus
Lake Bloomington – Blue Mound-Money Creek (HUC 71300040201)					
Deep Placement P	5,453 (ac)	n/a	724	n/a	36%
Split Application N	11,969 (ac)	59,073	n/a	57%	n/a
Lake Bloomington – Money Creek (HUC 071300040202)					
Deep Placement P	2,881 (ac)	n/a	358	n/a	41%
Split Application N	1,341 (ac)	6,337	n/a	17%	
Grand Total Lake Bloomington	**21,644 (ac)**	**65,410**	**1,082**	**46%**	**37%**
Evergreen Lake (HUC 071300040503)					
Deep Placement P	5,723 (ac)	n/a	722	n/a	41%
Split Application N	9,863 (ac)	48,323	n/a	61%	n/a
Grand Total (both lakes)	**37,230 (ac)**	**113,733**	**1,804**	**52%**	**39%**

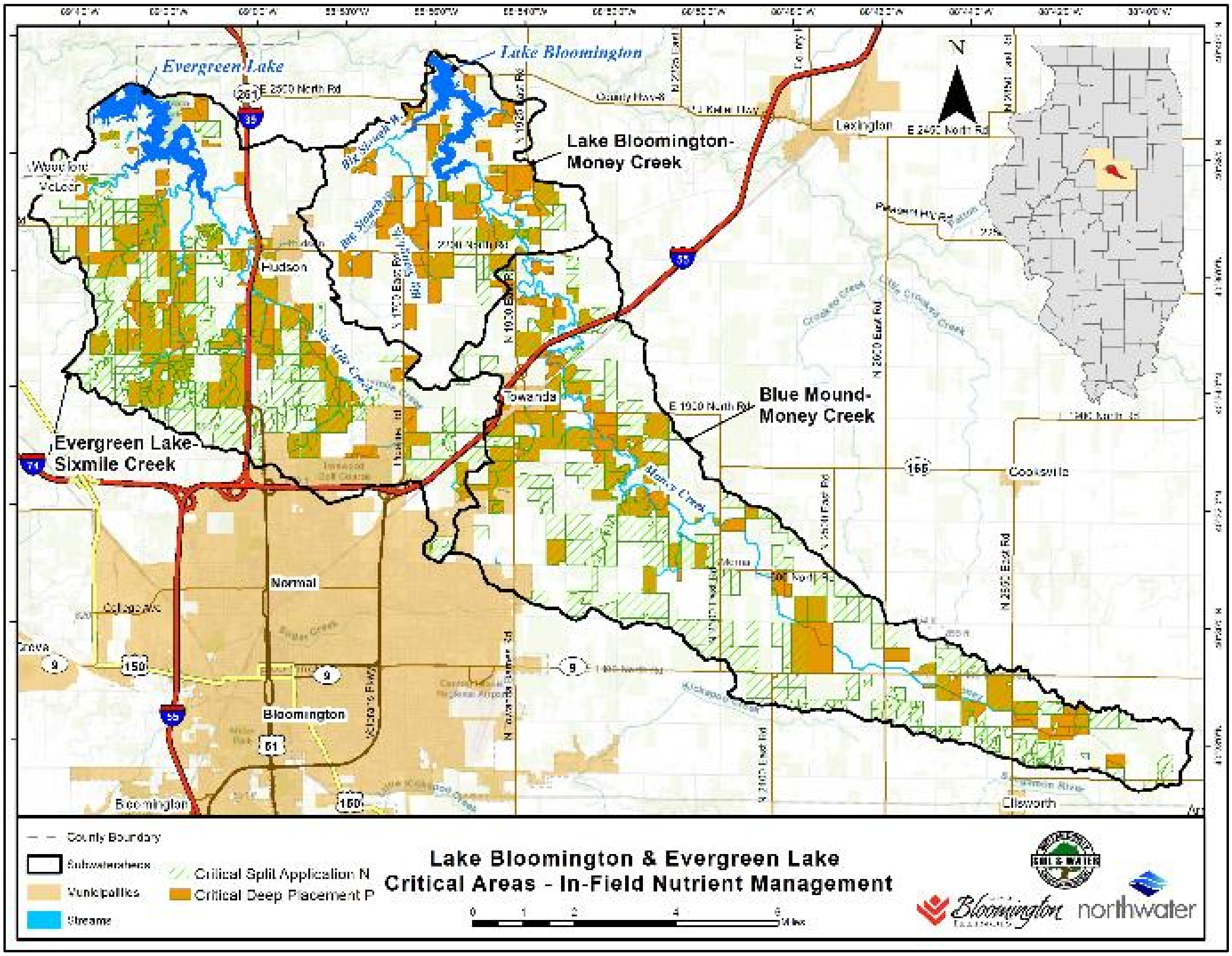


Figure 54 - Critical Areas - In-Field Nutrient Management

9.2.2 No-till or Strip-Till

No-till or strip-till critical areas were selected as the top 25% of fields greater than 5 acres in size that are expected to generate the greatest total sediment reductions. A total of 117 fields, or 10,232 acres were selected. If implemented, annual reductions of 15,124 lbs of nitrogen, 2,894 lbs phosphorus, and 5,061 tons of sediment are expected. As listed in Table 79 and depicted in Figure 55, critical areas for no-till or strip-till are expected to achieve 50% of the total nitrogen, 52% of the total phosphorus and 55% of the total sediment reductions associated with these practices, while only encompassing 48% of the total recommended acres.

Table 79 – Critical Areas - No-Till or Strip-Till

Practice	Quantity	Total Nitrogen Reduction	Total Phosphorus Reduction	Total Sediment Reduction	Percent of Total Practice Load Reduction Nitrogen	Percent of Total Practice Load Reduction Phosphorus	Percent of Total Practice Load Reduction Sediment
Lake Bloomington – Blue Mound-Money Creek (HUC 71300040201)							
No-Till / Strip-Till	4,103 (ac)	6,297	1,218	2,261	58%	60%	64%
Lake Bloomington – Money Creek (HUC 071300040202)							
No-Till / Strip-Till	1,431 (ac)	2,074	416	702	47%	50%	51%
Grand Total Lake Bloomington	**5,534 (ac)**	**8,371**	**1,634**	**2,963**	**55%**	**57%**	**60%**
Evergreen Lake (HUC 071300040503)							
No-Till / Strip-Till	4,698	6,753	1,260	2,098	45%	46%	48%
Grand Total (both lakes)	**10,232**	**15,124**	**2,894**	**5,061**	**50%**	**52%**	**55%**

9.2.3 Cover Crops

Cover crop critical areas were selected as the top 25% of fields greater than 5 acres in size that are expected to generate the greatest per-acre nitrogen reductions. A total of 298 fields, or 12,242 ac, were selected for cover crop implementation: 144 fields, or 5,534 ac in LB and 154 fields, or 6,390 ac in EL. If implemented, annual reductions of 177,642 lbs of nitrogen, 2,265 lbs of phosphorus, and 3,389 tons of sediment are expected. As listed in Table 80 and depicted in Figure 55, critical areas for cover crops are expected to achieve 28% of the total nitrogen, 30% of the total phosphorus and 32% of the total sediment reductions associated with these practices, while only encompassing 23% of the total recommended acres.

Table 80 – Critical Area - Cover Crop

Practice	Quantity	Total Nitrogen Reduction	Total Phosphorus Reduction	Total Sediment Reduction	Percent of Total Practice Load Reduction Nitrogen	Percent of Total Practice Load Reduction Phosphorus	Percent of Total Practice Load Reduction Sediment
Lake Bloomington – Blue Mound-Money Creek (HUC 71300040201)							
Cover Crop	5,144 (ac)	74,897	963	1,483	25%	29%	31%
Lake Bloomington – Money Creek (HUC 071300040202)							
Cover Crop	708 (ac)	10,201	144	223	10%	10%	11%
Grand Total Lake Bloomington	**5,852 (ac)**	**85,098**	**1,107**	**1,706**	**21%**	**24%**	**26%**
Evergreen Lake (HUC 071300040503)							
Cover Crop	6,390	92,544	1,158	1,684	41%	42%	43%
Grand Total (both lakes)	**12,242**	**177,642**	**2,265**	**3,390**	**28%**	**30%**	**32%**

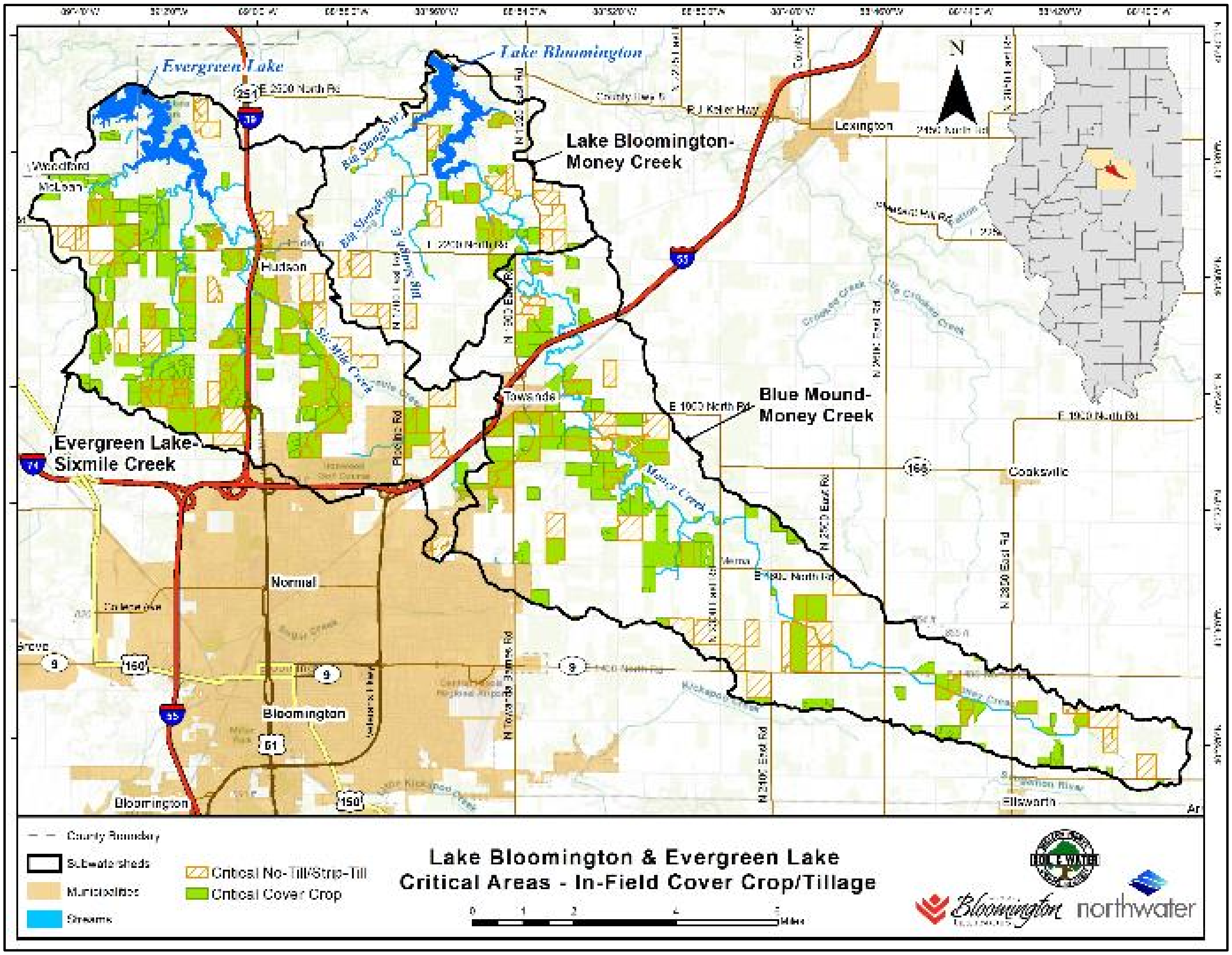


Figure 55 - Critical Areas - In-Field Cover Crop & No-Till/Strip-Till

9.3 Structural BMPs

A selection of structural practices are prioritized for implementation throughout both lake watersheds and classified as critical (Table 81 and Figure 56). Selection criteria includes cost/benefit, or the amount of sediment or nutrients reduced per dollar of expenditures, greatest total expected load reductions and feasibility for implementation.

Critical grass waterways - those that cost less than $100 per ton of sediment reduced. Four sites are selected in the LB watershed and 2 sites in EL. The 3 sites located in the Blue Mound – Money Creek subwatershed will generate the greatest reductions as a percentage of all recommended waterways.

Critical field borders - those that cost $14 or less per ton of sediment reduced and achieve at least 25% of the total expected annual load reductions form these practices. Fourteen sites are selected in the LB watershed and 6 sites in EL for a total of 29 acres. Critical field borders located in the Lake Bloomington – Money Creek subwatershed will be most effective at reducing sediment and phosphorus.

Critical filter strips - those that cost $15 or less per ton of sediment reduced and achieve at least 30% of the total expected annual load reductions form these practices. Fourteen sites are selected in the LB watershed and 7 sites in EL for a total of 38 acres. Critical filter strips located in the Blue Mound – Money Creek subwatershed will be most effective at reducing sediment and nutrients.

Critical saturated buffers – critical areas include those that generate at least 25% of the annual expected nitrogen reductions from these practices. Three sites are selected in the LB watershed, all within the Blue Mound – Money Creek subwatershed. One site is in EL.

Critical DWM - priority DWM include those that generate at least 25% of the annual expected nitrogen reductions from these practices. Four sites are selected in the LB watershed and 1 site in EL. Critical DWM located in the Blue Mound – Money Creek subwatershed will be most effective at reducing nitrogen loads.

Critical feed area treatment – one location in the LB watershed is selected based on phosphorus reductions achieved.

Critical wetlands – sites include those that achieve at least 50% of the total expected reductions from all wetlands, cost less than $50/lb of nitrogen treated and are in locations where implementation is more likely such as in existing pasture or grassed areas. Nine sites are in LB and 6 sites in EL. Priority should be given to wetlands in the Lake Bloomington – Money Creek subwatershed where substantial percent reductions are possible compared to other areas.

Table 81 - Critical Area - Structural Practices

Practice	Quantity	Total Nitrogen Reduction	Total Phosphorus Reduction	Total Sediment Reduction	Percent of Total Practice Load Reduction Nitrogen	Percent of Total Practice Load Reduction Phosphorus	Percent of Total Practice Load Reduction Sediment
Lake Bloomington – Blue Mound-Money Creek (HUC 71300040201)							
Grass Waterway	3 / 9.6 ac	5,199	414	832	32%	40%	43%
Field Border	9.6 ac	813	108	201	23%	22%	23%
Filter Strip	21 ac	1,484	227	466	37%	40%	43%
Saturated Buffer	74,400 ft tile	11,179	14	n/a	49%	48%	n/a
Drainage Water Management	1,012 ac	7,751	5.5	n/a	50%	50%	n/a
Wetland	11 ac	9,846	145	161	25%	21%	16%
Subtotal		**36,272**	**914**	**1,660**	**36%**	**32%**	**34%**
Lake Bloomington – Money Creek (HUC 071300040202)							
Grass Waterway	1 / 0.75 ac	915	36	81	22%	17%	21%
Field Border	11 ac	695	103	170	34%	36%	38%
Filter Strip	5.6 ac	378	54	89	25%	23%	22%
Feed Area Treatment	1	127	9.5	0.3	100%	100%	100%
Wetland	27	21,759	382	523	83%	83%	86%
Subtotal		**23,874**	**585**	**863**	**70%**	**49%**	**47%**
Grand Total Lake Bloomington		**60,146**	**1,499**	**2,523**	**25%**	**22%**	**22%**

Practice	Quantity	Total Nitrogen Reduction	Total Phosphorus Reduction	Total Sediment Reduction	Percent of Total Practice Load Reduction Nitrogen	Percent of Total Practice Load Reduction Phosphorus	Percent of Total Practice Load Reduction Sediment
Evergreen Lake (HUC 071300040503)							
Grass Waterway	2 / 1.2 ac	658	35	70	11%	9%	10%
Field Border	8 ac	553	89	180	21%	23%	26%
Filter Strip	11 ac	690	109	222	24%	26%	29%
Saturated Buffer	6,800 ft tile	2,936	3.8	n/a	10%	10%	n/a
Drainage Water Management	159 ac	1,406	1.0	n/a	8%	8%	n/a
Wetland	14 ac	11,093	167	194	59%	51%	53%
Subtotal		**17,336**	**405**	**666**	**22%**	**26%**	**26%**
Grand Total (both lakes)		**77,482**	**1,904**	**1,529**	**25%**	**23%**	**11%**

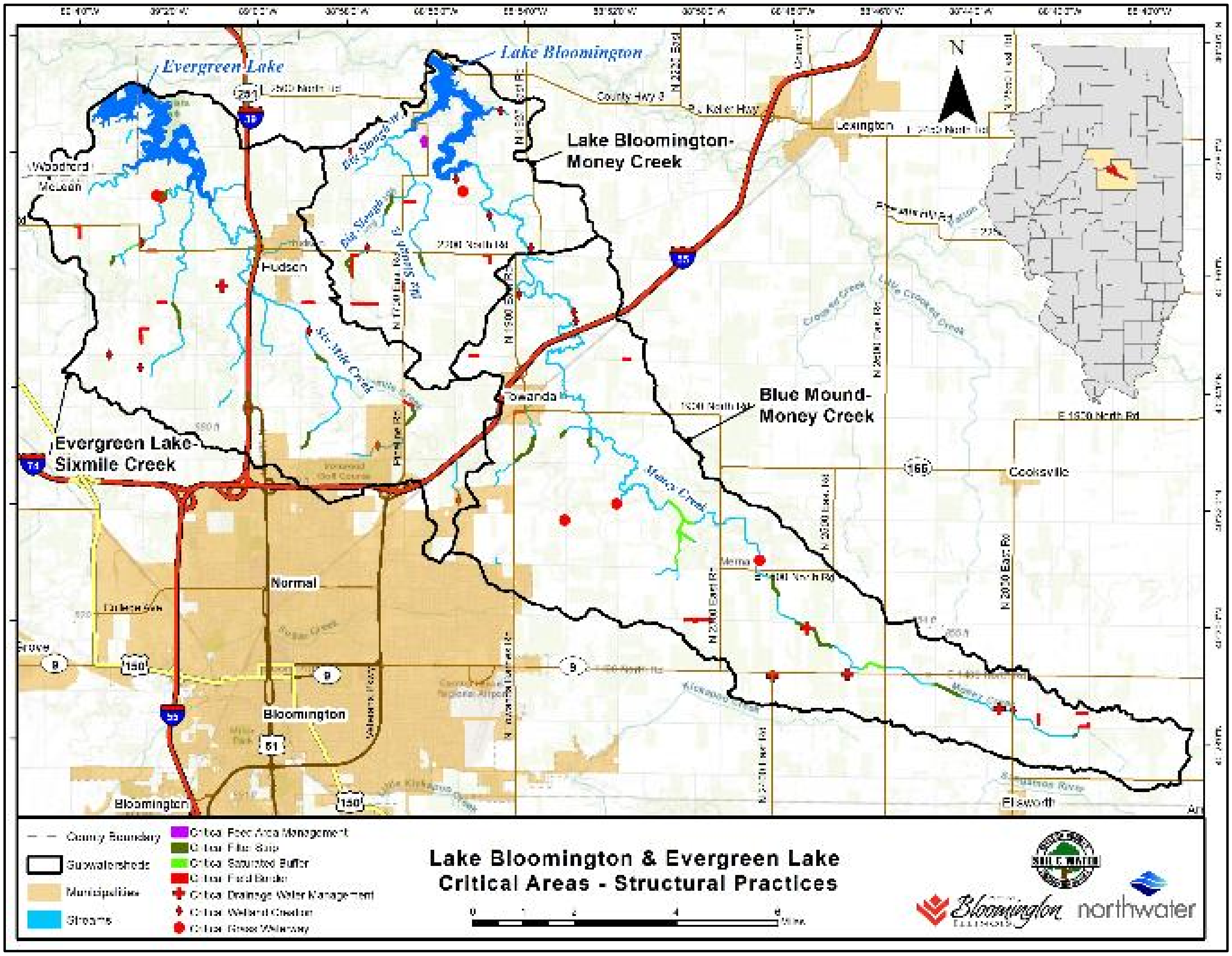


Figure 56 – Critical Areas – Structural Practices

10.0 Technical & Financial Assistance

Entities listed below are potentially available for plan implementation and funding. For those that can provide funding specific to the watersheds, descriptions of the programs or financial assistance mechanisms are provided, with a separate list of those that may provide in-kind contributions to watershed efforts. Entities that may not have a direct avenue to a funding apparatus are listed under the Section 10.1, Technical Assistance.

With implementation, primary responsibility lies with the owner of the land first. Any agency or entity providing a role in implementation will need to work with willing landowners but do not have the primary decision-making authority. All actions are completely voluntary.

City of Bloomington – the City will take a leadership role in the implementation of this plan and is the primary beneficiary of improvements in lake water quality.

Farmers/Landowners - in the LB and EL watershed, there are varying business arrangements on who farms the land and makes important conservation decisions. If the farmer is the landowner, then the farmer–landowner is considered the primary responsible party. If the person/entity who owns the land is an absentee owner, then it could be either the farmer-tenant or the absentee landowner who is responsible. In some cases, the conservation practice decisions are made together in a collaborative fashion by the tenant and landowner. Frequently, the lease terms will determine who makes conservation decisions on the agricultural parcel.

> **Financial Assistance:** Private funds can come from foundations, individual farmers, and landowners and can be used as cash match for grants or as private contributions to other conservation initiatives.

Natural Resources Conservation Service (NRCS) - the USDA has local offices in most Illinois counties which include the NRCS. The McLean County field office services the LB and EL watershed. The NRCS provides both conservation technical assistance and financial assistance to farmers and landowners. One of the static programs frequently used for financial assistance is the Environmental Quality Incentive Program (EQIP). The EQIP program provides cost sharing for implementation of approved conservation program practices. The farmer/landowner applies for conservation program funds and is assisted by NRCS staff to complete the application process, certify the practices and make payments. Five additional programs administered by the NRCS are also discussed below: The Regional Conservation Partnership Program (RCPP); the National Water Quality Initiative (NWQI); Mississippi River Basin Healthy Watersheds Initiative (MRBI), the Conservation Stewardship Program (CSP); and the Agricultural Conservation Easement Program (ACEP).

> **Financial Assistance:**
>
> **NRCS EQIP** - is a cost-share program for farmers and landowners to share the expenses of implementation and maintenance of approved soil and water conservation practices on farmland for qualified entities and is a dedicated source of funding available in the watershed.
>
> http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

NRCS/USDA RCPP - promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS aids producers through partnership agreements and through program contracts or easement agreements. It combines the authorities of four former conservation programs – the Agricultural Water Enhancement Program, the Chesapeake Bay Watershed Program, the Cooperative Conservation Partnership Initiative and the Great Lakes Basin Program. Assistance is delivered in accordance with the rules of other NRCS programs. RCPP encourages partners to join in efforts with producers to increase restoration and sustainable use of soil, water, wildlife, and related natural resources on regional or watershed scales. Through RCPP, NRCS and its partners help producers install and maintain conservation activities in selected project areas. The RCPP is becoming a more robust program at the USDA and is a key funding mechanism for the watershed as funds are prioritized for public water supplies.

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/rcpp/

NRCS NWQI - as USDA's premiere water quality initiative, NWQI provides a way to accelerate voluntary, on-farm conservation investments and focused water quality monitoring and assessment resources where they can deliver the greatest benefits for clean water. Now in its tenth year, the National Water Quality Initiative is a partnership among NRCS, state water quality agencies and the U.S. Environmental Protection Agency to identify and address impaired water bodies through voluntary conservation. NRCS provides targeted funding for financial and technical assistance in small watersheds most in need and where farmers can use conservation practices to make a difference. Conservation systems include practices that promote soil health, reduce erosion and lessen nutrient runoff, such as filter strips, cover crops, reduced tillage and manure management. State water quality agencies and other partners contribute additional resources for watershed planning, implementation and outreach. They also provide resources for monitoring efforts that help track water quality improvements over time. Source water protection and public water supplies are now a priority and component of NWQI.

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/?cid=stelprdb1047761

NRCS MRBI - launched in 2009, the 13-state Mississippi River Basin Healthy Watersheds Initiative (MRBI) uses several Farm Bill programs, including the Environmental Quality Incentives Program (EQIP) and the Agricultural Conservation Easement Program (ACEP), to help landowners sustain America's natural resources through voluntary conservation. The overall goals of MRBI are to improve water quality, restore wetlands, and enhance wildlife habitat, while ensuring economic viability of agricultural lands.

States within the Mississippi River Basin have developed nutrient reduction strategies to minimize the contributions of nitrogen and phosphorus to surface waters within the basin, and ultimately to the Gulf of Mexico. MRBI uses a small watershed approach to support the states' reduction strategies. Avoiding, controlling, and trapping practices are implemented to reduce the amount of nutrients flowing from agricultural land into waterways and to improve the resiliency of working lands. Both the LB and EL watersheds were the focus of an MRBI project in the early 2000s.

https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/initiatives/?cid=stelprdb1048200

NRCS CSP - through CSP, the NRCS provides conservation program payments. CSP participants will receive an annual landuse payment for operation-level environmental benefits they produce. Under CSP, participants are paid for conservation performance: the higher the operational performance, the higher their payment.

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/

NRCS ACEP - provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements component, NRCS helps Native American tribes, state and local governments, and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands.

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/

Illinois Environmental Protection Agency (Illinois EPA) - in Illinois, the Illinois EPA Bureau of Water's Watershed Management Section provides program direction and financial assistance for water quality protection through the Clean Water Act Section 319 program.

Financial Assistance: Administered by the Illinois EPA, the Section 319 program provides funds for addressing NPS pollution. The purpose of IEPA's 319 program is to work cooperatively with units of local government and other organizations toward the mutual goal of protecting the water quality in Illinois through the control of NPS pollution. The program includes providing funding to these groups to implement projects that utilize cost-effective BMPs on a watershed scale.

Projects may include structural BMPs, such as detention basins and filter strips; non-structural BMPs, such as construction erosion control ordinances; and setback zones to protect community water supply wells. Technical assistance and information and education programs are also eligible. Section 319 funds are reimbursable and require a match of either cash or in-kind services, or a combination of both cash and in-kind contributions. Applications for Section 319 funding are due August 1st of each year.

http://www.epa.illinois.gov/topics/water-quality/watershed-management/nonpoint-sources/section-319/index

The Illinois EPA also administers the Illinois Green Infrastructure Grant Program for Stormwater Management, or IGIG. This program is made available to local units of government and other organizations to demonstrate green infrastructure best management practices to control stormwater runoff for water quality protection in Illinois. Projects are located within a Municipal Separate Storm Sewer System (MS4) or Combined Sewer Overflow (CSO) area and may be applicable on the fringes of the watershed where the watershed encompasses the Town of Normal and urban areas of Bloomington exist.

Farm Service Agency (FSA) - included in the USDA local offices are officials of the FSA who also provide some conservation-oriented programs; specifically, they provide the administrative structure for the federal Conservation Reserve Program (CRP) and also support the state Conservation Reserve and Enhancement Program.

Financial Assistance:

USDA/FSA Conservation Reserve Program (CRP) - is a land conservation program administered by the FSA. In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Contracts for land enrolled in CRP are 10-15 years in length. The long-term goal of the program is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat. Land in the watershed is already enrolled in CRP and additional, eligible land is available for enrollment.

https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index

USDA FSA Conservation Reserve and Enhancement Program (CREP) - although currently on hold, CREP is an offshoot of the CRP. Administered on the federal level by the FSA, CREP targets high-priority conservation issues identified by local, state, or tribal governments or non-governmental organizations. In exchange for removing environmentally sensitive land from production and introducing conservation practices, farmers and agricultural landowners are paid an annual rental rate. Participation is voluntary, and the contract period is typically 10–15 years, along with other federal and state incentives as applicable per each CREP agreement. In Illinois, the CREP administrative agency is the Illinois Department of Natural Resources (IDNR) which provides additional and generous financial incentives on top of a FSA CREP contract, including payments for additional 15–35-year contract extensions; IDNR also offers a permanent easement option. Farmers and landowners locally apply for support through a SWCD for CREP consideration and funding.

https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index

US Fish and Wildlife Service (USFWS) - provides technical assistance to local watershed protection groups. It also administers several grant and cost-share programs that fund habitat restoration. The USFWS also administers the federal Endangered Species Act and supports a program called Endangered Species Program Partners, which features formal or informal partnerships for protecting endangered and threatened species and helping them to recover. These partnerships include federal partners, as well as states, tribes, local governments, nonprofit organizations, and individual landowners.

Financial Assistance: The **USFWS Partners program** restores, improves, and protects fish and wildlife habitat on private lands through alliances between the USFWS, other organizations and individuals, while leaving the land in private ownership. Opportunities may exist within the watershed to utilize financial assistance from the partners program for wetland or prairie restoration projects.

https://www.fws.gov/partners/

Trees Forever - work with communities to empower people through hands-on planting projects. Trees Forever is a nonprofit charitable organization, headquartered in Marion, Iowa, and founded in 1989. They help communities with local tree-planting projects by providing technical, planning, and financial assistance.

> **Financial Assistance:** Trees Forever manages the Illinois Buffer Partnership Program. The Illinois Buffer Partnership promotes and showcases the voluntary conservation efforts of Illinois farmers and landowners. Each year, 10-20 Illinois Buffer Partnership participants are selected to receive financial and technical assistance. Types of conservation projects eligible for the Illinois Buffer Partnership Program include riparian buffers, livestock buffers, streambank stabilization projects, wetland development, pollinator habitat, rain gardens, and agroforestry projects. Cost-share funds are available in an amount up to $2,000 for 50 percent of the expenses that remain after Conservation Reserve Program (CRP) or other federal, state or local funding has been applied to a project.
>
> http://www.treesforever.org/

National Fish and Wildlife Foundation (NFWF) - supports conservation in all 50 states and US territories. Their projects are rigorously evaluated and awarded to some of the nation's largest environmental organizations, as well as some of the smallest. NFWF focuses on bringing all partners to the table, getting results, and building a future for our world.

Strategic Partners

Corporations – private businesses and corporate sponsors such as State Farm or Deschutes Brewing can play a strategic and key role in the execution of the watershed plan. Local corporations and businesses rely on both lakes for water and almost all have developed some form of corporate sustainability program. Activities to improve water quality align with these programs and participation and partnerships can often help these businesses and corporations meet their "sustainability metrics."

Watershed Agricultural Retailers - major ag retailers in the watershed help their farmer-owners and customers by providing products and technology. This includes harvesting and selling crops, custom fertility and crop protection solutions, soil testing, nutrient management, cover crop seed, variable rate fertilizer application, and can assist with outreach. Retailers will be key strategic partners moving forward with nutrient management practices.

Illinois Corn Growers Association (ICGA) - established in 1972, it is a grassroots membership organization with approximately 5,000 members. ICGA runs the Precision Conservation Management Program described in the Technical Assistance section.

Illinois Soybean Association - is a statewide organization that strives to enable soybean producers to be the most knowledgeable and profitable soybean producers around the world. They represent more than 43,000 soybean farmers in Illinois through two primary roles: the state soybean checkoff and legislative and regulatory advocacy efforts.

McLean County Farm Bureau (MCFB) - is an organization with members who support agriculture in McLean County and Illinois at the state level. They engage in outreach and education, promotion of conservation, water quality and agricultural research and science and are a key partner in the watershed.

The Nature Conservancy (TNC) - founded in the U.S. through grassroots action in 1951, TNC has grown to become one of the most effective and wide-reaching environmental organizations in the world. Thanks to more than a million members and the dedicated efforts of its diverse staff and over 400 scientists, they impact conservation in 72 countries and territories: 38 by direct conservation impact and 34 through partners. TNC is very active in Illinois and has a long history working in the LB and EL watershed and will be an important technical assistance and financial resource partner moving forward.

The Wetland Initiative (TWI) – initiates designs, restores, and creates wetlands and employs sound science to improve water quality, habitat for plants and wildlife and climate. A 501(c)(3) non-profit corporation, the Wetlands Initiative was incorporated in 1994 and began regular operations in 1995. TWI is committed to showing how wetlands long drained and degraded can be returned to high-quality wetland ecosystems once again able to perform their natural "services" like cleaning water, providing habitat, and sequestering carbon. TWI may be able to provide technical assistance with wetland design, siting, and monitoring, as well as partner resources for collaborative wetland projects.

Walton Family Foundation (WFF) - focuses on improving water quality and restoring habitat in the Mississippi River watershed. Their goal is to ensure improved water quality and restored habitat that benefits people and nature in the Mississippi River Basin and ultimately the Gulf of Mexico by reforming the incentives that drive water quality degradation. This foundation may be able to engage as a partner in watershed efforts and assist with support for things like planning, monitoring, and outreach.

McKnight Foundation - focuses on restoring water quality and resilience in the Mississippi River watershed. Their goal is to restore the Mississippi River and to ensure a clean, resilient river system for communities across the American heartland. McKnight may be able to engage as a partner in watershed efforts and assist with support for things like planning, monitoring, and outreach.

10.1 Technical Assistance

In addition to the technical assistance provided by the entities listed below, there are conservation technical assistance resources provided through the University of Illinois Cooperative Extension Service (Coop Ext.) and by private professional consultants such as Certified Crop Advisors (CCA) or Technical Service Providers (TSP) which producers rely upon. Technical assistance relevant to the UMC watershed is also provided via non-profit organizations, such as the ISA, the AFT, Quail and Pheasants Forever, and TNC, among others.

McLean County Soil Water Conservation District (MCSWCD) - in many Illinois counties, it is the local county SWCD that takes a lead role in providing information, guidance and funding arrangements for local conservation practices on farmland. The MCSWCD has taken the lead on lake and watershed initiatives over the years and is critical to any effort moving forward. Their staff provide a range of support in achieving water quality goals, including serving a coordination role with the City of Bloomington, identifying farmers and landowners, conducting annual tillage and cover crop transect surveys, promoting and assisting in watershed programming and events, and directly managing on-the-ground projects.

American Farmland Trust (AFT) - the mission of AFT is to protect farmland, promote sound farming practices, and keep farmers on the land. The AFT advocates for programs and policies that protect farmland, food, and the environment, and conducts education and outreach and promotes conservation.

Illinois Department of Agriculture (IDOA) - IDOA's Bureau of Land and Water Resources distributes funds to Illinois' 98 soil and water conservation districts for programs aimed at reducing soil loss and protecting water quality. It also helps to organize the state's soil survey every two years which tracks progress toward the goal of reducing soil loss on Illinois cropland to tolerable levels.

Illinois Department of Natural Resources (IDNR) - provides technical assessments of streams for the IDOA's streambank stabilization program. The request for local assessment assistance comes through local county SWCDs. The IDNR also manages other state programs related to wildlife and forestry and oversees the state portion of the Conservation Reserve and Enhancement Program (CREP).

Illinois Stewardship Alliance (ISA) - is a membership-based organization whose mission is to promote environmentally sustainable, economically viable, socially just, local food systems through policy development, advocacy, and education. Most relevant to the watershed is ISA's work to promote cover crops and educate producers on their benefits. ISA staff can assist with landowner outreach and education programs related to conservation.

Illinois Sustainable Ag Partnership (ISAP) - ISAP's mission is to create a network to support a systems approach to improve soil health and reduce nutrient loss. They provide a platform for disseminating relevant research, coordinate field days and events, provide expertise through collaboration, resources for soil health networks, and outreach and education.

Precision Conservation Management (PCM) - is a farmer-led effort developed to address natural resource concerns on a field-by-field basis by identifying conservation practices that effectively address environmental issues in a financially viable way. Staff work with farmers to identify conservation needs and use data from agronomic management practices, economic models, and sustainability metrics to develop customized solutions. PCM is active in the area and they can provide staff support and promotion of watershed events.

Soil Heath Partnership (SHP) - is a farmer-led initiative that fosters transformation in agriculture through improved soil health, benefiting farmer profitability, a stable food supply, and the environment. Through a scientific program administered by the National Corn Growers Association, SHP brings together diverse partners to work toward common goals. With more than 100 working farms enrolled within 12 states, the SHP tests, measures, and advances progressive farm management practices that will enhance sustainability and farm economics for generations to come.

Saving Tomorrow's Agricultural Resources (S.T.A.R.) - championed by the Champaign County SWCD, S.T.A.R is an evaluation system assigns points for each cropping, tillage, nutrient application and soil conservation activity used on individual fields. The practices selected and the point values assigned are determined by a group of scientists and researchers, including some farmers who are involved in research.

The total points are used in a scale to determine a rating of 1 to 5 Stars for each field. The purpose is to motivate those making cropping decisions to use conservation management practices that will ultimately meet the goals of the INLRS.

11.0 Implementation Milestones, Objectives & Schedule

Implementation milestones and goals are intended to be measured by USDA-NRCS program contracts, Illinois EPA Section 319 and City and SWCD funded cost-share measures. The goals are meant to be both measurable and realistic. Targeted outreach and on-farm visits with landowners are vital to the success of future activities and will be a component of every effort to ensure the adoption of the BMPs listed below. Communication and outreach will also help to ensure practices are maintained over time.

An implementation schedule is presented in Table 82 (short term, 1-2 years), Table 83 (medium term, 3-5 years), and Table 84 (long term, 6-10 years). The milestones or objectives presented are intended to be achievable and realistic over each time period, though actual implementation will depend on interested landowners and funding availability. The schedule takes into consideration agency and City staff capacity and incorporates acres and practices necessary to achieve water quality targets. A reasonable number of critical in-field and structural BMPs (Section 9.0) are considered prioritized for implementation within 5 years. The plan and milestones should be revisited and updated after 10 years. Consistent throughout each period is the need for outreach, communication, partnerships, grant applications, water quality monitoring, and tracking of progress.

Table 85 summarizes BMP milestones or objectives, those responsible entities and the primary technical/financial assistance available. The implementation milestones or objectives needed to meet water quality targets are those that are realistic within a 10-year period. Given the high cost and limited resources available, it is anticipated that more than 10 years will be required to fully meet water quality targets and maintain it over time. This plan, milestones and objectives will be revisited and updated after 10 years.

In the first 5 years of plan implementation, priorities focus on critical areas or those locations and practices in the watershed where management measures will achieve the greatest nutrient reductions.

Table 82 – Yeas 1-2 - Implementation Milestones

Timeframe	Milestone
Years 1–2	1. Initiate targeted outreach and one-one-one communication with producers. 2. Apply for program funding and secure local corporate sponsors. 3. Plant 500 acres of cover crops. 4. Convert conventional or other tillage to strip-till or no-till on 500 acres. 5. Complete split application of nitrogen fertilizer on 500 acres 6. Install 4 high-priority grassed waterways. 7. Install 10 acres of high-priority filter strips. 8. Install 5 acres of high-priority field borders or prairie strips. 9. Install 5 acres of conservation cover or high-diversity habitat cover. 10. Stabilize 2 critical shoreline segments in LB and initiate 1 critical City-owned project. 11. Install 1 rain garden and native buffer at LB.

In years 3-5 of plan implementation, priorities continue with a focus on critical areas or those locations and practices in the watershed where management measures will achieve the greatest nutrient reductions.

Table 83 – Years 3-5 - Implementation Milestones

Timeframe	Milestone
Years 3–5	1. Continue targeted outreach and one-one-one communication with producers. 2. Plant 2,000 acres of cover crops. 3. Convert conventional or other tillage to strip-till or no-till on 1,500 acres. 4. Complete split application of nitrogen fertilizer on 2,000 acres 5. Install 5 grassed waterways. 6. Install 15 acres of high-priority filter strips. 7. Install 10 acres of high-priority field borders or prairie strips. 8. Install 1 high-priority saturated buffer system. 9. Install 1 high-priority DWM system. 10. Install 1 sediment basin. 11. Install 20 acres of conservation cover or high-diversity habitat cover. 12. Install 1 livestock pasture management system. 13. Install 1 rain garden and native buffer. 14. Stabilize 1 critical shoreline segments in LB and 4 in EL. 15. Complete in-lake structure planning and permitting and initiate construction.

In years 6-10, priorities continue to be on in-field management measures and begin to include other structural practices and some urban BMPs.

Table 84 – Years 6-10 - Implementation Milestones

Timeframe	Milestone
Years 6–10	1. Continue targeted outreach and one-one-one communication with producers. 2. Plant 5,000 acres of cover crops. 3. Convert conventional or other tillage to strip-till or no-till on 2,500 acres. 4. Complete split application of nitrogen fertilizer on 5,000 acres 5. Install 10 grassed waterways. 6. Install 5 WASCBS and 1 grade control project. 7. Install 30 acres of filter strips. 8. Install 20 acres of high-priority field borders or prairie strips. 9. Install 2 high saturated buffer systems. 10. Install 1 DWM system. 11. Create 5 acres of wetland. 12. Install 2 ponds. 13. Install 20 acres of conservation cover or high-diversity habitat cover. 14. Install 1 livestock pasture management system. 15. Stabilize 4 shoreline segments in EL. 16. Stabilize streambanks and streambeds at 3 locations. 17. Install 2 rain gardens and 2 urban native buffer systems.

Beyond 10 years, broad implementation should continue, and the watershed plan and milestones should be revisited and updated to accommodate changes over time.

Table 85 – Implementation Objectives, Responsible Parties & Technical Assistance

BMP/Objective	Responsible Party	Primary Technical Assistance/Funding Mechanism
Watershed BMPs/Education and Outreach (1–10 years)		
BMP: Cover Crops **Objective:** Plant 7,500 acres	Landowner/SWCD/NRCS/ City/Ag Retailers	**Technical Assistance**: SWCD/NRCS/AFT/ISAP/SHP /PCM/Ag Retailers **Funding Mechanism**: 319 Grant/Private Funds/NRCS and State Programs/City & Private Funds
BMP: No-Till/Strip-Till **Objective**: Convert 4,500 acres	Landowner/SWCD/NRCS/ City/Ag Retailers	**Technical Assistance**: SWCD/NRCS/AFT/ISAP/SHP /PCM/Ag Retailers **Funding Mechanism**: 319 Grant/Private Funds/NRCS and State Programs/City & Private Funds
BMP: Split Application N Fertilizer **Objective**: Complete 7,500 acres	Landowner/SWCD/NRCS/ City/Ag Retailers	**Technical Assistance**: SWCD/NRCS/AFT/ISAP/SHP /PCM/Ag Retailers **Funding Mechanism**: 319 Grant/Private Funds/NRCS and State Programs/City & Private Funds
BMP: Grassed waterway **Objective:** Install 19	Landowner/SWCD/NRCS/ City	**Technical Assistance:** SWCD /NRCS /FSA / Consultants **Funding Mechanism**: 319 Grant/Private Funds/NRCS and State Programs/City & Private Funds
BMP: Wetland Creation **Objective:** Install 5 acres	Landowner/SWCD/NRCS	**Technical Assistance**: SWCD/NRCS/Consultants/ USFWS/TWI/TNC **Funding Mechanism**: 319/Private Funds/ NRCS and USDA Programs /City & Private Funds
BMP: Filter strips **Objective:** Install 55 acres	Landowner/SWCD/NRCS/ FSA/City	**Technical Assistance:** SWCD/NRCS/FSA/Consultants **Funding Mechanism**: 319 Grant/NRCS and USDA Programs/State Cost Share/ City & Private Funds
BMP: Field Borders **Objective:** Install 35 acres	Landowner/SWCD/NRCS/ FSA/City	**Technical Assistance:** SWCD/NRCS/FSA/Consultants **Funding Mechanism**: 319 Grant/NRCS and USDA Programs/State Cost Share/City & Private Funds
BMP: Saturated Buffer **Objective:** Install 2 systems	Landowner/SWCD/NRCS/ FSA/City	**Technical Assistance:** SWCD /NRCS/FSA/Consultants **Funding Mechanism**: 319 Grant/NRCS and USDA Programs/City & Private Funds
BMP: Drainage Water Management **Objective:** Install 2 systems	Landowner/SWCD/NRCS/ City	**Technical Assistance:** SWCD/NRCS/Consultants **Funding Mechanism**: 319 Grant/NRCS and USDA Programs/City & Private Funds
BMP: Conservation Cover **Objective:** Install 45 acres	Landowner/SWCD/NRCS/ FSA/City	**Technical Assistance:** SWCD/NRCS/FSA/Consultants **Funding Mechanism**: 319 Grant/NRCS and USDA Programs/State Cost Share/ City & Private Funds
BMP: Livestock Pasture System **Objective:** Install 2	Landowners/NRCS/City	**Technical Assistance:** NRCS/Consultants **Funding Mechanism:** NRCS and USDA Programs/319 Grant
BMP: Pond/Sediment Basin **Objective:** Install 3	Landowners/SWCD/NRCS /City	**Technical Assistance:** NRCS/SWCD/Consultants **Funding Mechanism:** 319 Grant/City & Private Funds/NRCS
BMP: Lake Shoreline Stabilization **Objective:** Treat 8 segments	City/SWCD	**Technical Assistance:** SWCD/Consultants **Funding Mechanism:** 319 Grant/City Funds
BMP: Streambank Stabilization **Objective:** 3 segments/locations	Landowners/City/SWCD	**Technical Assistance:** SWCD/Consultants **Funding Mechanism:** 319 Grant/State Cost Share/ City & Private Funds

BMP/Objective	Responsible Party	Primary Technical Assistance/Funding Mechanism
BMP: WASCB/Grade Control **Objective:** Install 5	Landowner/SWCD/NRCS	**Technical Assistance**: SWCD/NRCS/Consultant **Funding Mechanism:** NRCS Programs/Private Funds/State Cost Share/ City Funds
BMP: Rain Gardens & Native Buffer **Objective:** Install 6	Landowner/SWCD/City	**Technical Assistance**: SWCD/NRCS/Consultant **Funding Mechanism:** 319 Grant/IGIG/City & Private Funds
BMP: In-Lake Basin or Floating Wetland **Objective:** Install 2	City	**Technical Assistance**: TWI/TNC/NRCS/Consultant **Funding Mechanism:** 319 Grant/City & Private Funds
BMP: Education and Outreach **Objective:** Stakeholder engagement	SWCD/City/Retailers/ Landowners	**Technical Assistance:** SWCD/NRCS/ISA/AFT/Coop Ext. **Funding Mechanism:** 319 Grant/City & Private Funds

12.0 Information & Education

The McLean County SWCD, City of Bloomington and Northwater Consulting conducted limited education and outreach throughout the watershed during the planning process. This included presentations to public on the plan and a series of individual farmer and residential landowner meetings. The intent moving forward is to accelerate outreach to gather support and gauge willingness to participate in implementation of the plan.

Effective education and outreach are crucial to a plan's success since many watershed problems and solutions result from human actions. Recommended communications strategies:

1. Increase communication with and outreach to individual landowners.
2. Develop key farmer workshops and demonstrations in partnership with other organizations.
3. Increase local media and corporate participation.
4. Increase the volume of voluntary adoption of conservation programs and incentives.
5. Increase farmer application of best practices.
6. Increase consistent use and visibility of key messages.

As described in a 2017 report compiled by McLean County SWCD and TNC, traditional, broad-scale outreach materials including newsletter articles, fact sheets, newspaper stories, and online content were useful for helping to concisely describe conservation opportunities and promote them to local landowners. However, their outreach most effectively led to practice adoption and implementation when it was targeted to specific individuals, when messages were delivered from trusted advisors, and when we demonstrated an understanding of how the practices being promoted fit within the context of an individual producer's management system. In many cases, an iterative approach, including conversations over many months, was required for adoption of long-term practices. Furthermore, it was generally recognized that achieving meaningful water quality improvements in Illinois requires a multi-practice, multi-partner program with on-the-ground, local outreach as a key component (Lemke and Mclean County SWCD, 2017).

Education and outreach/communication strategies to meet goals and objectives will include the following:

1. Conduct one-on-one and one-to-few outreach by knowledgeable, trusted local providers and advisors who understand the local farming community and context, as well as existing Farm Bill conservation programs. Immediate outreach and implementation in the watershed will focus on the critical areas identified in this plan and direct one-on-one landowner engagement.
2. Utilize practice demonstration using formal field days, informal site tours, and farmer-led discussions and workshops. Create farmer-led epicenters for outreach and work with farmers to plan small-scale "neighborhood" field days to discuss conservation options and opportunities.
3. Develop clear and concise outreach materials that address practice benefits, costs, and economic incentives associated with recommended conservation programs. Identify opportunities to participate in future efforts by providing landowners information about conservation programs, including Farm Bill processes and timelines, and incentives.
4. Present data showing sources of nitrate export into the watershed and practice effectiveness at reducing nitrogen loss from tiles.
5. Eliminate barriers to participation such as assistance with program paperwork and eligibility, utilization of TSPs and other private consultants for practice design and planning.
6. Approach and secure strategic partnerships from local businesses and corporations.
7. Encouraging placement of signage about conservation practices: S.T.A.R. program and watershed signs.
8. Create an interactive watershed map for the target audiences and regularly report results of plan implementation, the impacts of conservation and lake and stream water quality.
9. Publicize farmer efforts to improve water quality among municipal water rate payers. This promotes agriculture and builds greater understanding of farmers' efforts among downstream water users.

13.0 Monitoring & Tracking Strategy

Four components comprise of the monitoring and tracking strategy described in this section:

1. Programmatic monitoring, tracking investments and progress towards goals.
2. Watershed and lake water quality monitoring.
3. Site-level BMP monitoring.
4. Water quality database.

13.1 Programmatic Monitoring

The City of Bloomington and the McLean County SWCD have invested in the development of an online watershed assessment and management system. This online portal allows for the tracking and management of watershed investments such as BMPs. It includes key base map layers developed and present throughout this plan, as well as all existing and recommended BMPs (Figure 57).

The portal maintains a database of all those proposed/recommended and constructed BMPs and will be maintained and managed by the City, SWCD and partners using this system. Each future project will have pollutant load reduction estimates calculated from the base model presented in Section 4.0 and any new BMPs can be evaluated for their impacts on water quality and maintained in the system. Real-time project status and tracking of load reductions towards goals will be viewable in the portal dashboard (Figure 58).

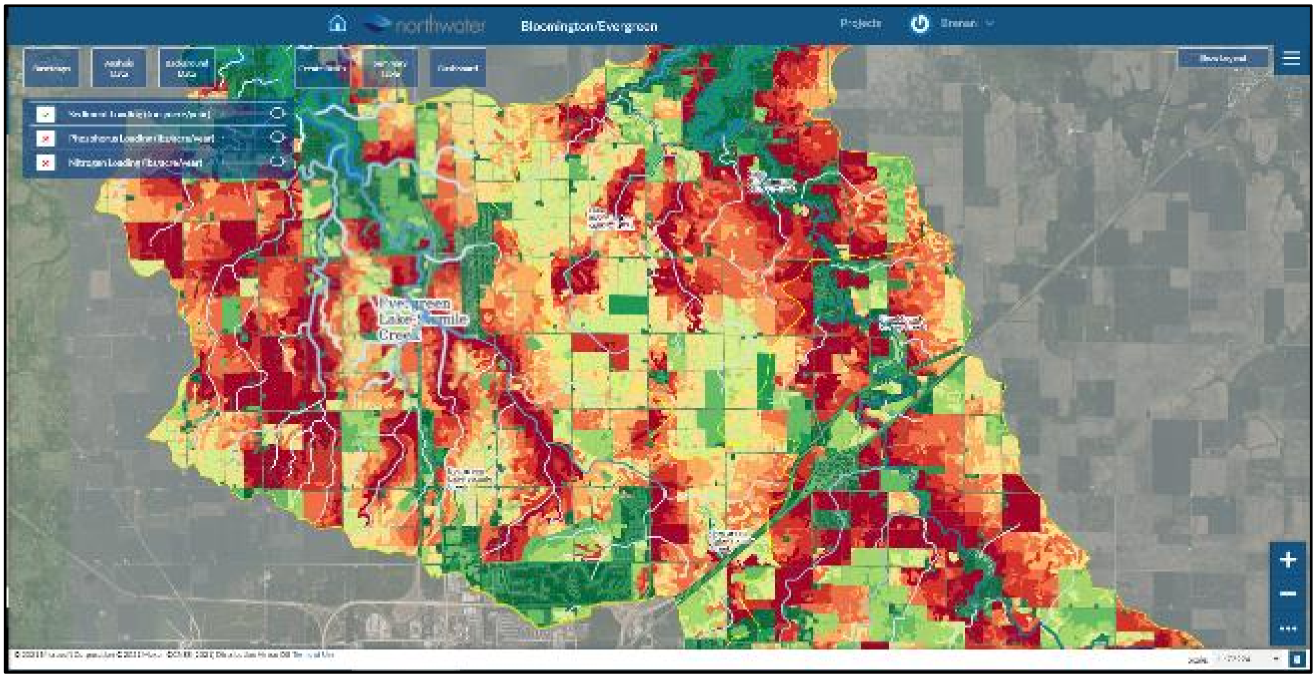
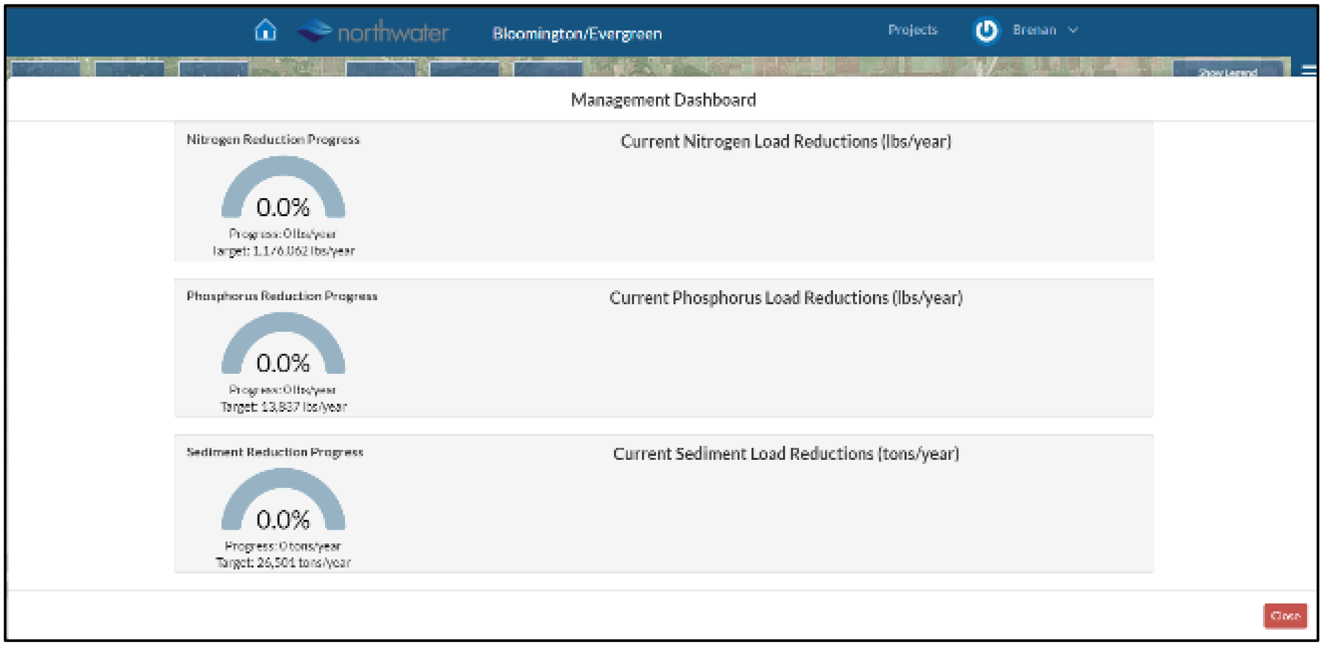


Figure 57 - Online Management System – Mapping Window



Management Dashboard

Nitrogen Reduction Progress
0.0%
Progress: 0 lbs/year
Target: 1,176,062 lbs/year

Current Nitrogen Load Reductions (lbs/year)

Phosphorus Reduction Progress
0.0%
Progress: 0 lbs/year
Target: 13,837 lbs/year

Current Phosphorus Load Reductions (lbs/year)

Sediment Reduction Progress
0.0%
Progress: 0 tons/year
Target: 26,501 tons/year

Current Sediment Load Reductions (tons/year)

Figure 58 - Online Management System – Management Dashboard

13.2 Watershed & Lake Water Quality Monitoring

The water quality monitoring strategy complements programmatic monitoring with temporal analytical data to evaluate the condition and health of the watershed in a consistent and on-going manner. The results serve to evaluate the effectiveness of plan implementation and better understand watershed dynamics to guide future decisions and investments.

The City, ISU and others have a long history of data collection and research in the lakes and watershed (Figure 59). The resulting datasets have proven valuable in terms of understanding water quality problems, trends, and drivers of sediment and nutrient loading. However, there are several organizational and structural improvements necessary to generate the most value and utility from these monitoring efforts.

The current monitoring program should continue with the following considerations and modifications:

1. Currently, there are over 10 monitoring stations and diverse water quality data captured between the lakes and watershed, representing a legacy of various and sometimes disconnected initiatives (Figure 59).
    - Station IDs need to be standardized in terms of location, nomenclature and definition. An opportunity exists to synthesize the number of active stations, the volume of data collected, and the parameters analyzed. However, this refinement of the current monitoring strategy is outside of the scope of this plan and requires an effort to review existing data, meet with the stakeholders and better understand objectives and purposes of all various monitoring stations.

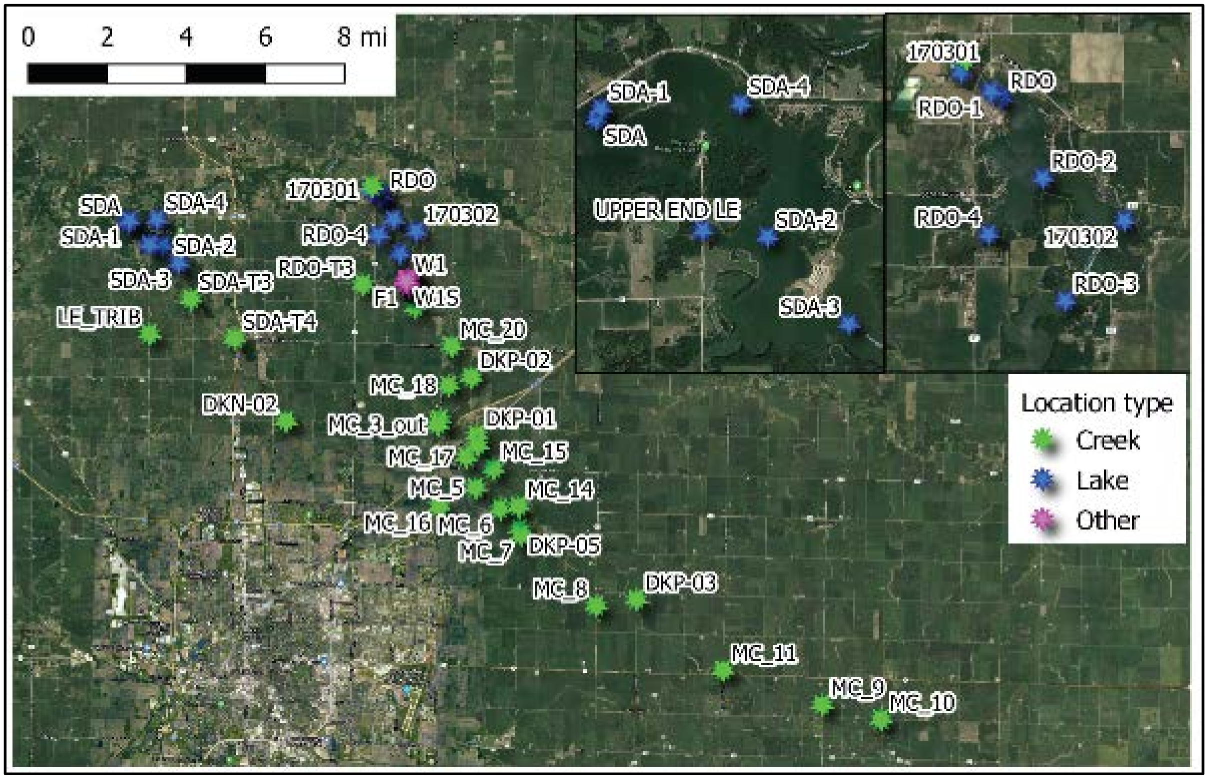


Figure 59 - Water Quality Data Locations Throughout the Watershed

2. Standard operating procedures should be developed for all components of monitoring from data collection, through lab analyses methods and data entry procedures. This is necessary to assure quality and consistency between all participants and to assure datasets are reviewed and compiled on a regular basis.
3. Installation and maintenance of permanent stream gauge infrastructure at Money and Sixmile Creeks and the development of a proper stage/discharge relationship. Work with ISU and other partners to execute an aggressive flow monitoring campaign over a larger range to make a more accurate relationship for both stations. One of the largest data gaps from the monitoring programs is accurate flow data.
4. The current program needs adjustment to better capture the range of flow events in the streams by including more storm-event monitoring. Flow measurements, nutrient concentrations and sediment concentrations are not strongly represented across the statistical quartiles of flow events.
5. Samples for sediment analysis should be collected with a depth integrated sampler, especially during storm-events. Sediment samples need to be analyzed for both TSS and SSC to better estimate and track loading. Bedload monitoring should be applied to capture the portion of sediment transported along the floor of the streams.
6. Annual monitoring reports should be generated that plot the datasets and provide basic interpretation and takeaways. The reports will allow for annual tracking of water quality impairments and yields. This activity also encourages discipline in terms of data organization and management, and also allows for monitoring program adjustments to be made if necessary, based on results or other factors.

13.2.1 Site-Level Monitoring – Hoffman Site

The City and other researchers have spent considerable time evaluating the use of created wetlands to improve water quality at the “Hoffman Site”. A series of wetlands were constructed, and substantial monitoring infrastructure installed to quantify improvements in water quality and evaluate impacts from various farming practices. Data was used in this plan to set removal efficiencies for recommended wetlands and to inform siting. Given that the monitoring infrastructure is already in place, this location can and should be used for future research initiatives. Initial research considerations could include:

1. Evaluate new and emerging cover crop systems such as “covercress.”
2. Given the wetlands are now well over 10-years old, evaluate the efficacy of “maintenance” on their ability to assimilate sediment and nutrients.
    a. Re-initiate monitoring for a minimum of 1 year to quantify any changes in efficiency of the wetland systems.
    b. Remove deposited sediment and vegetation and perform maintenance to return basins to initial post-construction conditions.
    c. Conduct a minimum of 2 years of post-maintenance monitoring.

13.2.2 Database

A relational database system for all monitoring data is strongly recommended. This can also be used to import historical data and support an efficient means to evaluate trends and watershed improvements over time. A database system is essential considering the volume of information being collected and such a system will force standardization and quality control. This will also make data usage and analysis significantly more efficient and affordable. The City and the SWCD have been evaluating a database architecture to accommodate the diversity of datasets (Figure 60).

The City and/or SWCD should designate a 'champion' of the database to ensure it is used and all data is regularly entered from all entities working in the watersheds. If in-house database expertise and capacity is limited, it may be necessary for external support in its management and utilization.

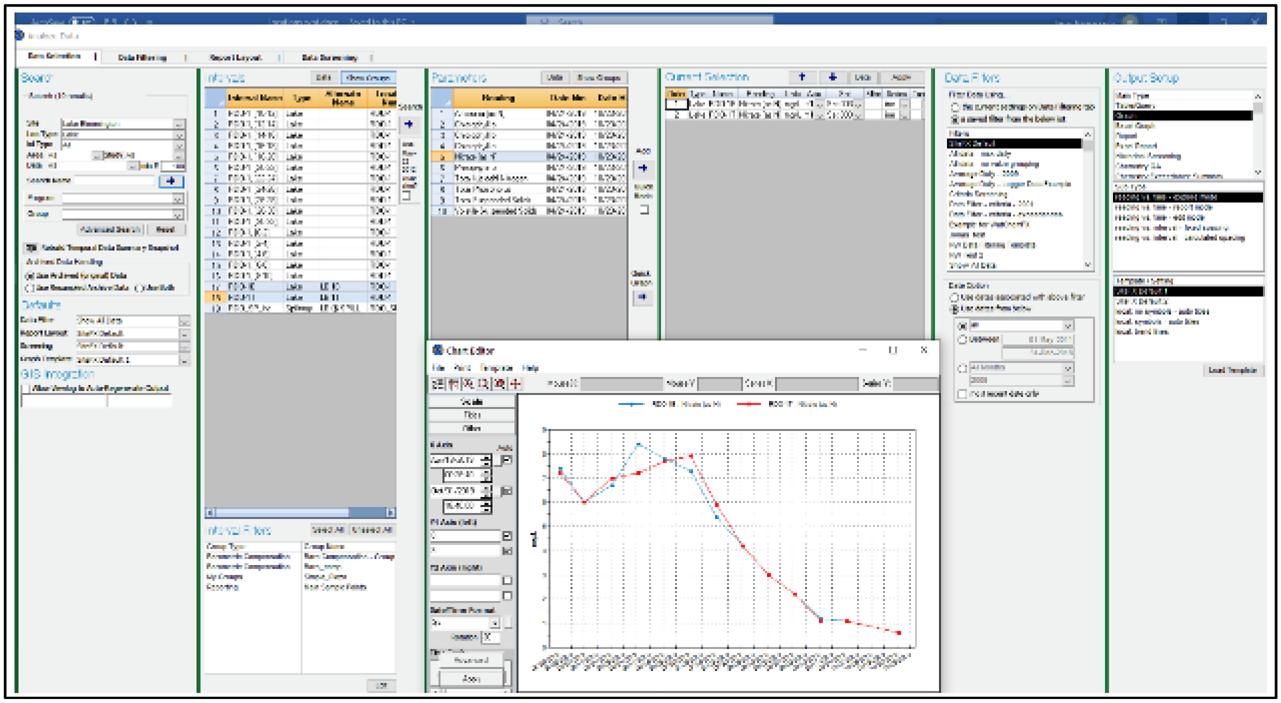


Figure 60 – Screenshot of Initial Database System

References

Aceves, Jessica; Anstirman, Michael; Backstrom, Jordan; Herbert, Ryan; Johnson, Courtney; Neaves, Julia; O'Hare, Alicia; Perez, Erika; Rego, Emily; and Spurgis, Mark, "Water Your Opinions: A Social Assessment of the Lake Bloomington and Lake Evergreen Watersheds" (2014). Stevenson Center for Community and Economic Development. 2. https://ir.library.illinoisstate.edu/scced/2

CDM Smith. 2014. Lake Springfield Watershed TMDL Stage 1 Report.

Christianson L, Bhandari A, Helmers M (2012a) A Practice-oriented Review of Woodchip Bioreactors for Subsurface Agricultural Drainage. Applied Engineering in Agriculture 28, 861-874.

David, M. B., McIsaac, G. F., Mitchell, C. A., 2008. Water Quality Improvement Case Study: Assessment of the Lake Bloomington Watershed. University of Illinois at Urbana-Champaign.

Hill M.S. 1997. Understanding Environmental Pollution. Cambridge, UK: Cambridge University Press. 316 pp.

Hassanpour B, Giri S, Pluer WT, Steenhuis TS, Geohring LD (2017) Seasonal performance of denitrifying bioreactors in the Northeastern United States: Field trials. J Environ Manage 202, 242-253.

Illinois Environmental Protection Agency, Bureau of Water. 2018. Illinois Integrated Water Quality Report and Section 303(d) List, 2018. Available at: https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Pages/303d-list.aspx

Illinois Environmental Protection Agency. 1998. Lake Notes: Common Lake Water Quality Parameters. Accessed February 2016. Available online at: http://www.epa.state.il.us/water/conservation/lake-notes/quality-parameters.pdf

Illinois Nutrient Science Advisory Committee. December 2018. Recommendations for Numeric Nutrient Criteria and Eutrophication Standards for Illinois Streams and Rivers. Available at: https://www2.illinois.gov/epa/topics/water-quality/standards/Documents/NSAC%20Report%20-%20Final.pdf

Illinois State Geological Survey. 1995. Stack-Unit Mapping of Geologic Materials in Illinois to a Depth of 15 Meters. Edition 20040422. ISGS GIS Database: GISDB_QTGEO.IL_Stack_Units_To_15m_Py

Illinois State Water Survey, 1994. Water Quality Characteristics of Lake Bloomington and Lake Evergreen. Contract Report 569.

Illinois State Water Survey, 1998. Aeration/Destratification in Lake Evergreen, McLean County, Illinois. Contract Report 623.

Jaynes DB, Kaspar TC, Moorman TB, Parkin TB (2008) In situ bioreactors and deep drainpipe installation to reduce nitrate losses in artificially drained fields. J Environ Qual 37, 429-436.

Kovacic, D.A., Twait, R.M., Wallace, M.P., and Bowling, J.M., 2006. Use of Created Wetlands to Improve Water Quality in the Midwest – Lake Bloomington Case Study. Ecological Engineering 28, 258-270.

Lake County Stormwater Management Commission. Naturalized Detention Basins. Available online at: https://www.lakecountyil.gov/2240/Naturalized-Detention-Basins

Lake County Stormwater Management Commission. P-Free Fertilizers. Available online at: https://www.lakecountyil.gov/3594/P-Free-Fertilizers

Lake Bloomington Watershed Planning Committee (LBWC), 2008. Lake Bloomington Watershed Plan.

Lemke, M., 2017. Bundling in-field and off-field nutrient practices to reduce nutrient export, improve drinking water quality, and address hypoxia in the Gulf of Mexico, Final Report. The Nature Conservancy.

Evergreen Lake Watershed Planning Committee (ELWPC), 2008. Evergreen Lake Watershed Plan.

Mitzelfelt, D. 1996. Sediment Classification for Illinois Inland Lakes, 1996 Update. Illinois Environmental Protection Agency, Bureau of Water, Division of Water Pollution Control Planning Section, Lake and Watershed Unit.

Natural Resources Conservation Service. 2010. Conservation Practice Standard Filter Strip (Ac.) CODE 393 [Pamphlet]. N.P. n.p. Natural Resources Conservation Service.

Natural Resources Conservation Service. 2018a. Hydric Soils Definition. Available online at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/pr/soils/?cid=nrcs141p2_037283

Natural Resources Conservation Service. 2018b. Official Soil Series Descriptions. Available online at: https://soilseries.sc.egov.usda.gov

Nurnberg, G.K., 1984. The Prediction of Internal Phosphorus Load in Lakes with Anoxic Hypolimnia, Journal of the American Society of Limnology and Oceanography, v.29, no.1, p. 111-124.

Nürnberg, G.K, 2009. Assessing internal phosphorus load – Problems to be solved, Lake and Reservoir Management, 25:4, 419-432, DOI: 10.1080/00357520903458848

Nürnberg, G.K., et al., Quantification of internal phosphorus load in large, partially polymictic and mesotrophic Lake Simcoe, Ontario, J Great Lakes Res (2013), http://dx.doi.org/10.1016/j.jglr.2013.03.017

Nürnberg, G.K, 1988. Prediction of phosphorus release rates from total and reductant-soluable phosphorus in anoxic lake sediments. Can. J Fish. Aquat. Sci. 45: 453-462.

Oklahoma State University. Oklahoma Cooperative Extension Service. Sergio MA, Boyanton L. 2017. Septic System Basics for Realtors. Available online at: http://factsheets.okstate.edu/documents/pss-2408-septic-system-basics-for-realtors/

Ruffatti, Michael D., 2016. Effect of Cover Crop and Nitrogen Application Timing on Nutrient Loading Concentration through Subsurface Tile Drainage. Thesis and Dissertations. 632. https://ir.library.illinoisstate.edu/etd/632

Simon A. 1989. A Model of Channel Response in Disturbed Alluvial Channels. Earth Surface Processes and Landforms 14(1):11-26.

Sondergaard M, Jensen JP, Jeppesen E. 2003. Role of Sediment and Internal Loading of Phosphorus in Shallow Lakes. National Environmental Research Institute, Department of Freshwater Ecology. Hydrobiologia. 506–509(1-3):135–145.

Streams Technical Resource Evaluation And Management Service (STREAMS), 2005. Stream Inventory and Analysis, Lake Evergreen Watershed.

Streams Technical Resource Evaluation And Management Service (STREAMS), 2006. Assessment of Sediment Delivery and Stream Conditions in the Lake Bloomington Watershed.

Tetra Tech EM, Inc., 2006. Lake Bloomington Watershed TMDL.

United States Census. 2010–2018. Population estimates from US Census. Available at: https://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml#none

United States Department of Agriculture, Soil Conservation Service. 2007. Chapter 7, Hydrologic Soil Groups; Part 630 Hydrology, National Engineering Handbook.

United States Environmental Protection Agency. 2002. Onsite Wastewater Treatment Systems Manual. EPA/625/R-00/008. Chapter 1: Background and Use of Onsite Wastewater Treatment Systems. Updated 2010. Available online at: http://www.epa.gov/nrmrl/pubs/625r00008/html/600R00008chap1.htm

United States Environmental Protection Agency. 2018. Polluted runoff: nonpoint source (nps), basic information about nonpoint source (nps) pollution. Available online at: https://www.epa.gov/nps/basic-information-about-nonpoint-source-nps-pollution

United States Fish and Wildlife Service. National Wetlands Inventory. Accessed February 2016. Available online at: https://www.fws.gov/wetlands/Data/Wetland-Codes.html

United States Geological Survey. 2014. Circular 1352. Water Quality in the Glacial Aquifer System, Northern United States, 1993–2009. 116 pp.

University of Illinois at Urbana-Champaign, College of Agriculture Cooperative Extension Service, 2012. Illinois Agronomy Handbook: 24th Edition.

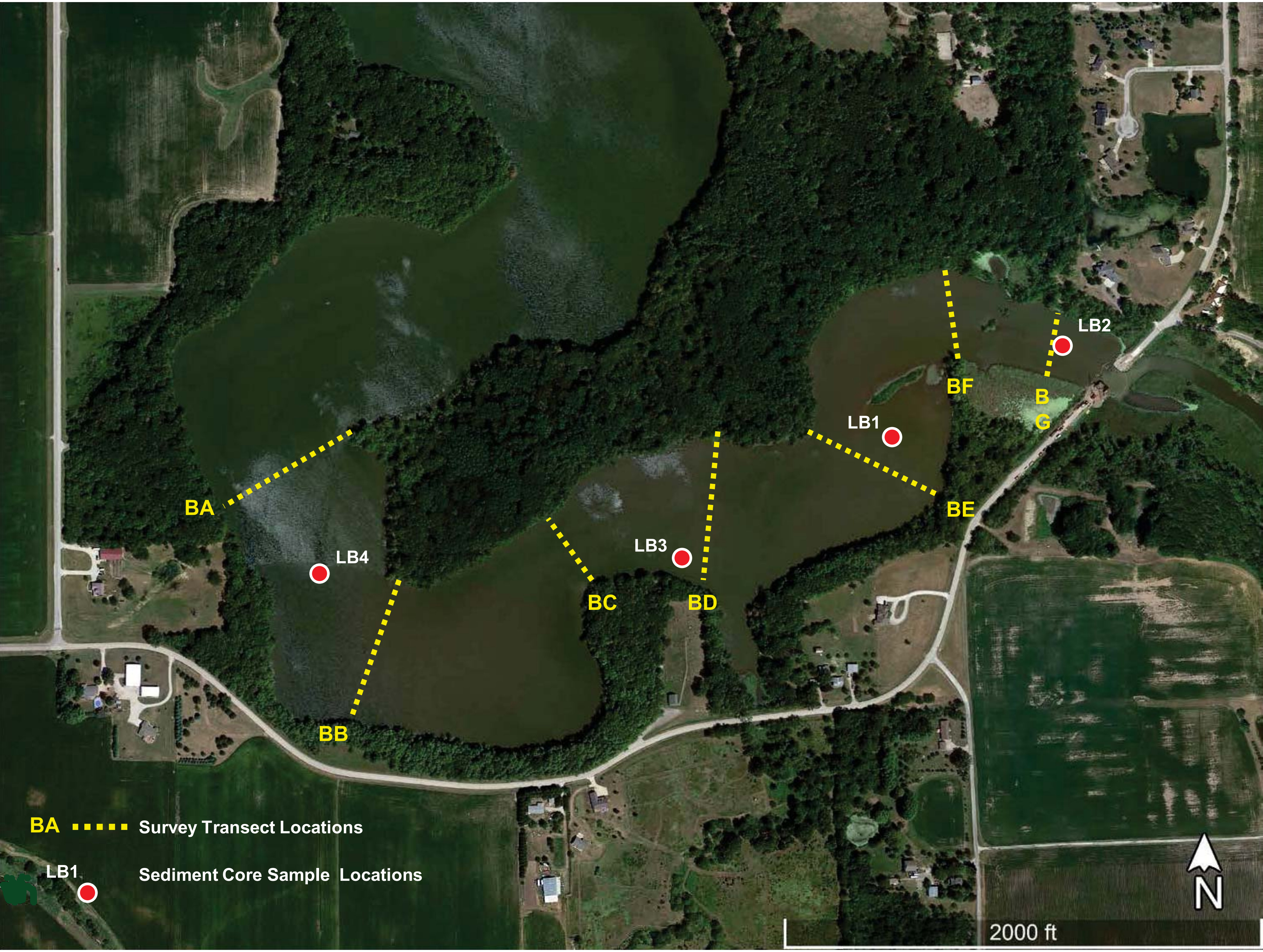
U.S. Water Alliance, 2014. Coming together to Protect Mississippi River Watersheds, Agriculture and Water Sector Collaboration for Nutrient Progress. Available online at: http://uswateralliance.org/sites/uswateralliance.org/files/publications/MRND-FINAL-REPORT.pdf

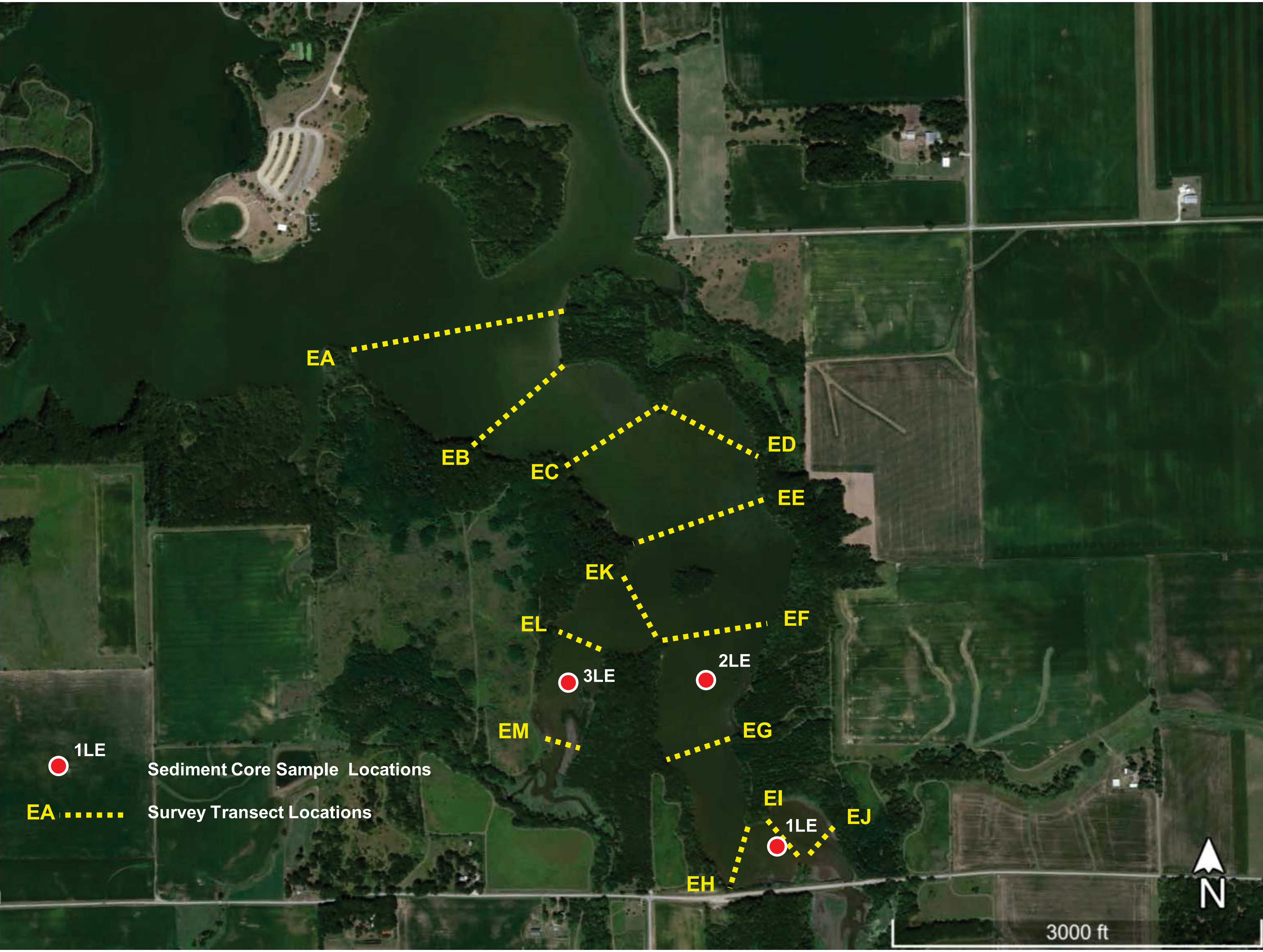
Vinsel, R.M. and A.P. Stodola. 2017. Freshwater Mussels of Money and Six Mile Creeks, McLean County, Illinois. Illinois Natural History Survey Technical Report 2017 (33). Champaign, Illinois. 21 pp.

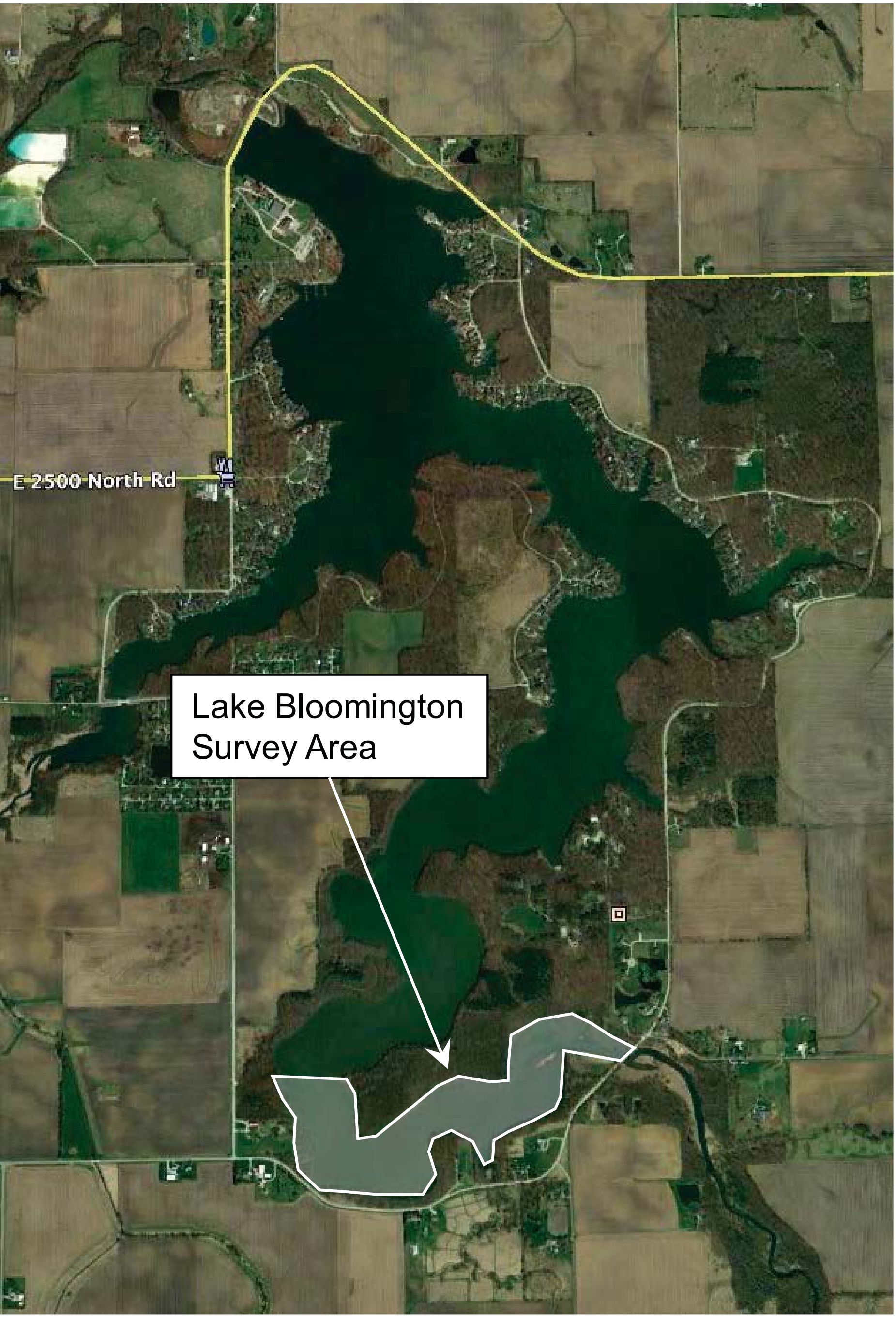
Water Resources Solutions. 2014. Spring Creek Basin Watershed Study; Sedgwick County Kansas.

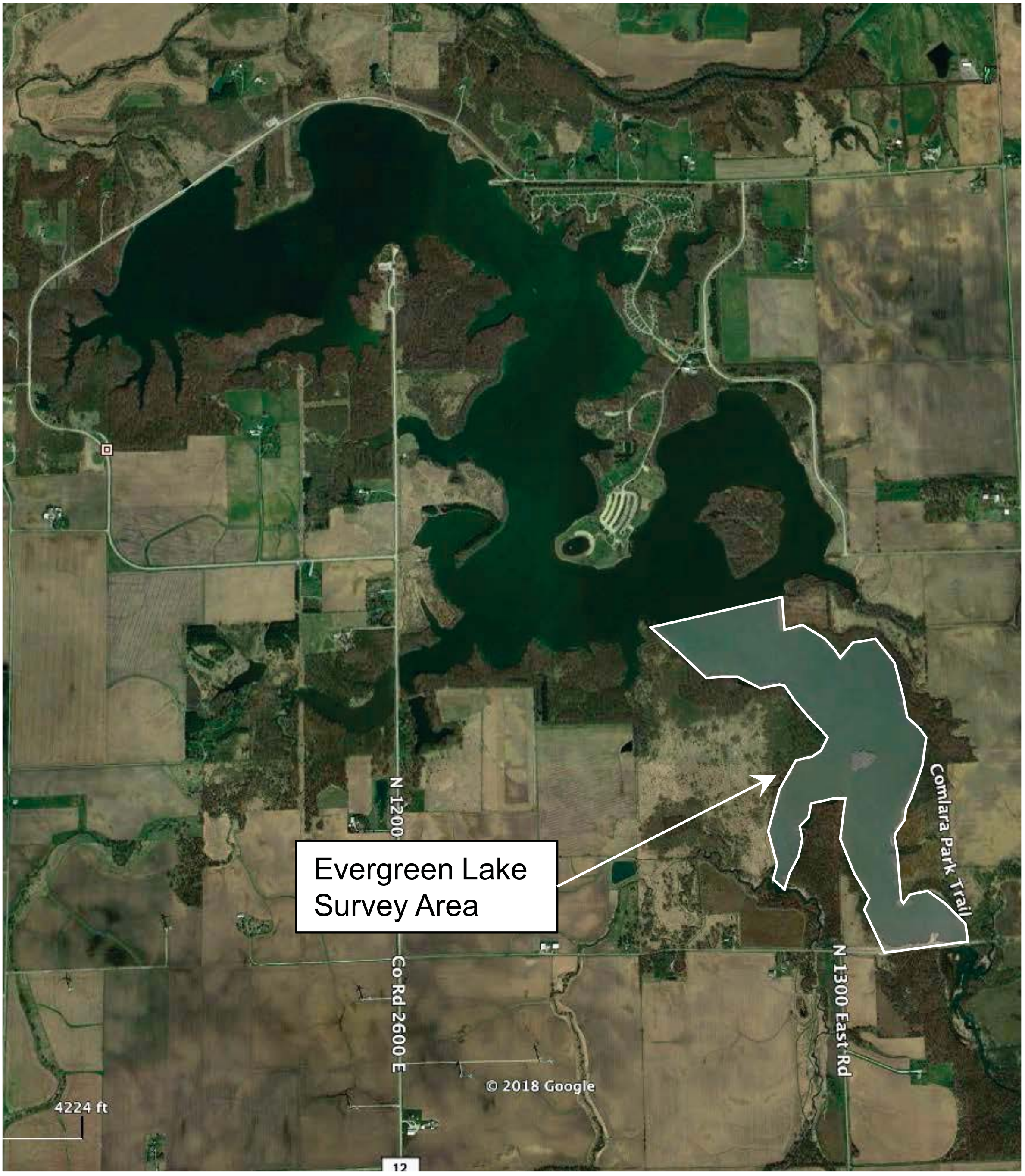
Wittman Hydro Planning Associates, 2010. Interim Water Supply Plan; Prepared for the City of Bloomington, Illinois.

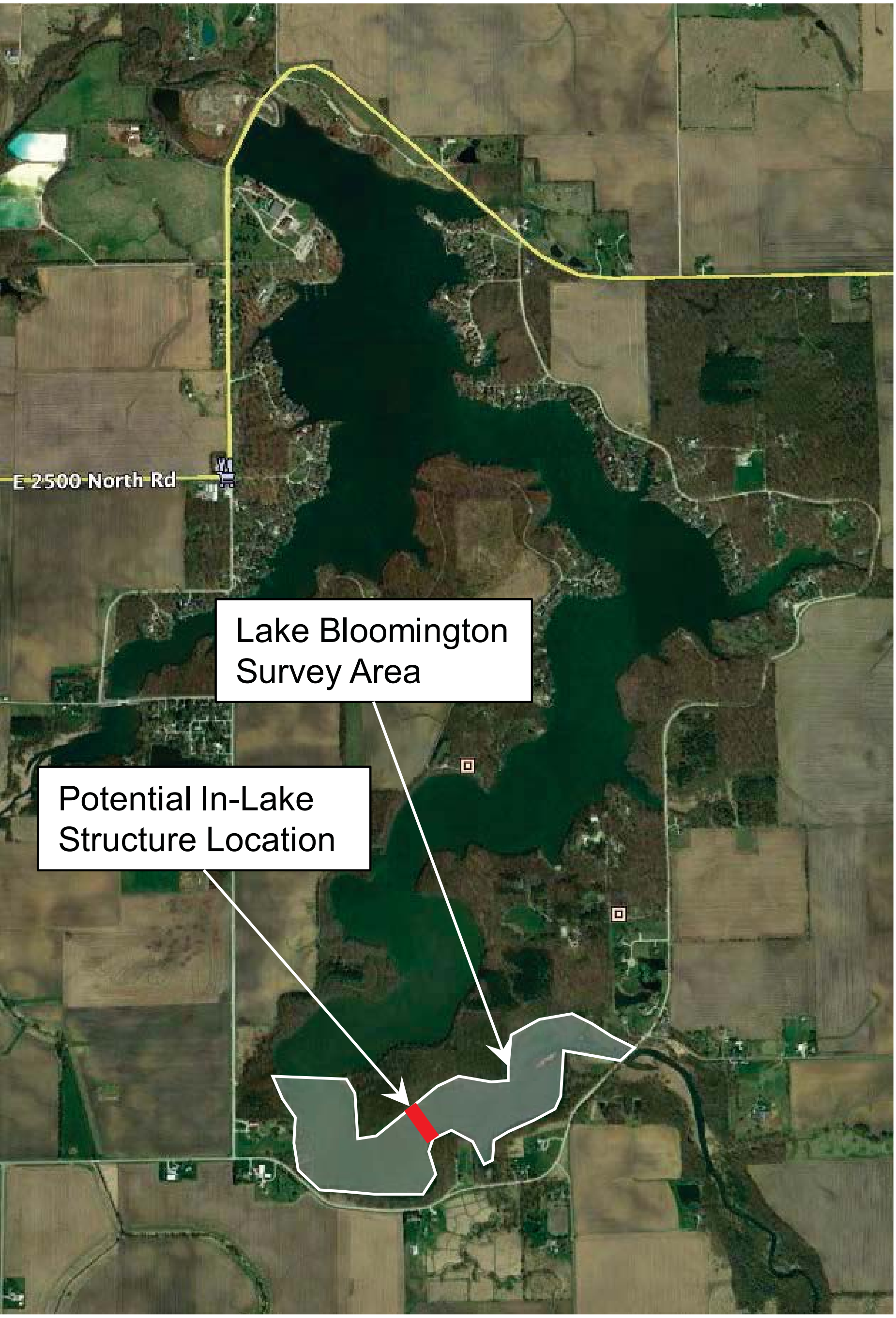
Appendix A: Lake Sediment Survey Details

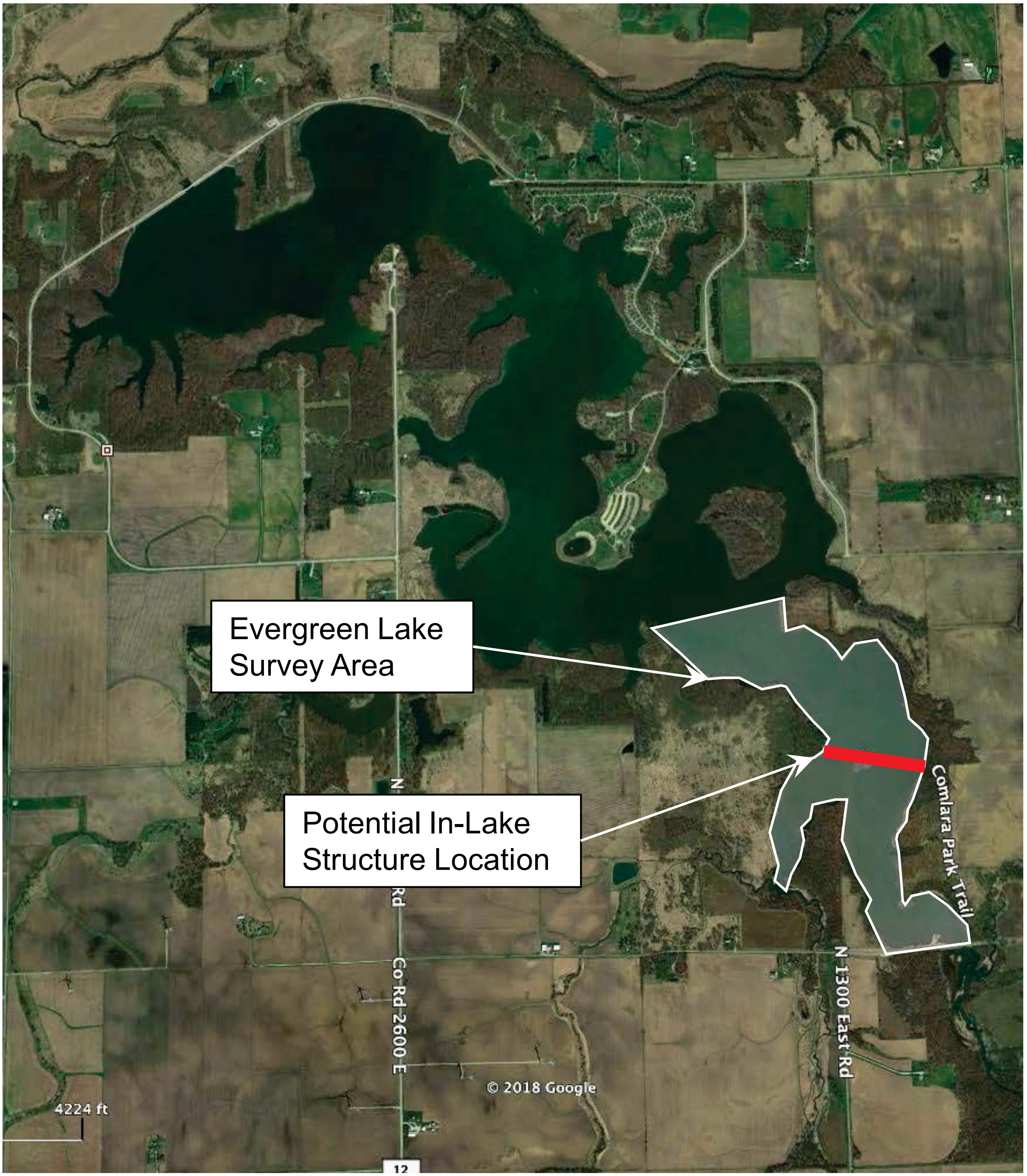

LB2
B
G
BF
LB1
BE
BA
LB4
BC
LB3
BD
BB
BA Survey Transect Locations
LB1 Sediment Core Sample Locations
N
2000 ft


EA
EB
EC
ED
EE
EK
EF
EL
3LE
2LE
EM
EG
EI
1LE
EJ
EH
N
3000 ft
1LE
Sediment Core Sample Locations
EA
Survey Transect Locations

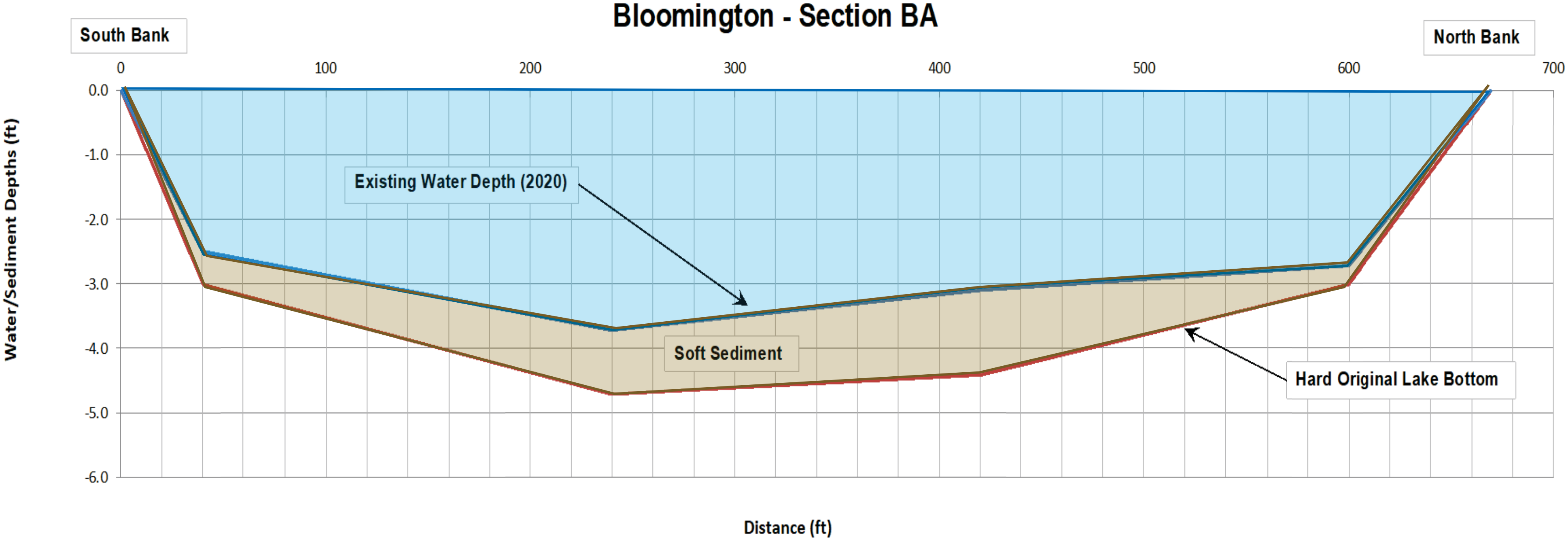

E 2500 North Rd
Lake Bloomington
Survey Area


N 1200
Co Rd 2600 E
N 1300 East Rd
Comlara Park Trail
Evergreen Lake
Survey Area
4224 ft
© 2018 Google
12

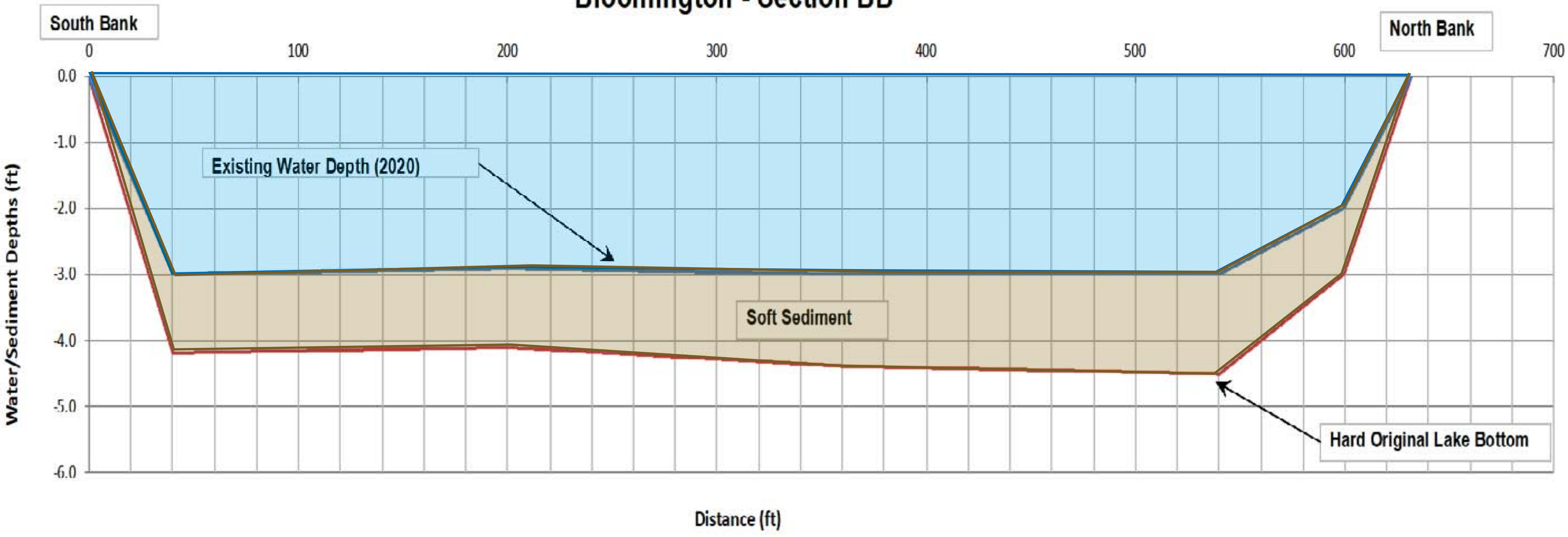

E 2500 North Rd
Lake Bloomington Survey Area
Potential In-Lake Structure Location

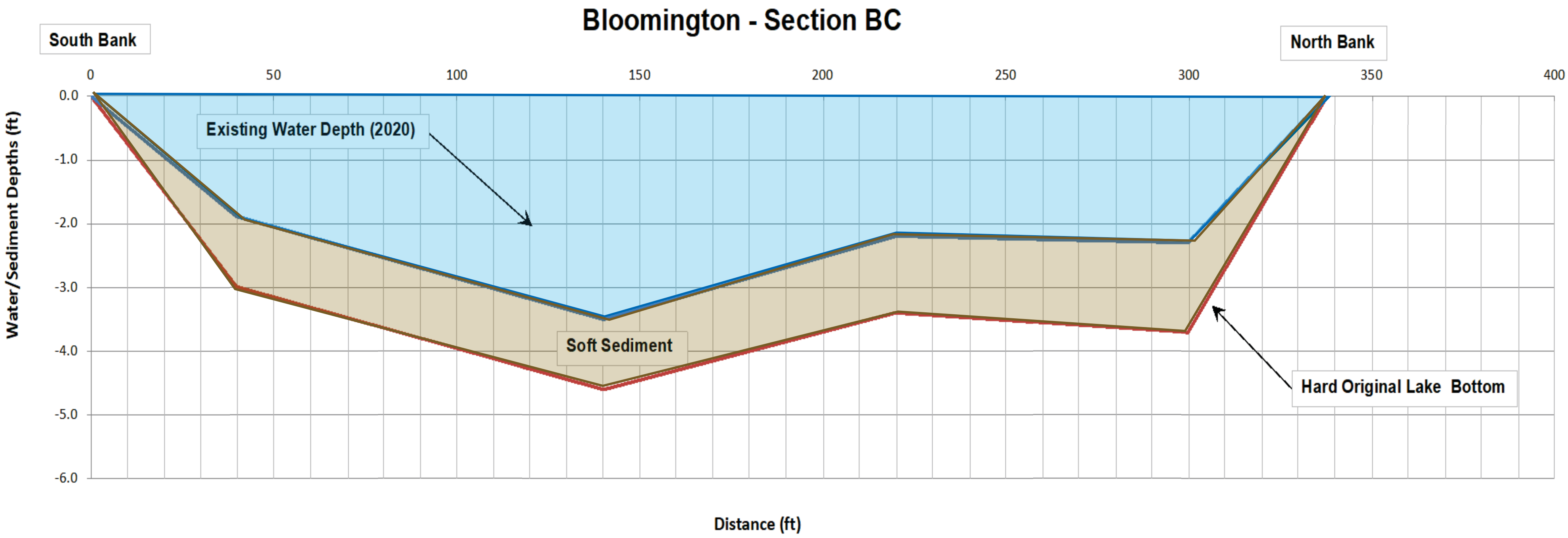

Evergreen Lake Survey Area
Potential In-Lake Structure Location
Comlara Park Trail
N 1300 East Rd
N Rd
Co Rd 2600 E
© 2018 Google
4224 ft
12

Bloomington - Section BA

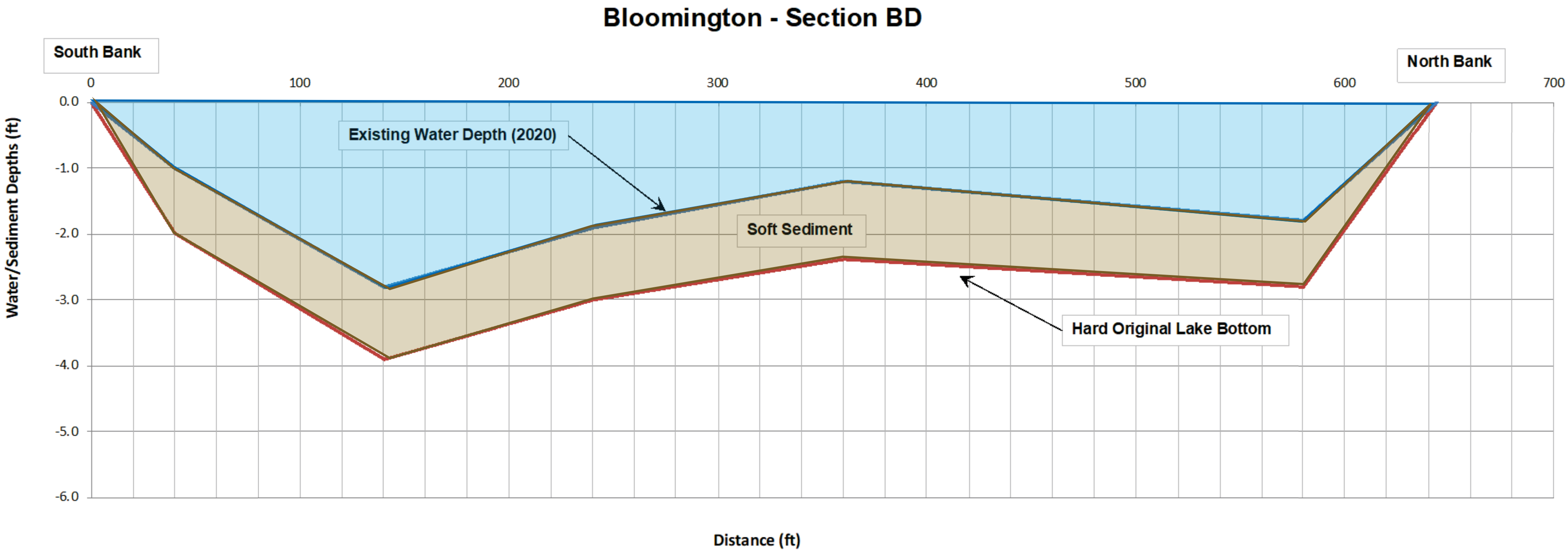


Bloomington - Section BB



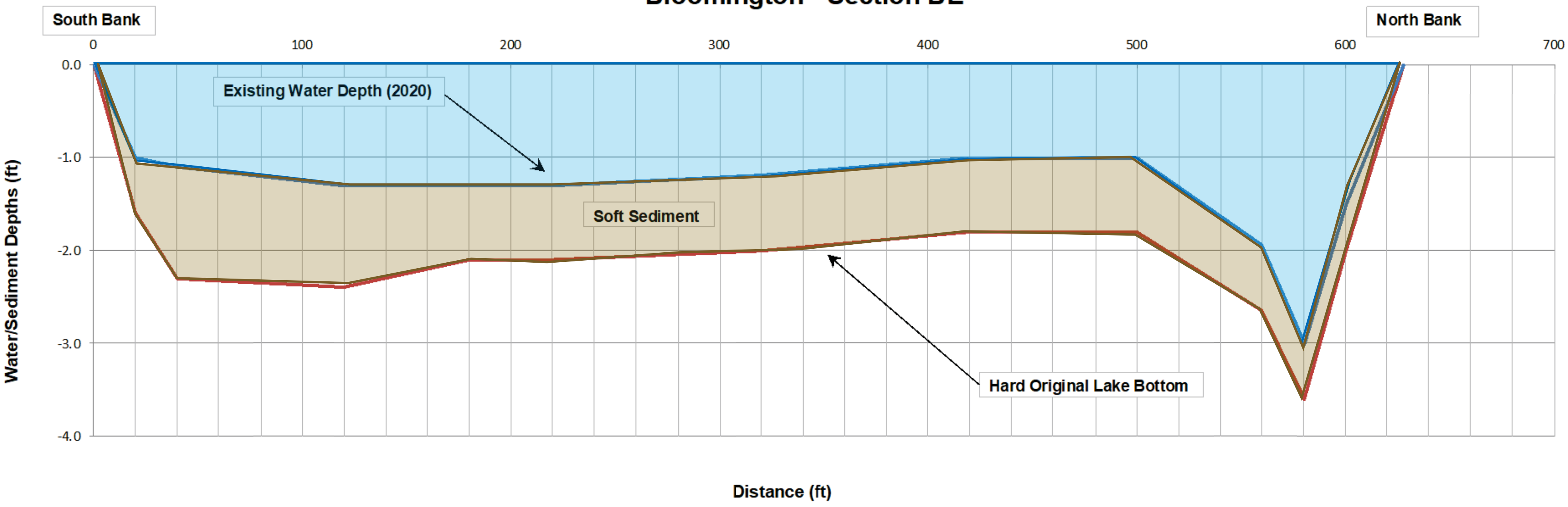


Bloomington - Section BC



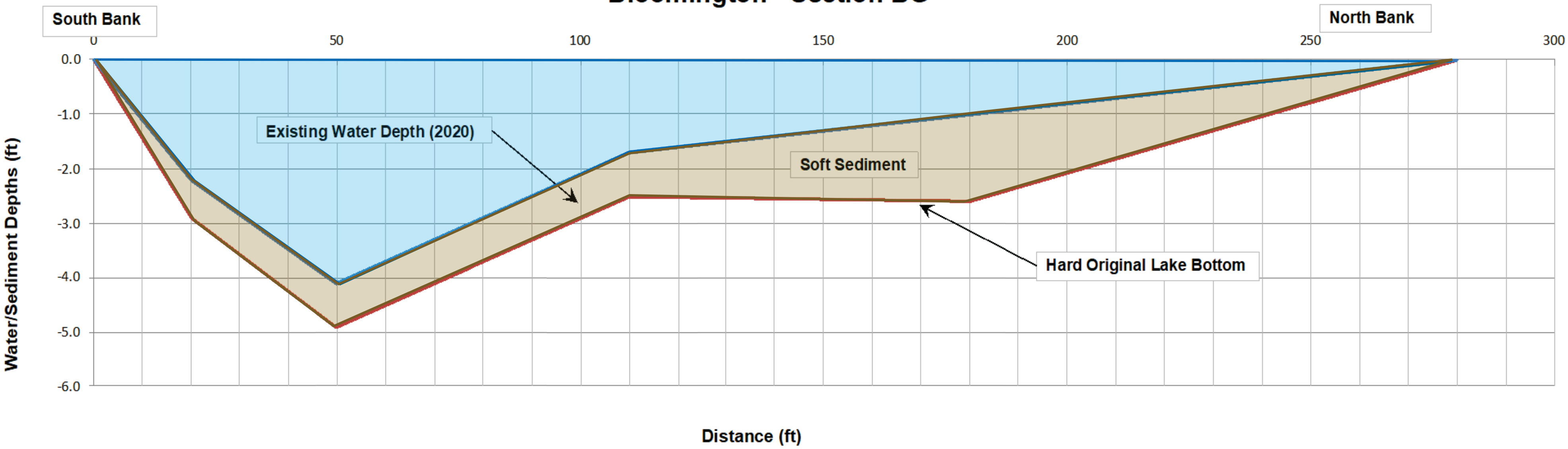
Bloomington - Section BD

Bloomington - Section BE

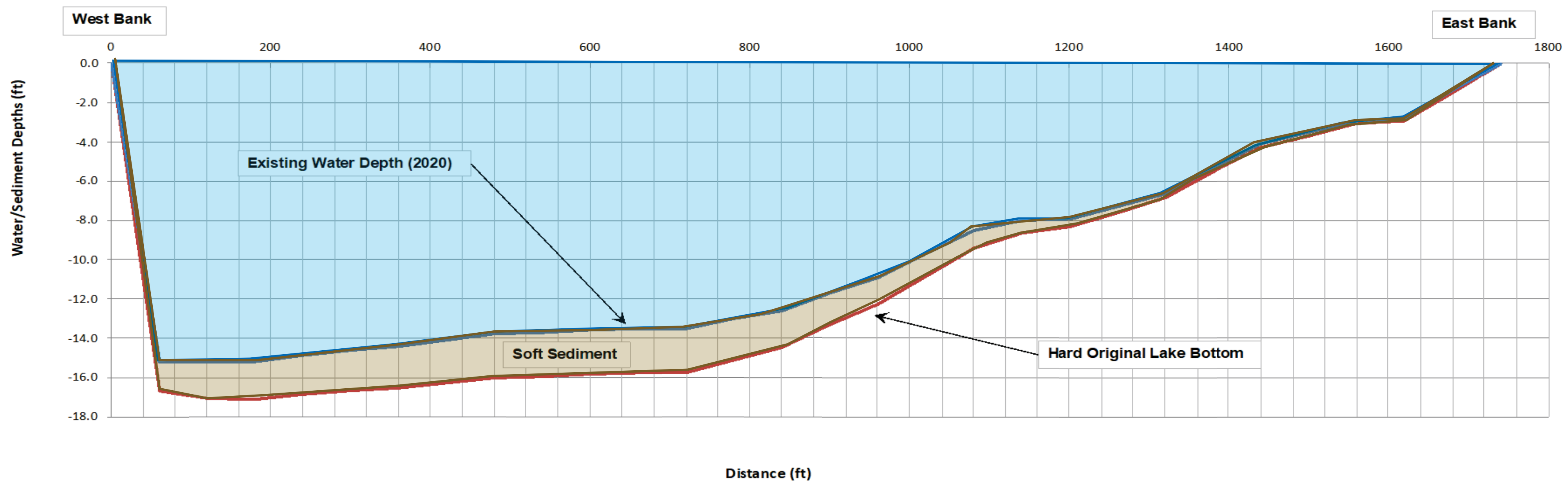


Bloomington - Section BF

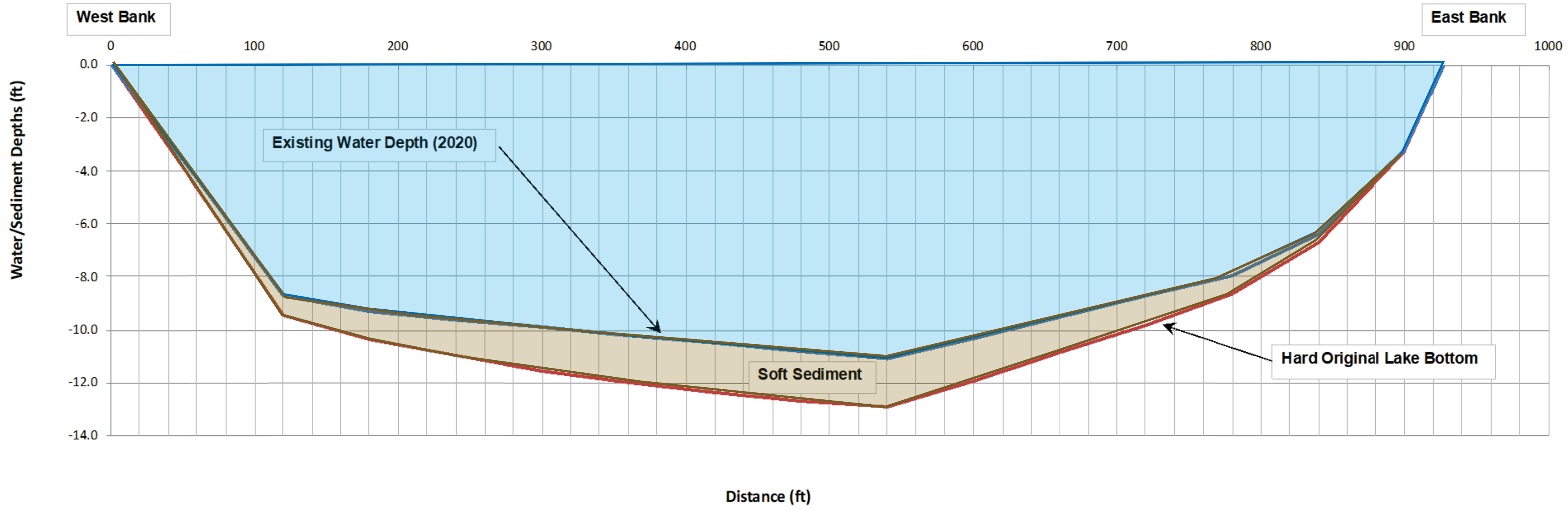
Bloomington - Section BG



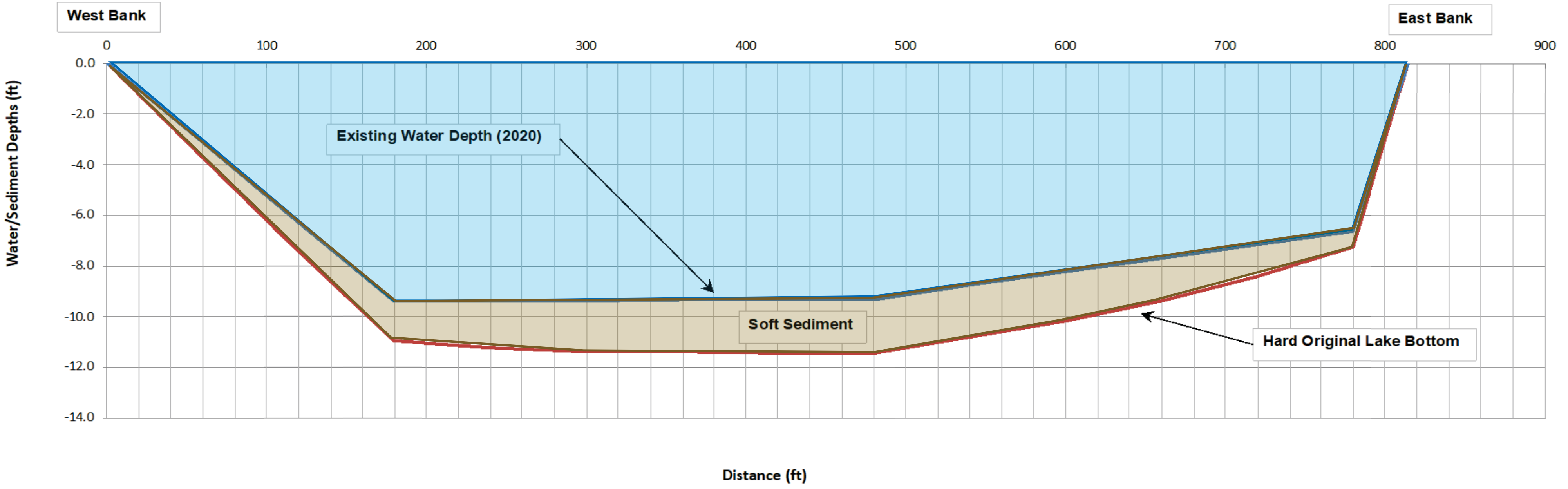
Evergreen - Section EA



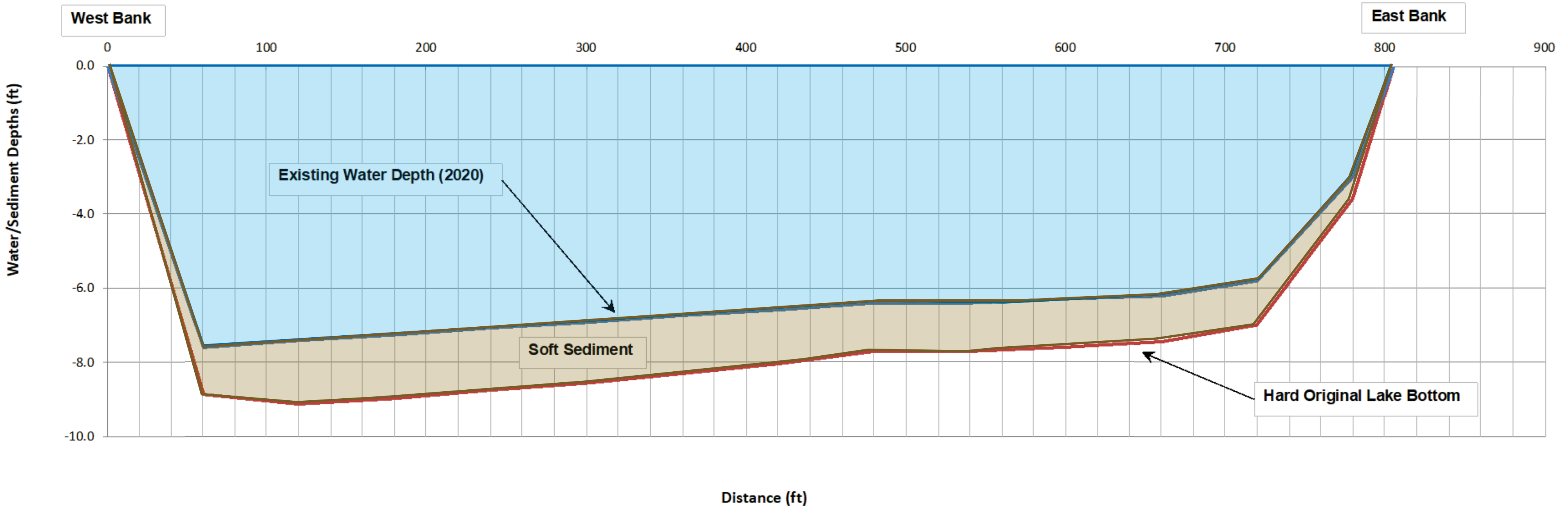
Evergreen - Section EB



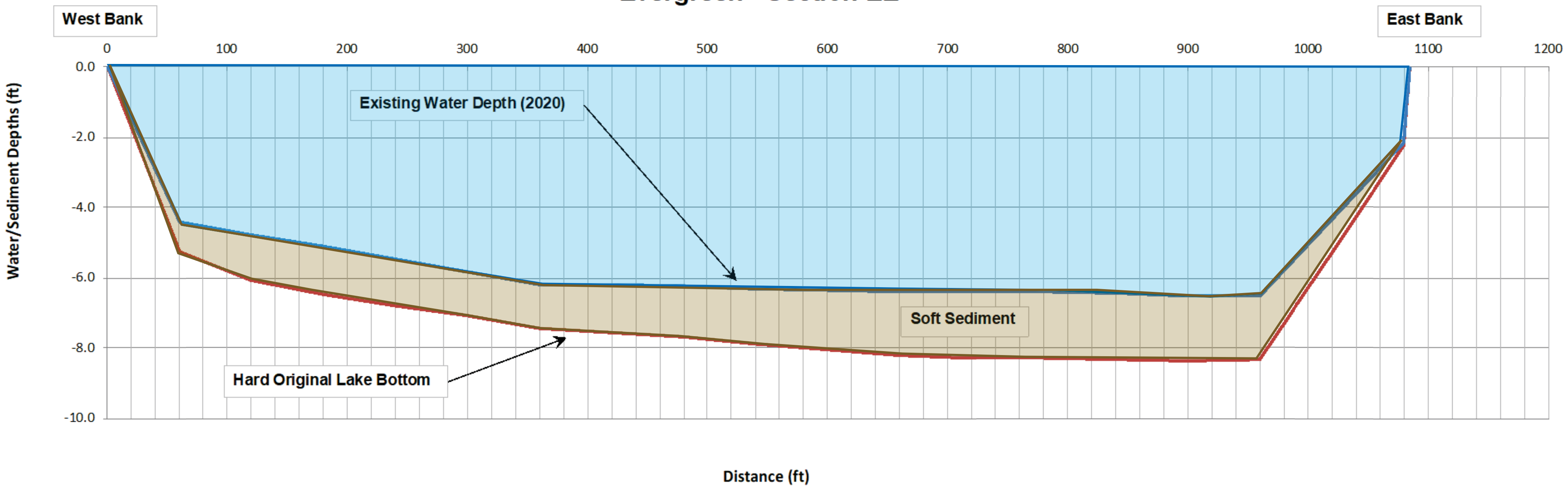
Evergreen - Section EC



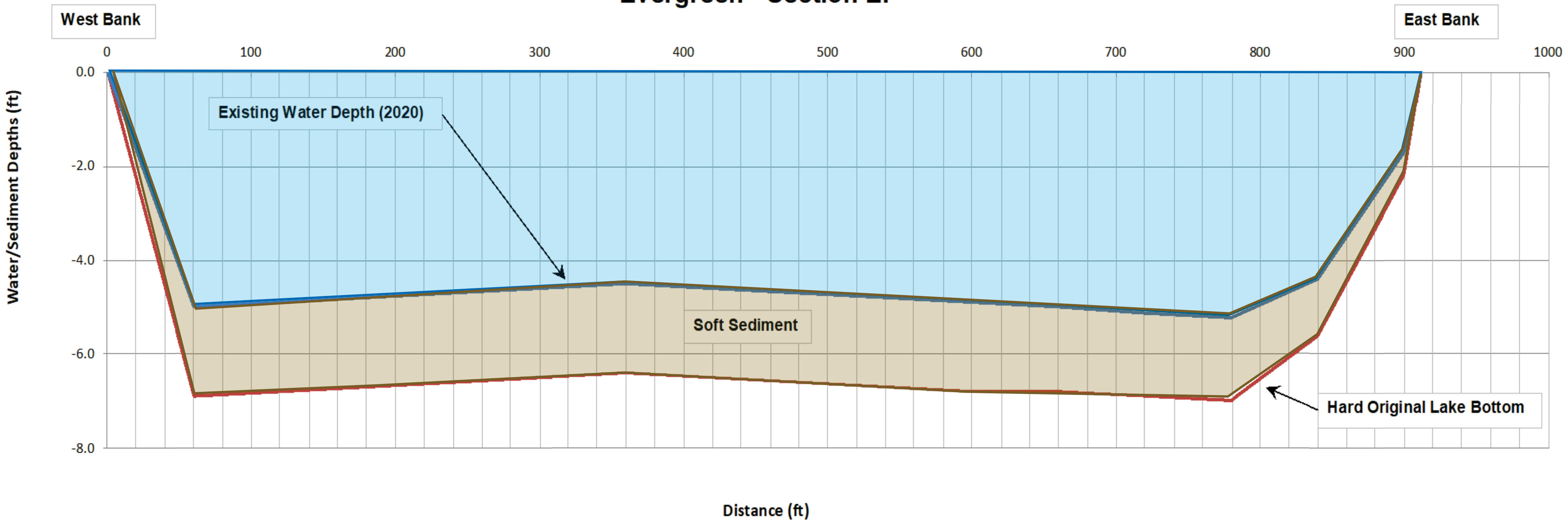
Evergreen - Section ED



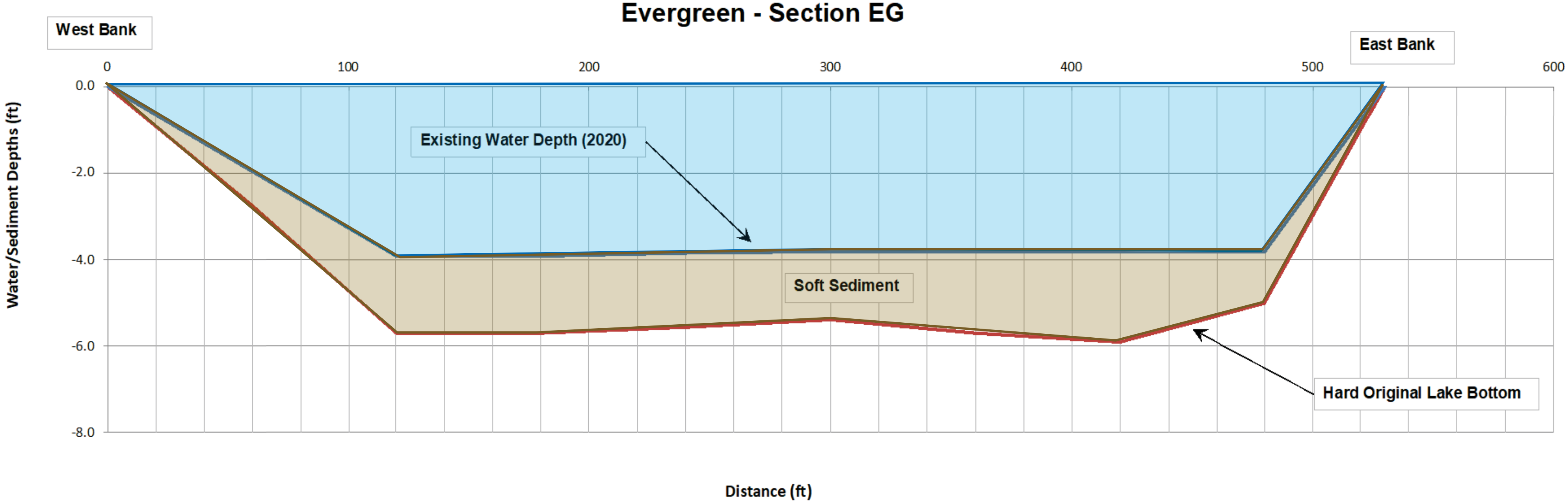
Evergreen - Section EE



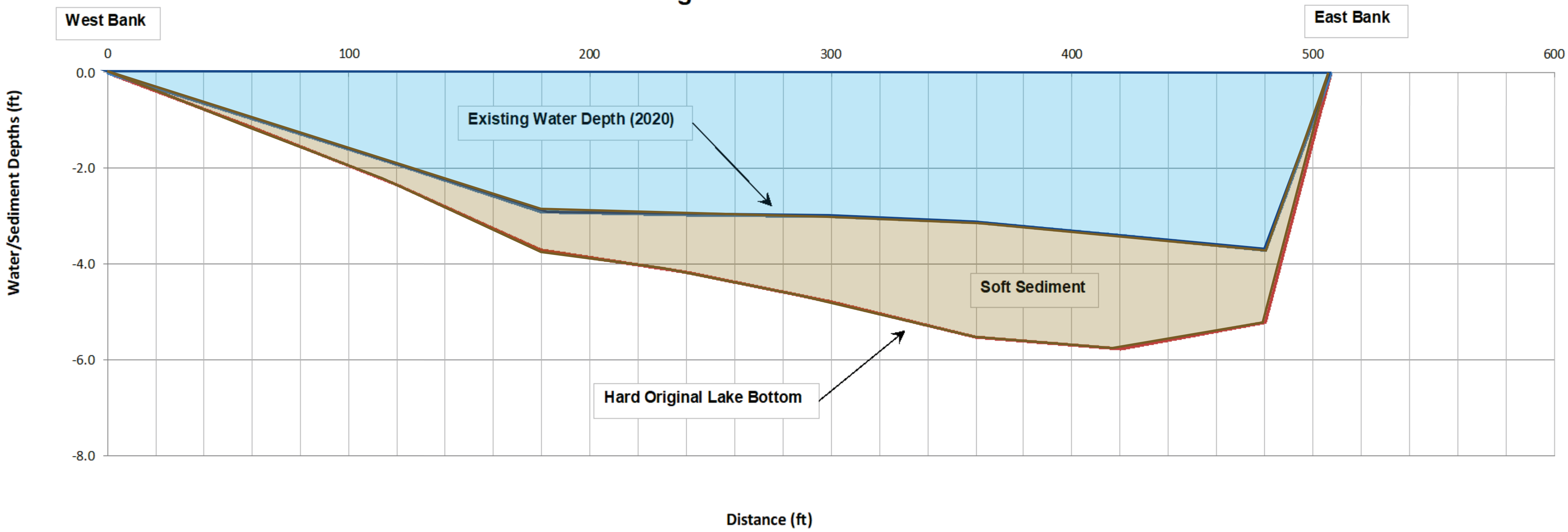
Evergreen - Section EF

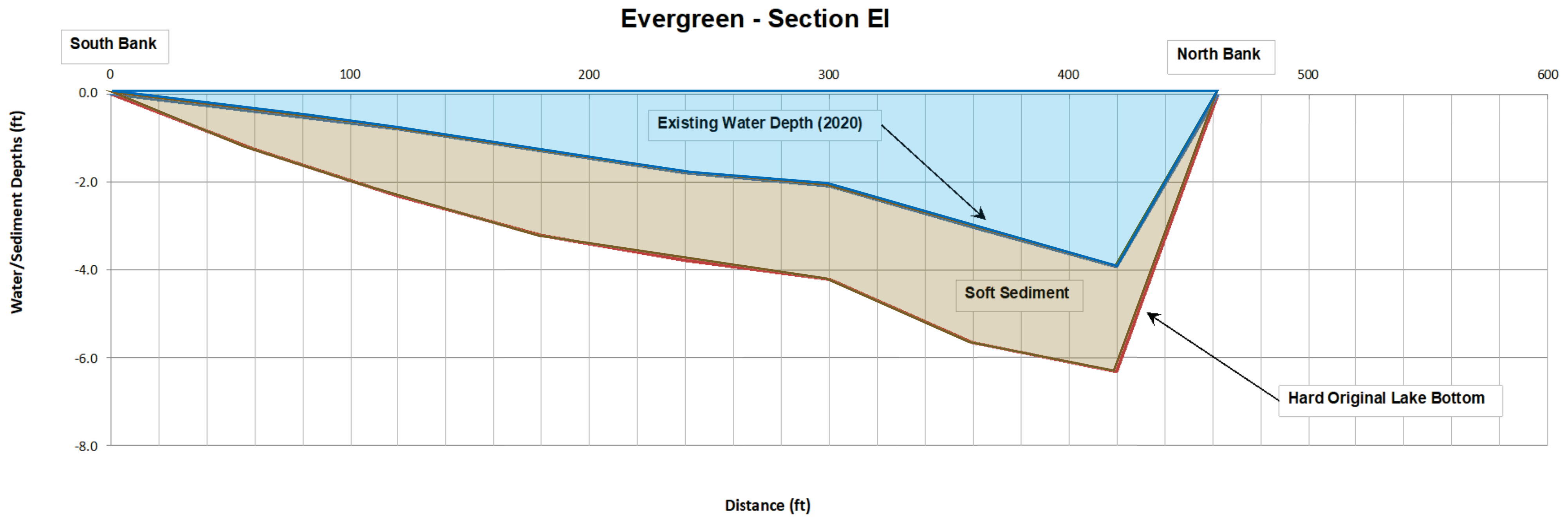


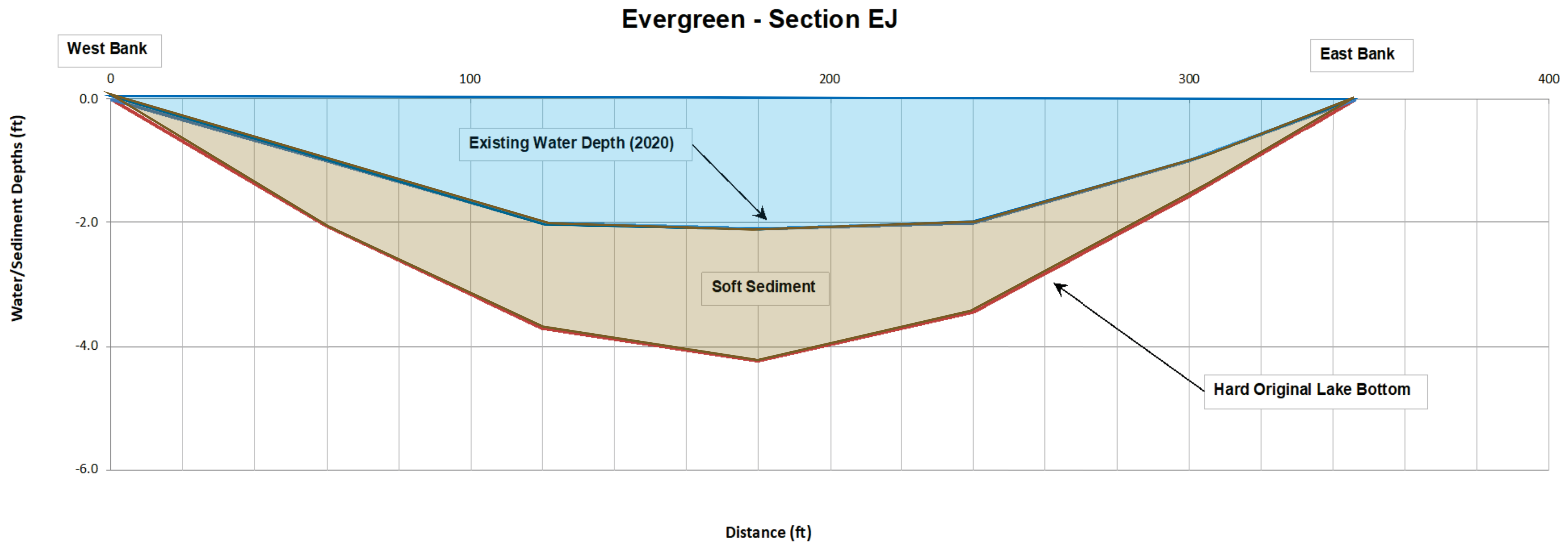
Evergreen - Section EG



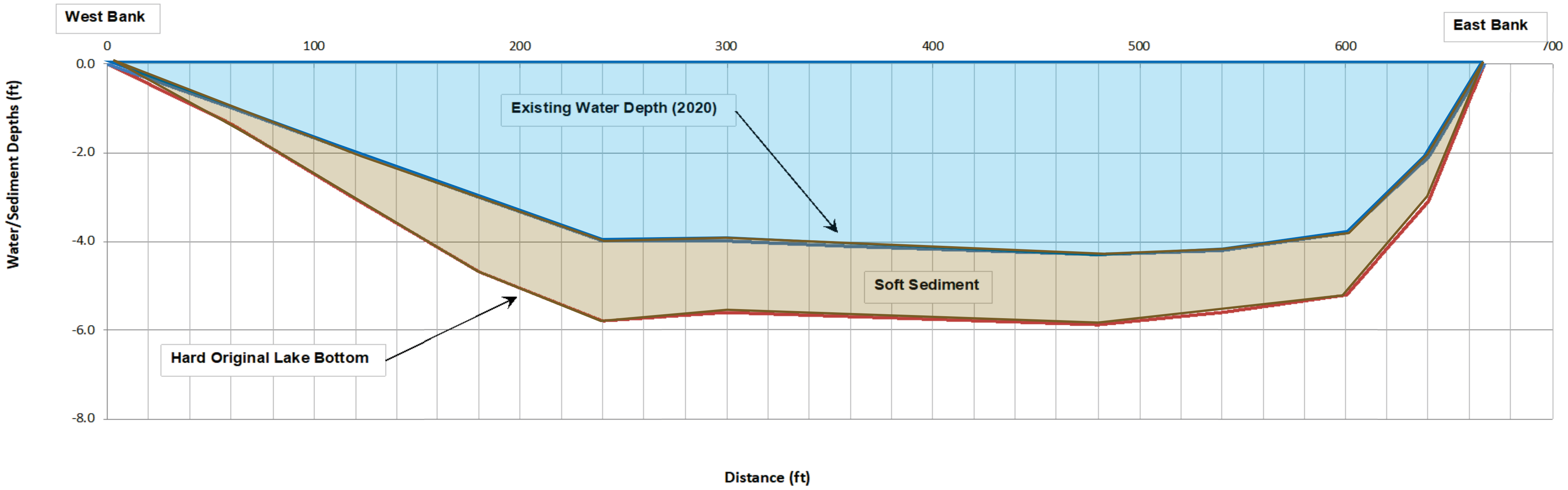
Evergreen - Section EH



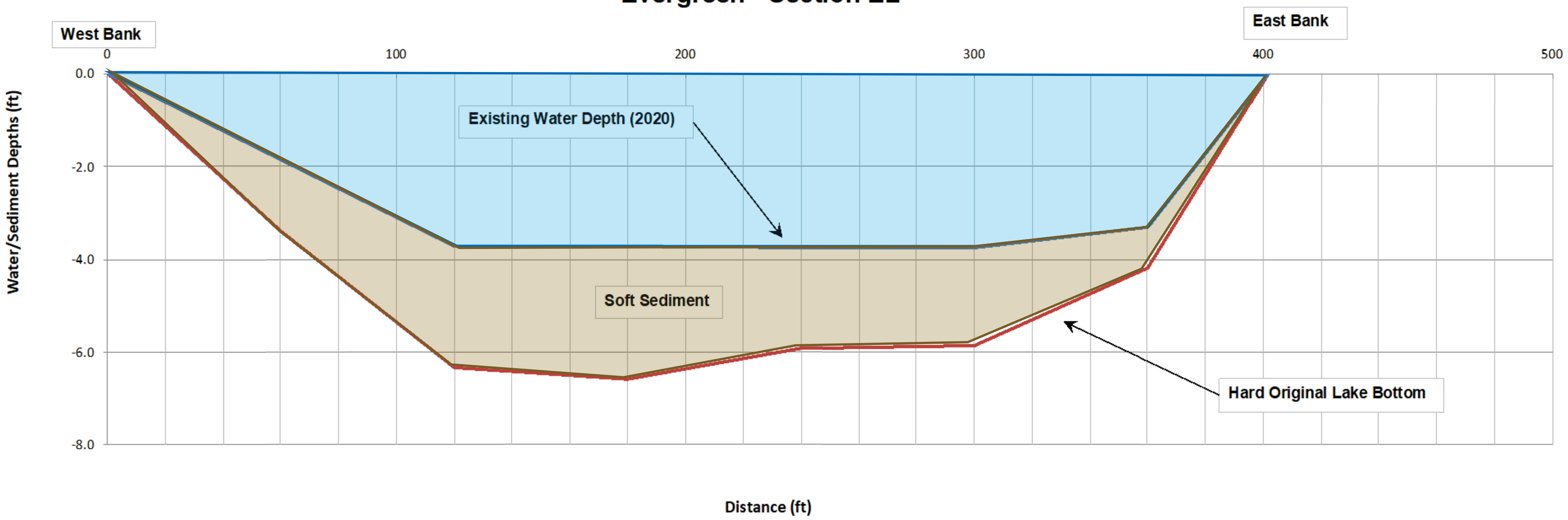

Evergreen - Section EI
South Bank
North Bank
0
100
200
300
400
500
600
0.0
-2.0
-4.0
-6.0
-8.0
Water/Sediment Depths (ft)
Existing Water Depth (2020)
Soft Sediment
Hard Original Lake Bottom
Distance (ft)


Evergreen - Section EJ
West Bank
East Bank
0
100
200
300
400
0.0
-2.0
-4.0
-6.0
Water/Sediment Depths (ft)
Existing Water Depth (2020)
Soft Sediment
Hard Original Lake Bottom
Distance (ft)

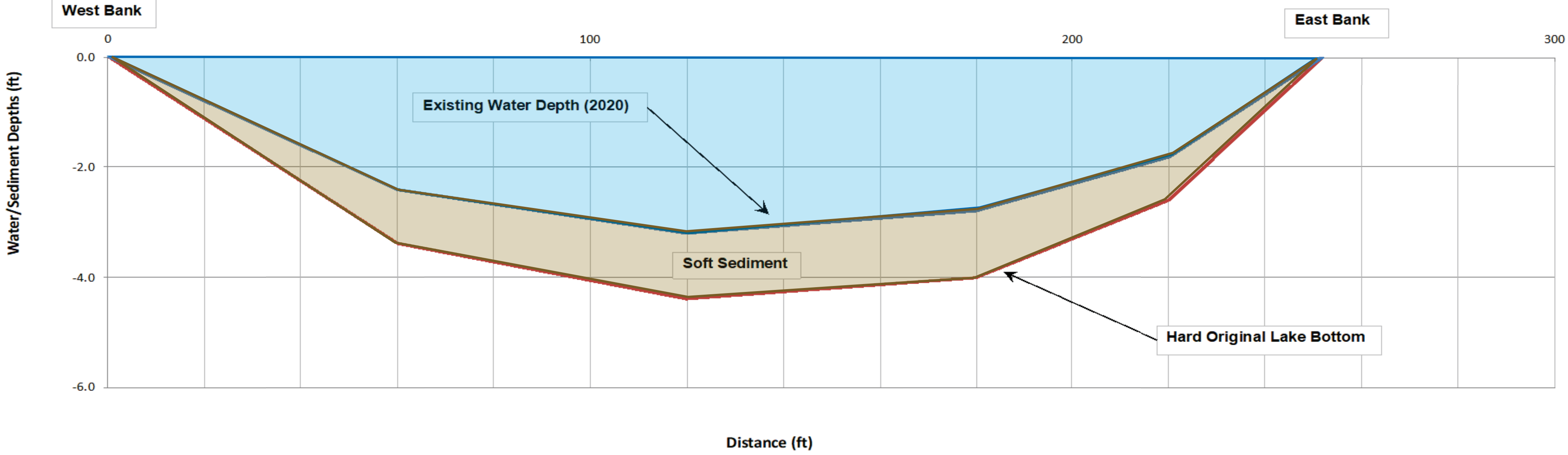
Evergreen - Section EK



Evergreen - Section EL



Evergreen - Section EM



PDC Laboratories, Inc.
PROFESSIONAL • DEPENDABLE • COMMITTED

August 10, 2020

Jill Mayes
Bloomington, City of
Water Treatment Plant 25515 Waterside Way
Hudson, IL 61748

Dear Jill Mayes:

Please find enclosed the analytical results for the **14** sample(s) the laboratory received on **7/22/20 3:00 pm** and logged in under work order **0075262**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of PDC Laboratories, Inc.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

PDC Laboratories, Inc. appreciates the opportunity to provide you with analytical expertise. We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lgrant@pdclab.com.

Sincerely,

Kurt Stepping
Senior Project Manager
(309) 692-9688 x1719
kstepping@pdclab.com

SAMPLE RECEIPT CHECK LIST

YES	Samples received within temperature compliance
YES	COC present
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Samples are free from signs of damage & contamination
NO	No headspace >6 mm present in VOA vials or TOX bottles
NO	Sulfide bottle(s) completely filled if required
NO	Trip blank(s) received if required
NO	Custody seals used
NO	Custody seals intact
YES	All analyses received within holding times
NO	Short hold time analysis requested
NO	RUSH TAT requested
NO	Field parameters recorded on COC
YES	Current PDC COC submitted
NO	Sample receipt case narrative provided

ANALYTICAL RESULTS

Sample: **0075262-05**
Name: CORE 1 LB
Matrix: Solid - Composite

Sampled: 07/22/20 10:53
Received: 07/22/20 15:00

General Chemistry - PIA

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Particle Size	91	%		07/27/20 15:22	1	0.50	07/27/20 15:22	CRD	ASTM D1140*
Solids - organic content	4.8	%		07/29/20 08:38	1	0.050	07/29/20 08:41	BMS	ASTM D2974*
Solids - total solids (TS)	64	%		07/29/20 08:38	1	0.050	07/29/20 09:18	BMS	SM 2540G*

Pesticides - PIA

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
4,4'-DDD	< 250	ug/kg dry	V2	07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
4,4'-DDE	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
4,4'-DDT	< 250	ug/kg dry	Q3, V	07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
Aldrin	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Alpha-BHC	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Beta- BHC	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Chlordane (technical)	< 2500	ug/kg dry		07/27/20 07:52	10	2500	07/28/20 20:57	JMT	EPA 8081A
Delta-BHC	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Dieldrin	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
Endosulfan I	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Endosulfan II	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
Endosulfan sulfate	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
Endrin	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
Endrin aldehyde	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 20:57	JMT	EPA 8081A
gamma-BHC (Lindane)	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Heptachlor	< 120	ug/kg dry	V	07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Heptachlor epoxide	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 20:57	JMT	EPA 8081A
Methoxychlor	< 1200	ug/kg dry	Q3, V	07/27/20 07:52	10	1200	07/28/20 20:57	JMT	EPA 8081A
Toxaphene	< 1200	ug/kg dry		07/27/20 07:52	10	1200	07/28/20 20:57	JMT	EPA 8081A

Polychlorinated Biphenyls (PCBs) - PIA

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Aroclor 1016	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 19:38	JMT	EPA 8082
Aroclor 1221	< 250	ug/kg dry		07/27/20 07:54	1	250	07/28/20 19:38	JMT	EPA 8082
Aroclor 1232	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 19:38	JMT	EPA 8082
Aroclor 1242	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 19:38	JMT	EPA 8082
Aroclor 1248	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 19:38	JMT	EPA 8082
Aroclor 1254	< 250	ug/kg dry		07/27/20 07:54	1	250	07/28/20 19:38	JMT	EPA 8082
Aroclor 1260	< 250	ug/kg dry		07/27/20 07:54	1	250	07/28/20 19:38	JMT	EPA 8082
Aroclors - Total	< 1200	ug/kg dry		07/27/20 07:54	1	1200	07/28/20 19:38	JMT	EPA 8082

Total Metals - PIA

ANALYTICAL RESULTS

Sample: **0075262-05**
Name: CORE 1 LB
Matrix: Solid - Composite

Sampled: 07/22/20 10:53
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Arsenic	4.0	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:18	JMW	EPA 6020A
Barium	120	mg/kg dry	Q3	07/27/20 07:45	10	1.6	07/27/20 14:18	JMW	EPA 6020A
Cadmium	< 1.6	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:18	JMW	EPA 6020A
Chromium	21	mg/kg dry		07/27/20 07:45	10	6.2	07/27/20 14:18	JMW	EPA 6020A
Lead	20	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:18	JMW	EPA 6020A
Selenium	< 1.6	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:18	JMW	EPA 6020A
Silver	< 7.8	mg/kg dry		07/27/20 07:45	10	7.8	07/27/20 14:18	JMW	EPA 6020A
Mercury	< 0.31	mg/kg dry		07/27/20 07:45	10	0.31	07/27/20 14:18	JMW	EPA 6020A

ANALYTICAL RESULTS

Sample: **0075262-06**
Name: CORE 2 LB
Matrix: Solid - Composite

Sampled: 07/22/20 11:30
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Particle Size	4.3	%		07/27/20 15:22	1	0.50	07/27/20 15:22	CRD	ASTM D1140*
Solids - organic content	0.92	%		07/29/20 08:38	1	0.050	07/29/20 08:41	BMS	ASTM D2974*
Solids - total solids (TS)	85	%		07/29/20 08:38	1	0.050	07/29/20 09:18	BMS	SM 2540G*
Pesticides - PIA									
4,4'-DDD	< 190	ug/kg dry	V2	07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
4,4'-DDE	< 190	ug/kg dry		07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
4,4'-DDT	< 190	ug/kg dry	V	07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
Aldrin	< 94	ug/kg dry		07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Alpha-BHC	< 94	ug/kg dry		07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Beta- BHC	< 94	ug/kg dry		07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Chlordane (technical)	< 1900	ug/kg dry		07/27/20 07:52	10	1900	07/28/20 21:42	JMT	EPA 8081A
Delta-BHC	< 94	ug/kg dry		07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Dieldrin	< 190	ug/kg dry		07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
Endosulfan I	< 94	ug/kg dry		07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Endosulfan II	< 190	ug/kg dry		07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
Endosulfan sulfate	< 190	ug/kg dry		07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
Endrin	< 190	ug/kg dry		07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
Endrin aldehyde	< 190	ug/kg dry		07/27/20 07:52	10	190	07/28/20 21:42	JMT	EPA 8081A
gamma-BHC (Lindane)	< 94	ug/kg dry		07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Heptachlor	< 94	ug/kg dry	V	07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Heptachlor epoxide	< 94	ug/kg dry		07/27/20 07:52	10	94	07/28/20 21:42	JMT	EPA 8081A
Methoxychlor	< 940	ug/kg dry	V	07/27/20 07:52	10	940	07/28/20 21:42	JMT	EPA 8081A
Toxaphene	< 940	ug/kg dry		07/27/20 07:52	10	940	07/28/20 21:42	JMT	EPA 8081A
Polychlorinated Biphenyls (PCBs) - PIA									
Aroclor 1016	< 94	ug/kg dry		07/27/20 07:54	1	94	07/28/20 21:58	JMT	EPA 8082
Aroclor 1221	< 190	ug/kg dry		07/27/20 07:54	1	190	07/28/20 21:58	JMT	EPA 8082
Aroclor 1232	< 94	ug/kg dry		07/27/20 07:54	1	94	07/28/20 21:58	JMT	EPA 8082
Aroclor 1242	< 94	ug/kg dry		07/27/20 07:54	1	94	07/28/20 21:58	JMT	EPA 8082
Aroclor 1248	< 94	ug/kg dry		07/27/20 07:54	1	94	07/28/20 21:58	JMT	EPA 8082
Aroclor 1254	< 190	ug/kg dry		07/27/20 07:54	1	190	07/28/20 21:58	JMT	EPA 8082
Aroclor 1260	< 190	ug/kg dry		07/27/20 07:54	1	190	07/28/20 21:58	JMT	EPA 8082
Aroclors - Total	< 940	ug/kg dry		07/27/20 07:54	1	940	07/28/20 21:58	JMT	EPA 8082
Total Metals - PIA									

ANALYTICAL RESULTS

Sample: **0075262-06**
Name: CORE 2 LB
Matrix: Solid - Composite

Sampled: 07/22/20 11:30
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Arsenic	4.0	mg/kg dry		07/27/20 07:45	10	1.2	07/27/20 14:40	JMW	EPA 6020A
Barium	33	mg/kg dry		07/27/20 07:45	10	1.2	07/27/20 14:40	JMW	EPA 6020A
Cadmium	< 1.2	mg/kg dry		07/27/20 07:45	10	1.2	07/27/20 14:40	JMW	EPA 6020A
Chromium	9.3	mg/kg dry		07/27/20 07:45	10	4.7	07/27/20 14:40	JMW	EPA 6020A
Lead	15	mg/kg dry		07/27/20 07:45	10	1.2	07/27/20 14:40	JMW	EPA 6020A
Selenium	< 1.2	mg/kg dry		07/27/20 07:45	10	1.2	07/27/20 14:40	JMW	EPA 6020A
Silver	< 5.9	mg/kg dry		07/27/20 07:45	10	5.9	07/27/20 14:40	JMW	EPA 6020A
Mercury	< 0.24	mg/kg dry		07/27/20 07:45	10	0.24	07/27/20 14:40	JMW	EPA 6020A

ANALYTICAL RESULTS

Sample: **0075262-07**
Name: Core 3 LB
Matrix: Solid - Composite

Sampled: 07/22/20 12:03
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Particle Size	91	%		07/27/20 15:22	1	0.50	07/27/20 15:22	CRD	ASTM D1140*
Solids - organic content	5.5	%		07/29/20 08:38	1	0.050	07/29/20 08:41	BMS	ASTM D2974*
Solids - total solids (TS)	59	%		07/29/20 08:38	1	0.050	07/29/20 09:18	BMS	SM 2540G*
Pesticides - PIA									
4,4'-DDD	< 270	ug/kg dry	V2	07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
4,4'-DDE	< 270	ug/kg dry		07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
4,4'-DDT	< 270	ug/kg dry	V	07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
Aldrin	< 140	ug/kg dry		07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Alpha-BHC	< 140	ug/kg dry		07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Beta- BHC	< 140	ug/kg dry		07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Chlordane (technical)	< 2700	ug/kg dry		07/27/20 07:52	10	2700	07/28/20 22:05	JMT	EPA 8081A
Delta-BHC	< 140	ug/kg dry		07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Dieldrin	< 270	ug/kg dry		07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
Endosulfan I	< 140	ug/kg dry		07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Endosulfan II	< 270	ug/kg dry		07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
Endosulfan sulfate	< 270	ug/kg dry		07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
Endrin	< 270	ug/kg dry		07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
Endrin aldehyde	< 270	ug/kg dry		07/27/20 07:52	10	270	07/28/20 22:05	JMT	EPA 8081A
gamma-BHC (Lindane)	< 140	ug/kg dry		07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Heptachlor	< 140	ug/kg dry	V	07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Heptachlor epoxide	< 140	ug/kg dry		07/27/20 07:52	10	140	07/28/20 22:05	JMT	EPA 8081A
Methoxychlor	< 1400	ug/kg dry	V	07/27/20 07:52	10	1400	07/28/20 22:05	JMT	EPA 8081A
Toxaphene	< 1400	ug/kg dry		07/27/20 07:52	10	1400	07/28/20 22:05	JMT	EPA 8081A
Polychlorinated Biphenyls (PCBs) - PIA									
Aroclor 1016	< 140	ug/kg dry		07/27/20 07:54	1	140	07/30/20 21:01	JMT	EPA 8082
Aroclor 1221	< 270	ug/kg dry		07/27/20 07:54	1	270	07/30/20 21:01	JMT	EPA 8082
Aroclor 1232	< 140	ug/kg dry		07/27/20 07:54	1	140	07/30/20 21:01	JMT	EPA 8082
Aroclor 1242	< 140	ug/kg dry		07/27/20 07:54	1	140	07/30/20 21:01	JMT	EPA 8082
Aroclor 1248	< 140	ug/kg dry		07/27/20 07:54	1	140	07/30/20 21:01	JMT	EPA 8082
Aroclor 1254	< 270	ug/kg dry		07/27/20 07:54	1	270	07/30/20 21:01	JMT	EPA 8082
Aroclor 1260	< 270	ug/kg dry		07/27/20 07:54	1	270	07/30/20 21:01	JMT	EPA 8082
Aroclors - Total	< 1400	ug/kg dry		07/27/20 07:54	1	1400	07/30/20 21:01	JMT	EPA 8082
Total Metals - PIA									

ANALYTICAL RESULTS

Sample: **0075262-07**
Name: Core 3 LB
Matrix: Solid - Composite

Sampled: 07/22/20 12:03
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Arsenic	4.8	mg/kg dry		07/27/20 07:45	10	1.7	07/27/20 14:44	JMW	EPA 6020A
Barium	150	mg/kg dry		07/27/20 07:45	10	1.7	07/27/20 14:44	JMW	EPA 6020A
Cadmium	< 1.7	mg/kg dry		07/27/20 07:45	10	1.7	07/27/20 14:44	JMW	EPA 6020A
Chromium	27	mg/kg dry		07/27/20 07:45	10	6.8	07/27/20 14:44	JMW	EPA 6020A
Lead	19	mg/kg dry		07/27/20 07:45	10	1.7	07/27/20 14:44	JMW	EPA 6020A
Selenium	< 1.7	mg/kg dry		07/27/20 07:45	10	1.7	07/27/20 14:44	JMW	EPA 6020A
Silver	< 8.5	mg/kg dry		07/27/20 07:45	10	8.5	07/27/20 14:44	JMW	EPA 6020A
Mercury	< 0.34	mg/kg dry		07/27/20 07:45	10	0.34	07/27/20 14:44	JMW	EPA 6020A

ANALYTICAL RESULTS

Sample: **0075262-08**
Name: Core 4 LB
Matrix: Solid - Composite

Sampled: 07/22/20 12:45
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Particle Size	89	%		07/27/20 15:22	1	0.50	07/27/20 15:22	CRD	ASTM D1140*
Solids - organic content	4.8	%		07/29/20 08:38	1	0.050	07/29/20 08:41	BMS	ASTM D2974*
Solids - total solids (TS)	65	%		07/29/20 08:38	1	0.050	07/29/20 09:18	BMS	SM 2540G*
Pesticides - PIA									
4,4'-DDD	< 250	ug/kg dry	V2	07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
4,4'-DDE	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
4,4'-DDT	< 250	ug/kg dry	V	07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
Aldrin	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Alpha-BHC	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Beta- BHC	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Chlordane (technical)	< 2500	ug/kg dry		07/27/20 07:52	10	2500	07/28/20 22:27	JMT	EPA 8081A
Delta-BHC	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Dieldrin	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
Endosulfan I	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Endosulfan II	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
Endosulfan sulfate	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
Endrin	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
Endrin aldehyde	< 250	ug/kg dry		07/27/20 07:52	10	250	07/28/20 22:27	JMT	EPA 8081A
gamma-BHC (Lindane)	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Heptachlor	< 120	ug/kg dry	V	07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Heptachlor epoxide	< 120	ug/kg dry		07/27/20 07:52	10	120	07/28/20 22:27	JMT	EPA 8081A
Methoxychlor	< 1200	ug/kg dry	V	07/27/20 07:52	10	1200	07/28/20 22:27	JMT	EPA 8081A
Toxaphene	< 1200	ug/kg dry		07/27/20 07:52	10	1200	07/28/20 22:27	JMT	EPA 8081A
Polychlorinated Biphenyls (PCBs) - PIA									
Aroclor 1016	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 23:09	JMT	EPA 8082
Aroclor 1221	< 250	ug/kg dry		07/27/20 07:54	1	250	07/28/20 23:09	JMT	EPA 8082
Aroclor 1232	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 23:09	JMT	EPA 8082
Aroclor 1242	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 23:09	JMT	EPA 8082
Aroclor 1248	< 120	ug/kg dry		07/27/20 07:54	1	120	07/28/20 23:09	JMT	EPA 8082
Aroclor 1254	< 250	ug/kg dry		07/27/20 07:54	1	250	07/28/20 23:09	JMT	EPA 8082
Aroclor 1260	< 250	ug/kg dry		07/27/20 07:54	1	250	07/28/20 23:09	JMT	EPA 8082
Aroclors - Total	< 1200	ug/kg dry		07/27/20 07:54	1	1200	07/28/20 23:09	JMT	EPA 8082
Total Metals - PIA									

ANALYTICAL RESULTS

Sample: 0075262-08
Name: Core 4 LB
Matrix: Solid - Composite

Sampled: 07/22/20 12:45
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Arsenic	4.6	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:47	JMW	EPA 6020A
Barium	140	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:47	JMW	EPA 6020A
Cadmium	< 1.6	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:47	JMW	EPA 6020A
Chromium	23	mg/kg dry		07/27/20 07:45	10	6.2	07/27/20 14:47	JMW	EPA 6020A
Lead	17	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:47	JMW	EPA 6020A
Selenium	< 1.6	mg/kg dry		07/27/20 07:45	10	1.6	07/27/20 14:47	JMW	EPA 6020A
Silver	< 7.8	mg/kg dry		07/27/20 07:45	10	7.8	07/27/20 14:47	JMW	EPA 6020A
Mercury	< 0.31	mg/kg dry		07/27/20 07:45	10	0.31	07/27/20 14:47	JMW	EPA 6020A

Sample: 0075262-09
Name: 4 Hour Supernatant CORE 1 LB
Matrix: Waste Water - Regular Sample

Sampled: 07/29/20 14:00
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total solids (TS)	210	mg/L		08/05/20 15:24	1	34	08/06/20 15:32	DMR	SM 2540 B 1991
Solids - total suspended solids (TSS)	34	mg/L		07/31/20 10:42	1	4.0	07/31/20 11:19	DMR	SM 2540 D 1997
Solids - total volatile solids (TVS)	120	mg/L		08/05/20 15:24	1	17	08/06/20 15:32	DMR	SM 2540E*
Nutrients - PIA									
Ammonia-N	0.43	mg/L		07/31/20 14:49	1	0.10	07/31/20 14:49	CJP	EPA 350.1 REV2
Total Metals - PIA									
Lead	< 0.010	mg/L		08/05/20 09:00	1	0.010	08/05/20 10:52	ZSA	EPA 200.7 REV 4.4
Zinc	0.17	mg/L		08/05/20 09:00	1	0.010	08/05/20 10:52	ZSA	EPA 200.7 REV 4.4

ANALYTICAL RESULTS

Sample: **0075262-10**
Name: 4 Hour Supernatant CORE 3 LB
Matrix: Waste Water - Regular Sample

Sampled: 07/29/20 14:00
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total solids (TS)	310	mg/L		08/05/20 15:24	1	34	08/06/20 15:32	DMR	SM 2540 B 1991
Solids - total suspended solids (TSS)	19	mg/L		07/31/20 10:42	1	4.0	07/31/20 11:19	DMR	SM 2540 D 1997
Solids - total volatile solids (TVS)	80	mg/L		08/05/20 15:24	1	17	08/06/20 15:32	DMR	SM 2540E*
Nutrients - PIA									
Ammonia-N	1.8	mg/L		07/31/20 14:50	1	0.10	07/31/20 14:50	CJP	EPA 350.1 REV2
Total Metals - PIA									
Lead	< 0.010	mg/L		08/05/20 09:00	1	0.010	08/05/20 10:54	ZSA	EPA 200.7 REV 4.4
Zinc	0.10	mg/L		08/05/20 09:00	1	0.010	08/05/20 10:54	ZSA	EPA 200.7 REV 4.4

Sample: **0075262-11**
Name: 4 HOUR SUPERNATANT CORE 4 LB
Matrix: Waste Water - Regular Sample

Sampled: 07/29/20 14:00
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total solids (TS)	130	mg/L		08/05/20 15:24	1	34	08/06/20 15:32	DMR	SM 2540 B 1991
Solids - total suspended solids (TSS)	38	mg/L		07/31/20 10:42	1	4.3	07/31/20 11:19	DMR	SM 2540 D 1997
Solids - total volatile solids (TVS)	< 17	mg/L		08/05/20 15:24	1	17	08/06/20 15:32	DMR	SM 2540E*
Nutrients - PIA									
Ammonia-N	1.7	mg/L		07/31/20 14:51	1	0.10	07/31/20 14:51	CJP	EPA 350.1 REV2
Total Metals - PIA									
Lead	< 0.010	mg/L		08/05/20 09:00	1	0.010	08/05/20 10:55	ZSA	EPA 200.7 REV 4.4
Zinc	0.10	mg/L		08/05/20 09:00	1	0.010	08/05/20 10:55	ZSA	EPA 200.7 REV 4.4

ANALYTICAL RESULTS

Sample: **0075262-12**
Name: 24 Hour Supernatant CORE 1 LB
Matrix: Waste Water - Regular Sample

Sampled: 07/30/20 10:00
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total suspended solids (TSS)	4.8	mg/L		07/31/20 10:42	1	4.0	07/31/20 11:19	DMR	SM 2540 D 1997
Nutrients - PIA									
Ammonia-N	0.85	mg/L		07/31/20 14:56	1	0.10	07/31/20 14:56	CJP	EPA 350.1 REV2

Sample: **0075262-13**
Name: 24 Hour Supernatant CORE 3 LB
Matrix: Waste Water - Regular Sample

Sampled: 07/30/20 10:00
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total suspended solids (TSS)	< 4.3	mg/L		07/31/20 10:42	1	4.3	07/31/20 11:19	DMR	SM 2540 D 1997
Nutrients - PIA									
Ammonia-N	2.3	mg/L		07/31/20 14:57	1	0.10	07/31/20 14:57	CJP	EPA 350.1 REV2

Sample: **0075262-14**
Name: 24 Hour Supernatant CORE 4 LB
Matrix: Waste Water - Regular Sample

Sampled: 07/30/20 10:00
Received: 07/22/20 15:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total suspended solids (TSS)	8.8	mg/L		07/31/20 10:42	1	4.0	07/31/20 11:19	DMR	SM 2540 D 1997
Nutrients - PIA									
Ammonia-N	1.7	mg/L		07/31/20 14:58	1	0.10	07/31/20 14:58	CJP	EPA 350.1 REV2

NOTES

Specifications regarding method revisions and method modifications used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Qualifiers

Q3	Matrix Spike/Matrix Spike Duplicate both failed % recovery acceptance limits. The associated blank spike recovery was acceptable.
V	Verification standard recovery failed to meet the required acceptance criteria on repeat instrumental analyses.
V2	Acceptance criteria for the Continuing Calibration Verification (CCV) were exceeded high with associated non-detect samples. The associated non-detect results are qualified and reported.

Kurt

Certified by: Kurt Stepping, Senior Project Manager

PDC LABORATORIES, INC.
WWW.PDCLAB.COM

REGULATORY PROGRAM (Check one:)	
MORBCA ☐	NPDES ☐
CCDD ☐	RCRA ☐
	TACO: RES OR IND/COMM ☐

CHAIN OF CUSTODY RECORD

STATE WHERE SAMPLE COLLECTED IL

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT)

① CLIENT: City of Bloomington Water Treatment Plant
ADDRESS: 25515 Waterside Way
CITY STATE ZIP: Hudson, IL 61748
CONTACT PERSON: Jill Mayes
PROJECT NUMBER:
PROJECT LOCATION:
PURCHASE ORDER #:
PHONE NUMBER: (309) 434-2153
E-MAIL: jmayes@cityblm.org
DATE SHIPPED: 7/22/20
SAMPLER (PLEASE PRINT): Tony Atwood
SAMPLER'S SIGNATURE:

MATRIX TYPES:
WW-WASTEWATER
DW-DRINKING WATER
GW-GROUND WATER
WWSL-SLUDGE
NAS-NON AQUEOUS SOLID
LCHT-LEACHATE
OIL-OIL
SO-SOIL
SOL-SOLID

③ ANALYSIS REQUESTED

④ (FOR LAB USE ONLY)
LOGIN # C075262-14
LOGGED BY:
CLIENT:
PROJECT: BLM-SED STUDY/SUPERNATANT
PROJ. MGR.:
CUSTODY SEAL #:

② SAMPLE DESCRIPTION (UNIQUE DESCRIPTION AS IT WILL APPEAR ON THE ANALYTICAL REPORT)	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	PRES CODE CLIENT PROVIDED	Metals ⊞	PCBs ⊞	Pesticides ⊞	Particle Size to #230 Sieve	Total Orgain Content, Total Solids	TSS, TVS, NH3-N, Pb, Zn	TSS, NH3-N ⊞	REMARKS
Core Sample #1	7/22/20	1053A		X	SO	1	6	X	X	X	X	X			Analyze 1 core (each site) as solid
Core Sample #2 –NO Supernant	7/22/20	1130A		X	SO	1	6	X	X	X	X	X			Analyze 1 core (each site) as solid
Core Sample #3	7/22/20	1203P		X	SO	1	6	X	X	X	X	X			Analyze 1 core (each site) as solid
Core Sample #4	7/22/20	1245P		X	SO	1	6	X	X	X	X	X			↓ ↓ ↓
Lake water 1 gal for each supernatant core (3) 1 gal total															Mix 1 part lake water to 4 parts sediment for Core #1 Core #2 Core #3
Core Sample #1 4 hour supernatant				X	SO	1	6						X		analyze 2nd sediment core for supernatant analysis
Core Sample #2 4 hour supernatant				X	SO	1	6						X		analyze 2nd sediment core for supernatant analysis
Core Sample #3 4 hour supernatant				X	SO	1	6						X		analyze 2nd sediment core for supernatant analysis
Core Sample #1 24 hour supernatant				X	SO	n/a								X	same core as 4 hour supernatant
Core Sample #2 24 hour supernatant				X	SO	n/a								X	same core as 4 hour supernatant
Core Sample #3 24 hour supernatant				X	SO	n/a								X	same core as 4 hour supernatant

CHEMICAL PRESERVATION CODES: 1 – HCL 2 – H2SO4 3 – HNO3 4 – NAOH 5 – NA2S2O3 6 – UNPRESERVED 7 – OTHER

⑤ TURNAROUND TIME REQUESTED (PLEASE CHECK) (RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE) ☑ NORMAL ☐ RUSH
DATE RESULTS NEEDED
RUSH RESULTS VIA (PLEASE CIRCLE) EMAIL ☐ PHONE ☐
EMAIL IF DIFFERENT FROM ABOVE:
PHONE # IF DIFFERENT FROM ABOVE:

⑥ *I understand that by initialing this box I give the lab permission to proceed with analysis, even though it may not meet all sample conformance requirements as defined in the receiving facility's Sample Acceptance Policy and the data will be qualified. Qualified data may NOT be acceptable to report to all regulatory authorities.*

PROCEED WITH ANALYSIS AND QUALIFY RESULTS: (INITIALS) ______

⑦ RELINQUISHED BY: (SIGNATURE) Jill Mayes	DATE 7/22/20 TIME 1500	RECEIVED BY: (SIGNATURE)	DATE TIME	
RELINQUISHED BY: (SIGNATURE)	DATE TIME	RECEIVED BY: (SIGNATURE)	DATE TIME	
RELINQUISHED BY: (SIGNATURE)	DATE TIME	RECEIVED BY: (SIGNATURE)	DATE 7/22/20 TIME 1500	

⑧ COMMENTS: (FOR LAB USE ONLY)
SAMPLE TEMPERATURE UPON RECEIPT 22.1 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR [✓ N]
SAMPLE(S) RECEIVED ON ICE Y OR [✓ N]
SAMPLE ACCEPTANCE NONCONFORMANT REPORT IS NEEDED Y OR [✓ N]
DATE AND TIME TAKEN FROM SAMPLE BOTTLE ______

Qualtrax ID #3219

Page 1 of 1

PDC Laboratories, Inc.
PROFESSIONAL • DEPENDABLE • COMMITTED

August 18, 2020

Accounts Payable
Bloomington, City of
109 E. Olive St.
Bloomington, IL 61701

Dear Accounts Payable:

Please find enclosed the analytical results for the **12** sample(s) the laboratory received on **7/29/20 2:13 pm** and logged in under work order **0076053**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of PDC Laboratories, Inc.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

PDC Laboratories, Inc. appreciates the opportunity to provide you with analytical expertise. We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lgrant@pdclab.com.

Sincerely,

Kurt

Kurt Stepping
Senior Project Manager
(309) 692-9688 x1719
kstepping@pdclab.com

NELAP ACCREDITED TNI LABORATORY

SAMPLE RECEIPT CHECK LIST

Work Order 0076053

NO	Samples received within temperature compliance
YES	COC present
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Samples are free from signs of damage & contamination
NO	No headspace >6 mm present in VOA vials or TOX bottles
NO	Sulfide bottle(s) completely filled if required
NO	Trip blank(s) received if required
NO	Custody seals used
NO	Custody seals intact
YES	All analyses received within holding times
NO	Short hold time analysis requested
NO	RUSH TAT requested
NO	Field parameters recorded on COC
YES	Current PDC COC submitted
YES	Sample receipt case narrative provided

Case Narrative

0076053 was received 07/29/20 14:13 at

Cooler	Temp C°
Default Cooler	30.0

Sample(s) did not meet regulatory thermal preservation requirement.

Only Core samples were received as is. Supernatant samples are prepared at the laboratory.

Sample(s) were:
1. Received on the same day of collection, above allowable maximum temperature, and not received on ice.

OR

2. Received after the day of collection and were above the allowable maximum temperature.

PLEASE NOTE: Results **MAY** not be acceptable to report to a regulatory authority.

Analyses that do not require thermal preservation are Radiochemistry, Drinking Water Bacteriology, Fluoride, Chloride, Bromide, Mercury 245.1/7470, metals methods 200.7/200.8 and 6010/6020.

ANALYTICAL RESULTS

Sample: **0076053-01**
Name: CORE 1 LE
Matrix: Solid - Regular Sample

Sampled: 07/29/20 08:35
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Particle Size	94	%		08/05/20 13:00	1	0.50	08/05/20 13:00	CRD	ASTM D1140*
Solids - organic content	5.0	%		07/31/20 13:33	1	0.050	07/31/20 13:38	dmr	ASTM D2974*
Solids - total solids (TS)	63	%		07/31/20 13:33	1	0.050	07/31/20 14:19	DMR	SM 2540G*
Pesticides - PIA									
4,4'-DDD	< 26	ug/kg dry	V2	08/03/20 08:57	1	26	08/04/20 18:06	JMT	EPA 8081A
4,4'-DDE	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:06	JMT	EPA 8081A
4,4'-DDT	< 26	ug/kg dry	V	08/03/20 08:57	1	26	08/04/20 18:06	JMT	EPA 8081A
Aldrin	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Alpha-BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Beta- BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Chlordane (technical)	< 260	ug/kg dry		08/03/20 08:57	1	260	08/04/20 18:06	JMT	EPA 8081A
Delta-BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Dieldrin	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:06	JMT	EPA 8081A
Endosulfan I	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Endosulfan II	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:06	JMT	EPA 8081A
Endosulfan sulfate	< 26	ug/kg dry		08/03/20 08:57	1	26	08/06/20 18:20	JMT	EPA 8081A
Endrin	< 26	ug/kg dry	V	08/03/20 08:57	1	26	08/04/20 18:06	JMT	EPA 8081A
Endrin aldehyde	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:06	JMT	EPA 8081A
gamma-BHC (Lindane)	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Heptachlor	< 13	ug/kg dry	V	08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Heptachlor epoxide	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:06	JMT	EPA 8081A
Methoxychlor	< 130	ug/kg dry	V	08/03/20 08:57	1	130	08/04/20 18:06	JMT	EPA 8081A
Toxaphene	< 130	ug/kg dry		08/03/20 08:57	1	130	08/04/20 18:06	JMT	EPA 8081A
Polychlorinated Biphenyls (PCBs) - PIA									
Aroclor 1016	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:14	JMT	EPA 8082
Aroclor 1221	< 260	ug/kg dry		08/03/20 09:02	1	260	08/07/20 00:14	JMT	EPA 8082
Aroclor 1232	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:14	JMT	EPA 8082
Aroclor 1242	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:14	JMT	EPA 8082
Aroclor 1248	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:14	JMT	EPA 8082
Aroclor 1254	< 260	ug/kg dry		08/03/20 09:02	1	260	08/07/20 00:14	JMT	EPA 8082
Aroclor 1260	< 260	ug/kg dry		08/03/20 09:02	1	260	08/07/20 00:14	JMT	EPA 8082

ANALYTICAL RESULTS

Sample: **0076053-01**
Name: CORE 1 LE
Matrix: Solid - Regular Sample

Sampled: 07/29/20 08:35
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Aroclors - Total	< 1300	ug/kg dry		08/03/20 09:02	1	1300	08/07/20 00:14	JMT	EPA 8082
Total Metals - PIA									
Arsenic	3.8	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:40	JMW	EPA 6020A
Barium	77	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:40	JMW	EPA 6020A
Cadmium	< 1.6	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:40	JMW	EPA 6020A
Chromium	11	mg/kg dry		08/05/20 10:00	10	6.4	08/10/20 07:40	JMW	EPA 6020A
Lead	10	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:40	JMW	EPA 6020A
Selenium	< 1.6	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:40	JMW	EPA 6020A
Silver	< 8.0	mg/kg dry		08/05/20 10:00	10	8.0	08/10/20 07:40	JMW	EPA 6020A
Mercury	< 0.32	mg/kg dry		08/05/20 10:00	10	0.32	08/10/20 07:40	JMW	EPA 6020A

ANALYTICAL RESULTS

Sample: **0076053-02**
Name: CORE 2 LE
Matrix: Solid - Regular Sample

Sampled: 07/29/20 08:53
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Particle Size	94	%		08/05/20 13:00	1	0.50	08/05/20 13:00	CRD	ASTM D1140*
Solids - organic content	4.3	%		07/31/20 13:33	1	0.050	07/31/20 13:38	dmr	ASTM D2974*
Solids - total solids (TS)	64	%		07/31/20 13:33	1	0.050	07/31/20 14:19	DMR	SM 2540G*
Pesticides - PIA									
4,4'-DDD	< 25	ug/kg dry	V2	08/03/20 08:57	1	25	08/04/20 18:28	JMT	EPA 8081A
4,4'-DDE	< 25	ug/kg dry		08/03/20 08:57	1	25	08/04/20 18:28	JMT	EPA 8081A
4,4'-DDT	< 25	ug/kg dry	V	08/03/20 08:57	1	25	08/04/20 18:28	JMT	EPA 8081A
Aldrin	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Alpha-BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Beta- BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Chlordane (technical)	< 250	ug/kg dry		08/03/20 08:57	1	250	08/04/20 18:28	JMT	EPA 8081A
Delta-BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Dieldrin	< 25	ug/kg dry		08/03/20 08:57	1	25	08/04/20 18:28	JMT	EPA 8081A
Endosulfan I	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Endosulfan II	< 25	ug/kg dry		08/03/20 08:57	1	25	08/04/20 18:28	JMT	EPA 8081A
Endosulfan sulfate	< 25	ug/kg dry		08/03/20 08:57	1	25	08/06/20 18:42	JMT	EPA 8081A
Endrin	< 25	ug/kg dry	V	08/03/20 08:57	1	25	08/04/20 18:28	JMT	EPA 8081A
Endrin aldehyde	< 25	ug/kg dry		08/03/20 08:57	1	25	08/04/20 18:28	JMT	EPA 8081A
gamma-BHC (Lindane)	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Heptachlor	< 13	ug/kg dry	V	08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Heptachlor epoxide	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:28	JMT	EPA 8081A
Methoxychlor	< 130	ug/kg dry	V	08/03/20 08:57	1	130	08/04/20 18:28	JMT	EPA 8081A
Toxaphene	< 130	ug/kg dry		08/03/20 08:57	1	130	08/04/20 18:28	JMT	EPA 8081A
Polychlorinated Biphenyls (PCBs) - PIA									
Aroclor 1016	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:49	JMT	EPA 8082
Aroclor 1221	< 250	ug/kg dry		08/03/20 09:02	1	250	08/07/20 00:49	JMT	EPA 8082
Aroclor 1232	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:49	JMT	EPA 8082
Aroclor 1242	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:49	JMT	EPA 8082
Aroclor 1248	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 00:49	JMT	EPA 8082
Aroclor 1254	< 250	ug/kg dry		08/03/20 09:02	1	250	08/07/20 00:49	JMT	EPA 8082
Aroclor 1260	< 250	ug/kg dry		08/03/20 09:02	1	250	08/07/20 00:49	JMT	EPA 8082
Aroclors - Total	< 1300	ug/kg dry		08/03/20 09:02	1	1300	08/07/20 00:49	JMT	EPA 8082
Total Metals - PIA									

ANALYTICAL RESULTS

Sample: **0076053-02**
Name: CORE 2 LE
Matrix: Solid - Regular Sample

Sampled: 07/29/20 08:53
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Arsenic	1.8	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:44	JMW	EPA 6020A
Barium	46	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:44	JMW	EPA 6020A
Cadmium	< 1.6	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:44	JMW	EPA 6020A
Chromium	< 6.3	mg/kg dry		08/05/20 10:00	10	6.3	08/10/20 07:44	JMW	EPA 6020A
Lead	5.7	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:44	JMW	EPA 6020A
Selenium	< 1.6	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:44	JMW	EPA 6020A
Silver	< 7.9	mg/kg dry		08/05/20 10:00	10	7.9	08/10/20 07:44	JMW	EPA 6020A
Mercury	< 0.31	mg/kg dry		08/05/20 10:00	10	0.31	08/10/20 07:44	JMW	EPA 6020A

ANALYTICAL RESULTS

Sample: **0076053-03**
Name: CORE 3 LE
Matrix: Solid - Regular Sample

Sampled: 07/29/20 10:35
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Particle Size	88	%		08/05/20 13:00	1	0.50	08/05/20 13:00	CRD	ASTM D1140*
Solids - organic content	3.9	%		07/31/20 13:33	1	0.050	07/31/20 13:38	dmr	ASTM D2974*
Solids - total solids (TS)	62	%		07/31/20 13:33	1	0.050	07/31/20 14:19	DMR	SM 2540G*
Pesticides - PIA									
4,4'-DDD	< 26	ug/kg dry	V2	08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
4,4'-DDE	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
4,4'-DDT	< 26	ug/kg dry	V	08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
Aldrin	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Alpha-BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Beta- BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Chlordane (technical)	< 260	ug/kg dry		08/03/20 08:57	1	260	08/04/20 18:51	JMT	EPA 8081A
Delta-BHC	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Dieldrin	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
Endosulfan I	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Endosulfan II	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
Endosulfan sulfate	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
Endrin	< 26	ug/kg dry	V	08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
Endrin aldehyde	< 26	ug/kg dry		08/03/20 08:57	1	26	08/04/20 18:51	JMT	EPA 8081A
gamma-BHC (Lindane)	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Heptachlor	< 13	ug/kg dry	V	08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Heptachlor epoxide	< 13	ug/kg dry		08/03/20 08:57	1	13	08/04/20 18:51	JMT	EPA 8081A
Methoxychlor	< 130	ug/kg dry	V	08/03/20 08:57	1	130	08/04/20 18:51	JMT	EPA 8081A
Toxaphene	< 130	ug/kg dry		08/03/20 08:57	1	130	08/04/20 18:51	JMT	EPA 8081A
Polychlorinated Biphenyls (PCBs) - PIA									
Aroclor 1016	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 01:24	JMT	EPA 8082
Aroclor 1221	< 260	ug/kg dry		08/03/20 09:02	1	260	08/07/20 01:24	JMT	EPA 8082
Aroclor 1232	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 01:24	JMT	EPA 8082
Aroclor 1242	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 01:24	JMT	EPA 8082
Aroclor 1248	< 130	ug/kg dry		08/03/20 09:02	1	130	08/07/20 01:24	JMT	EPA 8082
Aroclor 1254	< 260	ug/kg dry		08/03/20 09:02	1	260	08/07/20 01:24	JMT	EPA 8082
Aroclor 1260	< 260	ug/kg dry		08/03/20 09:02	1	260	08/07/20 01:24	JMT	EPA 8082
Aroclors - Total	< 1300	ug/kg dry		08/03/20 09:02	1	1300	08/07/20 01:24	JMT	EPA 8082
Total Metals - PIA									

ANALYTICAL RESULTS

Sample: **0076053-03**
Name: CORE 3 LE
Matrix: Solid - Regular Sample

Sampled: 07/29/20 10:35
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Arsenic	3.6	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:48	JMW	EPA 6020A
Barium	86	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:48	JMW	EPA 6020A
Cadmium	< 1.6	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:48	JMW	EPA 6020A
Chromium	16	mg/kg dry		08/05/20 10:00	10	6.4	08/10/20 07:48	JMW	EPA 6020A
Lead	11	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:48	JMW	EPA 6020A
Selenium	< 1.6	mg/kg dry		08/05/20 10:00	10	1.6	08/10/20 07:48	JMW	EPA 6020A
Silver	< 8.0	mg/kg dry		08/05/20 10:00	10	8.0	08/10/20 07:48	JMW	EPA 6020A
Mercury	< 0.32	mg/kg dry		08/05/20 10:00	10	0.32	08/10/20 07:48	JMW	EPA 6020A

Sample: **0076053-07**
Name: 4 Hour Supernatant CORE 1 LE
Matrix: Waste Water - Regular Sample

Sampled: 08/06/20 16:16
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total solids (TS)	190	mg/L		08/12/20 12:49	1	34	08/12/20 13:19	BMS	SM 2540 B 1991
Solids - total suspended solids (TSS)	74	mg/L		08/13/20 15:02	1	4.0	08/13/20 15:55	BMS/CJP	SM 2540 D 1997
Solids - total volatile solids (TVS)	93	mg/L		08/12/20 12:49	1	17	08/12/20 13:19	BMS	SM 2540E*
Nutrients - PIA									
Ammonia-N	0.66	mg/L		08/13/20 11:11	1	0.10	08/13/20 11:11	CJP	EPA 350.1 REV2
Total Metals - PIA									
Lead	< 0.010	mg/L		08/12/20 12:29	1	0.010	08/13/20 08:59	ZSA	EPA 200.7 REV 4.4
Zinc	0.26	mg/L		08/12/20 12:29	1	0.010	08/12/20 14:42	ZSA	EPA 200.7 REV 4.4

ANALYTICAL RESULTS

Sample: **0076053-08**
Name: 4 Hour Supernatant CORE 2 LE
Matrix: Waste Water - Regular Sample

Sampled: 08/11/20 14:40
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total solids (TS)	350	mg/L		08/12/20 12:49	1	34	08/12/20 13:19	BMS	SM 2540 B 1991
Solids - total suspended solids (TSS)	63	mg/L		08/17/20 13:11	1	8.3	08/17/20 13:55	DMR	SM 2540 D 1997
Solids - total volatile solids (TVS)	210	mg/L		08/12/20 12:49	1	17	08/12/20 13:19	BMS	SM 2540E*
Nutrients - PIA									
Ammonia-N	0.48	mg/L		08/13/20 11:12	1	0.10	08/13/20 11:12	CJP	EPA 350.1 REV2
Total Metals - PIA									
Lead	< 0.010	mg/L		08/13/20 09:48	1	0.010	08/13/20 13:01	ZSA	EPA 200.7 REV 4.4
Zinc	0.36	mg/L		08/13/20 09:48	1	0.010	08/13/20 13:01	ZSA	EPA 200.7 REV 4.4

Sample: **0076053-09**
Name: 4 Hour Supernatant CORE 3 LE
Matrix: Waste Water - Regular Sample

Sampled: 08/06/20 16:16
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total solids (TS)	260	mg/L		08/12/20 12:49	1	34	08/12/20 13:19	BMS	SM 2540 B 1991
Solids - total suspended solids (TSS)	80	mg/L		08/13/20 15:02	1	4.0	08/13/20 15:55	BMS/CJP	SM 2540 D 1997
Solids - total volatile solids (TVS)	230	mg/L		08/12/20 12:49	1	17	08/12/20 13:19	BMS	SM 2540E*
Nutrients - PIA									
Ammonia-N	0.17	mg/L		08/13/20 11:13	1	0.10	08/13/20 11:13	CJP	EPA 350.1 REV2
Total Metals - PIA									
Lead	< 0.010	mg/L		08/13/20 09:48	1	0.010	08/13/20 13:03	ZSA	EPA 200.7 REV 4.4
Zinc	0.22	mg/L		08/13/20 09:48	1	0.010	08/13/20 13:02	ZSA	EPA 200.7 REV 4.4

ANALYTICAL RESULTS

Sample: **0076053-10**
Name: 24 Hour Supernatant CORE 1 LE
Matrix: Waste Water - Regular Sample

Sampled: 08/07/20 12:23
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total suspended solids (TSS)	14	mg/L		08/14/20 13:03	1	4.0	08/14/20 13:52	DMR	SM 2540 D 1997
Nutrients - PIA									
Ammonia-N	0.69	mg/L		08/13/20 11:14	1	0.10	08/13/20 11:14	CJP	EPA 350.1 REV2

Sample: **0076053-11**
Name: 24 Hour Supernatant CORE 2 LE
Matrix: Waste Water - Regular Sample

Sampled: 08/11/20 10:45
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total suspended solids (TSS)	16	mg/L		08/17/20 13:11	1	8.0	08/17/20 13:55	DMR	SM 2540 D 1997
Nutrients - PIA									
Ammonia-N	0.41	mg/L		08/13/20 11:18	1	0.10	08/13/20 11:18	CJP	EPA 350.1 REV2

Sample: **0076053-12**
Name: 24 Hour Supernatant CORE 3 LE
Matrix: Waste Water - Regular Sample

Sampled: 08/07/20 12:23
Received: 07/29/20 14:13

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - PIA									
Solids - total suspended solids (TSS)	26	mg/L		08/14/20 13:03	1	4.0	08/14/20 13:52	DMR	SM 2540 D 1997
Nutrients - PIA									
Ammonia-N	0.21	mg/L		08/13/20 11:19	1	0.10	08/13/20 11:19	CJP	EPA 350.1 REV2

NOTES

Specifications regarding method revisions and method modifications used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
    TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
    Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
    TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
    Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
    Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
    Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
    Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
    USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
    TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
    TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
    Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
    Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Qualifiers

R	Matrix Spike/Matrix Spike Duplicate Failed %Relative Percent Difference criterion.
V	Verification standard recovery failed to meet the required acceptance criteria on repeat instrumental analyses.
V2	Acceptance criteria for the Continuing Calibration Verification (CCV) were exceeded high with associated non-detect samples. The associated non-detect results are qualified and reported.

NELAP ACCREDITED TNI LABORATORY

Certified by: Kurt Stepping, Senior Project Manager

PDC LABORATORIES, INC.
WWW.PDCLAB.COM

REGULATORY PROGRAM (Check one:)			
MORBCA	☐	NPDES	☐
CCDD	☐	RCRA	☐
		TACO: RES OR IND/COMM	☐

CHAIN OF CUSTODY RECORD

STATE WHERE SAMPLE COLLECTED IL

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT)

① **CLIENT** City of Bloomington Water Treatment Plant	PROJECT NUMBER	PROJECT LOCATION LE - SEDIMENT STUDY	PURCHASE ORDER #
ADDRESS 25515 Waterside Way	**PHONE NUMBER** (309) 434-2153	E-MAIL jmayes@cityblm.org	DATE SHIPPED
CITY STATE ZIP Hudson, IL 61748	**SAMPLER (PLEASE PRINT)** Tony Atwood		MATRIX TYPES: WW- WASTEWATER DW- DRINKING WATER GW- GROUND WATER WWSL- SLUDGE NAS- NON AQUEOUS SOLID LCHT- LEACHATE OIL- OIL SO- SOIL SOL- SOLID
CONTACT PERSON Jill Mayes	**SAMPLER'S SIGNATURE** Tony Atwood		

③ **ANALYSIS REQUESTED**

④ (FOR LAB USE ONLY)
LOGIN # 0076053-12
LOGGED BY: DCW
CLIENT:
PROJECT:
PROJ. MGR.:
CUSTODY SEAL #:

② **SAMPLE DESCRIPTION** (UNIQUE DESCRIPTION AS IT WILL APPEAR ON THE ANALYTICAL REPORT)	**DATE COLLECTED**	**TIME COLLECTED**	**SAMPLE TYPE** GRAB	**SAMPLE TYPE** COMP	**MATRIX TYPE**	**BOTTLE COUNT**	**PRES CODE** CLIENT PROVIDED	Metals	PCBs	Pesticides	Particle Size to #230 Sieve	Total Orgain Content, Total Solids	TSS, TVS, NH3-N, Pb, Zn	TSS, NH3-N	REMARKS
LE Core Sample #1	7/29/20	08:35A		X	SO	1	6	X	X	X	X	X			Analyze 1 core (each site) as solid
LE Core Sample #2	7/29/20	08:53A		X	SO	1	6	X	X	X	X	X			Analyze 1 core (each site) as solid
LE Core Sample #3	7/29/20	10:35A		X	SO	1	6	X	X	X	X	X			Analyze 1 core (each site) as solid
Lake water 1 gal for each supernatant core (3) 1															Mix 1 part lake water to 4 parts sediment for Core #1 Core #2 Core #3
LE Core Sample #1 4 hour supernatant				X	SO	1	6						X		analyze 2nd sediment core for supernatant analysis
LE Core Sample #2 4 hour supernatant				X	SO	1	6						X		analyze 2nd sediment core for supernatant analysis
LE Core Sample #3 4 hour supernatant				X	SO	1	6						X		analyze 2nd sediment core for supernatant analysis
LE Core Sample #1 24 hour supernatant				X	SO	n/a								X	same core as 4 hour supernatant
LE Core Sample #2 24 hour supernatant				X	SO	n/a								X	same core as 4 hour supernatant
LE Core Sample #3 24 hour supernatant				X	SO	n/a								X	same core as 4 hour supernatant

CHEMICAL PRESERVATION CODES: 1 – HCL 2 – H2SO4 3 – HNO3 4 – NAOH 5 – NA2S2O3 6 – UNPRESERVED 7 – OTHER

⑤ TURNAROUND TIME REQUESTED (PLEASE CHECK) (RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE) ☒ NORMAL ☐ RUSH

DATE RESULTS NEEDED

RUSH RESULTS VIA (PLEASE CIRCLE) EMAIL ☐ PHONE ☐

EMAIL IF DIFFERENT FROM ABOVE:

PHONE # IF DIFFERENT FROM ABOVE:

⑥ *I understand that by initialing this box I give the lab permission to proceed with analysis, even though it may not meet all sample conformance requirements as defined in the receiving facility's Sample Acceptance Policy and the data will be qualified. Qualified data may NOT be acceptable to report to all regulatory authorities.*

PROCEED WITH ANALYSIS AND QUALIFY RESULTS: (INITIALS) ____________

⑦ **RELINQUISHED BY: (SIGNATURE)** Tony Atwood	**DATE** 7/29/20 **TIME** 2:13pm	RECEIVED BY: (SIGNATURE)	DATE TIME
RELINQUISHED BY: (SIGNATURE)	DATE TIME	RECEIVED BY: (SIGNATURE)	DATE TIME
RELINQUISHED BY: (SIGNATURE)	DATE TIME	RECEIVED BY: (SIGNATURE)	DATE 7/29/20 TIME 1413

⑧ COMMENTS: (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 30.0 °C

CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR [✓ N]

SAMPLE(S) RECEIVED ON ICE Y OR [✓ N]

SAMPLE ACCEPTANCE NONCONFORMANT REPORT IS NEEDED [✓ Y] OR N

DATE AND TIME TAKEN FROM SAMPLE BOTTLE ____________

Summary of Laboratory Results

Parameters	Core #1 (Bloomington)	Core #2 (Bloomington)	Core #3 (Bloomington)	Core #4 (Bloomington)	Core #1 (Evergreen)	Core #2 (Evergreen)	Core #3 (Evergreen)	ICPB Tier 1 Resident. Soil (Ingestion) *	ICPB Tier 1 Resident. Soil (Inhalation) *	ICPB Effluent Standard *	IEPA Max. Allowable Concentrations for Clean Fill *
General Chemistry											
Particle Size (% Passing #230 Sieve)	91.0	4.3	91.0	89.0	94.0	94.0	88.0	-	-	-	-
Solids - % Organic Content	4.8	0.9	5.5	4.8	5.0	4.3	3.9	-	-	-	-
Solids - % Total	64.0	85.0	59.0	65.0	63.0	64.0	62.0	-	-	-	-
Pesticides (ug/kg)											
4,4'-DDD	< 250	< 190	< 270	< 250	< 26	< 25	< 26	3,000	-	-	3,000
4,4'-DDE	< 250	< 190	< 270	< 250	< 26	< 25	< 26	2,000	-	-	2,000
4,4'-DDT	< 250	< 190	< 270	< 250	< 26	< 25	< 26	2,000	-	-	2,000
Aldrin	< 120	< 94	< 140	< 120	< 13	< 13	< 13	40	3,000	-	940
Alpha-BHC	< 120	< 94	< 140	< 120	< 13	< 13	< 13	100	800	-	
Beta- BHC	< 120	< 94	< 140	< 120	< 13	< 13	< 13	-	-	-	
Chlordane (technical)	< 2500	< 1900	< 2700	< 260	< 260	< 250	< 260	1,800	72,000	-	1,800
Delta-BHC	< 120	< 94	< 120	< 120	< 13	< 13	< 13	-	-	-	
Dieldrin	< 250	< 190	< 270	< 250	< 26	< 25	< 26	40	1,000	-	603
Endosulfan I	< 120	< 94	< 140	< 120	< 13	< 13	< 13	470,000	-	-	
Endosulfan II	< 250	< 190	< 270	< 250	< 26	< 25	< 26	-	-	-	
Endosulfan sulfate	< 250	< 190	< 270	< 250	< 26	< 25	< 26	-	-	-	
Endrin	< 250	< 190	< 270	< 250	< 26	< 25	< 26	23,000	-	-	1,000
Endrin aldehyde	< 250	< 190	< 270	< 250	< 26	< 25	< 26	-	-	-	
gamma-BHC (Lindane)	< 120	< 94	< 140	< 120	< 13	< 13	< 13	500	-	-	
Heptachlor	< 120	< 94	< 140	< 120	< 13	< 13	< 13	100	-	-	871
Heptachlor epoxide	< 120	< 94	< 140	< 120	< 13	< 13	< 13	70	-	-	
Methoxychlor	< 1200	< 940	< 1400	< 1200	< 130	< 130	< 130	390,000	-	-	160,000
Toxaphene	< 1200	< 940	< 1400	< 1200	< 130	< 130	< 130	600	89,000	-	600
Polychlorinated Biphenyls (PCBs) (ug/kg)											
Aroclor 1016	< 120	< 94	< 140	< 120	< 130	< 130	< 130	-	-	-	-
Aroclor 1221	< 250	< 190	< 270	< 250	< 260	< 250	< 250	-	-	-	-
Aroclor 1232	< 120	< 94	< 140	< 120	< 130	< 130	< 130	-	-	-	-
Aroclor 1242	< 120	< 94	< 140	< 120	< 130	< 130	< 130	-	-	-	-
Aroclor 1248	< 120	< 94	< 140	< 120	< 130	< 130	< 130	-	-	-	-
Aroclor 1254	< 250	< 190	< 270	< 250	< 260	< 250	< 250	-	-	-	-
Aroclor 1260	< 250	< 190	< 270	< 250	< 260	< 250	< 250	-	-	-	-
Aroclors - Total	< 1200	< 940	< 1400	< 1200	< 1300	< 1300	< 1300	-	-	-	-
Metals (mg/kg)											
Arsenic	4.0	4.0	4.8	4.6	3.8	1.8	3.8	61.0	-	-	11.3
Barium	120.0	33.0	150.0	140.0	77.0	46.0	86.0	5,500	-	-	1,500
Cadmium	< 1.6	< 1.2	< 1.7	< 1.6	< 1.6	< 1.6	< 1.6	78.0	-	-	5.2
Chromium	21.0	9.3	27.0	23.0	11.0	< 6.3	16.0	230.0	-	-	21.0
Lead	20.0	15.0	19.0	17.0	10.0	5.7	11.0	400.0	-	-	107.0
Selenium	< 1.6	< 1.2	< 1.7	< 1.6	< 1.6	< 1.6	< 1.6	390.0	-	-	1.3
Silver	< 7.8	< 5.9	< 8.5	< 7.8	< 8.0	< 7.9	< 8.0	390.0	-	-	4.4
Mercury	< 0.31	< 0.24	< 0.34	< 0.31	< 0.32	< 0.31	< 0.32	23.0	-	-	0.1
Supernatant (4 hours)											
Total Suspended Solids (mg/l)	34	-	19	38	74	63	80	-	-	15.0	-
Total Volatile Solids (mg/l)	120	-	80	< 17	93	210	230	-	-	-	-
Ammonia Nitrogen (mg/l)	0.43	-	1.80	1.70	0.66	0.48	0.17	-	-	2.5	-
Lead (mg/l)	< 0.01	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-	0.2	-
Zinc (mg/l)	0.17	-	0.10	0.10	0.26	0.36	0.22	-	-	1.0	-
Supernatant (24 hours)											
Total Suspended Solids (mg/l)	4.8	-	< 4.3	8.8	14	16	26	-	-	15.0	-
Ammonia Nitrogen (mg/l)	0.85	-	2.3	1.7	0.69	0.41	0.21	-	-	2.5	-

* Illinois EPA Water Quality Standards 35IL Administrative Code Subtitle C

* Illinois Pollution Control Board (IPCB) Tier 1 Groundwater Remediation Objectives; 35 IAC 742, Appendix B, Table E

* Illinois Pollution Control Board (IPCB) Tier 1 Soil Remediation Objectives for Residential Properties; 35 IAC 742, Appendix B, Table A & IEPA Non-TACO Guidance

* Values are shown in ug/l rather than published data of mg/l to match laboratory results and units