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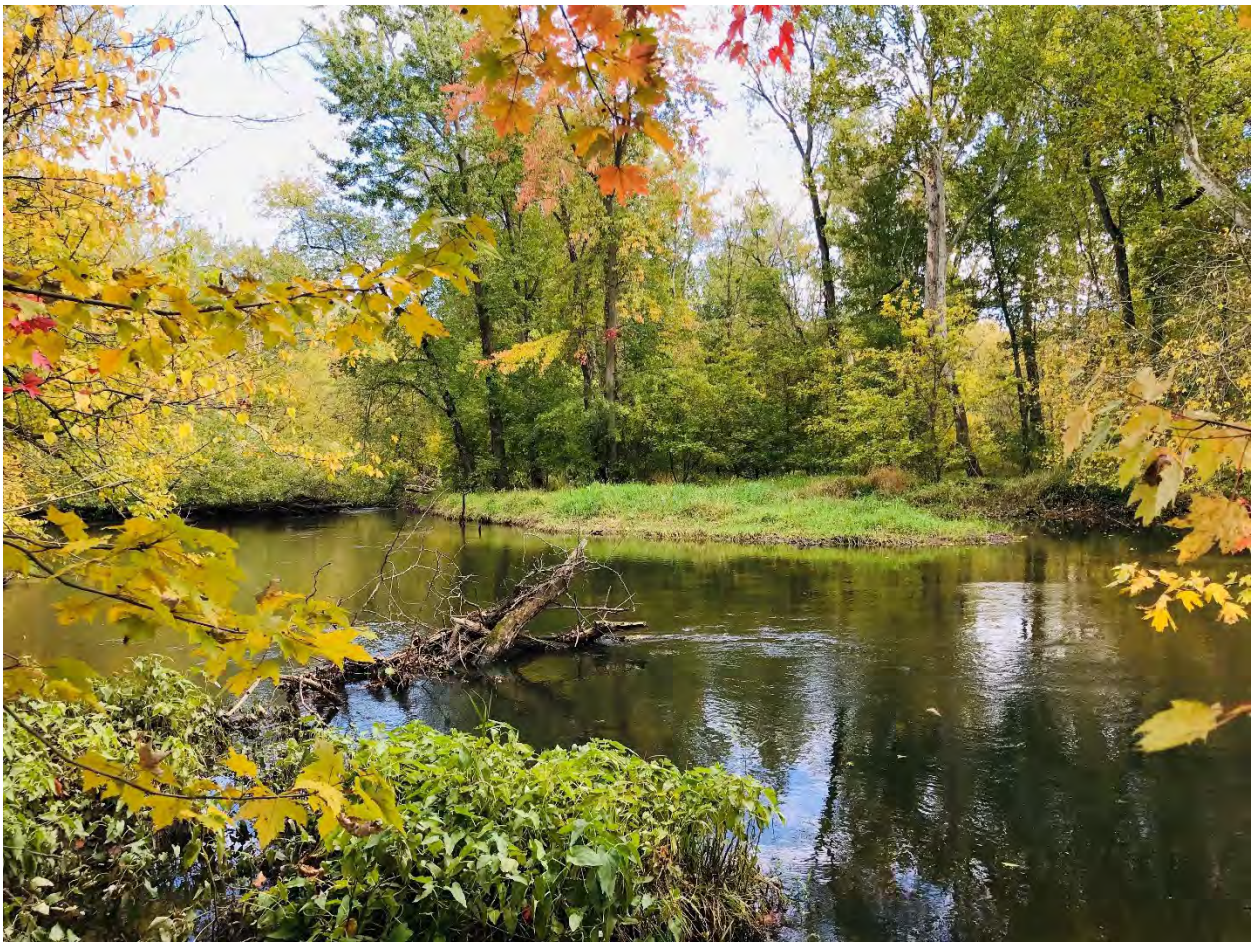
UPPER ELKHART RIVER WATERSHED MANAGEMENT PLAN

ELKHART, KOSCIUSKO, LAGRANGE AND NOBLE COUNTIES, INDIANA

2 JANUARY 2024



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1.0 WATERSHED INTRODUCTION

1.1 Watershed Community Initiative

A watershed is the land area that drains to a common point, such as a location on a river. All of the water that falls on a watershed will move across the landscape collecting in low spots and drainageways until it moves into the waterbody of choice. All activities that take place in a watershed can impact the water quality of the river that drains it. What we do on the land, such as constructing new buildings, fertilizing lawns, or growing crops, affects the water and the ecosystem that lives in it. A healthy watershed is vital for a healthy river, and a healthy river can enhance the community and help maintain a healthy local economy. Watershed planning is especially important in that it will help communities and individuals determine how best to preserve water functions, prevent water quality impairment; and produce long-term economic, environmental, and political health.

The Upper Elkhart River Watershed receives water from the North Branch Elkhart River, South Branch Elkhart River and Solomon Creek (Figure 1). In total, the Upper Elkhart River Watershed drains 403 square miles. The watershed includes drainage from The Towns of Wolcottville, Millersburg, Rome City, Albion and Cromwell and Cities of Ligonier and Kendallville. The watershed includes three 10-digit hydrologic unit codes (HUCs): 0405000115 (North Branch Elkhart River), 0405000116 (South Branch Elkhart River) and 0405000118 (Solomon Creek). The Upper Elkhart River Watershed gains water from the North and South Branches of the Elkhart River which join east of the City of Ligonier to form the mainstem of the Elkhart River. Solomon Creek joins the Elkhart River northeast of New Paris. The Elkhart River continues north and west through the Cities of Goshen and Elkhart to join with the St. Joseph River in downtown Elkhart. The St. Joseph River then flows west and then north into the State of Michigan before emptying into Lake Michigan (Figure 2).

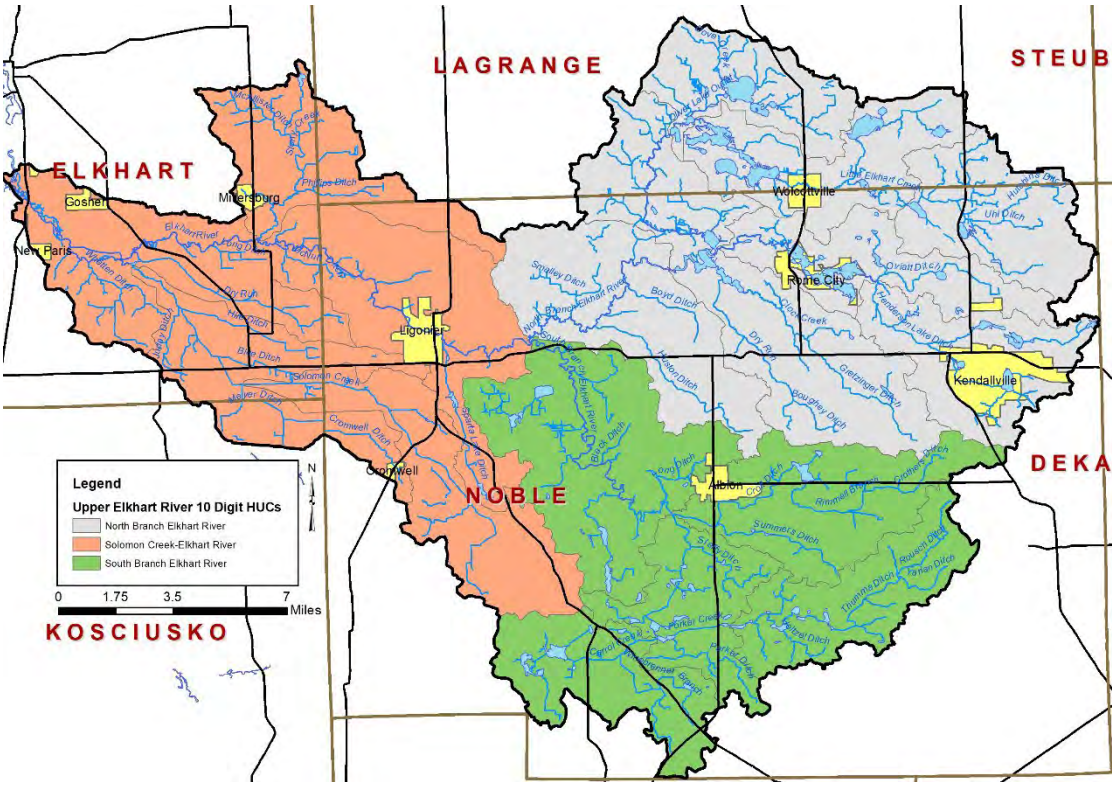


Figure 1. The Upper Elkhart River Watershed.

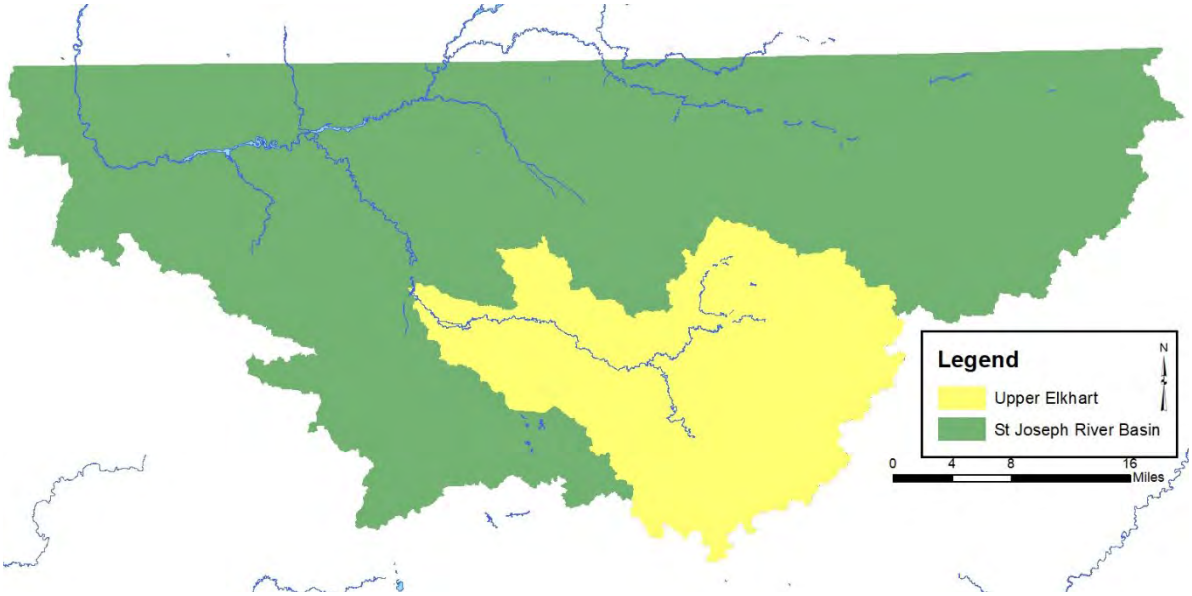


Figure 2. The St. Joseph River Basin highlighting the Upper Elkhart River Watershed.

1.2 Project History

The Upper Elkhart River Project launched in late 2021 as a result from a Section 319 grant awarded to update the 2008 Elkhart River Watershed Management Plan. The Elkhart River Restoration Association (ERRA) identified several changes in the Elkhart River Watershed since the 2008 plan's completion and initiated this effort to address these changes. Specifically, since the 2008 WMP was completed, there have been observable changes in land use with development focused throughout Elkhart County, cities and towns in the watershed, including Albion, Ligonier, Kendallville, and others and around the watershed's lakes with residents converting houses to larger, more permanent structures. In total, nearly 56 square miles of the watershed has been converted from natural (forest, wetland) and agricultural land uses into urban and urbanizing land uses over the last 14 years. Concurrently, the density of agricultural land use has also been impacted with permitted confined feeding operation populations increasing nearly 600% over 2008 animal populations. Further, the Indiana Department of Environmental Management focused their water quality assessments on the Upper Elkhart River Watershed listing 185 miles of impaired waterbodies – more than 100 stream miles added since the 2008 plan was completed. Impaired stream concerns include elevated pathogen (E. coli) and nutrient levels, low dissolved oxygen levels, and impaired biotic communities, while nutrient limitations impair several watershed lakes.

The update of the Elkhart River Watershed Management Plan was broken into two sections – the Upper Elkhart River Watershed and the Lower Elkhart River Watershed. This plan will address the Upper Elkhart River Watershed, which includes the North and South Branches of the Elkhart River and Solomon Creek drainages. The Upper Elkhart River Watershed includes a variety of land uses including agricultural, forest and natural areas, including nature preserves local parks, as well as urban and urbanizing land uses. Much of the watershed is dominated by agricultural land use with intact forested riparian areas especially adjacent to the mainstem of the Elkhart River. Urban and urbanizing land is found adjacent to the many watershed lakes and in its cities and towns including the Cities of Ligonier and Kendallville and Towns of Wolcottville, Millersburg, New Paris, Rome City, Albion and Cromwell. The mix of land uses generates a variety of concerns including: nutrient, sediment and pathogen runoff; flooding and loss of floodplain impacts; fish community impacts; algal blooms in watershed lakes and streams and more.

Based on these concerns, ERRA approached community groups and individuals throughout the watershed that might be interested in working with them to assess and improve water quality and quantity within Upper Elkhart River and its tributaries. Identified potential stakeholders included: Elkhart, Kosciusko, Lagrange and Noble County SWCD and NRCS staff; City of Kendallville and Elkhart County MS4s; City of Ligonier; Town of Wolcottville; Indiana DNR; Indiana State Department of Agriculture; Elkhart, Kosciusko, Lagrange and Noble County surveyors, parks departments, health departments and Purdue Extension; Goshen College faculty, students and staff; St. Joseph River Basin Commission; local landowners, educators and more. This group formed a Steering Committee (Table 1), conducted windshield surveys of the watershed, and held several meetings open to the public in order to generate input in the development of a watershed management plan for Upper Elkhart River Watershed.

1.3 Stakeholder Involvement

Development of a watershed management plan requires input from interested citizens, local government leaders, and water resource professionals. These individuals are required to not only buy into the project and the process but must also become an integral part of identifying the solution(s) which will result in improved water quality and addressed water quantity concerns. The Upper Elkhart River Project involved stakeholders in the watershed management planning process through a series of public meetings and education and outreach events including windshield surveys, workshops, field days and youth-focused education events.

1.3.1 Steering Committee

Individuals representing the towns and counties within the watershed, environmental groups, natural resource professionals, agricultural and commercial representatives, and private citizens comprised the steering committee. The steering committee has met quarterly to develop the WMP starting in January 2022. Table 1 identifies the steering committee members and their affiliation.

Table 1. Upper Elkhart River Watershed steering committee members and their affiliation.

Individual	Organization(s) Represented
Carolyn Moeller	Adams Lake Conservation Club
Sue McGee, Trevor Hampshire	City of Kendallville, City of Kendallville MS4
Jeff Boyle, Kenny Sprague, Ken Schuman	City of Ligonier
Donny Aleo	Elkhart County Parks
John Heiliger	Elkhart County MS4
Wes Krug, Troy Manges	Elkhart County NRCS
Jeff Burbrink	Elkhart County Purdue Extension
Philip Barker	Elkhart County Surveyor
Jim Hess	Elkhart County SWCD
Nancy Brown, Jason Kauffman	ERRA
Pete Kelly, Gary Brazel	Five Lakes
Jonathan Schramm	Goshen College
Kristi Todd	Indiana Department of Environmental Management
Chad Shotter	Kosciusko County NRCS
Kelly Heckaman	Kosciusko County Purdue Extension
Mike Kissinger	Kosciusko County surveyor
Tashina Lahr-Manifold	Kosciusko County SWCD
Robbie Miller	Lagrange County Floodplain Admin
Jennifer Walker	Lagrange County NRCS
Steve Engleking	Lagrange County Purdue extension
Zach Holsinger	Lagrange County surveyor
Martin Franke, Kyle Burchett	Lagrange County SWCD
Anita Hess	Noble County commissioner; SJRBC
Teresa Tackett	Noble County planning director
Russell Baker	Noble County NRCS
Ann Kline	Noble County Purdue Extension
Randy Sexton	Noble County surveyor
Patrick Wiltshire, Lynn Bowen	Olin-Oliver- Martin Lakes
Leigh Pranger	Rome City Conservancy District
Matt Meersman, Kate Barrett	St. Joseph River Basin Commission
Nancy Lough	Skinner Lake HOA
Scott Stienecker	Sylvan Lake
Steve Cords	Town of Wolcottville
Diann Scott	West Lakes

1.3.2 Public Meetings

Public participation is necessary for the long-term success of any watershed planning and subsequent implementation effort. One component of public participation for this project was public meetings and listening sessions. The purpose of the public meetings was to provide information on the overall planning effort and its progress; solicit stakeholder input, opinions, and participation; create opportunities for the public to recommend programs, policies, and projects to protect and improve water quality; and build support for future phases of the project.

The public meetings/listening sessions were advertised through press releases distributed to local newspapers in the watershed and via the project website and emails sent to local landowners and conservation partners. The meetings/listening sessions were also advertised through word of mouth as staff from the Soil and Water Conservation Districts put together mailings that advertised the events.

The first public meeting occurred on March 17, 2022 and was hosted as a drop in and chat meeting. In total, 22 people attended the meeting providing their input on water quality, water quantity, recreation and high-quality areas. Individuals noted their personal concerns and identified both high quality and problem areas on maps provided. These comments formed the initial basis of the stakeholder concerns list.

The second meeting occurred on September 25, 2023 with 37 people in attendance. The meeting provided an overview of the project and decisions made along the way and focused on gathering feedback on critical areas, practices selected for implementation and the likelihood of meeting project goals gathered. The draft watershed management plan was posted following the meeting and attendees and stakeholders were encouraged to provide feedback and/or comments.

1.4 Public Input

Throughout the planning process, project stakeholders, the steering committee, and the general public listed concerns for the Upper Elkhart River Watershed including the Elkhart River, its tributaries, and its watershed. Public and committee meetings were the primary mechanism of soliciting individual concerns. All comments were recorded and included as part of the concern documentation and prioritization process. Concerns voiced throughout the process are listed in Table 2. Similar stakeholder concerns were grouped roughly by topic and condensed by the committee. The order of concern listing does not reflect any prioritization by watershed stakeholders.

Table 2. Stakeholder concerns identified during public input sessions, steering committee meetings and via the watershed inventory process. Note: The order of concern listing does not reflect any prioritization by watershed stakeholders.

Stakeholder Concerns
Maintaining drainage and floodplain
Recreational use of the river and lakes
Water quantity
Poor water quality (sediment, nutrients, pathogens)
Elevated turbidity, phosphorus and E. coli and impacts on water quality
Fish community impacts
Sediment accumulation in river and lakes
In lake water quality – poor transparency, elevated nutrient levels
Property value impacts to lakeside residents (poor water quality)

Maintenance of previously installed best management practices
Streambank and bed erosion
Stormwater impacts
Building cohesion with groups across the basin
Blue green algae blooms on lakes
Flooding
Too much water received in Rome City during storm events
Explore the need for dam removal – Elkhart County Parks Baintertown and Benton dam removal feasibility study ongoing
Maintaining natural areas and providing access to local residence
Maintain outfall for regulated drains to keep the Elkhart River healthy (keep the river clean by keeping tributaries clean)
Be holistic and work across the watershed with the goal of no negative impact to any other area of the basin
Engaging agricultural and urban landowners to implement BMPs
Livestock accessing streams
Agricultural BMP implementation is needed
Impacts of City of Kendallville wastewater treatment plant impacts on Henderson Lake and Sylvan Lake
Excessive Sediment Load
Stream bank deterioration caused by severe erosion as general observed, especially along legal drains)
Interest in making legal drains more natural, install buffer strips between agricultural
Concerns about unregulated drain erosion, working with private landowners
Managing regulated to reduce sediment loading (two stage, buffer strip incentives) – examples – see Kosciusko
Non-point source pollution (agricultural row crop and animal runoff & septic)
Nutrient loading due to the use of (lawn, agriculture) fertilizers
Vegetation growth due to eutrophication in lakes and streams
Illicit Discharge
Mercury and PCBs in fish tissue
Drainage for agricultural production (both the positive aspect of achieving appropriate drainage for agriculture and the negative aspect of alteration of the hydrologic system were discussed)
Long-term viability of the Watershed as an irrigation source (both surface and ground water quantity issues)
Livestock access to surface waters within the Watershed
Loss of habitat with increased development
Increases in impervious surface in the Watershed
Development/encroachment on the floodplain
Combined Sewer Overflows – E. coli, nutrients – long term control. All CSOs have been eliminated per city of Kendallville
Preserve a natural buffer along the water. Need proper planning of developments
Continue sewer development on pace with development- areas that are developed but are not sewered needs to be mapped
Growing Canada goose, mute swan population
Preservation of wetlands upstream, to protect floodplain areas
Loss of habitat for endangered, threatened and rare (ETR) species
Invasive species

Fish kills after heavy rains (pollutants in the runoff) – no current evidence of fish kills – leaving but may remove if evidence does not support
Addressing beaver dams and logjams for recreation, flood storage and flow conveyance
Evaluate dam removal or dam modifications to assist with upstream and downstream fish passage
Perception of health of river, lakes and streams - E coli, cryptosporidium, harmful algal blooms other aquatic health concerns.
Fish consumption advisories
Concerned over attempts to make the Elkhart River a legal drain: concern over drainage policy in general
Logjams
The Wolcottville town dam to historic recreation opportunities with pond, beach and more post failure in the 1950s – maintain and manage (10 feet of fall between Wolcottville and Witmer Lake) – 3 dams, 2 private, 1 public
Septic systems, maintenance needed, density, straight pipes, small leach beds
Wetland loss
Eve Lake still has a cisco population (others?)
Henderson Lake – very high nutrient levels/dead lake – suggested no swimming/bodily contact by City of Kendallville
Floodplain development
In lake boating/shallow lake boating impacts
Nutrient impacts from yard waste
Confined feeding operations, concentrated animal feeding operation impacts
Manure volume produced from unregulated, animal operations and CFO/CAFO in the watershed
Increased intensity and duration of rain events
Heavy metal releases from in lake treatment – need a better understanding of heavy metal accumulation in lake sediment and potential impacts
Watershed lake overuse (bass tournaments, boat density, lack of facilities as access points)
Impediments to navigation (barbed wire, low head dams)
Limited recreation access points

2.0 WATERSHED INVENTORY I: WATERSHED DESCRIPTION

2.1 Watershed Location

The Upper Elkhart River includes three 10-digit hydrologic unit codes (HUCs): 0405000115 (North Branch Elkhart River), 0405000116 (South Branch Elkhart River) and 0405000118 (Solomon Creek) and covers portions of Elkhart, Lagrange, Noble and Kosciusko counties (Figure 1). The Upper Elkhart River Watershed includes all the land that enters Elkhart River, Solomon Creek, Stony Creek, Little Elkhart Creek, North and South Branch Elkhart River upstream of New Paris and their drainage. The watershed includes drainage from The Towns of Wolcottville, Millersburg, Rome City, Albion and Cromwell and Cities of Ligonier and Kendallville. The Upper Elkhart River Watershed gains water from the North and South Branches of the Elkhart River, which join east of the City of Ligonier to form the mainstem of the Elkhart River. Solomon Creek joins the Elkhart River east of New Paris. The Elkhart River continues north and west through the Cities of Goshen and Elkhart to join with the St. Joseph River in downtown Elkhart. The St. Joseph River then flows west and then north into the State of Michigan before emptying into Lake Michigan.

2.2 Subwatersheds

In total, seventeen 12-digit Hydrologic Unit Codes are contained within the Upper Elkhart River Watershed (Figure 3,Table 3). Each of these drainages will be discussed in further detail under Watershed Inventory II.

Table 3. 12-digit Hydrologic Unit Code (HUC) watersheds in the Upper Elkhart River Watershed.

Subwatershed Name	Hydrologic Unit Code	Area (acres)	Percent of Watershed
Tamarack Lake-Little Elkhart Creek	040500011501	12,395	5%
Dallas Lake-Little Elkhart Creek	040500011502	13,311	5%
Oliver Lake-Little Elkhart Creek	040500011503	10,126	4%
Waterhouse Ditch-Henderson Lake Ditch	040500011504	12,788	5%
Oviate Ditch-Middle Branch Elkhart River	040500011505	11,052	4%
Jones Lake-North Branch Elkhart River	040500011506	26,049	10%
Huston Ditch-North Branch Elkhart River	040500011507	18,488	7%
Rivir Lake-Forker Creek	040500011601	11,960	5%
Winebrenner Branch-Carrol Creek	040500011602	11,799	5%
Skinner Lake-Croft Ditch	040500011603	15,890	6%
Muncie Lake-South Branch Elkhart River	040500011604	10,527	4%
Diamond Lake-South Branch Elkhart River	040500011605	22,904	9%
Phillips Ditch-Stony Creek	040500011801	13,017	5%
Indian Lake-Elkhart River	040500011802	20,182	8%
Headwaters Solomon Creek	040500011803	15,158	6%
Hire Ditch-Solomon Creek	040500011804	14,189	5%
Whetten Ditch-Elkhart River	040500011805	18,207	7%
	Entire Watershed	**258,040.9**	**100%**

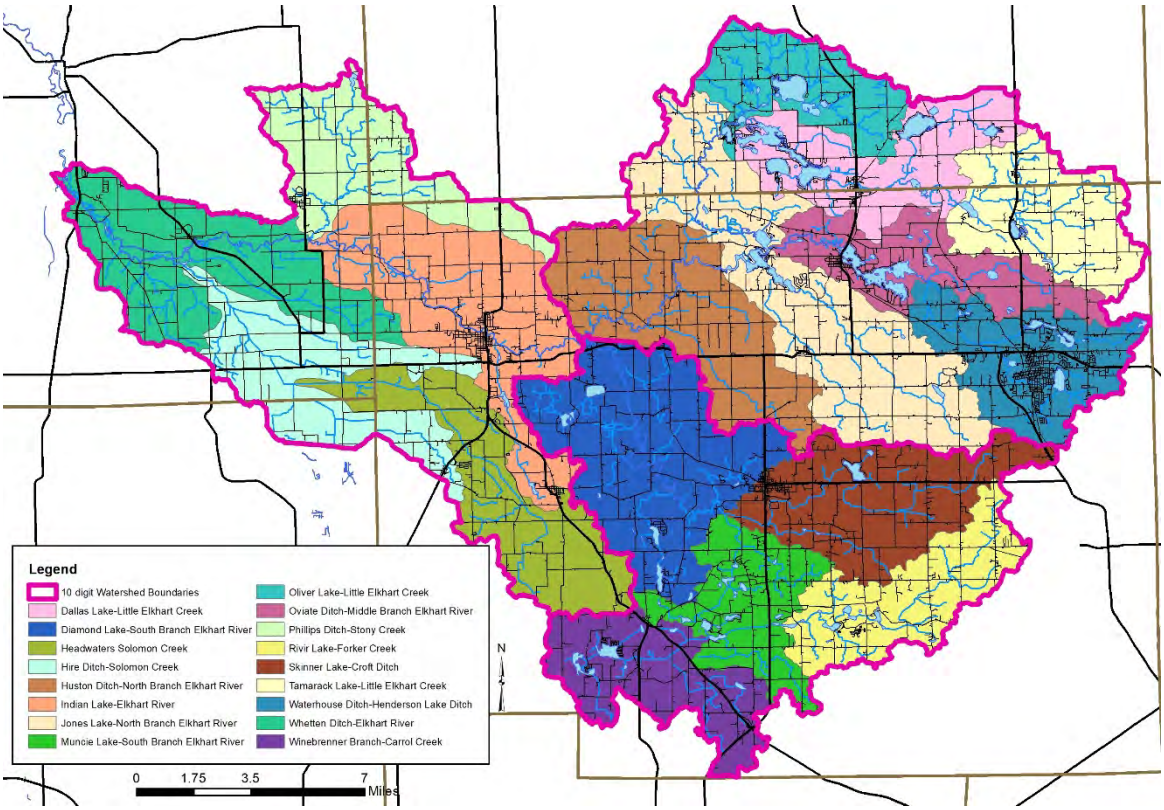


Figure 3. 12-digit Hydrologic Unit Code subwatersheds in the Upper Elkhart River Watershed.

2.3 Climate

In general, Indiana has a temperate climate with warm summers and cool or cold winters. Climate in the Upper Elkhart River Watershed is no different than the rest of the state. There are four seasons throughout the year. The average temperatures measure approximately 71°F in the summer, while low temperatures measure below freezing (25.9°F) in the winter. The growing season typically extends from April through September. On average, 38 inches of precipitation occurs within the watershed per year; approximately 58% of this precipitation falls during the 205-day growing season. Rainfall intensity and timing affect watershed response to precipitation. NOAA's climate at a glance website (1895-present) indicate rainfall varies from 25 to over 50 inches annually (Figure 4). Christopher B. Burke Engineering Limited (CBBEL) calculated the 10-year moving average as between 30 and 40 inches/year. The Purdue Climate Change Research Center indicates an increase in average annual precipitation of over 4.2 inches/year from 1895 to 2029 (PCCRC, 2019). CBBEL (2020) further notes an increase in heavy rainfall events with one day per year exceeding the 99th percentile in 1900 to more than three days exceeding this level in 2016 (Figure 5). This suggests that more frequent extreme events and larger annual precipitation totals are likely occurring in the Upper Elkhart River Basin. This likely results in more water moving through the system which impacts the watershed's lakes, streams and wetlands.

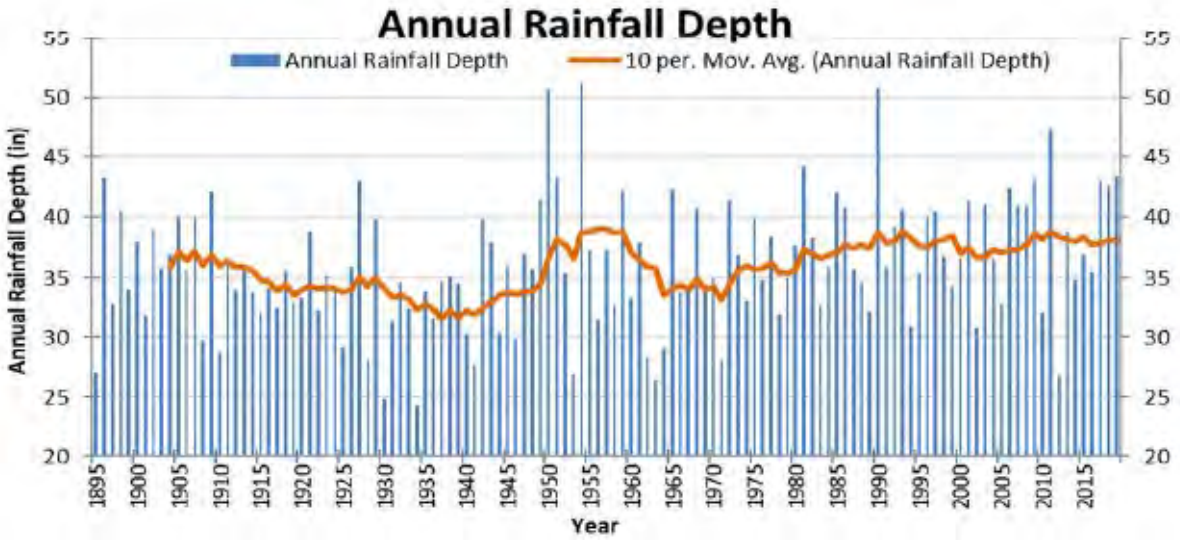


Figure 4. Annual rainfall depth for Noble County (CBBEL, 2020).

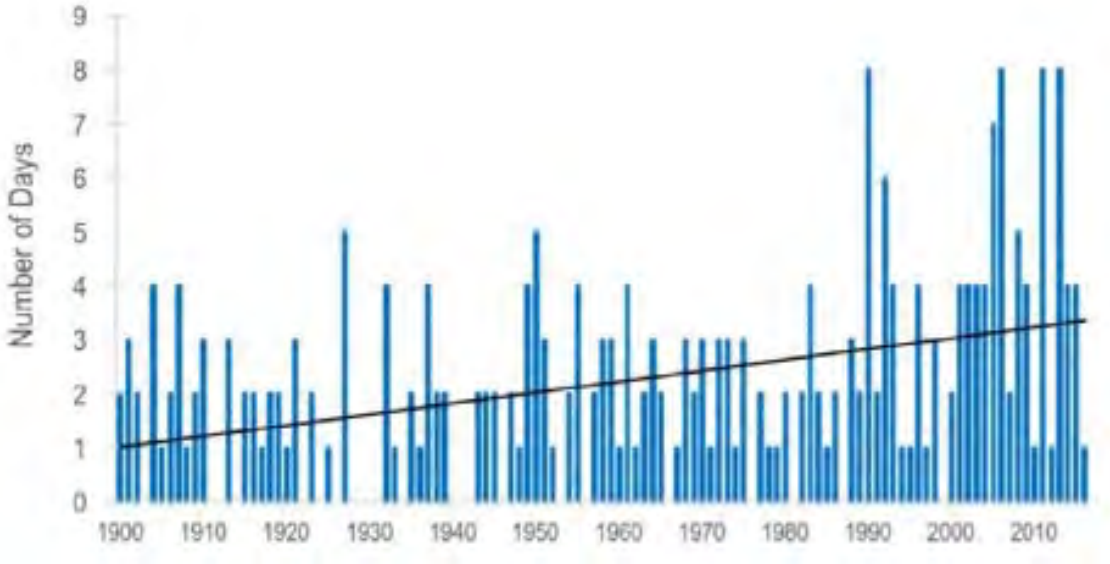


Figure 5 Number of days with extreme precipitation (ie events exceeding 99th percentile for Indiana (PCCRC from CBBEL, 2020).

2.4 Geology and Topography

Bedrock deposits within much of the Upper Elkhart River Watershed are from the Silurian to middle Mississippian age. These deposits consist primarily of layered Paleozoic limestone, dolomite, sandstone, siltstone and shale, which are indicative of ancient inland seas (Clendenon and Beaty, 1987). The bedrock geology of the watershed is comprised of three major types of Devonian Era Shale, with a small amount of Muscatatuck Group present in the southernmost outcrop of the watershed. Antrim Shale bedrock covers most of the southern portion of the Upper Elkhart River Watershed covering much of the South Branch of the Elkhart River drainage. The main stem of the Elkhart River flows through Ellsworth Shale. Coldwater Shale deposits cover much of the northeastern portion where lakes predominate in the Little

Elkhart Creek (Figure 6). Most of the Upper Elkhart River Watershed is covered by glacial drift measuring from zero to 200 feet in thickness with deeper drift filling preglacial drainageways. Two distinct glacial stages are represented by the watershed's till and drift deposits. The most recent Wisconsinan drift was deposited by the Ontario-Erie Lobe of the Wisconsinan glacier (Wayne, 1963). Sand and gravel deposits found along all major and many minor streams originate from the Wisconsinan outwash. Lacustrine deposits found in the watershed's headwaters originate from the Illinoian till (Figure 7). Sand and gravel are readily available resources along watershed stream floodplains.

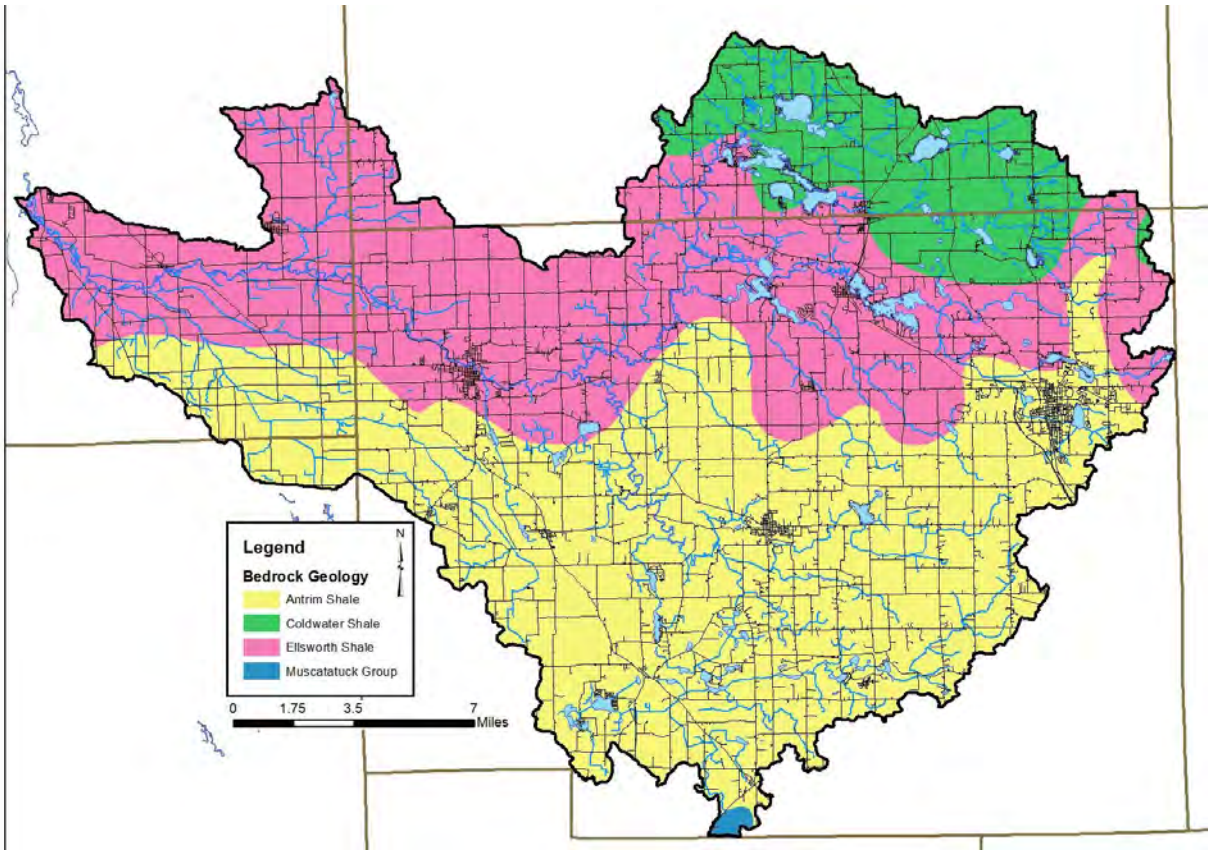


Figure 6. Bedrock in the Upper Elkhart River Watershed.

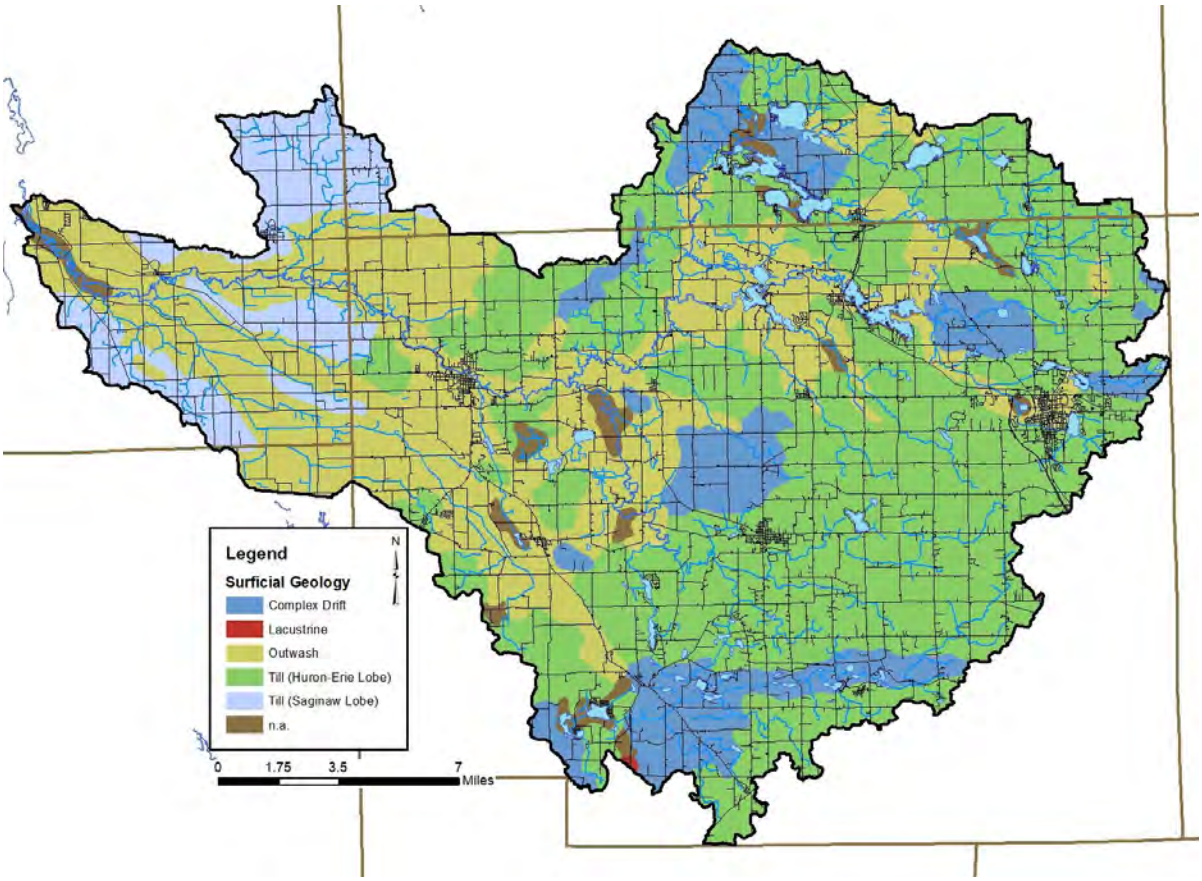


Figure 7. Surficial geology throughout the Upper Elkhart River Watershed.

The topography of the Upper Elkhart River Watershed ranges from flat rolling agricultural fields to undulating hills and valleys (Figure 8). The landscape changes from steeply sloped to rolling terrain in the Tamarack Lake-Little Elkhart Creek Subwatershed, Waterhouse Ditch-Henderson Lake Ditch Subwatershed, Skinner Lake-Croft Ditch Subwatershed and Rivir Lake-Forker Creek Subwatershed drainages (eastern edge of the watershed) to gently rolling terrain and relatively flat plains along the main stem of the Elkhart River. The lowest elevation (790 feet msl) occurs at the watershed outlet near Waterford Mills, which is located in the Whetten Ditch-Elkhart River subwatershed. The Upper Elkhart River Watershed elevation is highest measuring 1075 feet mean sea level (msl) just south of Kendallville in the eastern portion of the watershed and in the town of South Milford in the northeastern portion of the watershed. Steep valleys surround many of the Upper Elkhart River Watershed streams in the eastern portion of the watershed.

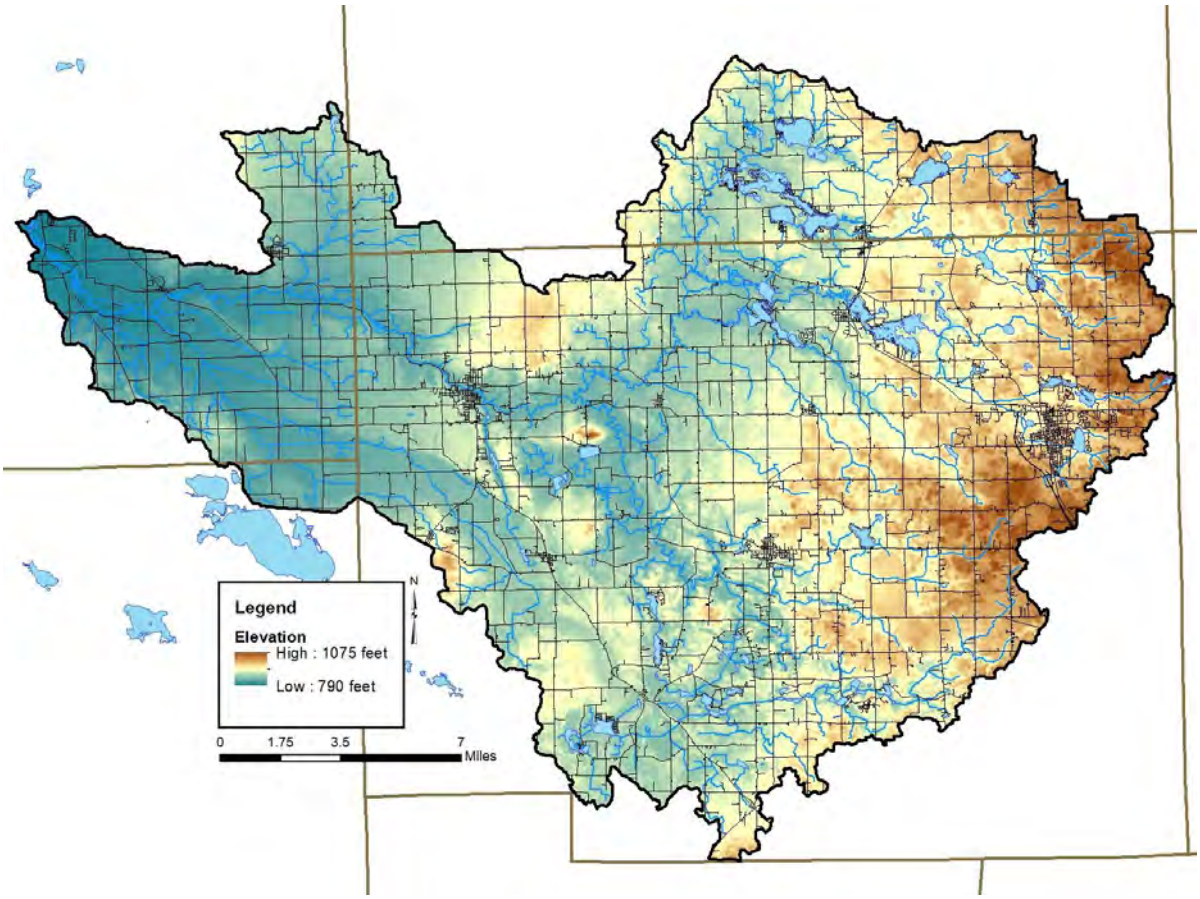


Figure 8. Surface elevation in the Upper Elkhart River Watershed.

2.5 Soil Characteristics

There are hundreds of different soil types located within the Upper Elkhart River Watershed. These soil types are delineated by their unique characteristics. The types are then arranged by relief, soil type, drainage pattern, and position within the landscape into soil associations. These associations provide the overall characteristics across the landscape. Soil associations are not used at the individual field level for decision making. Rather, the individual soil types are used for field-by-field management decisions. Some specific soil characteristics of interest, including septic limitations and soil erodibility, for watershed and water quality management are detailed below.

2.5.1 Hydrologic Soil Group

The hydrologic soil group classification is a means for categorizing soils by similar infiltration and runoff characteristics during periods of prolonged wetting. The vast majority of the Upper Elkhart River Watershed is covered by well-drained soils from materials weathered from shale, siltstone and limestone. These moderately deep to deep soils are found on moderately sloping to steeply sloped land. Within floodplains, somewhat poorly drained to well-drained soils are located within river deposits on nearly level land. Soils are classified by the NRCS into four hydrologic soil groups based on the soil's runoff potential (Table 4). The majority of the watershed is covered by category C soils (28%) followed by category B soils (27%), category D soils (25%) and category A soils (15%). While the majority of soils are nearly evenly split by C, B, and D soil types, the location of each hydrologic soil group is important. C soils dominate the southern and eastern portions of the watershed, whereas B soils dominate much of the rest of the watershed (Figure 9). Category B soils are moderately deep and well drained, while

Category C soils are finer and allow for slower infiltration. A soils are abundant in the northern section of the watershed around Olin, Oliver, and Martin Lakes. While A soils can be found in this region of the watershed, overall, the watershed is not heavily represented by A soil types. Elkhart County's hydrologic soils are dominated by D soils, which differ greatly from the remainder of the watershed, likely due to the predominance of glacial drift in this portion of the watershed. While this soil type has the slowest infiltration rates, Elkhart County is also significantly lower in elevation than the rest of the watershed. In these areas, D soils are slow infiltration soils, where flooding can regularly occur. This means that regular flooding is likely in this portion of the watershed.

Table 4. Hydrologic soil group summary.

Hydrologic Soil Group	Description
A	Soils with high infiltration rates. Usually deep, well-drained sands or gravels. Little runoff.
B	Soils with moderate infiltration rates. Usually moderately deep, moderately well-drained soils.
C	Soils with slow infiltration rates. Soils with finer textures and slow water movement.
D	Soils with very slow infiltration rates. Soils with high clay content and poor drainage. High amounts of runoff.

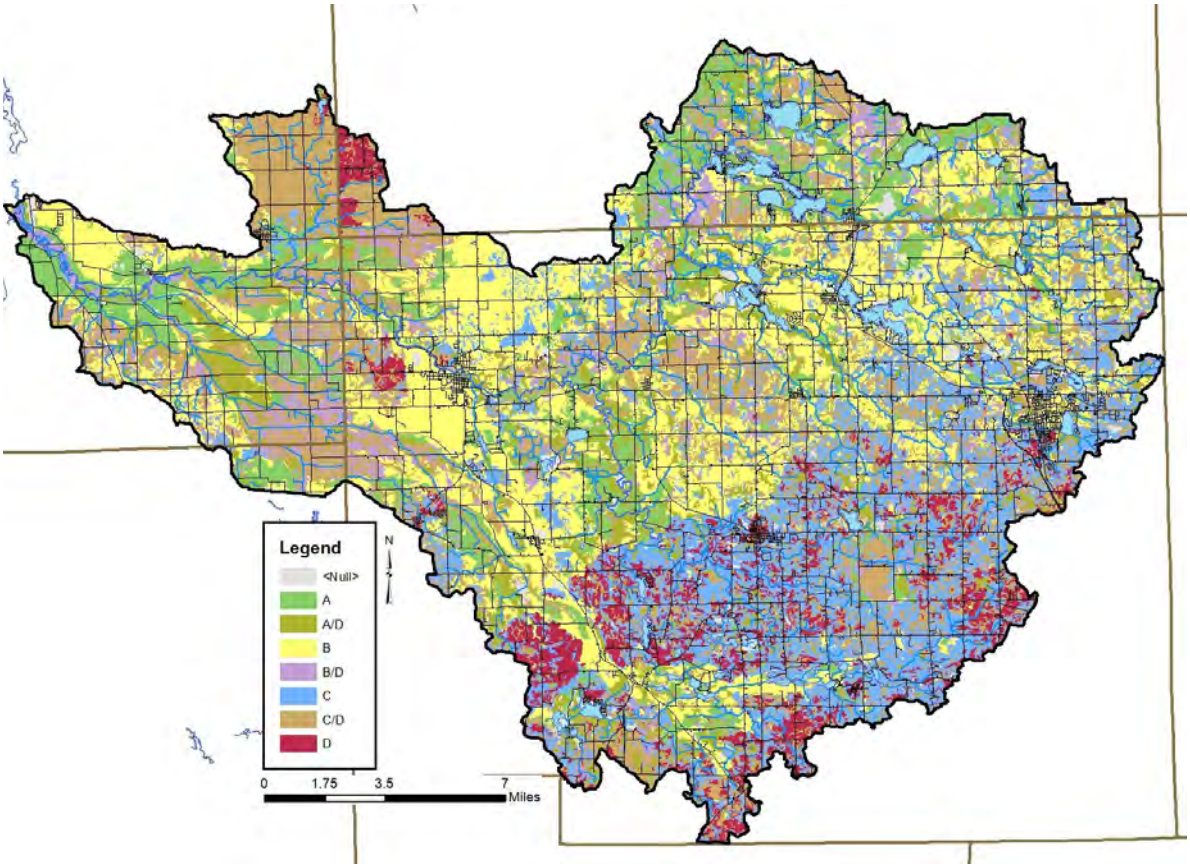


Figure 9. Hydrologic Soil Groups in the Upper Elkhart River Watershed.

2.5.2 Soil Erodibility

Soils that move from the landscape to adjacent waterbodies result in degraded water quality, limited recreational use, and impaired aquatic habitat and health. Soils carry attached nutrients and pesticides, which can result in impaired water quality by increasing plant and algae growth or even killing aquatic life. The ability and/or likelihood for soils to move from the landscape to waterbodies are rated by the Natural Resources Conservation Service (NRCS). The NRCS uses soil texture and slope to classify soils into those that are considered highly erodible, potentially highly erodible, and not highly erodible. The classification is based on an erodibility index which is determined by dividing the potential average annual rate of erosion by the soil unit's soil loss T value or tolerance value. The T value is the maximum annual rate of erosion that can occur for a particular soil type without causing a decline in long-term productivity.

Watershed stakeholders are concerned about soil erosion. As detailed above, soils which have high erodibility index values are those that are located on steep slopes and are easily moved by wind, water, or land uses. Figure 10 details locations of highly erodible soils within the Upper Elkhart River Watershed. Highly erodible soils cover 45% of the watershed or 116,889 acres. Highly erodible soils are found throughout the watershed with no discernable pattern of location. However, it should be noted that there is limited highly erodible soils coverage in the Solomon Creek basin.

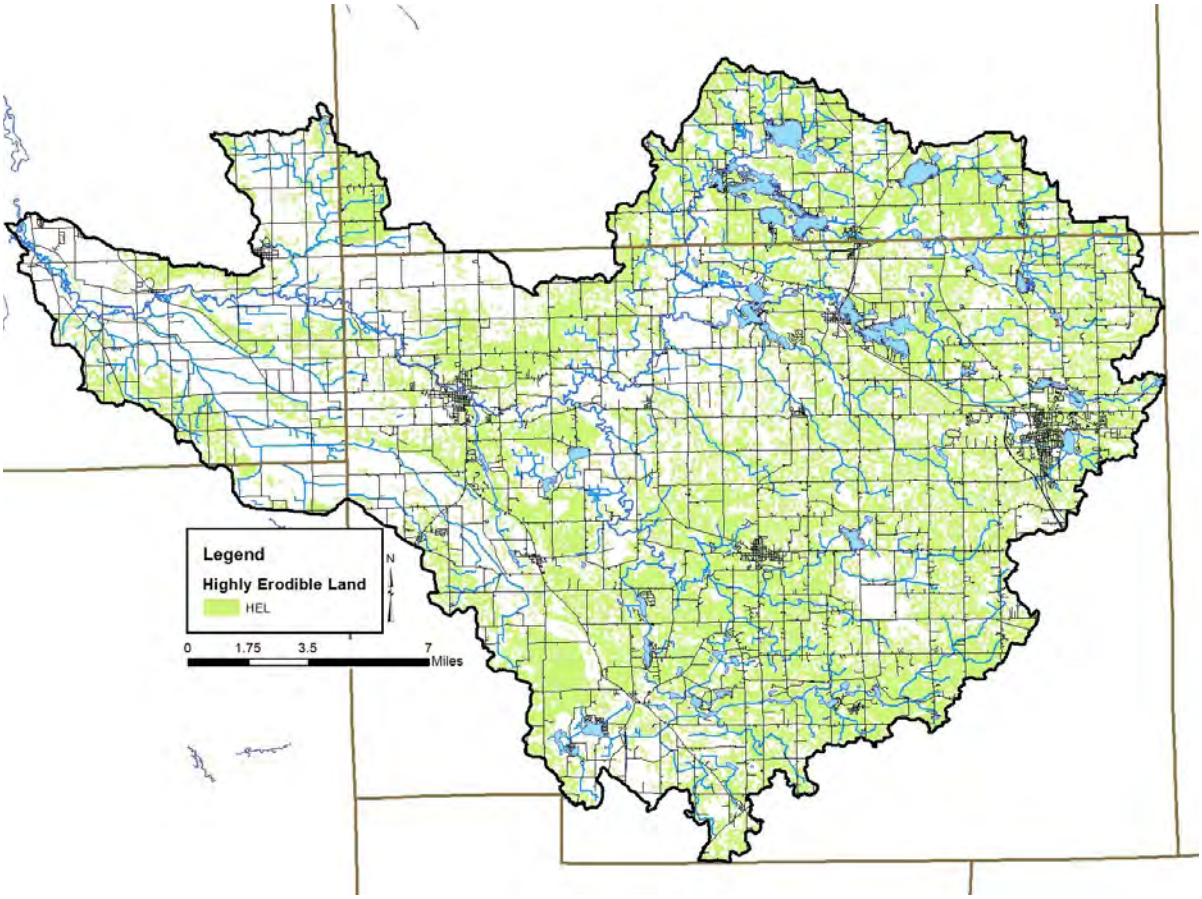


Figure 10. Highly erodible land in the Upper Elkhart River Watershed.

2.5.3 Hydric Soils

Hydric soils are those which remain saturated for a sufficient period of time to generate a series of chemical, biological, and physical processes. The oxidation and reduction of iron in the soil, or "redox", causes color changes characteristic of prolonged fluctuations in the water table. After undergoing these processes, the soils maintain the resultant characteristics even after draining or use modification occurs. Approximately 73,254 acres (28%) of the watershed was covered by hydric soils (Figure 11). While much of western Noble County has limited hydric soils, they cover much of eastern Noble County and much of Lagrange County. Hydric soils are more densely packed along the Elkhart River and Solomon Creek floodplains. They are also relatively dense in Kosciusko County portion of the watershed. As these soils are considered to have developed under wetland conditions, they are a good indicator of historic wetland locations and therefore will be revisited in the land use section.

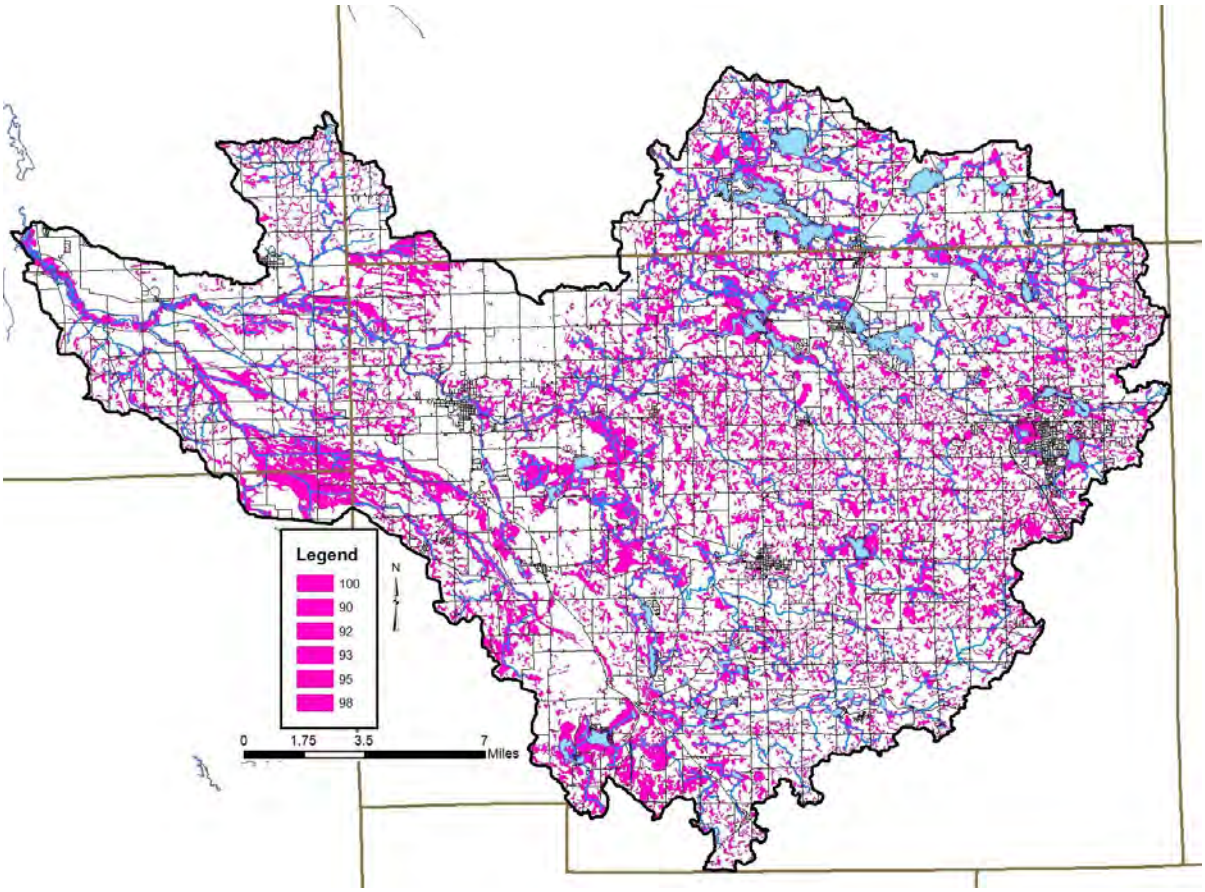


Figure 11. Hydric soils in the Upper Elkhart River Watershed.

2.5.4 Tile-Drained Soils

Soils drained by tile drains cover 94,092 acres or 36% of the Upper Elkhart River Watershed as estimated utilizing methods details in Sugg, 2007. This method of drainage is widely used in row crop agricultural settings within the watershed and has become even more intensively used within the last ten years. This results in altered hydrology, allowing the water to drain from the landscape more quickly to improve conditions for farming, but also potentially exacerbating downstream flooding and incising streams which cuts them off from their natural floodplains. In these areas, materials such as nutrients applied to agricultural soils are directly transported downstream, bypassing natural features such as filter strips that might otherwise filter out or assimilate nutrients. As the demands of production on each acre of land

increases more tile is put in, typically in a network or series as extensive as 30 to 50 foot spacing between tiles. Impacts to stream water quality can be reduced by the use of tile control structures and drainage water management. CBBEL (2020) notes that successful agriculture in a naturally poorly drained watershed like the North Branch Elkhart River requires good drainage or the installation of tile drains. This means water more quickly escapes the landscape which in turn means the stream channel receives water more quickly. Coupling the high infiltration rates of soils in the watershed with tile drainage allows more water to infiltrate or soak into the ground rather than runoff as overland flow (CBBEL, 2020). A majority of tile-drained soils are located along the eastern boundary of Elkhart County and in much of Noble County. Tile-drained soils can also be found along the mainstem of the Elkhart River and Solomon Creek in Elkhart and Kosciusko counties (Figure 12). Most of these areas are relatively flat where drainage augmentation is required to move water from agricultural fields in order to produce row crops. In these areas, materials applied to agricultural soils are directly transported to downstream waterbodies.

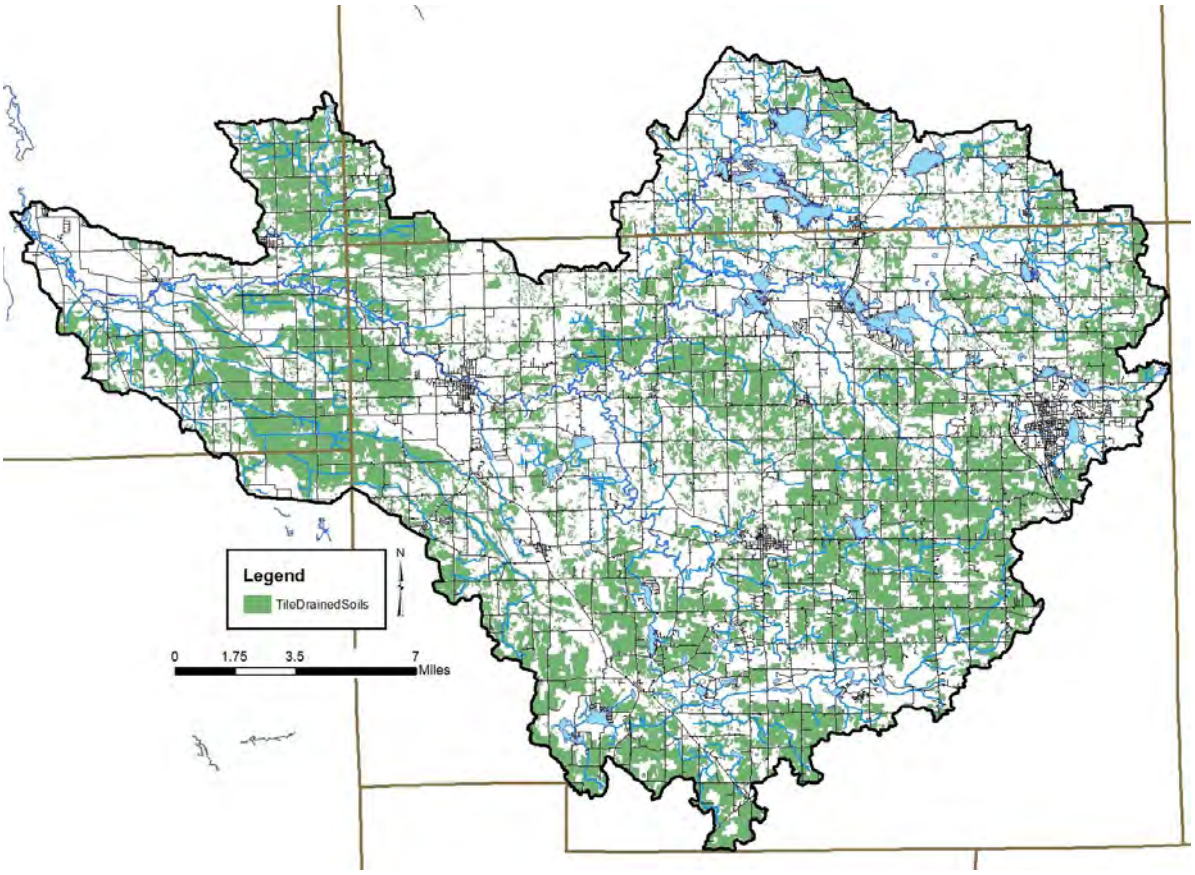


Figure 12. Tile-drained soils in the Upper Elkhart River Watershed.

2.6 Wastewater Treatment

2.6.1 Soil Septic Tank Suitability

Throughout Indiana, households depend upon septic tank absorption fields in order to treat wastewater. Seven soil characteristics, including position in the landscape, soil texture, slope, soil structure, soil consistency, depth to limiting layers and depth to seasonal high water table, are utilized to determine suitability for on-site septic treatment. Septic tanks require soil characteristics that allow for gradual movement of wastewater from the surface into the groundwater. A variety of characteristics limit the ability for soils to adequately treat wastewater. High water tables, shallow soils, compact till, and coarse soils all limit soils abilities in their use as septic tank absorption fields. Specific system modifications are

necessary to adequately address soil limitation; however, in some cases, soils are too poor for treatment and therefore prove inadequate for use in septic tank absorption fields.

Until 1990, residential homes located on 10 acres or more and occurring at least 1,000 feet from a neighboring residence were not required to comply with any septic system regulations. In 1990, a new septic code corrected this loophole. Current regulations address these issues and require that individual septic systems be examined for functionality. Additionally, newly constructed systems cannot be placed within the 100-year floodplain and systems installed at existing homes must be placed above the 100-year flood elevation. However, many residences grandfathered into this code throughout the state have not upgraded or installed fully functioning systems (Krenz and Lee, 2005). In these cases, septic effluent discharges into field tiles or open ditches and waterways and will likely continue to do so due to the high cost of repairing or modernizing systems ($4,000 to $15,000; ISDH, 2001). Lee et al. (2005) estimates that 76,650 gallons of untreated wastewater per system is expelled in the state of Indiana annually. The true impact of these systems on the water quality in the watershed cannot be determined without a complete survey of systems.

The NRCS ranks each soil series in terms of its limitations for use as a septic tank absorption field. Each soil series is placed in one of three categories: severely limited, moderately limited, and slightly limited. Some soils are also unranked. Severe or very limited limitations delineate areas whose soil properties present serious restrictions to the successful operation of a septic tank tile disposal field. Using soils with a severe limitation increases the probability of the system's failure and increases the costs of installation and maintenance. Areas designated as having moderate or somewhat limited limitations have soil qualities which present some drawbacks to the successful operation of a septic system; correcting these restrictions will increase the system's installation and maintenance costs. Slight limitations delineate locations whose soil properties present no known complications to the successful operation of a septic tank tile disposal field. Use of soils that are rated moderately or severely limited generally require special design, planning, and/or maintenance to overcome limitations and ensure proper function.

Watershed stakeholders are concerned about the lack of maintenance associated with septic tanks, the use of soils that are not suited for septic treatment and the presence of straight pipe systems within the watershed. These concerns are exacerbated by the fact that severely limited soils cover essentially the entire watershed (Figure 13). Nearly 241,951 acres or 94% of the watershed is covered by soils that are considered very limited for use in septic tank absorption fields. Nearly 182,374.4 (2%) acres are somewhat limited meaning that these soils are generally suitable for septic systems. The remaining 10,724 acres (4%) not rated for septic usage as it is not generally industry standard to install a septic system in these geographic locations.

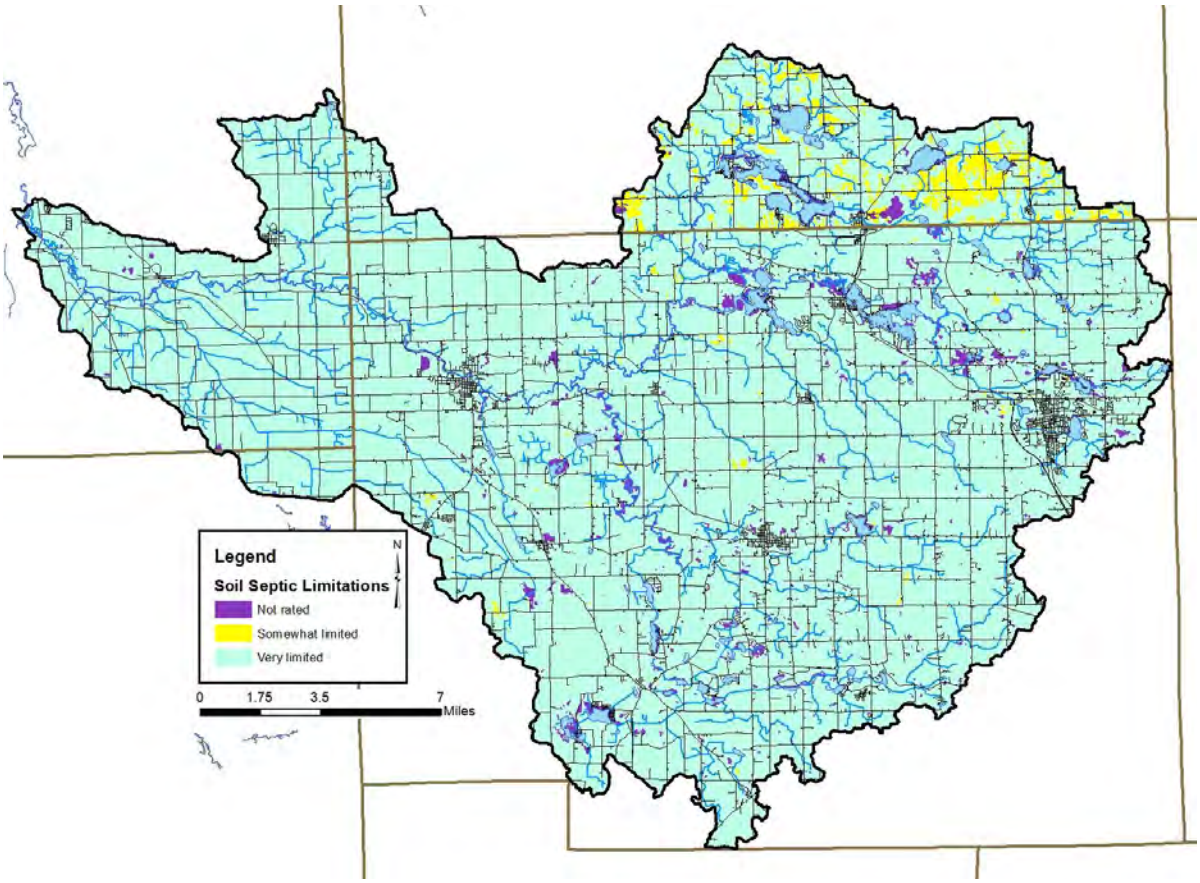


Figure 13. Suitability of soils for septic tank usage in the Upper Elkhart River Watershed.

Septic systems that are properly designed and maintained should not serve as a source of contamination to surface waters. However, septic systems do fail for a variety of reasons. Common soil-type limitations which contribute to failure are seasonal high water tables, compact glacial till, bedrock, coarse sand and gravel outwash and fragipan. When these septic systems fail via surface breakouts or due to inadequate soil filtration there can be adverse effects to surface waters due to E. coli, nitrate, and total phosphorus (Horsely and Witten, 1996). Septic systems contain all the water discharged from homes and business and can be significant sources of pathogens and nutrients.

A comprehensive database of septic systems within the Upper Elkhart River Watershed is not available. It is assumed that the numbers of septic systems in the subwatersheds are directly proportional to rural household density. Based on estimates, more than 123,300 individuals live in rural residences within the Upper Elkhart River Watershed. Those located on Group C and D soils have slow infiltration rates with finer textures and slow water movement and are of higher concern for septic system maintenance issues.

2.6.2 Wastewater Treatment

Several facilities which treat wastewater and are permitted to discharge the treated effluent are located within the watershed. These facilities are regulated by National Pollution Discharge Elimination System (NPDES) permits. These include several wastewater treatment plants ranging in size from small, local plants to larger, publicly owned facilities and school facilities. In total, 14 NPDES-regulated facilities are located within the watershed (Figure 14). Wastewater treatment plant septage sludge is not applied to

the land in the Upper Elkhart River Watershed. Table 5 details the NPDES facility name, activity, and permit number. More detailed information for each wastewater facility is discussed below.

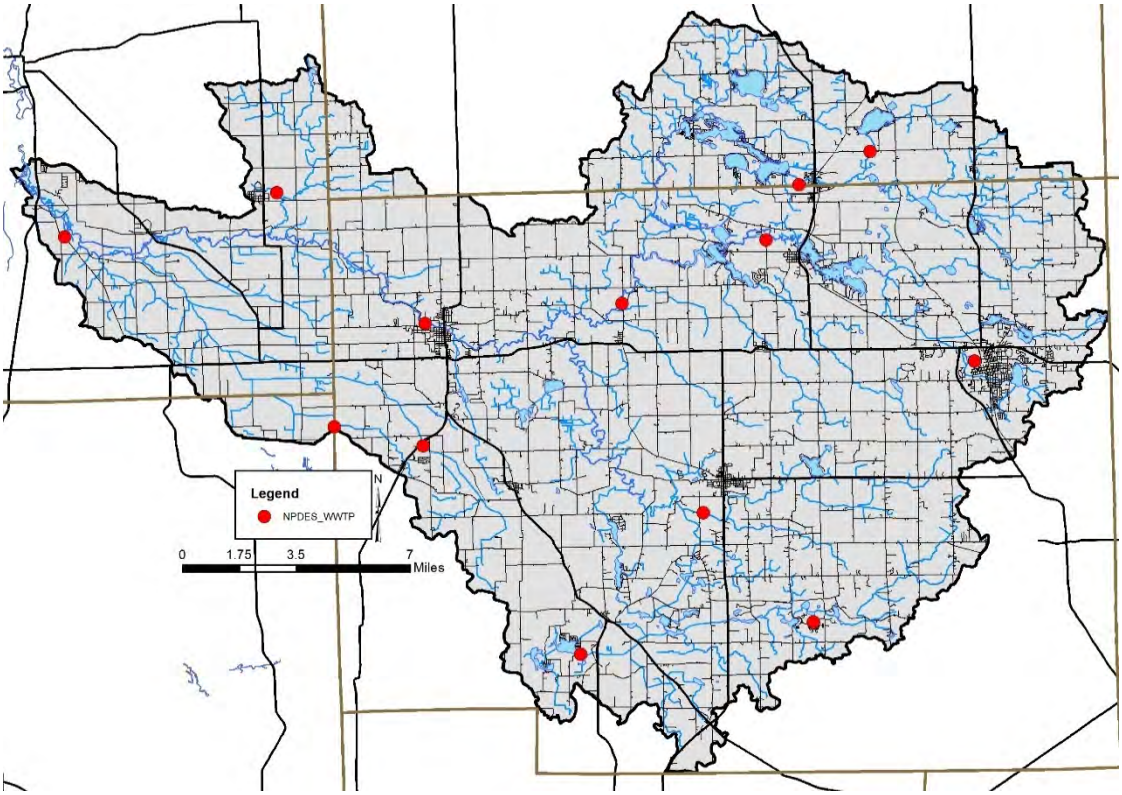


Figure 14. NPDES-regulated facilities in the Upper Elkhart River Watershed.

Table 5. NPDES-regulated facility information.

NPDES ID	Facility Name	Volume (MGD)
IN0055123	ADAMS LAKE RSD	0.069
IN0022144	ALBION WWTP	0.34
IN0038822	BEAR HIGH WOLF LAKE RSD	0.125
IN0030333	CHAIN-O-LAKES STATE PARK	0.06
IN0021814	CROMWELL WWTP	0.15
IN0020656	KENDALLVILLE WWTP	2.68
IN0023582	LIGONIER WWTP	1.5
IN0040363	MILLERSBURG WWTP	0.12
IN0058025	NEW PARIS CONSERVANCY WWTP	0.36
IN0040541	ROME CITY WWTP	0.15
IN0045802	TURKEY CREEK RSD	0.37
IN0063088	WEST LAKES RSD	0.145
IN0021229	WOLCOTTVILLE WWTP	0.25

2.6.3 Municipal Wastewater Treatment

There are 14 wastewater treatment facilities or regional sewer districts located within and discharging to waterbodies in the Upper Elkhart River Watershed including Adams Lake Regional Sewer District (RSD), Albion Waste Water Treatment Plant (WWTP), Bear High Wolf Lake RSD, Cromwell WWTP, Kendallville WWTP, Ligonier WWTP, Millersburg WWTP, New Paris Conservancy WWTP, Rome City WWTP, Skinner Lake RSD, Turkey Creek RSD, West Lakes RSD, Wolcottville WWTP and Chain-O-Lakes State Park as well as three corporate dischargers (Figure 15). The City of Kendallville WWTP facility possesses one combined sewer overflow (CSO) as stated on their website.

Adams Lake RSD currently operates a Class I-SP, 0.069 MGD (Millions of Gallons per Day) waste stabilization lagoon facility operating in controlled discharge mode. The waste stabilization lagoon facility consists of a two-cell lagoon covering 8.68 acres and holding up to 13.9 million gallons with influent and effluent flow measurement and a stream gauge. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. In January of 2021, it was noted that the Adams Lake RSD's Self-Monitoring Program was rated as unsatisfactory. At the time of the inspection, it was identified that a sample log is not being maintained. They began to rectify the monitoring issue the following week and have not been cited since.

The Town of Albion currently operates a Class I-SP, 0.34 MGD controlled discharge waste stabilization lagoon treatment facility. The facility consists of a stream gauge, an influent flow meter, a grit chamber, a fine screen, a primary treatment lagoon, two secondary treatment lagoons with fine- bubble aeration, chlorination/dechlorination facilities and an effluent flow meter. The collection system is comprised of 100% separate sanitary sewers by design with one Sanitary Sewer Overflow (SSO) and no bypass points. In August of 2021, the Town of Albion began an improvement project on their wastewater lagoons to add diffusers and additional air to Cell No. 1, relocating the inlet pipe to avoid short-circuiting and installing a baffler to further avoid short-circuiting and increase detention time. Over the course of the first quarter of 2022, the town's ammonia-nitrogen levels were higher than is allowed by their NPDES permit. There was also an instance of effluent limitation violation in January of 2022.

Bear, High and Wolf lakes currently operate a regional sewer district. The RSD is a Class I, 0.125 MGD extended aeration treatment facility consisting of screening, flow equalization, secondary clarification, post-aeration, ultraviolet light disinfection and an effluent flow meter. Sludge handling includes aerobic digestion and storage in a holding tank. Final biosolids are landfilled. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. In April of 2022, their 2019 permit was reissued to accommodate an increase in volume. The plant has a design rating of 0.125 MGD but was only permitted for 0.100 MGD. The permit was modified to reflect the design of the plant. The plant treats sustained peaks of 250,000 gallons per day with hourly peaking capabilities up to 648,000 gallons. There are currently no maintenance issues or concerns at the Bear Lake, High Lake, or Wolf Lake RSDs.

Chain-O-Lakes State Park currently operates a Class I, 0.06 MGD extended aeration treatment facility consisting of a fine screen, a bar screen, phosphorus removal, two aeration tanks, two secondary clarifiers, a sludge holding tank, ultraviolet light (UV) disinfection, an ultrasonic effluent flow meter and post-aeration. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. There are currently no maintenance issues or concerns at the Chain-O-Lakes State Park.

The Town of Cromwell currently operates a Class I, 0.15 MGD oxidation ditch-type treatment facility consisting of a bar screen, an influent flow meter, an oxidation ditch, two secondary clarifiers, post aeration, an ultraviolet light disinfection unit and an effluent flow meter. Sludge handling includes two aerobic digesters and two sludge drying beds. Biosolids are hauled to nearby permitted agricultural land for land application. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. There are currently no maintenance issues or concerns at the Town of Cromwell's WWTP.

The City of Kendallville currently operates a Class III, 2.68 MGD single-stage nitrification activated sludge plant consisting of grit removal, bar screening, primary clarification, aeration, secondary clarification, phosphorus removal, ultraviolet light disinfection, and post aeration. Sludge is to be treated by anaerobic and aerobic digesters. Sludge will be de-watered via a screw press. Final sludge is landfilled. The collection system is comprised of combined sanitary and storm sewers with one CSO location. The permit identifies the CSO overflow location as 002 and has been identified and prohibited in Attachment A of the permit. The collection system is composed of approximately 35 miles of separate storm sewers, 53 miles of separate sanitary sewers and four miles of combined sanitary and storm sewers. There is one privately owned facility near Kendallville, owned by Kraft Heinz Global Inc. (INRM00599).

As of April 2022, the Kendallville Wastewater facility had several violations and an unsatisfactory rating due to effluent discharge. There are multiple instances in the last year of high flow events, as well as trends of unhealthy biomass dating to November 2021. There was also a spike in effluent TSS and ammonia levels in February of 2022 due to the screw press being inoperable for a period of time. Due to the screw press event, the plant biology couldn't fully convert all available nitrogen, and as a result higher levels of nitrates were present in the subsequent sample. Based on the ongoing communications between the City of Kendallville WWTP and IDEM, this is not a new problem. Inspection reports noted continued BOD and TSS loading rates entering the plant which exceed the plant design criteria. These elevated loading rates cause major issues in the treatment process. IDEM and the City of Kendallville traced the issue to Kraft-Heinz which is continually discharging to Kendallville. IDEM and the City of Kendallville are working to formulate a plan to minimize loading, increase treatment capacities to treat the wastewater stream and remain in consistent compliance with the City of Kendallville NPDES permit.

The Lagrange County Regional Sewer District serves the entire county with the exception of four towns, which each have their own sewer system. The plant and discharge are located outside of the Upper Elkhart River Watershed and are therefore not detailed here. However, 646 residences and businesses around Oliver, Martin, Dallas, Hackenburg and Atwood lakes are connected to the Lagrange County RSD.

The City of Ligonier currently operates a 1.5 MGD Class III plant with grit removal, primary clarification, trickling filters, secondary clarifications, phosphorus removal by ferric chloride with a flocculation tank, post aeration and UV disinfection. Anaerobic digested biosolids are thickened by sludge drying beds. Plant design peak flow is 5.33 MGD. The Public Owned Treatment Works also serves Advanced Metal Etching (INP000119) and Carlex Glass of Indiana (INP000631). There are currently no compliance issues for the City of Ligonier's WWTP.

The Town of Millersburg currently operates a Class I, 0.12 MGD dual package extended aeration wastewater treatment facility consisting of a plant lift station, an influent flow meter, a communicator with bar screen bypass and a flow splitter box which divides the flow into two parallel aeration basins. The flow from the aeration basins flows to a common secondary clarifier, a chlorine contact tank, a sulfur dioxide gas dechlorination unit and an effluent flow meter. Sludge handling units include an aerobic

digester and two reed-type sludge drying beds. Biosolids are hauled to nearby permitted agricultural land for land application. The collection system consists of 100% separate sanitary sewers by design with no overflow or bypass points. The Millersburg WWTP was cited with a compliance issue in May of 2021 when it was found that their flow meter had not been calibrated since November 2019, when it should be recalibrated every 12 months. Recalibration occurred and the Millersburg WWTP is back in compliance.

The New Paris Conservancy District currently operates a Class II, 0.36 MGD extended aeration treatment facility consisting of an influent flow meter, a fine screen auger, four extended aeration tanks, clarifiers, ultraviolet light disinfection, an effluent flowmeter, digesters and four reed beds. Final solids are hauled off-site to a landfill or are land applied. The collection system consists of 100% separate sanitary sewers by design with no overflow or bypass points. There are currently no maintenance issues or concerns at the New Paris Conservancy District's WWTP.

The Town of Rome City currently operates a Class I, 0.15 MGD aerated lagoon treatment facility consisting of two aerated primary lagoons, chemical feed phosphorus removal, two parallel sludge settling basins, one aerated tertiary pond with tertiary drum filter, ultraviolet light disinfection and influent and effluent flow meters. The collection system consists of 100% separate sanitary sewers by design with no overflow or bypass points. There are currently no maintenance issues or concerns at the Town of Rome City's WWTP.

Turkey Creek Regional Sewer District currently operates Class I, 0.37 MGD oxidation ditch treatment facility consisting of an influent flow-meter, a grinder, grit removal, two oxidation ditches, three secondary clarifiers, chemical addition for phosphorus removal, two aerobic digesters, a septic sludge receiving tank, sand drying beds, ultraviolet light disinfection, post aeration and an effluent flow meter. Much of the Turkey Creek RSD's treatment area is located outside of the Upper Elkhart River Watershed. Waste sludge is land applied. The facility is currently undergoing upgrades which include replacement of the existing grinder with a new mechanical fine screen, addition of a second grit removal tank, addition of a fourth secondary clarifier and installation of an additional pump in the influent lift station to increase the peak hourly design flow of the facility from 1.2 MGD to 1.5 MGD. The average design flow and plant capacity rating will remain 0.37 MGD. It is also proposed to reroute flows from three lift stations within the collection system to divert flows currently conveyed to the Syracuse (approximately 0.074 MGD) and send to this facility. This work was approved under Construction Permit No. 22590 on June 18, 2018, and no permits have been published since.

The West Lakes Regional Sewer District currently operates a Class I, 0.145 MGD extended aeration treatment facility consisting of an influent flow meter, a comminutor, two extended aeration units with fine bubble diffusers, two circular secondary clarifiers, ultraviolet light disinfection, cascade post-aeration and an effluent flow meter. Sludge handling includes an aerobic digester and two sludge drying beds. Final sludge is hauled off-site and landfilled. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. The West Lakes RSD has 400 connections, all of which are located adjacent to the West Lakes. There are currently no maintenance issues or concerns at the West Lakes RSD.

The Town of Wolcottville currently operates a operate a Class II, 0.25 MGD activated sludge treatment facility consisting of fine screens, a surge tank, a two aeration tanks, two secondary clarifiers, ultraviolet light disinfection, cascade post aeration, an effluent pump station, an effluent flow meter, and aerobic sludge digestion. Sludge is hauled off-site to be disposed of at a landfill. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. The facility

does have the capability to bypass the aeration tank at the surge tank to the secondary clarifiers; however, it is anticipated to only occur in emergency situations. In October of 2020, paperwork was submitted to propose the relocation of an outfall from the current discharges to the North Branch of Elkhart River. The proposed outfall would be relocated to discharge to an unnamed tributary to West Lakes, which are within two miles downstream of the proposed outfall. The Wolcottville WWTP has had incidences of overflow in the last year, with overflows into a wetland and a private home basement, and are working on improving facility structures to rectify the issue and prevent future overflows.

2.6.4 Unsewered Areas

Approximately 2,307.5 acres of unsewered areas were identified within the watershed (Figure 15). Areas that have at least 25 houses within a square mile outside of the sanitary district boundaries were classified as dense, unsewered areas.

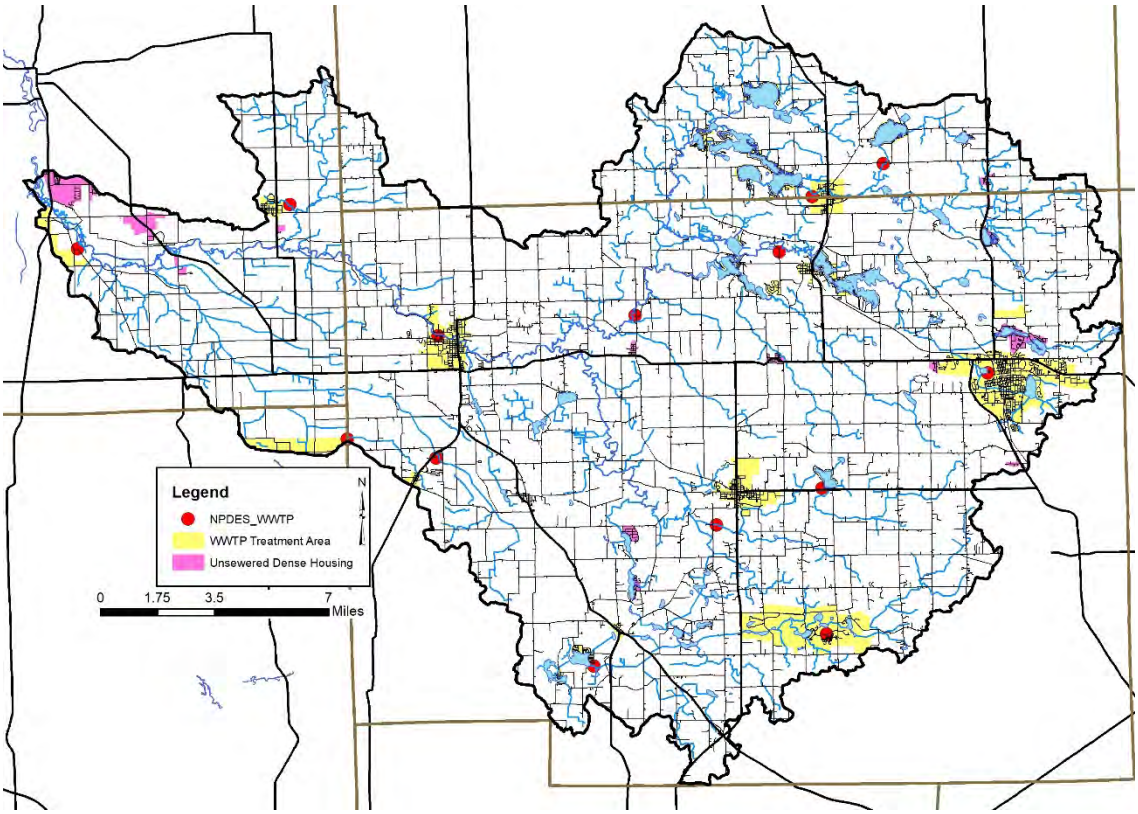


Figure 15. WWTP Treatment Areas and Unsewered Dense Housing in the Upper Elkhart Watershed.

2.7 Hydrology

Watershed streams, reservoirs, legal drains, floodplains, wetlands, storm drains, groundwater, subsurface conveyances, and manmade drainage channels all contribute to the watershed's hydrology. Each component moves water into, out of, or through the system. Their contributions will be covered in further detail in subsequent sections.

2.7.1 Watershed Streams

The Upper Elkhart River Watershed contains approximately 540 miles of perennial streams, regulated drains and artificial paths. Of these, approximately 198 miles are regulated drains, while 131 miles are artificial flow paths which flow through lakes throughout the watershed. The majority of streams in the Upper Elkhart River Watershed are not regulated. It should be noted that regulated drains are maintained by the County surveyor's office and all of the regulated drains within the watershed have both a regular maintenance fund and a regular maintenance schedule. Maintenance practices can include dredging with large construction equipment to maintain flow, debris removal, and vegetation management both within the regulated drain and the riparian zone. As these waterbodies are subject to periodic cleaning, it is important to work with the county surveyor to establish priorities for these waterbodies in terms of water quality improvement and erosion control. Each time a ditch is cleaned out or maintained, this action increases the amount of sediment going downstream towards the mainstem of the Elkhart River.

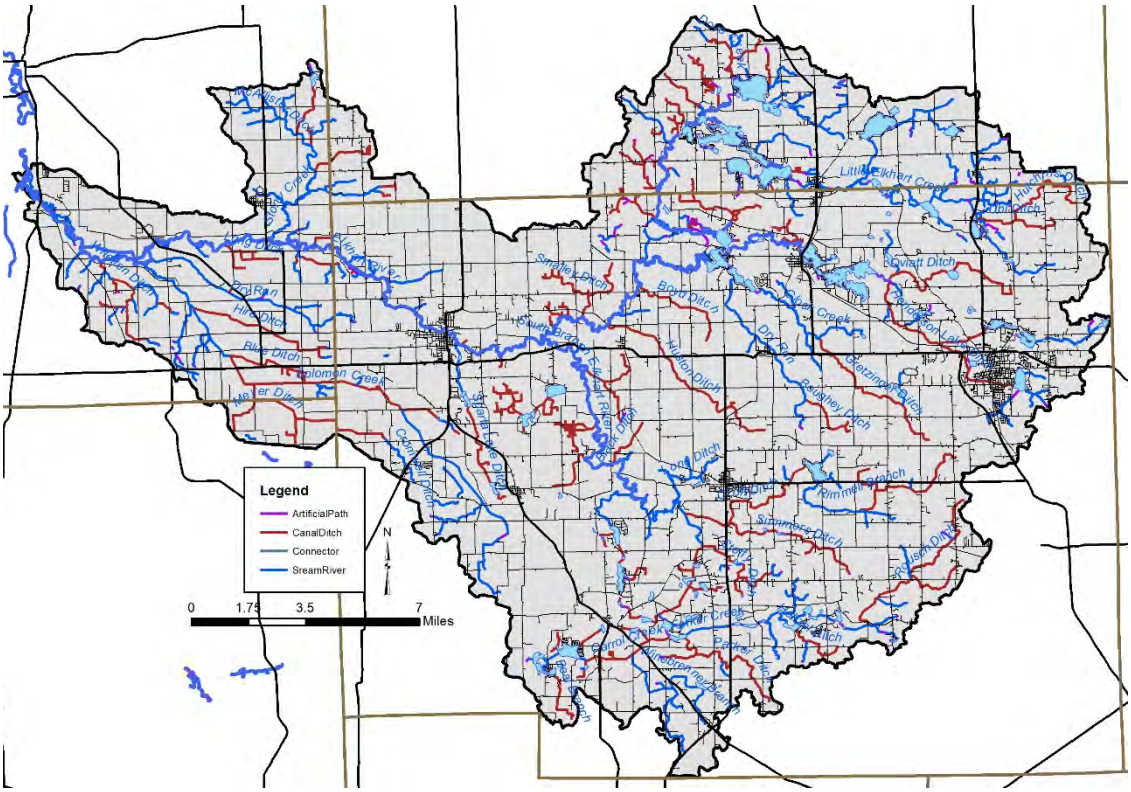


Figure 16. Waterbodies by type in the Upper Elkhart River Watershed.

The North Branch Elkhart River begins downstream of Waldron Lake and flows 18.9 miles. The South Branch Elkhart River flows begins at Port Mitchell Lake and flows 19.8 miles. When the two branches meet west of Wawaka/east of Ligonier, their confluence forms the main stem of the Elkhart River. The Elkhart River flows 26.2 miles from this point to the end of this watershed. The major tributaries to Upper Elkhart River include the North Branch Elkhart River, South Branch Elkhart River, Solomon Creek, Little Elkhart Creek, Dry Run, Huston Ditch, and Stony Creek (Table 6). The Elkhart River is used for recreational kayaking and canoeing as well as fishing, swimming and aesthetic enjoyment. Several tributaries to Upper Elkhart River Creek are also used for canoeing, kayaking, fishing and aesthetic enjoyment.

Table 6. Streams in the Upper Elkhart River Watershed.

Steam Name	Length (mi)	Stream Name	Length (mi)
Beal Branch	1.9	Long Ditch	5.2
Bixler Lake Ditch	1.8	McAllister Ditch	3.9
Black Ditch	1.7	McNutt Ditch	2.1
Blue Ditch	2.6	Meyer Ditch	3.0
Bollinger Ditch	0.9	North Branch Elkhart River	18.9
Boughey Ditch	2.1	Oliver Lake Outlet	1.5
Boyd Ditch	3.4	Oviatt Ditch	2.4
Brown Ditch	0/9	Parker Ditch	4.0
Carrol Creek	3.2	Phillips Ditch	2.1
Clock Creek	5.0	Rimmell Branch	5.2
Croft Ditch	5.6	Rousch Ditch	3.7
Cromwell Ditch	5.0	Schwab Ditch	1.9
Crothers Ditch	2.3	Smalley Ditch	2.0
Dove Creek	2.6	Solomon Creek	16.0
Dry Run	14.0	South Branch Elkhart River	19.8
Elkhart River	26.2	Sparta Lake Ditch	2.7
Forker Creek	1.5	Steffy Ditch	2.8
Gandy Ditch	1.3	Stony Creek	7.0
Gretzinger Ditch	5.4	Summers Ditch	5.1
Heltzel Ditch	2.0	Thumma Ditch	2.8
Henderson Lake Ditch	4.3	Turkey Creek	0.02
Hire Ditch	4.4	Uhl Ditch	3.0
Huston Ditch	7.0	Waterhouse Ditch	1.6
Hutchins Ditch	3.5	Whetten Ditch	1.5
Iden Branch	1.4	Winebrenner Branch	3.5
Jacobs Ditch	0.8	Worley Ditch	2.7
Juday Ditch	3.1	Yarian Ditch	2.1
Little Elkhart Creek	8.1	Unnamed Tributary	291.1

CBBEL (2020) notes that while most Indiana watersheds are dominated by surface water flows, the hydrology of the North Branch Elkhart River is dominated by groundwater. As detailed above in the geology section, much of the basin is underlain by thick (100-300 ft) deposits of sand and gravel. These sands and gravels form an extensive unconfined buried aquifer with very high transmissivity rates that recharge the river (Crompton and others, 1986; Fowler,1992). Crompton and others estimated that 80 percent of the flow in the river is supplied by these aquifers. CBBEL (2020) completed a mass balance of yearly rainfall, evapotranspiration and infiltration. Their calculations indicate that of the 38 inches of rainfall received annually, less than 2 inches is available for runoff. When runoff occurs, much of it flows through muck soils which absorbs the available water. This results in the North Branch Elkhart River being a groundwater driven system creating a more stable flow of water reaching the mainstem of the Elkhart River. Peak flows are likely mitigated by this flow pattern meaning flows are never as low or as high as they would be with a runoff driven, surface water system. Additionally, CBBEL (2020) notes that the stable, non-flashy flow in the North Branch Elkhart River leads to low erosion rates except in highly disturbed areas.

Elkhart River from Whetten Ditch to the confluence of the South Branch and North Branch of the Elkhart River is recognized as an outstanding river. The South Branch Elkhart River is also recognized as an outstanding river. These rivers are categorized as outstanding as the Elkhart River is: 1) One of 1,524 river segments identified by the National Park Service as part of the 1982 Nationwide River Inventory; 2) An outstanding river identified as part of a state assessment; 3) Considered a state heritage program site; 4) A state-designated canoe/boating route; 5) Considered a national landmark river as designated by the National Natural Landmarks; and 6) a state study river proposed for state protection or designation (NRC, 1997; Figure 17). Stakeholders are concerned with maintaining the recreational value of the Elkhart River and its tributaries due to watershed streams designated as impaired by IDEM for E. coli, nutrients, impaired biotic communities and PCBs.

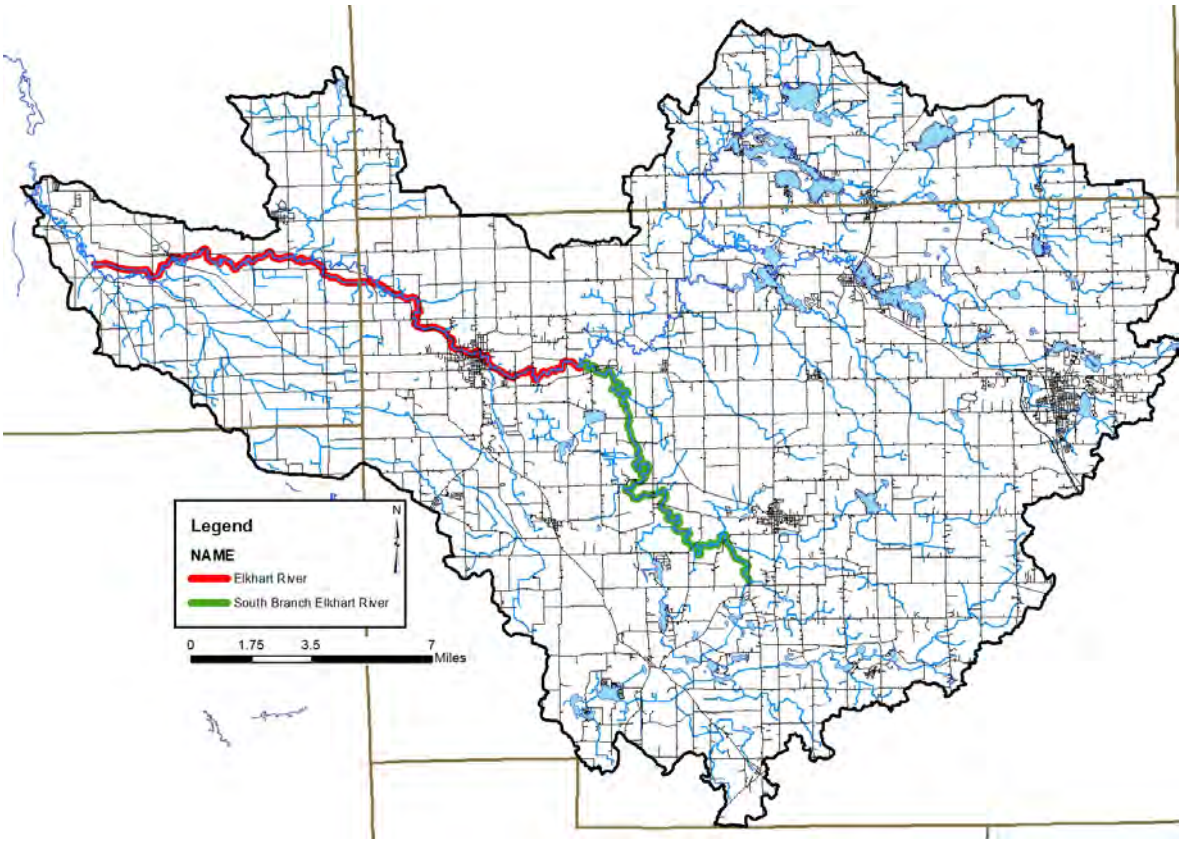


Figure 17. Outstanding rivers in the Upper Elkhart River Watershed.

2.7.2 Lakes, Ponds and Impoundments

Nearly 100 lakes and ponds dot the Upper Elkhart River Watershed landscape. The largest of these include Sylvan Lake, Dallas Lake, Waldron Lake, Oliver Lake, Adams Lake and Witmer Lake, all of which measure 200 or more acres. In total, four dam structures create Lake Maxler, Richard Greiger Lake, Lake Barbara and Sylvan Lake (Figure 18). Many other lakes in the Upper Elkhart River Watershed possess water control structures; however, these are not mapped by the IDNR as part of their dams GIS layer. Lakes throughout the watershed provide local swimming holes, recreational boating options and localized fishing as well as providing water storage and retention to assist with flooding.

Table 7 details lakes with public access sites, which are more readily used for fishing, swimming, boating and other recreation. Seven lakes are used by the Indiana BASS Federation for fishing tournaments.

These lakes include the four lakes in the West Lakes chain, Diamond Lake, Sylvan Lake, and Waldron Lake. There are also three low head dams in the Upper Elkhart Watershed, the Baintertown and Benton Dams, both of which are being considered for removal by Elkhart County Parks, and Wolcottville Town Dam.

Table 7. Publicly accessible lakes in the Upper Elkhart River Watershed.

Lake Name	Area (acres)	Lake Name	Area (acres)
Adams Lake	295.3	Long Lane	35.9
Atwood Lake	167.0	Lower Long Lane	61.7
Bear Lake	131.1	Messick Lake	65.1
Beck Lake	9.0	Olin Lake	87.9
Bixler Lake	119.91	Oliver Lake	384.3
Blackman Lake	68.8	Pleasant Lake	18.9
Cree Lake	77.1	Round Lake	95.4
Dallas Lake	396.7	Sand Lake	43.9
Diamond Lake	106.5	Silver Lake	29.5
Engle Lake	40.7	Skinner Lake	120.4
Fish Lake	34.7	Sylvan Lake	628.9
Hackenburg Lake	33.3	Tamarack Lake	82.6
High Lake	102.9	Upper Long Lake	79.8
Indian Lake	13.7	Waldron Lake	395.4
Kuhns Lake	6.3	Witmer Lake	233.1
Latta Lake	37.5	Wolf Lake	13.4
Little Long Lake	71.6		

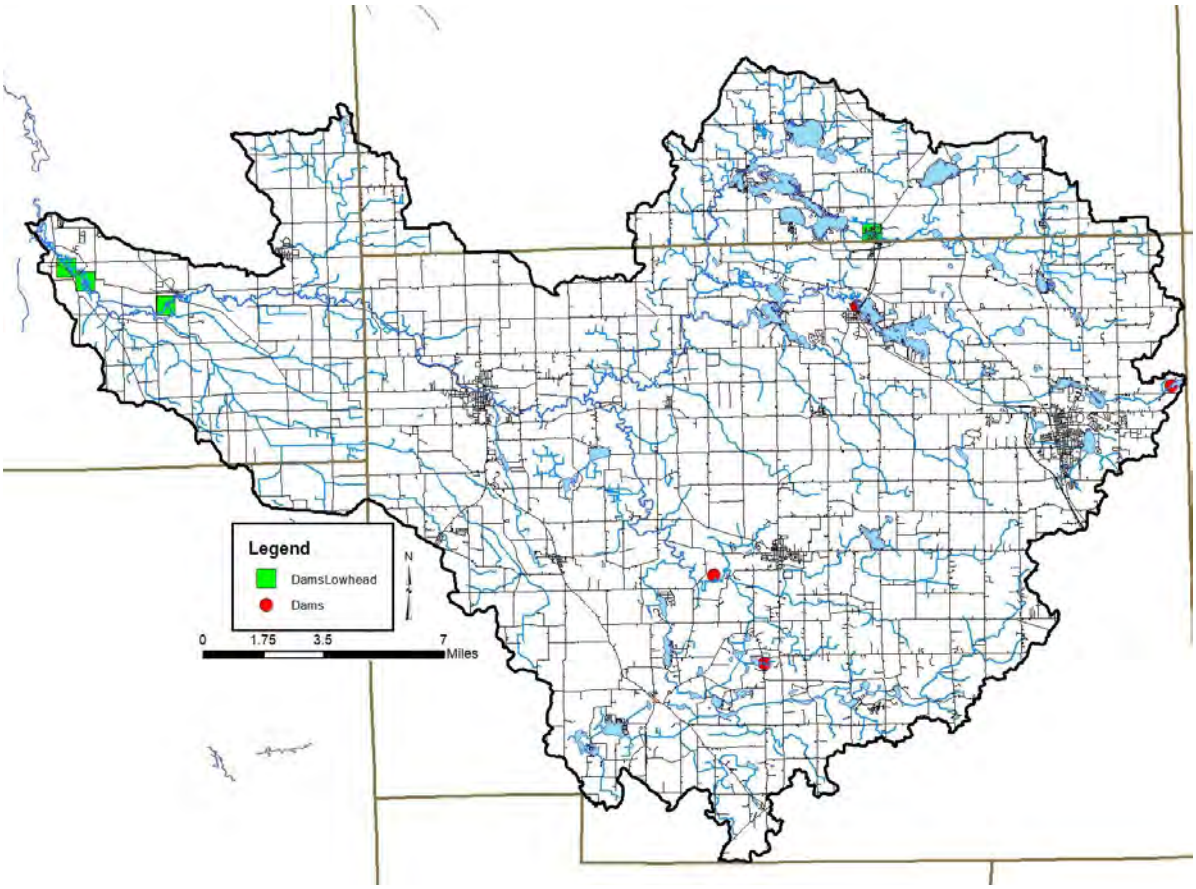


Figure 18. Dams including lowhead dams located in the Upper Elkhart River Watershed.

In an effort to assess stream flow capacity of the North Branch Elkhart River and its floodplain, CBBEL (2020) developed a model to detail how flow moves through the system. CBBEL notes that the North Branch is a groundwater flow system and thus their surface water model is a substitute for a groundwater system. While all details of their effort are not repeated here, it should be noted that each lake reduces the peak discharge flowing from the lake which allows the lake to act as flood storage. In total, more than 2,100 acre-feet of flood storage is provided by the Oliver Lake Chain, Indian or Five Lakes Chain, Sylvan Lake and the West Lakes Chain. Additionally, CBBEL reviewed annual peak flow rates from the Cosperville stream gage noting it varies from 200 to 900 cfs with the last five years of record measuring higher than any other time during the 50 years of record (Figure 19). Additionally, CBBEL reviewed the number of days that lakes measure one foot or more above the legal lake level for both the West Lakes and Indian/Five Lakes Chain (Figure 20). CBBEL notes that the volume of rainfall does not correlate with the number of days above legal lake level.

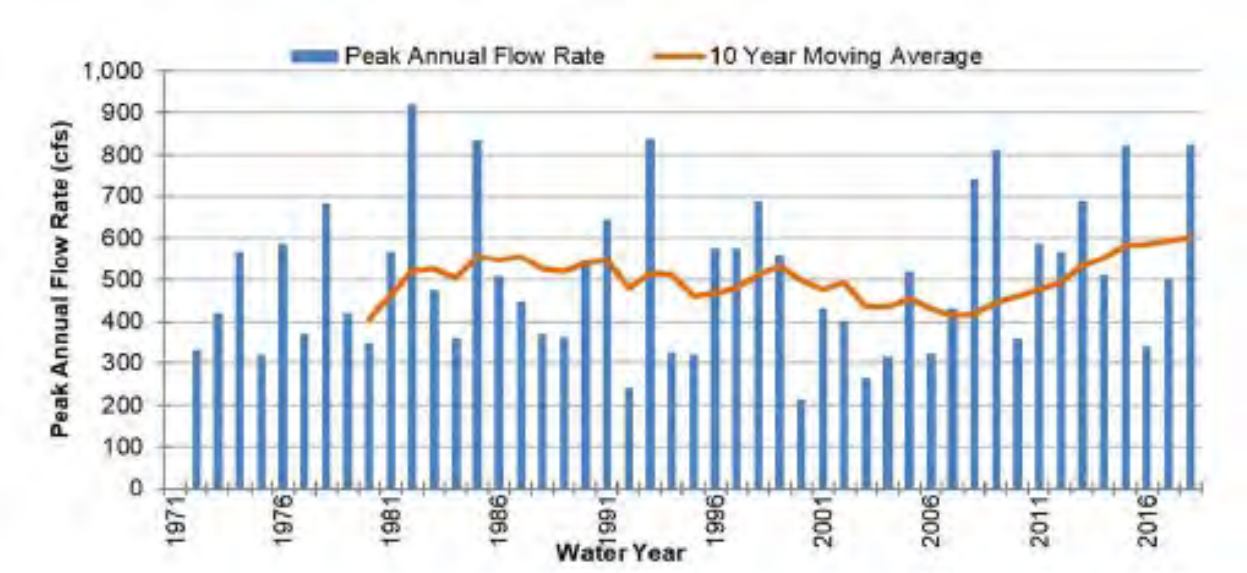


Figure 19. Peak annual flow rate at North Branch Elkhart River at Cosperville, IN USGS gage (CBBEL, 2020).

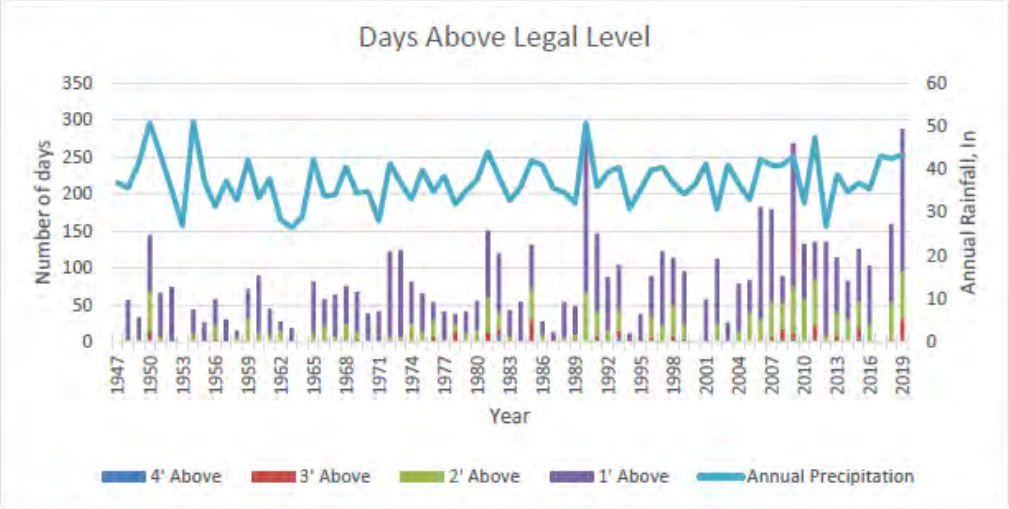


Figure 18: West Lakes Chain - Number of Days above Legal Lake Level

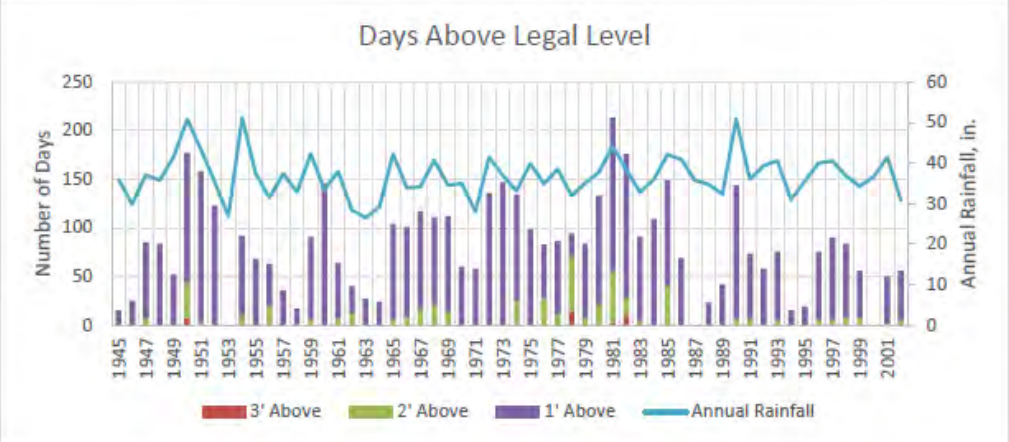


Figure 19: Indian Lakes Chain - Number of Days above Legal Lake Level

Figure 20. Days above legal lake level in the West Lakes Chain and Indian Lakes Chain (CBBEL, 2020).

2.7.3 Floodplains

Flooding is a common hazard that can affect a local area or an entire river basin. Flooding is a concern to Upper Elkhart River Watershed stakeholders. Increased imperviousness, encroachment on the floodplain, deforestation, stream obstruction, tiling or failure of a flood control structure all are mechanisms by which flooding occurs. Impacts of flooding include property and inventory damage, utility damage and service disruption, bridge or road impasses, streambank erosion and riparian vegetation loss, water quality degradation, and channel or riparian area modification.

Floodplains are lands adjacent to streams, rivers and other waterbodies that provide temporary storage for water. These systems act as nurseries for wildlife, offer green space for humans and wildlife, improve water quality, and buffer the waterbody from adjacent land uses. Local stakeholders are concerned about impacts to floodplains from development, lack of landowner maintenance, and soil erosion and deposition within the floodplain.

Figure 21 details the locations of floodplains within the Upper Elkhart River Watershed. Narrow floodplains lie adjacent to Little Elkhart Creek, Solomon Creek, the mainstem of the Elkhart River, South Branch Elkhart River, Bixler Lake, Sylvan Lake, Tamarack Lake, West Lakes, and several unnamed tributaries. The widest floodplain lies adjacent to the South Branch Elkhart River's confluence with the North Branch Elkhart River. Approximately 8% (19,780 acres) of the Upper Elkhart River Watershed lies within the 100-year floodplain (Figure 21). This 100-year floodplain is composed of three regions:

- Zone A is the area inundated during a 100-year flood event for which no base flood elevations (BFE) have been established. Nearly 5,064 acres (2%) of the Upper Elkhart River Watershed floodplain is in Zone A.
- Zone AE is the area inundated during a 100-year flood event for which BFEs have been determined. The chance of flooding in Zone AE is the same as the chance of flooding in Zone A; however, floodplain boundaries in Zone A are approximated, while those in Zone AE are based on detailed hydraulic models which allows Zone AE floodplains to be more accurate. Nearly 14,716 acres (6%) of the Upper Elkhart River Watershed floodplain is in Zone AE.
- Zone X includes areas outside the 100-year and 500-year floodplains which have a 1% chance of flooding to a depth of one foot of water. No BFEs are available for these areas and no flood insurance is required.

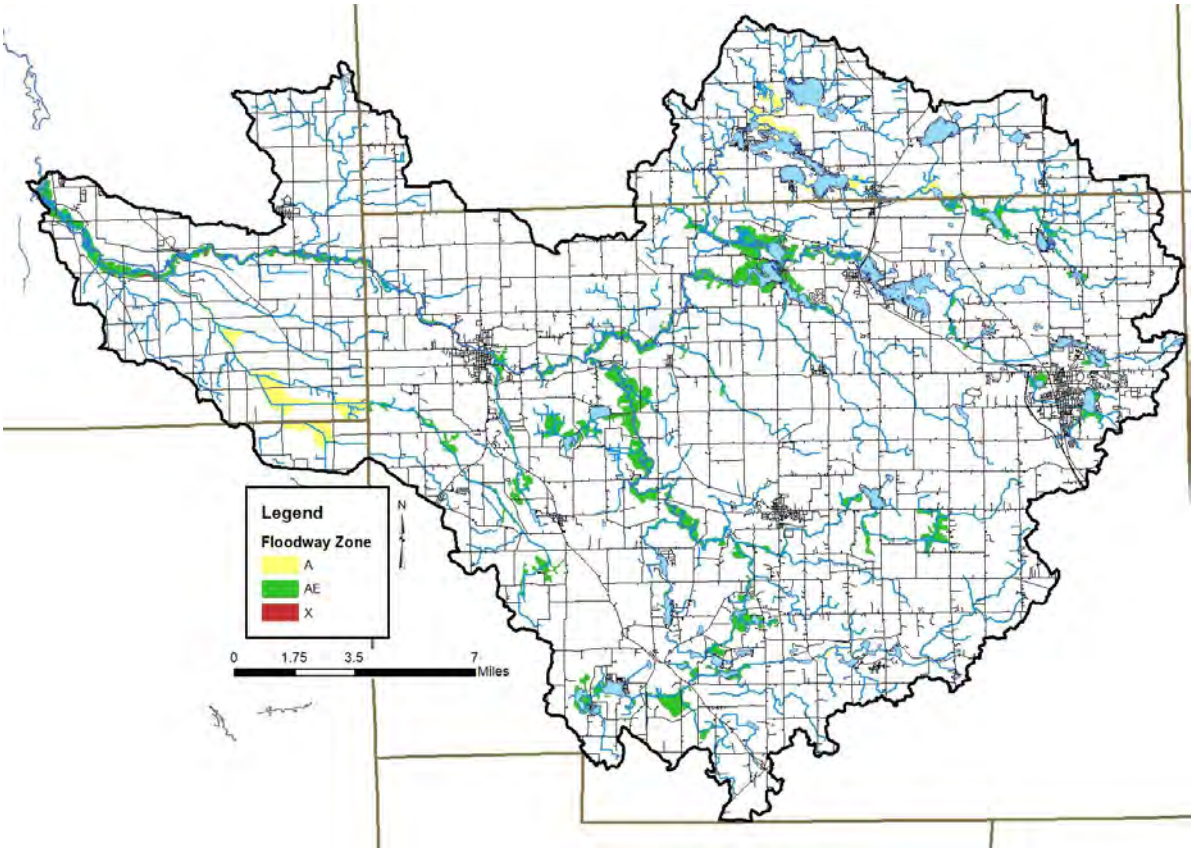


Figure 21. Floodplain locations within the Upper Elkhart River Watershed.

2.7.4 Wetlands

Approximately 25% of Indiana was covered by wetlands prior to European settlement (IDEM, 2007). Overall, 85% of wetlands have been lost resulting in Indiana ranking fourth in the nation in terms of percentage of wetland loss. Wetlands provide numerous valuable functions that are necessary for the

health of a watershed and waterbodies. Wetlands play critical roles in protecting water quality, moderating water quantity, and providing habitat. Wetland vegetation adjacent to waterways stabilizes shorelines and streambanks, prevents erosion, and limits sediment transport to waterbodies. Additionally, wetlands have the capacity to increase stormwater detention capacity, increase stormwater attenuation, and moderate low water levels or flow volumes by allowing groundwater to slowly seep back into waterbodies. These benefits help to reduce flooding and erosion. Wetlands also serve as high quality natural areas providing breeding grounds for a variety of wildlife. They are typically diverse ecosystems which can provide recreational opportunities such as fishing, hiking, boating, and bird watching. It should be noted that natural wetlands are regulated through the IDEM and the U.S. Army Corps of Engineers while USDA has jurisdiction over wetlands on agricultural fields. Any modification to wetlands requires permits from these agencies.

Wetlands cover only 45,018 acres, or 17%, of the watershed. When hydric soil coverage is used as an estimate of historic wetland coverage, it becomes apparent that more than 39% of wetlands have been modified or lost over time. This represents more than 28,200 acres of wetland loss within the Upper Elkhart River Watershed. As commodity prices continue to go up and down, area land values remain high and as a result, individuals are spending a great deal of money to drain small natural wetlands in their fields in order to be able to farm that additional couple acres of land as it is cheaper to tile it than to buy ground already in production.

Figure 22 shows the current extent of wetlands within the Upper Elkhart River Watershed. Wetlands displayed in Figure 22 results from compilation efforts by the U.S. Fish and Wildlife Service as part of the National Wetland Inventory (NWI). The NWI was not intended to map specific wetland boundaries that would compare exactly with boundaries derived from ground surveys. As such, NWI boundaries are not exact and should be considered to be estimates of wetland coverage. Using this map will help us to identify which portions of the watershed would make ideal candidates for wetland restoration efforts, which would reduce the amount of sediment and nutrients reaching the creek, as well as helping to restore the natural hydrology of the area which could help to reduce flooding impacts locally.

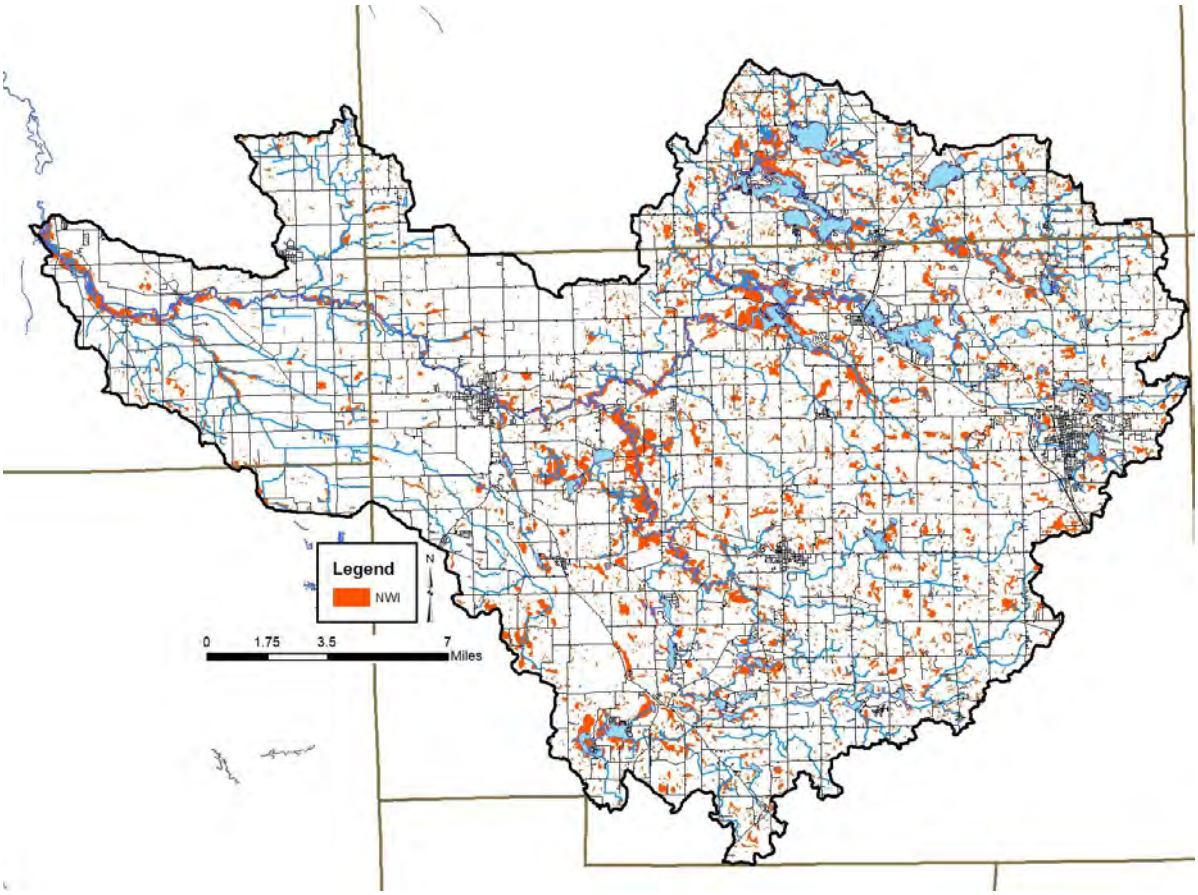


Figure 22. Wetland locations within the Upper Elkhart River Watershed. Source: USFWS, 2017.

2.7.5 Stormwater and Storm Drains

Under natural conditions, the majority of precipitation is allowed to infiltrate the soil and recharge groundwater resources. The volume of infiltration and groundwater recharge diminishes as development increases. To handle the large volume of precipitation falling in urban areas, stormwater systems have been constructed. Storm drain systems are present in most urban areas throughout the watershed. There are two municipal separate storm sewer systems (MS4) in the Upper Elkhart River Watershed: City of Kendallville and Elkhart County. MS4s are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying stormwater. Regulated conveyance systems include roads with drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels and conduits. It does not include CSOs and publicly owned treatment works. Figure 23 details the MS4 boundaries for the City of Kendallville MS4 and the Elkhart County MS4.

The City of Kendallville MS4 covers incorporated Kendallville. The Elkhart County MS4 is managed by the Elkhart County Stormwater Partnership which is a cooperative effort covering the town of Bristol, the City of Elkhart, the City of Goshen and Greater Elkhart County. Both the City of Kendallville and Elkhart County Stormwater Partnership have plans which include six minimum control measures and outlines programs to improve the quality of stormwater that runs off of the land and into rivers, lakes, and streams within their boundaries. More than 24,714 acres of the Upper Elkhart River Watershed are located in one of the two designated MS4s (Table 8).

Table 8. MS4 communities in the Upper Elkhart River Watershed.

MS4 Community	Permit ID	Area (Acres)
City of Kendallville	INR040012	3,688
Elkhart County Stormwater Partnership	INR040137	36,147

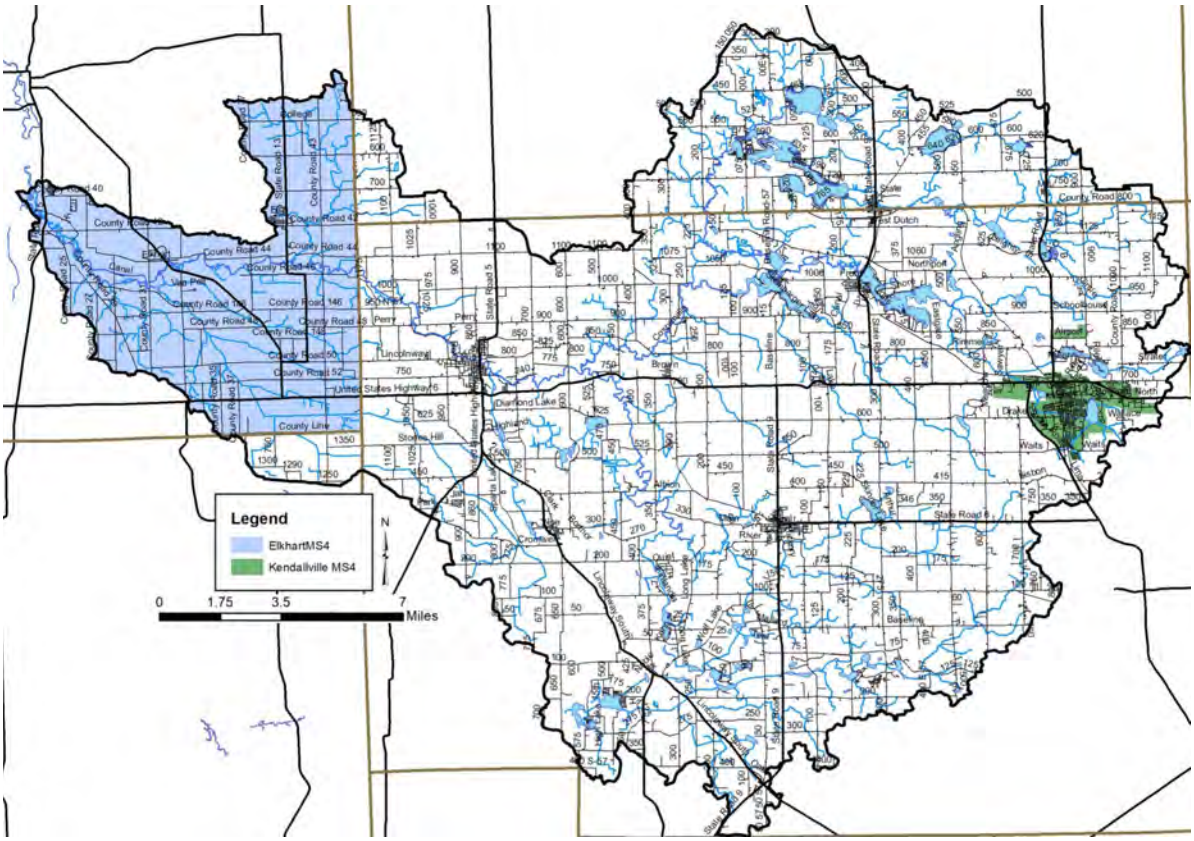


Figure 23. MS4 boundaries for the City of Kendallville and the Elkhart County Stormwater Partnership located within the Upper Elkhart River Watershed.

2.7.6 Wellfields/Groundwater Sensitivity

Recharge to the bedrock aquifer occurs at bedrock outcrops where precipitation enters the aquifer directly or indirectly via unconsolidated deposits. Table 9 lists wellhead protection areas within and adjacent to the Upper Elkhart River Watershed. Potential pollution from construction, sewage outfalls or overflows, illegal dumping, agriculture, and stormwater runoff must be avoided or controlled due to the recharge of these aquifers from runoff and river water.

Table 9. Wellhead protection areas in and adjacent to the Upper Elkhart River Watershed.

County	PWSID	System Name	Population
Elkhart	5220015	Millersburg Water Company	907
Lagrange	5244010	Wolcottville Water Works	1,035
Noble	5257001	Albion Water & Sewer	2,349
Noble	5257004	Cromwell Water Works	550
Noble	5257006	Eagles Nest Estates	350
Noble	5257008	Kendallville Water Department	9,905
Noble	5257010	Ligonier Water Works	4,405
Noble	5257011	Northport Mobile Home Park	47
Noble	5257016	Sunset Vue Mobile Home Park	51
Noble	5257022	Lakeland Manor Mobile Home Park	66
Noble	5257023	Chain-O-Lakes Correctional Facility	186
Noble	5257024	Rome city Housing Auth. – Warrener Court	94
Noble	5257026	Leisure Lane Mobile Home Park	31

2.8 Natural History

Geology, climate, geographic location, and soils all factor into shaping the native flora and fauna which occurs in a particular area. Categorization of these floral and faunal communities has been completed by a number of ecologists since the earliest efforts by Coulter in 1886. Since this time, Petty and Jackson (1966) identified regional communities; Homoya et al. (1985) classified Indiana into natural regions, while Omernik and Gallant (1988) categorized Indiana into ecoregions.

2.8.1 Natural and Ecoregion Descriptions

According to Homoya et al.'s (1985) classification of natural regions in Indiana, the Upper Elkhart River Watershed lies within the Northern Lakes Section Region (Figure 24). The Northern Lakes section natural region is best identified by the numerous freshwater lakes of glacial origin which were formed by the Wisconisian age ice sheet. As a result, the area is also covered with a thick and complex deposit of glacial material which, in places, is over 450 feet thick. Glacial topography can be characterized by knobs, kettles, kames, valley trains and outwash plains.

The Upper Elkhart River Watershed also lies in the Southern Michigan/Northern Indiana Drift Plains Ecoregion as defined by Omernik and Gallant (1988). The SMNID plains ecoregion is defined as broad till plains with thick and complex deposits of drift, paleo beach ridges, relict dunes, morainal hills, kames, drumlins, meltwater channel, and kettles. This region could be further classified into two sub-regions. The first sub-region is Ecoregion 56a, Lake Country. The Lake Country ecoregion is a hummocky and pitted morainal area characterized by many pothole lakes, ponds, marshes, bogs and clear streams. The well-drained end moraines and kames once supported oak-hickory forests with wetter areas including beech forests or northern swamp forests. The very poorly drained kettles had tamarack swamp, cattail-bulrush marshes or sphagnum bogs. Today, marshes and woodland remain but corn, soybean and livestock farming are dominant. Additionally, recreational and residential developments commonly surround the lakes of Ecoregion 56a. Lake Country covers the northeastern portion of the watershed. Ecoregion 56b, Elkhart Till Plains, cover the remainder of the watershed. This ecoregion is punctuated by end moraines, kames and lacustrine flats.; Kettle hole lakes occur in the Elkhart Till Plains ecoregion, but are much rarer than in the Lake Country ecoregion. Oak-hickory forests and beech maple forests once dominated the Elkhart Till Plains ecoregion; however, corn, soybean, and wheat farming is more extensive than woodland in present day. The Elkhart Till Plains ecoregion is fairly diverse as it is also

covered with bog, fen, marsh, prairie, sedge meadow, swamp, seep spring, lake and various deciduous forest types. Streams of this sub-region are typically clear, medium to low-gradient, and have sandy gravel beds.

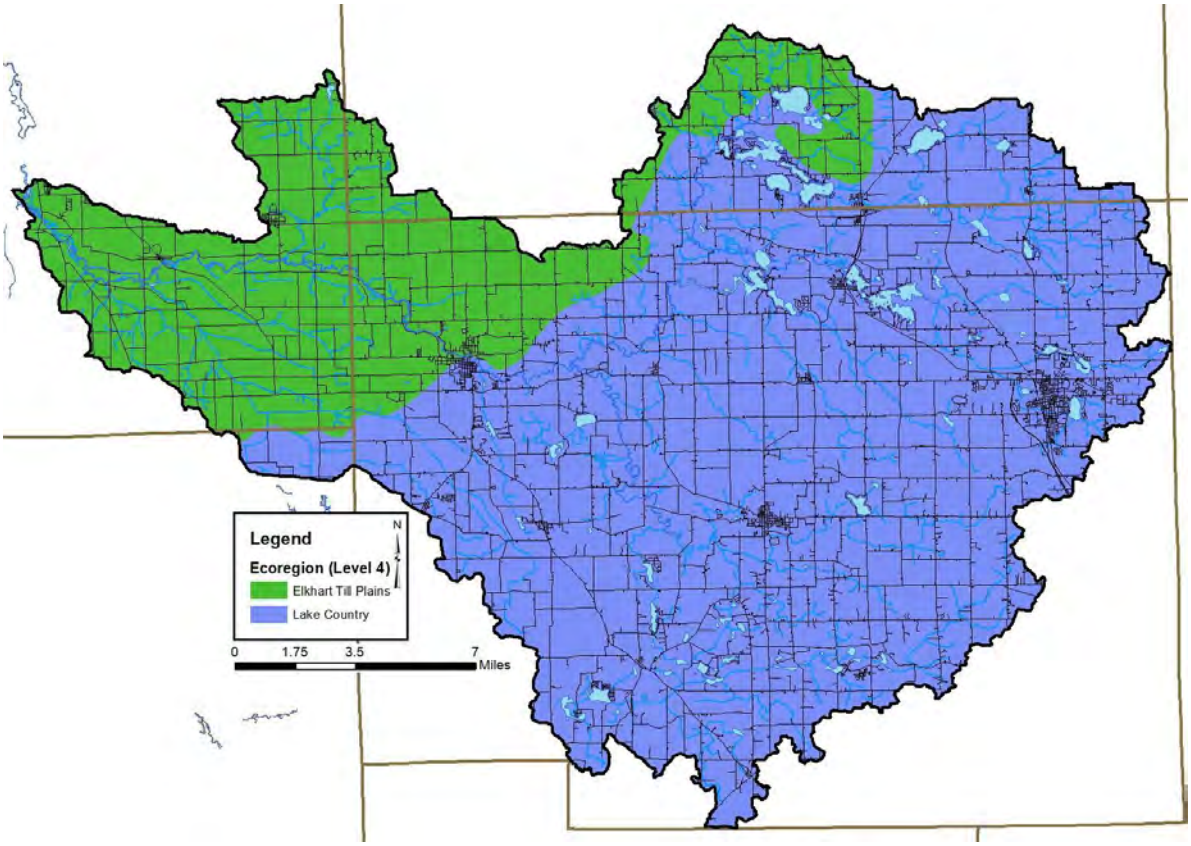


Figure 24. Level 3 eco-regions in the Upper Elkhart River Watershed.

2.8.2 Wildlife Populations and Pets

Individuals are concerned about local wildlife and pet populations, the impact that these have on pathogen levels and the impact that changing land uses could have on these populations. These will be quantified in subsequent sections. With these concerns in mind, wildlife density can be estimated from a variety of sources. The Indiana Department of Natural Resources (IDNR) is tasked with managing wildlife populations throughout the state. In order to complete this task, the IDNR must have an idea of the population density within specific areas, counties, or regions. The most recent survey of wildlife populations for which data are publicly available occurred in 2005. Those densities are shown in Table 10 with deer, squirrels and turkey being the most common wildlife present within the region. It should be noted that these numbers could both underestimate and overestimate populations within the watershed. Densities are recorded based on animal observations per 1000 hours of overall observation. If observation areas are not equally spread throughout the region, over or underestimates of the populations could occur. Likewise, animals are not likely equally distributed throughout the region; therefore, the regional density may again over or underestimate the true density of the animal in question. Nonetheless, these estimates provide the best guess at wildlife densities. Wildlife waste will be an issue in the more natural, forested or wetland portions of the watershed.

Table 10. Surrogate estimates of wildlife density in the IDNR northeast region, which includes the Upper Elkhart River Watershed.

Animal	2005 Population Observation (per 1,000 hours of observation)
Badger	0.4
Bobcat	0.2
Bobwhite	31.1
Coyote	14.4
Deer	1,038.2
Fox squirrel	564.5
Gray fox	0.2
Gray squirrel	61.8
Grouse	0.7
Domestic cat	24.8
Muskrat	3.7
Opossum	8.3
Rabbit	29.9
Raccoon	53.5
Red fox	8.5
Skunk	10.2
Turkey	205.7

Source: Plowman, 2006.

Pet populations can affect pathogen levels similar to the impacts provided by wildlife. While a count of pets for the Upper Elkhart River Watershed was not completed, dog and cat populations were estimated for the watershed as part of the Upper Elkhart River Watershed Management Plan. Statistics reported in the 2012 U.S. Pet Ownership & Demographics Sourcebook were used to find these figures. Specifically, the Sourcebook reports that on average 36.5 percent of households own dogs and 30.4 percent of households own cats. Typically, the average number of pets per household is 1.6 dogs and 2.1 cats. However, pets are likely only a significant source of E. coli in population centers including Kendallville, Albion, Rome City and Ligonier. The estimated number of domestic pets in the Upper Elkhart River Watershed is based on the average number of pets per household multiplied by the population of the watershed resulting in a suggested population of 91,997 cats and 91,433 dogs. Pet waste issues are more predominant in the urban areas noted above but are also present at any residential parcel.

2.8.3 Endangered Species

The Indiana Natural Heritage Data Center, part of the Indiana Department of Natural Resources, Division of Nature Preserves, maintains a database documenting the presence of endangered, threatened, or rare species; high quality natural communities; and natural areas in Indiana. The database originated as a tool to document the presence of special species and significant natural areas and to assist with management of said species and areas where high quality ecosystems are present. The database is populated using individual observations which serve as historical documentation or as sightings occur; no systematic surveys occur to maintain the database.

The state of Indiana uses the following definitions to list species:

- Endangered: Any species whose prospects for survival or recruitment with the state are in immediate jeopardy and are in danger of disappearing from the state. This includes all species

classified as endangered by the federal government which occur in Indiana. Plants currently known to occur on five or fewer sites in the state are considered endangered.

- Threatened: Any species likely to become endangered within the foreseeable future. This includes all species classified as threatened by the federal government which occur in Indiana. Plants currently known to occur on six to ten sites in the state are considered threatened.
- Rare: Plants and insects currently known to occur on eleven to twenty sites.

In total, 296 observations of listed species and/or high-quality natural communities occurred within the Upper Elkhart River Watershed (Figure 25; Davis, personal communication). These observations include three invertebrates, 79 vascular plants, 35 vertebrate animals, including two bat species, 18 birds, two turtle and three snake species, as well as 55 terrestrial high quality natural terrestrial communities including Mesic Floodplain Forest, wet Floodplain Forest, Wet-mesic Floodplain Forest, Northern Lakes Dry-mesic Upland Forest, Northern Lakes Dry Upland Forest, Lake, Pond, Marl Beach, Acid Bog, Circumneutral Bog, Fen, Forested Fen, Marsh, Sedge Meadow, Forested Swamp, and Shrub Swamp. State endangered species include the Upland Sandpiper, American Bittern, Henslow's Sparrow, barn owl, cisco (fish), Dorcas Copper (insect), Indiana Bat, Evening bat, spotted turtle, Blanding's turtle, copperbelly water snake, eastern massasauga, Butler's garter snake, bristly sarsaparilla, wild calla, softleaf sedge, mud sedge, Clinton's woodfern, horse-tail spikerush, purple avens, American water-pennywort, pale vetchling peavine, smooth veiny pea, green adder's-mouth orchid, yellow fringe orchid, Eastern prairie white-fringed orchid, Oakes' pondweed, hooded ladies'-tresses, horned bladderwort, northeastern bladderwort, northern wild-raisin, highbush-cranberry. While state threatened species include red baneberry, bog rosemary, white camas, cuckoo flower, Bebb's sedge, thinleaf sedge, scarlet hawthorn, small white lady's-slipper, small yellow lady's slipper, Hickey's clubmoss, tree clubmoss, Leiberg's witchgrass, spoon-leaved sundew, Robbins' spikerush, slender cotton-grass, green-keeled cotton-grass, bog bedstraw, yellow gentian, great St.John's-wart, tamarack, tall millet-grass, whorled water-milfoil, leafy northern green orchid, small purple-fringe orchid, bog bluegrass, white-stem pondweed, redheadgrass, straight-leaf pondweed, fire cherry, alderleaf buckthorn, autumn willow, purple pitcher-plant, shining lady's-tresses, rushlike aster, false asphodel, lesser bladderwort, small cranberry. State rare species include: midwestern fen buckmoth. These species are found in high quality natural areas identified in the Upper Elkhart River Watershed as well as in forests, wetlands and other natural areas throughout the watershed. Appendix A includes the database results for the Upper Elkhart River Watershed, as well as County-wide listings for Elkhart, Noble, Kosciusko, and Lagrange counties.

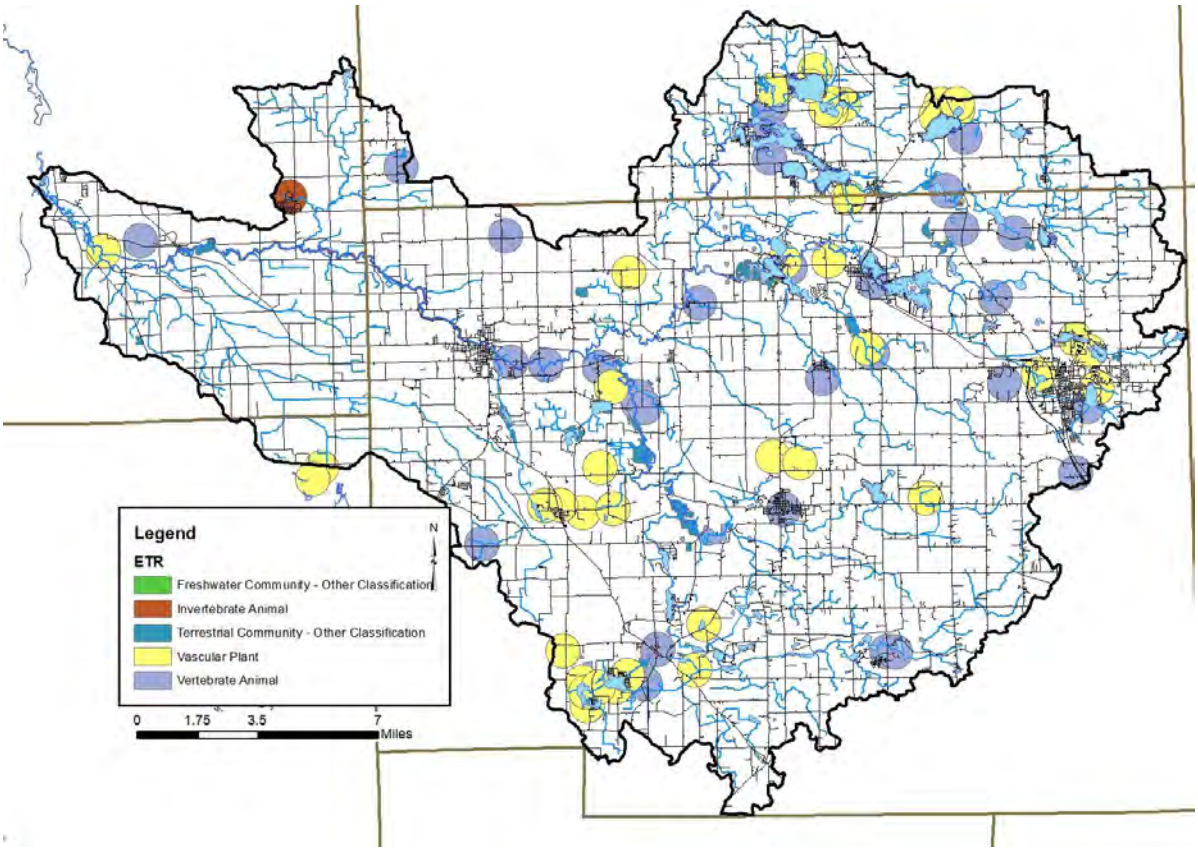


Figure 25. Locations of special species and high quality natural areas observed in the Upper Elkhart River Watershed. Source: Davis, 2021.

2.8.4 Recreational Resources and Significant Natural Areas

A variety of recreational opportunities and natural areas exist within the Upper Elkhart River Watershed. Recreational opportunities include state and local parks, fish and wildlife areas, nature preserves, fairgrounds, golf courses and school grounds (Table 11, Figure 26). There are several significant natural areas located within the Upper Elkhart River Watershed. The Indiana DNR, The Nature Conservancy, ACRES Trust, Lagrange County, Cromwell, Kendallville, Rome City and Ligonier Park Boards and Goshen College maintain, preserve and protect these properties. There are many lake public access sites maintained by the Indiana DNR. Additional recreational opportunities exist at Goshen College, various schools and recreational facilities.

Table 11. Natural areas in the Upper Elkhart River Watershed.

Natural Area	County	Organization	Access
Adams Lake Public Access Site	Lagrange	DNR Fish & Wildlife Division	Open
Atwood Lake Public Access Site	Lagrange	DNR Fish & Wildlife Division	Open
Bear Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open
Bender (Lloyd W.) Managed Area	Noble	ACRES Land Trust, Inc	Restricted
Bender (Lloyd W.) Nature Preserve	Noble	ACRES Land Trust, Inc	Open
Chain O' Lakes State Park	Noble	DNR State Parks & Reservoirs	Open
Clock Creek	Noble	The Nature Conservancy	Restricted
Cree Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open
Cromwell Park	Noble	Cromwell Park Board	Open

Natural Area	County	Organization	Access
Curtis Wetland Conservation Area	Noble	DNR Fish & Wildlife Division	Open
Dallas Lake Park	Lagrange	Lagrange Co. Parks & Rec.	Open
Eagle Lake Wetlands Conservation Area	Noble	DNR Fish & Wildlife Division	Restrictions
Engle Lake Access Site	Noble	DNR Fish & Wildlife Division	Open
Fish Lake (Elkhart) Public Access Site	Elkhart	DNR Fish & Wildlife Division	Open
Gene Stratton Porter State Historic Site	Noble	DNR State Museum & Historic Sites	Open
Hammer (Art) Wetlands Addition	Noble	ACRES Land Trust, Inc	Open
Hammer (Art) Wetlands Nature Preserve	Noble	ACREA Land Trust, Inc	Open
Kelly Street Park	Noble	Rome City Park Board	Open
Kendallville Fairgrounds	Noble	Kendallville Park Board	Open
Leacock Woods	Elkhart	The Nature Conservancy	Open
Little Long Lake Public Access Site	Noble	Unknown	Unknown
Lonidaw Nature Preserve	Noble	ACRES Land Trust, Inc	Open
Mainland Park	Noble	Rome City Park Board	Open
Mallard Roost Wetland Conservation Area	Noble	DNR Fish & Wildlife Division	Restrictions
Martin Kenny Memorial Park	Noble	Ligonier Park Board	Open
Martin Lake Nature Preserve	Lagrange	ACRES Land Trust, Inc	Open
Mendenhall Wetland Conservation Area	Noble	DNR Fish & Wildlife Division	Restrictions
Merry Lea Nature Preserve	Noble	Goshen College	Open
Northport Feeder Dam	Noble		Restricted
Olin Lake (Raber Tract TNC)	Lagrange	The Nature Conservancy	Restricted
Olin Lake Managed Area	Lagrange	DNR Nature Preserves	Restricted
Olin Lake Nature Preserve	Lagrange	DNR Nature Preserves	Open
Oliver Lake Access Site	Lagrange	DNR Fish & Wildlife Division	Open
Rome City Wetland Conservation Area	Noble	DNR Fish & Wildlife Division	Restrictions
Round Lake Wetlands	Noble	ACRES Land Trust, Inc	Open
Sacarider Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open
Skinner Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open
Skinner Lake Surplus Parcel	Noble	DNR Fish & Wildlife Division	Restricted
Sparta Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open
Spurgeon (Edna W.) Nature Preserve	Noble	ACRES Land Trust, Inc	Open
Swamp Angel Nature Preserve	Noble	The Nature Conservancy	Restricted
Sylvan Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open
Upper Long Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open
West Lakes Conservacy Inc Tract	Elkhart	DNR Fish & Wildlife Division	Restrictions
Westler Lake Public Access Site	Lagrange	DNR Fish & Wildlife Division	Open
Whirledge Wetlands Conservation Area	Noble	DNR Fish & Wildlife Division	Restrictions
William Malle Memorial Public Access Site	Noble	DNR Fish & Wildlife Division	Open
Wolf Lake Public Access Site	Noble	DNR Fish & Wildlife Division	Open

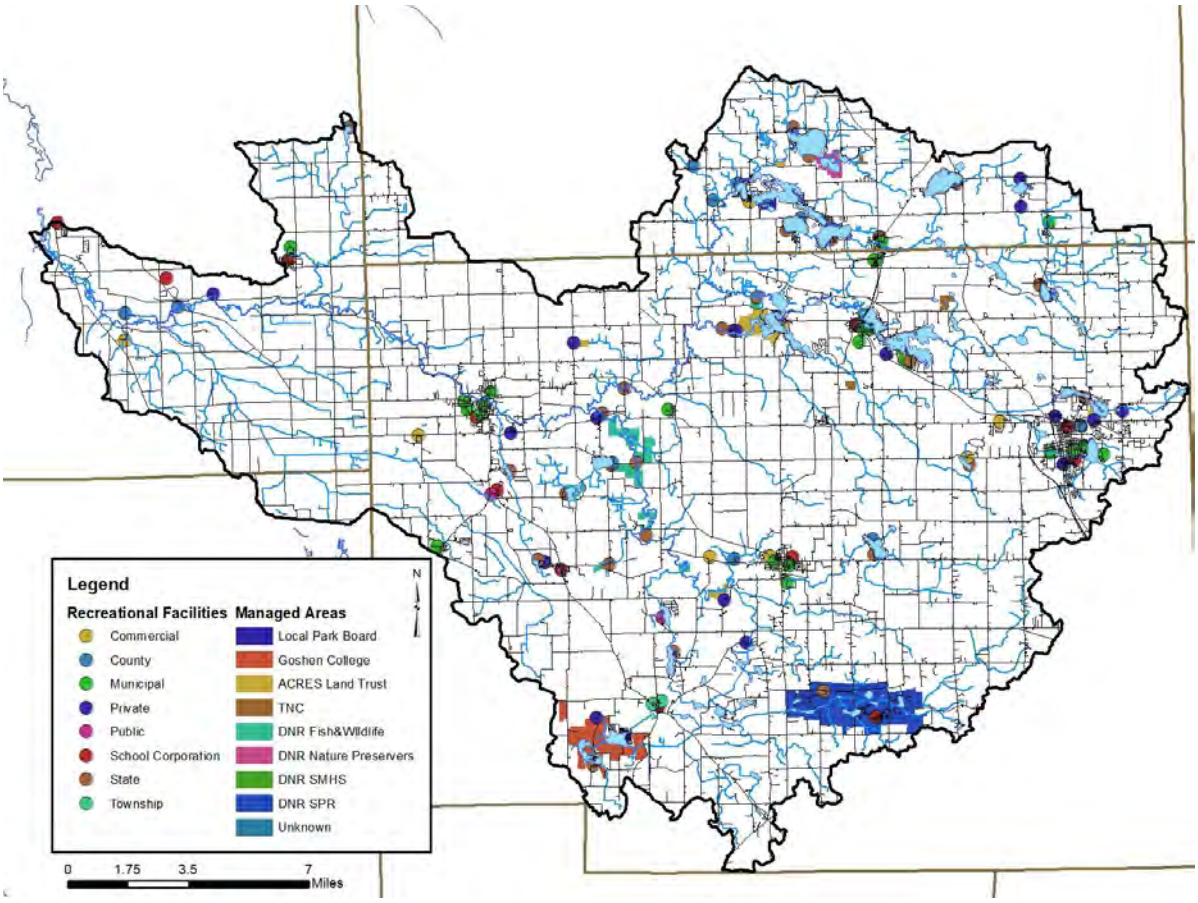


Figure 26. Recreational opportunities and natural areas in the Upper Elkhart River Watershed.

2.9 Land Use

Water quality is greatly influenced by land use both past and present. Different land uses contribute different contaminants to surface waters. As water flows across agricultural lands, it can pick up pesticides, fertilizers, nutrients, sediment, pathogens and manure, to name a few. However, when water flows across parking lots or from roof tops it not only picks up motor oil, grease, transmission fluid, sediment and nutrients, but it reaches a waterbody faster than water flowing over natural or agricultural land. Hard or impervious surfaces present in parking lots or on rooftops create a barrier between surface and groundwater. This barrier limits the infiltration of surface water into the groundwater system resulting in increased rates of transport from the point of impact on the land to the nearest waterbody.

2.9.1 Current Land Use

Today, the majority of the Upper Elkhart River Watershed is covered by agricultural land uses (173,561.6 acres or 67%; (Table 12, Figure 27) which consists of pastureland (18,689.3 acres or 7%) and row crop agriculture (154,872.3 acres or 60%). Nearly 16% of the watershed is mapped in open water and wetlands. Developed open space and low, medium and high density developed land covers 8% of the watershed, while forest and grassland covers the remaining 8% of the watershed.

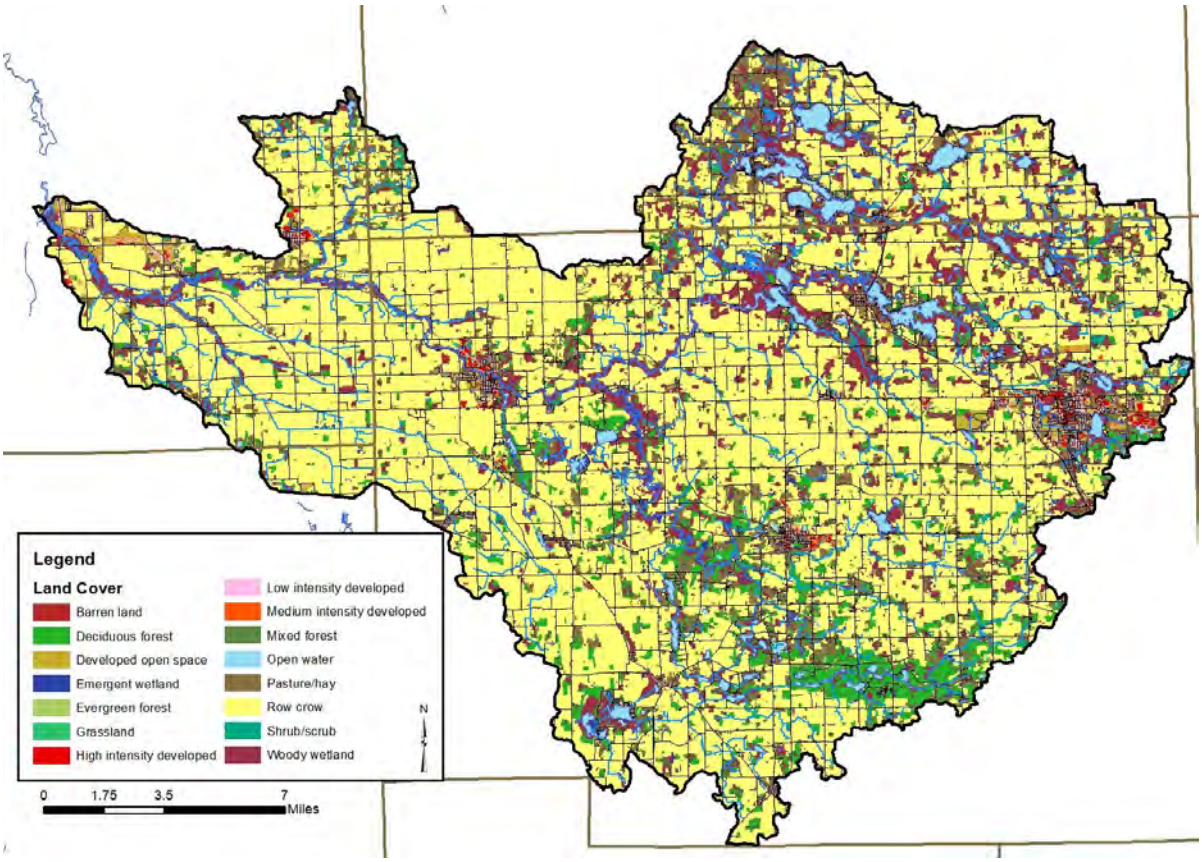


Figure 27. Land use in the Upper Elkhart River Watershed. Source: NLCD, 2016.

Table 12. Detailed land use in the Upper Elkhart River Watershed.

Classification	Area (acres)	Percent of Watershed
Cultivated crop	154,872	60%
Woody wetland	34,781	14%
Pasture/hay	18,690	7%
Deciduous forest	17,701	7%
Developed open space	12,320	5%
Open water	6,125	2%
Low intensity developed	5,987	2%
Emergent wetland	2,657	1%
Medium intensity developed	1,520	0.6%
Mixed forest	1,270	0.5%
Shrub/scrub	1,399	0.5%
High intensity developed	717	0.2%
Grassland	398	0.1%
Evergreen forest	386	0.1%
Barren land	125	0.0%
Entire Watershed	258,948	100%

Source: USGS, 2016

2.9.2 Agricultural Land Use

Individuals are concerned about the impact of agricultural practices on water quality. Specifically, the volume of exposed soil entering adjacent waterbodies, the prevalence of tiled fields and thus the transport of chemicals into waterbodies, the use of agricultural chemicals, and the volume of manure applied via small animal farms and through confined animal feeding operations are concerning to local residents. Each of these issues will be discussed in further detail below.

Tillage Transect

Tillage transect information data for Elkhart, Kosciusko, Lagrange and Noble counties was compiled for 2021 (Table 13; ISDA, 2023 A-B). As reported by ISDA, members of Indiana's Conservation Partnership (ICP) conduct a field survey of tillage methods. A tillage transect is an on-the-ground survey that identifies the types of tillage systems farmers are using and long-term trends of conservation tillage adoption using GPS technology, plus a statistically reliable model for estimating farm management and related annual trends. Table 13 provides the number of acres and percent of acres on which conservation tillage was utilized for each county by corn and soybeans. These numbers may be an underestimate due to the timing of tillage transects in each county.

Table 13. Conservation tillage data as identified by County tillage transect data for corn and soybeans (ISDA, 2023).

County	Corn (%)	Soybeans (%)
Elkhart	51%	68%
Kosciusko	33%	52%
Lagrange	52%	73%
Noble	83%	92%

Agricultural Chemical Usage

Agricultural pesticides and fertilizers are commonly applied to row crops in Indiana. These chemicals can be carried into adjacent waterbodies through surface runoff and via tile drainage. This is especially an issue if a storm occurs prior to the chemicals being broken down and used by the crops.

Data for chemical usage on an individual County or watershed level are not currently collected. Rather, data is collected for the state as a whole in two forms. First, the National Agricultural Statistics Survey (NASS) collects information on chemical usage, number of applications per year, type of chemical applied, and the application rate. These data were last collected in 2006 (NASS, 2006). Additionally, NASS collects farmland data for the number of acres in agricultural production by type (i.e. corn, soybeans, grains) by County (NASS, 2021). These data indicate that corn (297,996 acres planted in Elkhart, Lagrange, Kosciusko and Noble counties) and soybeans (233,750 acres planted in Elkhart, Lagrange, Kosciusko and Noble counties) are the two primary crops grown in the watershed.

Nitrogen is more typically applied to corn than to soybeans. Soybeans have symbiotic bacteria on their roots that act as nitrogen fixers, which means that they pull the nitrogen that they need from the atmosphere then convert it into a form which they can use. Corn does not fix nitrogen; therefore, nitrogen needs to be applied. Nitrogen is typically applied twice in Indiana – once at or before planting and a second time when corn reaches approximately one foot in height (NASS, 2007). Fall application of nitrogen also occurs and is particularly problematic. Agricultural data indicate that corn receives 98% of the nitrogen applied in the state and 87% of the phosphorus. For these reasons, nutrient calculations were only completed for corn as applications to soybeans are likely negligible. Based on these data, it is

estimated that 21,962 tons of nitrogen and 10,864 tons of phosphorus are applied annually within the counties in which the Upper Elkhart River Watershed is located (Table 14).

Table 14. Agricultural nutrient usage for corn in the Upper Elkhart River Watershed counties.

Nutrient	Acres of Corn	% of Area Applied	Applications (#/year)	Rate/Application (lb/acre)	Total Applied/Year (tons)
Nitrogen	297,996	100	2.2	67	21,962
Phosphorus	297,996	93	1.4	56	10,864

Source: NASS, 2007; NASS, 2021

Pesticides are also used on crops grown in Indiana. The Office of the Indiana State Chemist indicates that the two predominant herbicide active ingredients applied are atrazine and glyphosate. Atrazine is most commonly applied as a corn herbicide, while glyphosate is used on both corn and soybean fields as an herbicide. NASS indicates that in 2005, an average of 1.24 pounds of atrazine and 0.6 pounds of glyphosate were applied per acre of corn and 0.73 pounds of glyphosate were applied per acre of soybeans (NASS, 2006). Using these rates, we estimated that a little over 185 tons of atrazine and approximately 174 tons of glyphosate are applied to cropland in the Upper Elkhart River Watershed counties annually (Table 15).

Table 15. Agricultural herbicide usage in the Upper Elkhart River Watershed counties.

Crop	Acres	Application Rate (lb/acre)	Total Applied (lbs)	Total Applied/Year (tons)
Corn (Atrazine)	297,996	1.24	369,515	185
Corn (Glyphosate)	297,996	0.60	178,798	89
Soybeans (Glyphosate)	233,750	0.73	170,637	85

Source: NASS, 2006; NASS, 2021

Confined Feeding Operations and Hobby Farms

A mixture of small, unregulated and larger, regulated livestock operations (concentrated animal and confined feeding operations) is found within the Upper Elkhart River Watershed. Small farms are those which house less than 300 animals, while larger farms that house large numbers of animals for longer than 45 days per year are regulated by IDEM. These regulations are based on the number and type of animals present. IDEM requires permit applications which document animal housing, manure storage, and disposal and nutrient management plans for farms which maintain 300 or more cows, 600 or more hogs or 30,000 or more fowl. These facilities are considered confined feeding operations (CFO). In Indiana, all regulated animal feeding operation are considered CFOs. The difference between a CFO and a concentrated animal feeding operation (CAFO) relates to the size of the operation. A CFO that meets the size classification as a CAFO is a farm that meets or exceeds an animal threshold number in the U.S. Environmental Protection Agency's definition of a large CAFO, which is 700 mature dairy cows, 1,000 veal calves, 1,000 cattle other than mature dairy cows, 2,500 swine above 55 pounds, 10,000 swine less than 55 pounds, 500 horses, 10,000 sheep or lambs, 55,000 turkeys, 30,000 laying hens or broilers with a liquid manure handling system, 125,000 broilers with a solid manure handling system, 82,000 laying hens with a solid manure handling system, 30,000 ducks with a solid manure handling system or 5,000 ducks with a liquid manure handling system.

There are 13 CAFOs and 25 CFOs located in the watershed (Figure 28). In total, these facilities are permitted to house up to 127,726 pigs, 259 beef cattle, 6,630 dairy cattle, 262,105 chickens, 100 sheep and 194 horses. In total, 794 small, unregulated animal farms containing more than 13,170 animals were identified during the windshield survey, which is most likely an underestimate of the actual number. These small "mini farms" contain small numbers of cattle, horses, bison, sheep or goats, which could be sources of nutrients and E. coli as these animals exist on small acreage lots with limited ground cover. In total, approximately 410,188 animals per year are housed in CAFOs, CFOs and on unregulated farms in the watershed, generating approximately 963,298 tons of manure per year spread over the watershed. This volume of manure contains approximately 8,692,474 pounds of nitrogen, 6,883,014 pounds of phosphorus and 5.49E+19 col of E. coli.

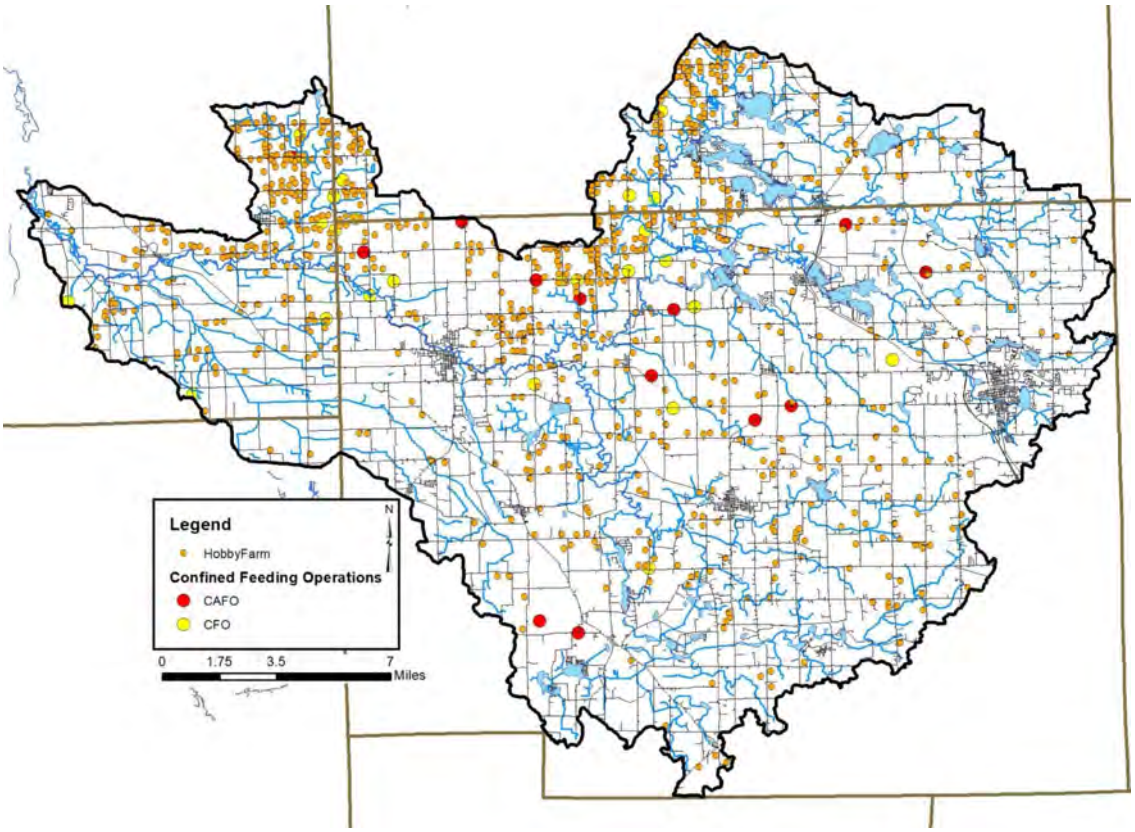


Figure 28. Confined feeding operation and unregulated animal farm locations within the Upper Elkhart River Watershed.

2.9.3 Natural Land Use

Natural land uses including forest, wetlands, and open water cover approximately 25% of the watershed. Approximately 18,917 acres or 7% of the watershed is covered by trees. Forest cover occurs adjacent to waterbodies throughout the watershed.

2.9.4 Urban Land Use

Urban land uses cover approximately 20,544 acres or 8% of the watershed (Table 12). Most developed areas are associated with the Cities of Kendallville and Ligonier, as well as the various lake communities in the northern portion of the watershed. Although this is only a small portion of the watershed, there are some significant issues related to the developed areas. Especially troublesome are issues related to

failing septic systems, impervious surfaces, flooding and stormwater runoff that allow untreated sewage and stormwater to flow into the watershed during heavy rain events.

2.9.5 Impervious Surfaces

Impervious surfaces are hard surfaces which limit surface water from infiltrating into the land surface to become groundwater thereby creating high overland flow rates. Hard surfaces include concrete, asphalt, compacted soils, rooftops, and buildings or structures. In developed areas, land which was once permeable has been covered by hard, impervious surfaces. This results in rain which once absorbed into the soil running off of rooftops and over pavement to enter the stream with not only higher velocity but also higher quantities of pollutants. There are also two MS4 Communities in the watershed, covering more than 24,713 acres of the Upper Elkhart River Watershed.

2.9.6 Legacy Pollutant Remediation Sites

Remediation sites including industrial waste, leaking underground storage tanks (LUST), open dumps and brownfields are present throughout the Upper Elkhart River Watershed (Figure 29). Most of these sites are located within the developed areas of the watershed including Wolcottville, Ligonier, Albion, Rome City and Kendallville. In total, 32 industrial waste sites (RCRA), 150 underground storage tanks of which 67 are considered LUST facilities, five voluntary remediation project (VRP) locations, three solid waste sites and six brownfields are present within the watershed.

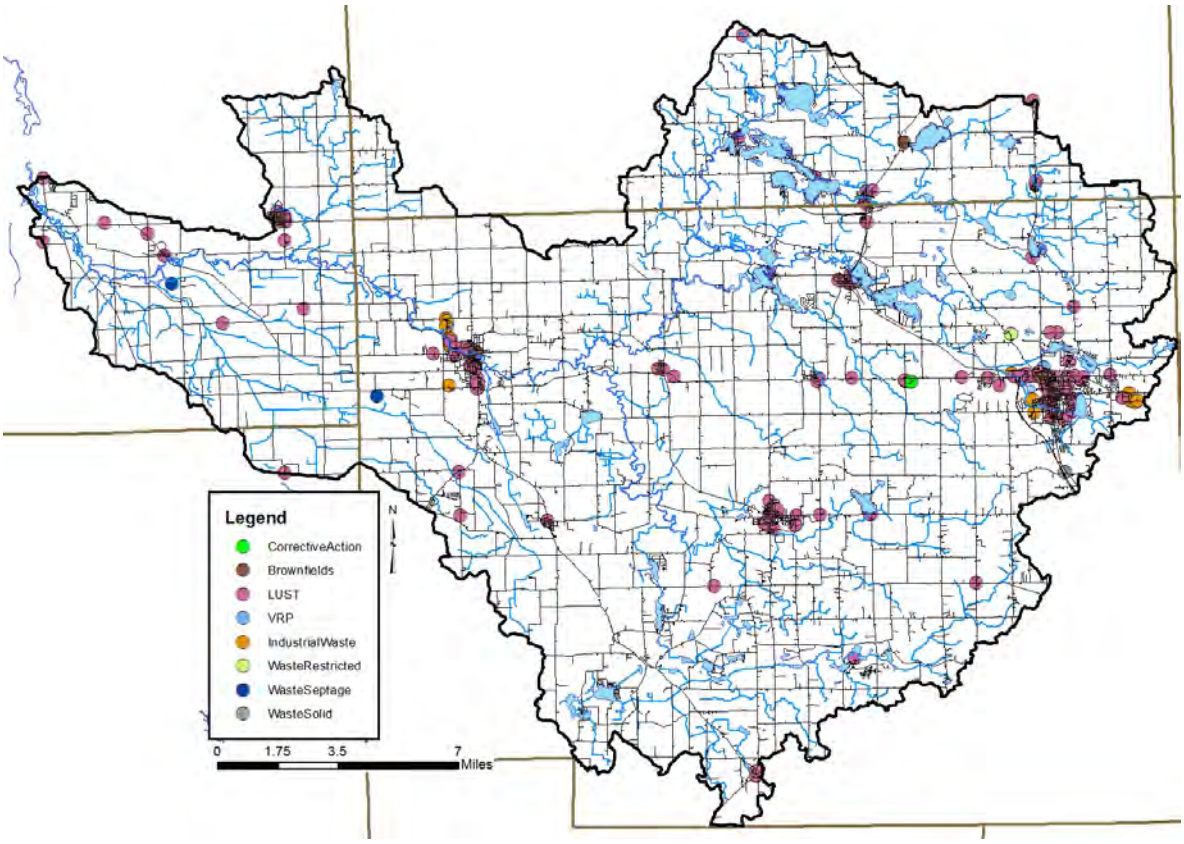


Figure 29. Industrial remediation and waste sites within the Upper Elkhart River Watershed.

2.10 Population Trends

The Upper Elkhart River Watershed is a mix of relatively sparsely populated areas and urban centers in general. The City of Kendallville, City of Ligonier and Town of Albion house the highest density populations. Table 16 details the population of each County in the Upper Elkhart River Watershed. These data indicate that three of the counties, Elkhart, Kosciusko and Lagrange, are growing; however, Noble County saw a decrease in population from 2010 to 2020. The steering committee identified that development can be sources of pollutants including sediment, nutrients and pathogens.

Table 16. Population data for counties in the Upper Elkhart River Watershed.

County	2000	2010	2020
Elkhart	182,791	197,559	207,047
Kosciusko	74,057	77,358	80,240
Lagrange	34,909	37,128	40,446
Noble	46,275	47,536	47,457

Tracking population changes within a watershed is challenging as data is published by counties and townships rather than watershed boundaries. Changes in watershed population and the associated land use changes and infrastructure impacts were noted by watershed stakeholders. Estimated populations in the Upper Elkhart River Watershed indicate that 86% of the population is rural residents while 14% of the population reside in urban locations. Table 17 displays estimated populations for the portion of each County located within the watershed (US Census data, 2020).

Table 17. Estimated watershed demographics for the Upper Elkhart River Watershed.

County	2020 Population	Total Estimated Watershed Population	Total Estimated Watershed Urban Population	Total Estimated Watershed Rural Population	Percent of Total Watershed Population
Elkhart	207,047	28,987	0	28,987	14.0%
Kosciusko	80,240	883	0	883	1.1%
Lagrange	40,446	5,096	957	4,139	12.6%
Noble	47,457	34,311	19,832	14,479	72.3%
Total	**375,190**	**69,277**	**20,789**	**48,488**	**100%**

2.11 Planning Efforts in the Watershed

Multiple plans have encompassed portions of the Upper Elkhart River Watershed or areas which it drains or outlets into. Planning efforts cover three main areas: 1) Project-focused planning efforts where a specific area or portion of the Upper Elkhart River Basin was assessed and specific water quality improvement projects identified, 2) Flow-based assessments and planning efforts, and 3) Comprehensive plans. Plans are listed in chronological order.

2.11.1 Project-Focused Planning Efforts

Bixler Lake Feasibility Study (1990)

In May of 1990, International Science & Technology, Inc. (IS&T) submitted a report to the Kendallville Parks and Recreation Department concerning the restoration of Bixler Lake. This glacially formed water body experienced accelerated sedimentation in the late 1980s. In 1986, IDEM placed Bixler Lake in its Class Two category of intermediate quality lakes. The water bodies in this class are known to be adversely

impacted by human activities and are moving slowly toward moderate to advanced stages of eutrophication. Recommendations created by IS&T concluded through this study included:

- Review wastewater treatment and park runoff management plans to ensure adequate capacity for peak use periods and implement appropriate maintenance routines; and install any new septic systems in appropriate soil types, with adequate distance buffers between leach fields and lake/tributary systems.
- Apply BMPs including encouraging the use of agricultural BMPs, protecting wetland areas (especially along tributaries) that act as sediment/nutrient filters for incoming pollutants, implementing effective erosion control measures at construction sites and in residential areas and developing and enforcing appropriate zooming and development planning regulations for controlling the production of off-site pollutants.
- Perform in-lake restoration as needed including aquatic plan treatment only to impact navigational problems, following management recommendations for aquatic plants and assessing the lake's fishery to monitor carp population growth as needed.

Sylvan Lake Feasibility (1990)

In May of 1990, Crisman submitted a feasibility report to the Sylvan Lake Improvement Association. Sylvan Lake is a eutrophic lake in Noble County composed of four interconnected basins. Water quality began to deteriorate early in the 20th century associated with untreated sewage from the town of Kendallville so that by the 1930's, management problems were apparent for algal and macrophytes and the gamefish population was being altered. The lake has been the subject of several management investigations including a series of winter drawdowns during the 1970s and a fish eradication program in 1984. The most dramatic improvement to water quality occurred as a result of the latter, and macrophytes have begun to recolonize the lake after a prolonged period of near total absence. Crisman (1990) noted that the principal contributing factors for the eutrophication of Sylvan Lake has been the sewage from the town of Kendallville and runoff from agricultural areas of the watershed. Together, these factors contribute an estimated 59% of total phosphorous loading annually to Sylvan Lake. Crisman (1990) recommended the following:

- Expand the wetland at the eastern end of Gravel Put Basin to serve as a nutrient trap for the principal streams entering the lake.
- Identify additional wetland construction sites along Henderson Lake Ditch to trap nutrients from the town of Kendallville.
- Consider restoration of Henderson Lake in any future lake or watershed planning efforts as this lake receives the sewage from Kendallville it has becoming increasingly infilled in recent years and will act as a significant nutrient load to Sylvan Lake for decades via sediment release of phosphorus even if the nutrient loading from Kendallville is totally eliminated.

Cree and Schockopee Feasibility Study (1990)

In October of 1990, IS&T submitted a report to the Cree Lake Association of Kendallville concerning the restoration of Cree and Schockopee Lakes. Cree Lake experienced accelerated loss of depth and severe plant grown problems in the canal system located along the lake's southeastern shore. Schockopee Lake, also glacially formed, is situated directly upstream from Cree Lake and exerts considerable influence on the quality of the Cree system. In the 1970's, IDEM placed both lakes in its Class Two category of intermediate-quality lakes. The water bodies in this class are known to be adversely impacted by human activities and are moving slowly toward moderate to advanced stages of eutrophication. Recommended actions created by IS&T included:

- Become familiar with agricultural BMPs and work with the local NRCS District Conservationist, Noble County SWCD, and IDNR to encourage area farmers to install appropriate BMPs in locations deemed critical for preserving the quality of the lake resources.
- Homeowners along the main body and canal system of Cree Lake should review alternatives to the current septic system arrangement.
- Initiate a design study for the removal of the organic sediments in the Cree Lake canal system. It is recommended that the canals be dredged down to the original hard bottom.

Ten Lakes Feasibility Study (1992)

In February 1993, F. X. Browne Associates, Inc. (FXBrowne) prepared a feasibility study for the South-Central Lagrange County Water Quality commission. This report presents the water quality and modeling results for the LARE T by 2000 studies of ten Indiana chain lakes in Lagrange County. These ten lakes include Adams Lake, Atwood Lake, Dallas Lake, Hackenburg Lake, Martin Lake, Messick Lake, Olin Lake, Oliver Lake, Westler Lake and Witmer Lake. Watershed-wide recommendations include:

- A watershed management district serving the entire ten Lagrange County lakes should be established. The watershed management district would be responsible for overseeing all activities that may impact the water quality of all of ten lakes.
- Implement agricultural best management practices, homeowner best management practices, wastewater management practices and stabilization practices for both roadways and streambanks.
- Establish erosion control and stormwater runoff ordinances within the boundaries of the ten Lagrange County lakes watershed.
- Failing septic systems should be identified and action taken to repair or replace them.
    - A wastewater treatment facility feasibility study should be initiated at Atwood Lake, where septic systems contribute an estimated 22 percent of the annual phosphorus load to the lake.
    - Loading from septic systems is only a small percentage of the annual budgets on the remaining lakes excluding Adams Lake. An effort to reduce septic impacts should be investigated.
- The watershed management district should apply for funding to implement agricultural BMP's.
- Assess the impacts of the county landfill on the water quality of Dove Creek including investigating existing groundwater and stream water quality data collected near this landfill.
- Consider the use of benthic barriers for macrophyte control around private docks should be implemented wherever possible.
- Consider spot dredging areas of sediment accumulation within all lakes including in lake channels.
- The use of alum for nutrient inactivation and aeration are recommended for some lakes if land treatment fails to improve water quality in the lake. Specifically, FXBrowne recommended these techniques for Adams Lake (alum), Atwood Lake (aeration), Messick Lake (dredging), Oliver Lake (dredging), Martin Lake (aeration), Oliver Lake (dredging), Westler Lake (aeration) and Witmer Lake (alum).

Upper Long Lake Diagnostic Study (1998)

In April of 1998, Gensic & Associates and Environmental Testing released a diagnostic study of the restoration of the Upper Long Lake Watershed. The study was funded by the Upper Long Lake Association with the aid of a grant from the IDNR, Division of Soil Conservation "T-by-2000" LARE program.

Members of the Upper Long Lake Association became increasingly concerned with the perceived deterioration of lake water quality. Principal areas of concern included aquatic plant density and algal blooms, quality of runoff water in inflowing ditches and tiles, sediment deposition at inlets and a declining fishery. The growing environmental awareness of local residents, and the desire to reverse the causes of cultural eutrophication of the lake were primary factors for the authorization of the study. Recommendations for watershed improvement include:

- Institutional actions by the Upper Long Lake Property Owners Association to better enable the organization to deal with environmental and lake and watershed management issues.
- Implementation of best management practices in both agricultural areas and developed lake shorelines areas of the watershed.
- Restoration or construction of wetland areas or construction of detention ponds in the watershed to reduce peak runoff flows and alleviate sedimentation.

Indian Lakes Improvement Project (2001)

In January of 2001, Commonwealth Biomonitoring conducted a feasibility study to assist the Five Lakes Conservation Club. This study was funded by a grant from the IDNR Division of Soil Conservation through the Indiana Lake and River Enhancement (LARE) Program. All available information on lake quality was assembled. Then new information was gathered on lake water budgets, rare biological resources, watershed land use, stormwater management, property ownership, wetland quality, sediment nutrient values, wastewater treatment and bacteria. The new information was used to identify problems in the lakes and work toward economical solutions. Excessive phosphorus loading was identified as the major impediment to water quality in the Indian Lakes chain. Four major phosphorus control treatments were identified:

- Sediment removal in lake channels receiving off-site drainage and from the Mill Pond on Little Elkhart Creek including removing 200 cubic meters of sediment from the southeast Witmer Lake, southwest Witmer Lake, north Witmer Lake and northeast Westler Lake tributaries, 240 cubic meters of sediment from the main Westler Lake tributary and 1360 cubic meters of Witmer Lake channels. In total 2400 kg/year of phosphorus would be removed at an estimated cost of $40,000 for dredging and project oversight.
- Continue to implement the on-going watershed land treatment project in partnership with the DNR LARE program ($54,000 in 1999).
- Consider additional wastewater treatment at the Adams Lake Regional Sewer District.
- Implement stormwater runoff treatment in the Town of Wolcottville.
- Consider creating a volunteer program of algae harvesting.

Whetten Ditch, Solomon Creek and Dry Run Watersheds Diagnostics Study (LARE, 2002)

In August of 2002, J.F. New & Associates (JFNew) released a diagnostic study for the Whetten Ditch, Solomon Creek and Dry Run Watersheds that was developed through funding from the IDNR LARE Program and the Elkhart County SWCD. A windshield and aerial survey was conducted as a part of the study (Figure 30). These watersheds are part of the Upper Elkhart River Watershed. Recommendations of this study include:

- Apply for LARE Watershed Land Treatment Funds to implement recommended BMPs and projects discussed for each subwatershed based on subwatershed priority. Some of these projects include: wetland restoration, filter strip installation, allowing for natural riparian vegetation growth, bank stabilization, livestock fencing, information and education efforts,

buffer zone establishment, revegetation of exposed areas, and grassed waterway construction. This work should focus on interested landowners in identified critical areas first.

- Extend management to the watershed-level including addressing potential project sites identified as part of the diagnostic study (Figure 30).
- Develop a watershed or land use management plan.
- Work with a bulk seed distributor to make native plant seed available in large quantities at low prices.
- Work with the Elkhart County Health Department to ensure proper siting and engineering of septic systems. The use of alternative technology should be encouraged when conditions may compromise proper waste treatment.
- Working with landowners that have drainage tiles that directly convey water to streams in the watershed to install treatment wetlands or filter areas so that drainage water receives both mechanical and chemical treatment prior to discharge.
- Scheduling meetings with active land developers in the area to encourage the use of conservation design when planning new development areas.
- Working with New Paris Speedway owners and operators to ensure that best septic system management practices are used, and that racetrack runoff is properly controlled.

The DNR LARE program provided six years of watershed land treatment funding to implement the watershed diagnostic study. An assessment of which projects remain to be implemented occurred planned to occur as part of this planning process. In total, 105 individual projects were identified through various LARE planning projects. After review of LARE reports and discussions with local lake associations and SWCD and NRCS staff, it was determined that approximately 74% of these projects have not been completed to date.

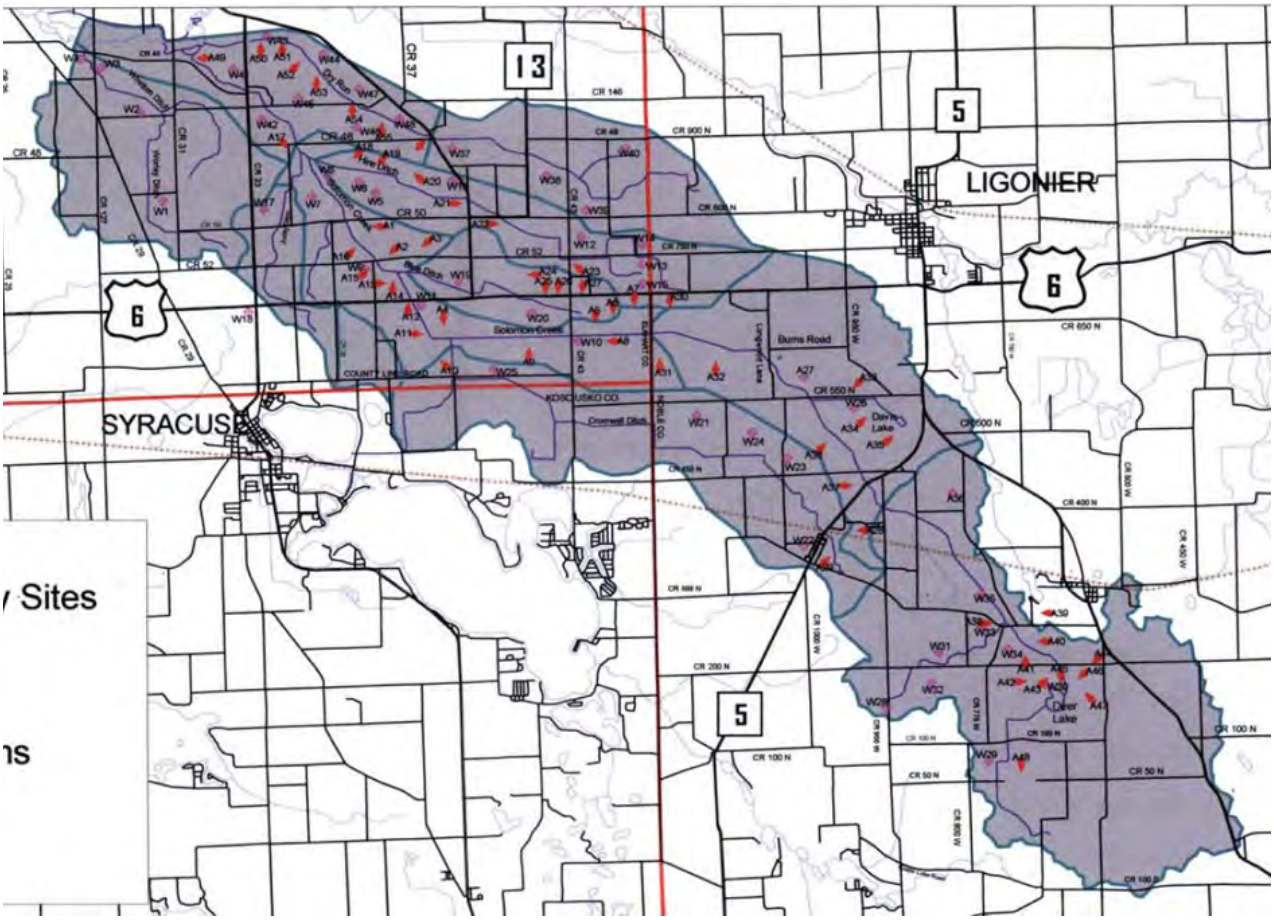


Figure 30. Aerial and windshield survey site location map from the Whetten Ditch, Solomon Creek and Dry Run Watersheds Diagnostic Study.

Chain O' Lakes Watershed Diagnostic Study (2002)

In October of 2002, Gensic & Associates released a diagnostic study targeting implementation of land conservation practices in the Chain O' Lakes Watershed. The study was funded by the Noble County SWCD with the aid of a grant from the IDNR LARE program. The Noble County SWCD identified that the Chain O' Lakes Watershed was one of the most potentially erodible areas in Noble County. It was deemed a priority area for developing a watershed management plan, implementing best land use management practices and developing a follow up program to assure long term effectiveness.

Gensic determined that problems in the Chain O' Lakes Watershed stemmed primarily from erosion due to agricultural practices on erodible land adjacent to open drainage channels. Other land management problems included livestock in open channels, gully erosion in fields, gravel roads, side ditches, terraces and inlets in cultivated erodible areas, concentrated livestock, yards and streambank erosion in meandering open channels. Land management problem areas were distributed throughout the Chain O'Lakes Watershed. Common recommendations within this report include:

- Install vegetative filter strips between erodible cropland and open drainage channels.
- Install grassed waterways and rock chutes in eroded gullies.
- Complete livestock exclusion fencing and streambank protection.

Five Lakes Engineering Feasibility Study (2004)

In July of 2004, JFNew released an Engineering Feasibility Study for Witmer, Dallas, Hackenburg, Messick and Westler Lakes (Five Lakes). The study specifically targets the immediate watershed of the lakes including Little Elkhart Creek from Witmer Lake upstream to the town of Wolcottville and several smaller tributaries in the immediate vicinity of the lakes. Three potential projects listed below were identified during the course of this study (Figure 31). Potential water quality improvement projects investigated during the study include:

- Project 1: Grade control and sediment trap construction along Little Elkhart Creek, Witmer Lake. The project was considered feasible, pursued and agreements made with landowners to secure access for construction.
- Project 2: Livestock fencing along J.J. Charles Drain to Hackenburg Lake. This project was considered feasible, pursued and agreements made with landowners to secure access for construction.
- Project 3: Sediment and sediment-attached pollutant load reduction from the unnamed southern tributary, Witmer Lake. This project was considered feasible but was not recommended for future design and construction.

Recommendations of this project were:

- Apply for LARE grant funding in 2004 for construction of the sediment trap and grade control structure along Little Elkhart Creek. Begin construction of the project in the Fall of 2004 following the crop removal.
- Apply for LARE grant funding in 2004 for livestock fencing. Construction of the fence and tree planting can occur in the fall of 2004.
- Pursue project recommendations from the Five Lakes Watershed Management Plan that was concurrently developed.

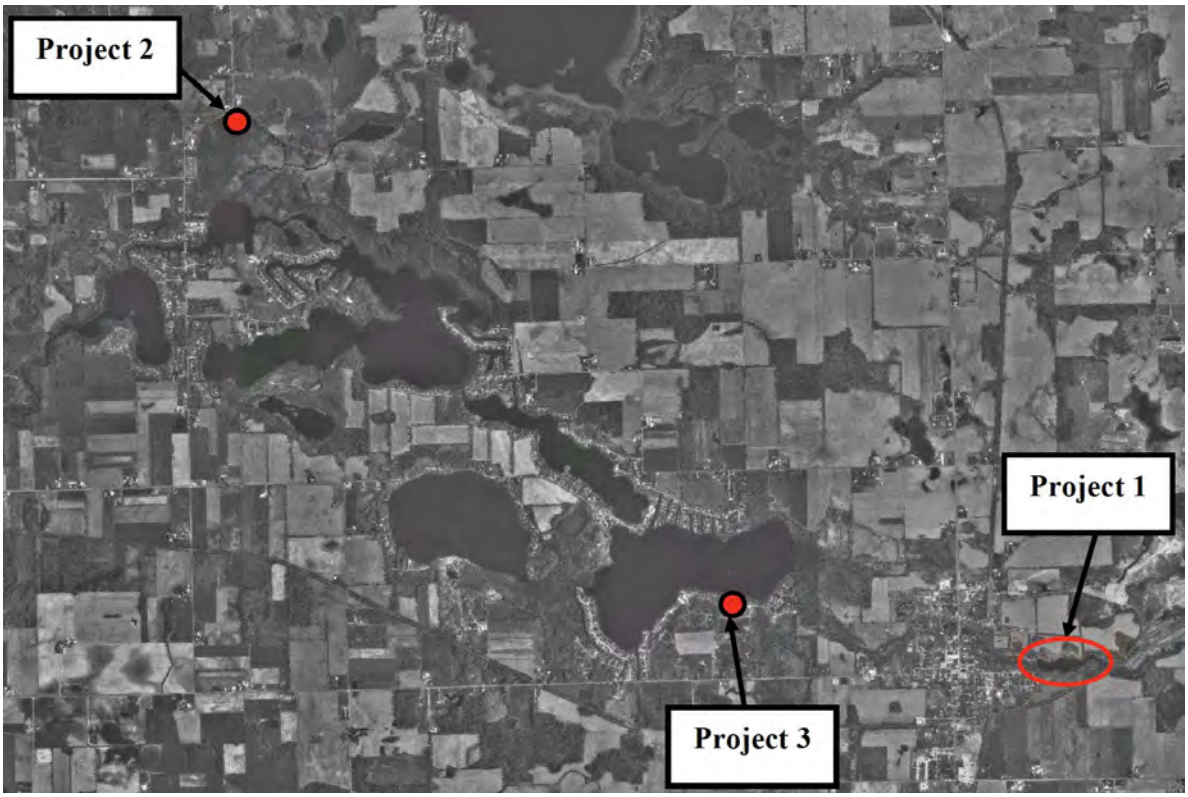


Figure 31. Engineering feasibility/design proposed locations from the Five Lakes Feasibility Study.

Pettit Mill Pond Sediment Control Project Design Project (2004)

In July of 2004, JFNew released a design report for the sediment control project on Pettit Mill Pond. The Five Lakes Conservation Association received funding for the design report through the IDNR LARE program. The design project addressed the problem of accumulation of sediment and sediment-attached pollutants in the Mill Pond and the general state of disrepair of the Mill Pond's failed dam structure, which pose water quality concerns to Little Elkhart Creek and its receiving waterbody, Witmer Lake. The project design was to capture sediment and sediment-attached pollutants from the Little Elkhart Creek Watershed and to stabilize the existing Mill Pond structure by installing a grade control structure.

The design recommendations include moving the existing failed dam structure at the outlet of the Mill Pond on Little Elkhart Creek and replacing this structure with a grade control structure to maintain the Mill Pond at its existing water level. Designers indicated that leaving Mill Pond at the existing water level would prevent the release of sediment and sediment-attached nutrients trapped in the Mill Pond (Figure 32). A sediment trap and dewatering basin were included in the design strategy to reduce sediment inputs. Permits were filed for the construction of the design. Construction began in late 2004 following the removal of crops from the agricultural field where the sediment dewatering basin was constructed.

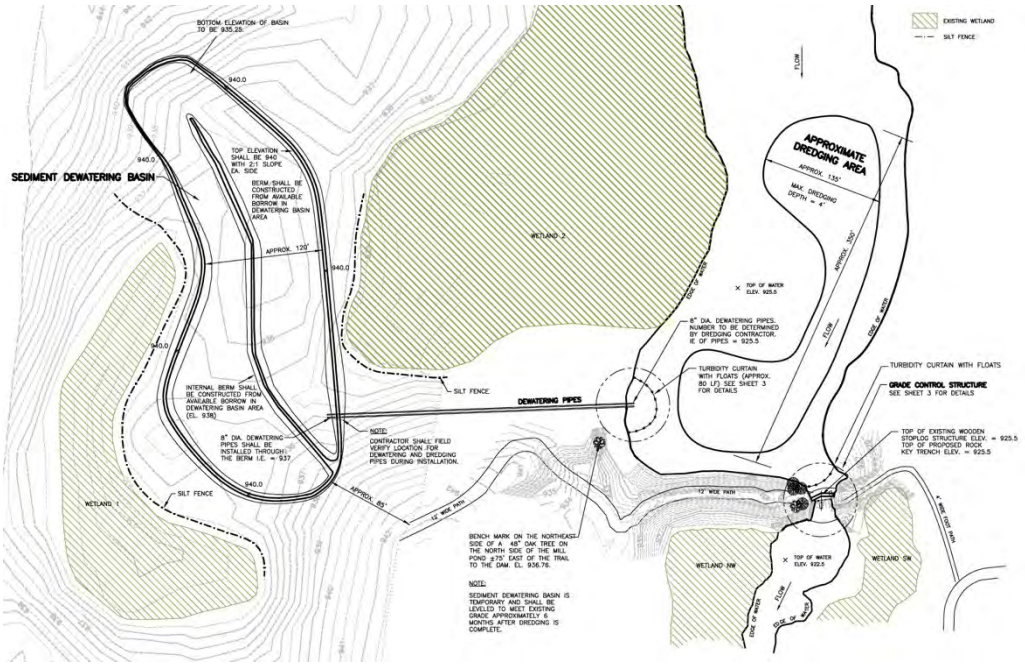


Figure 32. Site Plan for Petit Mill Pond sediment control project.

Five Lakes WMP (2006)

In July of 2006, D.J. Case & Associates and JFNew released a watershed management plan for the Five Lakes Watershed. The plan detailed the current and historical condition of the watershed through a review of historical reports and included sampling the biological, chemical, and physical condition of waterbodies in the watershed. More importantly, the planning process provided a forum for watershed stakeholders to discuss their water quality concerns related to the waterbodies in the Five Lakes Watershed and develop an action plan to address those concerns. This plan documents the stakeholders' concerns and vision for the future of the Five Lakes Watershed. It outlines the stakeholders' strategies and action items selected to achieve their vision. Finally, the plan includes methods for measuring stakeholders' progress toward achieving their vision and timeframes for periodic refinement of the plan. Ultimately, the plan serves to guide and educate the stakeholders on the importance of improving water quality in the Five Lakes watershed. These goals and objectives are as follows:

- Reduce phosphorus loads to streams from 2004 levels by 50% to reach recommended phosphorus concentrations of <0.075 mg/L (Dodd et al., 1998) by 2015.
- Reduce total suspended solid loads to streams from 2004 levels by 50% by 2015.
- Reduce E. coli concentrations in waterbodies in the Five Lakes Watershed so that water within the streams and lakes meet the Indiana state standards of 235 colonies/100 ml by 2015.
- Within four years, 50% of landowners within the Five Lakes Watershed will learn and/or implement at least one water quality improvement practice/technique on his/her own property.
- Maintain and improve the recreational setting of the Five Lakes Watershed by developing and implementing a recreational management plan within five years.

In addition to goals and objectives, eight areas of concern were identified within the watershed. Suggestions on implementing BMPs such as grassed waterways, buffer strips, the installation of WASCOBs, and stream bank stabilization were provided on a case-by-case basis (Table 18).

Table 18. Concerns and sources of pollutants associated with the water quality sites sampled as part of Five Lakes watershed plan development and suggested management practices.

Site	Concern/Source	Suggested Management Practice
S1	-Eroding waterways and use of improper tillage methods -Sediment and nutrient and phosphorous input from gravel roads, fields and impaired wetlands	-Grass waterways and use correct tillage methodology -Wetland restoration below corn field -Install a berm to reduce sediment input into creek/stream from road -WASCOB to check flow off field; use grass waterways as well -Install buffer strip and restore wetland -Restore 8 wetland areas to reduce flow velocities at upper end and restore two wetlands at scattered sites
S2	Erosion	-Install buffer strips -Limit impact of gravel roads to streams at crossings
S3	- Manure and erosion due to sheep and cattle access to stream - P-loading of Cree Lake and potential problems with septic systems on the lake (11) -Stream bank erosion	- Review grazing management for cattle and sheep - Potential installation of mounded septic systems - Stream bank stabilization - Installation of grassed water ways and grade control structures - Maintain no-till or mulch-till and haying practices in this area -Install a WASCOB on drainage to Shockopee
S4	-Stormwater issues	-Determine stormwater/wastewater impacts from South Milford -Implement stormwater BMPs as necessary
S5	No specific concerns identified	-All practices installed upstream in S1-S4 subwatersheds should positively impact water quality -Identify additional projects (wetland restoration)
S6	-Ditch problems through barn yard	-Install grassed waterways in fields to Blackman Lake - Review BMP for buffalo in this area
S7	-No specific problems identified	
S8	-No specific projects identified	-Determine potential impact of old landfill -Review impact of development of shoreline areas (Oliver, Olin, Martin lakes)

Skinner Lake Engineering Feasibility Study Noble County, Indiana (2007) and Rimmell Ditch Design-Build (2009)

The Skinner Lake Homeowners Association (SLHOA) received an IDNR LARE grant to complete an engineering feasibility study of lake improvement projects. The goal of the feasibility study was to analyze potential project sites where sources of pollution may exist, suggest projects that may address pollution, and examine the feasibility of project design and construction. In April of 2007, JFNew released an Engineering Feasibility Study for Skinner Lake. This study examined the feasibility of five projects and sediment mapping within the Skinner Lake Watershed. The projects included:

- Shoreline stabilization along the northern shoreline of Skinner Lake.
- Bed and bank stabilization along the length of Rimmel Ditch.
- Five minor projects within the Rimmel Ditch Watershed.

- Documentation of the serpentine filter's history and identification of potential solutions.
- Wetland restoration at four potential sites throughout the Watershed.

The study revealed that neither the sediment mapping nor the wetland restoration projects were deemed feasible at this time. JFNew recommended that the Skinner Lake Homeowners Association complete design and construction work on the shoreline stabilization project in 2007 and apply for additional LARE grant funds to address other projects along Rimmell Ditch.

In 2009, JFNew and the Noble County Drainage Board completed several projects along Rimmell Ditch (Figure 33). The projects that were completed by JFNew included the installation of two pipe drop structures, three grassed waterways, two grade control structures, 40 feet of streambank stabilization, a rock-line chute, and culvert erosion stabilization. The Noble County Drainage Board completed the installation of a culvert to replace a deteriorating bridge. They also performed bottom dipping, channel re-alignment, bank re-sloping, bank stabilization, spoils leveling, and seeding on approximately 5,600 feet of the Rimmell Open/ Melvin System.

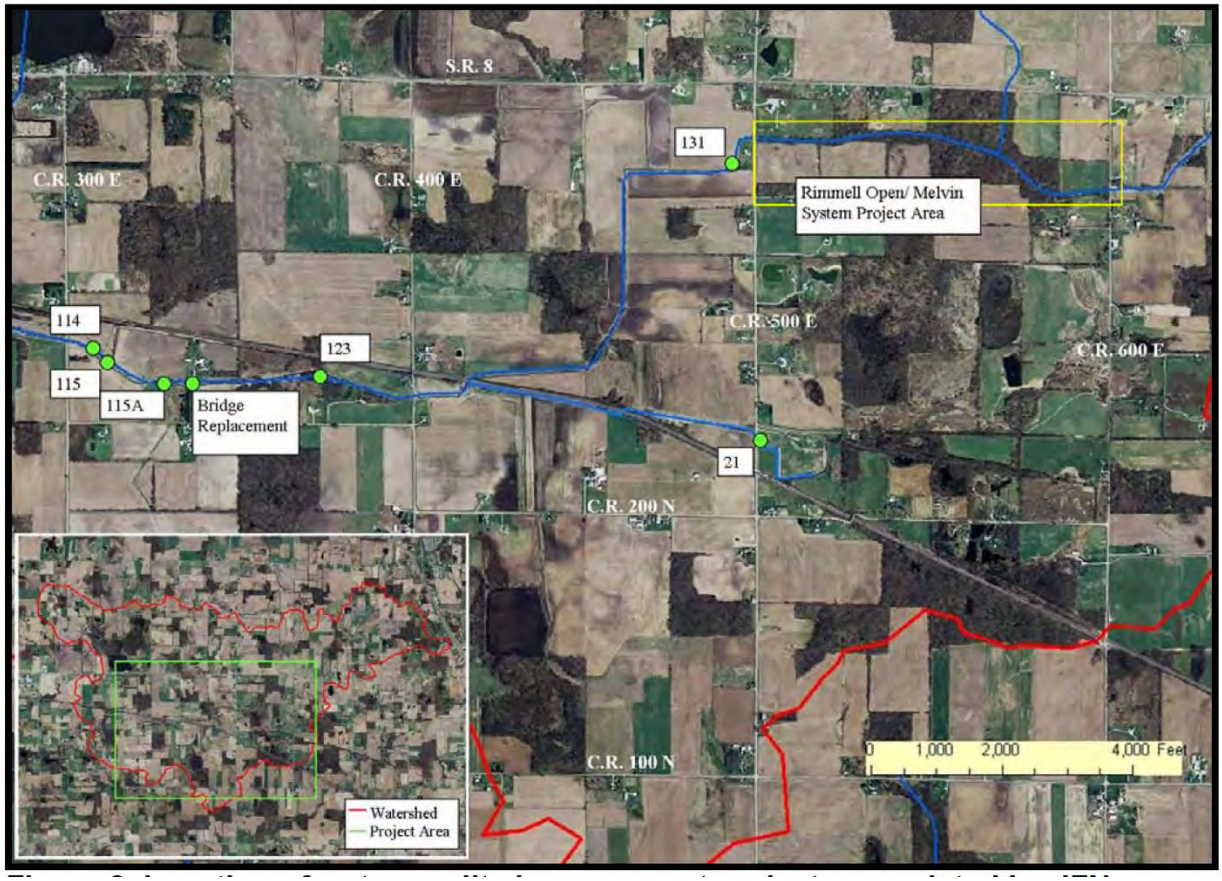


Figure 33. Location of water quality improvement projects completed by JFNew and Noble County Drainage Board within the Rimmell Ditch watershed.

Skinner Lake Shoreline Stabilization Design-Build (2009)

In April of 2009, JFNew released the design/build report for the Rimmel Ditch shoreline stabilization project, which was included in the 2007 Skinner Lake Engineering Feasibility study. Due to heavy rains and flooding in spring 2008, an additional erosion area was identified, and funding was requested to

design and implement shoreline treatment. An agreement was made to modify the original contract by replacing work on two smaller project sites with the implementation of the design/build for the newly identified site.

Due to County funding issues and unforeseen projects, an agreement was made to shift from the originally identified in-kind projects to other projects within the Rimmell Ditch drainage area. These projects met the same criteria in reducing sedimentation and nutrient loading and provided water quality benefits to Skinner Lake.

Elkhart River WMP (2008)
The Elkhart River Alliance (ERA) was formed as a committee of the Elkhart River Restoration Association, Inc. (ERRA) to address concerns regarding sediment in the Goshen Dam Pond and pollution in the Elkhart River Watershed. With assistance from the Elkhart County SWCD, the ERRA obtained funding from a Section 319 grant for the development and implementation of a watershed management plan for the Elkhart River Watershed. A Steering Committee was organized to work with the watershed coordinator to develop and implement the WMP and contracted with V3 Companies to guide WMP development.

The Elkhart River WMP is intended as a guide for the protection and enhancement of the environment and quality of the Elkhart River Watershed while balancing the different uses and demands of the community on this natural resource. Watershed plan goals include:

- Sustain the financial and institutional capacity of a stakeholder group. Increase the collaboration of both urban and agricultural stakeholders to eliminate program duplication, reduce costs and identify effective solutions.
- Reduce soil erosion and sedimentation so that surface water functions and aesthetics are improved and protected. By the year 2027, surface waters within the Elkhart River Watershed will comply with the recommended water quality threshold of 80 mg/L total suspended solids.
- Reduce the concentration levels of E. coli so the primary and secondary contact waters within the Watershed do not pose an adverse human health impact. By the year 2027, surface waters within the Elkhart River Watershed will comply with the Indiana state E. coli water quality standard of 235 cfu/100 ml.
- Reduce the amount of nutrient loading (phosphorus and nitrogen) so that surface water functions and aesthetics are improved and protected. By the year 2027, surface waters within the Elkhart River Watershed will comply with the recommended water quality threshold of 10 mg/L of nitrate/nitrite and 0.3 mg/L of phosphorus.
- Increase preservation, restoration, and appreciation of open space and maintain a proper balance between the many diverse land uses in the Elkhart River Watershed.
- Develop an outreach and education program that keeps stakeholders involved in issues in the Watershed, and coordinate volunteer activities that benefit the health of the Elkhart River Watershed.

ERRA initiated one round of cost share project implementation including implementing 13 rain gardens, 50 rain barrels, completed three stream buffers, seven bioretention projects, eight pervious pavement projects, one green roof, two grassed waterways, one WASCOB and two rotational grazing systems.

Oliver, Olin, and Martin Lakes Diagnostic Study (2009)
In October of 2009, JFNew released a Diagnostic Study for Oliver, Olin and Martin lakes. These lakes have historically exhibited good water quality and are considered one of Indiana's least developed lake chains.

The combination of low nutrient levels and overall morphology of the three lakes limit the potential for the establishment and flourishing of aquatic plant communities in the chain. In general, the area within the lakes able to support a rooted plant community is between one-fourth and one-third the total area of each lake.

The following list summarizes the recommendations for maintaining and improving Oliver, Olin, and Martin lakes' chemical, biological, and physical condition. Each of the following recommendations should be implemented and will help maintain the lakes' good water quality (Figure 34).

- Implement agricultural best management practices such as restoring existing failed structures, installing and increasing stream buffer width, and repairing and installing grassed waterways.
- Stabilize the eroding ravines on the IDNR's Olin Lake Nature Preserve to reduce sediment and nutrient loading to Olin and Oliver lakes. This project has a high probability of success to protect water quality because the project is located on property owned and managed by the Department of Natural Resources.
- Implement individual property owner management techniques. These apply to all watershed property owners rather than simply those who live immediately adjacent to Oliver and Martin lakes.

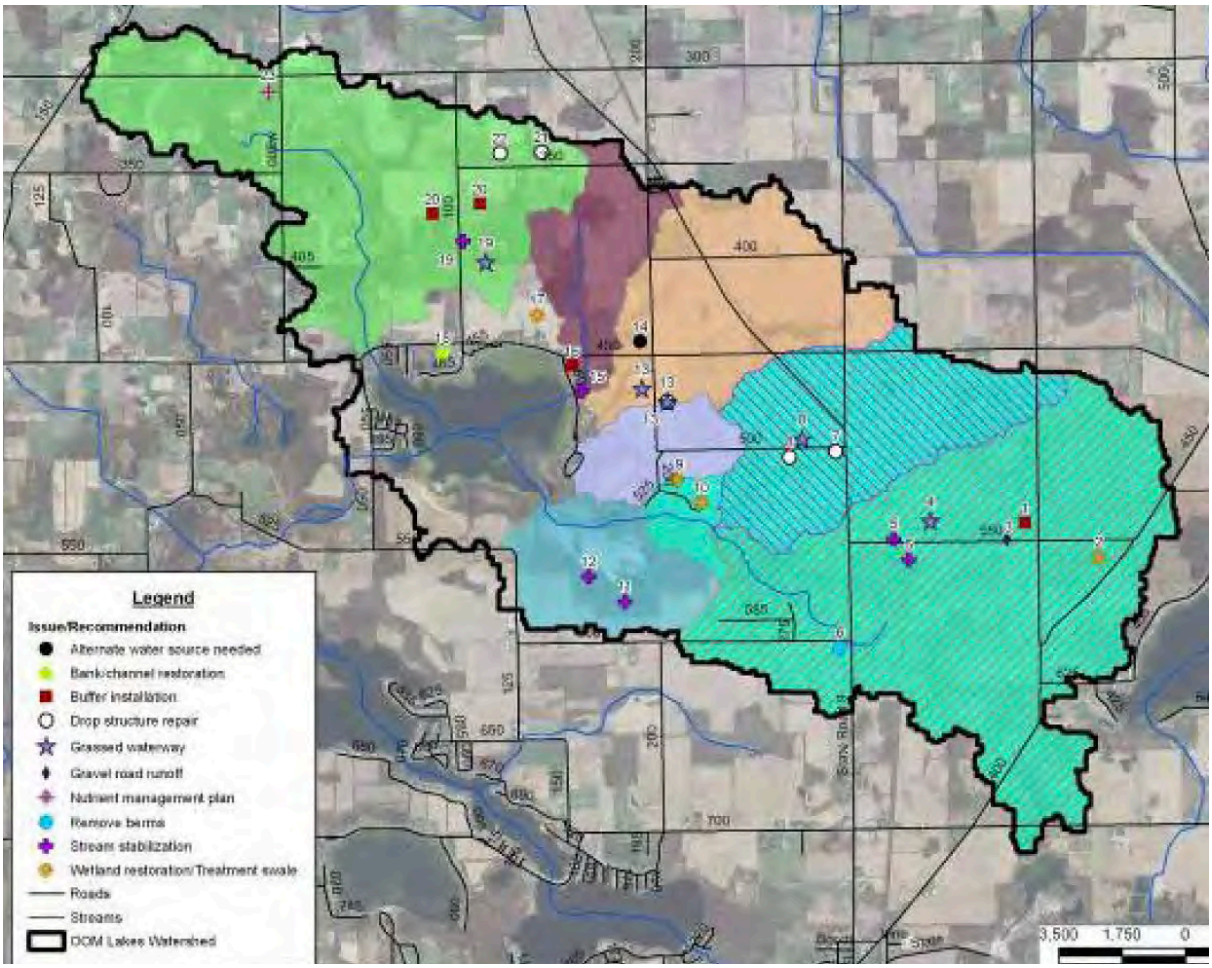


Figure 34. Areas in the Oliver, Olin, and Martin lakes watershed that would benefit from watershed management technique installation.

Engineering Feasibility and Design Study for Oliver, Olin, and Martin Lakes Watershed (2014)
The Olin, Oliver and Martin Lakes Feasibility Study was funded by an IDNR LARE grant with a match provided by the Oliver and Martin Lakes Conservation and Improvement Association (OMLCIA). OMLCIA retained Davey Resource Group and Gensic Engineering to conduct the study to investigate the feasibility of implementing projects that will reduce sediment, nutrients and other pollutants from reaching Oliver, Olin, and Martin Lakes.

The purpose of the study was to investigate the feasibility of implementing six projects; the first five were previously identified in the Oliver, Olin and Martin Lakes Watershed and a sixth project was added as a result of issues raised during public meetings. The study designed plans for two specific projects (Projects 3 and 5). The proposed projects are as follows:

- Project 1: Erosion control along a ditch adjacent to CR 550 South. The project was considered highly feasible.
- Project 2: Erosion control on a ditch bank southwest of the intersection of SR 9 and CR 600 South.
- Project 3: Streambank erosion control on a stream located at the Olin Lake Nature Preserve owned by IDNR. Stabilization of the eroding stream channel within the Olin Lake Nature Preserve is highly feasible.
- Project 4: Erosion control on a ditch located south of CR 450 South, north of Oliver Lake. The erosion can be easily addressed by planting native shrubs along the stream edge to anchor soils.
- Project 5: Hydrological enhancement to a degraded wetland on property owned by The Nature Conservancy east of Martin Lake. Davey indicated that the proposed project had the potential to result in significant pollutant reduction reaching the Oliver Lake chain. The proposed project is costly; however, there are multiple potential funding sources that may aid in implementation. As the property was undergoing acquisition by ACRES at the time of the study, it was recommended that OMLCIA begin coordinating with IDNR LARE Program staff and ACRES to pursue funding once acquisition is complete.
- Project 6: Minimize sediment reaching the lake from an agricultural field north of Oliver Lake. The landowner and agricultural producer currently farming the field expressed support for installation of the grass waterway and associated drop box outlet and have been working with the Lagrange County SWCD and NRCS regarding the project.

Skinner Lake Diagnostic Study (2021)
The Skinner Lake Diagnostic Study is a comprehensive examination of Skinner Lake and its surrounding watershed (Arion Consultants, 2022). In 2021, with funding from the IDNR LARE Program, the Skinner Lake Homeowners Association hired Arion Consultants to conduct the study. Arion Consultants concluded that all of the subwatersheds within the Skinner Lake Watershed could benefit from soil health and targeted stormwater retention strategies as already described in detail above. However, based on loading calculations and field observations, efforts should target the Rimmel Ditch drainage first followed by the Hardendorf Drain drainage and/or shoreline projects. Finances, time, volunteer time, and other restraints make it impossible to implement all of these management techniques at once. Recommendations for the Skinner Lake Watershed were developed as follows:

- Work with the Noble County Surveyors Office to improve the current conditions of previously installed rock chutes and check dams along Rimmel Ditch. These structures are in disrepair and are no longer functioning as designed. This results in additional sediment and nutrients erosion from the channel cutting caused by the poorly maintained structures. The structures were designed to reduce the gradient of the stream and minimize instream head cutting.

- Consider dredging the mouth of Rimmel Ditch and other inlets to help reduce the volume of sediments flowing into Skinner Lake. Based on assessments completed as part of the Skinner Lake Feasibility Study (JFNew, 2007), between 1.6 and 2.9 feet of accumulated sediment is present at Skinner Lake inlets.
- Reduce total suspended solids concentrations in streams throughout the watershed. Best management practice implementation to reduce TSS loading to the streams, including streambank stabilization, cover crop planting, conservation tillage, and streambank erosion and lakeshore erosion practices should be the focus.
- Reduce E. coli concentrations in streams throughout the watershed. The specific sources of E. coli in the Skinner Lake Watershed have not been identified; however, wildlife, livestock and/or domestic animal defecations; manure fertilizers; previously contaminated sediments; and failing or improperly sited septic systems are common sources of the bacteria. Livestock restriction, manure management planning, septic inspection and maintenance can all address pathogen issues in the Skinner Lake Watershed.
- Reduce total phosphorus concentrations in streams throughout the watershed. Best management practice implementation to reduce phosphorus loading to the streams, including livestock fencing, septic system inspection and maintenance, sewer maintenance, rock chute and check dam maintenance, streambank stabilization, rain garden and rain barrel installation, and filter strips should be targeted.
- Apply for LARE funds to best management practices. LARE watershed land treatment funds could be utilized to address agricultural BMPs, including filter strips, livestock distribution, and soil health-focused conservation tillage and cover crop planting.
- Target best management practice implementation on non-protected parcels mapped as highly erodible land. Efforts for these parcels should focus on enrolling tracts of land mapped as highly erodible in the conservation reserve program.

Benton and Baintertown Dam Feasibility Study (2022)

The Elkhart County Parks Department received an IDNR LARE grant to determine the feasibility of removing or modifying the Benton and Baintertown Dams (Cardno, 2022). Low-head dams present a number of concerns primarily related to safety, aquatic passage, and recreational paddling. Multiple alternatives were identified for each dam including: no action, dam removal, and dam modification. The focus of the study was to assess the feasibility of each of these identified alternatives and ultimately present a manageable number of recommended alternatives for consideration by the Elkhart County Parks Board. The feasibility assessment included field investigation, land availability, cultural resource impacts, water resource impacts, regulatory requirements, wetland and vegetation impacts, environmental impacts, upstream sediment characterization, public outreach and communication, unusual physical and/or social costs and potential for funding. Based on the feasibility assessment, Cardno now Stantec, in communication with the Elkhart County Parks Department, selected two recommended alternatives for each dam. These recommended alternatives were determined to be feasible based on assessments completed for this report.

Recommended Alternatives for Benton Dam include modifying the Dam by implementing a full rock riffle, or rows of boulders and rocks installed downstream of a dam to resemble natural rapids or modifying of the dam to include partial lowering and rock riffle. The no action alternative for Benton Dam was also determined to be feasible but if funding can be secured for one of the recommended alternatives, then Stantec recommends this be pursued.

Recommended Alternatives for Baintertown Dam include dam removal or no action other than installation of safety signage. Final design and permitting could be initiated at any time. Stantec recommended that outside funding be secured before permitting is initiated.

2.11.2 Flow-based Assessments and Plans

North Branch Elkhart River West Lakes Task Team Report (2010)

In May of 2010, the Indiana Silver Jackets partnered with the recently formed Flood Focus Committee of the Elkhart River Alliance to form a voluntary multi-agency group and author a report that shared data and improvement recommendations from federal, state, and regional governmental perspectives (Indiana Silver Jackets, 2010). The Flood Focus Committee was created after an extended period of above normal precipitation resulted in multiple flooding events in 2008 and 2009 throughout Indiana. The pertinent findings include:

- The North Branch Elkhart River watershed/drainage basin is a fairly unique system. The extensive, naturally existing storage and the natural regional relationships between precipitation, geology, topography, stream flow, the groundwater resource, lake levels, and flooding have not been altered dramatically.
- Water level issues exist in many previously developed areas around lakes within the basin. These issues range from seasonal high-water levels that persist over extended time frames and limit road access to existing homes, to infrequent but potentially devastating flood levels that could cause extensive property damage.
- Over several decades, studies have stated that flood damage in the watershed can be attributed to a combination of factors, with a major cause being the construction of structures in the floodplain, many at or below the minimum recommended elevation.
- Data show that during normal conditions, Waldron Lake's outlet channel carries a large rate of flow, and it responds with a substantial increase in flow during flooding events.

Recommendations include the following:

- Pursue Federal and State grants to initiate a volunteer home acquisition and relocation program for homes located in the most vulnerable flood prone areas.
- Continue to work with homeowners to properly elevate flood prone homes and pursue additional funding opportunities for this activity.
- Reinvigorate the existing flood warning system. Routinely test, educate residents about, and seek opportunities to expand the system. Develop an Emergency Flood Response Plan, including evacuation planning, to be tested with the Sylvan Lake Emergency Action Plan.
- Seek to provide education regarding the national flood insurance program. Explain typical costs, benefits, flood risks, and attempt to dispel myths regarding this type of insurance.
- Work with homeowners, local health officials, or local zoning officials, to upgrade protection for water well heads located in a flood hazard area.
- Work with homeowners, local zoning officials, and local energy providers to anchor propane tanks located in floodplain areas.
- Inventory and prioritize those areas where seasonal road access difficulties exist.
- Prepare a plan to reduce the access issue for the more vulnerable areas.
- Create an inventory of natural areas that currently and historically provided natural storage and detention in the watershed/drainage basin.
- Seek funding and partnership opportunities to protect and/or restore these areas from future development.

- Work with landowners, homeowners, land management contractors, public utilities, and local agriculture agency officials to seek, construct, and implement conservation practices to limit fertilizer, nutrient and sediment loading.
- This is especially important for streams and drains discharging directly into the "transition area" identified in the report.
- Once the source of nutrients is addressed, contact regulatory agencies to discuss authorizations needed to conduct in-channel aquatic vegetation removal at the "transition area" identified in the report.
- Work with local officials, adjoining property owners, recreation groups, and volunteer groups to fund and/or conduct routine stream maintenance and drainage projects consistent with the Indiana Drainage Handbook.
- Create and/or strengthen an existing local group to be regional administrator of floodplain management practices (covering the communities and counties that are part of the North Branch Elkhart River watershed/drainage basin).
- Develop consistent basin wide practices, seek, and be the local administrator for grant opportunities. Installing and maintaining new gages to expand the coverage of documentation could prove useful to a broad base of stakeholders. Discuss partnering opportunities with the U.S. Geological Survey and the National Weather Service.
- Organize a flood related public education and outreach event for the NBR Elkhart River watershed/drainage basin stakeholders. Provide a forum-style question and answer area with information tables, displays, staff from various Federal, State, Regional, and Local water resource agencies, and local officials. Routinely provide public outreach and education activities.
- Develop a long-term strategic improvement plan to begin reducing flood risk for the basin. The strategic planning process would be founded upon a review of the North Branch Elkhart River basin's strengths, opportunities, weaknesses, and threats. A typical strategic plan would then identify and prioritize goals with measurable objectives set for each goal.
- Yearly action steps would then be outlined to begin addressing the many likely objectives. To be effective, the strategic planning creation, vision, and implementation must have the involvement and commitment of the local stakeholders.
- Seek funding to create a detailed, calibrated, basin-wide hydrologic and hydraulic engineering computerized flow and flood level prediction model.
- Ensure consistent regional use of floodplain management and storm water ordinances. Seek to strengthen these ordinances to incorporate best management practices.
- To minimize future disruption to local business and area employment, seek to locate future economic growth opportunities in pre-planned, low risk zones where natural hazards such as floods would not jeopardize the local business growth. Limit and, if possible, prohibit construction of new critical structures and utilities in flood hazard areas.

North Branch Elkhart River Corridor Flood Risk Management Plan (2020)

To begin addressing the St Joseph River Basin Commission's need for a comprehensive understanding of the overall functional health of the North Branch Elkhart River Basin in northeast Indiana, Christopher B. Burke Engineering, LLC (CBBEL) was asked to develop a flood risk management plan for the North Branch Elkhart River (CBBEL, 2020). The flood risk management plan is based on investigation of overall stream function and flooding in the mainstem North Branch Elkhart River from its headwaters on the far east side of Noble County to the confluence with the South Branch Elkhart River near Ligonier. Some of the recommendations given based on this study include:

- Develop and adopt location-specific Smart Growth flood resilience strategies including identification of river corridor impact areas, undeveloped high flood hazard and storage areas, moderate flood hazard areas, vulnerable developed areas, safer areas and the entire drainage areas. Consider adoption strategies for each area as detailed in the report.
- Update stormwater and floodplain regulations to include storage and detention, retention, compensatory floodplain storage, strict prohibitions on floodway development and disturbance and encourage Low Impact Development and Green Infrastructure.
- Encourage county drainage boards to consider the impact of agricultural drainage impact mitigation measures and require/provide compensation for impacts of farm drainage and county drainage board ditch improvements.
- Investigate the feasibility of and construct a 2-stage ditch system along a 4-mile reach of Henderson Lake Ditch through and near Kendallville.
- Consider initiating additional studies and models to better understand the groundwater/surface water interaction.
- Preserve the existing USGS gages and commission additional stream gages at Sylvan Lake near CR 600 N south of Rimmel Road, upstream of Hackenburg Lake near SR 3 and between Indian Lakes and West Lakes and reestablish lake gages on developed lakes.
- Consider requiring a higher flood protection grade when permitting new construction.
- Establish a Flood Resilience Planning Team in each county and/or community within the watershed including the basin commission director, city and county elected officials, council members and officials who are responsible for land use decisions, planning and engineering staff.
- Consider a facilitator or consultant to conduct meetings among Flood Resilience Planning Team members and identify and agree on strategies for each area.
- Work with various communities within the watershed to help the adoption and implementation of agreed upon flood resilience strategies and implementation of other study recommendations.

2.11.3 Comprehensive Plans

St. Joseph River TMDL Study (2004)

In February of 2004, IDEM released a Total Maximum Daily Load (TMDL) report for E. coli for the St. Joseph River in Elkhart and St. Joseph counties. This TMDL evaluated the data collected on the St. Joseph River and several tributaries, including the Elkhart River, and made recommendations for load reductions to bring the St. Joseph River into compliance with both Indiana and Michigan's WQS.

It was noted in the study that when E. coli limits were being surpassed in the St. Joseph River, many of the tributaries, including the Elkhart River were also exceeding the WQS for E. coli. Problems, therefore, were not restricted to the St. Joseph River itself, but were being exacerbated by inputs from tributaries. Data from the report indicated several violations in the Elkhart River. The St. Joseph River TMDL indicated that both point and nonpoint sources of pollution were responsible for the E. coli contamination in the St. Joseph River. It was also determined that to meet the State's WQS the target load had to be set at a concentration value of 125 cfu per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over thirty days. This is how the standard is defined in the State's WQS. Some specific sources indicated in the TMDL include combined sewer overflows. The communities named in the TMDL that are part of the Elkhart River Watershed are the cities of Elkhart and Goshen. All of these communities are required to reduce the impact of CSOs by developing Long Term Control Plans (LTCPs) for their CSOs. These plans are approved by IDEM through the National Pollutant Discharge Elimination System (NPDES).

St. Joseph River Watershed Management Plan (2005)

In June 2005, the Friends of the St. Joe River (FOTSJR) released a watershed management plan for the St. Joseph River Watershed. In the fall of 2002, the Friends of the St. Joe River was awarded a grant from the Michigan Department of Environmental Quality to develop a Watershed Management Plan for the entire St. Joseph River Watershed. This plan was intended to unite stakeholders in a concerted effort to address water quality issues and natural resource protection across jurisdictional boundaries. Although several Lake Michigan Lakewide Management Plan, LARE and federally funded Clean Water Act projects had been conducted in subwatersheds in both Michigan and Indiana, and the St. Joseph River was identified by U.S. EPA as the biggest contributor of atrazine to Lake Michigan and a significant contributor of sediments and toxic substances such as mercury and PCBs, comprehensive planning efforts for the entire watershed had not been conducted at the time in which this WMP was written.

The FOTSJR coordinated with other key organizations for watershed plan preparation. The watershed management plan was developed from November 2002 through June 2005 and objectives include:

- Reduce soil erosion and sedimentation so that surface water functions and aesthetics are improved and protected.
- Reduce the amount of nutrient loading that so that surface water functions and aesthetics are improved and protected.
- Increase preservation, restoration, protection and appreciation of open space (a system of natural areas, natural systems, corridors, farmland, open land, and parklands).
- Educate local planning officials/commissions about water quality issues, smart growth and the protection of natural resources through coordinated planning, zoning and ordinances.
- Provide riparian landowners, both private and public, with information regarding shoreline protection.
- Establish Michigan Heritage Water Trails on all navigable rivers in the watershed.
- Eliminate/correct sources of disease-causing organisms that are harmful to public health and that limit the use of rivers, creeks, and lakes.
- Increase the development of certified manure management plans.
- Reduce the levels of pesticides, and other toxins that are harmful to public health and that degrade aquatic habitat.
- Develop and implement residential/commercial stormwater education programs in urban areas to reduce volume and velocity of runoff.
- Increase the number of small and medium size producers who complete chemical storage and handling assessments, particularly in areas with high water tables, porous soils, and those near surface or sensitive water resources.
- Provide and/or enhance hazardous waste collection programs.

Chain O' Lakes States Park Interpretive Master Plan (2010)

In response to new management, and the resulting opportunity to assess and evaluate, the IDNR Division of State Parks and Reservoirs developed an Interpretive Master Plan for Chain O' Lakes State Park in 2010. The plan provides a resource overview of the park's natural and cultural resources and a summary of existing conditions for interpretation. Key elements of the Interpretive Master Plan include:

- The management issues of historic preservation and lake eutrophication.
- Full-time staff to ensure program expansion, evaluation and long-term high quality with less turnover. This includes a Resource Manager.
- Identifying and managing invasive species including autumn olive, bush honeysuckle, multiflora rose, privet and garlic mustard.

- Preserving species such as the Henslow's Sparrow and protecting ash trees from the Emerald Ash Borer.
- Maintaining physical structures such as Stanley School House and the Iron Bridge.

Noble County Comprehensive Plan (2019)

In 2019, Noble County and its major cities wrote comprehensive plans to govern their future. The Countywide plans are detailed below, as well as the subsequent paragraphs for the City of Ligonier, City of Kendallville, and Town of Albion.

The first County comprehensive plan was adopted in 1968 and updated in 1986. The next plan was adopted in 2007 and the 2019 comprehensive plan was written with the intent to replace it. The planning process for the 2019 Noble County Comprehensive Plan, Noble Tomorrow, was started in Spring of 2017. A steering committee comprised of Noble County citizens and stakeholders convened to write this plan based on the input of the public through surveys, workshops and interest group meetings. While this plan also has goals that cover economic values and other areas of Noble County resources, the goals that pertain to natural resources include:

- Protecting lakes and natural resources.
- Preserving agricultural heritage while continuing to use innovative farming practices.
- Implement land use planning and strategic investments to encourage growth.
- Prioritize incremental development in towns rather than large scale development further away from towns.
- Require sanitary sewer in all new large-scale developments.
- Protect prime farmland from development.
- Restrict development in environmentally sensitive areas beyond minimum requirements from the state and federal government to ensure higher quality building.
- Development should be symbiotic with the natural environment.
- Establish a county regional sewer district to decrease pollution potential from septic systems on ill-suited lands.
- Sensitive land like wetlands, floodplain, and older growth forests should be conserved through education of existing programs that provide financial incentives.
- Require all development in hazardous areas to meet strong flood protection standards.
- Require all development to have no adverse impact on neighboring landowners.
- Promote the establishment of conservancy districts to effectively manage flood risks and maintain waterways.
- Prohibit new septic systems in the floodplain without higher regulatory standards for the protection from infiltration.
- Encourage use of innovative stormwater management practices like bio-swales, on-site bio-retention, and filter strips on developments both big and small.
- Strictly limit impervious surfaces that do not mitigate their own ill effects.
- Become a participating community in FEMA's Community Rating System in order to reduce flood risks and decrease flood insurance costs.
- Keep all parts of the Elkhart River clean and free from excessive obstruction.
- Build a multi-modal trail between Ligonier and West Noble Schools along the creek, between Cromwell and West Noble Schools, between Albion and Chain O' Lakes State Park, and between Albion and West Noble Schools.

Town of Albion Comprehensive Plan (2019)

In 2019, Noble County drafted a new county-wide comprehensive plan as well as new plans for its major cities. While the county-wide plan is an all-encompassing document, the individual city plans were written with each town's unique needs in mind. In addition to the county-wide goals listed above in the Noble County section (2019), goals and policies that are specific to Albion include:

- Encourage traditional neighborhood development that prioritizes people.
- Prioritize incremental development in town instead of largescale development further away from towns.
- Mix land uses in communities to promote walkable neighborhoods where one's needs can be met within a twenty-minute walk.
- Provide consistent and predictable land use decisions through well-articulated and implemented policy.
- Modify land use regulations to allow for easier division of smaller building sites in town.
- Strictly limit impervious surfaces that do not mitigate their own ill effects.
- Support the Noble County Parks Board and Town of Albion Parks Board in establishing recreation opportunities, especially through their Master Plan.
- Build a multi-modal trail between Albion and Chain O' Lakes State Park.
- Build a multi-modal trail between Albion and West Noble Schools.

City of Kendallville Comprehensive Master Plan (2019)

In 2019, the City of Kendallville worked with Ground Rules Company to create a new Comprehensive Plan. This plan replaced the City's 1963 Comprehensive Plan. The plan has six broad goals, two of which pertain to environmental quality including 1.) Manage Land Use and Growth and 2.) Nurture Environmental Quality. These two goals can be further defined as follows:

- Manage Land Use and Growth.
    - Update the Kendallville Zoning Ordinance to accommodate and support infill, redevelopment, and compact form.
    - Promote redevelopment by placing an equal priority on providing improved infrastructure and services to vacant lots in need of infill development and areas in need of redevelopment.
    - Utilize the Comprehensive Plan and Future Land Use Classification Map when considering development proposals and rezoning petitions.
    - Recognize that small deviations from this Plan and the Future Land Use Classification Map will accumulate and have a negative impact on the City's future.
    - Update, utilize, and enforce the Kendallville Zoning Ordinance, Kendallville Subdivision Control Ordinance, and other applicable ordinances.
    - Ensure an adequate quantity of suitable land exists for all desired land uses.
    - Develop policies to help evaluate the expansion of the Kendallville City Limits through annexation.
    - Explicitly permit existing agricultural operations to continue at current levels.
    - Buffer residential and other sensitive land uses from commercial and industrial development or redevelopment.
- Nurture Environmental Quality.
    - Allow flexibility for new developments to preserve (i.e. avoid developing) existing high quality natural features and habitats.
    - Require buffers to filter surface water before it reaches a lake, creek, or ditch.

- Integrate open space in future developments to provide recreational amenities and natural habitats.
- Require suitable soils as a prerequisite for development.
- Work through the Noble County Surveyor and appropriate state agencies to strengthen and enforce regulations that minimize soil erosion and prevent pollution at construction sites.
- Monitor changes in State and Federal laws dealing with groundwater supplies and comply with applicable requirements.
- Manage stormwater runoff to maintain and enhance water quality of lakes and streams.
- Denote wellhead protection areas around the community's wells and protect them from uses that can contaminate drinking water.
- Reduce discharges of non-point source pollutants through education, storm water management, and reduction of impervious surfaces.
- Require buildings and impervious surfaces to be set back from the top of the bank of a stream or ditch.
- Utilize native or prairie grasses and other absorption plant materials along regulated ditches.
- Participate in State and Federal programs to conserve, sustain, and restore natural areas.
- Support the newly created Tree Commission in its efforts to achieve "Tree City USA" status.
- Require appropriate landscaping be installed, especially canopy trees, when new development occurs.
- Encourage new development to preserve existing natural areas through the use of development incentives.
- Support efforts to make trails accessible, reliable, safe, convenient, and an attractive alternative to vehicular transportation.

City of Ligonier Comprehensive Plan (2019)

In 2019, Noble County drafted a new county-wide comprehensive plan as well as new plans for its major cities. While the county-wide plan is an all-encompassing document, the individual city plans were written with each town's unique needs in mind. In addition to the county-wide goals listed above, goals and policies that are specific to Ligonier include:

- Encourage smart growth and self-sustaining development with low barriers to entry.
- Improve quality of life and quality of place through strategic community investments.
- Prioritize incremental development in town instead of large-scale development further away from towns.
- Provide consistent and predictable land use decisions through well-articulated and implemented policy.
- Limit the use of suburban development patterns that are financially insolvent.
- Mix land uses in communities to promote walkable neighborhoods where one's needs can be met within a twenty-minute walk.
- Maintain historic properties as productive land uses and prevent disuse.
- Modify land use regulations to allow for easier division of smaller building sites in town.
- Strictly limit impervious surfaces that do not mitigate their own ill effects.
- Support the Noble County Parks Board and City of Ligonier Parks Board in establishing recreation opportunities, especially through their Master Plan.

Noble County Parks Plan (2019)
The Noble County 2019-2024 Parks Plan was created in order to provide direction for the parks board to accomplish their goal of providing recreational facilities that meet the needs of Noble County residents. Goals of the park plan include:

- Increase the miles of trails available to residents.
- Develop a trail head for the Fishing Line trail.
- Install emergency trail markers along trails.
- Improve Americans with Disabilities Act (ADA) accessibility along trails.
- Develop water based recreational opportunities on the Elkhart River.
- Publicize recreation assets.
- Develop a master plan for the next five years.

Elkhart County Parks & Recreation Master Plan (2019)
The 2019-2023 Elkhart County Parks & Recreation Master Plan was prepared by Lehman & Lehman, Inc in April of 2019. Their purpose of writing this master plan was to enable Elkhart County Parks to continue balanced planning for the overall park system; meet local recreation needs within available resources and to help the Parks and Recreation Board, community members and leaders to establish their current state of operations, their future desired state and provide structure to help achieve their goals and to monitor their successes. The Elkhart County Park Department staff and the Park Board have agreed on the following goals for the 5-Year Parks and Recreation Plan:

- Use national recreation standards, combined with a careful needs analysis to create new priorities for parks and recreation in the county.
- Receive approval from IDNR for eligibility for application for Land and Water Conservation Fund grant programs.
- Make park sites more ADA accessible.
- Protect natural resources through land acquisition and invasive species removal.
- Survey property boundaries.

Lagrange County Comprehensive Plan (2021)
As of spring 2022, Lagrange County is continuing to draft their comprehensive plan. Lagrange County Together is a community-driven process to prepare a comprehensive plan for the county, the towns of Lagrange, Shipshewana, Topeka and Wolcottville, and all unincorporated areas. The 16-month process is a blend of technical analysis and community engagement.

Kosciusko County Comprehensive Plan (2022)
As of spring 2022, Kosciusko County is in the midst of updating their county plan as well as each town plan. More information will be added as it becomes available.

2.12 Watershed Summary: Parameter Relationships

Several relationships among watershed parameters become apparent when watershed-wide data are examined. These relationships are discussed here in general, while relationships within specific subwatersheds are discussed in more detail in subsequent sections.

2.12.1 Topography, Soils and Nutrient and Sediment Loss

Much of the topography and terrain characteristics within the Upper Elkhart River Watershed have a direct correlation to water quality. Approximately 45% of the Upper Elkhart River Watershed is mapped in highly erodible lands. Highly erodible lands are very susceptible to erosion. Nutrients, such as

phosphorus, and sediment erode easily when these soils are not covered. Sediments and nutrients that reach Upper Elkhart River waterbodies are likely to degrade water quality. Highly erodible lands that are used for animal production or are located on cropland are more susceptible to soil erosion.

2.12.2 Wetland Loss, Hydromodification and Flooding

Wetlands cover 45,018 acres, or 17% of the watershed. When hydric soil coverage (73,254 acres) is used as an estimate of historic wetland coverage, it becomes apparent that more than 39% of wetlands have been modified or lost over time. Additionally, it is estimated that more than 198 miles of surface drains have been constructed in the watershed to move water more rapidly from land to adjacent waterbodies. In total, nearly 36% of the watershed is estimated to be covered by tile-drained soils. As commodity prices continue to go up and down, area land values remain high and as a result, individuals are spending a great deal of money to drain small natural wetlands in their fields in order to be able to farm that additional couple acres of land as it is cheaper to tile it than to buy ground already in production. The modification of the Upper Elkhart River Watershed directly impacts its ability to retain and store water. Additionally, these efforts push water from one area to another resulting in flooding in portions of the watershed. It should be noted that the outstanding rivers identified in the Upper Elkhart River Watershed are listed for the contiguous wetland complexes which exist within the river's floodplain.

2.12.3 Topography, Population Centers and Septic Soil Suitability/Manure Volume

Much of the watershed's population is located within unincorporated areas outside cities and towns in the Upper Elkhart River Watershed. Unsewered, dense housing areas are located throughout the watershed with small subdivisions and lake and roadside housing developments occurring throughout the watershed. This is a concern because adequate filtration may not occur and this water may easily reach water sources and groundwater. With a lack of natural filtration of septic fields to groundwater, degradation of water quality is likely if septic systems are not maintained. Septic maintenance is a concern of Upper Elkhart River Watershed stakeholders. Additionally, the large volume of manure produced on small, unregulated animal farms, confined feeding operations and concentrated animal feeding operations lead to E. coli impairments throughout the watershed.

2.12.4 High-quality Habitat and ETR Species

Many high-quality communities occur throughout the Upper Elkhart River Watershed. Several of these are preserved for future generations. The high-quality natural areas including, heavily forested riparian areas associated with the mainstem of Elkhart River provide unique habitats which house several endangered, threatened or rare communities and species. The topography, bedrock and soils in this area support ravines and mature forest habitats that provide rare habitat that is home to many species of wildlife, fish, and plants. The topography here made this area less suitable for farming and so more of the natural community and habitat has been preserved here. Many of the endangered, threatened and rare species and high-quality natural communities in the watershed are found along this stretch of the stream corridor, making this an important area to focus habitat preservation and restoration efforts.

3.0 WATERSHED INVENTORY II-A: WATER QUALITY AND WATERSHED ASSESSMENT

In order to better understand the watershed, an inventory and assessment of the watershed and existing water quality studies conducted within the watershed is necessary. Examining previous efforts allowed the project participants to determine if sufficient data was available or if additional data needed to be collected in order to characterize water quality problems. Once the water quality data assessment occurred, the watershed was then characterized to determine potential sources of any water quality issues identified by the data review. Subsequently, pollutant sources could then be tied to stakeholder

concerns and collected data could be used to estimate pollutant loads from each identified source location. The following sections detail the water quality and watershed assessment efforts on both the broad, watershed-wide scale and in a focused manner looking at each subwatershed within the Upper Elkhart River Watershed.

3.1 Water Quality Targets

Many of the historic water quality assessments occurred using different techniques or goals. Several sites were sampled only one time and for a limited number of parameters. Monitoring committee members were reluctant to draw too many conclusions based on a single sampling event. Nonetheless, the available data are detailed below and compared in general with water quality targets. In order to compare the results of these assessments, the monitoring committee identified a standard suite of parameters and parameter benchmarks. Table 19 details the selected parameters and the benchmark utilized to evaluate collected water quality data.

Table 19. Water quality benchmarks used to assess water quality from historic and current water quality assessments.

Parameter	Water Quality Benchmark	Source
Dissolved oxygen	>4 mg/L or <12 mg/L	Indiana Administrative Code
pH	>6 or <9	Indiana Administrative Code
Temperature	Monthly standard	Indiana Administrative Code
Conductivity	<1050 µmhos/cm	Indiana Administrative Code
E. coli	<235 colonies/100 mL	Indiana Administrative Code
Nitrate-nitrogen	<1 mg/L	Dodds et al. (1998)
Ammonia-nitrogen	Varies by pH/temp	Indiana Administrative Code
Total Kjeldahl nitrogen	2.18 mg/L	USEPA (2000)
Total phosphorus	<0.08 mg/L	Dodds et al. (1998)
Orthophosphorus	<0.005 mg/L	Dunne and Leopold (1978)
Total suspended solids	<15 mg/L	Waters (1995)
Turbidity	<6.36 NTU	USEPA (2000)
Qualitative Habitat Evaluation Index	>51 points	IDEM (2008)
Index of Biotic Integrity	>36 points	IDEM (2008)
Macroinvertebrate Index of Biotic Integrity	>2.2 points (old) >36 points (new)	IDEM (2008)

3.2 Stream Historic Water Quality Sampling Efforts

A variety of water quality assessment projects have been completed within the Upper Elkhart River Watershed (Figure 35). Statewide assessments and listings include the impaired waterbodies assessment and fish consumption advisories. The Indiana Department of Environmental Management (IDEM), St. Joseph River Basin Commission (SJRBC), Lagrange County Lakes Council (LCLC), Elkhart County, and several consulting firms which used DNR Lake and River Enhancement Program and/or IDEM Section 319 grant funds have all completed assessments within the watershed. Additionally, volunteer-based sampling of water quality through the Hoosier Riverwatch program also provide water quality data with which the watershed can be characterized. A summary of each assessment methodology and general results are discussed below. Specific data results are detailed within subwatershed discussions in subsequent section.

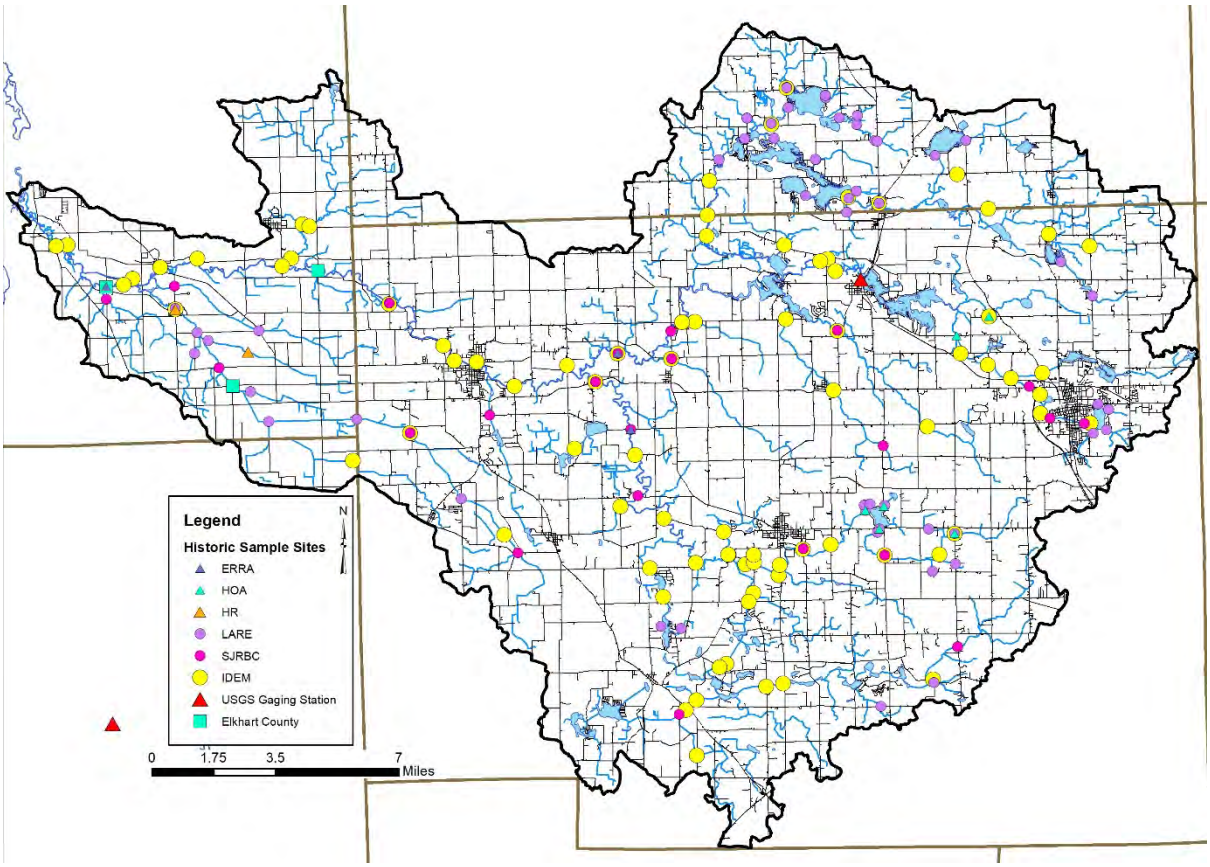


Figure 35. Historic stream water quality assessment locations.

3.2.1 Impaired Waterbodies (303(d) List)

The impaired waterbodies, or 303(d), list is prepared biannually by the Indiana Department of Environmental Management. Waterbodies are included on the list if water quality assessments indicate that they do not meet their designated use. In total, 48 stream segments and 19 lakes within the Upper Elkhart River Watershed are included on the list of impaired waterbodies (IDEM, 2018). Figure 35 details the listings in the watershed, while Figure 36 maps the segments and their locations within the watershed. Waterbodies are listed as impaired for E. coli (184 miles), nutrients/total phosphorus (10.2 miles), impaired biotic communities (5.3 miles), dissolved oxygen (16.9 miles), chloride (10.2 miles) and mercury (0.5 miles) and PCBs (9.7 miles) in fish tissue. More than 597 acres of lakes are impaired for biological integrity, 24 acres for mercury in fish tissue, 1,173 acres for PCBs in fish tissue and 313 acres for total phosphorus.

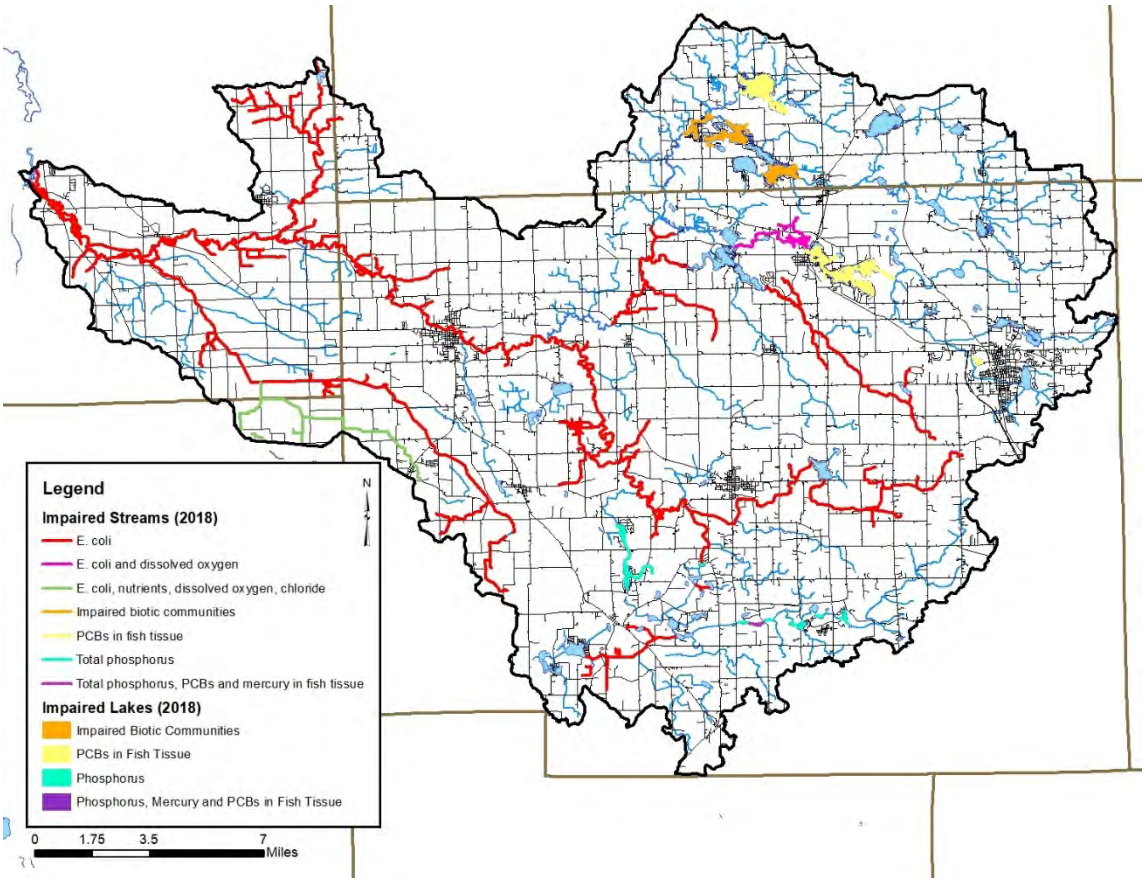


Figure 36. Impaired waterbody locations in the Upper Elkhart River Watershed. Source: IDEM, 2018.

Table 20. Impaired waterbodies in the Upper Elkhart River Watershed 2018 IDEM 303(d) list.

Waterbody Name	Assessment Unit	Impairment	Miles/ Acres
ELKHART RIVER, MIDDLE BRANCH	INJ01F5_02	BI, DO, E. coli	4.71
ELKHART RIVER, MIDDLE BRANCH	INJ01F5_03	BI, DO, E. coli	2.09
GRETZINGER DITCH	INJ01F6_T1010	BI, E. coli	11.35
GRETZINGER DITCH	INJ01F6_T1010A	BI, E. coli	0.61
ELKHART RIVER, NORTH BRANCH	INJ01F7_02	E. coli	4.29
ELKHART RIVER, NORTH BRANCH	INJ01F7_03	E. coli	2
ELKHART RIVER, NORTH BRANCH - UNNAMED TRIBUTARY	INJ01F7_T1001	E. coli	1.72
BOYD DITCH	INJ01F7_T1002	E. coli	3.39
CARROL CREEK	INJ01G2_02	BI, E. coli	2.37
CARROL CREEK	INJ01G2_03	BI, E. coli	1.35
CUB LAKE INLET	INJ01G2_T1006	BI, E. coli	0.67
CARROL CREEK - UNNAMED TRIBUTARY	INJ01G2_T1007	BI, E. coli	1.05
DEEP LAKE OUTLET	INJ01G2_T1010	BI, E. coli	0.48
DEEP LAKE INLET	INJ01G2_T1010A	BI, E. coli	0.33
CROFT DITCH	INJ01G3_02	E. coli	4.81
CROFT DITCH	INJ01G3_03	E. coli	0.74

Waterbody Name	Assessment Unit	Impairment	Miles/ Acres
CROFT DITCH	INJ01G3_04	E. coli	0.67
RIMMELL BRANCH	INJ01G3_T1001	BI, E. coli	10.84
ELKHART RIVER, SOUTH BRANCH	INJ01G4_04	BI, E. coli	2.05
ELKHART RIVER, SOUTH BRANCH	INJ01G4_05	BI, E. coli	0.55
ELKHART RIVER, SOUTH BRANCH	INJ01G4_05	E. coli	0.55
ELKHART RIVER, SOUTH BRANCH	INJ01G5_02	E. coli	4.92
ELKHART RIVER, SOUTH BRANCH	INJ01G5_03	E. coli	10.26
ELKHART RIVER, SOUTH BRANCH	INJ01G5_04	E. coli	5.81
ELKHART RIVER, SOUTH BRANCH	INJ01G5_T1004	E. coli	4.8
STONY CREEK	INJ01I1_01	BI, E. coli	3.68
STONY CREEK	INJ01I1_02	E. coli	1.95
MCALLISTER DITCH	INJ01I1_T1001	E. coli	9.25
MCALLISTER DITCH - UNNAMED TRIBUTARY	INJ01I1_T1002	E. coli	1.87
FISH LAKE INLET	INJ01I1_T1002A	E. coli	0.33
ELKHART RIVER	INJ01I2_01	E. coli	4.54
ELKHART RIVER	INJ01I2_02	E. coli	2.2
ELKHART RIVER	INJ01I2_03	E. coli	12.31
ELKHART RIVER - UNNAMED TRIBUTARY	INJ01I2_T1004	E. coli	1.89
SOLOMON CREEK	INJ01I3_01	BI, E. coli	6.59
SOLOMON CREEK	INJ01I3_02	BI, E. coli	8.66
IDEN BRANCH	INJ01I3_T1001	E. coli	2.94
SOLOMON CREEK	INJ01I4_02	E. coli	5.29
SOLOMON CREEK	INJ01I4_03	E. coli	2.47
CROMWELL DITCH	INJ01I4_T1005	BI, Chloride, DO, E. coli, Nutrients	3.48
CROMWELL DITCH	INJ01I4_T1006	BI, Chloride, DO, E. coli, Nutrients	6.69
ELKHART RIVER	INJ01I5_01	E. coli	7.76
ELKHART RIVER	INJ01I5_02	E. coli	6.41
ELKHART RIVER	INJ01I5_03	BI, E. coli	2.86
ELKHART RIVER	INJ01I5_04	E. coli	4.32
LONG DITCH	INJ01I5_T1001	E. coli	3.55
ELKHART RIVER HYDRAULIC CANAL	INJ01I5_T1004	BI, E. coli	2.25
ELKHART RIVER - UNNAMED TRIBUTARY	INJ01I5_T1006	E. coli	1.12
DALLAS LAKE	INJ01P1263_00	BI	283
DOCK LAKE	INJ01P1228_00	TP	16
HACKENBURG LAKE	INJ01P1262_00	BI	42
HENDERSON LAKE	INJ01P1240_00	PCBS in fish tissue	22
LONG LAKE (CHAIN O' LAKES)	INJ01P1232_00	TP	40
LONG LAKE (LOWER)	INJ01P1208_00	TP	66
MESSICK LAKE	INJ01P1261_00	BI	68

Waterbody Name	Assessment Unit	Impairment	Miles/ Acres
MILLER LAKE (CHAIN O'LAKES SP)	INJ01P1222_00	TP	11
MUD LAKE (CHAIN O' LAKES)	INJ01P1224_00	TP	8
OLIN LAKE	INJ01P1026_00	PCBS in fish tissue	103
OLIVER LAKE	INJ01P1025_00	PCBS in fish tissue	394
PORT MITCHELL LAKE	INJ01P1211_00	TP	15
RIVIR LAKE	INJ01P1223_00	Mercury in fish tissue	24
RIVIR LAKE	INJ01P1223_00	PCBS in fish tissue	24
RIVIR LAKE	INJ01P1223_00	TP	24
SAND LAKE	INJ01P1226_00	TP	47
SYLVAN LAKE	INJ01P1248_00	PCBS in fish tissue	630
UPPER LONG LAKE (UPPER)	INJ01P1210_00	TP	86
WITMER LAKE	INJ01P1267_00	BI	204

3.2.2 Fish Consumption Advisory (FCA)

Three state agencies collaborate annually to compile the Indiana Fish Consumption Advisory (FCA). The Indiana Department of Natural Resources, Indiana Department of Environmental Management, and Indiana State Department of Health have worked together since 1972 on this effort. Samples are collected through IDEM's rotating basin assessment for bottom feeding, mid-water column feeding, and top feeding fish. Fish tissue samples are then analyzed for heavy metals, PCBs, and pesticides. Advisories listings by the ISDH are as follows:

- Level 3 – limit consumption to one meal per month for adults with pregnant or breastfeeding women, women who plan to have children, and children under 15 consuming zero volume of these fish.
- Level 4 – limit consumption to one meal every 2 months for adults with women and children detailed above having zero consumption.
- Level 5 – zero consumption or do not eat.

Further, sensitive populations are defined as females under 50 except those no longer able to become pregnant, males under 15 or people with compromised immune systems, while general populations are defined as males over the age of 15 and women over the age of 50 or who are no longer capable of becoming pregnant.

Based on these listings, the following conclusions can be drawn:

- Consumption of all sizes bluegill, bullhead, common carp and largemouth bass from Skinner Lake should be limited for sensitive populations. The general population should also limit common carp and largemouth bass over 16 inches consumption to one meal per week,
- For sensitive populations, consumption of all sizes of bluegill and white sucker from Eagle Lake should be limited to one per week and largemouth bass should be limited to consumption of one meal per month. The general population should limit consumption to one meal per week.
- Sensitive populations should limit consumption of bullhead, largemouth bass, northern pike and walleye from Sylvan Lake to one meal per week and common carp should be limited to one meal per month. The general population should limit consumption of bullhead, northern pike and largemouth bass to one meal per week, while common carp consumption should be limited to one meal per month.

- Sensitive populations should limit bowfin, brown trout, common carp consumption from Oliver Lake to one meal per week and largemouth bass consumption to one meal per month. The general population should limit consumption of bowfin larger than 21 inches, brown trout and largemouth bass to one meal per week.
- Sensitive populations should limit consumption of channel catfish larger than 20 inches to one meal per year; channel catfish up to 20 inches, redhorse and white sucker larger than 16 inches to one meal per month and northern hogsucker, rock bass, smallmouth bass and walleye consumption should be limited to one meal per week from the Elkhart River in Elkhart County. The general population should limit redhorse species, smallmouth bass and walleye consumption to one meal per week, catfish up to 20 inches to one meal per month and those over 20 inches to one meal per year.

3.2.3 IDEM Rotational Basin Assessments (1991-2021)

IDEM sampled water chemistry, macroinvertebrates, fish and habitat at several locations in the Upper Elkhart River Watershed via their rotational basin, watershed assessment, and source ID assessment programs between 1991 and 2020. Additionally, one site on the Elkhart River at Benton (US Highway 33) is sampled monthly as part of IDEM's fixed station monitoring program. A few of the assessments which occurred via various IDEM assessment program included a single sample event with most assessments including five sample events and a few assessments including up to 12 events. Based on the water chemistry assessments, the following conclusions can be drawn:

- E. coli concentrations exceeded the state standard in 52% of samples collected in the Upper Elkhart River Watershed.
- Nitrate-nitrogen concentrations exceeded target concentrations in 98% of samples collected in the Upper Elkhart River Watershed.
- Total phosphorus concentrations exceeded the recommended criteria in 34% of samples collected in the Upper Elkhart River Watershed.
- Total suspended solids concentrations exceeded the recommended criteria in 16% of samples collected in the Upper Elkhart River Watershed.
- Turbidity levels routinely exceed the recommended standard in 65% of samples collected in the Upper Elkhart River Watershed.
- Further, 6% of conductivity, 13% of dissolved oxygen and 1% of pH samples also exceeded water quality standards.

Based on the fish and macroinvertebrate community and habitat assessments, the following conclusions can be drawn:

- Macroinvertebrate community assessments indicate that the Elkhart River and its tributaries rate as moderately impaired to slightly impaired using the kick net sampling procedure with scores ranging from 2.2 to 5. Only two of the 27 sites sampled using the multimetric habitat approach rate as impaired scoring 36 points or less.
- Fish community assessments indicate that the Elkhart River and its tributaries rate as very poor (16) to excellent (56). Only two of 21 sampling events rated below the level at which IDEM states the fish community supports its aquatic life use designation.
- Habitat assessments completed along the Elkhart River and its tributaries indicate that habitat is generally fully support for aquatic life uses with QHEI scores ranging from 24 to 81 during fish community assessments and from 30 to 87 during macroinvertebrates. In total, 13 of 30 habitat assessments rate below the aquatic life use designation rating for Indiana (51).

3.2.4 St Joseph River Basin Commission (2014-2015)

The SJRBC completed monthly sampling at 22 sites in the Upper Elkhart River Watershed in an effort to characterize water quality in the basin. Based on the water chemistry assessments, the following conclusions can be drawn:

- E. coli concentrations exceeded the state standard in 13% of samples collected in the Upper Elkhart River Watershed.
- Nitrate-nitrogen concentrations exceeded target concentrations in 59% of samples collected in the Upper Elkhart River Watershed.
- Total phosphorus concentrations exceeded the recommended criteria in 51% of samples collected in the Upper Elkhart River Watershed.
- Total suspended solids concentrations exceeded the recommended criteria in 18% of samples collected in the Upper Elkhart River Watershed.
- Turbidity levels routinely exceed the recommended standard in 26% of samples collected in the Upper Elkhart River Watershed.
- Further, 2% of conductivity and 22% of dissolved oxygen samples also exceeded water quality standards.

3.2.5 Elkhart County (1997-2007)

Elkhart County agencies including the Health Department and MS4 sampled five Upper Elkhart River Watershed sites every two weeks during the growing season. Based on the assessments completed since 1997, the following conclusions can be drawn:

- E. coli concentrations exceeded the state standard in 31% of samples collected in the Upper Elkhart River Watershed.
- Nitrate-nitrogen concentrations exceeded target concentrations in 76% of samples collected in the Upper Elkhart River Watershed.
- Total phosphorus concentrations exceeded the recommended criteria in 86% of samples collected in the Upper Elkhart River Watershed.
- Total suspended solids concentrations exceeded the recommended criteria in 6% of samples collected in the Upper Elkhart River Watershed.
- Further, 1% of conductivity and 9% of dissolved oxygen samples also exceeded water quality standards.

3.2.6 Lagrange County Lakes Council (LCLC)

The Lagrange County Lakes Department have sampled nine lake inlets since 2013. Sampling occurred under various patterns most often occurring twice per summer. Based on assessments completed, the following conclusions can be drawn:

- E. coli concentrations exceeded the state standard in 3% of samples collected in the Upper Elkhart River Watershed.
- Nitrate-nitrogen concentrations exceeded target concentrations in 25% of samples collected in the Upper Elkhart River Watershed.
- Total phosphorus concentrations exceeded the recommended criteria in 47% of samples collected in the Upper Elkhart River Watershed.
- Total suspended solids concentrations exceeded the recommended criteria in 16% of samples collected in the Upper Elkhart River Watershed.
- Further, 2% of pH and 4% of dissolved oxygen samples also exceeded water quality standards.

3.2.7 Oliver Lake Sampling

In 2022, the Greater Olin Lake Conservancy initiated assessment of their stream inlets sampling five stream sites four times in 2022 following storm events. Based on the assessments, the following conclusions can be drawn:

- E. coli concentrations exceeded the state standard in 75% of samples collected in the Upper Elkhart River Watershed. Concentrations collected during the July sampling event were elevated at all sample sites.
- Nitrate-nitrogen concentrations exceeded target concentrations in 70% of samples collected in the Upper Elkhart River Watershed.
- Total phosphorus concentrations exceeded the recommended criteria in 35% of samples collected in the Upper Elkhart River Watershed.
- Total suspended solids concentrations exceeded the recommended criteria in 30% of samples collected in the Upper Elkhart River Watershed.

3.2.8 Sylvan Lake Monitoring (2021)

The City of Kendallville, Sylvan Lake Association and other partners initiated a three-year monitoring project in 2019. As part of the project, two stream gaging stations and continuous samplers were installed on Sylvan Lake's inlet streams and one at the lake's outlet. Based on the report for data collected in 2021, the following conclusions can be drawn:

- Sylvan Lake is a hypereutrophic lake with excess phosphorus which causes regular summer algal blooms.
- Average TP concentrations at both lake sampling points exceeds water quality targets set by the project.
- Henderson Lake Ditch is the largest source of TP to the lake loading an excess of 19,250 lb/year to Sylvan Lake.

3.2.9 IDNR Lake and River Enhancement Program Projects

Several IDNR LARE-funded projects have been completed in the Upper Elkhart River Watershed since 1988. Each project and their stream monitoring efforts are detailed below.

Preliminary Investigation of 24 Lakes, Lagrange County, Indiana (1989)

In 1988, the Lagrange County Commissioners completed an assessment of 24 Lagrange County lakes including 10 lakes located in the Upper Elkhart River Watershed. Sampling of five stream sites occurred as part of this assessment. Based on assessments completed, the following conclusions can be drawn:

- Nutrient concentrations are elevated in Lagrange County lake inlet streams with 40% of nitrate, 70% of orthophosphorus and 84% of total phosphorus samples exceeding water quality targets.

Feasibility Study for Cree and Shockopee Lakes (1990)

In 1989, International Science and Technology (IS&T) completed an assessment of Cree and Shockopee lakes. Sampling occurred at two locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- Under storm flow conditions, nutrients including nitrate, orthophosphorus, and total phosphorus were elevated. Overall, 25% of nitrate and ammonia, 50% of orthophosphorus, 75% of total phosphorus samples and 100% of TKN samples exceeded water quality targets.
- TSS samples were also elevated under storm flow conditions with 75% of samples exceeding targets.

Feasibility Study on the Restoration of Bixler Lake (1990)
In 1989, International Science and Technology (IS&T) completed an assessment of Bixler Lake for the Kendallville Park and Recreation Department. Sampling occurred at four locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- Under storm flow conditions, nutrients including nitrate, orthophosphorus, and total phosphorus were elevated. Overall, 50% of sampled exceeded water quality targets.
- Total Kjeldahl nitrogen concentrations were elevated in all samples exceeding water quality targets in 100% of collected samples.
- TSS samples were also elevated under storm flow conditions with 50% of samples exceeding targets.

Feasibility Study of Ten Lagrange County Lakes (1992)
In 1991, FXBrowne completed an assessment of 10 Lagrange County lakes located in the Upper Elkhart River Watershed. Sampling of 22 stream sites occurred as part of this assessment. Based on assessments completed, the following conclusions can be drawn:

- Nutrient concentrations are elevated in Lagrange County lake inlet streams with 18% of nitrate, 82% of orthophosphorus and 59% of total phosphorus samples exceeding water quality targets.
- Elevated total Kjeldahl nitrogen (36%) and total suspended solids (18%) suggest that sediment attached nutrients and sediment itself are also of concern under high flow conditions.

Feasibility Study for Cree and Shockopee Lakes (1990)
In 1989, International Science and Technology (IS&T) completed an assessment of Cree and Shockopee lakes. Sampling occurred at two locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- Under storm flow conditions, nutrients including nitrate, orthophosphorus, and total phosphorus were elevated. Overall, 50% of sampled exceeded water quality targets.
- Total Kjeldahl nitrogen concentrations were elevated in all samples exceeding water quality targets in 100% of collected samples.
- TSS samples were also elevated under storm flow conditions with 50% of samples exceeding targets.

Chain o' Lakes Diagnostic Study (2002)
In 2002, Gensic and Associates completed the water quality portion of the assessment of the Chain of Lakes state park lakes and their inlet streams. Sampling occurred at two locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- Under storm flow conditions, dissolved nutrients including nitrate and orthophosphorus were elevated. Overall, 50% of sampled exceeded water quality targets.
- TKN, TP and TSS concentrations were elevated in all samples exceeding water quality targets in 100% of collected samples.
- E. coli concentrations exceeded state standards in 25% of collected samples.
- QHEI scores ranged from 56 to 66 with both sites scoring above Indiana's aquatic life use designation and one site scoring below the level at which the Ohio EPA indicates is conducive to warmwater fauna.
- mIBI scores were low for all watershed streams ranging from moderate to severe impairment with scores ranging from 3.25 to 3.75.

Whetten Ditch, Solomon Creek and Dry Run Watersheds Diagnostic Study (2002)

The Whetten Ditch, Solomon Creek and Dry Run Watersheds drain approximately 36,242 acres in Elkhart, Noble and Kosciusko Counties. As part of the project, JFNew sampled nine stream sites across the watershed. Based on assessments completed in 2001, the following conclusions can be drawn:

- Physical and chemical parameter data indicate moderate to severe degradation when compared with ideal conditions.
- Nutrient concentrations measure higher than median nutrient concentrations observed in modified Ohio streams known to support healthy modified warmwater habitat for aquatic life.
- Stormflow runoff conditions generated nutrient and bacteria concentrations that violated human and aquatic biota health targets and standards. Overall, 94% of nitrate, 61% of orthophosphorus and total phosphorus samples exceed water quality targets.
- Sediment loading rates were variable but high ranging from 1 to 5845 kg/d depending on flow regime and location. More than 39% of samples collected exceed TSS targets.
- The Juday Ditch subwatershed delivered more sediment, phosphorus and E. coli than any other subwatershed during storm conditions per unit area.
- Juday Creek, Blue Ditch, Solomon Creek east, Dry Run and Whetten Ditch could be considered impaired based on water chemistry data.
- Poor pool-riffle development, excessive siltation/substrate embeddedness, channel alterations from ditching and dredging and very narrow riparian buffers limit habitat present at each sampled reach. QHEI scores ranged from 25.5 to 54.5 with only one site scoring above Indiana's aquatic life use designation and all sites scoring below the level at which the Ohio EPA indicates is conducive to warmwater fauna.
- mIBI scores were low for all watershed streams ranging from moderate to severe impairment with scores ranging from 0.75 to 6.

Feasibility Study for Cree and Shockopee Lakes (1990)

In 1989, International Science and Technology (IS&T) completed an assessment of Cree and Shockopee lakes. Sampling occurred at two locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- Under storm flow conditions, nutrients including nitrate, orthophosphorus, and total phosphorus were elevated. Overall, 50% of sampled exceeded water quality targets.
- Total Kjeldahl nitrogen concentrations were elevated in all samples exceeding water quality targets in 100% of collected samples.
- TSS samples were also elevated under storm flow conditions with 50% of samples exceeding targets.

Feasibility Study for Sylvan Lake Improvement Association (1990)

In 1988, Crisman completed an assessment of Sylvan Lake and its watershed. Sampling occurred at two locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- Nitrate concentration (2 mg/L) in Henderson Lake Ditch measured 10 times greater than in Waterhouse Ditch or any of the lake stations during both the May and August assessments with concentrations measuring lower in August than in May. Overall, 33% of samples exceeded water quality targets.
- Ammonia, TKN, orthophosphorus and TP concentrations were also elevated in Henderson Lake Ditch compared to Waterhouse Ditch or the lake stations. Ammonia concentrations in Henderson Lake Ditch exceeded state standards during all assessments. More than 75% of TKN

samples, more than 67% of orthophosphorus and more than 50% of TP samples exceeded water quality targets.

Upper Long Lake Watershed Diagnostic Study (1998)

In 1998, Gensic and Associates completed an assessment of Upper Long Lake and its watershed. Sampling occurred at two locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- TKN and TP samples exceeded water quality targets in 100% of collected samples.
- TSS measured low with none of the samples exceeding targets during the assessment.

Oliver, Olin and Martin Lakes Diagnostic Study (2009)

In 2008, JFNew completed an assessment of Olin, Oliver and Martin lakes and their inlet streams. Sampling occurred at four locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- Nutrients including nitrate, orthophosphorus, and total phosphorus were elevated with 100% of nitrate samples, 50% of TKN samples, 33% of total phosphorus, 67% of orthophosphorus and 17% of ammonia samples exceeding water quality targets.
- TSS samples were also elevated; however, only 33% of samples exceeding targets.
- Dissolved oxygen levels measured low with 17% of samples measuring below the lower state water quality standard.
- E. coli concentrations were elevated with 75% of samples exceeding the state standard.
- QHEI scores ranged from 31.5 to 66 with only one sites scoring above Indiana's aquatic life use designation (51) and all but one site scoring below the level at which the Ohio EPA indicates is conducive to warmwater fauna (60).
- mIBI scores were low for all watershed streams ranging from 2 to 4.4 indicating that macroinvertebrate communities are moderately to severely impaired.

Skinner Lake Diagnostic Study (2022)

In 2021, Arion Consultants completed an assessment of Skinner Lake and its watershed. Sampling occurred at 10 locations under base and storm flow conditions. Based on assessments completed, the following conclusions can be drawn:

- In general, physical and chemical parameter data collected from streams in the Skinner Lake Watershed indicate the potential for water quality degradation when compared with ideal conditions. In total, 10% of dissolved oxygen samples exceed state water quality standards measuring lower than state standards.
- Particulate phosphorus concentrations were elevated throughout the watershed under all sampling conditions. Nearly 80% of TP samples exceed water quality targets while only 15% of orthophosphorus concentrations exceed targets.
- Total Kjeldahl nitrogen concentrations measured above EPA target concentrations; however, concentrations were generally low throughout the Skinner Lake Watershed. Nearly 90% of TKN samples exceed water quality targets.
- Nitrate-nitrogen concentrations were also low throughout the watershed during base flow conditions; however, all sites exceeded levels at which high productivity (eutrophication) can occur during storm flow conditions. This suggests that nitrate-nitrogen is loaded to the system during storm events. More than 70% of nitrate samples exceed water quality targets.

- Total suspended solids concentrations measured low under base flow conditions but exceeded targets at all sites during storm flow conditions. Nearly 30% of TSS samples exceed water quality targets.
- E. coli concentrations exceeded state standards during base flow and at all but two sites under storm flow conditions. Overall, 71% of E. coli samples exceed water quality targets.
- The overall evaluation of biotic health and habitat quality in the Skinner Lake Watershed indicates that stream sites are slightly to moderately degraded. Many of the sites lacked at least one of the key elements of natural, healthy stream habitats. These missing key elements limit the functionality of these systems. The QHEI evaluations generally reflected the moderate pool and limited to moderate riffle development in watershed streams; there was almost a complete absence of sufficient pool-riffle development within most sites where habitat scored poorly. Channel alterations and minimal riparian buffer zones reduce streams' resilience to agricultural runoff. These factors are critical for habitat diversity and biological integrity in the stream ecosystems. Further, instream cover is limited at almost all sites. As these streams are all legal drains, the modification of their habitat is not unexpected.

3.2.10 Elkhart River Watershed Management Plan (2008)

V3 assessed five Elkhart River sites during development of the Elkhart River Watershed Management Plan. Three of those sites are located in the Upper Elkhart River Watershed. Based on assessments completed in 2007, the following conclusions can be drawn:

- E. coli concentrations exceeded the state standard in 33% of samples collected in the Upper Elkhart River Watershed.
- Nitrate-nitrogen concentrations exceeded target concentrations in 33% of samples collected in the Upper Elkhart River Watershed.
- Total phosphorus concentrations exceeded the recommended criteria in 17% of samples collected in the Upper Elkhart River Watershed.
- Total suspended solids concentrations exceeded the recommended criteria in 33% of samples collected in the Upper Elkhart River Watershed.
- Turbidity, pH, and conductivity samples did not exceed water quality standards or targets. However, 17% of dissolved oxygen samples measured below the lower state water quality standard.
- QHEI scores ranged from 55.5 to 79 with all sites scoring above Indiana's aquatic life use designation (51) and above the level at which the Ohio EPA indicates is conducive to warmwater fauna (60).
- mIBI scores were low for all watershed streams ranging from moderate impairment with scores ranging from 2.2 to 4.8.

3.2.11 Hoosier Riverwatch Sampling (2002-2014)

From 2002 to 2014, volunteers trained through the Hoosier Riverwatch program assessed two sites in the Upper Elkhart River Watershed. Volunteers monitored stream stage, flow rate, and discharge; collected water chemistry samples for analysis using HACH test kits; assessed instream habitat using the Citizen's QHEI; and surveyed the stream's macroinvertebrate community. Using the chemical data, the Water Quality Index (WQI) was calculated. Volunteers calculated a Pollution Tolerance Index (PTI) using the biological data. Based on these data, the following conclusions can be drawn:

- When measured, E. coli concentrations were elevated in 71% of samples. Concentrations above the state standard ranged from 250 to 915 col/100 ml.

- Nitrate concentrations ranged from 0.15 to 22 mg/L with 50% of samples exceeding the water quality target.
- Orthophosphorus concentrations were elevated in 100% of samples.
- Turbidity levels were elevated across all sample sites with 35% of samples exceeding the transparency which indicates poor water quality (29 cm).

3.3 In-Lake Monitoring

A variety of lake assessment projects have been completed within the Upper Elkhart River Watershed with sampling occurring at more than 93 lakes in the basin (Figure 37). The Indiana Clean Lakes Program and their volunteer monitors are the primary collectors of data. A summary of each assessment methodology and general results are discussed below. Specific data results are detailed within subwatershed discussions in subsequent sections.

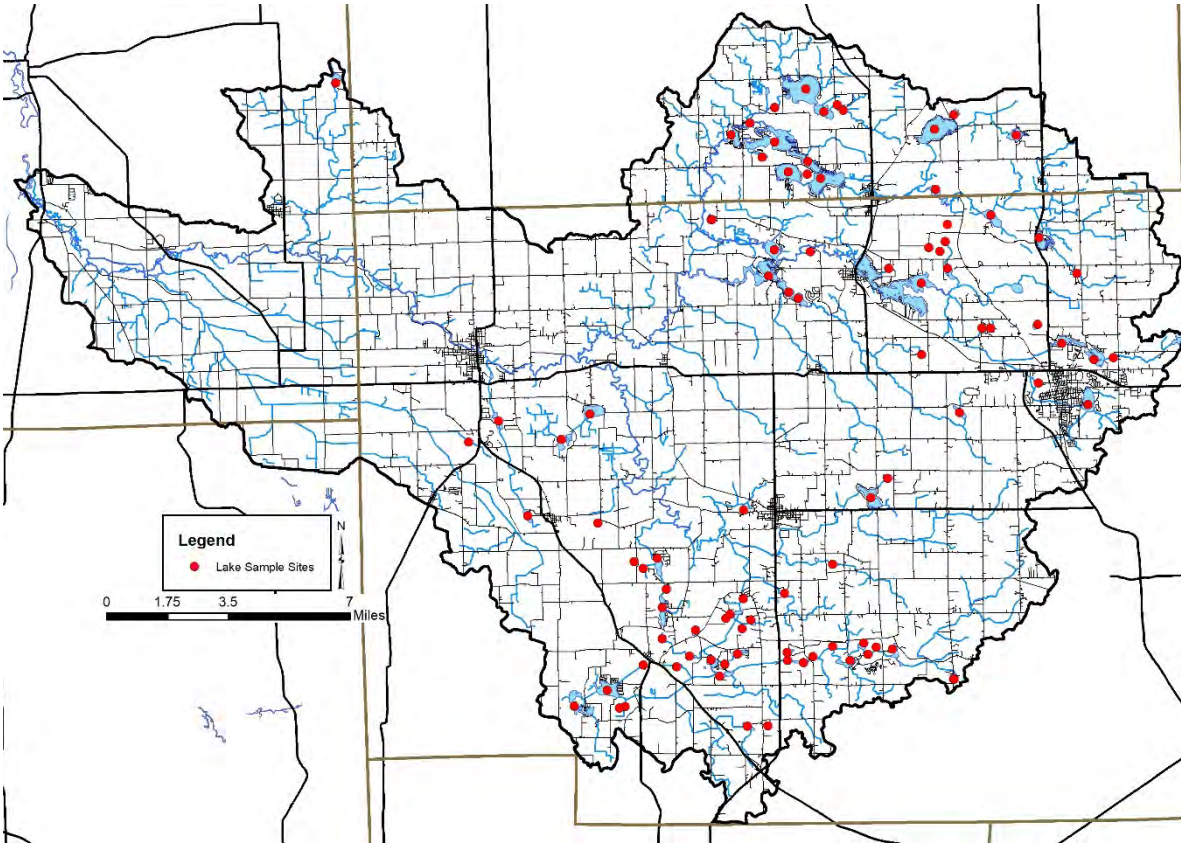


Figure 37. Historic lake assessment locations.

3.3.1 Indiana Clean Lakes Program

Since 1989, the Indiana Clean Lakes Program assessed water quality in 52 lakes in the Upper Elkhart River Watershed. Soluble and dissolved nitrogen, soluble and dissolved phosphorus, chlorophyll a, dissolved oxygen, temperature and plankton counts were collected at the deepest point of each lake. Based on these data, the following conclusions can be drawn:

- In total, 237 transparency measurements were collected and nearly 48% of these measures lower than the median transparency measured for Indiana lakes (5.6 feet).
- Nearly 237 total phosphorus samples were collected with 99% of the average surface and bottom water samples concentrations exceeding the median concentration for Indiana lakes (51 mg/L).

- More than 114 chlorophyll a samples were collected with 57% exceeding the median concentration for Indiana lakes (4.92 mg/L).
- Plankton samples indicate blue-green algae typically dominate samples collected from lakes in the Upper Elkhart River Watershed. Nearly 65% of lakes sampled possess plankton communities which are dominated by blue-green algae.

3.3.2 Indiana Clean Lakes Program Volunteers

Since 1989, volunteers trained through the Indiana Clean Lakes Program assessed water quality in 16 lakes in the Upper Elkhart River Watershed. Volunteers at all lakes monitored secchi disk transparency and assessed total phosphorus, total nitrogen and chlorophyll a concentrations four times each summer in five lakes. Based on these data, the following conclusions can be drawn:

- In total, 2303 transparency measurements were collected and nearly 35% of these measures lower than the median transparency measured for Indiana lakes (5.6 feet).
- Nearly 364 total phosphorus samples were collected with 15% of these concentrations exceeding the median concentration for Indiana lakes (51 mg/L).
- More than 345 chlorophyll a samples were collected with 19% exceeding the median concentration for Indiana lakes (4.92 mg/L).
- Nearly 55 total nitrogen samples were collected with 87% of these concentrations exceeding the median concentration for Indiana lakes (1.069 mg/L).

3.3.3 Global Lake Ecological Observatory Network (GLEON) Volunteers

The Water Quality Portal shows that GLEON volunteers sampled 93 lakes in the Upper Elkhart River Watershed. However, only six results are available in the portal. Based on these few data, all six lakes possess secchi disk transparencies which measure higher than the average transparency for Indiana lakes.

3.4 Current Water Quality Assessment

3.4.1 Water Quality Sampling Methodologies

As part of the current project, the Upper Elkhart River Watershed Project implemented a one-year water quality monitoring program. The program included monthly water chemistry sample collection and one macroinvertebrate community and habitat assessment. The program is detailed below and in the Quality Assurance Project Plan for the Upper Elkhart Watershed Management Plan approved on January 21, 2022. Sites sampled through this program are displayed in Figure 39. Sample sites were selected based on watershed drainage and correspond with sites sampled by IDEM in the past. The monthly sampling regimen was enacted to create a baseline of water quality data.

Stream Flow

Stream flow was calculated by scaling stream flow measured at the U.S. Geological Survey (USGS) stream gages to subwatershed drainage area. The Shatto Ditch near Mentone (USGS 03331224) and Cedar Creek at Auburn (USGS 04179520) gages were used for tributary stream sites, while the Elkhart River at Goshen (USGS 04100500) was used to scale flow for the mainstem Elkhart River sites. As shown in Figure 38, stream flows dropped from February 2022 through November 2022. Field observations suggest that many of the tributary streams experienced limited watershed runoff throughout the sampling due to low precipitations levels across the Upper Elkhart River Watershed. The early summery of 2022 was identified by NOAA as abnormally dry, while the fall of 2022 was identified as a moderate drought for northern Indiana (NOAA, 2023).

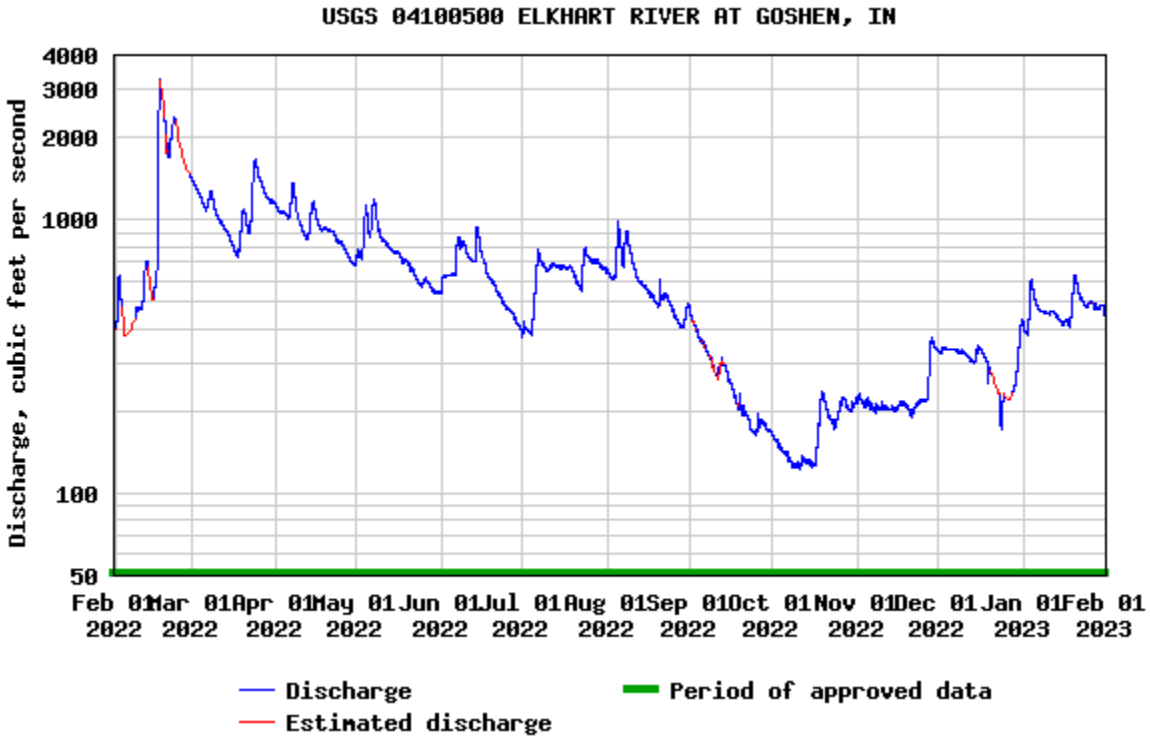


Figure 38. Stream flow measured during the sampling period at the Elkhart River at Goshen USGS stream gage.

Field and Laboratory Chemistry Parameters

The Upper Elkhart River Watershed Project established twenty chemistry monitoring stations as part of the monitoring program. Dissolved oxygen, temperature, pH, turbidity, conductivity, nitrate-nitrogen, total phosphorus, E. coli and total suspended solids were measured monthly at the sampling stations. Sampling occurred from February 2022 through January 2023.

Biological Community and Habitat

The physical habitat at each of the 20 sample sites was evaluated using the Qualitative Habitat Evaluation Index (QHEI). The Ohio EPA developed the QHEI for streams and rivers in Ohio (Rankin, 1989, 1995) and the IDEM adapted the QHEI for use in Indiana. Macroinvertebrate communities were assessed using the macroinvertebrate Index of Biotic Integrity (mIBI) with 17 of 20 sites assessed October 7, 2022.

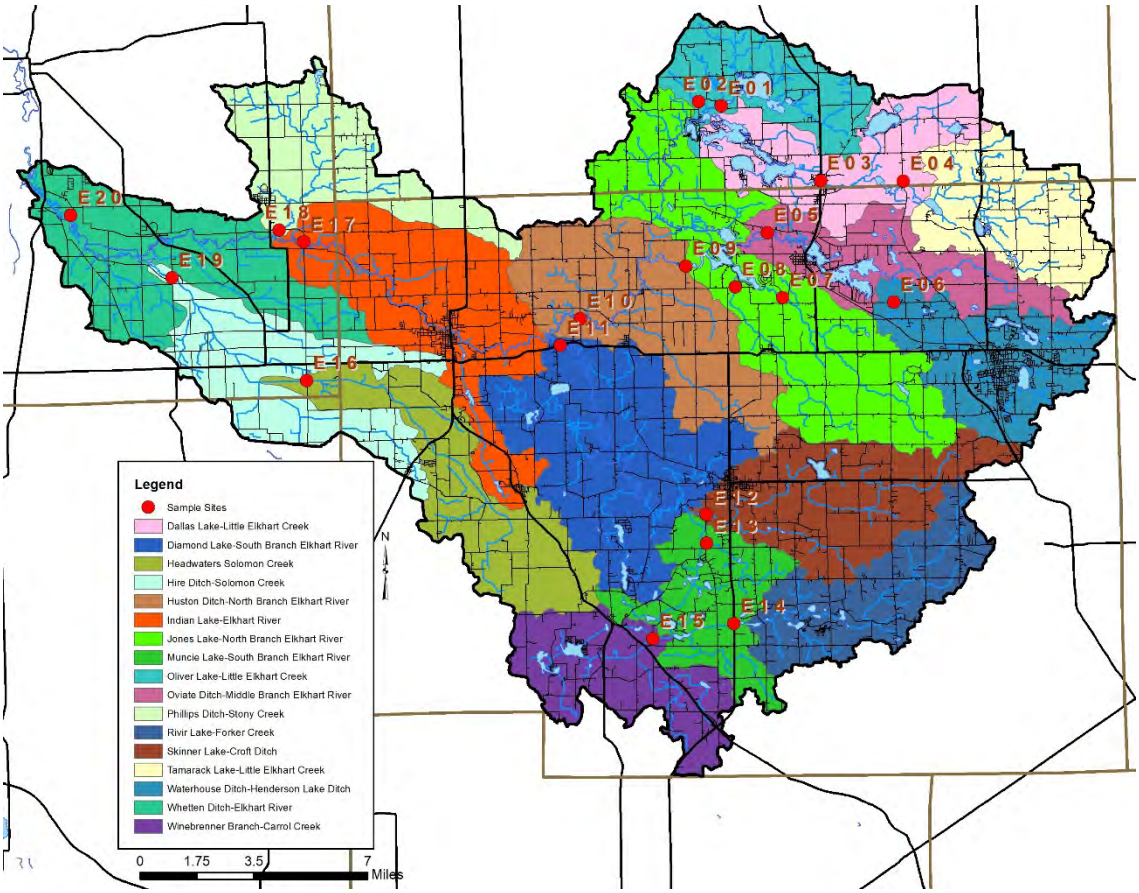


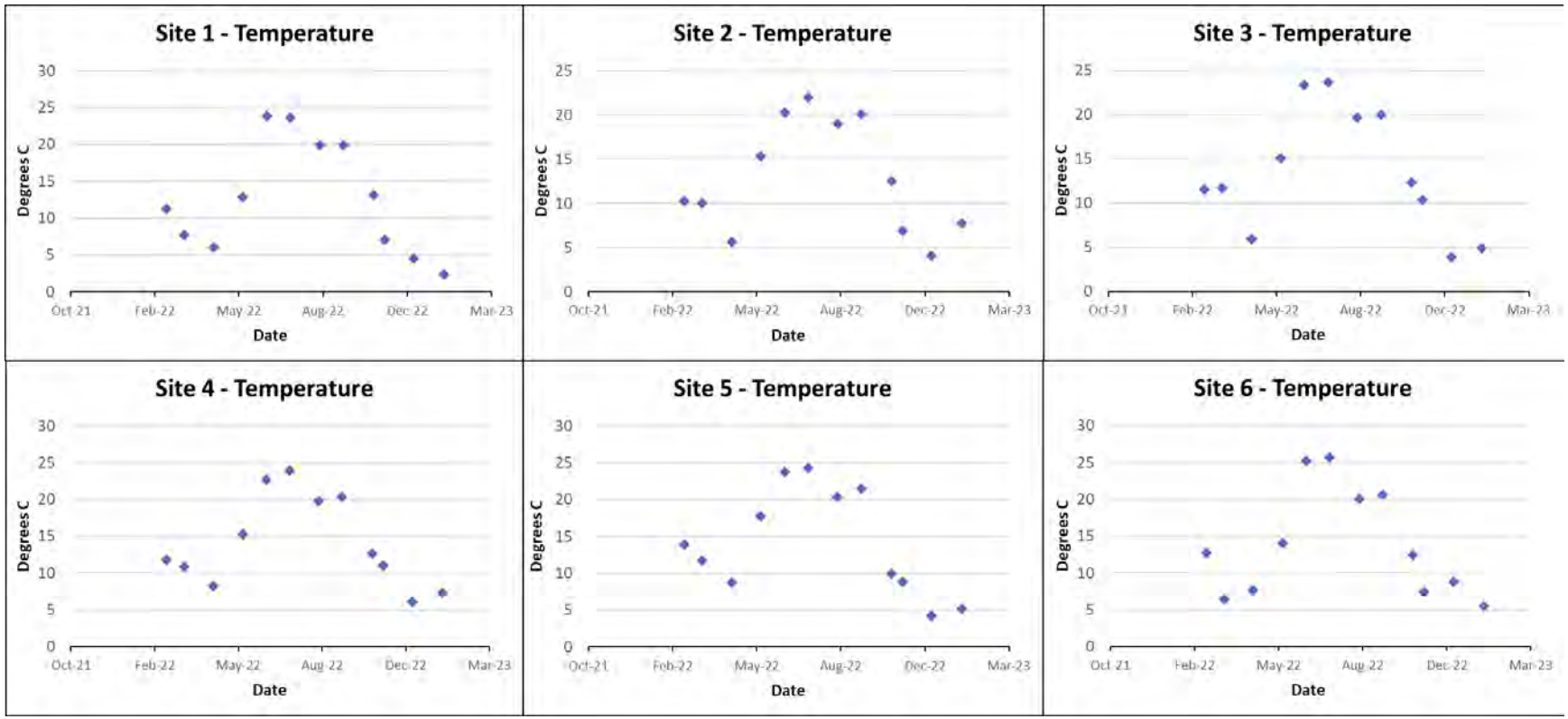
Figure 39. Sites sampled as part of the Upper Elkhart River Watershed Management Plan.

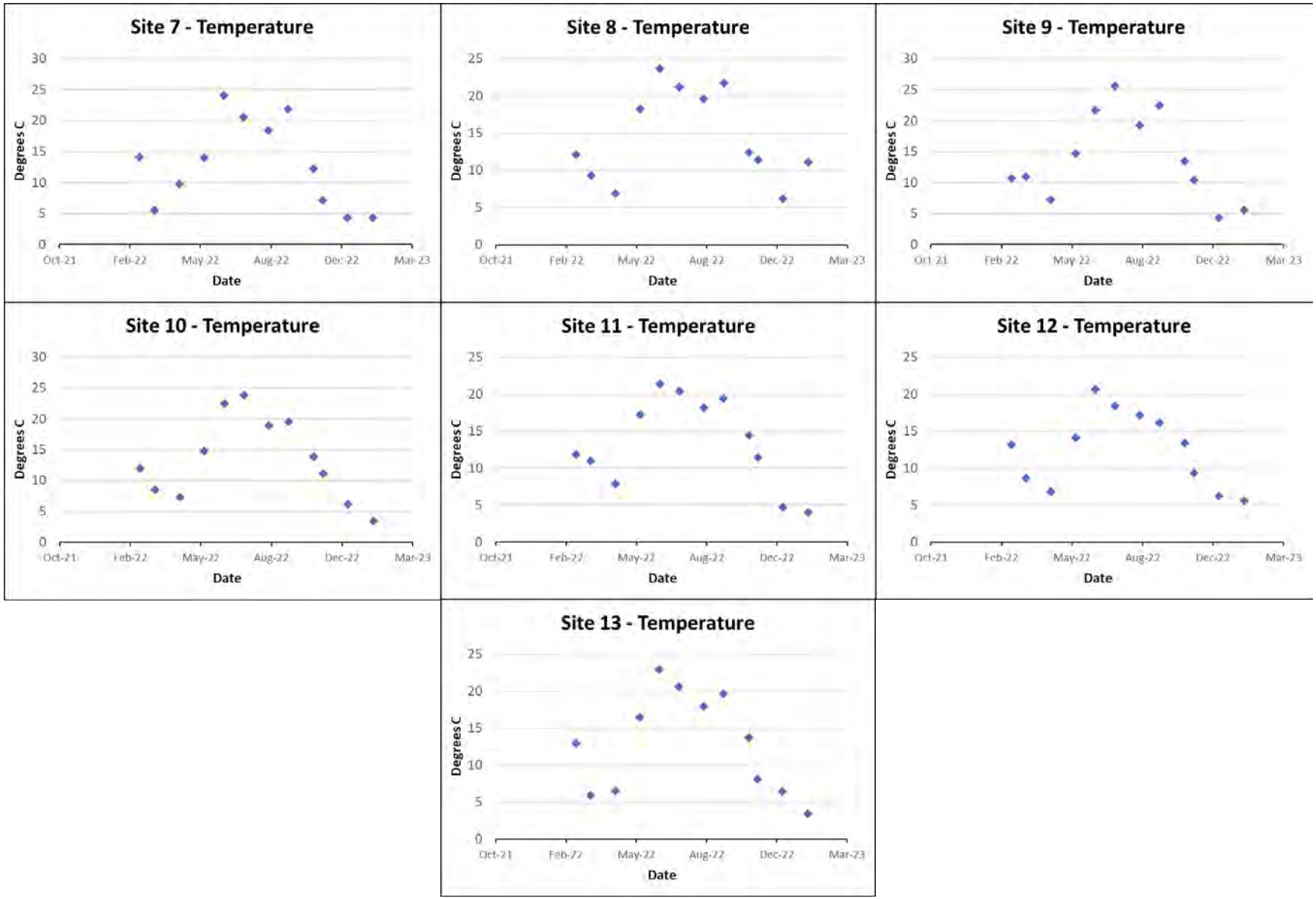
3.4.2 Field Chemistry Results

Figure 40 through Figure 44 displays results for non-nutrient field chemistry data collected monthly at the twenty sample sites. At each of the stream sites, a multi-parameter probe was deployed during each sampling event. The probe collects data for temperature, dissolved oxygen, specific conductivity, and pH. Water chemistry data are detailed in Appendix B.

Temperature

Figure 40 illustrates monthly temperatures in the watershed streams. As shown, temperatures measure approximately the same in each of the twenty stream sites with seasonal changes in temperature creating major differences in temperatures throughout the sampling period. Temperatures measured between 2.38 to 25.71 °C in all streams. The highest temperatures occurred during the June and July sampling events depending on riparian cover and stream depth present at each location.




Site 7 - Temperature
Degrees C
Date
Site 8 - Temperature
Degrees C
Date
Site 9 - Temperature
Degrees C
Date
Site 10 - Temperature
Degrees C
Date
Site 11 - Temperature
Degrees C
Date
Site 12 - Temperature
Degrees C
Date
Site 13 - Temperature
Degrees C
Date

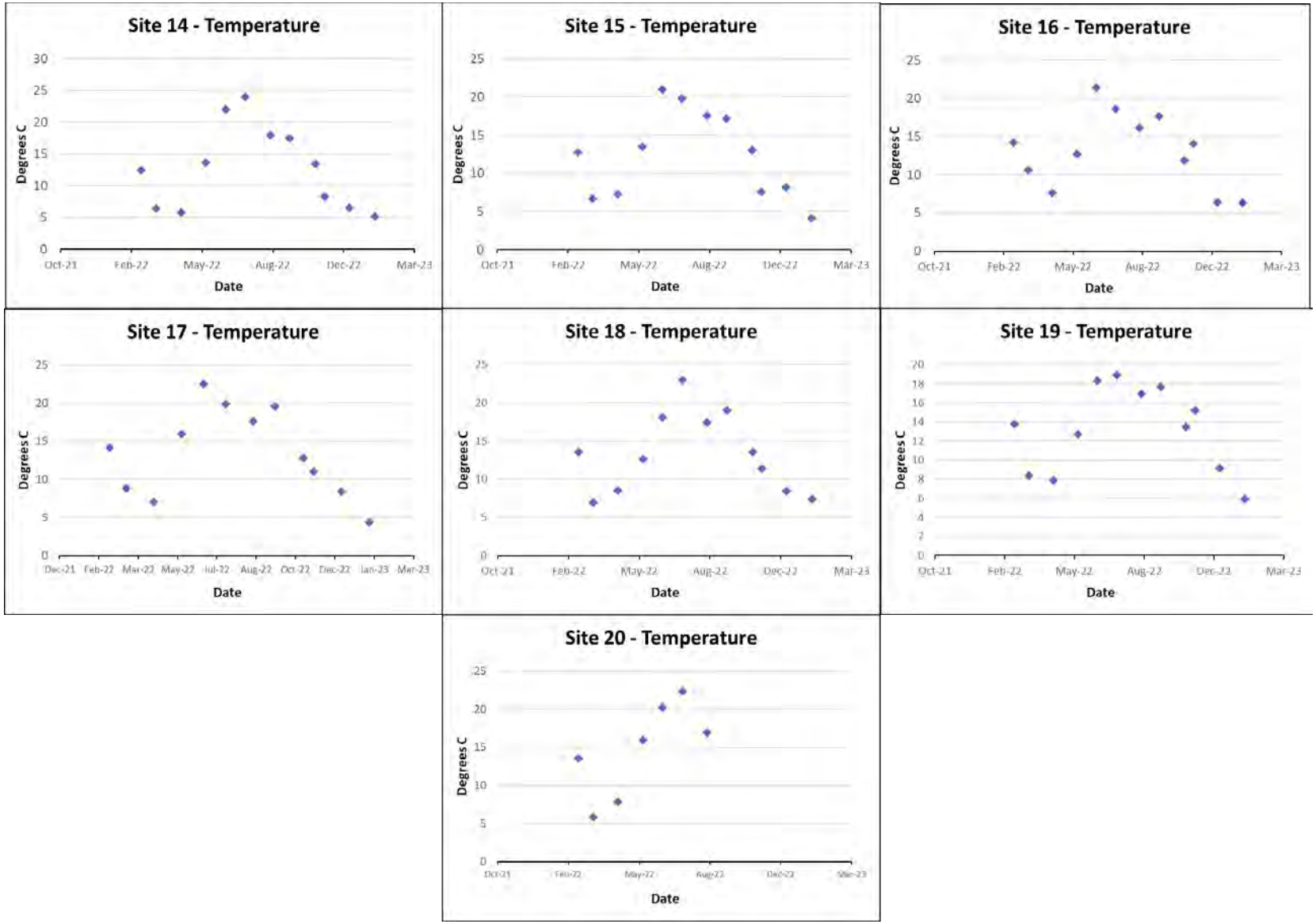
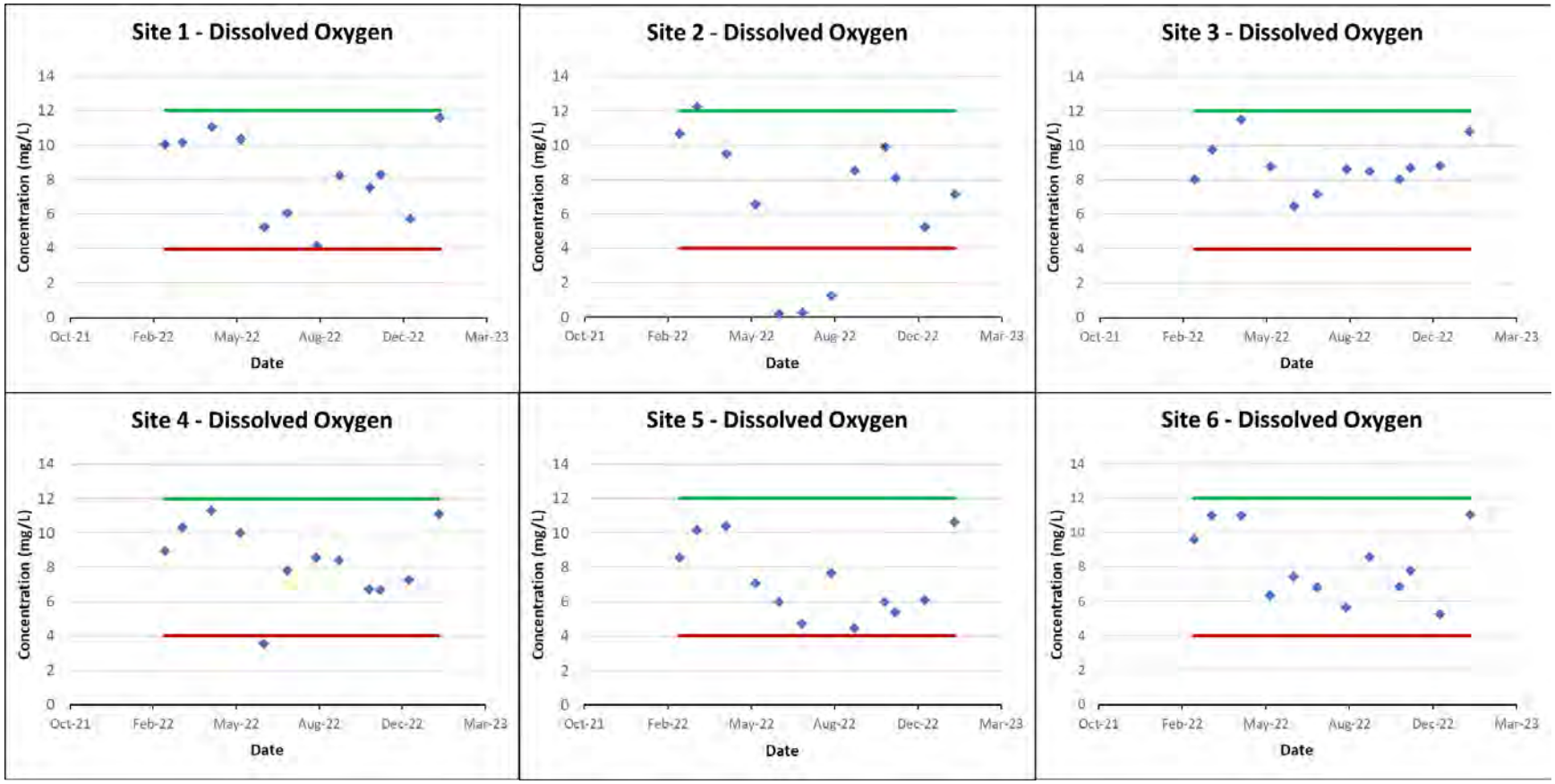


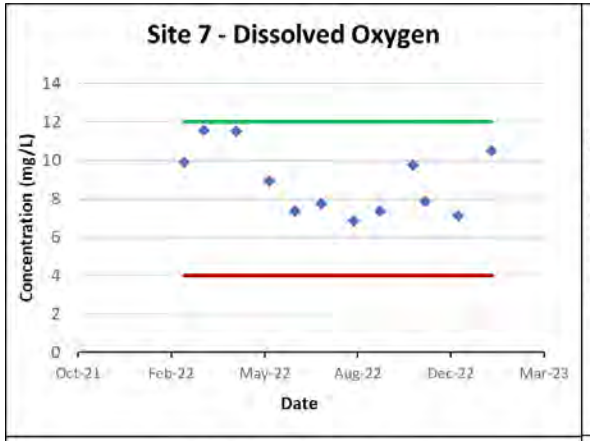
Figure 40. Temperature measurements in Upper Elkhart River Watershed sample sites from February 2022-January 2023. Note difference in scale along the concentration (y) axis.

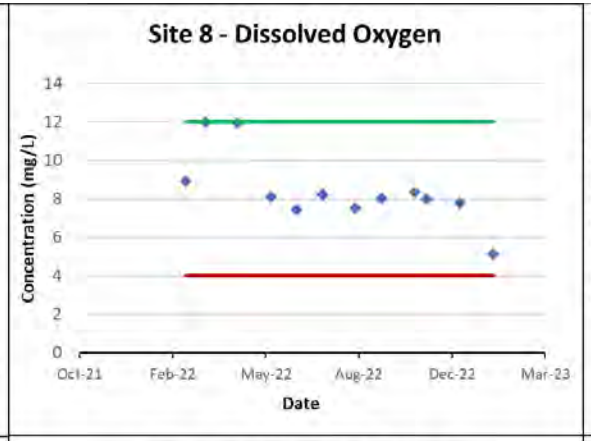
Dissolved Oxygen

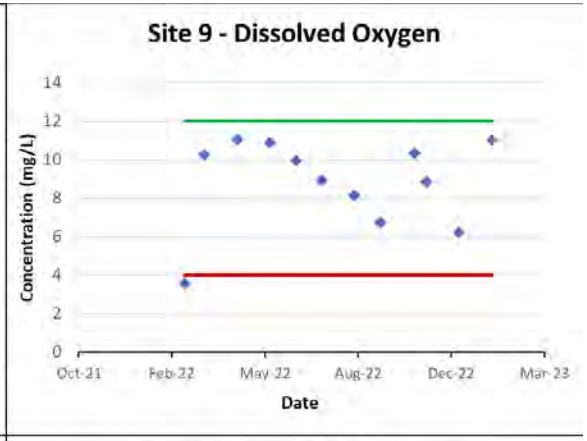
Dissolved oxygen concentrations mostly displayed seasonal changes as observed in temperature with the highest dissolved oxygen levels measured when temperatures were typically lowest (

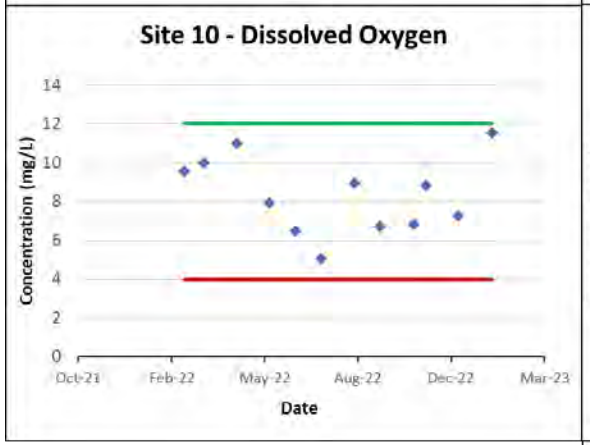
Figure **41**). The lowest and highest dissolved oxygen concentration occurred at the Hackenburg Lake inlet (Site 2) with the lowest occurring during June 2022 with a concentration level of 0.22 m/g/Land the highest occurring during March 2022 with a concentration level of 12.24 m/g/L. In total, 5% of samples (13 of 280) measured below or above the lower and higher dissolved oxygen state standard (4 m/g/L and 12 m/g/L). Exceedances occurred at the Hackenburg Lake inlet (Site 2), Little Elkhart Creek (Site 4), North Branch Elkhart River downstream of West Lakes (Site 9), South Branch Elkhart River (Site 11) and Rivir Lake tributary (Site 14).

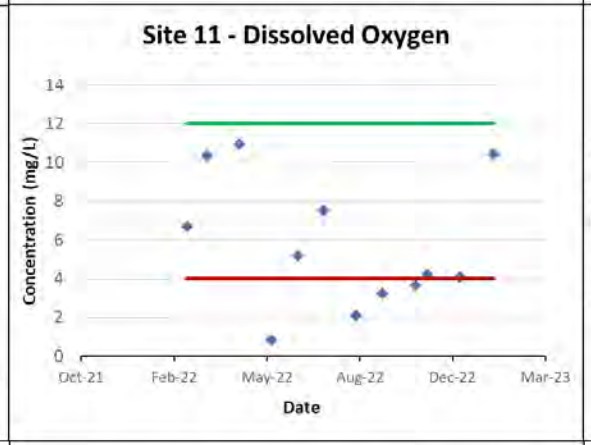


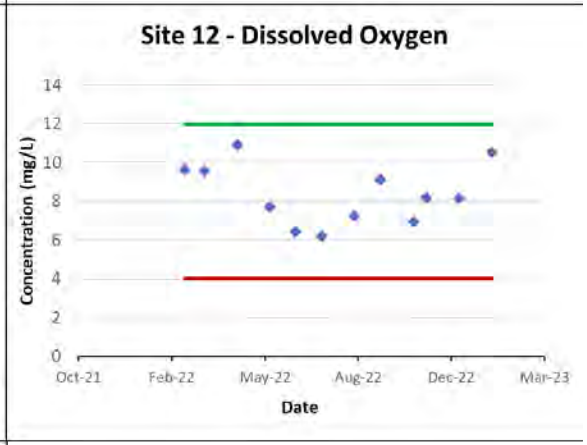

Site 7 - Dissolved Oxygen
Concentration (mg/L)
0
2
4
6
8
10
12
14
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date

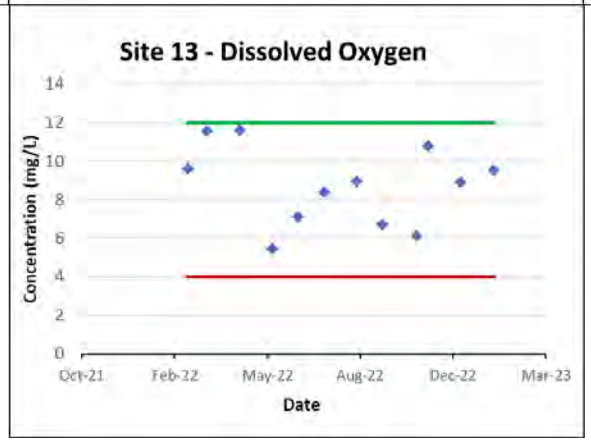

Site 8 - Dissolved Oxygen
Concentration (mg/L)
0
2
4
6
8
10
12
14
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date


Site 9 - Dissolved Oxygen
Concentration (mg/L)
0
2
4
6
8
10
12
14
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date


Site 10 - Dissolved Oxygen
Concentration (mg/L)
0
2
4
6
8
10
12
14
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date


Site 11 - Dissolved Oxygen
Concentration (mg/L)
0
2
4
6
8
10
12
14
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date


Site 12 - Dissolved Oxygen
Concentration (mg/L)
0
2
4
6
8
10
12
14
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date


Site 13 - Dissolved Oxygen
Concentration (mg/L)
0
2
4
6
8
10
12
14
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date

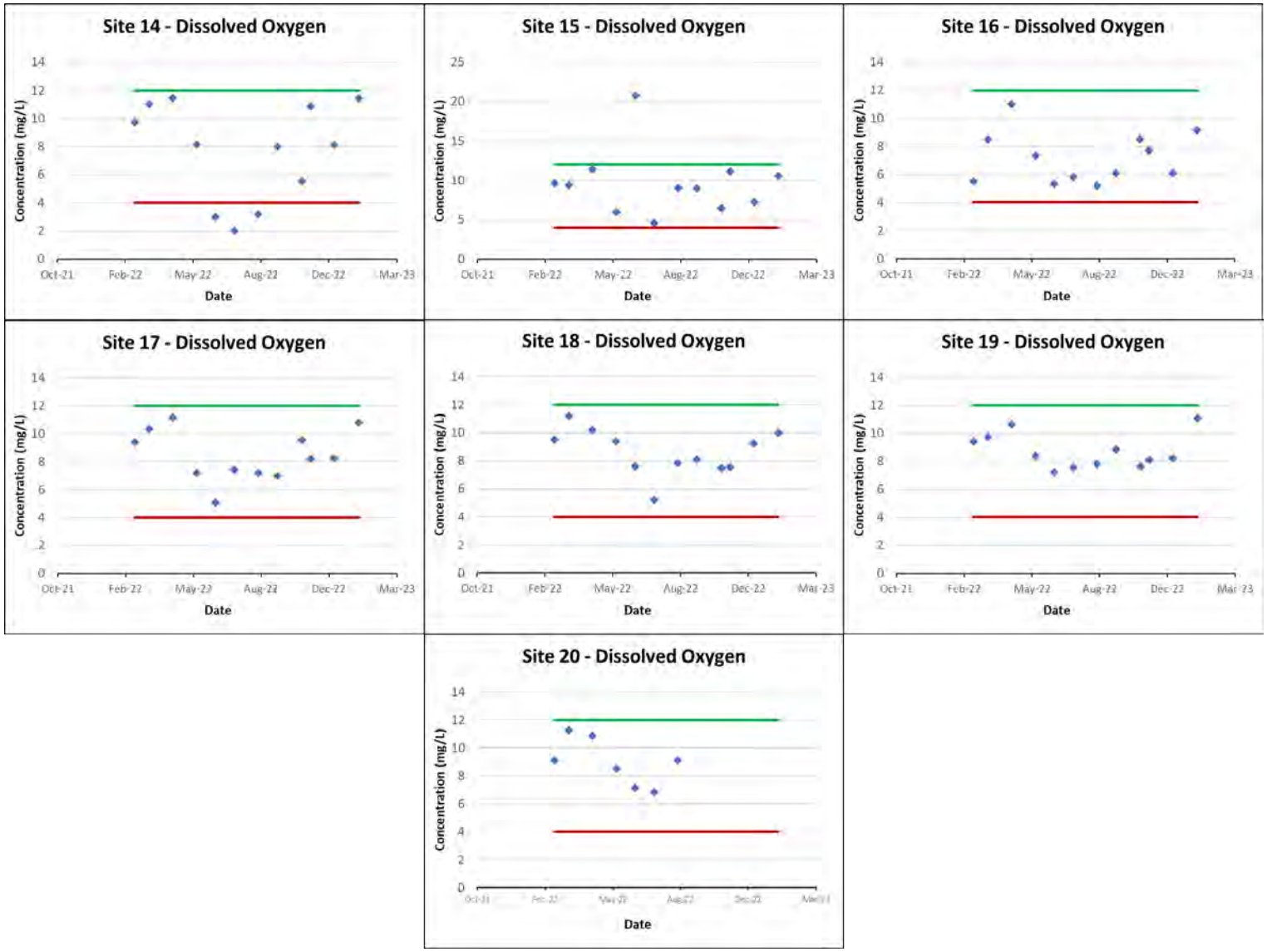
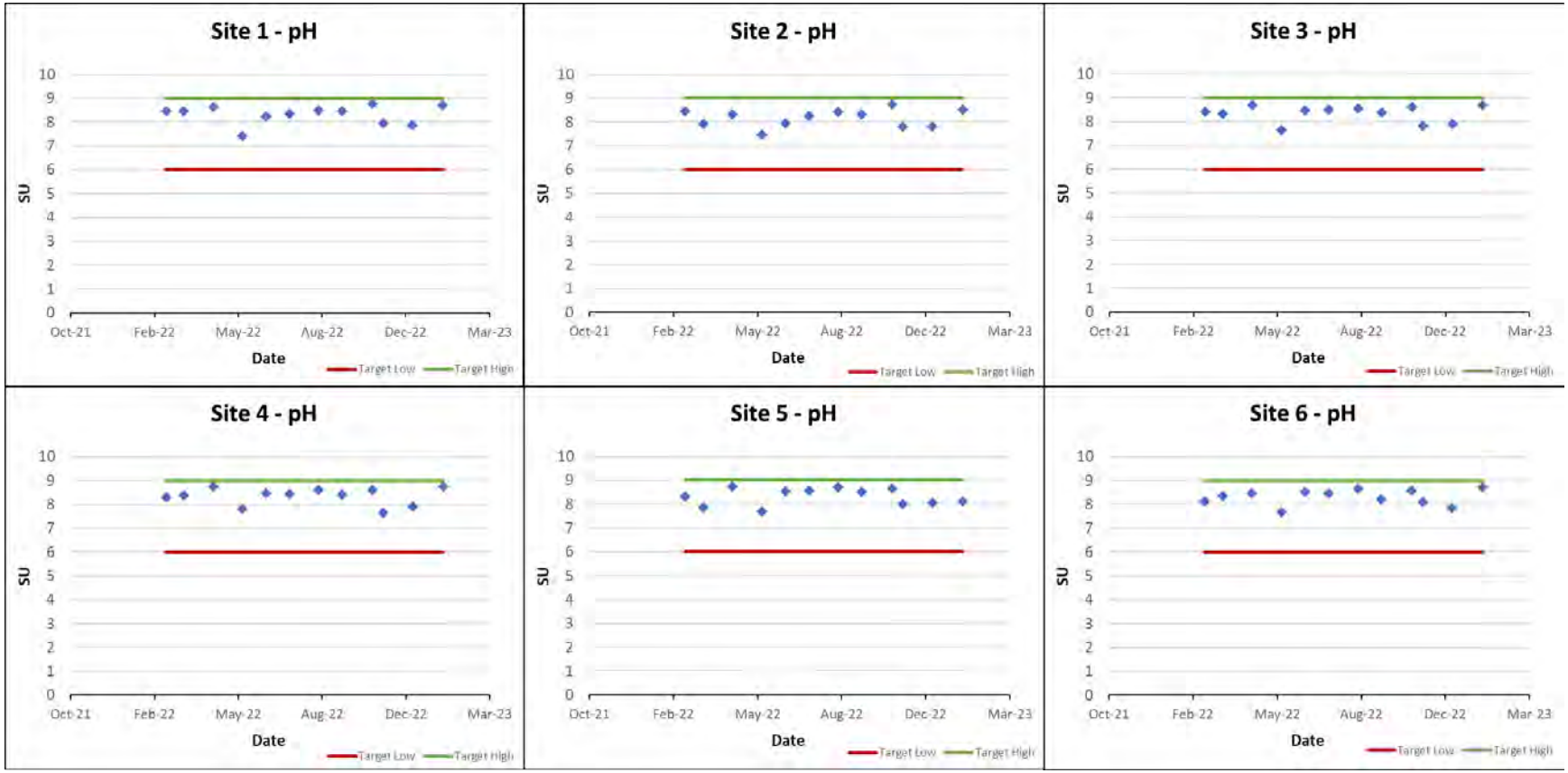
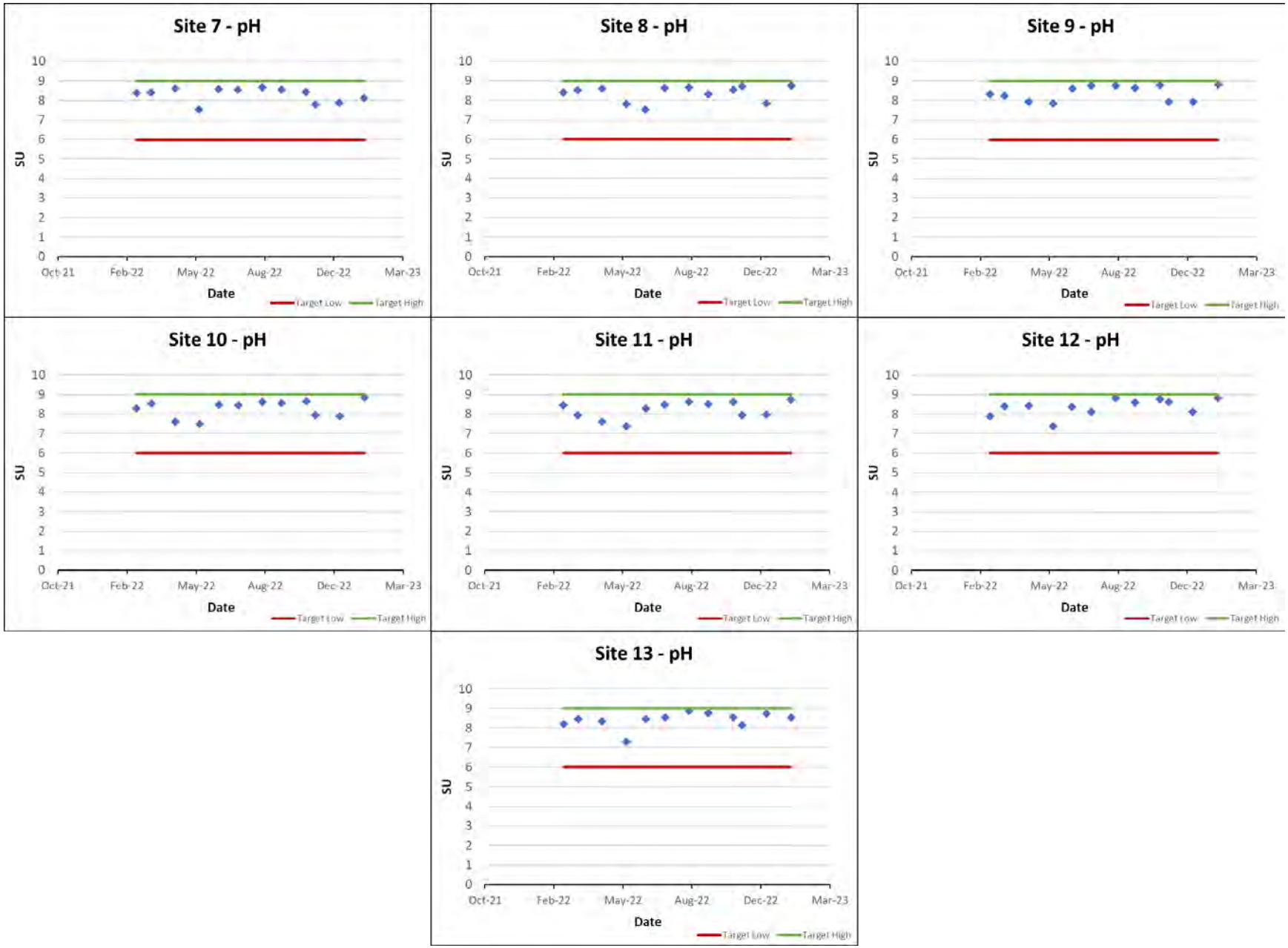


Figure 41. Dissolved oxygen measurements in Upper Elkhart River Watershed sample sites from February 2022-January 2023. Note the differences in scale along the concentration (y) axis.

pH

Throughout the sampling period, pH remained in an acceptable range in all watershed streams (Figure 42). The highest pH level occurred in South Branch Elkhart River (Site 13) during August 2022 sampling period with a level of 8.88. The lowest pH level occurred in Solomon Creek (Site 16) during April 2022 sampling period with a level of 7.05. In general, the pH levels show a consistent pattern in all watershed streams between early summer and late fall.




Site 7 - pH
Site 8 - pH
Site 9 - pH
Site 10 - pH
Site 11 - pH
Site 12 - pH
Site 13 - pH
SU
Date
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Target Low
Target High

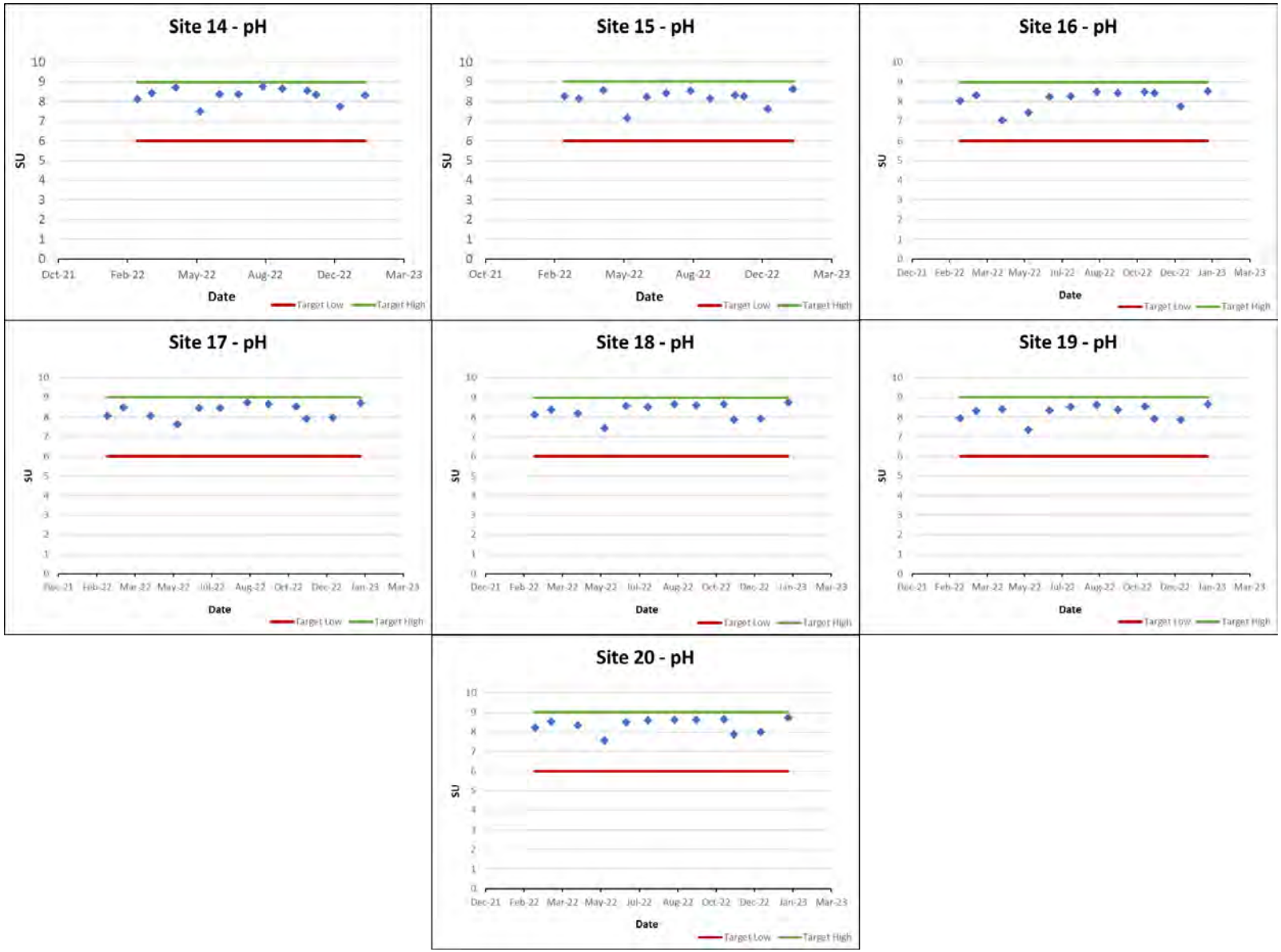
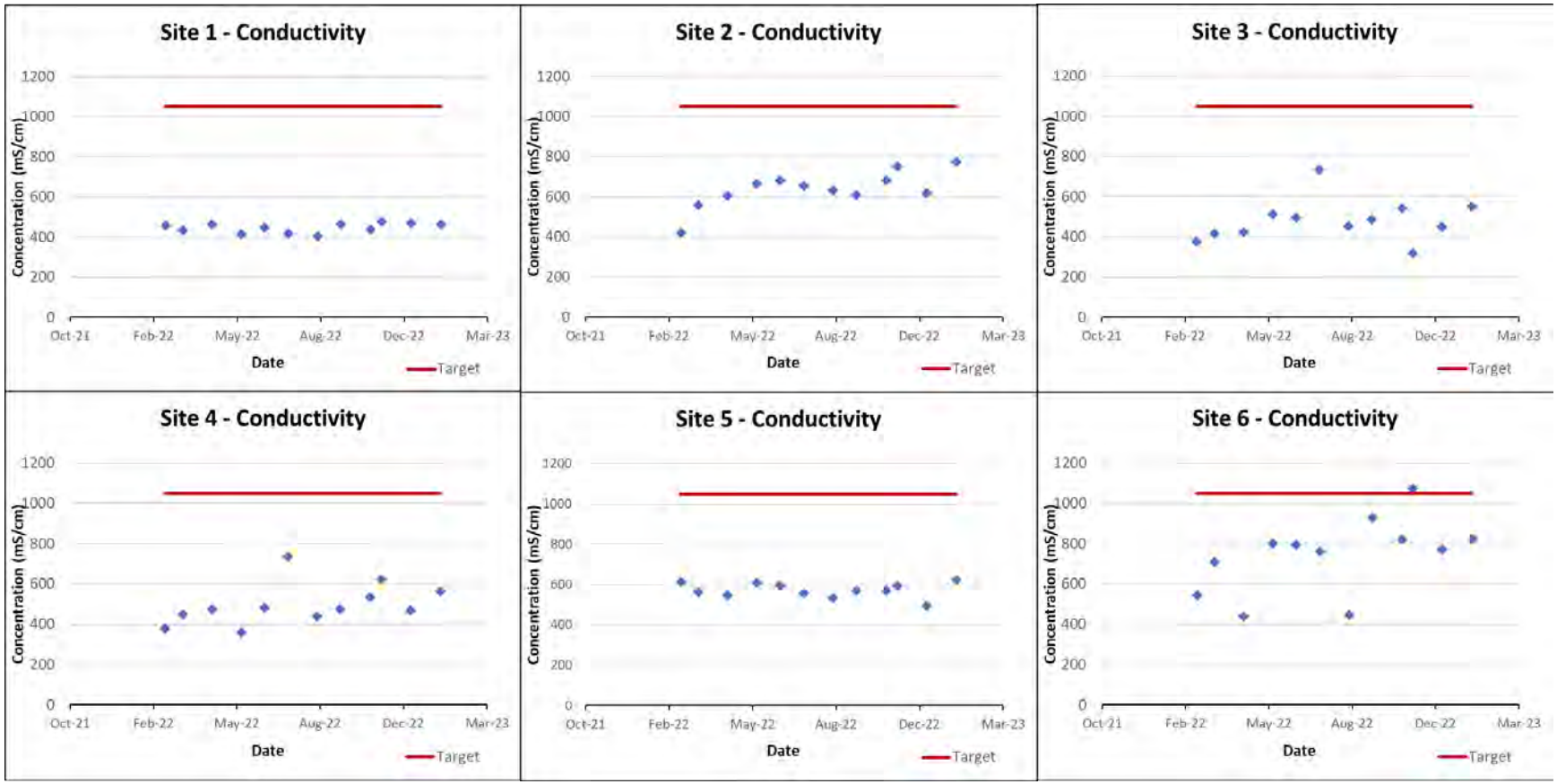
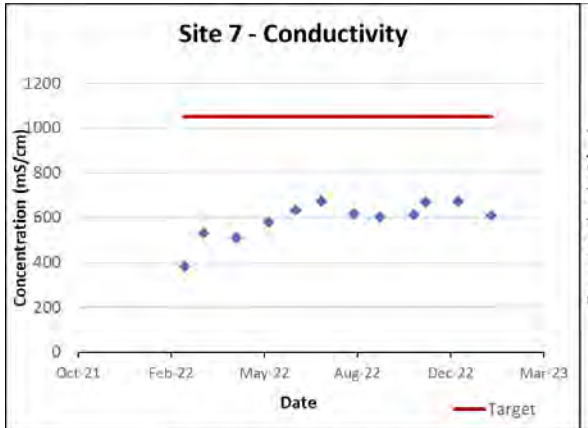


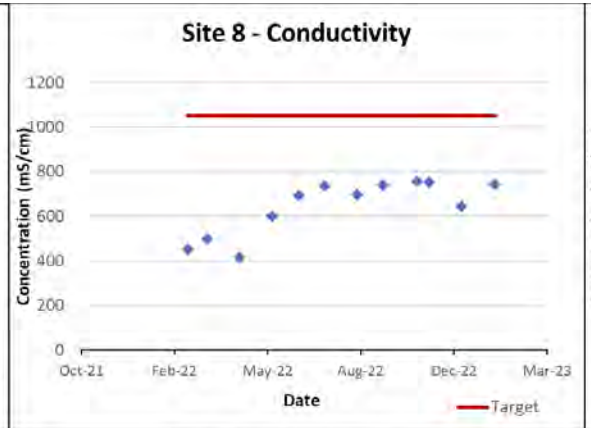
Figure 42. pH measurements in Upper Elkhart River Watershed sample sites from February 2022-January 2023.

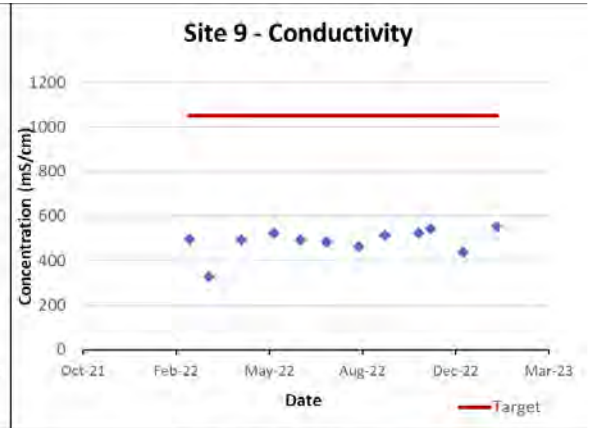
Specific Conductivity

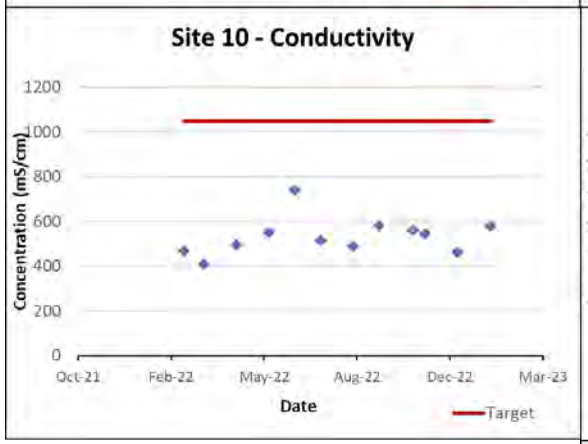
In general, conductivity measurements varied over the sampling period, but mostly remained below the conductivity target of 1050 µS/cm (Figure 43). Only 1 of 240 sample periods (0.4%) exceeded the state standard. Henderson Lake Ditch (Site 6) exceeded the water quality target during the November 2022 sampling event with a level of 1074 µmhos/cm.

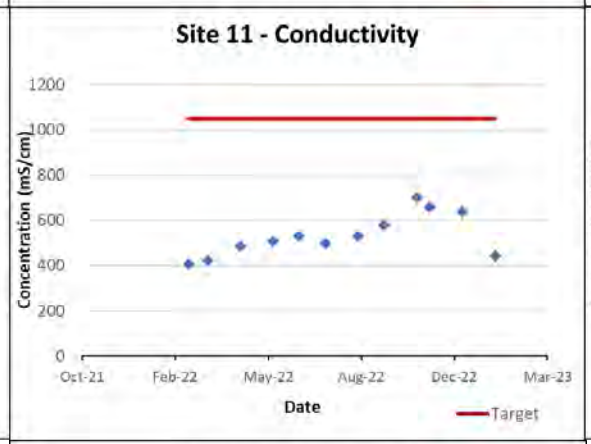


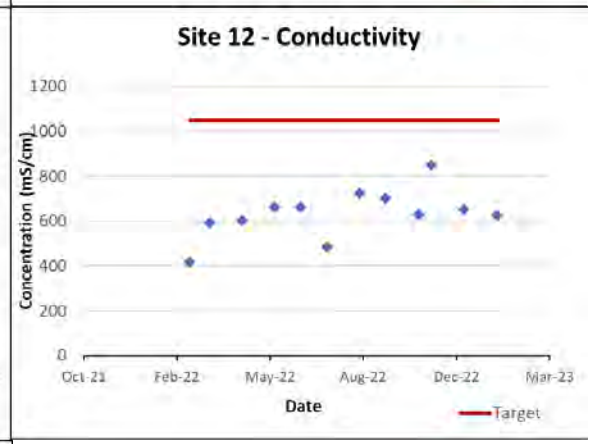

Site 7 - Conductivity
Concentration (mS/cm)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

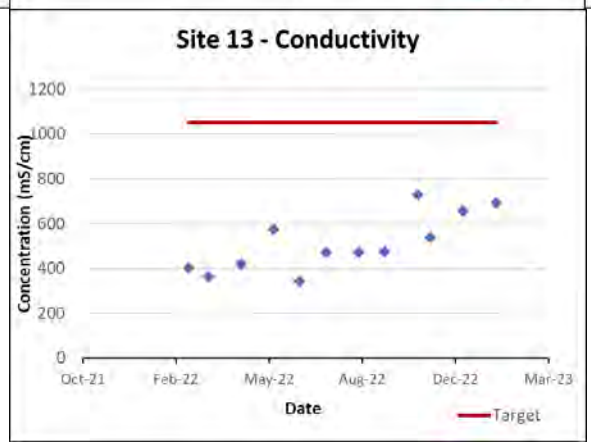

Site 8 - Conductivity
Concentration (mS/cm)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 9 - Conductivity
Concentration (mS/cm)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 10 - Conductivity
Concentration (mS/cm)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 11 - Conductivity
Concentration (mS/cm)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 12 - Conductivity
Concentration (mS/cm)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 13 - Conductivity
Concentration (mS/cm)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

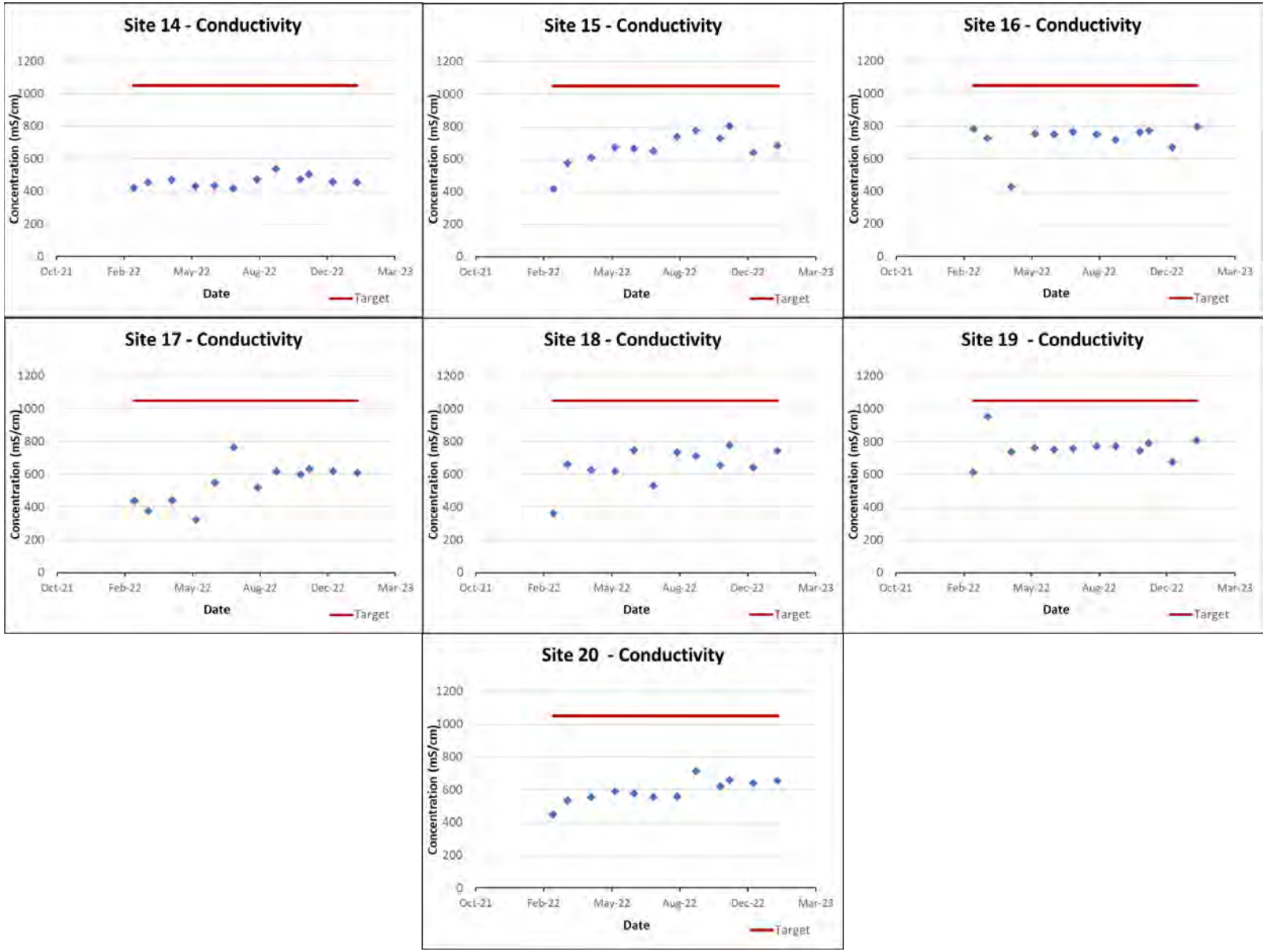
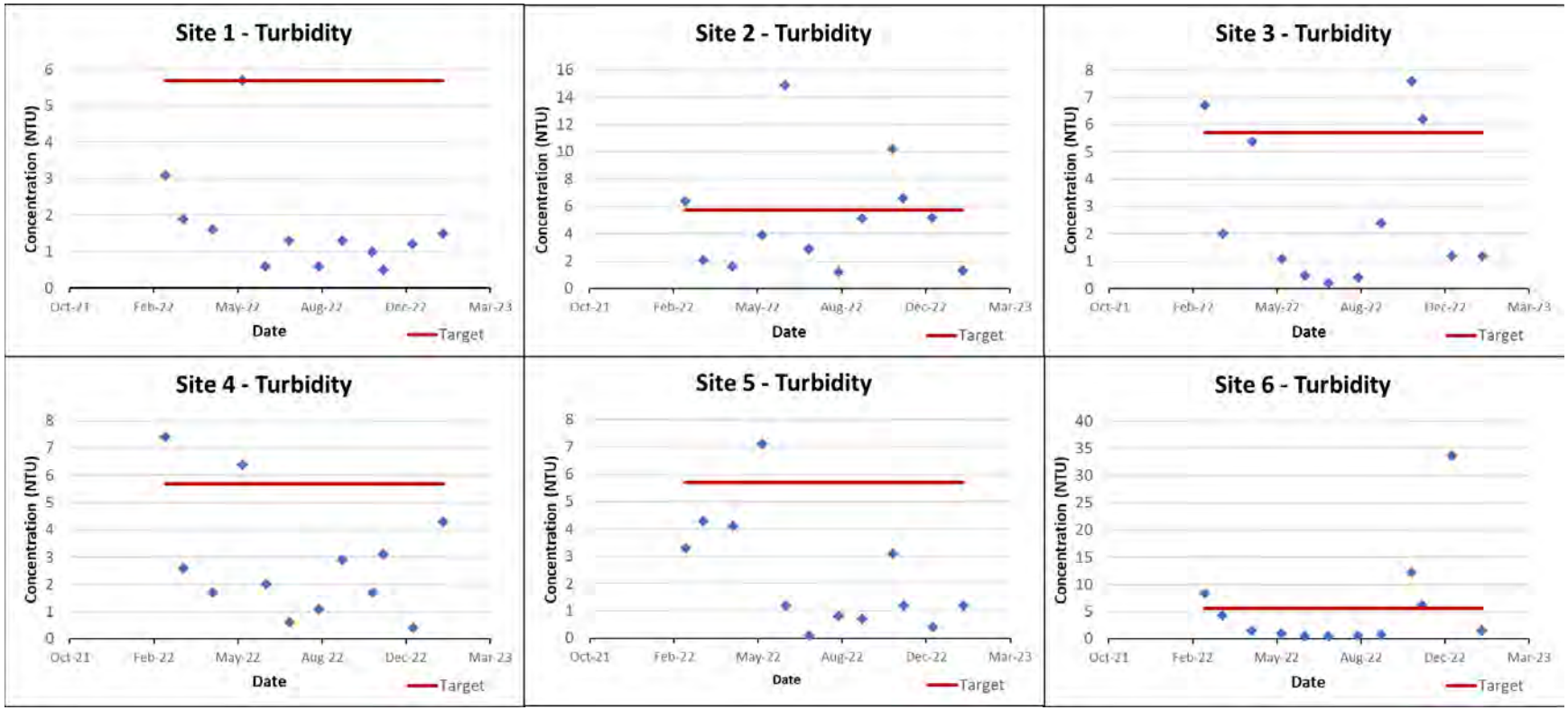
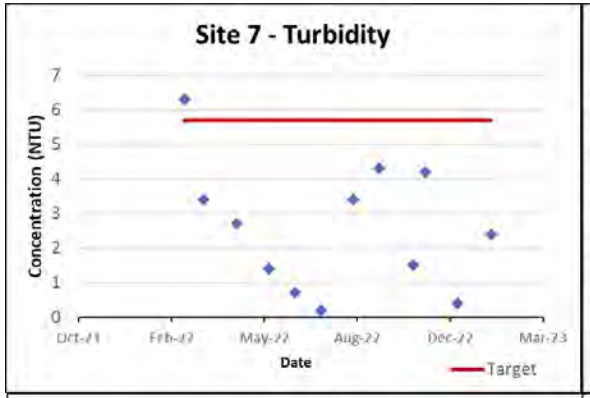


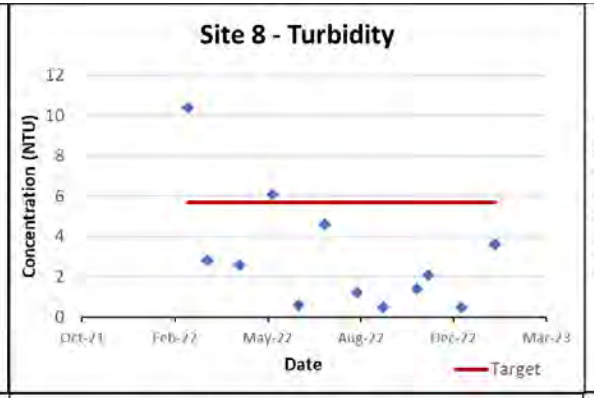
Figure 43. Conductivity measurements in Upper Elkhart River Watershed sample sites from February 2022-January 2023.

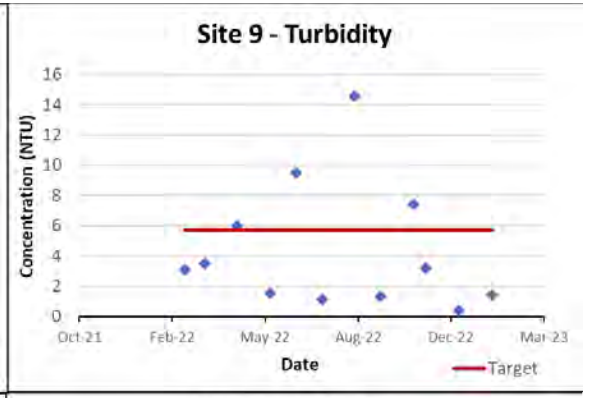
Turbidity

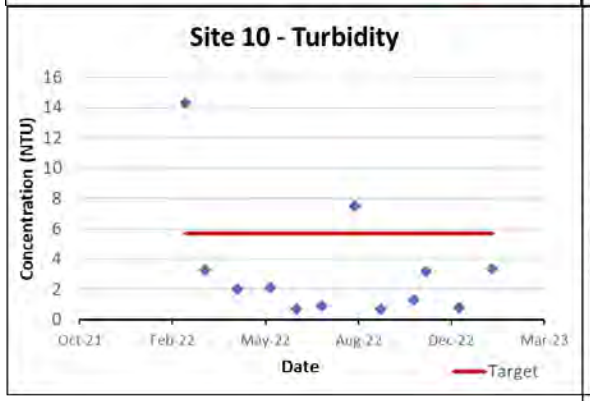
Turbidity measurements varied greatly over the sampling period (Figure 44). In total, 54 of 240 samples (23%) exceeded turbidity targets of6.36 NTU during the sampling period. The highest conductivity level occurred during the November 2022 sampling period. The highest turbidity level occurred at Henderson Lake Ditch (Site 6) with a level of 33.6 NTU. The lowest turbidity level occurred at North Branch Elkhart River downstream of Sylvan (Site 5) with a level of 0.1 NTU during the July 2022 sampling event. In total, 17 of 20 (85%) sites possessed turbidities in excess of water quality targets during the February 2022 sampling event. While there are no other discernable patterns at sites with exceedance levels, South Branch Elkhart River (Site 13) and Solomon Creek (Site 16) exceeded turbidity targets in 50% or more of collected samples.

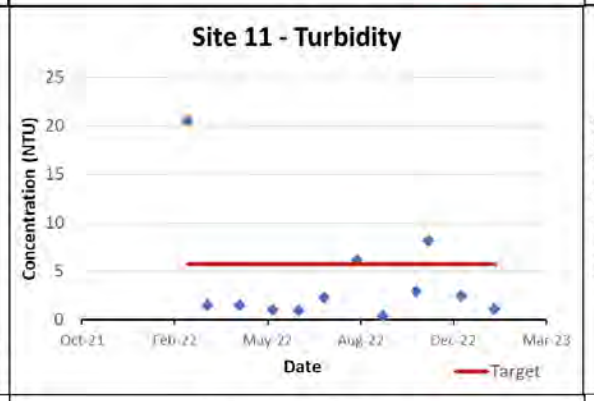


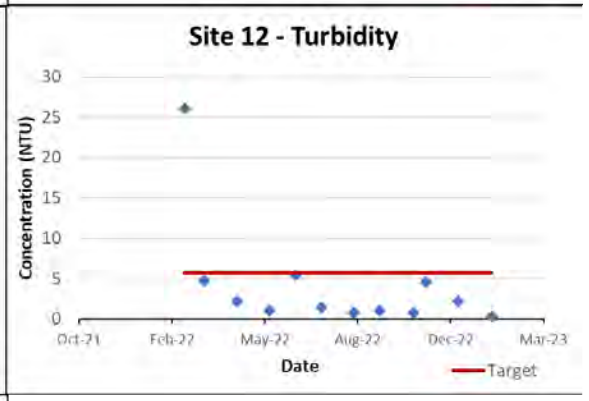

Site 7 - Turbidity
Concentration (NTU)
0
1
2
3
4
5
6
7
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

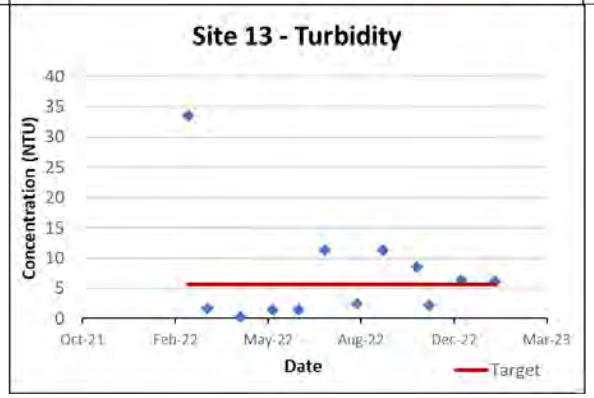

Site 8 - Turbidity
Concentration (NTU)
0
2
4
6
8
10
12
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 9 - Turbidity
Concentration (NTU)
0
2
4
6
8
10
12
14
16
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 10 - Turbidity
Concentration (NTU)
0
2
4
6
8
10
12
14
16
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 11 - Turbidity
Concentration (NTU)
0
5
10
15
20
25
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 12 - Turbidity
Concentration (NTU)
0
5
10
15
20
25
30
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 13 - Turbidity
Concentration (NTU)
0
5
10
15
20
25
30
35
40
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

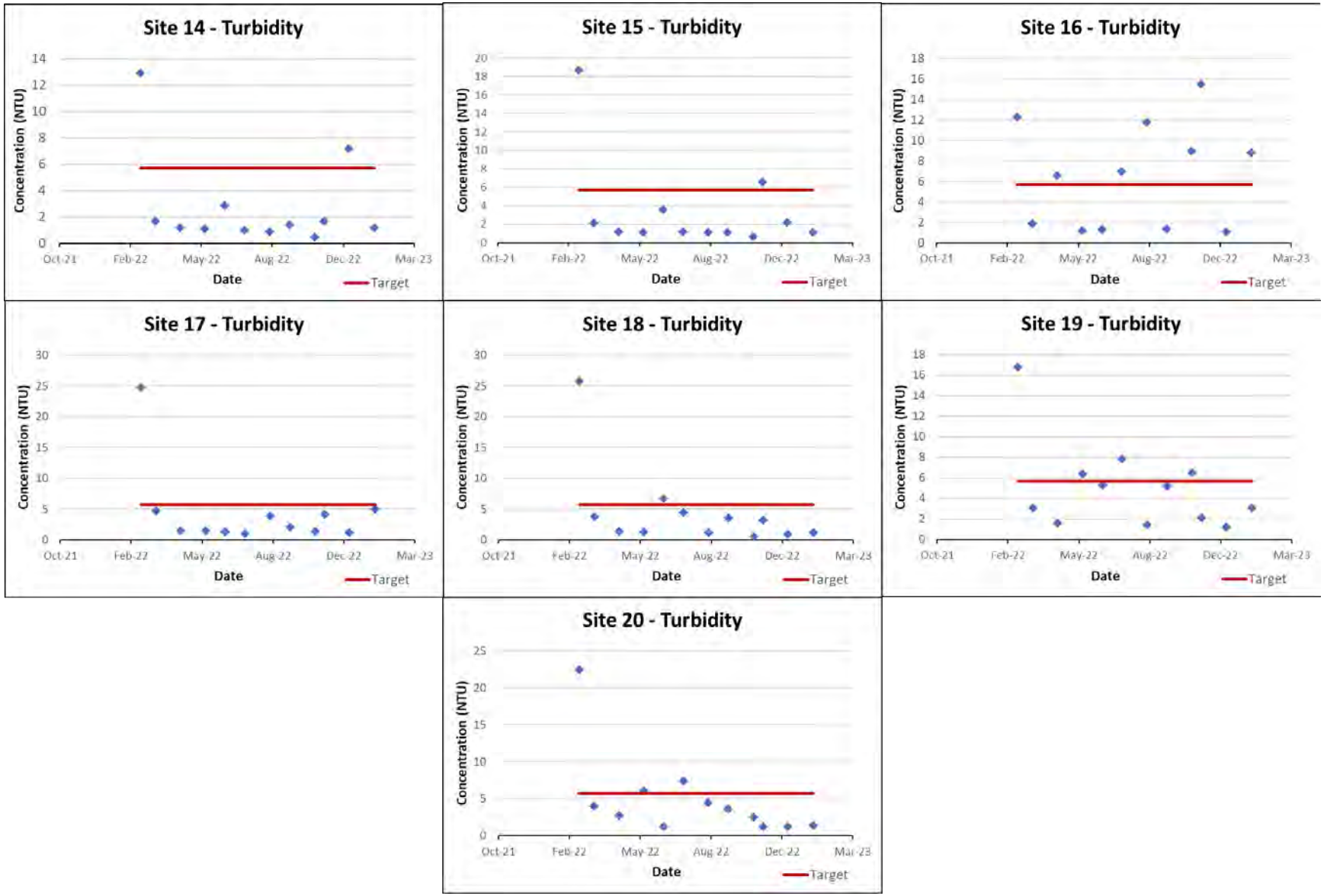


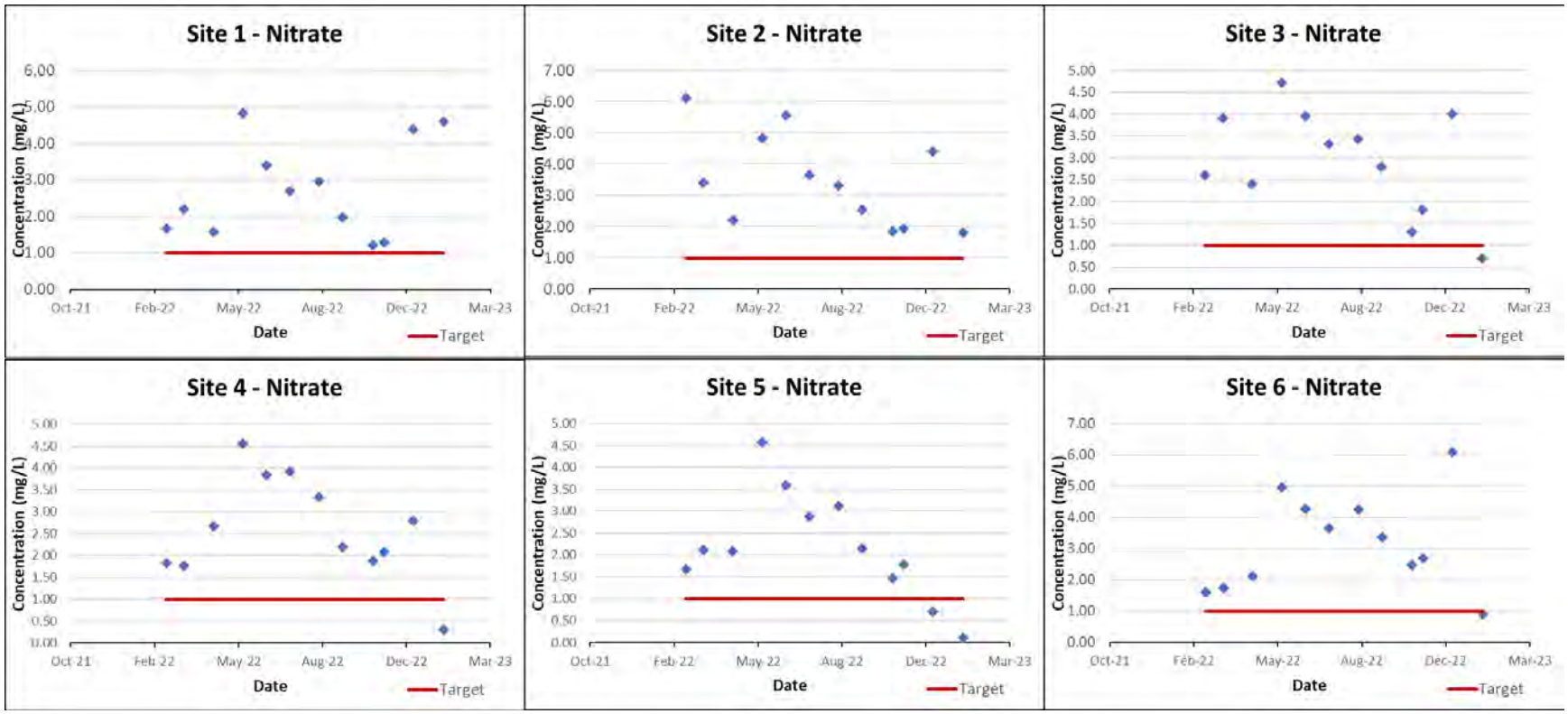
Figure 44. Turbidity measurements in Upper Elkhart River Watershed sample sites from February 2022-January 2023. Note differences in scale along the concentration (y) axis.

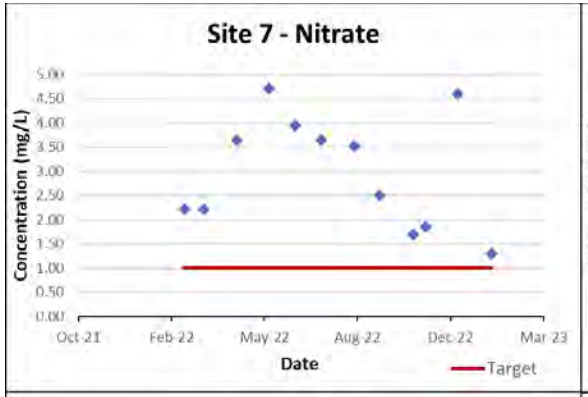
3.4.3 Water Chemistry Results

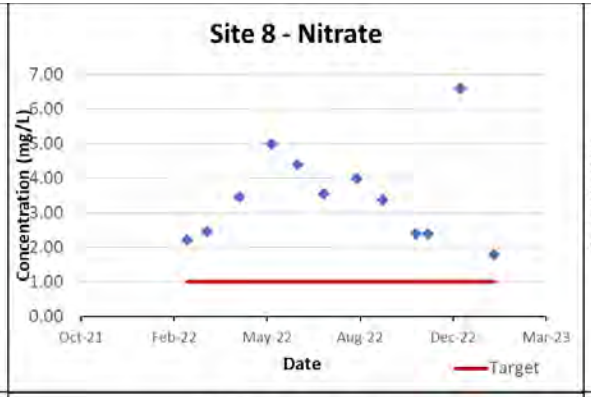
Figure 45 to Figure 48 display results for nitrate-nitrogen, total phosphorus, total suspended solids, and *E. coli* collected monthly from twenty locations in the Upper Elkhart River Watershed. Data are displayed in comparison to target concentration and on load duration curves during the sample period.

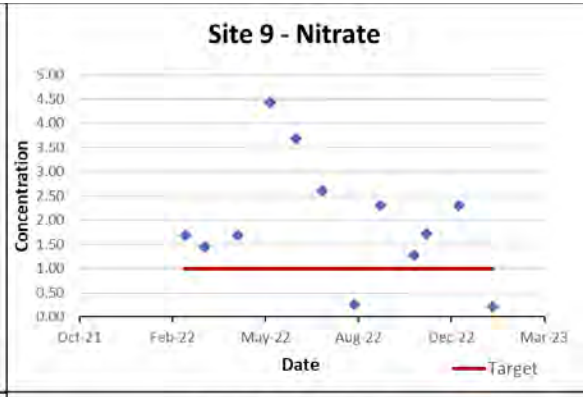
Nitrate-nitrogen

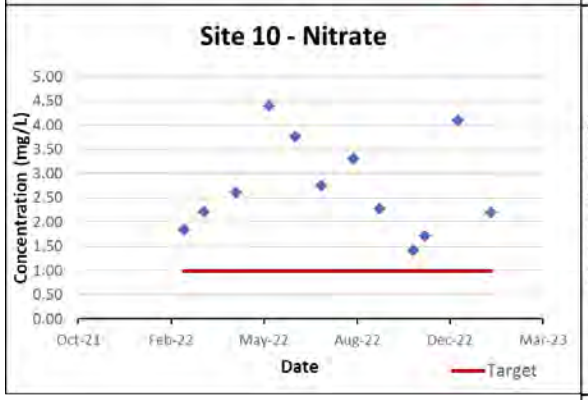
Figure 45 displays nitrate-nitrogen concentrations compared to target levels (1 mg/L). As displayed below, nitrate-nitrogen concentrations exceeded target levels in 230 of 240 collected samples (96%). The lowest concentrations occurred during the December 2022 and January 2023 sampling events with less than 10% of samples exceeding targets. The Oliver Lake Outlet (Site 1), Hackenburg Lake inlet (Site 2), Clock Creek (Site 7), Dry Run (Site 8), North Branch Elkhart River (Sites 10 and 11), South Branch Elkhart River (Site 13), Rivir Lake Tributary (Site 14), Solomon Creek (Site 16), Elkhart River (Sites 17 and 20) and Solomon Creek outlet (Site 19) exceeded target levels 100% of the time.

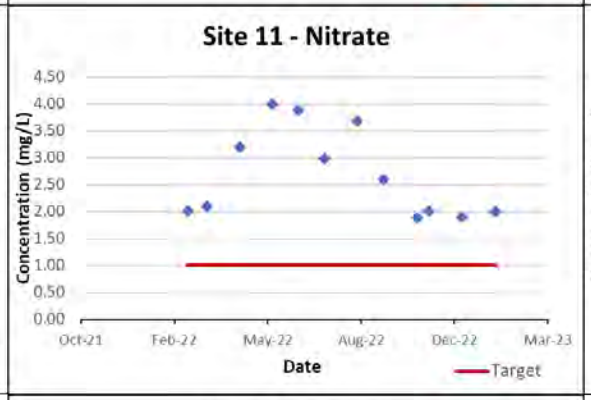


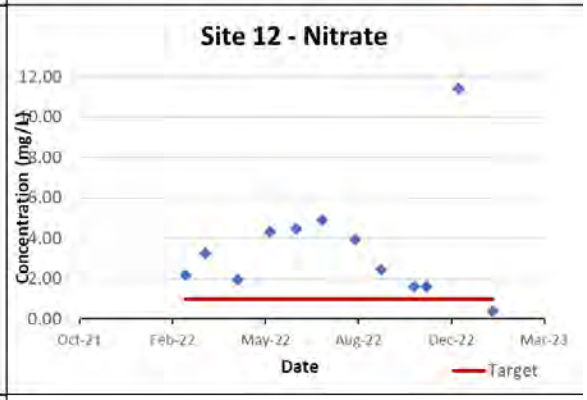

Site 7 - Nitrate
Concentration (mg/L)
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

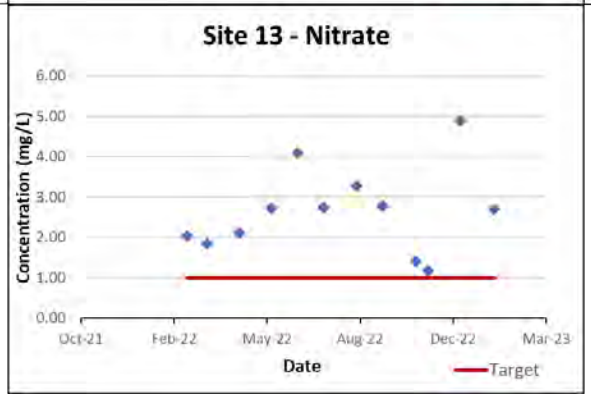

Site 8 - Nitrate
Concentration (mg/L)
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 9 - Nitrate
Concentration
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 10 - Nitrate
Concentration (mg/L)
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 11 - Nitrate
Concentration (mg/L)
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 12 - Nitrate
Concentration (mg/L)
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 13 - Nitrate
Concentration (mg/L)
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

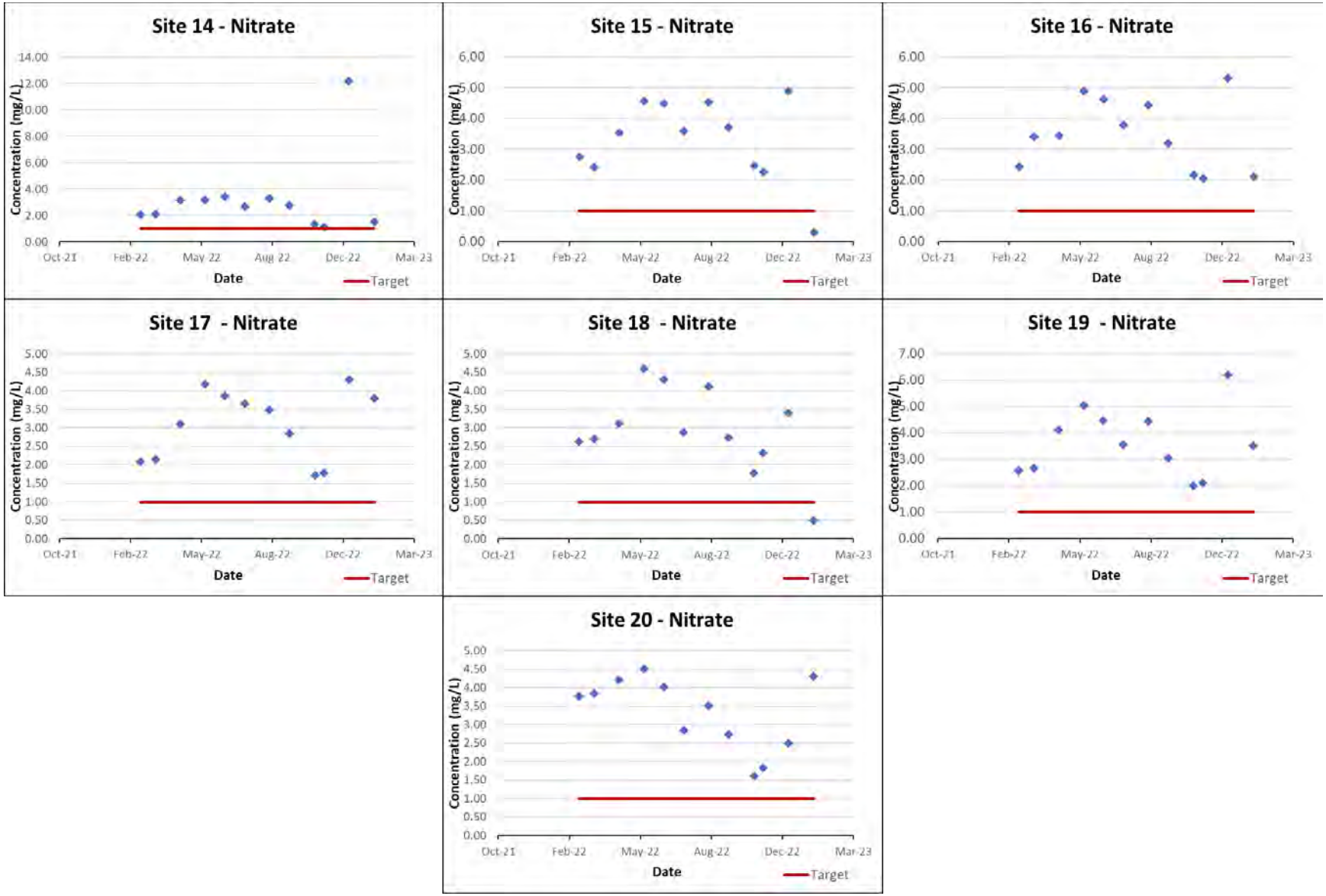
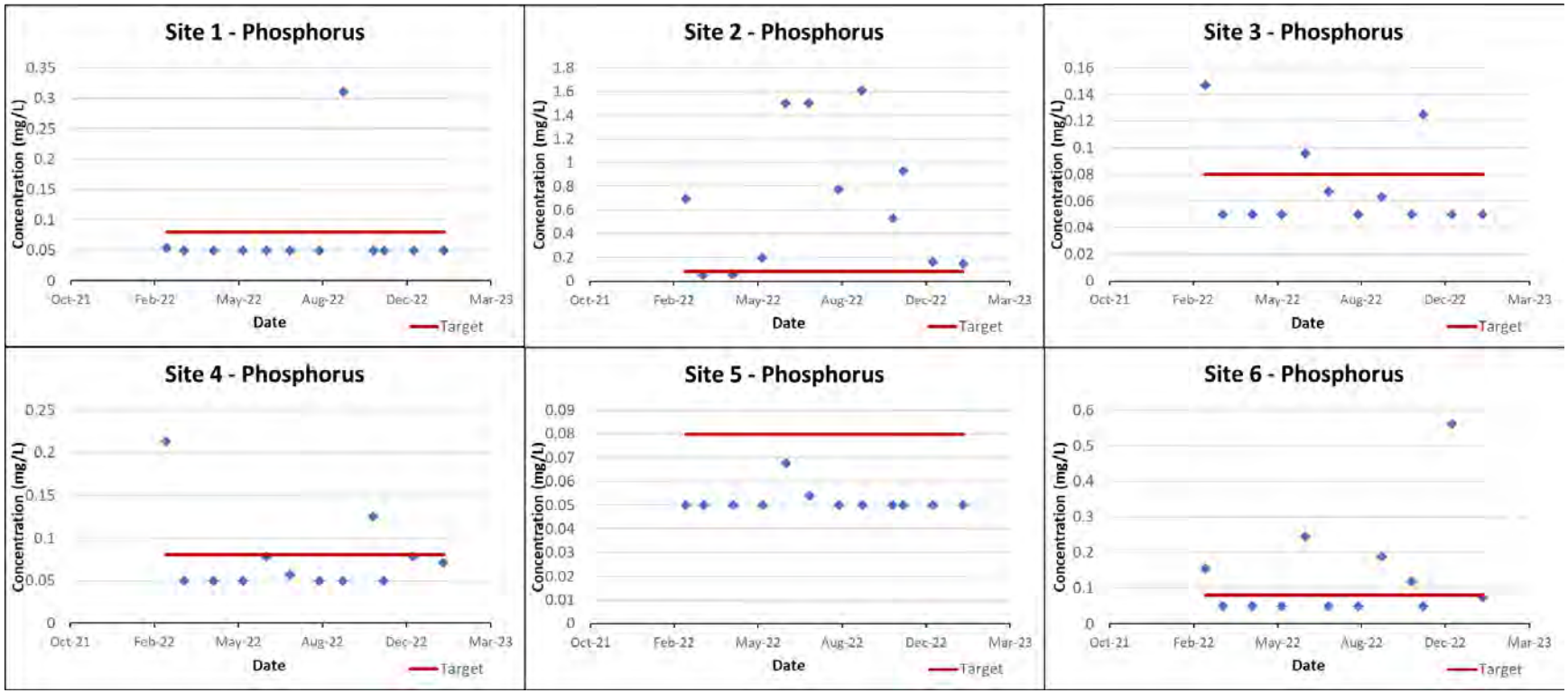
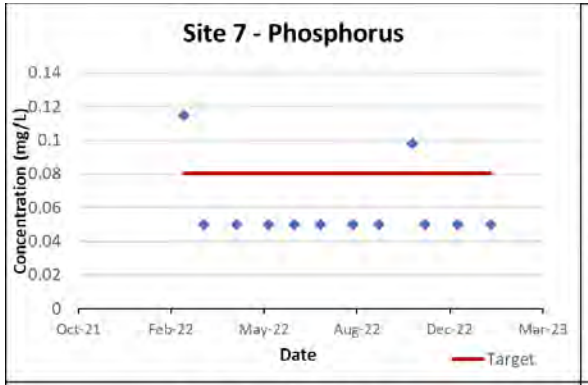


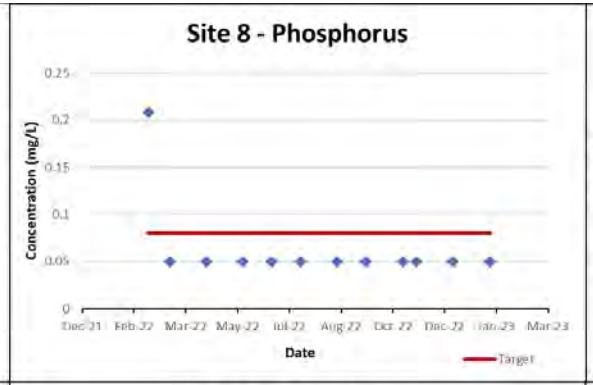
Figure 45. Nitrate-nitrogen concentrations measured in Upper Elkhart River Watershed sample sites from February 2022-January 2023. Note differences in scales along the concentration (y) axis.

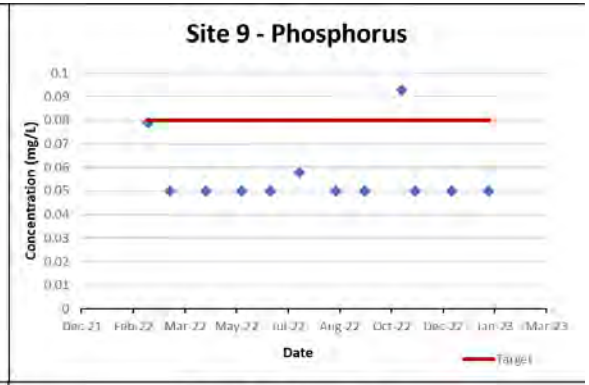
Total Phosphorus

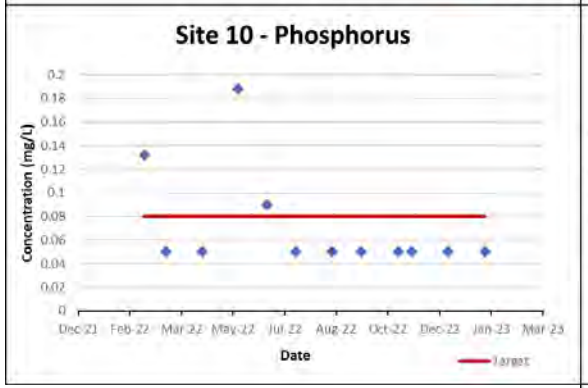
Total phosphorus concentrations exceeded the target concentration of 0.08 mg/L in 63 of 240 sample sites (26%, Figure 46). Stony Creek (Site 18) possessed the highest total phosphorus average concentration (0.203 mg/L), while Solomon Creek (Site 16) possessed the lowest average concentration (0.051 mg/L). Only North Branch Elkhart River downstream of Sylvan Lake (Site 5) and Solomon Creek (Site 16) never exceeded target concentrations during sampling events. In total, six sites possess average total phosphorus concentrations in excess of the level at which biological impairments occur (0.08 mg/L) including the Hackenburg Lake inlet (Site 2), Henderson Lake Ditch (Site 6), South Branch Elkhart River (Site 11), Croft Ditch (Site 12), Elkhart River (Site 17) and Stony Creek (Site 18).

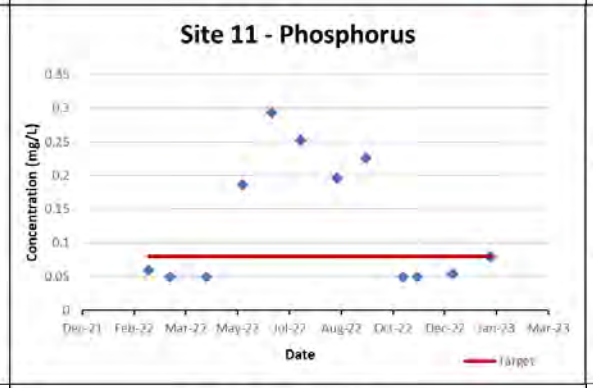


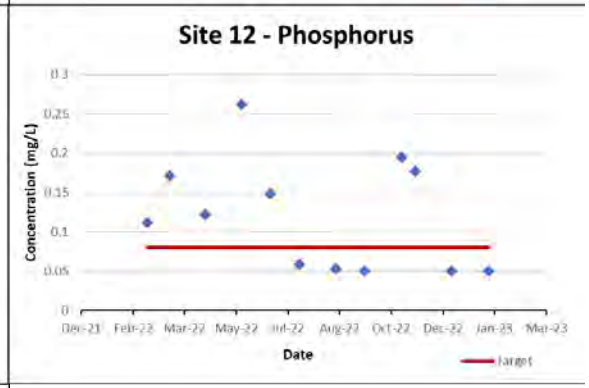

Site 7 - Phosphorus
Concentration (mg/L)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

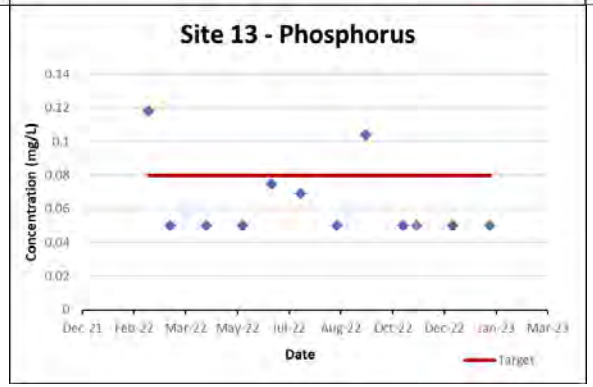

Site 8 - Phosphorus
Concentration (mg/L)
0.25
0.2
0.15
0.1
0.05
0
Date
Target


Site 9 - Phosphorus
Concentration (mg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Date
Target


Site 10 - Phosphorus
Concentration (mg/L)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Date
Target


Site 11 - Phosphorus
Concentration (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Date
Target


Site 12 - Phosphorus
Concentration (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
Date
Target


Site 13 - Phosphorus
Concentration (mg/L)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Dec-21
Feb-22
Mar-22
May-22
Jul-22
Aug-22
Oct-22
Dec-22
Jan-23
Mar-23
Date
Target

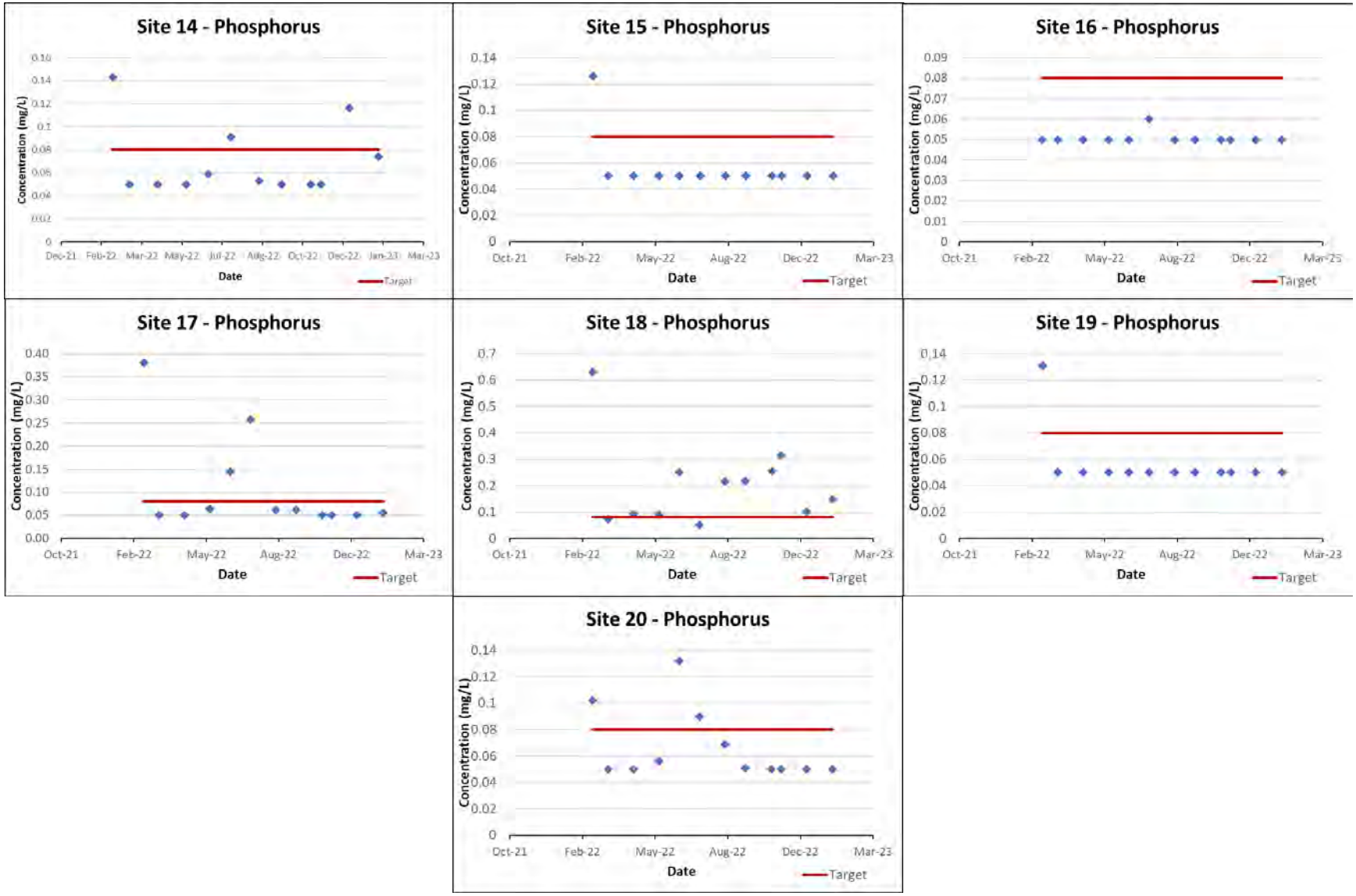
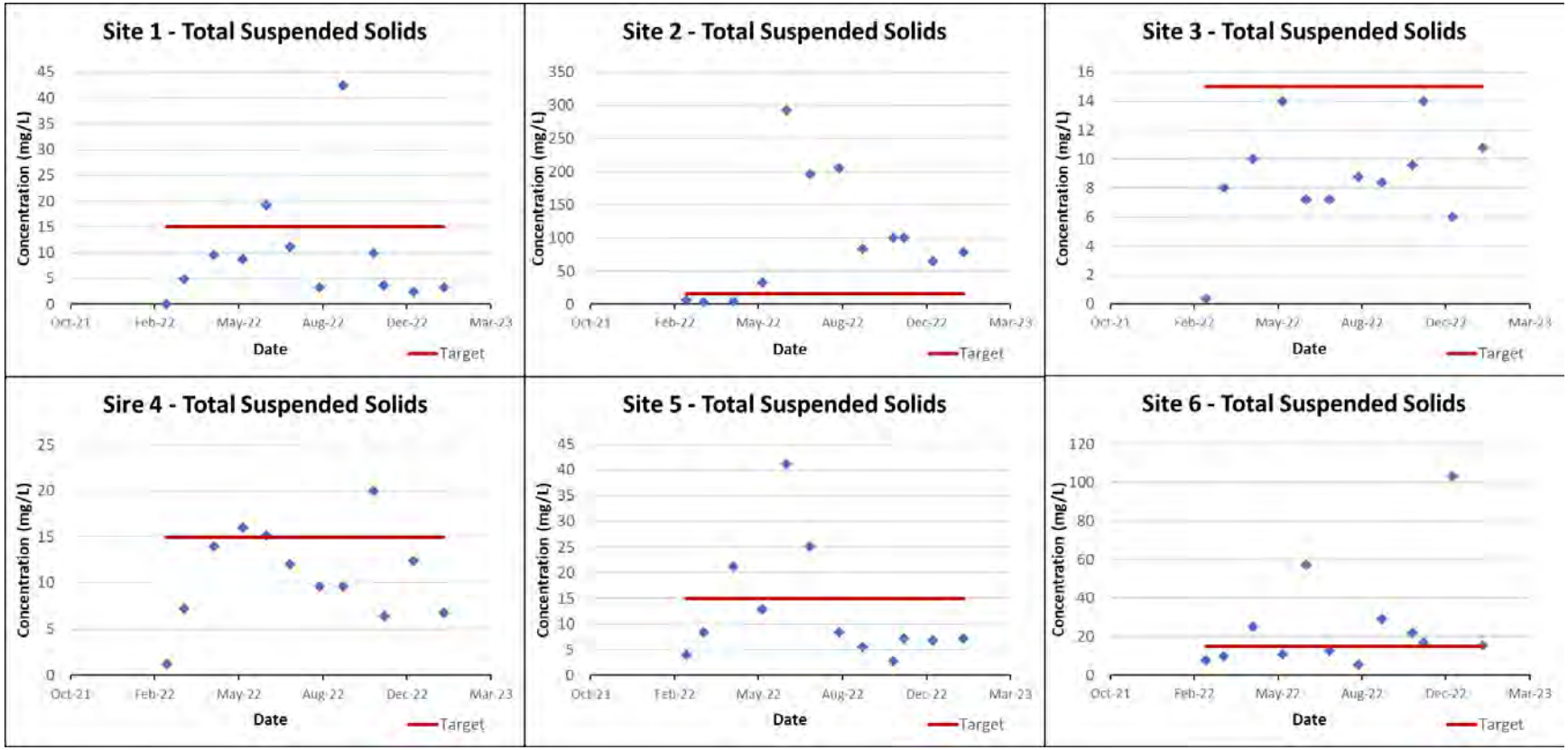
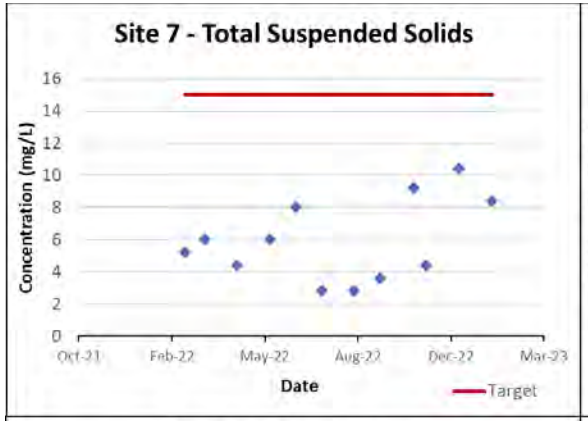


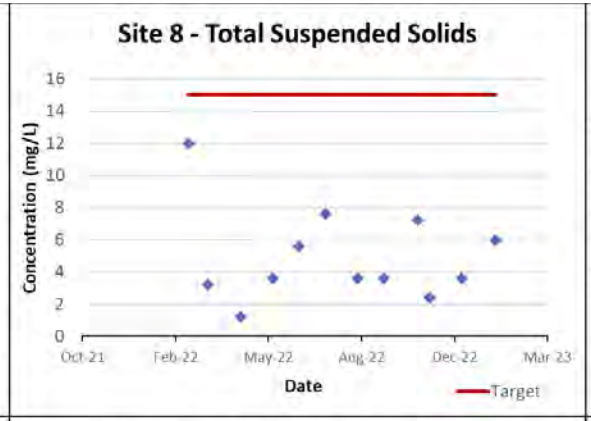
Figure 46. Total phosphorus concentrations measured in Upper Elkhart River Watershed sample sites from February 2022-January 2023. Note differences in scale along the concentration (y) axis.

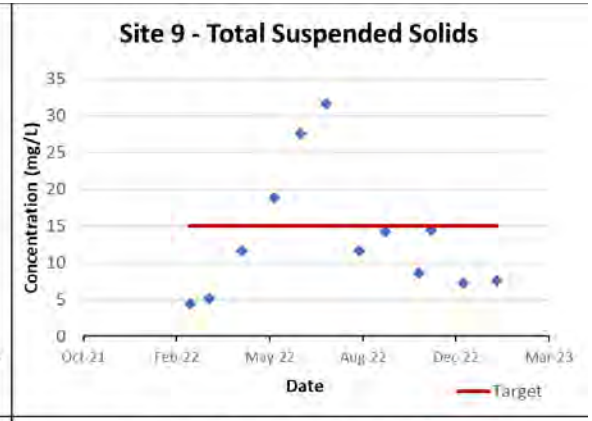
Total Suspended Solids

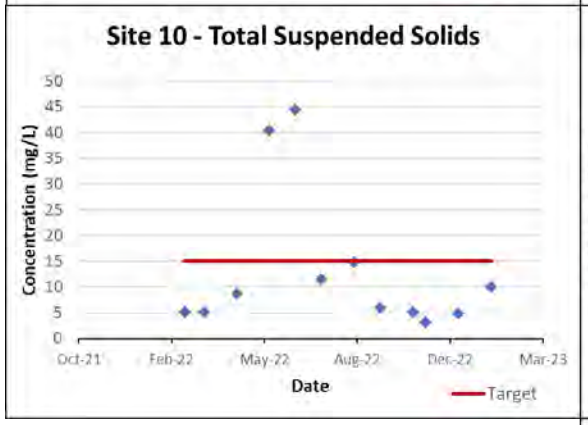
Total suspended solids (TSS) levels measured above target levels in 45 of 240 samples (19%,Figure 47). In total, four of 20 sites had average concentrations greater than the target concentration of 15 mg/L including the Hackenburg Lake Outlet (Site 2), Henderson Lake Ditch (Site 6), South Branch Elkhart River (Site 13) and Solomon Creek (Site 16). The Hackenburg Lake Outlet (Site 2) possessed the highest site average (97.3 mg/L). Clock Creek (Site 7), Dry Run (Site 8), South Branch Elkhart River (Site 11), Croft Ditch (Site 12), Rivir Lake Tributary (Site 14), Elkhart River (Site 17) and Stony Creek (Site 18) never exceeded target levels during any sampling event.

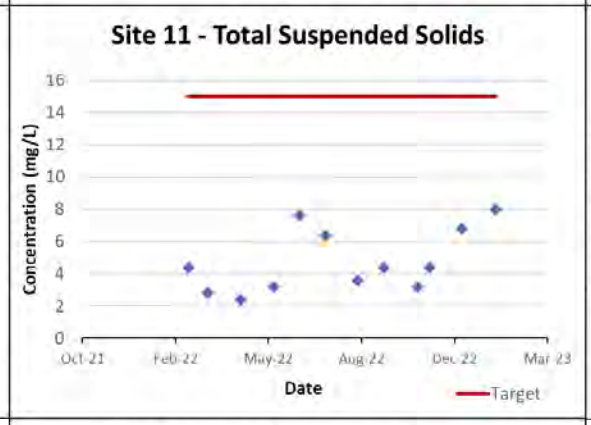


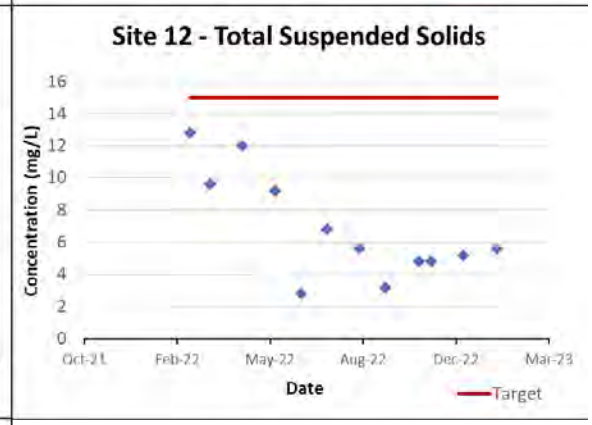

Site 7 - Total Suspended Solids
Concentration (mg/L)
0
2
4
6
8
10
12
14
16
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

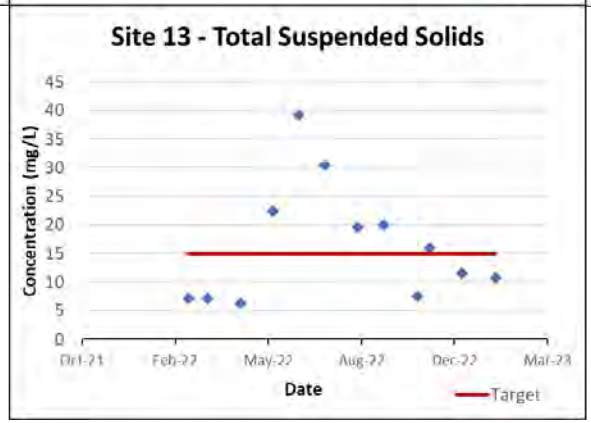

Site 8 - Total Suspended Solids
Concentration (mg/L)
0
2
4
6
8
10
12
14
16
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 9 - Total Suspended Solids
Concentration (mg/L)
0
5
10
15
20
25
30
35
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 10 - Total Suspended Solids
Concentration (mg/L)
0
5
10
15
20
25
30
35
40
45
50
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 11 - Total Suspended Solids
Concentration (mg/L)
0
2
4
6
8
10
12
14
16
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 12 - Total Suspended Solids
Concentration (mg/L)
0
2
4
6
8
10
12
14
16
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 13 - Total Suspended Solids
Concentration (mg/L)
0
5
10
15
20
25
30
35
40
45
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

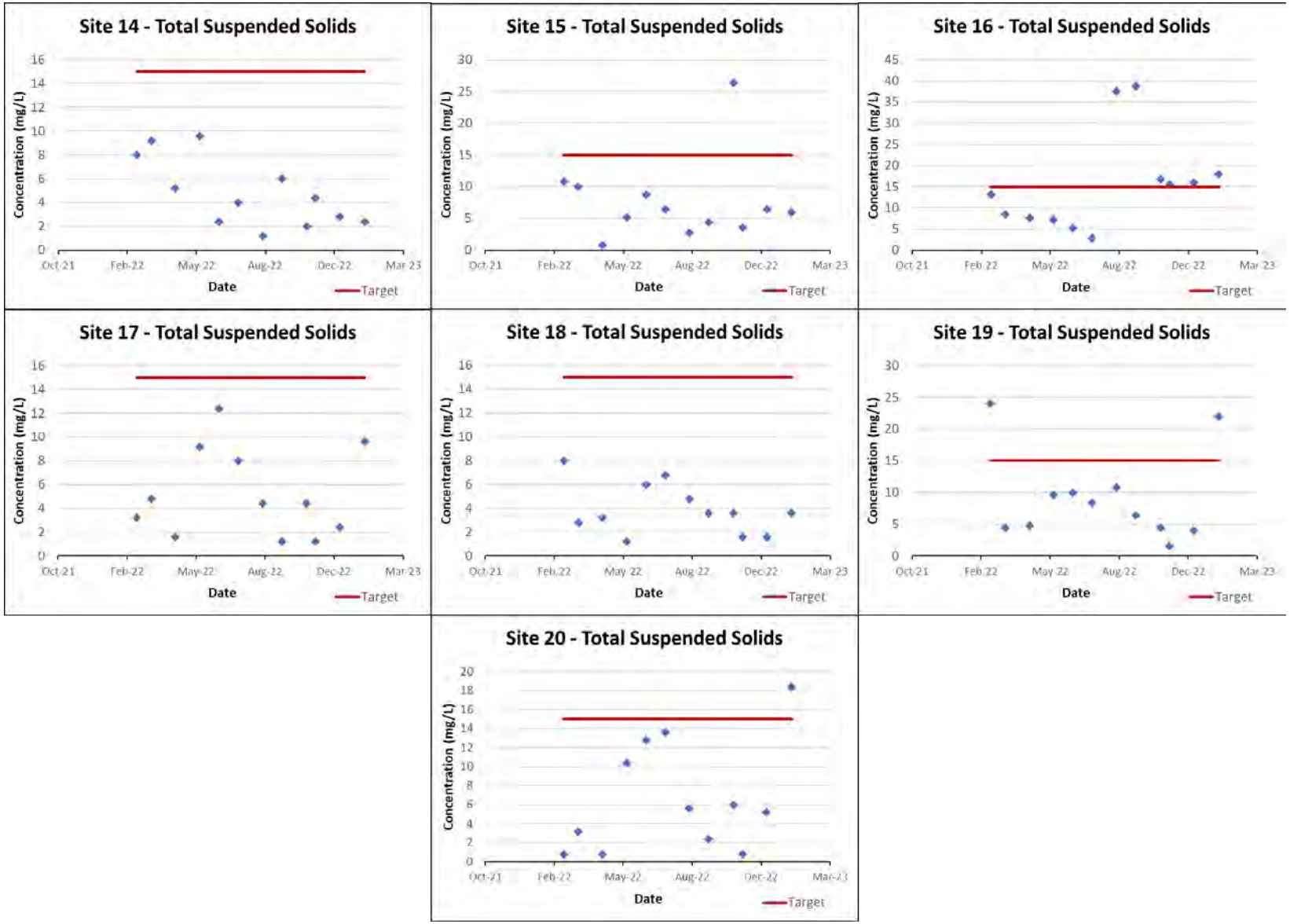
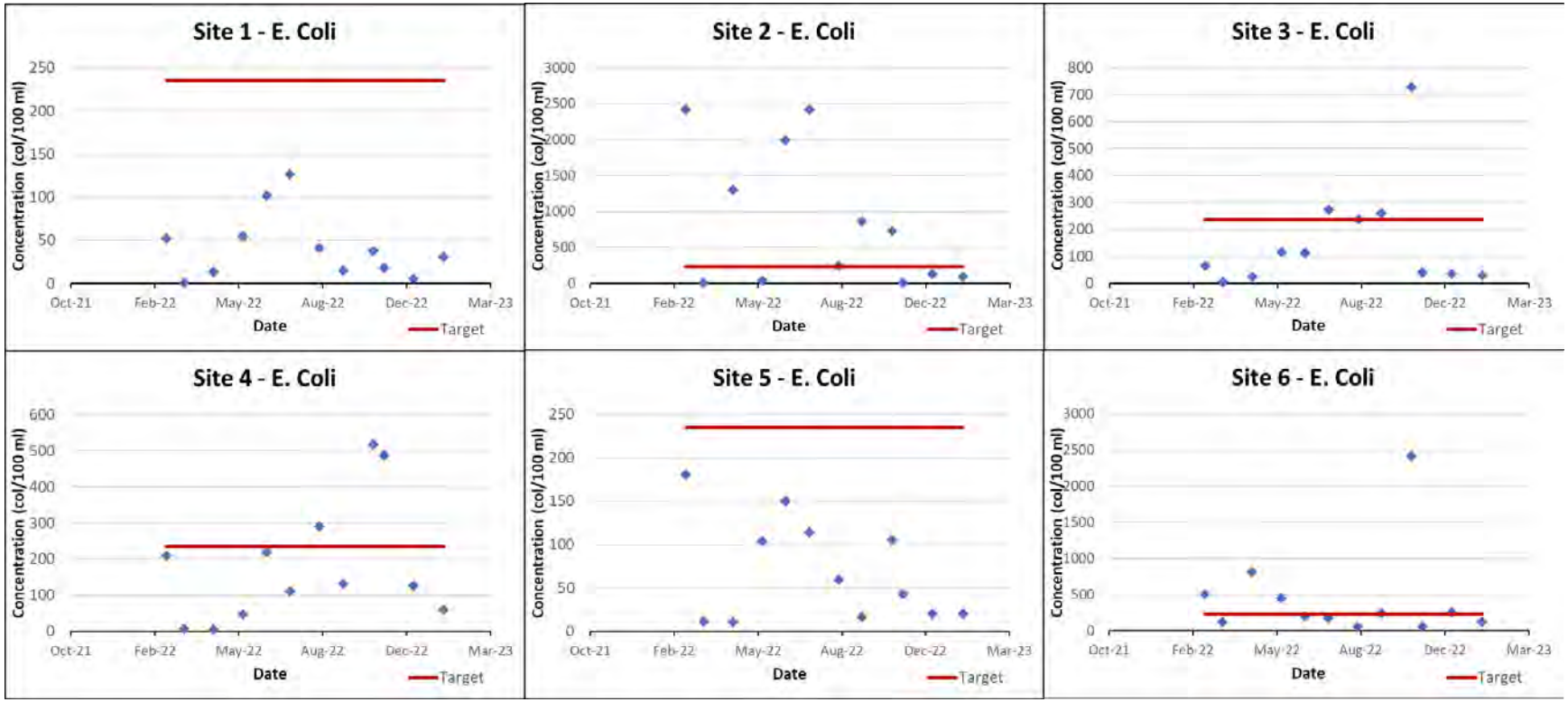
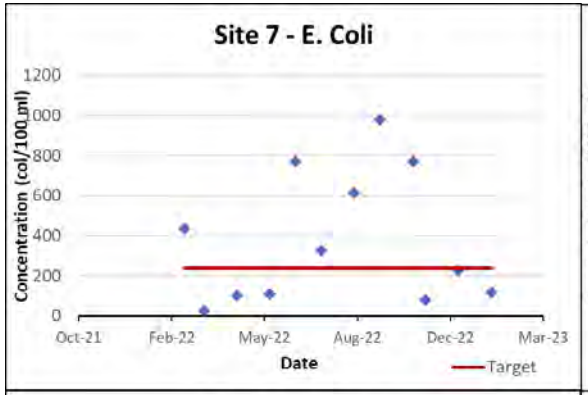


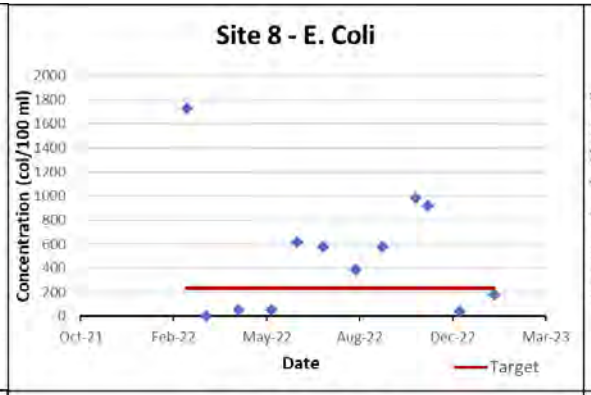
Figure 47. Total suspended solids concentrations measured in Upper Elkhart River Watershed sample sites from February 2022-January 2023. Note Difference in scale along the concentration (y) axis.

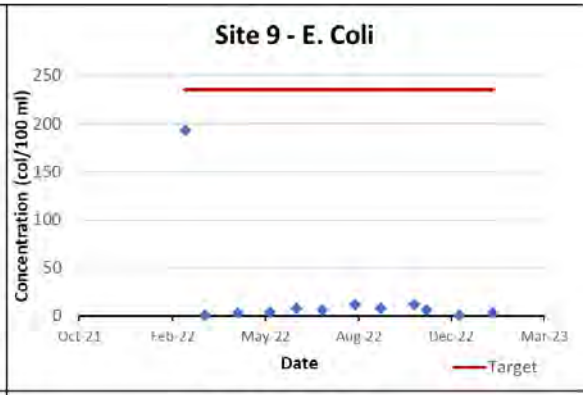
E. coli

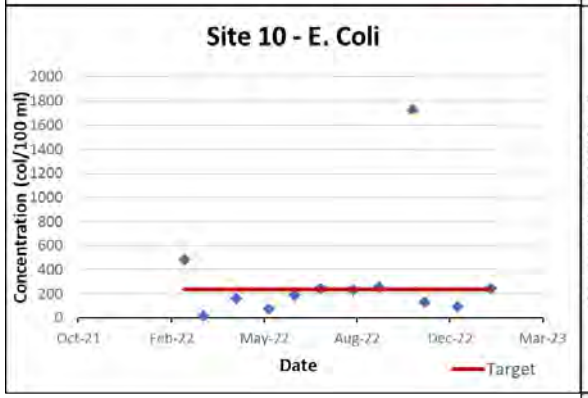
E. coli concentrations observed at Upper Elkhart River Watershed sites are shown in Figure 48. *E. coli* concentrations exceed state standards (235 col/100 mL) in 79 of 240 samples (33%). Half (10 of 20) of the sample sites average possessed concentrations in excess of state standards. Only Site 1 (Oliver Lake Outlet) and Sites 5 and 9 (North Branch Elkhart River) did not exceed the state standard during any sampling event.

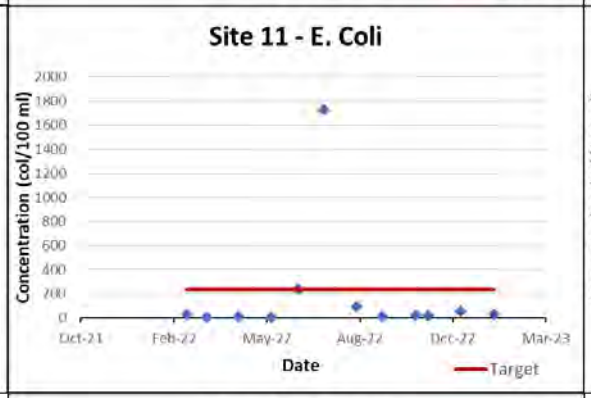


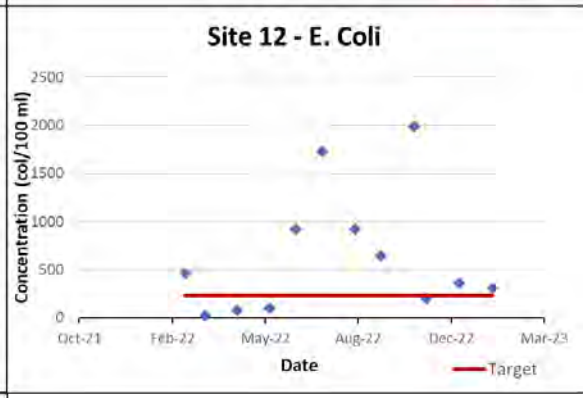

Site 7 - E. Coli
Concentration (col/100 ml)
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

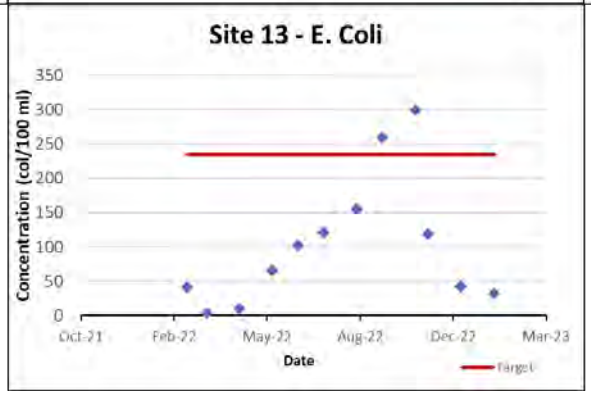

Site 8 - E. Coli
Concentration (col/100 ml)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 9 - E. Coli
Concentration (col/100 ml)
250
200
150
100
50
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 10 - E. Coli
Concentration (col/100 ml)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 11 - E. Coli
Concentration (col/100 ml)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 12 - E. Coli
Concentration (col/100 ml)
2500
2000
1500
1000
500
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target


Site 13 - E. Coli
Concentration (col/100 ml)
350
300
250
200
150
100
50
0
Oct-21
Feb-22
May-22
Aug-22
Dec-22
Mar-23
Date
Target

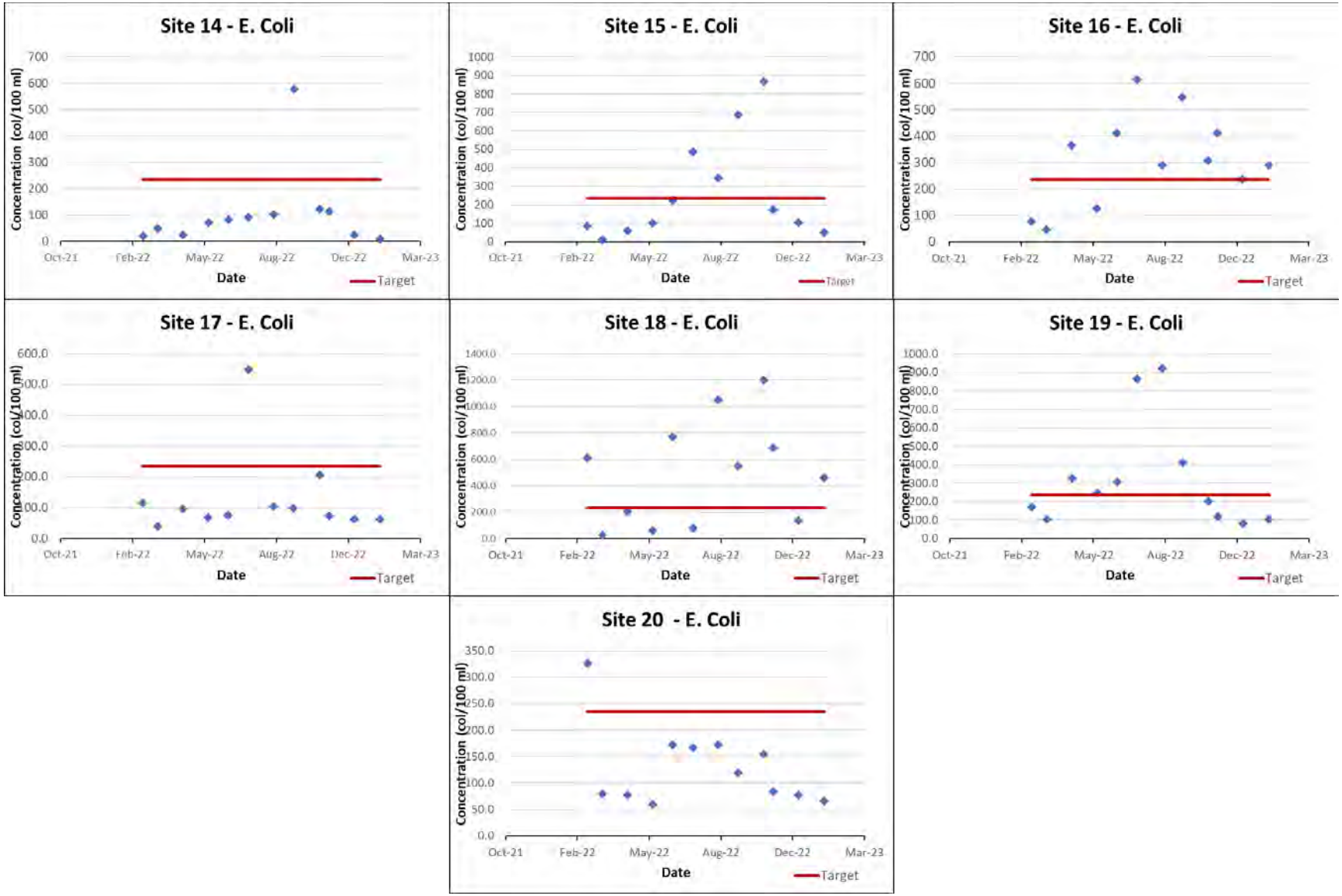


Figure 48. *E.coli* concentrations measured in Upper Elkhart River Watershed sample sites from February 2022-January 2023. Note differences in scale along the concentration (y) axis.

3.4.4 Load Duration Curves

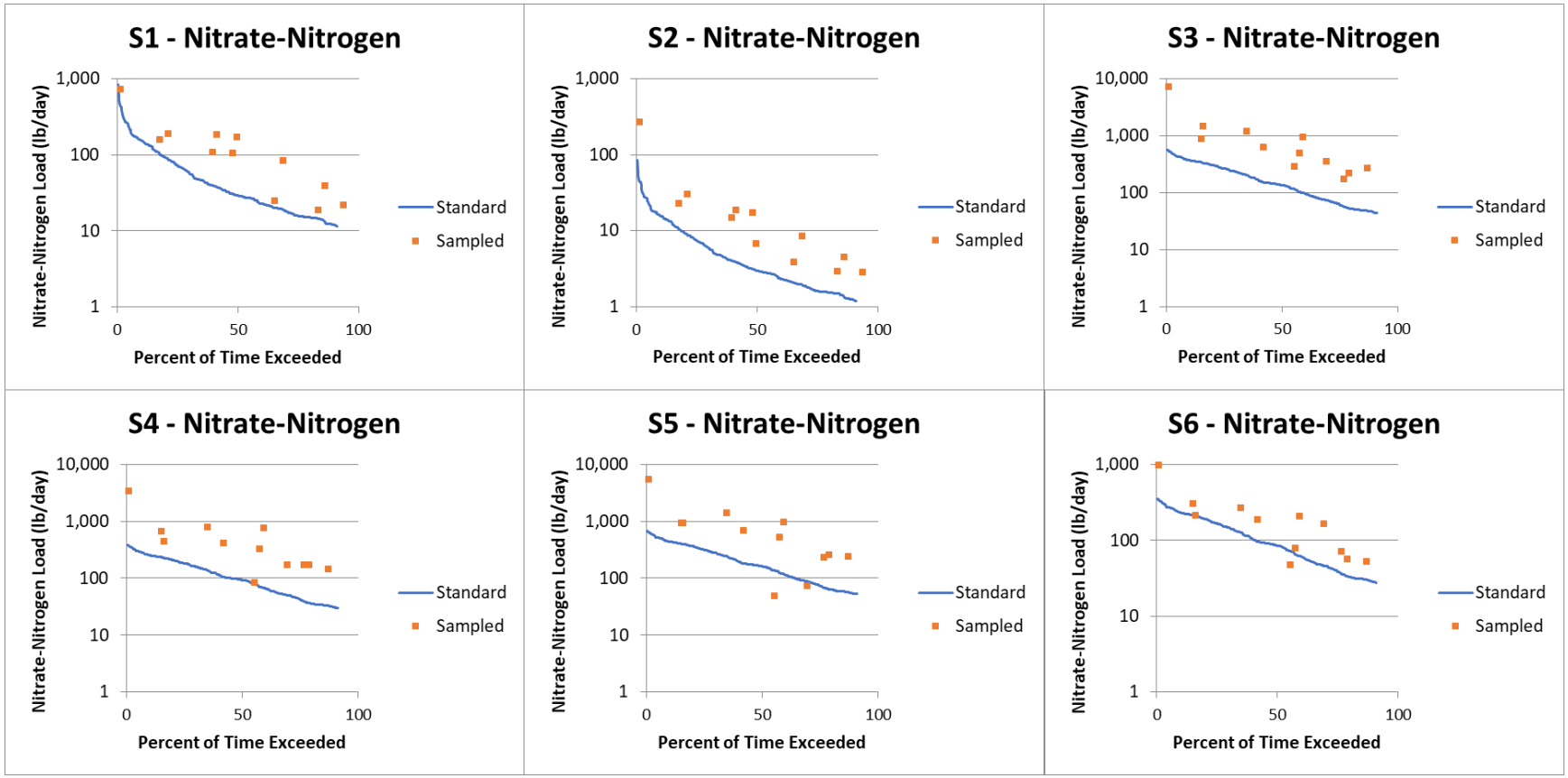
Load duration curves allow for comparison of instream loading with stream flow so that conditions of concern can be identified. The load duration curves present the flow characteristics for twenty sample sites during the time of study from February 2022 to January 2023. Shatto Ditch near Mentone (USGS 03331224) was used to scale the flow for the Oliver Lake-Little Elkhart Creek sites (Site 1 and 2), the North Branch Elkhart River Cosperville (USGS 04100222) gage was used to scale flow for all other tributary stream sites (Sites 3-16, 18-19), while the Elkhart River at Goshen (USGS 04100500) was used to scale flow for the mainstem Elkhart River sites (Sites 17 and 20). Stream flow measured at the U.S. Geological Survey gauge was scaled to watershed size for each of the twenty monitoring stations as follow:

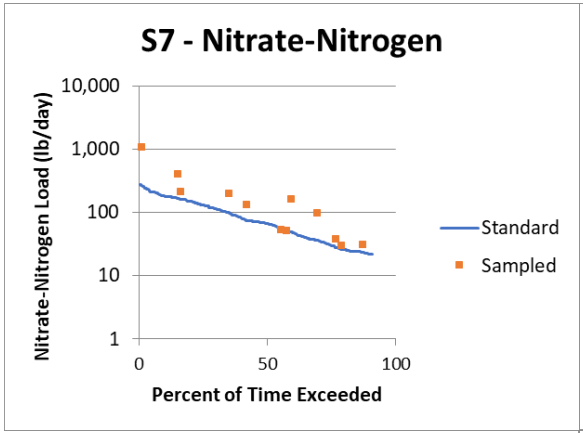
observed flow (cfs)) x (conversion factor) x (target concentration or state criteria) = total load /day

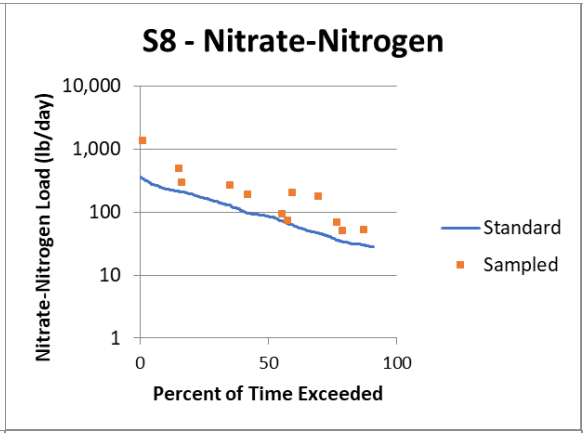
The individual load duration curves, also known as the allowable load curves, are displayed below (Figure 49 to Figure 52). In the graphs, the total daily load of each contaminant sample results (points) is plotted against the "percent time exceeded" for the day of sampling (curve). The time exceeded refers to instream flow conditions. Those points above the curve exceed the state criterion or target concentration. Values on a load duration curve can be grouped by hydrologic condition to help identify possible sources and conditions that result in the material being present in the system under those flow conditions. Most often, the flow ranges fall in High (0-10), Moist (10-40), Mid-Range (40-60), Dry (60-90), and Low (90-100). Exceedances falling in the moist range (10-40) are typically associated with surface runoff or stormwater loads, while exceedances associated with the dry zone are most often associated with dry conditions. These exceedances are suggested to result from point sources that are the most likely source. Load duration curve data are detailed in Appendix C.

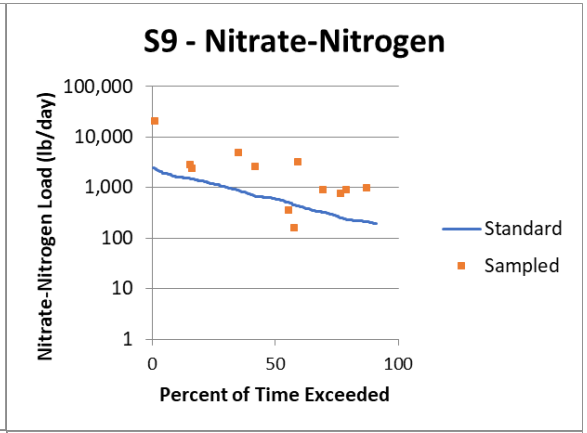
Nitrate-nitrogen Load Duration Curves

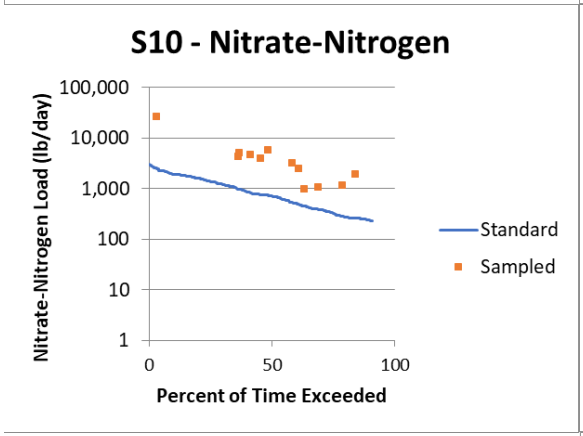
Nitrate-nitrogen loads measure higher than target loads at most sites during all conditions. In total, 13 sites exceeded target loads 100% of the time (Figure 49). The remaining seven sites exceeded target loads more than 80% of the time. This suggests that a steady stream of nitrate-nitrogen is available within these subwatersheds. Further, nitrate-nitrogen concentrations at all sites are highest during high flow conditions (0% of the time) and lower during low flow conditions (100% of the time). Most of the loads that remained under the target measured within the 40-60 flow ranges. The sites that measured above target at all times (Sites 3, 4, 8, 10, 11, 13, 16, 17, 19, and 20) indicate sources of nitrate-nitrogen to these streams under all flow conditions, suggesting that nitrate-nitrogen loads into the streams during both high flow, high runoff conditions and low flow, low runoff conditions. This could mean that there are continuous sources of nitrate-nitrogen at these sites including septic system inputs or nitrogen from manure or other dissolved sources.

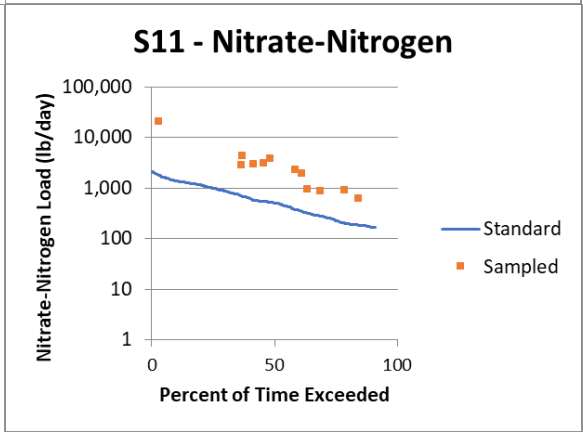


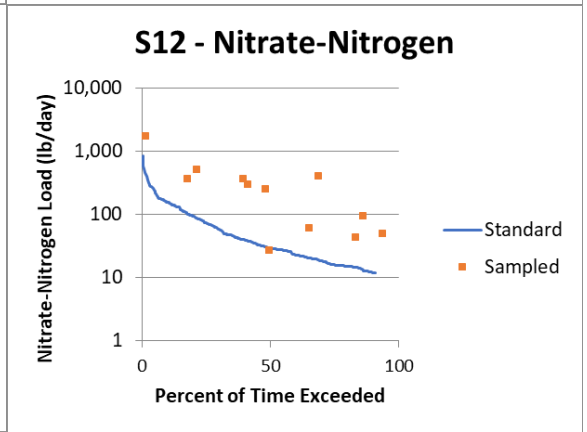

S7 - Nitrate-Nitrogen
Nitrate-Nitrogen Load (lb/day)
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled

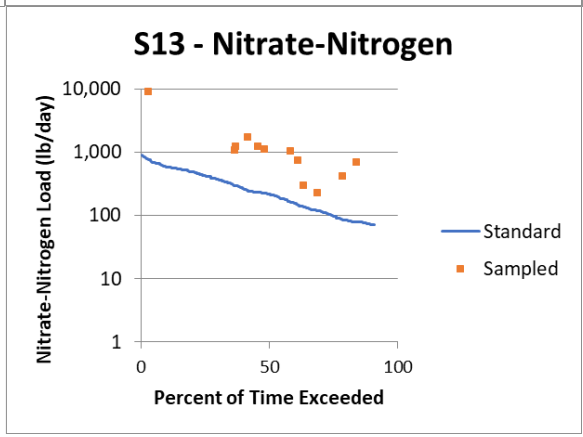

S8 - Nitrate-Nitrogen
Nitrate-Nitrogen Load (lb/day)
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S9 - Nitrate-Nitrogen
Nitrate-Nitrogen Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S10 - Nitrate-Nitrogen
Nitrate-Nitrogen Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S11 - Nitrate-Nitrogen
Nitrate-Nitrogen Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S12 - Nitrate-Nitrogen
Nitrate-Nitrogen Load (lb/day)
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S13 - Nitrate-Nitrogen
Nitrate-Nitrogen Load (lb/day)
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled

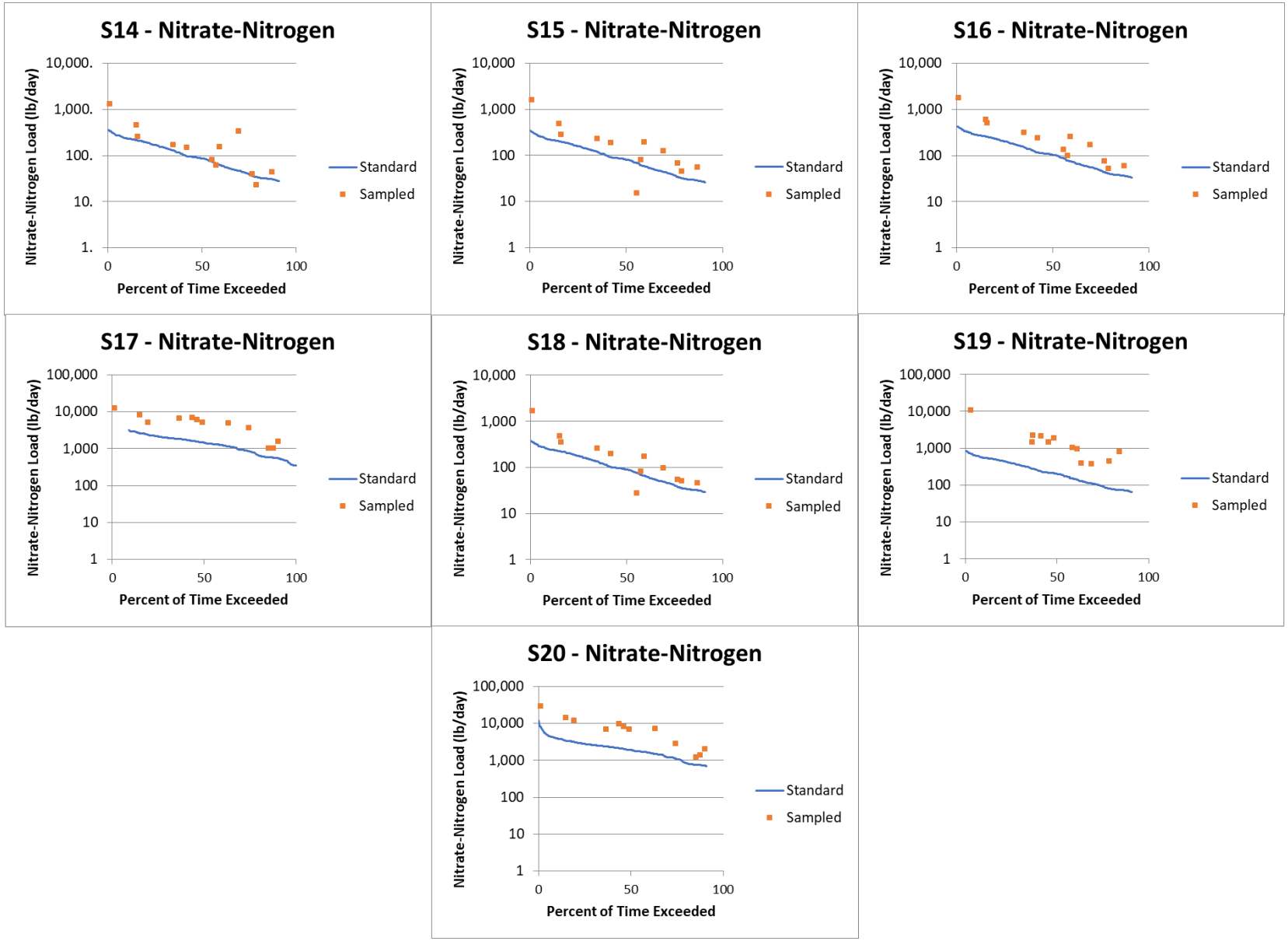
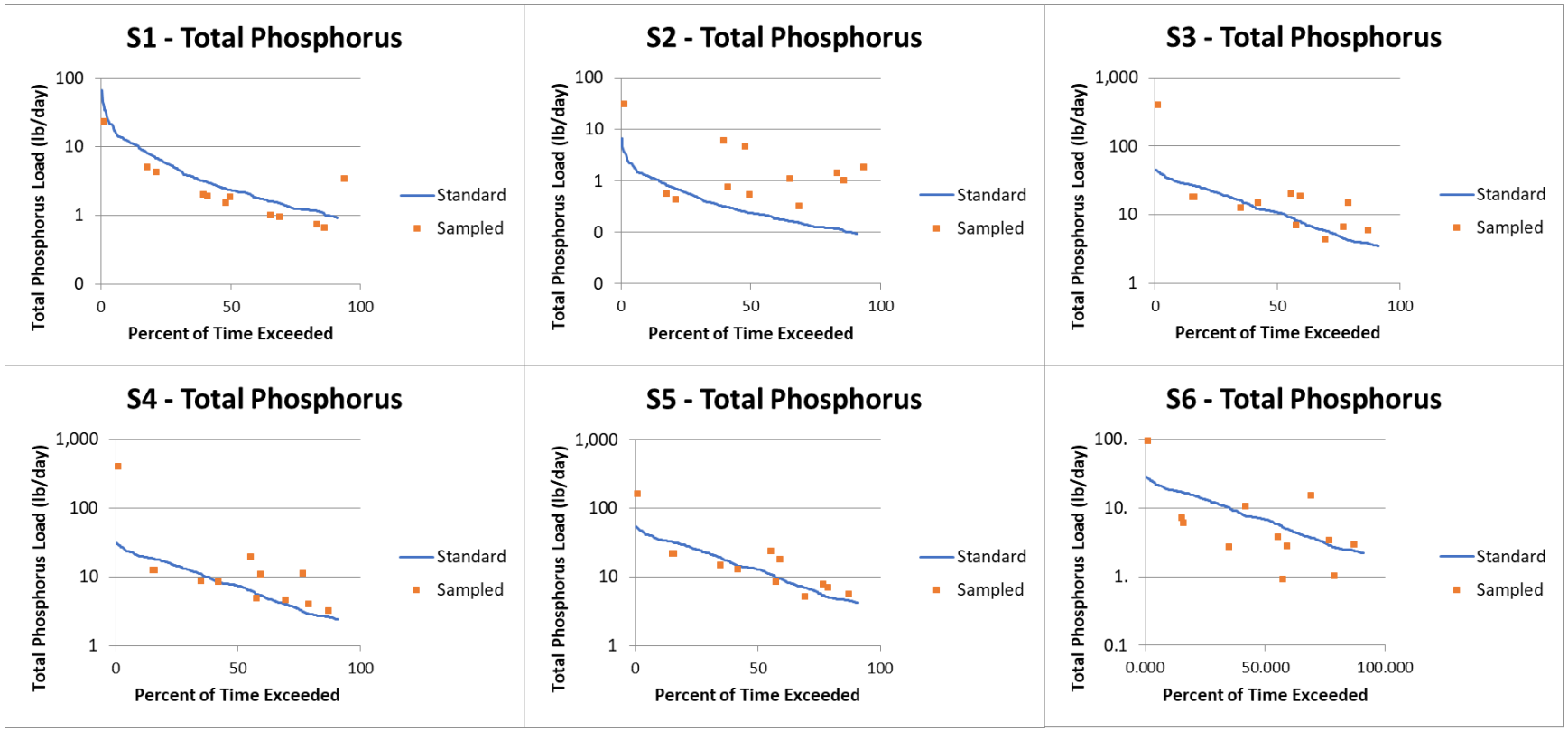
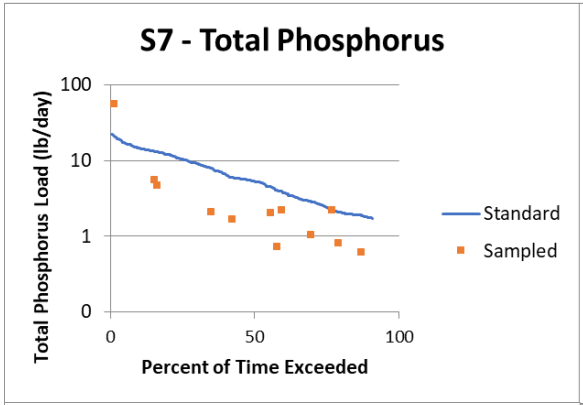


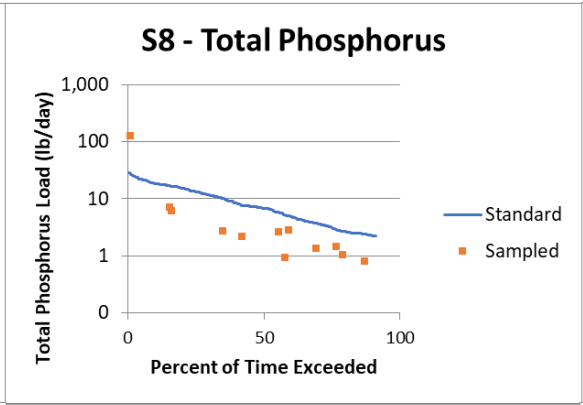
Figure 49. Nitrate-nitrogen load duration curves for Upper Elkhart River Watershed sample sites from February 2022-January 2023.

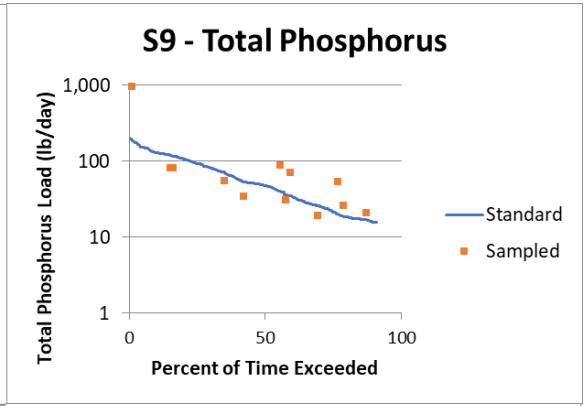
Total Phosphorus Load Duration Curves

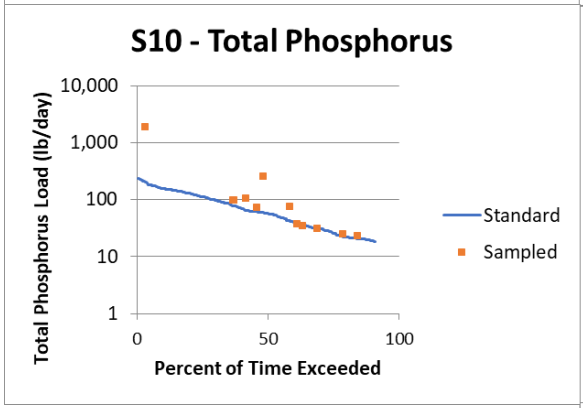
Total phosphorus levels generally measured at or above target levels under varying flow conditions (Figure 50). Most sites had levels that consistently measured at or around load target levels. Most exceedances occurred during high flow conditions or between mid-range to dry conditions. Several sites (4, 5, 10, 11, 13 and 20) possessed exceedances that occurred during all flow conditions. Exceedances of the target levels that occur under storm flow conditions (10-40) suggest erosion or runoff may be the cause of exceedance values. More than half of the sites exceeded target levels under high flow conditions. Under low flow conditions, more than half of the sites had measurements remain at or near the target load level. This suggests that a heavier stream of total phosphorus is more present under higher flow conditions than lower flow conditions in the Upper Elkhart River Watershed.

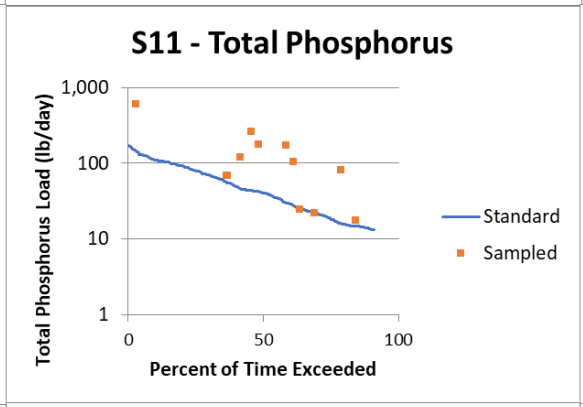


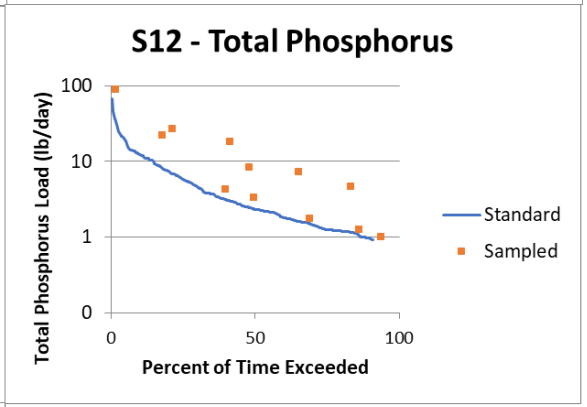

S7 - Total Phosphorus
Total Phosphorus Load (lb/day)
100
10
1
0
0
50
100
Percent of Time Exceeded
Standard
Sampled

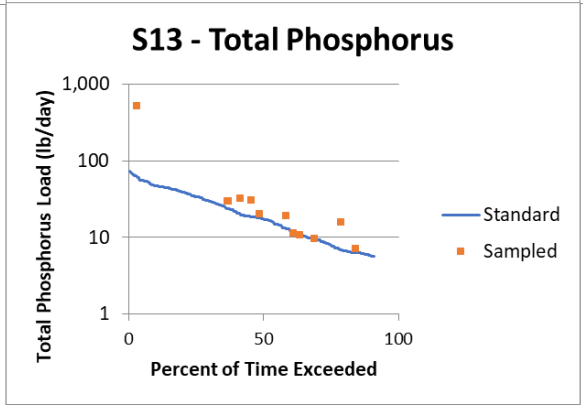

S8 - Total Phosphorus
Total Phosphorus Load (lb/day)
1,000
100
10
1
0
0
50
100
Percent of Time Exceeded
Standard
Sampled


S9 - Total Phosphorus
Total Phosphorus Load (lb/day)
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S10 - Total Phosphorus
Total Phosphorus Load (lb/day)
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S11 - Total Phosphorus
Total Phosphorus Load (lb/day)
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S12 - Total Phosphorus
Total Phosphorus Load (lb/day)
100
10
1
0
0
50
100
Percent of Time Exceeded
Standard
Sampled


S13 - Total Phosphorus
Total Phosphorus Load (lb/day)
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled

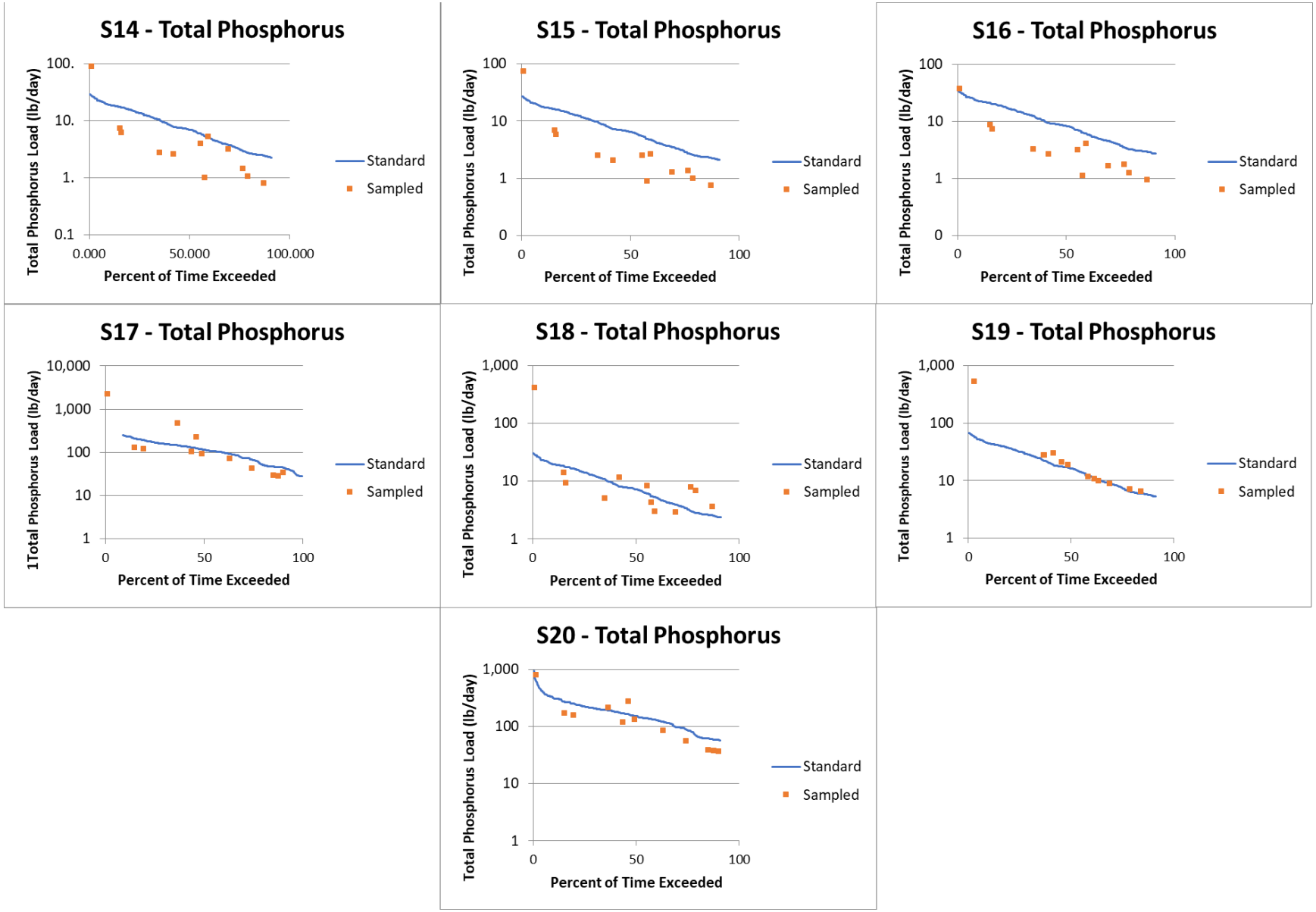
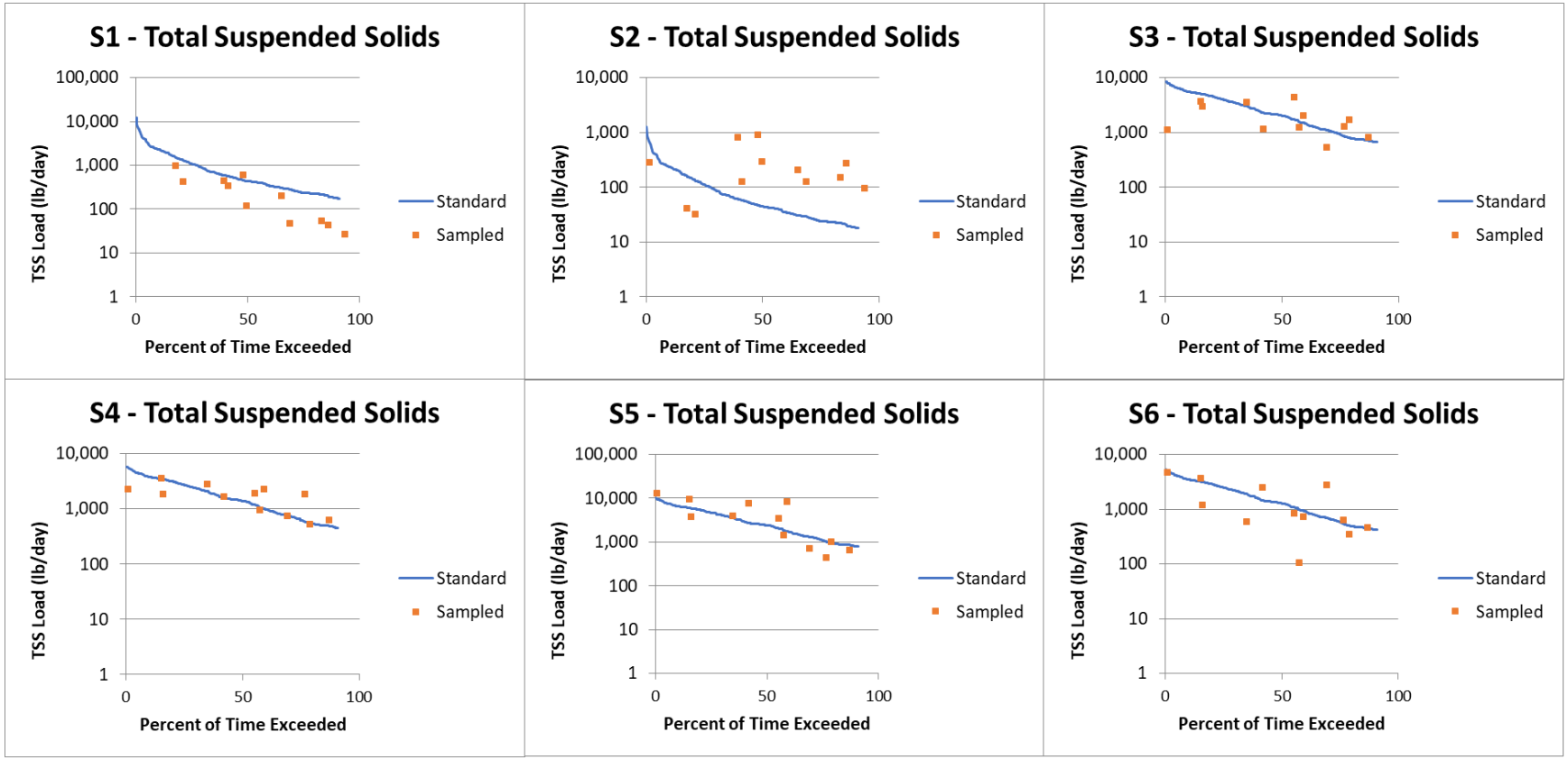
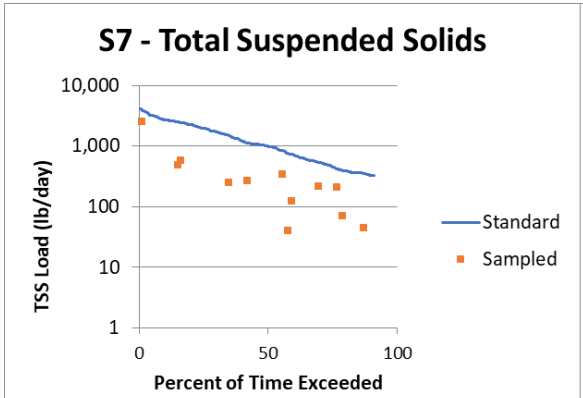


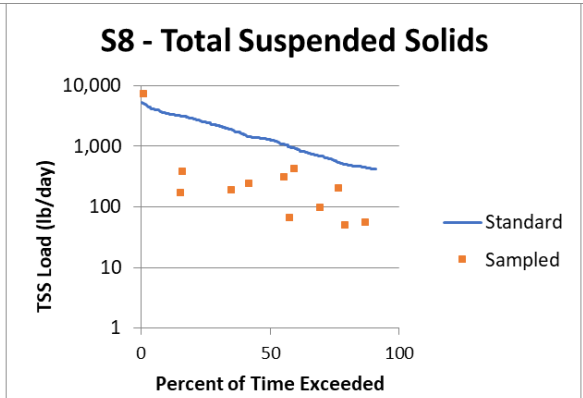
Figure 50. Total phosphorus load duration curves for Upper Elkhart River Watershed sample sites from February 2022-January 2023.

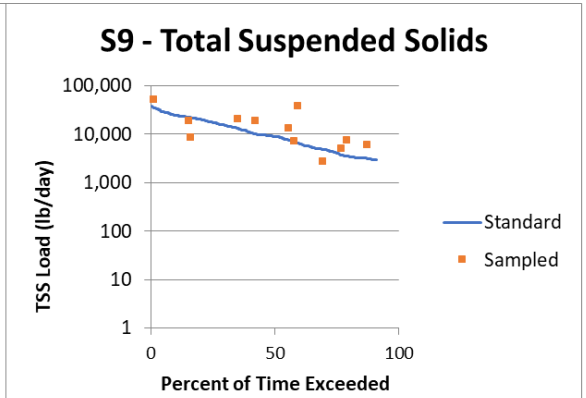
Total Suspended Solids Load Duration Curves

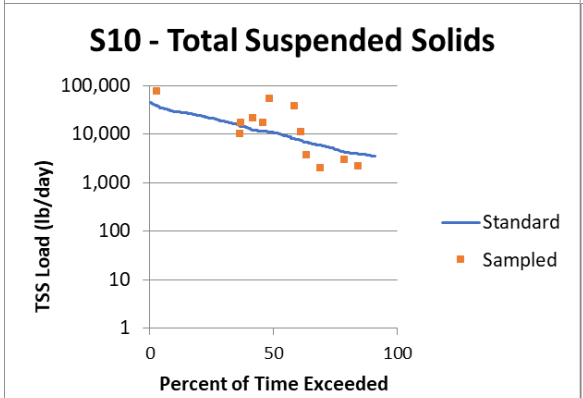
Total suspended solids (TSS) levels varied at all stream sites (Figure 51). Many of the sites exceeded target levels either half or more than half the time. Several sites (Site 4, 5, 9 and 10) exceeded load targets 100% of the time. Exceedances occurred during all flow conditions, but mostly during mid-range or dry conditions. This suggests total suspended solids enter the stream under mostly any flow condition. Possible sources of total suspended solids include livestock access or streambank and bed erosion, both of which can provide a continuous source of total suspended solids.

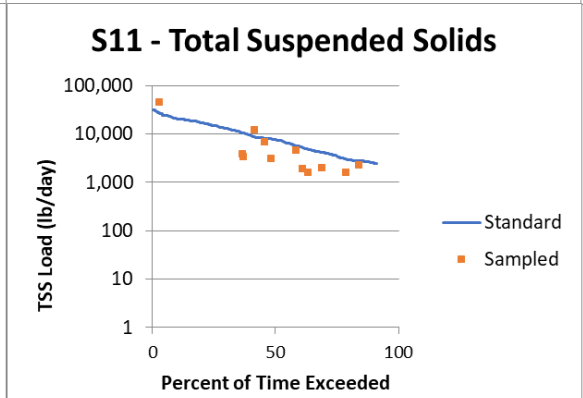


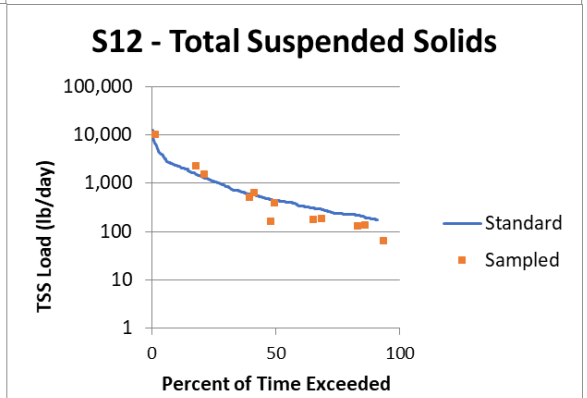

S7 - Total Suspended Solids
TSS Load (lb/day)
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled

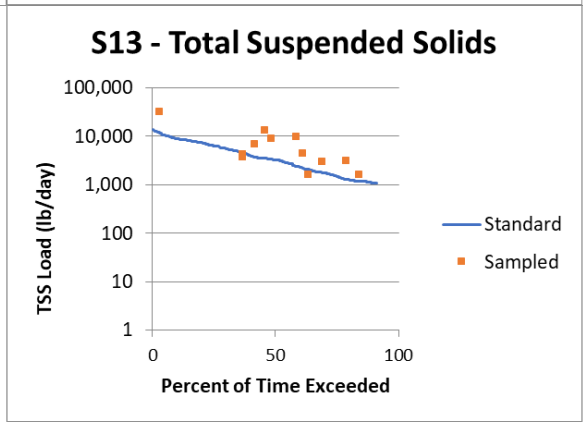

S8 - Total Suspended Solids
TSS Load (lb/day)
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S9 - Total Suspended Solids
TSS Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S10 - Total Suspended Solids
TSS Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S11 - Total Suspended Solids
TSS Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S12 - Total Suspended Solids
TSS Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled


S13 - Total Suspended Solids
TSS Load (lb/day)
100,000
10,000
1,000
100
10
1
0
50
100
Percent of Time Exceeded
Standard
Sampled

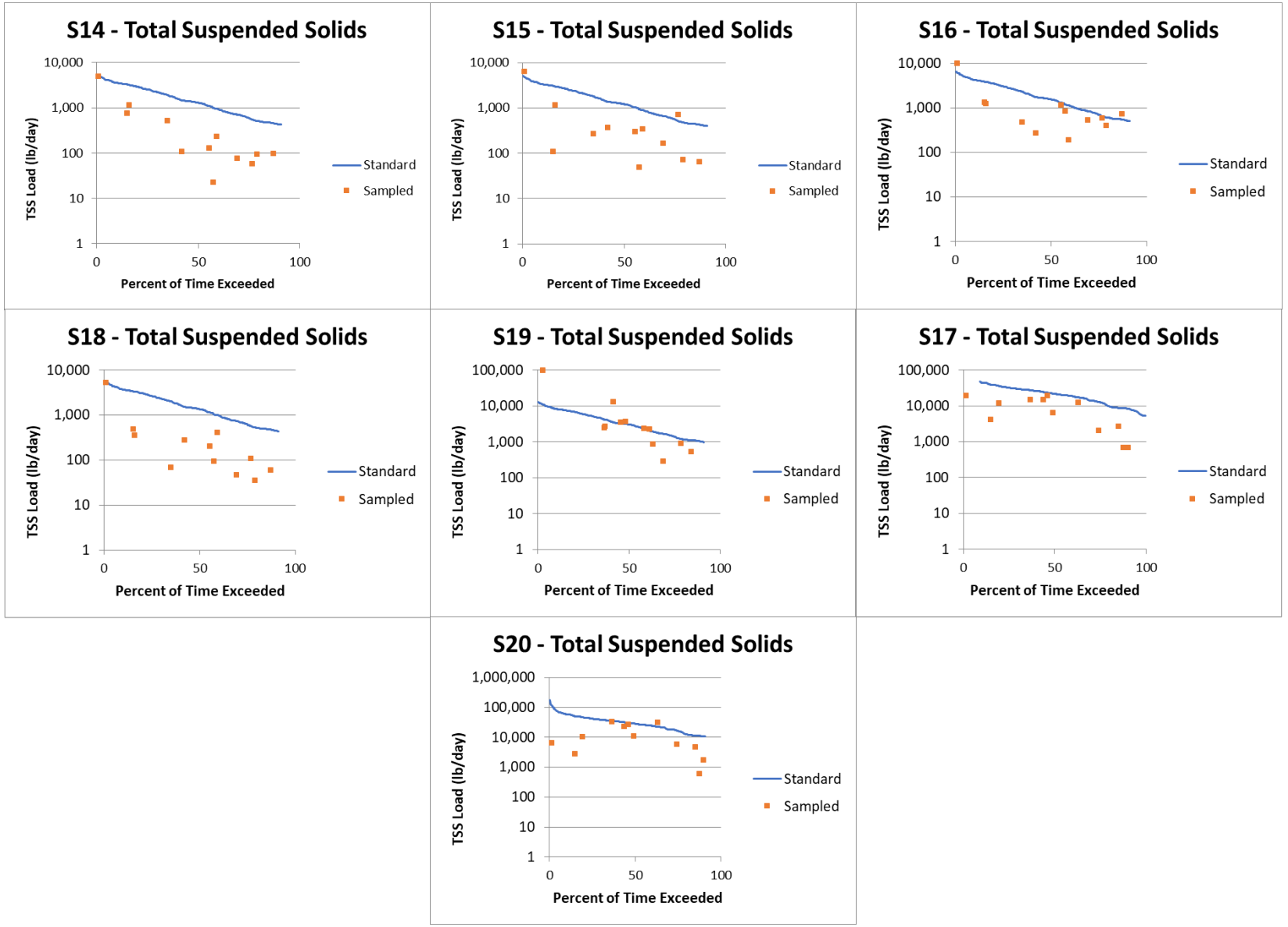
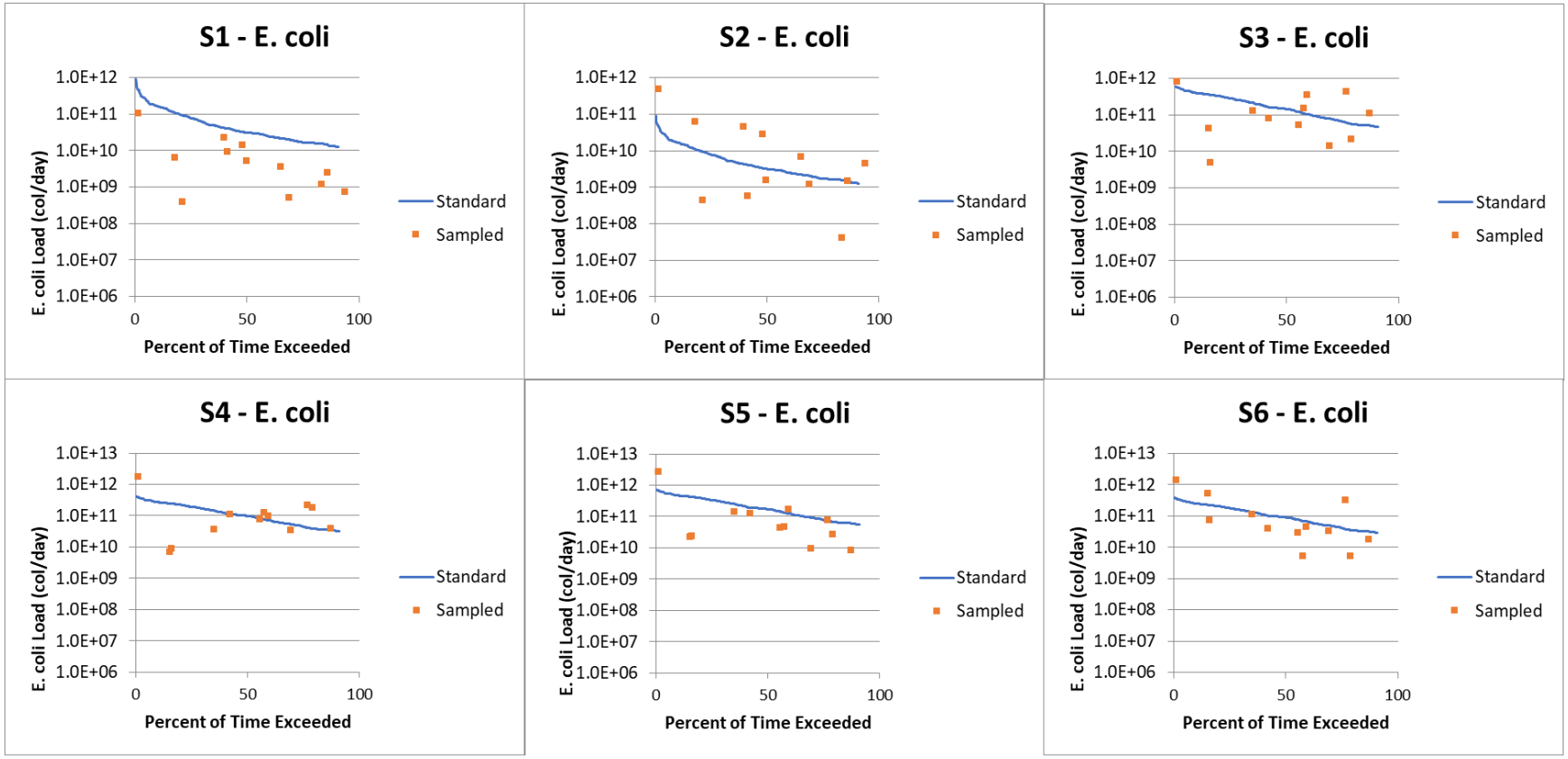
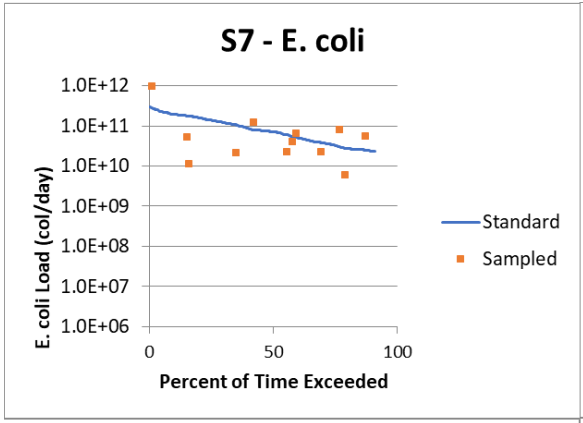


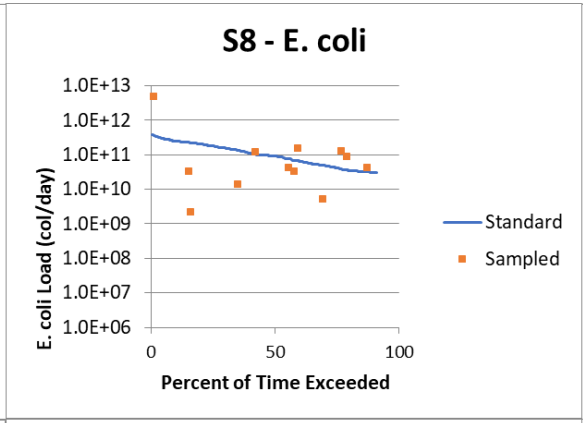
Figure 51. Total suspended solids load curves for Upper Elkhart River Watershed samples sites from February 2022-January 2023.

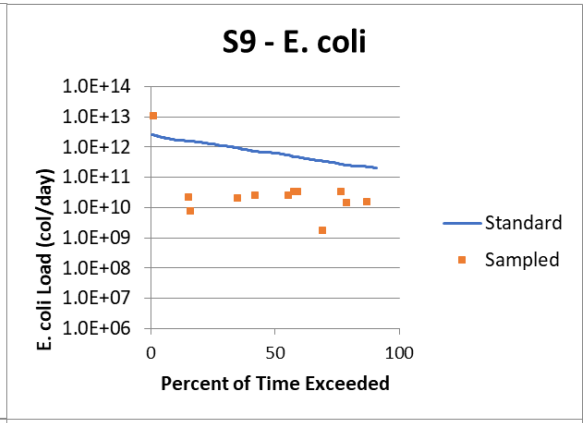
E. coli Load Duration Curves

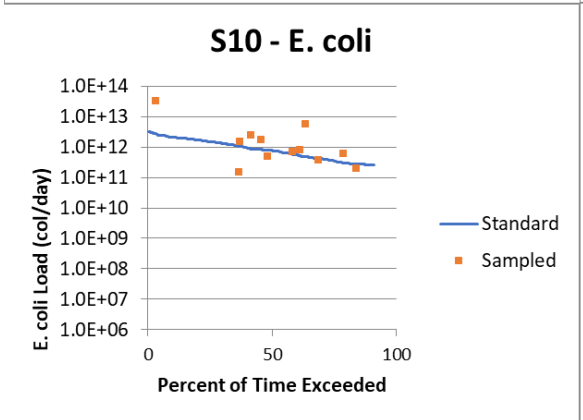
E. coli curves indicate that levels exceed targets during all flow conditions (Figure 52). Half of the sites measured at or above target levels. When targets were exceeded, they varied during flow conditions. Most exceedances occurred between mid-range to low conditions, with some exceedances during high flow conditions. These data suggest a nearly continuous source of *E. coli* within these streams under most flow conditions.

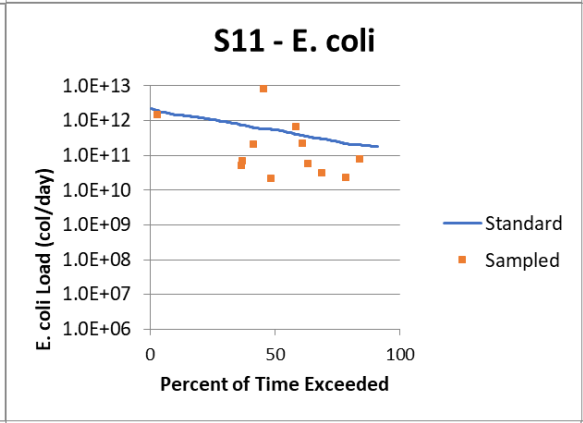


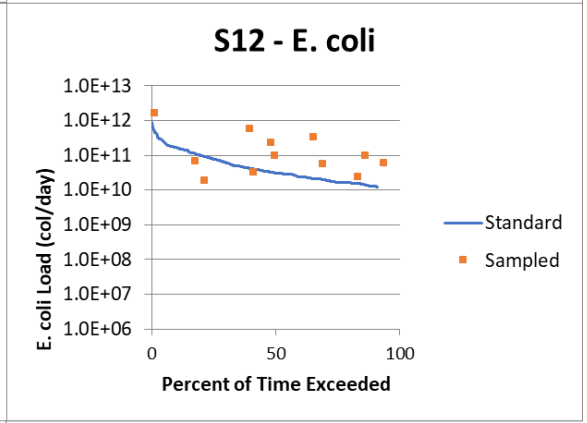

S7 - E. coli
E. coli Load (col/day)
1.0E+12
1.0E+11
1.0E+10
1.0E+09
1.0E+08
1.0E+07
1.0E+06
0
50
100
Percent of Time Exceeded
Standard
Sampled

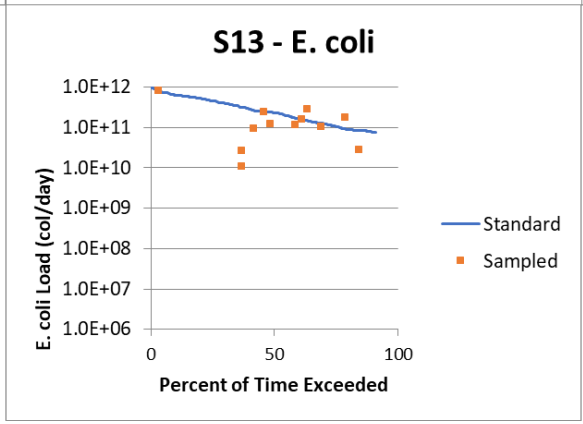

S8 - E. coli
E. coli Load (col/day)
1.0E+13
1.0E+12
1.0E+11
1.0E+10
1.0E+09
1.0E+08
1.0E+07
1.0E+06
0
50
100
Percent of Time Exceeded
Standard
Sampled


S9 - E. coli
E. coli Load (col/day)
1.0E+14
1.0E+13
1.0E+12
1.0E+11
1.0E+10
1.0E+09
1.0E+08
1.0E+07
1.0E+06
0
50
100
Percent of Time Exceeded
Standard
Sampled


S10 - E. coli
E. coli Load (col/day)
1.0E+14
1.0E+13
1.0E+12
1.0E+11
1.0E+10
1.0E+09
1.0E+08
1.0E+07
1.0E+06
0
50
100
Percent of Time Exceeded
Standard
Sampled


S11 - E. coli
E. coli Load (col/day)
1.0E+13
1.0E+12
1.0E+11
1.0E+10
1.0E+09
1.0E+08
1.0E+07
1.0E+06
0
50
100
Percent of Time Exceeded
Standard
Sampled


S12 - E. coli
E. coli Load (col/day)
1.0E+13
1.0E+12
1.0E+11
1.0E+10
1.0E+09
1.0E+08
1.0E+07
1.0E+06
0
50
100
Percent of Time Exceeded
Standard
Sampled


S13 - E. coli
E. coli Load (col/day)
1.0E+12
1.0E+11
1.0E+10
1.0E+09
1.0E+08
1.0E+07
1.0E+06
0
50
100
Percent of Time Exceeded
Standard
Sampled

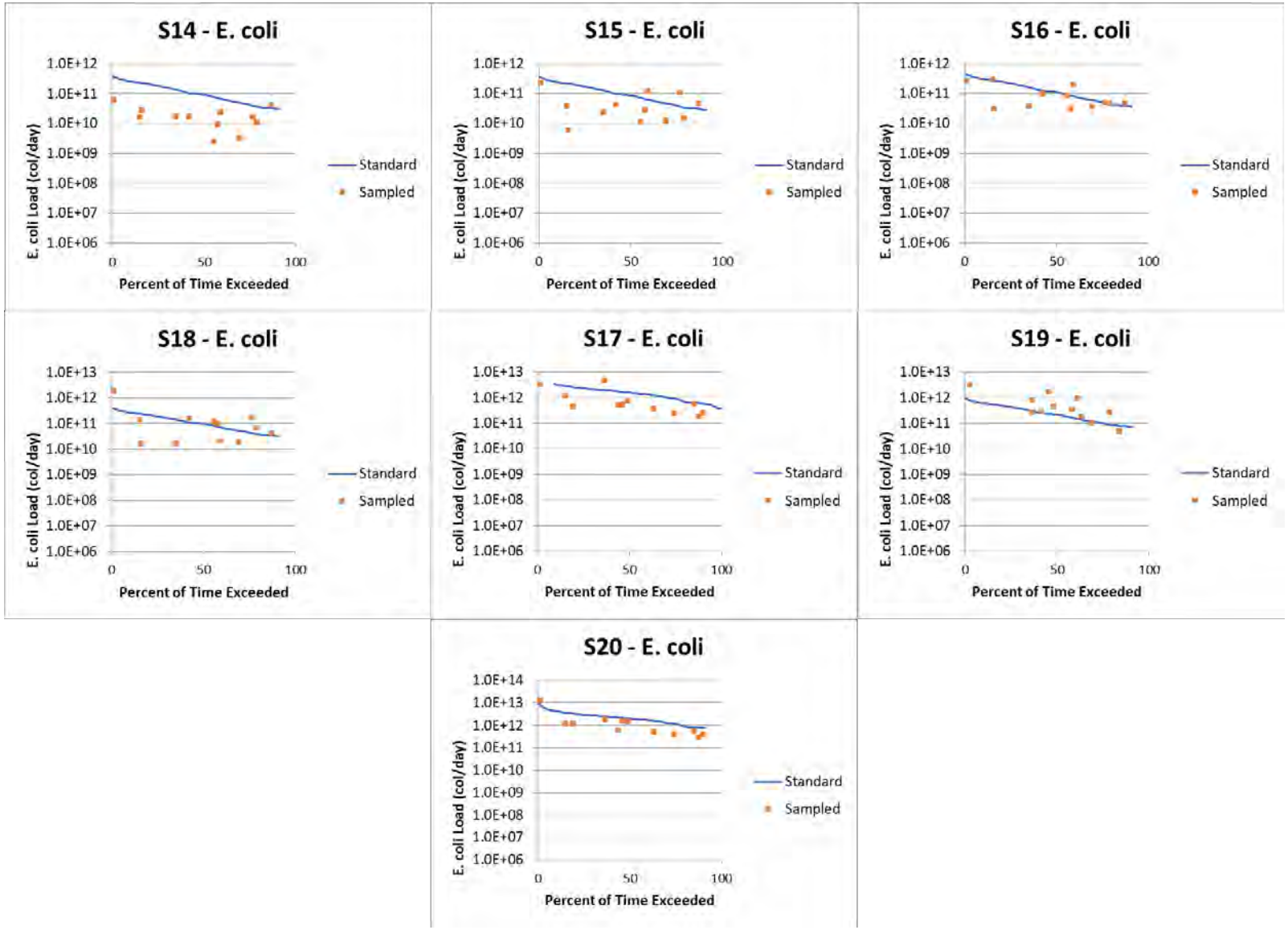


Figure 52. *E. coli* load duration curves for Upper Elkhart River Watershed sample sites from February 2022-January 2023.

3.4.5 Macroinvertebrate Community Assessment

Clock Creek (Site 7) and Croft Ditch (Site 12) supported the most diverse communities compared to the other sites in the Upper Elkhart River Watershed with 31 taxa and 24 taxa observed, respectively (Table 21, Figure 53). Additionally, Clock Creek (Site 7) possessed the greatest mIBI score and Croft Ditch (Site 12) and Elkhart River (Site 17) possessed the second highest mIBI scores, with Clock Creek having a score of 44 and Croft Ditch having a score of 42. It is important to note, however, that *no* intolerant species were observed at both Site 7 (Clock Creek) and Site 12 (Croft Ditch). Rather, Clock Creek (Site 7) had 12% of species observed classified as tolerant while Site 12 (Croft Ditch) had 35% classified as tolerant. Like Site 12 (Croft Ditch), the Elkhart River (Site 17) also had an mIBI score of 42. Elkhart River (Site 17) had the greatest percentage of intolerant species observed (33%) with only 3% of observed taxa classified as tolerant. Additionally, the Elkhart River (Site 17) had the most observed EPT taxa (11 individuals). Site 10 (North Branch Elkhart River) had the greatest percentage of tolerant species, with 91% of observed taxa identified as tolerant. Site 2 (Hackenburg Lake inlet) had the lowest mIBI score with a score of 22. Hackenburg Lake inlet (Site 2) also had the lowest number of sensitive EPT taxa observed with 0 individuals collected. Macroinvertebrate data are detailed in Appendix B.

Table 21. Metric classification scores and mIBI score for the Upper Elkhart River Watershed sample sites as sampled in 2022.

Metrics Scoring	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 10	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20
Total Taxa Score	1	3	1	1	1	3	3	1	3	1	1	3	1	3	1	1	1
Total # Individuals Score	1	5	5	5	5	5	1	5	5	5	5	5	5	5	5	5	5
#EPT Taxa Score	1	3	1	1	1	3	1	3	1	1	3	1	1	3	3	3	3
% Orthoclads &Tanytarsids Score	5	5	5	5	3	3	5	5	5	5	5	5	5	5	5	5	5
% Non-Insects Score	1	5	1	1	5	5	5	1	5	5	1	3	1	5	1	5	3
# Dipteran Taxa Score	1	1	3	1	1	3	3	1	3	3	1	3	1	1	1	3	3
% Intolerant Score	1	3	1	1	1	1	1	1	1	1	1	1	1	5	1	1	1
% Tolerant Score	1	5	1	1	1	5	1	1	1	1	1	1	5	5	5	5	5
%Predators Score	1	1	3	3	5	1	1	1	5	3	1	1	1	1	1	1	1
%Shredders & Scrapers Score	5	5	5	1	1	5	5	5	5	5	1	1	1	5	1	5	3
% Collector-Filterers Score	3	1	3	5	1	5	3	5	3	5	1	3	5	3	1	1	3
% Sprawlers Score	1	1	5	5	5	5	1	1	5	5	3	5	1	1	1	1	1
mIBI Score	**22**	**38**	**34**	**30**	**30**	**44**	**30**	**30**	**42**	**40**	**24**	**32**	**28**	**42**	**26**	**36**	**34**
Rating	**VP**	**F**	**P**	**P**	**P**	**F**	**P**	**P**	**F**	**F**	**P**	**P**	**P**	**F**	**P**	**F**	**P**

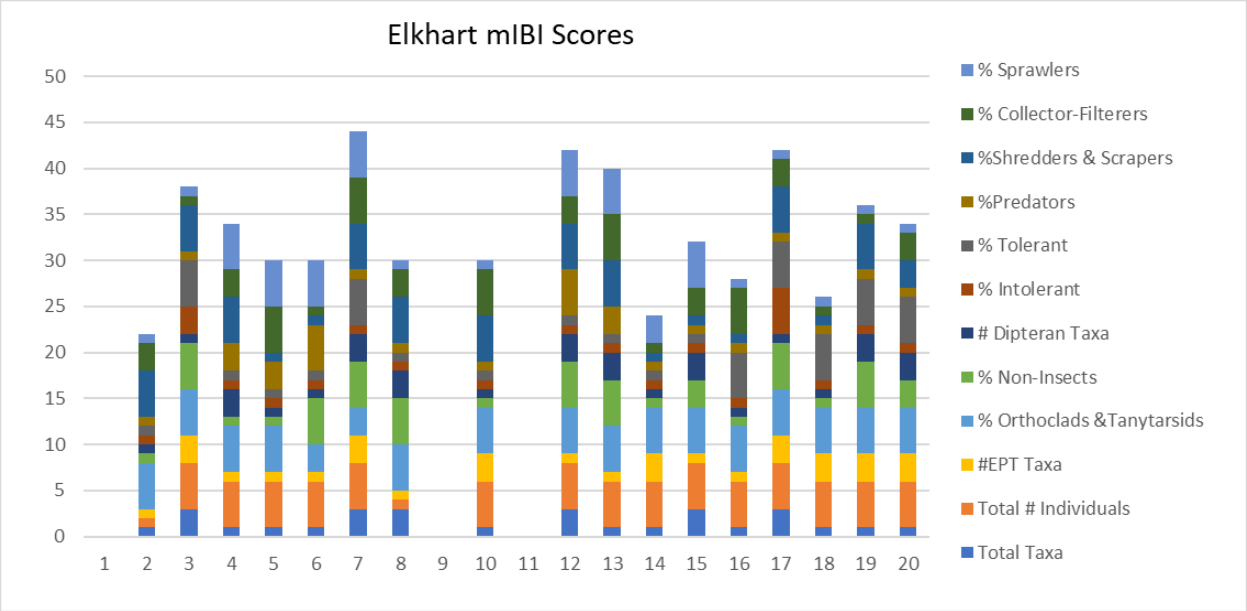


Figure 53. Cumulative metrics used to calculate mIBI scores for Upper Elkhart River Watershed streams in 2022.

As shown in Figure 54, Site 2 (Hackenburg Lake inlet), Site 4 (Little Elkhart Creek) , Site 5 (North Branch downstream of Sylvan Lake), Site 6 (Henderson Lake Ditch), Site 8 (Dry Run), Site 10 (North Branch Elkhart River), Site 14 Rivir Lake Tributary), Site 15 (Carrol Lake), Site 16 (Solomon Creek), Site 18 (Stony Creek) and Site 20 (Elkhart River) possessed mIBI scores which rated as impaired. Site 3 (North Branch Elkhart River downstream of Five Lake), Site 7 (Clock Creek), Site 12 (Croft Ditch), Site 13 (South Branch Elkhart River), Site 17 (Elkhart River) and Site 19 (Solomon Creek) possessed mIBI scores which rated as not impaired.

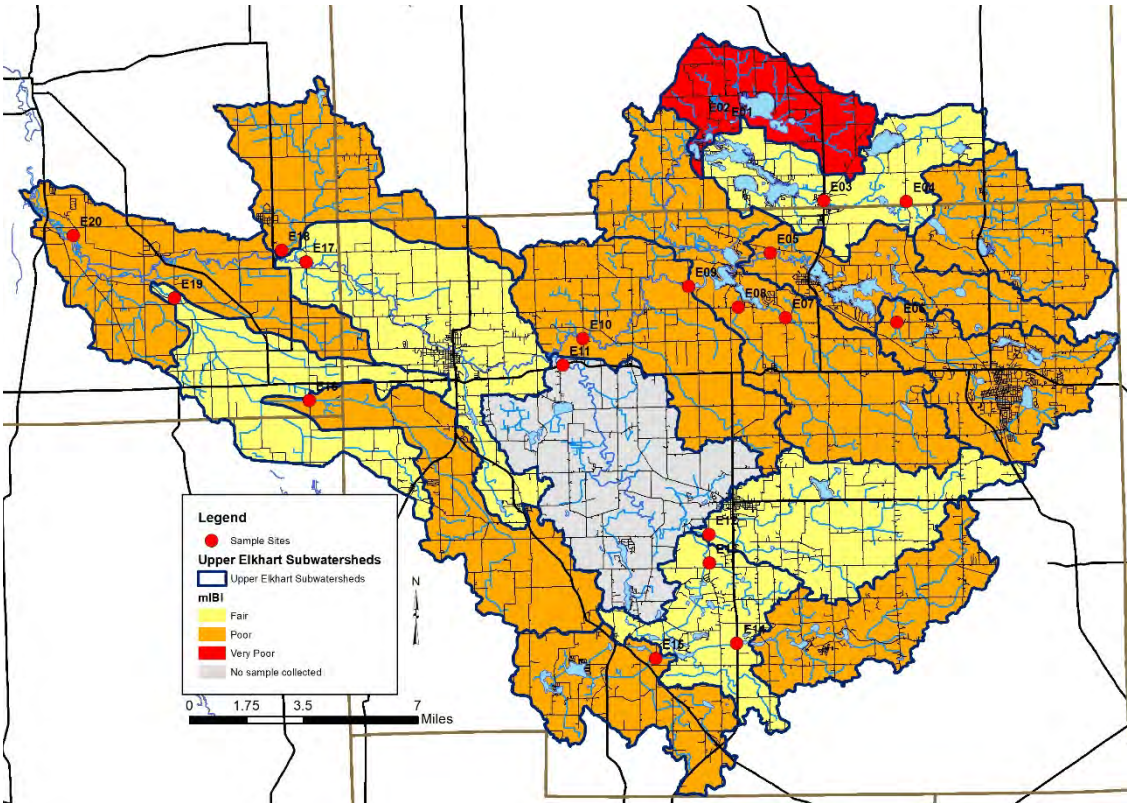


Figure 54. mIBI ratings for Upper Elkhart River Watershed stream sites.

3.4.6 Habitat Quality Assessment

Stream water quality and available habitat influence the quality of a biological community in a stream, and it is necessary to assess both factors when reviewing biological data. Table 22 presents the results of QHEI assessments at each of the 20 stream sites sampled in the Upper Elkhart Watershed during October 2022. Figure 55 details metric and total scores for all sites. Only the Elkhart River (Site 17) rated as excellent, while North Branch Elkhart River downstream of Five Lakes (Site 3), South Branch Elkhart River (Site 13), Stony Creek (Site 18), Solomon Creek (Site 19) and Elkhart River (Site 20) rated as good. For these sites, pool/riffle development scores, stream substrate, instream cover, and gradient were relatively good for Indiana streams contributing to overall high quality QHEI scores. Clock Creek (Site 7), Dry Run (Site 8) and North Branch Elkhart River (Site 10) rated as fair. Little Elkhart Creek (Site 4), North Branch Elkhart River downstream of Sylvan Lake (Site 5), Henderson Lake Ditch (Site 6), Croft Ditch (Site 12) and Solomon Creek (Site 16) rated poor while Hackenburg Lake inlet (Site 2), Rivir Lake tributary (Site 14) and Carrol Creek (Site 15) rated very poor. The lowest scores occurred at sites which possessed poor substrate, poor instream cover, limited riparian quality and lacked pool/riffle complexes. Habitat data are detailed in Appendix B.

Table 22. Qualitative Habitat Evaluation Index (QHEI) scores measured in the Upper Elkhart River Watershed.

Site	Substrate	Cover	Channel	Riparian	Pool Quality	Riffle/Run Quality	Gradient	Total Score	Rating
1	Habitat not assessed.								
2	0	3	4	3	3	0	2	15	Very poor
3	14	12	14	4	7	3	4	58	Good
4	4.5	8	13	3.5	8	0	2	39	Poor
5	4	15	10	3	9	0	2	43	Poor
6	5	7	4	4	6	1	4	31	Poor
7	5.5	14	12	5.5	9	2	2	50	Fair
8	12	11	9	4	7	2	4	49	Fair
9	Habitat not assessed.								
10	10	9	16	6	7	2	2	52	Fair
11	Habitat not assessed.								
12	5.5	7	6	4	6	0	4	32.5	Poor
13	14	20	13	4	9	5	4	69	Good
14	0.5	8	5	3.5	3	0	2	22	Very poor
15	0.5	7	4	3.5	6	0	6	27	Very poor
16	1	8	5	3	8	0	6	31	Poor
17	13	17	15	9	8	5	6	73	Excellent
18	15	14	15	6	9	4	2	65	Good
19	15	13	16	6	5	4	4	63	Good
20	6	17	13	8.5	9	0	4	57.5	Good

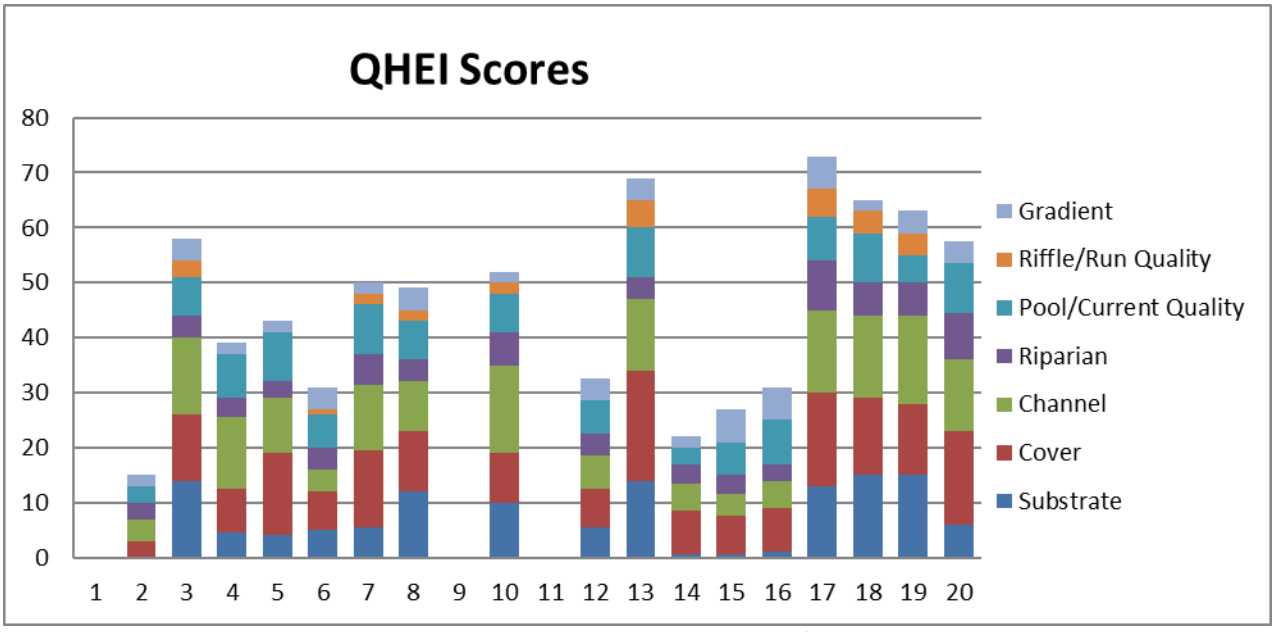


Figure 55. Cumulative metrics used to calculate QHEI scores for Upper Elkhart River Watershed streams in 2022.

As shown in Figure 56, Site 2 (Hackenburg Lake inlet), Site 14 (Rivir Lake Tributary), Site 15 (Carrol Creek) rated as very poor. Site 4 (Little Elkhart River), Site 5 (North Branch d/s Sylvan Lake), Site 6 (Henderson Lake Ditch), Site 12 (Croft Ditch), Site 16 (Solomon Creek) rated as poor. Site 7 (Clock Creek), Site 8 (Dry Run), Site 10 (North Branch Elkhart River) rated as fair. Site 3 (North Branch Elkhart River d/s Five Lake), Site 13 (South Branch Elkhart River), Site 18 (Stony Creek Outlet), Site 19 (Solomon Creek Outlet), Site 20 (Elkhart River) rated as good. Site 17 (Elkhart River) rated as excellent.

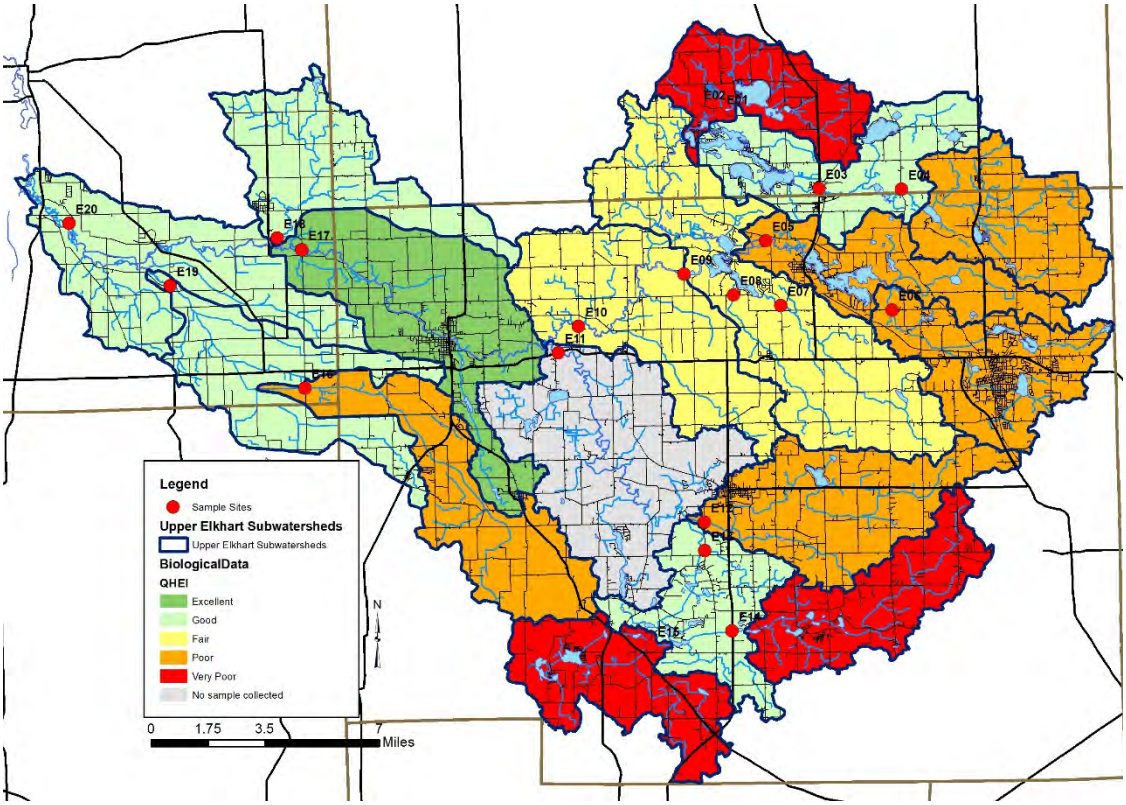


Figure 56. QHEI ratings for Upper Elkhart River Watershed stream sites.

3.5 Watershed Inventory Assessment

3.5.1 Watershed Inventory Methodologies

Volunteers completed windshield surveys throughout the Upper Elkhart River Watershed in spring 2021. Volunteers conducted surveys by driving all accessible roads throughout the watershed. Large maps with aerial photographs, road and stream names, and public property labels were provided to each volunteer group. Volunteers recorded observations on the provided maps and data sheets, documented field conditions with photographs, and provided all notes to the Project Coordinator for review. The windshield surveys were also used to confirm GIS map layer data throughout the watershed. Items targeted during the surveys included, but were not limited to the following:

- Aerial land use category
- Field or gully erosion
- Pasture locations and condition
- Livestock access and impact to streams
- Buffer condition and width
- Bank erosion or head-cutting

- Logjams located within the stream
- Dumping areas or areas where trash or debris accumulate
- Small, unregulated farms
- Environmental site confirmation (NPDES, CFO, open dump, Superfund, etc.)

3.5.2 Watershed Inventory Results

All accessible road-stream crossings were inventoried. A majority of issues identified fall into five categories: stream buffers limited in width or lacking altogether, areas of livestock access, streambank erosion, dumping areas, and unregulated farms. Figure 57 details locations throughout the Upper Elkhart River Watershed where problems were identified. Much of the watershed is not visible from the road and additional assessments will be on-going; therefore, those identified in Figure 57 should not be considered exhaustive. Nearly 63.8 miles of streams possessed limited buffers, nearly 20.6 miles of streambank were eroded, and livestock had access to nearly 3.5 miles of streams. Note that these data are preliminary and additional inventory efforts will augment this map as the project moves forward.

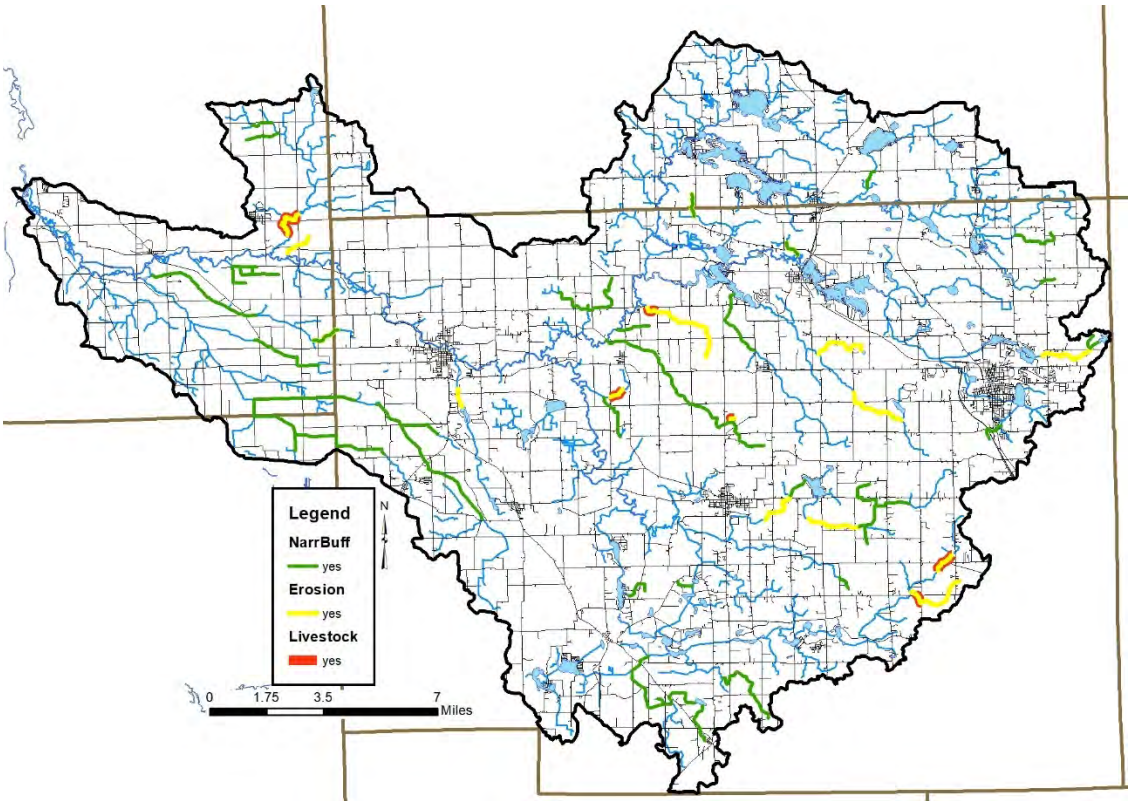


Figure 57. Stream-related watershed concerns identified during watershed inventory efforts.

4.0 WATERSHED INVENTORY II-B: SUBWATERSHED DISCUSSIONS

To gather more specific, localized data, the Upper Elkhart River Watershed was divided into seventeen (17) subwatersheds with each subwatershed reflecting one 12-digit Hydrologic Unit Code (HUC; Figure 58). These subwatersheds reflect specific tributary drainages and similar land uses and hydrology. Land uses, point and non-point watershed concern areas, and historic water quality sampling locations and results are discussed in detail below for each subwatershed. Subwatershed data are detailed in Appendix D.

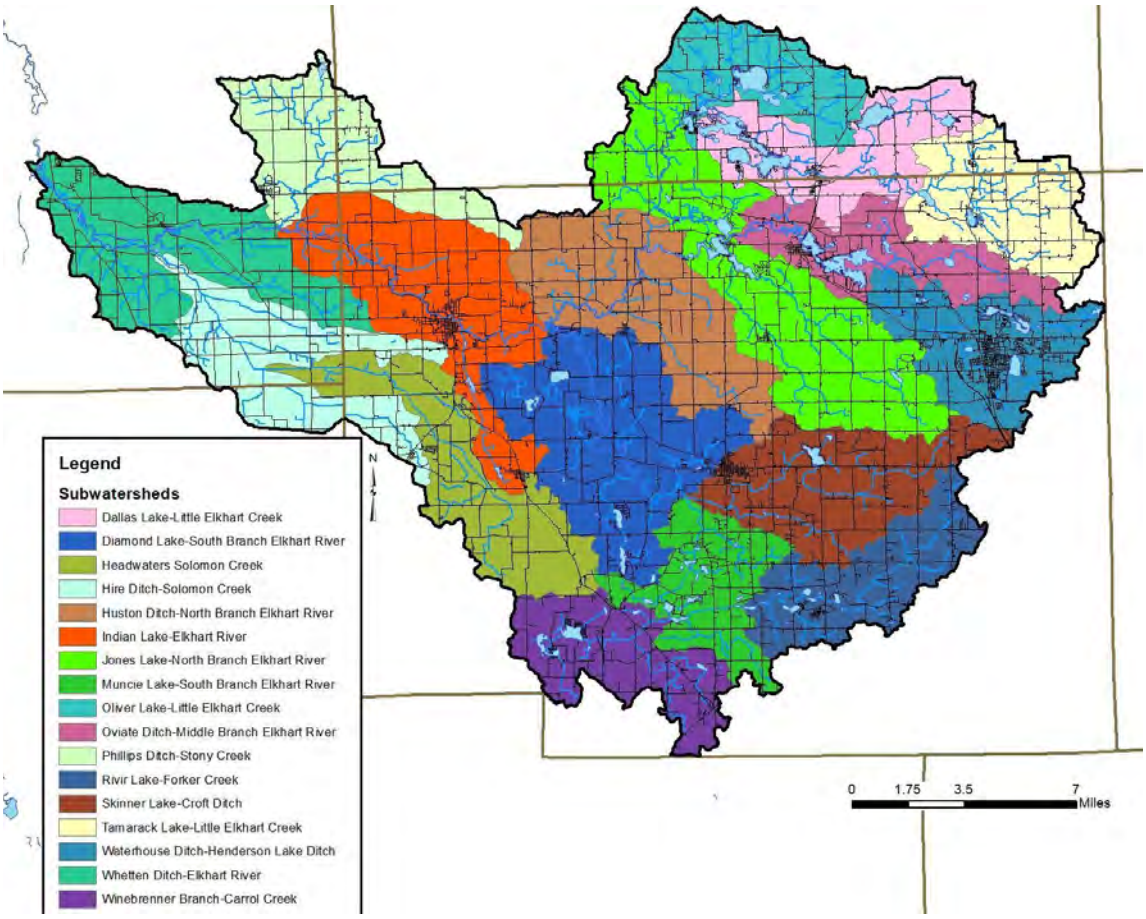


Figure 58. 12-digit Hydrologic Unit Codes subwatersheds in the Upper Elkhart River Watershed.

4.1 Tamarack Lake-Little Elkhart Creek subwatershed

The Tamarack Lake-Little Elkhart Creek Subwatershed forms a portion of the northeast boundary of the Upper Elkhart River Watershed and lies within Lagrange and Noble counties (Figure 59). It encompasses one 12-digit HUC watershed: 040500011501. This subwatershed drains 12,395 acres or 19.4 square miles. The Tamarack Lake-Little Elkhart Creek subwatershed accounts for 5% of the total watershed area. There are 28.5 miles of stream. There are no recorded impairments for the Tamarack Lake-Little Elkhart Creek subwatershed.

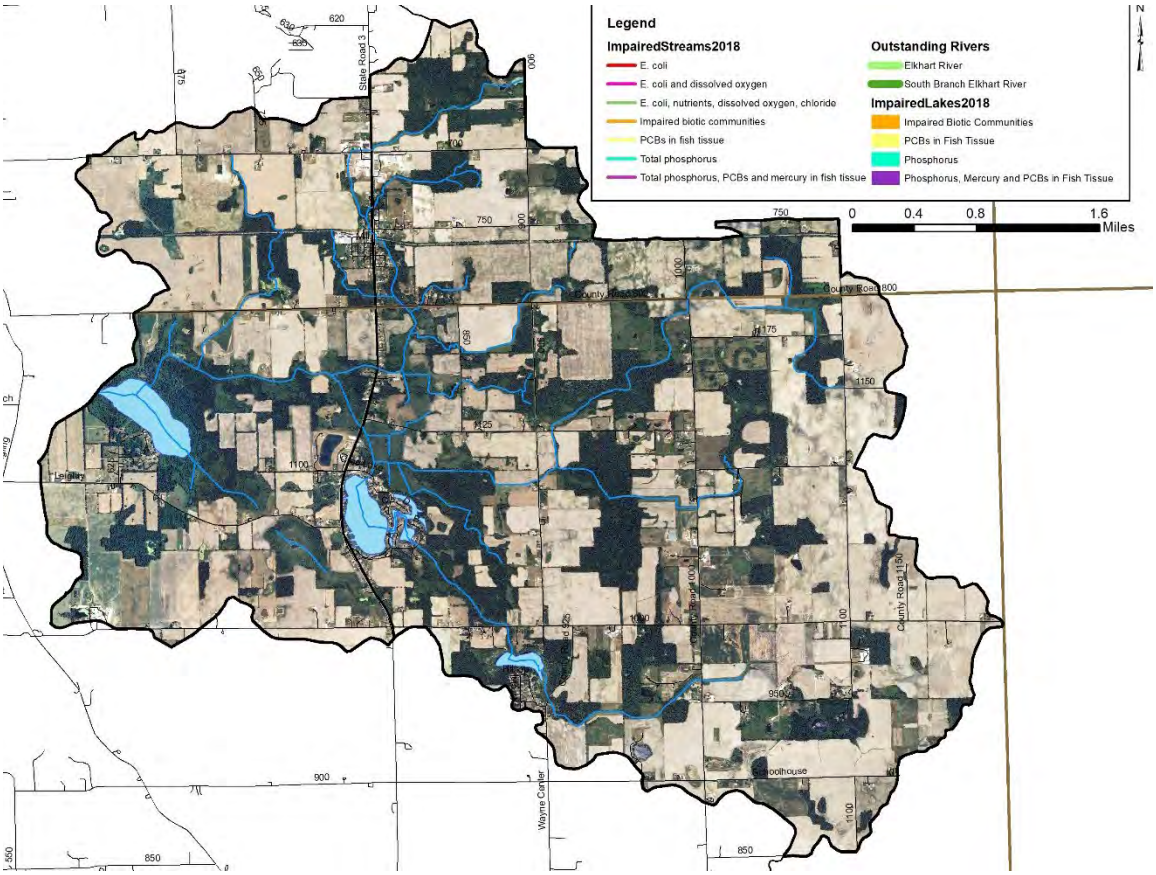


Figure 59. Tamarack Lake-Little Elkhart Creek subwatershed.

4.1.1 Soils

Hydric soils cover 3,675.8 acres or 30% of the subwatershed; wetlands currently cover 26% (3,272.3 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils are prevalent throughout the subwatershed covering 7,107.0 acres or 57% of the subwatershed. Nearly all of the subwatershed, 90% (11,189.2 acres), has soils which are very limited for septic use. The majority of the Tamarack Lake-Little Elkhart Creek subwatershed is rural, indicating many homes utilize on-site septic systems. Based on the soil septic suitability, maintenance and inspection of septic systems is important to ensure proper function and capacity.

4.1.2 Land Use

Agricultural land use dominates the Tamarack Lake-Little Elkhart Creek subwatershed with 63% (7,813.5 acres) mapped as row crop and pastureland. Wetlands, open water and grassland cover 3,272.3 acres, or 26% of the subwatershed. Urban land use is the next largest use of the subwatershed, but only accounts for 6% (720.1 acres) of use. Forest land makes up just 0.2% (26.6 acres) of the subwatershed.

4.1.3 Point Source Water Quality Issues

There are three leaking underground storage tanks. There are no open dumps, brownfields, corrective action sites, NPDES-permitted facilities, or industrial waste facilities located within the Tamarack Lake-Little Elkhart Creek subwatershed (Figure 60).

4.1.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Tamarack Lake-Little Elkhart Creek subwatershed. As a result, various small animal operations and pastures are also present (Figure 60). Seven unregulated animal operations housing more than 31 cows, horses and sheep which were identified during the windshield survey. Livestock do not have access to streams in the Tamarack Lake-Little Elkhart Creek subwatershed streams based on observations during the windshield survey. Manure from small animal operations total over 431 tons per year, which contains almost 449 pounds of nitrogen, 217 pounds of phosphorus and 9.91E+13 col of E. coli. A lack of buffers is also a concern in the subwatershed. Approximately 2.2 miles (8%) of narrow buffer were identified within the subwatershed (Figure 60).

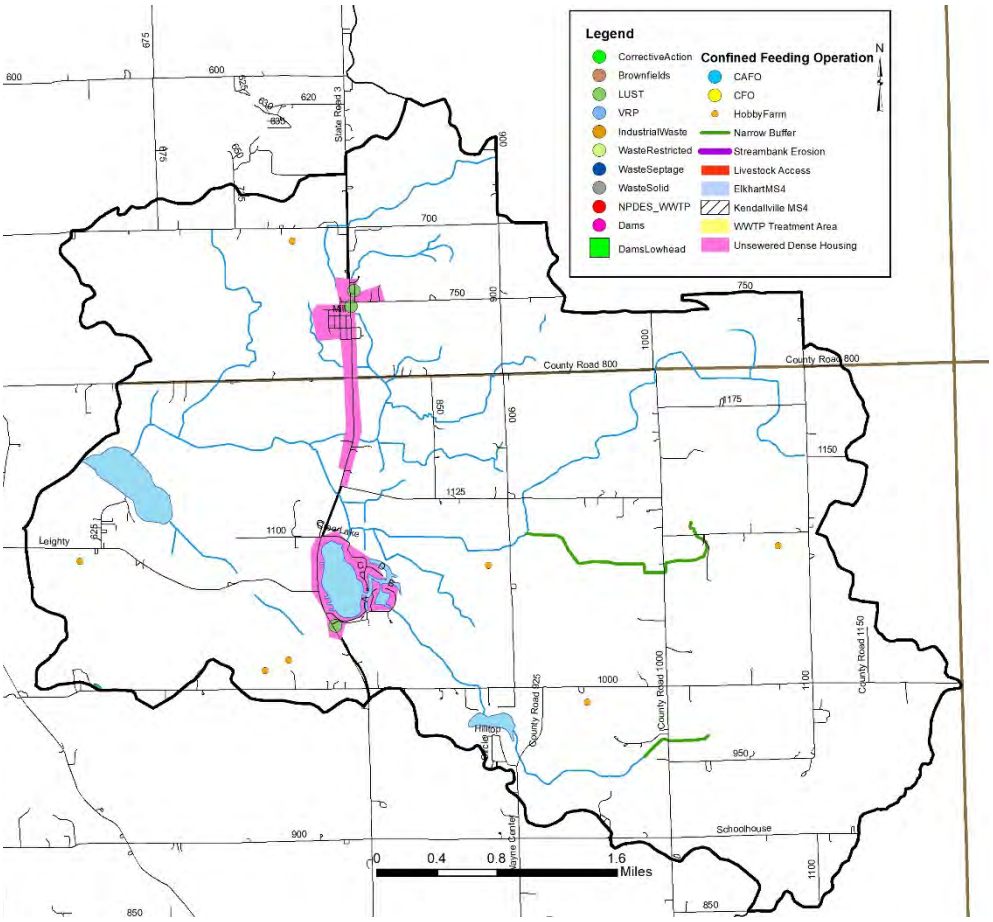


Figure 60. Potential point and non-point sources of pollution and suggested solutions in the Tamarack Lake-Little Elkhart Creek subwatershed.

4.1.5 Water Quality Assessment

Waterbodies within the Tamarack Lake-Little Elkhart Creek subwatershed have been sampled at four locations (Figure 61). Assessments include collection of water chemistry data by IDEM (2 sites) and by IS&T as part of the Cree and Shockopee Lakes Feasibility Study (2 sites). One site in the Tamarack Lake-Little Elkhart Creek subwatershed is being sampled as part of the current project (shown as Upper Sample Sites). No stream gages are in the Tamarack Lake-Little Elkhart Creek subwatershed.

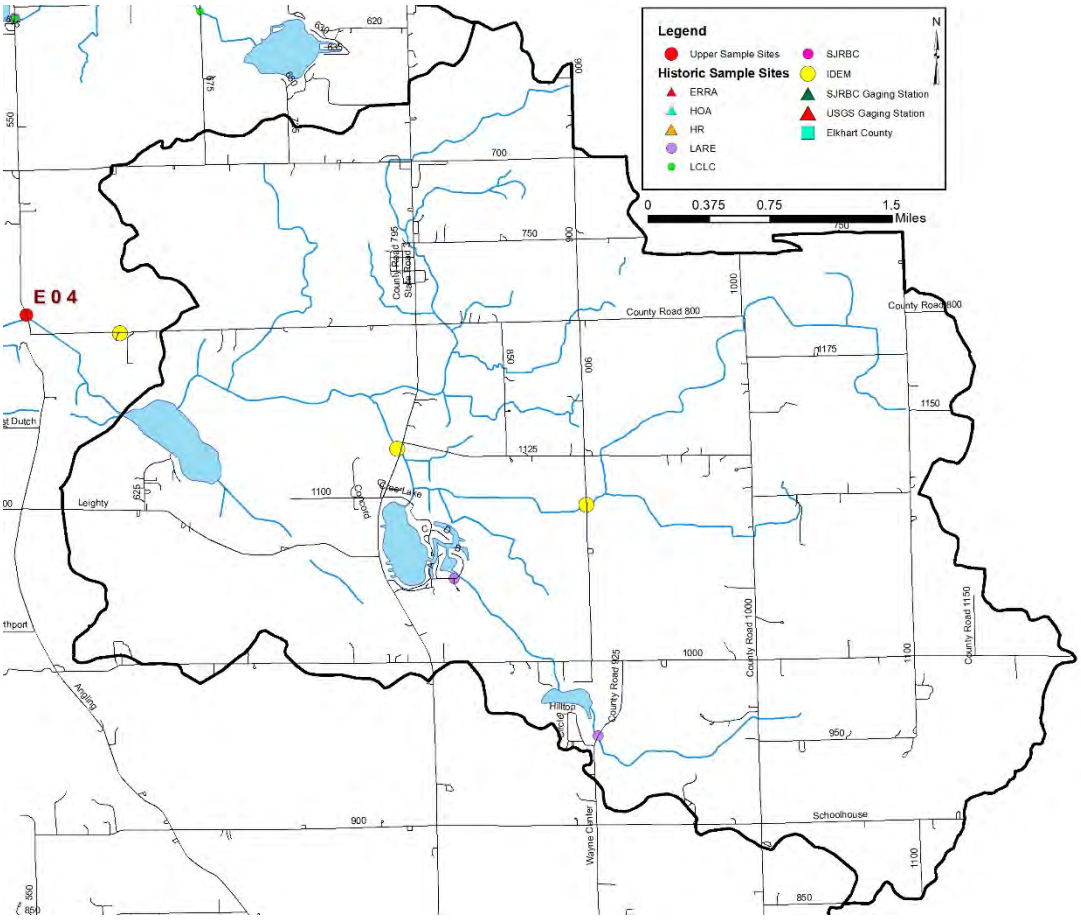


Figure 61. Locations of historic and current water quality data collection in the Tamarack Lake-Little Elkhart Creek subwatershed.

Table 23 details water chemistry data collected in the Tamarack Lake-Little Elkhart Creek subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm) in any samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 80% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 100% collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 80% of samples. Total suspended solids exceed water quality targets (15 mg/L) in 25% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 100% of samples.

Table 23. Tamarack Lake-Little Elkhart Creek subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	564	715	0	3	0%
Dissolved Oxygen	6.5	11	0	7	0%
Ammonia-Nitrogen	0.01	0.23	1	4	25%
Nitrate-Nitrogen	0.41	8	4	5	80%
pH	7.55	8.32	0	7	0%
Total Kjeldahl Nitrogen	1.6	8.02	5	5	100%
Total Phosphorus	0.07	1.05	4	5	80%
Total Suspended Solids	0.11	120	2	5	20%
Turbidity	13	21	2	2	100%

Table 24 details water quality data collected in the Tamarack Lake-Little Elkhart Subwatershed at Little Elkhart Creek stream (Site 4). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 25% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 92% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 17% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 25% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 17% of samples. Dissolved oxygen concentrations exceed water quality standards in 8% of samples collected from this site.

Table 24. Tamarack Lake-Little Elkhart Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
4	Min	6.11	3.57	7.66	358.60	0.40	0.30	0.05	1.20	6.00
	Median	12.23	8.49	8.43	474.95	2.30	2.43	0.05	10.80	130.00
	Max	23.95	11.31	8.75	734.40	7.40	4.56	0.21	20.00	517.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		1	0	0	2	11	2	3	3
	% Exceed	0%	8%	0%	0%	17%	92%	17%	25%	25%

The only biological assessment in the Tamarack Lake-Little Elkhart Creek subwatershed occurred as part of the current project. Little Elkhart Creek's macroinvertebrate community rated as impaired, and the habitat rated as poor.

4.2 Dallas Lake-Little Elkhart Creek subwatershed

The Dallas Lake-Little Elkhart Creek subwatershed is one of the northernmost subwatershed of the Upper Elkhart River Watershed forming part of the northeastern border of the watershed. The Dallas Lake-Little Elkhart Creek subwatershed lies in LaGrange and Noble counties (Figure 62). It encompasses one 12-digit HUC watershed: 040500011502. This subwatershed drains 13,311 acres or 20.8 square miles and accounts for 5% of the total watershed area. There are 30.5 miles of stream. IDEM has classified 3.81 miles of stream as impaired for impaired biotic communities. IDEM classified Dallas and Witmer Lakes as impaired for biological communities.

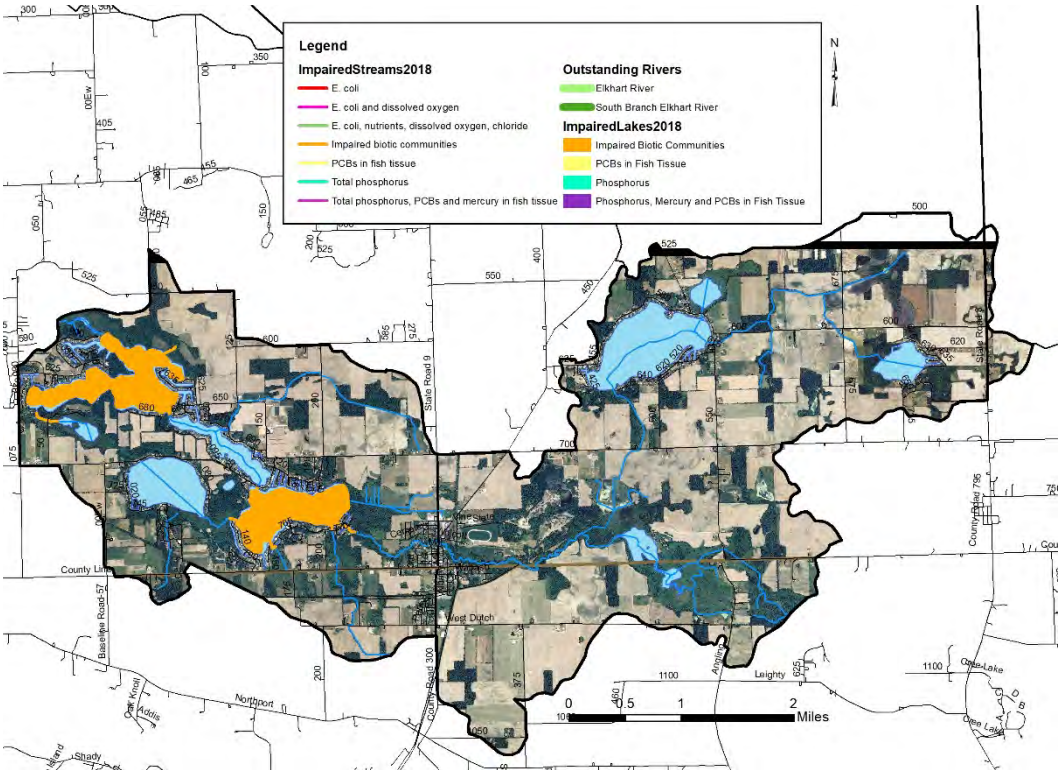


Figure 62. Dallas Lake-Little Elkhart Creek subwatershed.

4.2.1 Soils

Hydric soils cover 2,953.1 acres or 22% of the subwatershed; wetlands cover 35% (4,621.9 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils are prevalent throughout the subwatershed covering 6,899.2 acres or 52% of the subwatershed. Nearly two-thirds of the subwatershed, 67% (8,855.2 acres), has soils which are very limited for septic use. The majority of the Dallas Lake-Little Elkhart Creek Subwatershed is rural, indicating many homes utilize on-site septic systems. Based on the soil septic suitability, maintenance and inspection of septic systems is important to ensure proper function and capacity.

4.2.2 Land Use

Agricultural land use dominates the Dallas Lake-Little Elkhart Creek subwatershed with 55% (13,315.1 acres) mapped with row crop and pastureland. Wetlands, open water and grassland cover 4,621.9 acres, or 35% of the subwatershed. Urban land use is the next largest use of the subwatershed, but only accounts for 8% (1,090.5 acres) of use. Forest land makes up just 2% (290.7 acres) of the subwatershed.

4.2.3 Point Source Water Quality Issues

There are seven underground storage tanks, two of which are listed as leading underground storage tanks, located in the subwatershed and there is one NPDES-permitted facility (Wolcottville WWTP). The Lagrange County Regional Sewer District also handles effluent from businesses and residences around several subwatershed lakes. The Wolcottville WWTP has had incidences of overflow in the last year including overflows into a wetland and a private home basement. The Wolcottville WWTP is working on facility structure improvements to rectify the issue and prevent future overflows. There are no open dumps, brownfields, corrective action sites or industrial waste facilities located within the Dallas Lake-Little Elkhart Creek subwatershed (Figure 63).

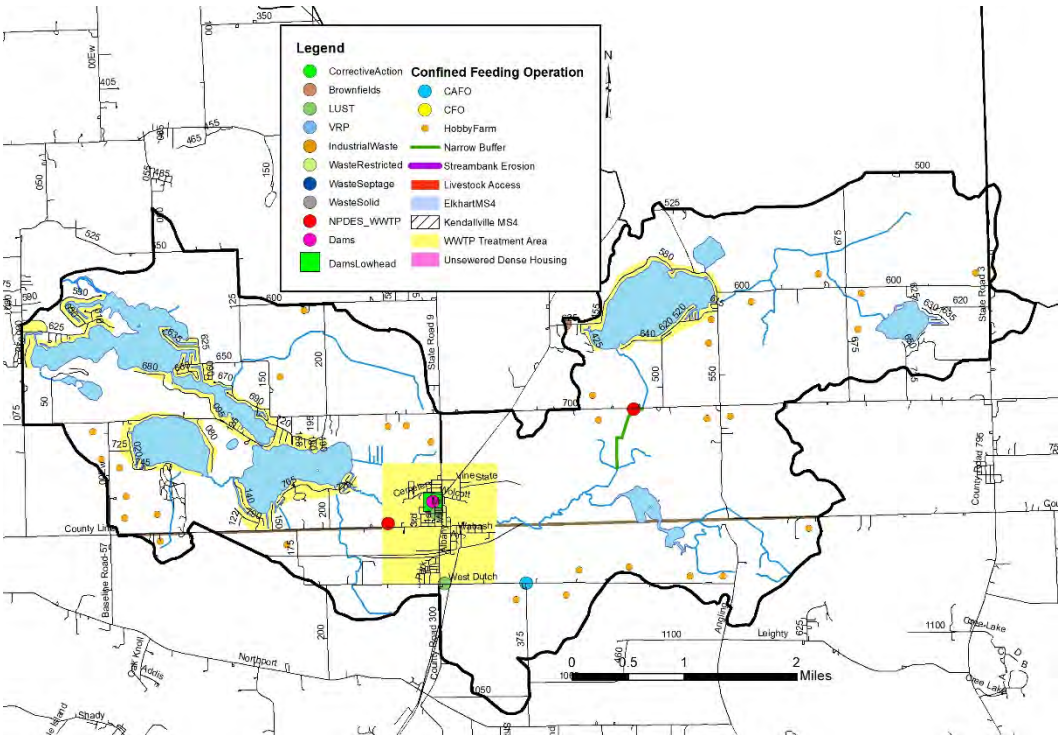


Figure 63. Potential point and non-point sources of pollution and suggested solutions in the Dallas Lake-Little Elkhart Creek subwatershed.

4.2.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Dallas Lake-Little Elkhart Creek subwatershed. As a result, various small animal operations, CAFOs, and pastures are also present (Figure 63). There are 31 unregulated animal operations housing more than 475 cows, horses, bison and goats which were identified during the windshield survey. One CAFO housing 1,000 cows is located in the subwatershed. Livestock do not have access to streams in the Dallas Lake-Little Elkhart Creek subwatershed streams based on observations during the windshield survey. Manure from small animal operations and the CAFO total over 30,179 tons per year, which contains almost 15,804 pounds of nitrogen, 7,876 pounds of phosphorus and 8.88E+14 col of E. coli. A lack of buffers is also a concern in the subwatershed. Approximately 0.7 miles (2%) of narrow buffers were identified within the subwatershed (Figure 63).

4.2.5 Water Quality Assessment

Waterbodies within the Dallas Lake-Little Elkhart Creek subwatershed have been sampled at 22 locations (Figure 64). Assessments include collection of water chemistry and by IDEM (4), by FX Browne (11 sites), by Tri State University (3 sites) and as part of the Five Lakes Feasibility Study (JFNew, 4 sites). One site in the Dallas Lake-Little Elkhart Creek subwatershed is being sampled as part of the current project (noted as Upper sample sites). No USGS stream gages are in the Dallas Lake-Little Elkhart Creek subwatershed.

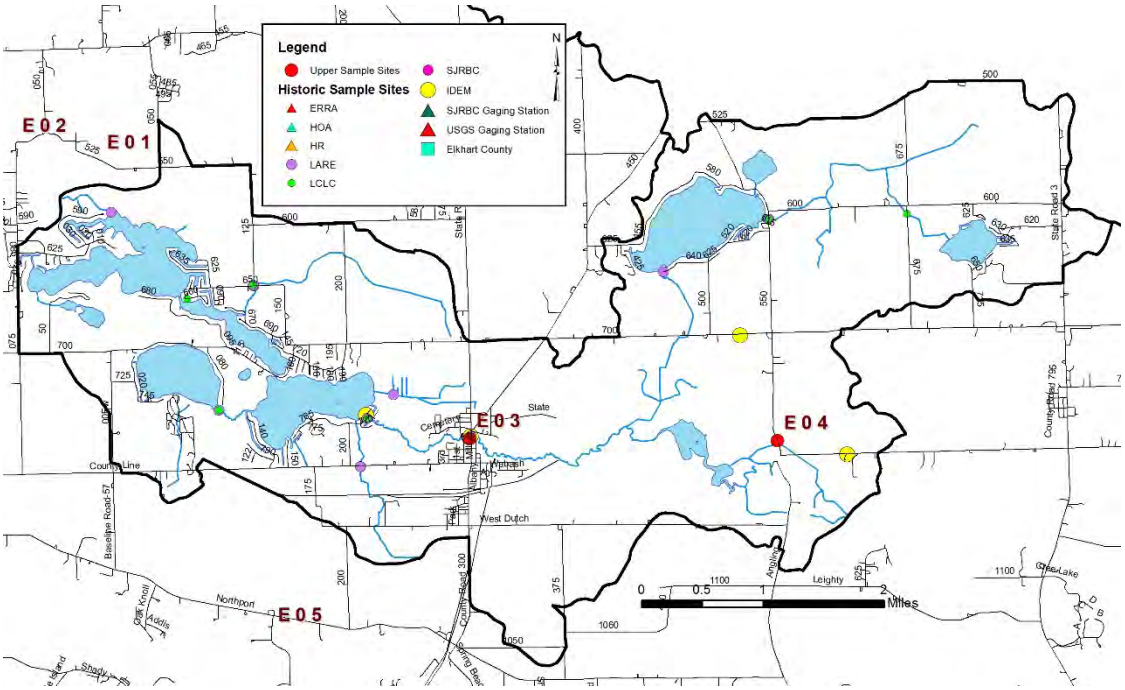


Figure 64. Locations of historic water quality data collection and impairments in the Dallas Lake-Little Elkhart Creek subwatershed.

Table 25 details historic water quality data. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm). E. coli samples exceed state grab sample standards (235 col/100 ml) in 100% of samples collected. Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 7% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 13% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 54% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 67% of samples. Total suspended solids exceed water quality targets (15 mg/L) in 19% of samples.

Table 25. Dallas Lake-Little Elkhart Creek subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	251	679	0	11	0%
Dissolved Oxygen	3.1	10.3	1	15	7%
E. coli	1,060	1,840	2	2	100%
Ammonia-Nitrogen	0.12	0.18	0	11	0%
Nitrate-Nitrogen	0.03	1.7	2	15	13%
Dissolved Phosphorus	0.02	1.14	9	17	53%
pH	7.3	8.3	0	26	0%
Total Kjeldahl Nitrogen	0.17	1.3	7	13	54%
Total Phosphorus	0.01	0.59	14	21	67%
Total Suspended Solids	0.2	29	3	16	19%

Table 26 details water quality data collected in the Dallas Lake-Little Elkhart Creek Subwatershed at North Branch Elkhart River downstream of Five Lakes stream (Site 3). As shown in the table, *E. coli*

samples exceed state standards (235 col/100 ml) in 33% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 92% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 25% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 0% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 25% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 26. Dallas Lake-Little Elkhart Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
3	Min	3.90	6.48	7.66	317.10	0.20	0.70	0.05	0.40	3.00
	Median	12.01	8.66	8.44	468.45	1.60	3.06	0.05	8.60	88.20
	Max	23.68	11.52	8.71	734.90	7.60	4.72	0.15	14.00	727.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	3	11	3	0	4
	% Exceed	0%	0%	0%	0%	25%	92%	25%	0%	33%

The only biological data collected in the Dallas Lake-Little Elkhart Creek subwatershed occurred as part of the current project. The North Branch Elkhart River's macroinvertebrate community rated as not impaired, and the habitat rated as good.

4.3 Oliver Lake-Little Elkhart Creek subwatershed

The Oliver Lake-Little Elkhart Creek subwatershed is the northernmost subwatershed of the Upper Elkhart River Watershed and lies fully within LaGrange County (Figure 65). It encompasses one 12-digit HUC watershed: 040500011503. This subwatershed drains 10,126 acres (15.8 square miles) and accounts for 4% of the total watershed area. There are 31 miles of stream. IDEM has classified 3.79 miles of stream as impaired for PCBs in fish tissue and 1.33 miles of stream as impaired for impaired biotic communities. IDEM classified Oliver Lake as impaired for PCBs in fish tissue and Hackenburg and Messick Lakes as impaired for biological communities.

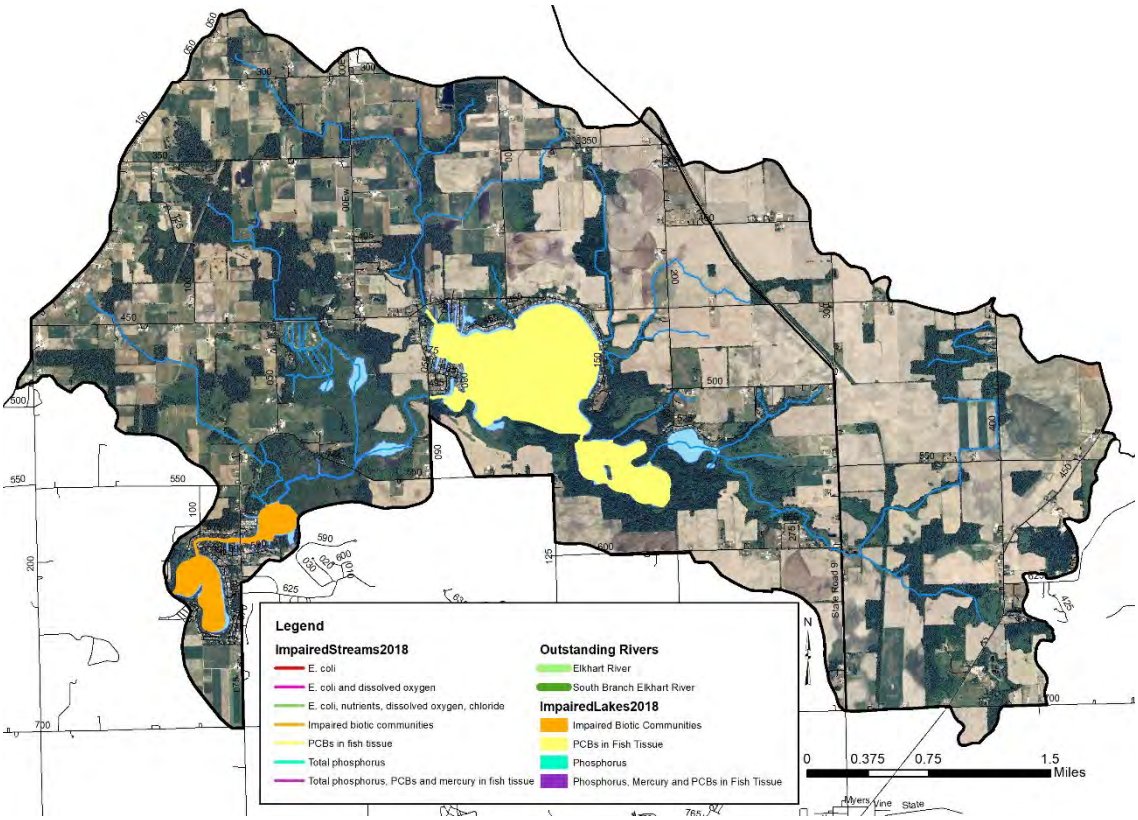


Figure 65. Oliver Lake-Little Elkhart Creek subwatershed.

4.3.1 Soils

Hydric soils cover 2,922.6 acres or 29% of the subwatershed; wetlands currently cover 31% (3,106.0 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils are prevalent throughout the subwatershed covering 5,268.7 acres or 52% of the subwatershed. A majority of the subwatershed, 84% (8,452.2 acres), has soils which are very limited for septic use. The majority of the Oliver Lake-Little Elkhart Creek Subwatershed is rural, indicating many homes utilize on-site septic systems. Based on the soil septic suitability, maintenance and inspection of septic systems is important to ensure proper function and capacity.

4.3.2 Land Use

Agricultural land use dominates the Oliver Lake-Little Elkhart Creek subwatershed with 61% (6,156.3 acres) mapped with row crop and pastureland. Wetlands, open water and grassland cover 3,106 acres, or 31% of the subwatershed. Urban land use is the next largest use of the subwatershed but only accounts for 6% (619.1 acres) of use. Forest land makes up just 3% (248.3 acres) of the subwatershed.

4.3.3 Point Source Water Quality Issues

There are few point sources of water pollution in the subwatershed (Figure 66). There are three underground storage tanks, two of which are designated as leaking underground storage tanks (LUST). There are no open dumps, brownfields, corrective action sites, voluntary remediation sites, NPDES-permitted facilities, or industrial waste facilities located within the Oliver Lake-Little Elkhart Creek subwatershed (Figure 66). It should be noted that the Lagrange County Regional Sewer District provides wastewater services for several lakes in the subwatershed.

4.3.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Oliver Lake-Little Elkhart Creek subwatershed. As a result, various small animal operations and pastures are also present (Figure 66). There are 77 unregulated animal operations housing more than 1,147 cows, horses and sheep which were identified during the windshield survey. Livestock do not have access to streams in the Oliver Lake-Little Elkhart Creek subwatershed based on observations during the windshield survey. Manure from small animal operations total over 21,692 tons per year, which contains almost 13,795 pounds of nitrogen, 6,833 pounds of phosphorus and 1.50E+15 col of E. coli. A lack of buffers and streambank erosion are not a concern within the subwatershed based on observations during the windshield survey (Figure 66).

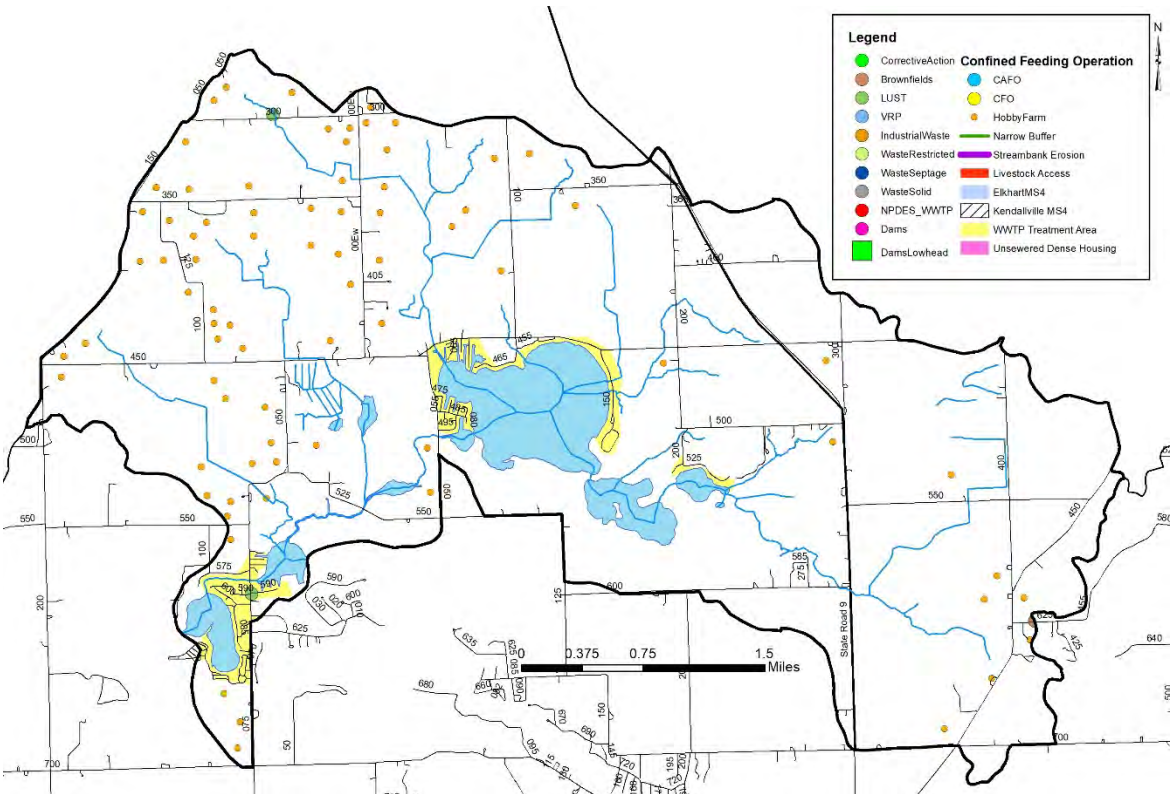


Figure 66. Potential point and non-point sources of pollution and suggested solutions in the Oliver Lake-Little Elkhart Creek subwatershed.

4.3.5 Water Quality Assessment

Waterbodies within the Oliver Lake-Little Elkhart Creek subwatershed have been sampled at 19 locations (Figure 67). Assessments include collection of water chemistry data as part of multiple LARE projects including the Ten Lakes Chain Feasibility Study (FXBrowne, 11 sites), by Tri State University (3 sites), the Five Lakes Feasibility Study (JFNew, 2 sites), the Oliver Lakes Chain Diagnostic Study (JFNew, 4 sites) and through recent HOA-funded, storm-event focused sampling. Two IDEM sampling locations are shown on the map; however, data are not available for these sites. Additionally, biological monitoring occurred at two sites as part of the LARE-funded Oliver Lakes Chain Diagnostic Study. Two sites in the Oliver Lake-Little Elkhart Creek subwatershed is being sampled as part of the current project (shown as Upper Sample sites). No stream gages are located in the Oliver Lake-Little Elkhart Creek subwatershed.

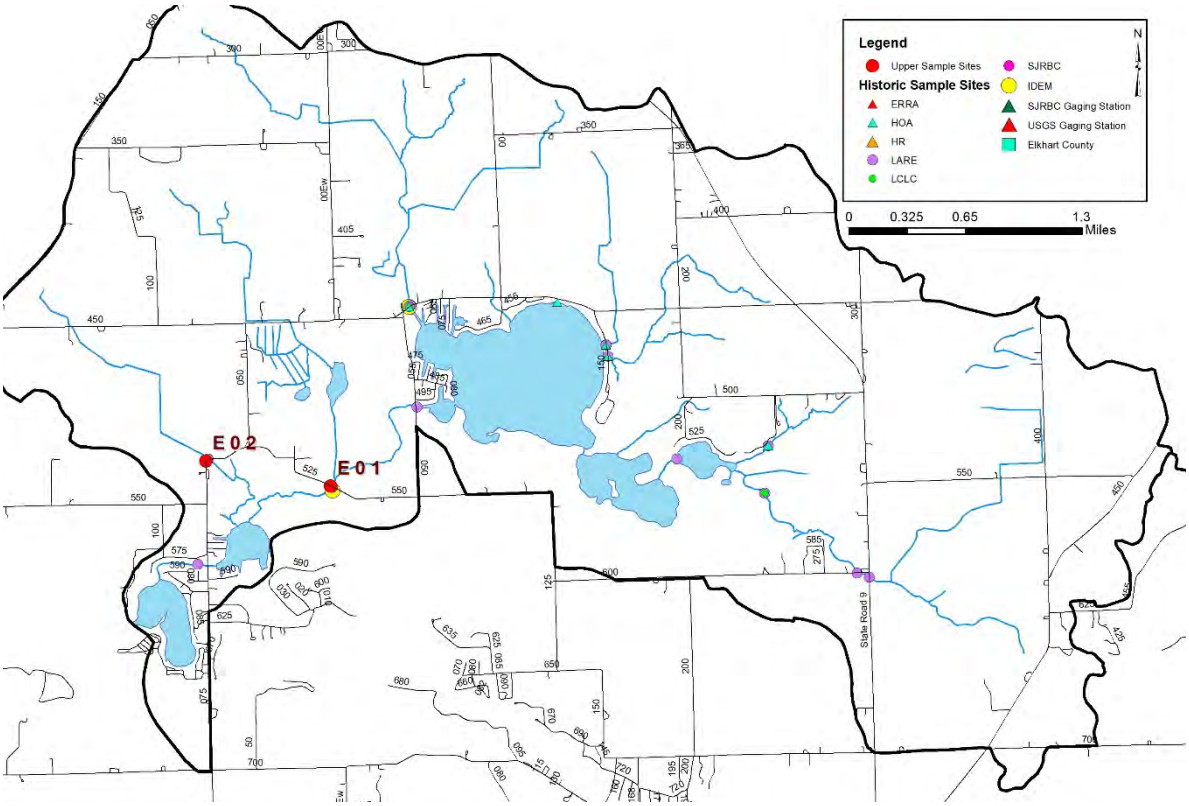


Figure 67. Locations of historic and current water quality data collection in the Oliver Lake-Little Elkhart Creek subwatershed.

Table 27 details historic water chemistry data collected in the Oliver Lake-Little Elkhart Creek subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm). Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 8% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 80% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 48% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 42% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 66% of samples. Total suspended solids exceed water quality targets (15 mg/L) in 17% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 33% of samples.

Table 27. Oliver Lake-Little Elkhart Creek Subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	402	756	0	16	0%
Dissolved Oxygen	2.9	10	1	12	8%
E. coli	64	10,100	8	10	80%
Ammonia-Nitrogen	0.03	0.35	2	16	13%
Nitrate-Nitrogen	0.01	8.81	10	21	48%
Dissolved Phosphorus	0.01	0.32	10	24	42%
pH	7.2	8.3	0	22	0%
Total Kjeldahl Nitrogen	0.05	1.7	8	18	42%
Total Phosphorus	0.01	0.7	19	29	66%
Total Suspended Solids	0	560	4	23	17%
Turbidity	2.5	16	2	6	33%

Table 28 details water quality data collected in the Oliver Lake-Little Elkhart Creek Subwatershed (Site 1 and 2). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 0% of samples collected in Site 1 and 58% in Site 2. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples in Site 1 and Site 2. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 8% of samples in Site 1 and 83% of samples in Site 2. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 17% of samples in Site 1 and 75% of samples in Site 2. Turbidity levels exceed water quality targets (5.7 NTU) in 0% of samples in Site 1 and 33% of samples in Site 2. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from Site 1. Dissolved oxygen concentrations exceed water quality standards in 33% of samples collected from Site 2.

Table 28. Oliver Lake-Little Elkhart Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
1	Min	2.38	4.15	7.41	404.70	0.50	1.22	0.05	0.00	1.00
	Median	12.09	8.28	8.47	451.65	1.30	2.45	0.05	6.80	34.50
	Max	23.83	11.62	8.77	478.00	5.70	4.83	0.31	42.40	127.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	0	12	1	2	0
	% Exceed	0%	0%	0%	0%	0%	100%	8%	17%	0%
2	Min	4.10	0.22	7.46	420.90	1.20	1.80	0.05	3.60	6.00
	Median	11.39	7.63	8.29	642.15	4.50	3.36	0.61	80.80	487.50
	Max	22.01	12.24	8.73	773.00	14.90	6.11	1.61	292.00	2420.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		4	0	0	4	12	10	9	7
	% Exceed	0%	33%	0%	0%	33%	100%	83%	75%	58%

JFNew assessed the biological community at 2 sites for macroinvertebrates and habitat. One site was assessed as part of the current project. Habitat scores ranged from 22 to 66 with 67% of sites scoring below the state target (51). Macroinvertebrate assessments rated moderately to severely impaired using the kick sampling method with 100% of sites not meeting their aquatic life use designation and rated as

impaired using the multihabitat method with 100% of sites not meeting their aquatic life use designation (Table 29).

Table 29. Oliver Lake-Little Elkhart Creek subwatershed historic and current biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	22	66	2	3	67%
Fish (IBI)	--	--	--	--	--
Macroinvertebrates (mIBI, Kick)	2.0	4.4	2	2	100%
Macroinvertebrates (mIBI, Multi Habitat)	22	22	1	1	100%

4.4 Waterhouse Ditch-Henderson Lake Ditch subwatershed

The Waterhouse Ditch-Henderson Lake Ditch subwatershed forms a portion of the eastern boundary of the Upper Elkhart River Watershed and lies fully within Noble County (Figure 68). It encompasses one 12-digit HUC watershed: 040500011504. This subwatershed drains 12,788 acres or 20 square miles, and accounts for 5% of the total watershed area. There are 22.3 miles of stream. IDEM has classified 0.3 miles of stream as impaired for PCBs in fish tissue. IDEM classifies Henderson Lake as impaired for PCBs in fish tissue.

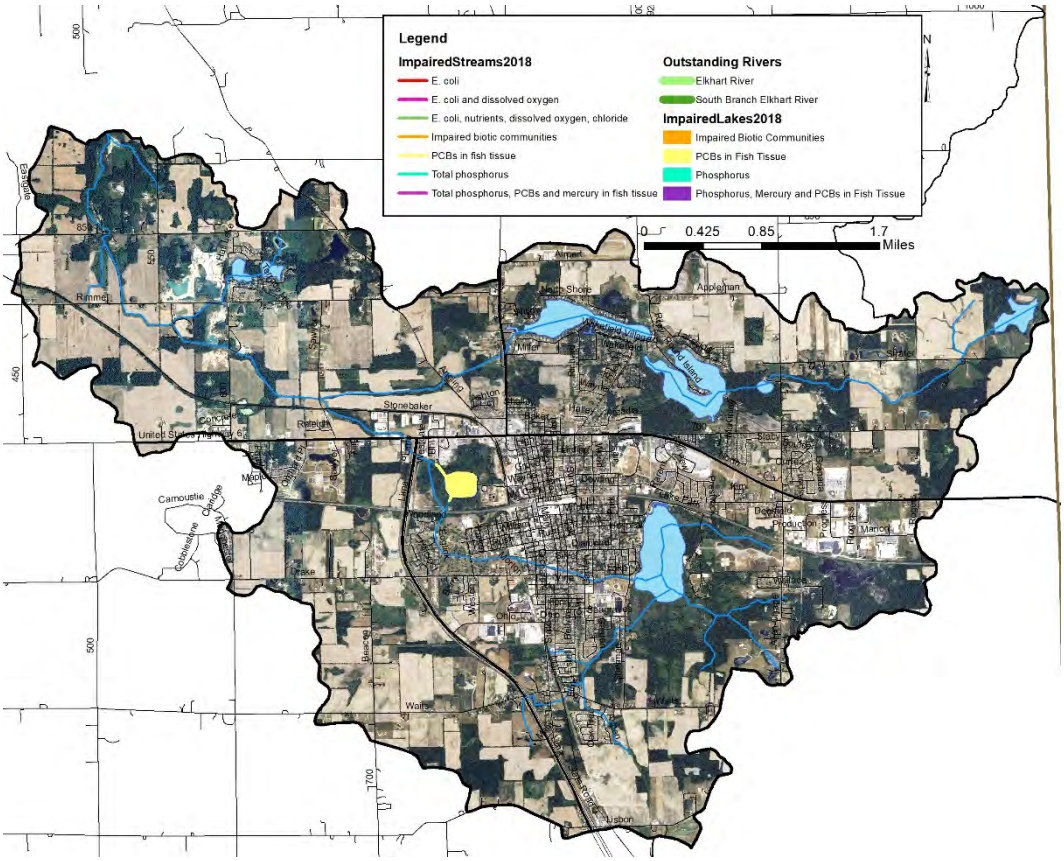


Figure 68. Waterhouse Ditch-Henderson Lake subwatershed.

4.4.1 Soils

Hydric soils cover 3,679.8 acres or 29% of the subwatershed; wetlands currently cover 23% (2,879.8 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils are prevalent throughout the subwatershed covering 7,524.2 acres or 59% of the subwatershed. A majority of the subwatershed, 92% (11,773.5 acres), has soils which are very limited for septic use. The majority of the Waterhouse Ditch-Henderson Lake Ditch subwatershed is also rural, indicating many homes utilize on-site septic systems. Based on the soil septic suitability, maintenance and inspection of septic systems is important to ensure proper function and capacity.

4.4.2 Land Use

Agricultural land use is the predominant land use of the Waterhouse Ditch-Henderson Lake Ditch subwatershed with 45% (5,767.7 acres) mapped as row crop and pastureland. Urban land use is the next largest use of the watershed covering 2,086.8 acres, or 16% of the subwatershed, with the City of Kendallville residing in the subwatershed. Wetlands, open water and grassland are the next largest use of the subwatershed accounting for 31% (3,952.7 acres) of use. Forest land makes up 8% (984.2 acres) of the subwatershed.

4.4.3 Point Source Water Quality Issues

There are 56 leaking underground storage tanks sites and one NPDES-permitted facility (Kendallville Wastewater Treatment Plant). The City of Kendallville is a regulated MS4 community. There are multiple instances in the last year of high flow events, as well as trends of unhealthy biomass dating to November 2021. There was also a spike in effluent TSS and ammonia levels in February of 2022 due to the screw press being inoperable for a period of time. Due to the Screw Press event, the plant biology could not fully convert all available nitrogen, and as a result, higher nitrate levels were present in the subsequent sample. No open dumps, brownfields, industrial waste facilities, solid waste facilities, superfund sites, corrective action sites or voluntary remediation sites are located within the Waterhouse Ditch-Henderson Lake Ditch subwatershed (Figure 69).

4.4.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Waterhouse Ditch-Henderson Lake Ditch subwatershed. Additionally, a number of small animal operations, pastures and one confined feeding operation are also present. In total, seven unregulated animal operations housing more than 87 horses, sheep and goats which were identified during the windshield survey. There is one active confined feeding operation located within the Waterhouse Ditch-Henderson Lake Ditch subwatershed, which is permitted to house 994 pigs. In total, manure from small animal operations and one CFO total over 4,297 tons per year, which contains almost 13,803 pounds of nitrogen, almost 9,965 pounds of phosphorus and 6.36E+14 colonies of E. coli. Based on windshield survey observations, livestock do not appear to have access to the subwatershed streams. Streambank erosion is a concern in the subwatershed. Approximately 1.8 miles (8%) of streambank erosion were identified within the subwatershed. Additionally, 1.6 miles (7%) of subwatershed streams were observed to have narrow buffers (Figure 69).

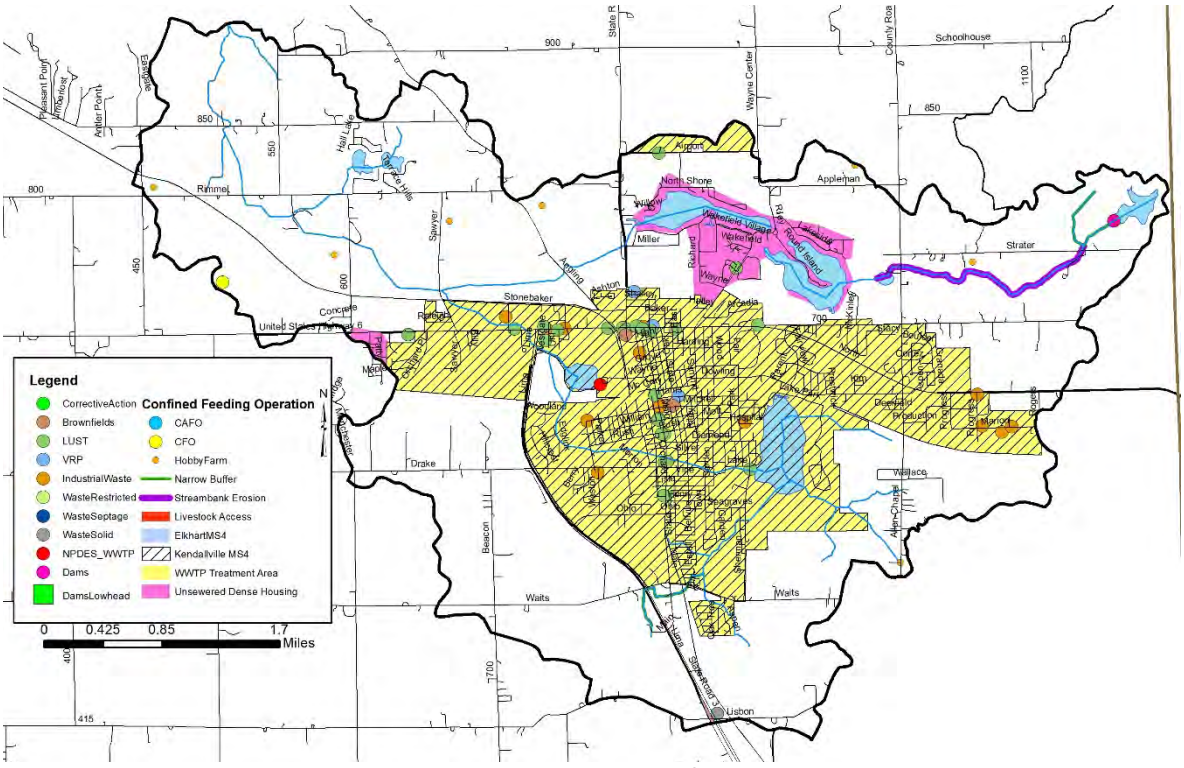


Figure 69. Potential point and non-point sources of pollution and suggested solutions in the Waterhouse Ditch-Henderson Lake Ditch subwatershed.

4.4.5 Water Quality Assessment

Waterbodies within the Waterhouse Ditch-Henderson Lake subwatershed have been sampled at 15 locations (Figure 70). Assessments include collection of water chemistry data by IDEM (7 sites), by the St. Joseph River Basin Commission (3 sites), as part of the LARE-funded Bixler Lake Feasibility Study (4 sites) and through an on-going project of the Sylvan Lake HOA, City of Kendallville and other partners (mapped as HOA). One site in the Waterhouse Ditch-Henderson Lake Ditch subwatershed is being sampled as part of the current project (shown us Upper sample sites). No USGS stream gages are located in the Waterhouse Ditch-Henderson Lake Ditch subwatershed; however, the Sylvan Lake Project is operating one stream gage and the SJRBC are operating one stream gage in the Waterhouse Ditch-Henderson Lake subwatershed.

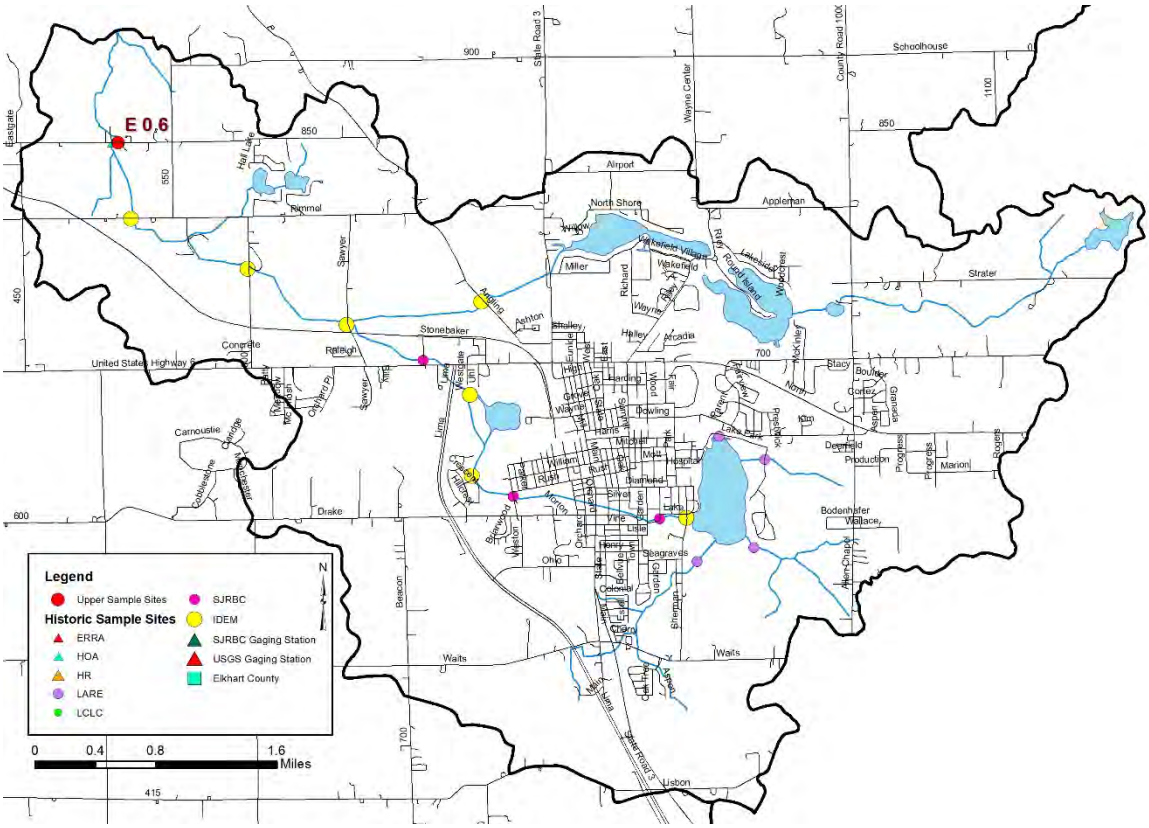


Figure 70. Locations of historic and current water quality data collection in the Waterhouse Ditch-Henderson Lake Ditch subwatershed.

Table 30 details data collected by IDEM, the SJRBC and via the IS&T. As shown in the table, conductivity samples exceed state standards (1050 µmhos/cm) in 14% of collected samples. Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 10% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 6% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 60% of samples. Total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 80% of collected samples. Similarly, total suspended solids exceed water quality targets (15 mg/L) in 25% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 36% of samples.

Table 30. Waterhouse Ditch-Henderson Lake Ditch subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	425	1,356	5	36	14%
Dissolved Oxygen	2.1	17.4	6	59	10%
E. coli	0	500	2	36	6%
Ammonia-Nitrogen	0.02	0.35	1	4	25%
Nitrate-Nitrogen	0	9.7	24	40	60%
Dissolved Phosphorus	0.01	0.12	2	4	50%
pH	6.79	8.78	0	59	0%
Total Kjeldahl Nitrogen	1.1	1.78	4	4	100%
Total Phosphorus	0.04	0.77	32	40	80%
Total Suspended Solids	0.8	70.9	10	40	25%
Turbidity	0	45	13	36	36%

Table 31 details water quality data collected in the Waterhouse Ditch-Henderson Lake Subwatershed at North Branch d/s Sylvan Lake stream (Site 6). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 50% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 92% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 42% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 58% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 33% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 31. Waterhouse Ditch-Henderson Lake Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
6	Min	5.51	5.26	7.67	437.30	0.50	0.90	0.05	5.60	56.00
	Median	12.60	7.63	8.41	784.00	1.50	3.03	0.06	16.20	223.50
	Max	25.71	11.05	8.72	1074.00	33.60	6.10	0.56	103.20	2420.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	1	4	11	5	7	6
	% Exceed	0%	0%	0%	8%	33%	92%	42%	58%	50%

The only biological data collected in the Waterhouse Ditch-Henderson Lake Ditch subwatershed occurred as part of the current project. Henderson Lake Ditch's macroinvertebrate community rated as impaired and the habitat rated as poor.

4.5 Oviate Ditch-Middle Branch Elkhart River subwatershed

The Oviate Ditch-Middle Branch Elkhart River subwatershed lies fully within Noble County (Figure 71). It encompasses one 12-digit HUC watershed: 040500011505. This subwatershed drains 11,052 acres (17.3 square miles) and accounts for 4% of the total watershed area. There are 20.2 miles of stream. IDEM has classified 6.8 miles of stream as impaired for E. coli and DO and 5.14 miles of stream as impaired for PCBs in fish tissue.

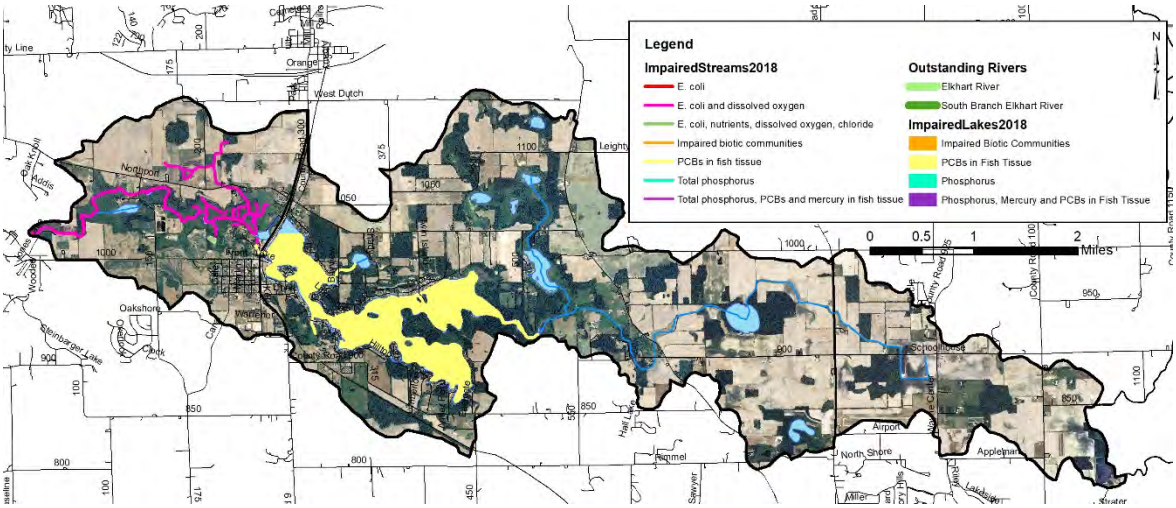


Figure 71. Oviate Ditch-Middle Branch Elkhart River subwatershed.

4.5.1 Soils

Hydric soils cover 2,538.5 acres (23%) of the subwatershed. Wetlands currently cover 32% (3,565.1 acres) of the subwatershed. Highly erodible soils cover just over half of the subwatershed at 54% (5,910.3 acres). A majority of the subwatershed soils (9,542 acres or 86%) are identified as very limited for septic use. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity.

4.5.2 Land Use

Agricultural land use covers over half of the Oviate Ditch-Middle Branch Elkhart River subwatershed with 55% (6,113.8 acres) of the subwatershed mapped in row crop and pastureland. In total, 494.9 acres or 5% of the subwatershed are in forested land uses. An additional 33% of the watershed (3,565.1 acres) is in wetlands, open water and grassland. Urban land uses cover 881.6 acres, or 8%, of the subwatershed.

4.5.3 Point Source Water Quality Issues

There are eight underground storage tanks, one of which is listed as a LUST site, and one NPDES-permitted facility (Rome City WWTP). In January of 2021, it was noted that the Adams Lake RSD's self-monitoring program was rated as unsatisfactory. At the time of the inspection, IDEM determined that a sample log was not being maintained. The Adams Lake RSD began to rectify the monitoring issue the following week and have not been cited since. There are no open dumps, brownfields, corrective action sites, voluntary remediation sites, industrial waste facilities or industrial waste facilities located within the Oviate Ditch-Middle Branch Elkhart River subwatershed (Figure 72).

4.5.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Oviate Ditch-Middle Branch Elkhart River subwatershed. There is one active concentrated animal feeding operation located within the Waterhouse Ditch-Henderson Lake Ditch subwatershed, which is permitted to house 1,415 dairy cows. Additionally, a number of small animal operations and pastures are also present. In total, 16 unregulated animal operations housing more than 102 cows, horses and goats which were identified during the windshield survey. In total, manure from small animal operations and the CAFO total over 33,050 tons per year, which contains almost 15,767 pounds of nitrogen, 7,741 pounds of phosphorus and 9.32E+14 colonies of E. coli. Based on windshield survey observations, livestock do not appear to have access to the subwatershed streams. Streambank erosion is a concern in the subwatershed. Approximately 0.6 miles

(3%) of streambank erosion were identified within the subwatershed. Additionally, 0.6 miles (3%) of the subwatershed streams were found to have narrow buffers (Figure 72).

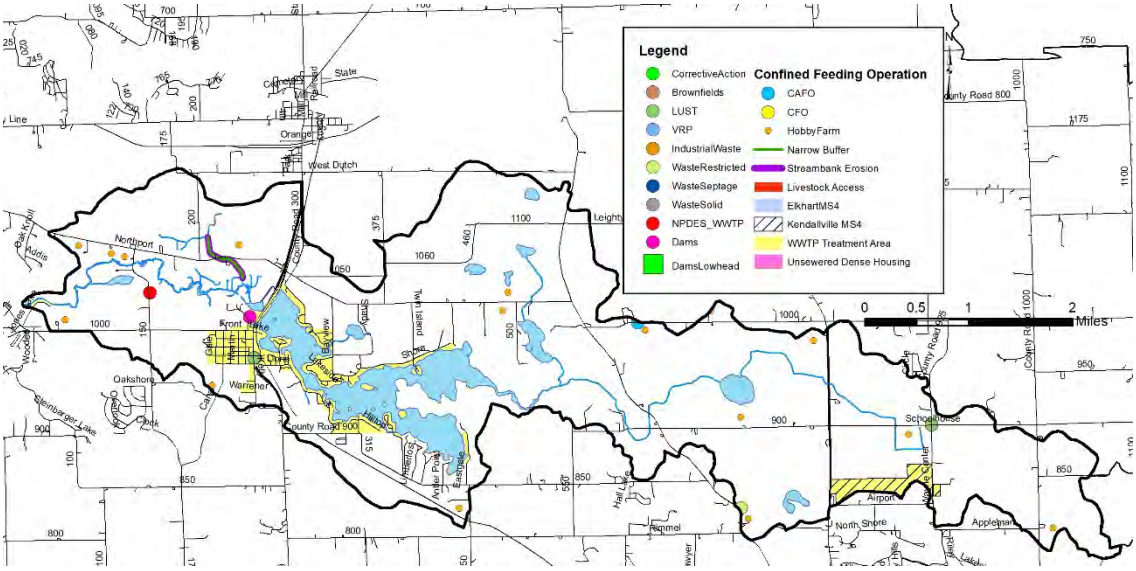


Figure 72. Potential point and non-point sources of pollution and suggested solutions in the Oviate Ditch-Middle Branch Elkhart River subwatershed.

4.5.5 Water Quality Assessment

Waterbodies within the Oviate Ditch-Middle Branch Elkhart River subwatershed have been sampled at four locations (Figure 73). Assessments include collection of water chemistry data by IDEM (4 sites) and one site, which is being monitored by the Sylvan Lake HOA-City of Kendallville project. One site in the Oviate Ditch-Middle Branch Elkhart River subwatershed is being sampled as part of the current project (shown as Upper Sample sites). One USGS stream gage and one gage collecting data for the Sylvan Lake Project is located at the Sylvan Lake outlet.

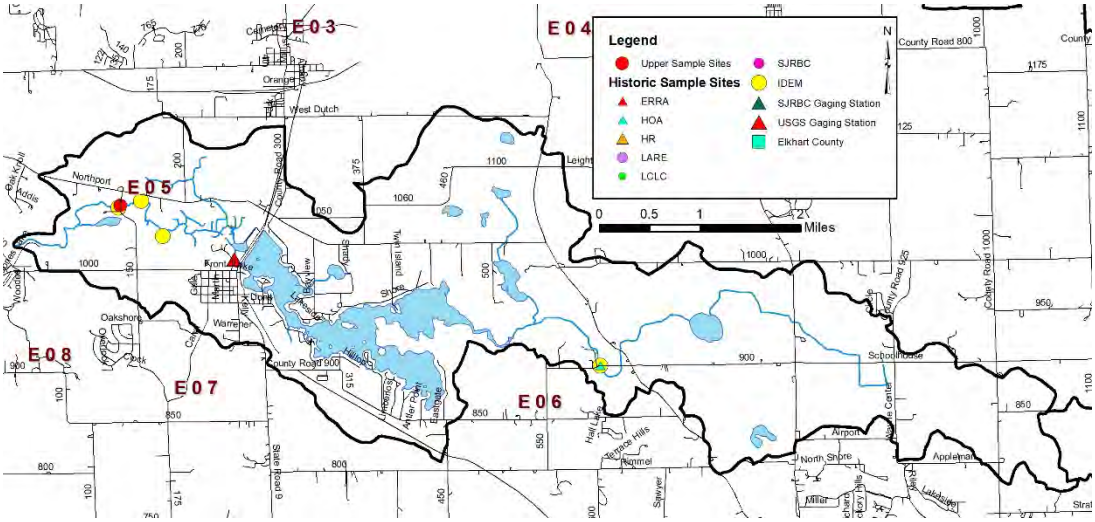


Figure 73. Locations of historic and current water quality data collection in the Oviate Ditch-Middle Branch Elkhart River subwatershed.

Table 32 details historic water chemistry data collected in the Oviate Ditch-Middle Branch Elkhart River subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm). Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 26% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 60% of samples collected. Nitrate-nitrogen concentrations do not exceed water quality targets (1 mg/L). Total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 33% of samples. Total suspended solids do not exceed water quality targets (15 mg/L), while turbidity levels exceed water quality targets (5.7 NTU) in 30% of samples.

Table 32. Oviate Ditch-Middle Branch Elkhart River subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	390	641	0	11	0%
Dissolved Oxygen	2.3	12.6	6	23	26%
E. coli	186	396.8	3	5	60%
Ammonia-Nitrogen	0.1	0.2	0	3	0%
Nitrate-Nitrogen	BDL	0.3	0	3	0%
pH	7.21	8.1	0	23	0%
Total Kjeldahl Nitrogen	1.1	1.4	3	3	100%
Total Phosphorus	0.06	0.09	1	3	33%
Total Suspended Solids	BDL	10	0	3	0%
Turbidity	1	7.3	3	10	30%

BDL = Below Detection Limit

Table 33 details water quality data collected in the Oviate Ditch-MB Elkhart Creek Subwatershed at Little Elkhart Creek stream (Site 5). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 0% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 83% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 0% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 25% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 8% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 33. Oviate Ditch-Middle Branch Elkhart Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
5	Min	4.20	4.48	7.69	496.00	0.10	0.10	0.05	2.80	11.00
	Median	12.81	6.60	8.41	571.10	1.20	2.10	0.05	7.80	51.50
	Max	24.30	10.64	8.75	621.60	7.10	4.58	0.07	41.20	181.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	1	10	0	3	0
	% Exceed	0%	0%	0%	0%	8%	83%	0%	25%	0%

IDEM assessed the biological community at one site including one habitat assessment, one fish community assessment and two macroinvertebrate community assessments. One site was assessed as part of the current project. Habitat scored 43 with 100% of sites scoring below the state target (51). The

fish community assessment rated excellent with 100% of assessments meeting the state aquatic life use designation. Macroinvertebrate assessments scored 30 to 34 during all assessments with 100% of multihabitat sites not meeting their aquatic life use designation (Table 34).

Table 34. Oviate Ditch-Middle Branch Elkhart River subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	43	43	2	2	100%
Fish (IBI)	57	57	0	1	0%
Macroinvertebrates (mIBI, Kick)	--	--	--	--	--
Macroinvertebrates (mIBI, Multi Habitat)	30	34	3	3	100%

4.6 Jones Lake-North Branch Elkhart River subwatershed

The Jones Lake-North Branch Elkhart River subwatershed forms part of the northwest border of the Elkhart River watershed and sits in both Noble and LaGrange counties (Figure 74). It encompasses one 12-digit HUC watershed: 040500011506. This subwatershed drains 26,049 acres (40.7 square miles) and accounts for 10% of the total watershed area. There are 62.3 miles of stream. IDEM has classified 11.98 miles of stream as impaired for E. coli and 0.16 miles of stream as impaired for impaired biotic communities.

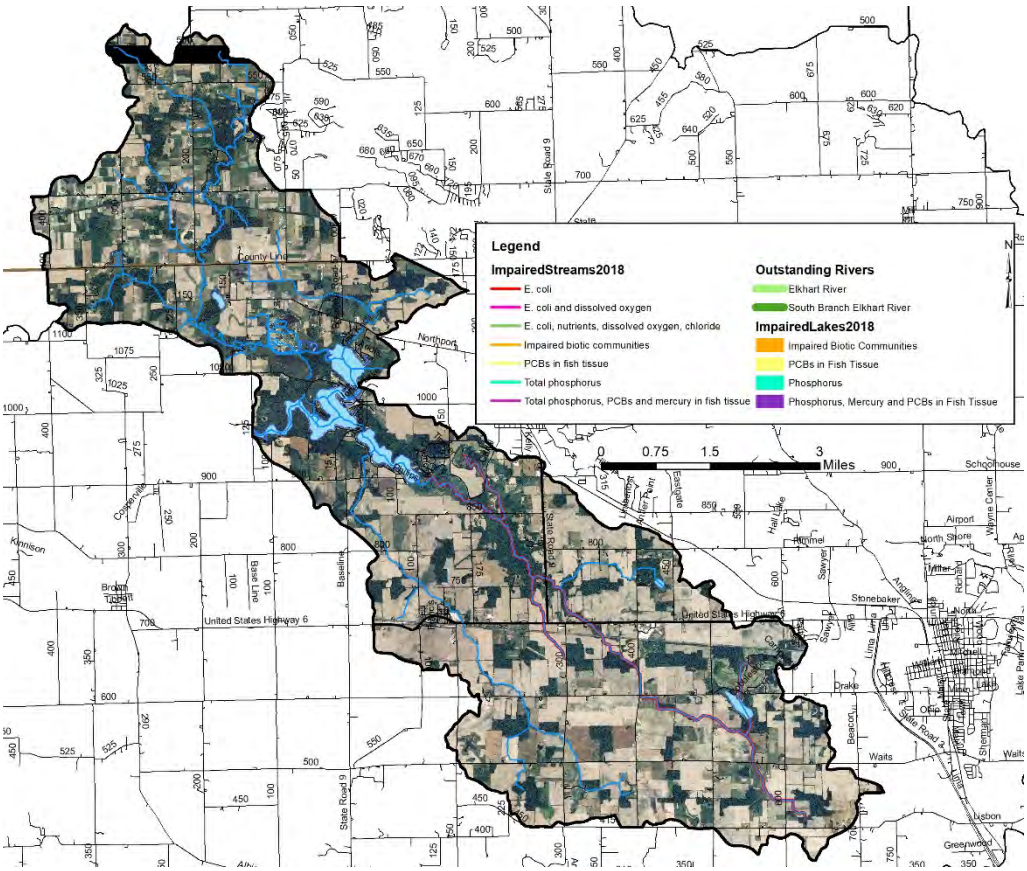


Figure 74. Jones Lake-North Branch Elkhart River subwatershed.
ARN #58550

4.6.1 Soils

Hydric soils cover 8,574.3 acres or 33% of the subwatershed; wetlands currently cover 24% (6,181.6 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils are found in nearly half of the subwatershed covering 12,847.3 acres or 49%. A majority of the subwatershed, 94% (24,355.1 acres), has soils which are very limited for septic use. The majority of the Jones Lake-North Branch Elkhart River Subwatershed is also rural, indicating many homes utilize on-site septic systems. Based on the soil septic suitability, maintenance and inspection of septic systems is important to ensure proper function and capacity.

4.6.2 Land Use

Agricultural land use dominates the Jones Lake-North Branch Elkhart River subwatershed with 66% (17,110.1 acres) mapped in row crop and pasture and 24% (6,181.6 acres) in wetlands, open water and grassland. Urban land uses cover 1,606.9 acres, or 6%, of the subwatershed. In total, 1,160.1 acres or 5% of the subwatershed are in forested land uses.

4.6.3 Point Source Water Quality Issues

There are seven LUST sites located in the subwatershed (Figure 75). There are no open dumps, brownfields, corrective action sites, voluntary remediation sites, NPDES-permitted sites, industrial waste facilities, or industrial waste facilities located within the Jones Ditch-North Branch Elkhart River subwatershed (Figure 75).

4.6.4 Non-Point Source Water Quality Issues

Agricultural land use is the predominant land use in the Jones Lake-North Branch Elkhart River subwatershed. There are four active CFOs and one active CAFOs located within the Jones Lake-North Branch Elkhart River subwatershed, which are permitted to house more than 75,962 cows, chickens, pigs and turkeys. Additionally, 90 unregulated animal operations housing more than 1,322 cows, horses, sheep and goats which were identified during the windshield survey. In total, manure from small animal operations and CFO/CAFOs total over 109,397 tons per year, which contains almost 1,761,761 pounds of nitrogen, almost 1,410,210 pounds of phosphorus and 1.21E+19 colonies of E. coli. Based on windshield survey observations, livestock do not have access to Jones Lake-North Branch Elkhart River subwatershed streams. Streambank erosion and lack of buffers is a concern in the subwatershed. Approximately 4.6 miles (7%) of streambank erosion and 3.1 miles (5%) of narrow buffers were identified within the subwatershed (Figure 75).

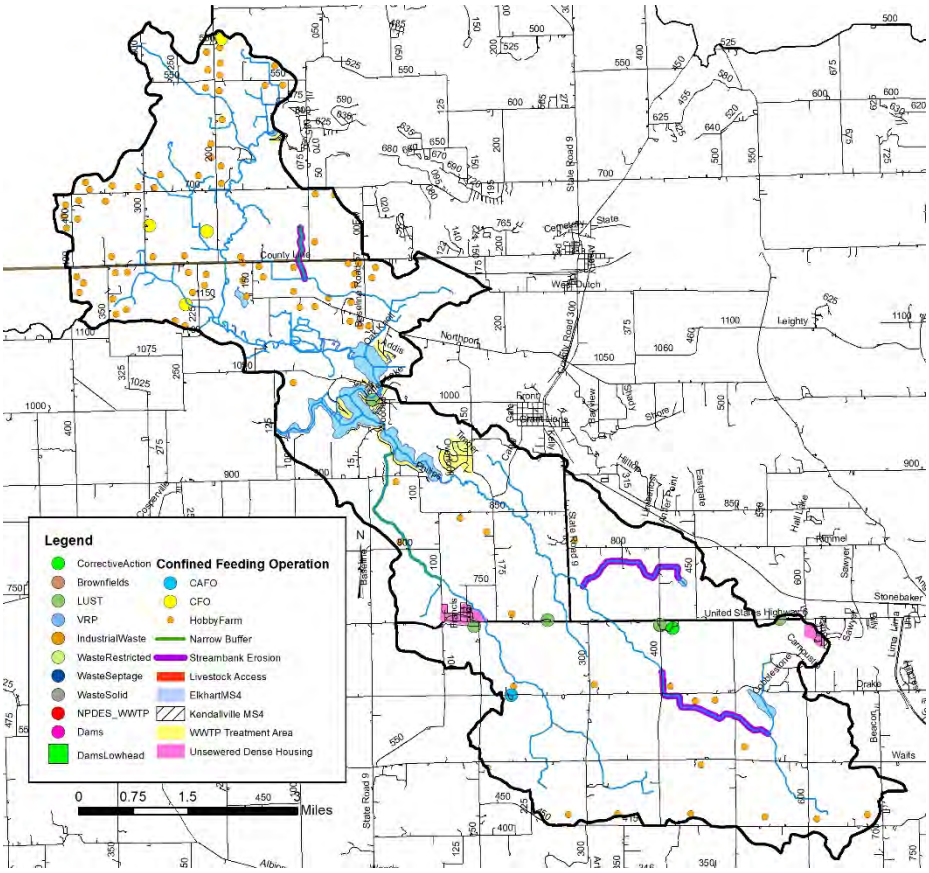


Figure 75. Potential point and non-point sources of pollution and suggested solutions in the Jones Lake-North Branch Elkhart River subwatershed.

4.6.5 Water Quality Assessment

Waterbodies within the Jones Lake-North Branch Elkhart River subwatershed have been sampled at 10 locations (Figure 76). Assessments include collection of water chemistry data by IDEM (8 sites) and the SJRBC (2 sites). Additionally, IDEM assessed one site for fish and macroinvertebrates (twice) and two sites for habitat. Three sites in the Jones Lake-North Branch Elkhart River subwatershed is being sampled as part of the current project (shown as Upper sample sites). There are no USGS stream gages in the Jones Lake-North Branch Elkhart River subwatershed.

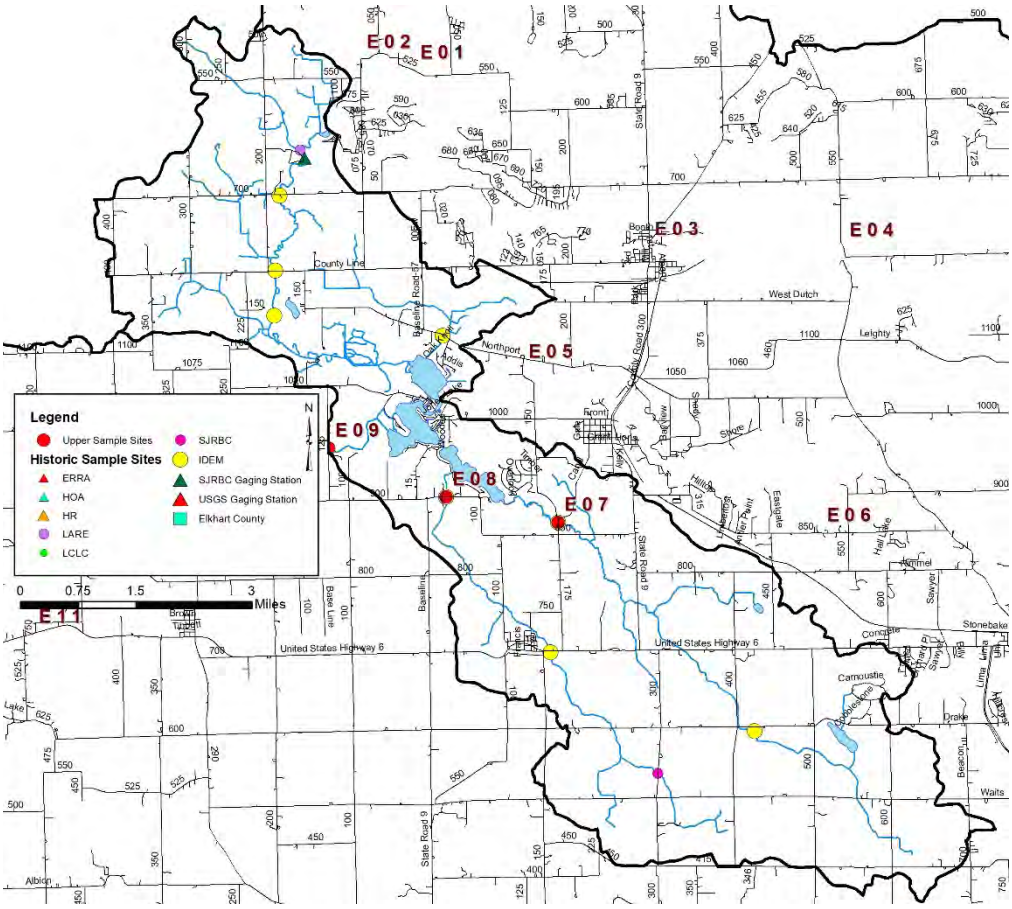


Figure 76. Locations of historic and current water quality data collection in the Jones Lake-North Brank Elkhart River subwatershed.

Table 35 details water chemistry data collected in the Jones Lake-North Branch Elkhart River subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm). Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 10% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 29% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 79% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 83% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 65% of samples. Total suspended solids exceed water quality targets (15 mg/L) in 15% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 28% of samples.

Table 35. Jones Lake-North Branch Elkhart River subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	300	869	0	34	0%
Dissolved Oxygen	2.44	12.8	5	48	10%
E. coli	BDL	8400	8	28	29%
Ammonia-Nitrogen	BDL	0.20	0	6	0%
Nitrate-Nitrogen	BDL	23	23	29	79%
pH	6.16	8.63	0	48	0%
Total Kjeldahl Nitrogen	BDL	2.6	5	6	83%
Total Phosphorus	BDL	0.86	17	26	65%
Total Suspended Solids	BDL	62	4	26	15%
Turbidity	0	65	9	32	28%

BDL = Below Detection Limit

Table 36 details water quality data collected in the Jones Lake-NB Elkhart River Subwatershed (Site 7, Site 8, Site 9). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 50% of samples collected in Site 7, 58% of samples collected in Site 8 and 0% of samples collected in Site 9. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples in Site 7 and Site 8 and in 83% of samples collected in Site 9. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 17% of samples collected in Site 7 and in 8% of samples collected in Site 8 and Site 9. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 0% of samples collected in Site 7 and Site 8 and 25% of samples collected in Site 9. Turbidity levels exceed water quality targets (5.7 NTU) in 8% of samples collected in Site 7, 17% of samples collected in Site 8 and 33% of samples collected in Site 9. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from Site 7 and Site 8. Dissolved oxygen concentrations exceed water quality standards in 8% of samples collected from Site 9.

Table 36. Jones Lake-North Branch Elkhart River Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
7	Min	4.30	6.86	7.52	383.40	0.20	1.30	0.05	2.80	26.00
	Median	13.11	8.40	8.43	611.00	2.55	3.01	0.05	5.60	277.00
	Max	24.09	11.57	8.68	674.20	6.30	4.70	0.12	10.40	980.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	1	12	2	0	6
	% Exceed	0%	0%	0%	0%	8%	100%	17%	0%	50%
8	Min	6.20	5.12	7.52	414.40	0.50	1.80	0.05	1.20	4.00
	Median	12.25	8.07	8.53	694.10	2.35	3.41	0.05	3.60	483.00
	Max	23.70	11.97	8.74	756.20	10.40	6.60	0.21	12.00	1730.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	2	12	1	0	7
	% Exceed	0%	0%	0%	0%	17%	100%	8%	0%	58%
9	Min	4.31	3.55	7.84	326.90	0.40	0.20	0.05	4.40	1.00
	Median	12.19	9.44	8.47	496.20	3.15	1.70	0.05	11.60	6.00
	Max	25.64	11.04	8.81	552.00	14.60	4.43	0.09	31.60	193.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		1	0	0	4	10	1	3	0
	% Exceed	0%	8%	0%	0%	33%	83%	8%	25%	0%

IDEM assessed the biological community at two sites including two sites assessed for macroinvertebrates, one site assessed for fish and two sites assessed for habitat. Two sites were assessed as part of the current project. Habitat scores ranged from 49 to 67 with 50% of sites scoring below the state target (51). Fish community assessments rated good (50) with all assessments meeting the state aquatic life use designation. Macroinvertebrate assessments rated moderately impaired using the kick sampling method with all sites meeting their aquatic life use designation and from 30 to 56 with 75% of multihabitat samples not meeting their aquatic life use designation (Table 37).

Table 37. Jones Lake-North Branch Elkhart River subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	49	67	2	4	50%
Fish (IBI)	50	50	0	1	0%
Macroinvertebrates (mIBI, Kick)	4.6	4.6	0	1	0%
Macroinvertebrates (mIBI, Multi Habitat)	30	56	3	4	75%

4.7 Huston Ditch-North Branch Elkhart River subwatershed

The Huston Ditch-North Branch Elkhart River subwatershed is very central to the watershed and forms the northern boundary of the Upper Elkhart River Watershed (Figure 77). It encompasses one 12-digit HUC watershed: 040500011507. This subwatershed drains 18,488 acres or 28.9 square miles and accounts for 7% of the total watershed area. There are 32.1 miles of stream. IDEM has classified 11.31 miles of stream impaired for E. coli.

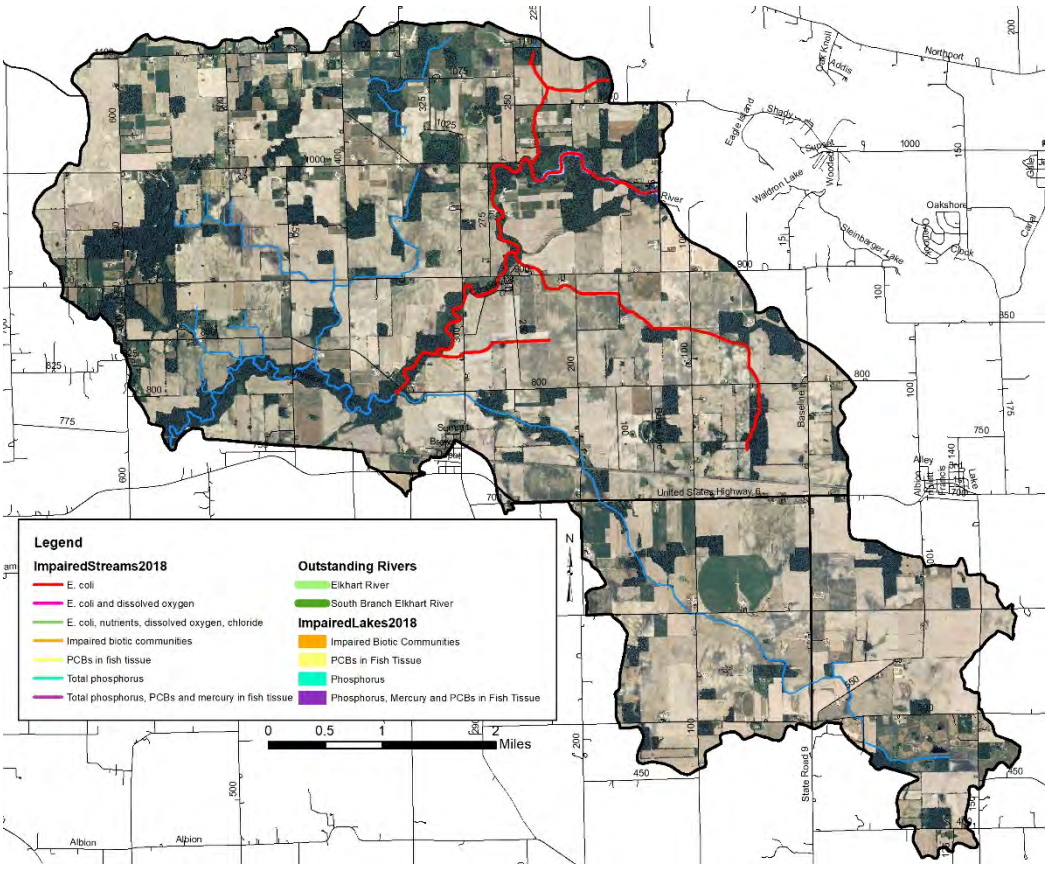


Figure 77. Huston Ditch-North Branch Elkhart River subwatershed.

4.7.1 Soils

Hydric soils cover 5,767.6 acres (31%) of the subwatershed. Wetlands currently cover 13% (2,400.8 acres) of the subwatershed. Highly erodible soils nearly cover 6,877.4 acres (37%) of the subwatershed. In total, 18,204.4 acres (99%) of the subwatershed are identified as very limited for septic use. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, the majority of the subwatershed is very limited. Therefore, maintenance and inspections of septic systems in the area are important to ensure proper function and capacity.

4.7.2 Land Use

Agricultural land use dominates the Huston Ditch-North Branch Elkhart River subwatershed with 79% (14,549.6 acres) mapped in row crop and pasture. An additional 13% (2,400.8 acres) in mapped as wetlands, open water and grassland. Urban land uses make up 857.8 acres, or 5%, of the subwatershed. Forested land uses cover just 686.8 acres or 4% of the subwatershed.

4.7.3 Point Source Water Quality Issues

There is one leaking underground storage tank site (Figure 78) and one NPDES-permitted facility in the subwatershed, the West Lakes RSD. There are no open dumps, brownfields, corrective action sites, voluntary remediation sites or industrial waste facilities located within the Huston Ditch-North Branch Elkhart River (Figure 78).

4.7.4 Non-Point Source Water Quality Issues

Agricultural land use is the predominant land use in the Huston Ditch-North Branch Elkhart River subwatershed. There are six active CFOs and four active CAFOs which are permitted to house 41,847 cows, chickens, pigs, horses and sheep located within the Huston Ditch-North Branch Elkhart River subwatershed. Nearly 106 unregulated animal operations housing more than 4,821 cows, horses, goats and sheep which were identified during the windshield survey. Livestock have access to 0.6 miles (2%) of Huston Ditch-North Branch Elkhart River streams. In total, livestock located on small animal operations and the CFO/CAFOs produce more than 287,891 tons of manure per year, which contains almost 566,533 pounds of nitrogen, almost 410,845 pounds of phosphorus and 1.04E+16 colonies of E. coli. Streambank erosion is a concern in the subwatershed. Approximately 3.3 miles (10%) of streambank erosion and 11.4 miles (36%) of narrow buffers were identified within the subwatershed (Figure 78).

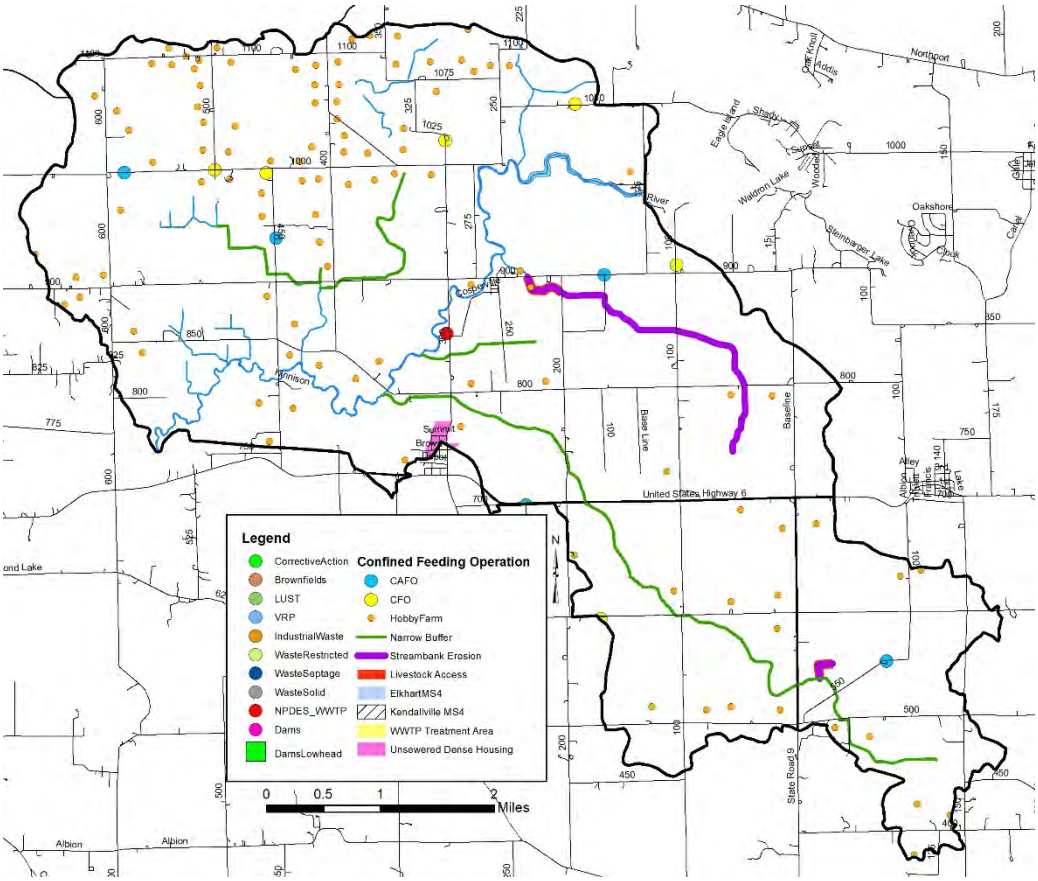


Figure 78. Potential point and non-point sources of pollution and suggested solutions in the Huston Ditch-North Branch Elkhart River subwatershed.

4.7.5 Water Quality Assessment

Waterbodies within the Huston Ditch-North Branch Elkhart River subwatershed have been sampled at eight locations (Figure 79). Assessments include collection of water chemistry data by IDEM (4 sites), by the SJRBC (3 sites) and as part of the 2008 ERRA Elkhart River WMP (1 site). Additionally, IDEM assessed the macroinvertebrate and fish communities and habitat at one site. One site in the Huston Ditch-North Branch Elkhart River subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are in the Huston Ditch-North Branch Elkhart River subwatershed.

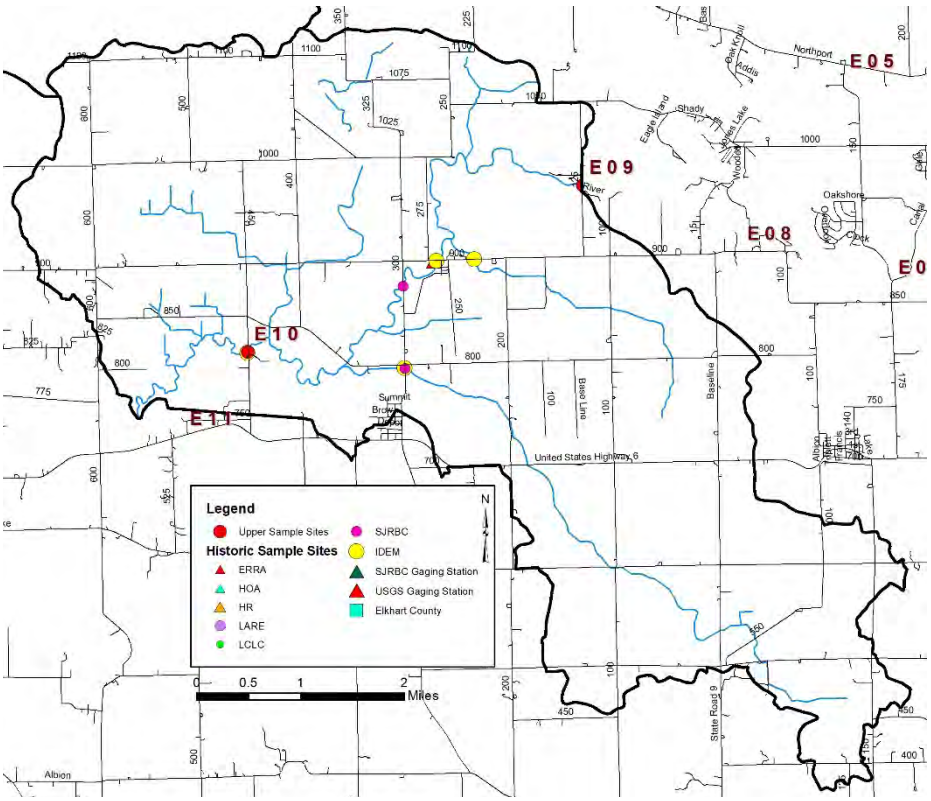


Figure 79. Locations of historic and current water quality data collection in the Huston Ditch-North Branch Elkhart River subwatershed.

Table 38 details water chemistry data collected in the Huston Ditch-North Branch Elkhart River subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm). Dissolved oxygen concentrations measure both above the upper state standard (12 mg/L) and below the lower state standards (4 mg/L) in 6% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 21% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 80% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 78 of samples. Total suspended solids exceed water quality targets (15 mg/L) in 30% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 43% of samples.

Table 38. Huston Ditch-North Branch Elkhart River subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	30	766	0	63	0%
Dissolved Oxygen	4.35	14.83	5	77	6%
E. coli	50	500	9	43	21%
Ammonia-Nitrogen	0.16	0.28	1	2	50%
Nitrate-Nitrogen	0.1	4.2	33	41	80%
pH	7.16	8.51	0	77	0%
Total Kjeldahl Nitrogen	1.2	1.4	3	3	100%
Total Phosphorus	0.04	0.54	32	41	78%
Total Suspended Solids	2	31	12	40	30%
Turbidity	1	31.39	26	61	43%

Table 39 details water quality data collected in the Huston Ditch-North Branch Elkhart River Subwatershed at North Branch Elkhart River stream (Site 10). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 42% of samples collected. Nitrate-nitrogen concentrations also exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 25% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 17% of samples, while turbidity levels also exceed water quality targets (5.7 NTU) in 17% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 39. Huston Ditch-North Branch Elkhart River Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
10	Min	3.42	5.04	7.50	408.40	0.70	1.42	0.05	3.20	17.00
	Median	12.87	8.37	8.47	529.10	2.05	2.44	0.05	7.40	209.00
	Max	23.89	11.54	8.85	741.00	14.30	4.40	0.19	44.40	1730.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	2	12	3	2	5
	% Exceed	0%	0%	0%	0%	17%	100%	25%	17%	42%

IDEM assessed the biological community at one site including two macroinvertebrate assessments, one fish assessment and one habitat assessment. V3 assessed the macroinvertebrate community and habitat at one site as part of the Elkhart River WMP. One site was assessed as part of the current project. Habitat scores ranged from 52 to 81 with 0% of sites scoring below the state target (51). Fish community assessments rated excellent with all assessments meeting the aquatic life use designation. Macroinvertebrate assessments rated 2.8 to 4.8 using the kick sampling method and 30 to 46 using the multihabitat assessment with 50% of assessments meeting their aquatic life use designation (Table 40).

Table 40. Huston Ditch-North Branch Elkhart River subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	52	81	0	3	0%
Fish (IBI)	81	81	0	1	0%
Macroinvertebrates (mIBI, Kick)	2.8	4.8	0	2	0%
Macroinvertebrates (mIBI, Multi Habitat)	30	46	1	2	50%

4.8 Rivir Lake-Forker Creek subwatershed

The Rivir Lake-Forker Creek subwatershed forms the southeastern corner of the Upper Elkhart River Watershed and sits fully in Noble County (Figure 80). It encompasses one 12-digit HUC watershed: 040500011601. This subwatershed drains 11,960 acres or 18.7 square miles and accounts for 5% of the total watershed area. There are 25.6 miles of stream. IDEM has classified 0.46 miles of stream between Rivir and Mud lakes as impaired for PCBs in fish tissue. IDEM classified Mud, Sand, Dock and Long Lakes as impaired for phosphorus and Rivir Lake as impaired for phosphorus and mercury and PCBs in fish tissue.

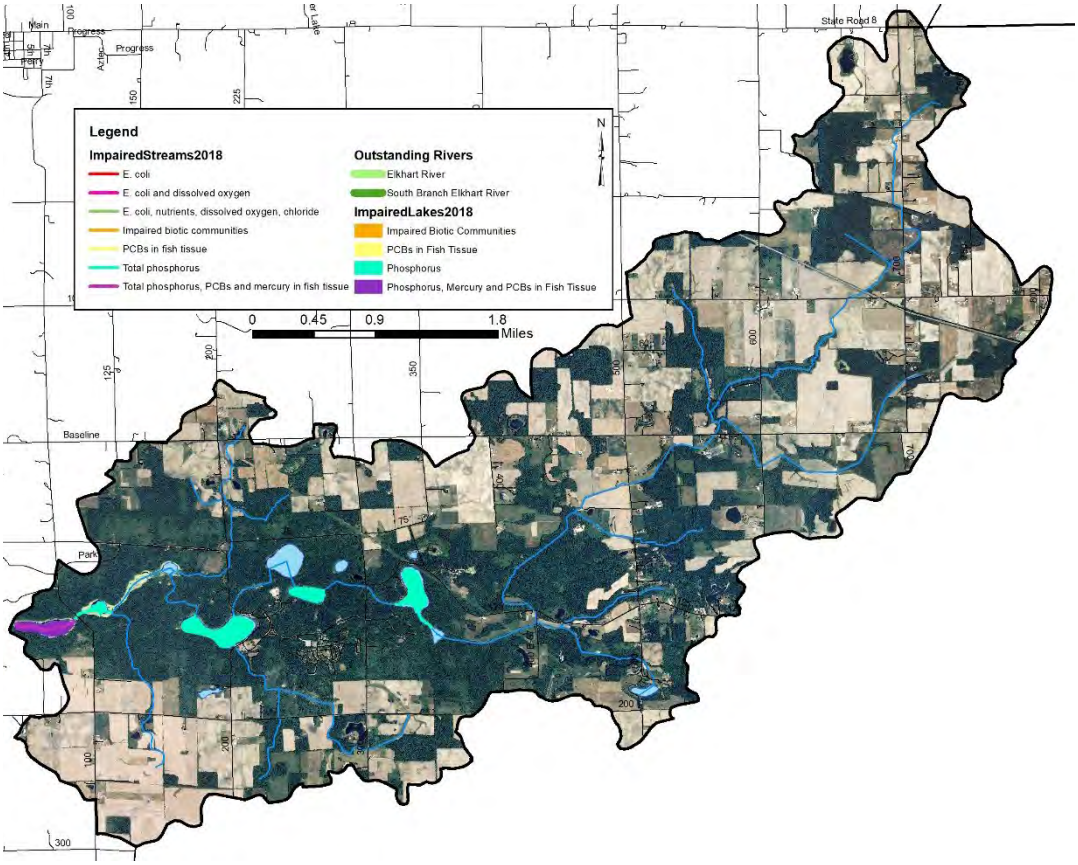


Figure 80. Rivir Lake-Forker Creek subwatershed.

4.8.1 Soils

Hydric soils cover 2,637.2 acres (22%) of the Rivir Lake-Forker Creek subwatershed. Wetlands currently cover 10% (1,188.3 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils cover over two-thirds of the subwatershed (69%). In total, 11,638.4 acres (97%) of the subwatershed are identified as very limited for septic use. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, the majority of the subwatershed is very limited. Therefore, maintenance and inspections of septic systems in the area are important to ensure proper function and capacity.

4.8.2 Land Use

Agricultural land use makes up just over half of the Rivir Lake-Forker Creek subwatershed with 52% (6,162.2 acres) in agricultural land uses, including row crop and pasture. An additional 31% (3,739.2acres) of the subwatershed is in forested land use. Wetlands, open water and grassland cover 1,188.3 acres, or 10%, of the subwatershed. Urban land use accounts for 4% of the subwatershed as well (532.1 acres). Chain O'Lakes State Park is located in this subwatershed accounting for a portion of the natural land uses (wetlands, open water, forest).

4.8.3 Point Source Water Quality Issues

While there are only three point sources of water pollution in the subwatershed, the Chain O' Lakes State Park WWTP facility and two underground storage tanks.

4.8.4 Non-Point Source Water Quality Issues

Agricultural land use is the predominant land uses in the Rivir Lake-Forker Creek subwatershed. A number of small animal operations and pastureland are also present (Figure 81). In total, 18 unregulated animal operations housing more than 242 cows, goats, horses and sheep which were identified during the windshield survey. No active confined feeding operations are located within the Rivir Lake-Forker Creek subwatershed. In total, manure from small animal operations total over 3,870 tons per year, which contains almost 2,604 pounds of nitrogen, almost 1,271 pounds of phosphorus and 3.67E+14 colonies of E. coli. Livestock appear to have access to 1 mile (4%) the subwatershed streams based on windshield survey observations. Approximately 2.9 miles (11.2%) of streambank erosion and 1.0 miles (4%) of livestock access were identified within the subwatershed (Figure 81).

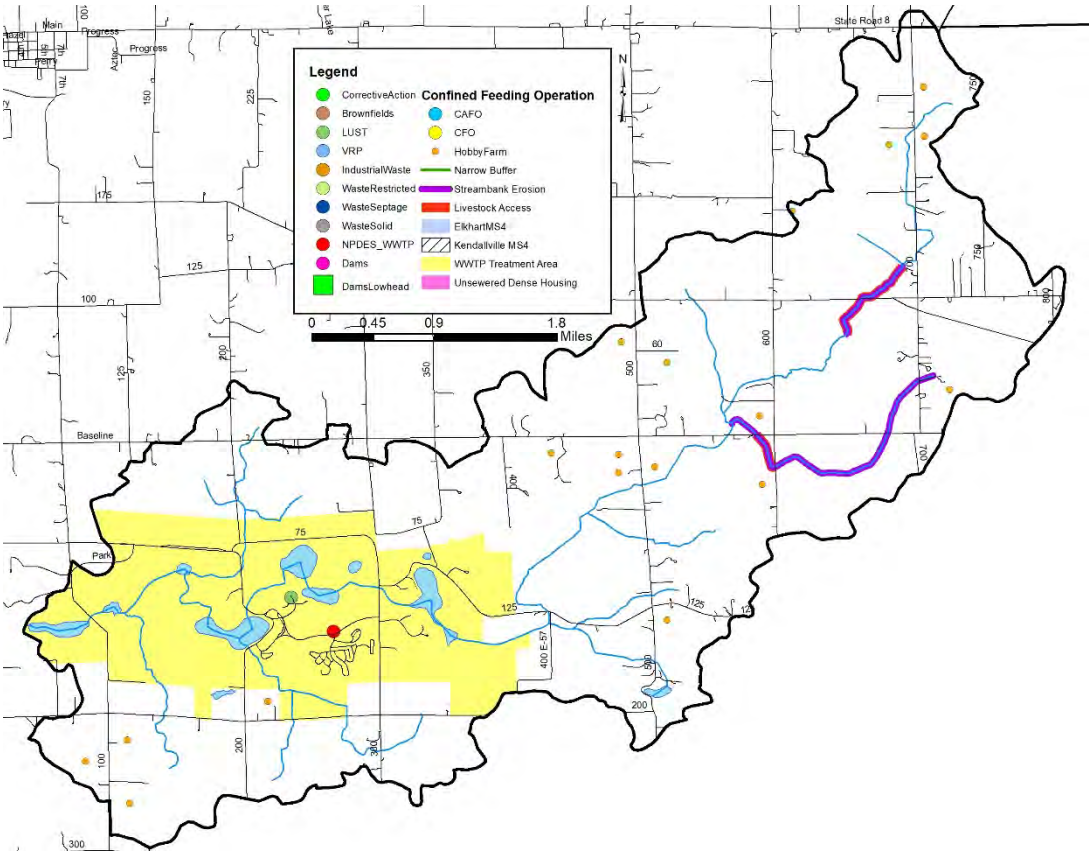


Figure 81. Potential point and non-point sources of pollution and suggested solutions in the Rivir Lake-Forker Creek subwatershed.

4.8.5 Water Quality Assessment

Waterbodies within the Rivir Lake-Forker Creek subwatershed have been sampled at four locations (Figure 82). Assessments include collection of water chemistry data by IDEM (one site), by SJRBC (one site) and at two sites as part of the LARE-funded Chain O'Lakes Diagnostic Study. One site in the Rivir Lake-Forker Creek subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are in the Rivir Lake-Forker Creek subwatershed.

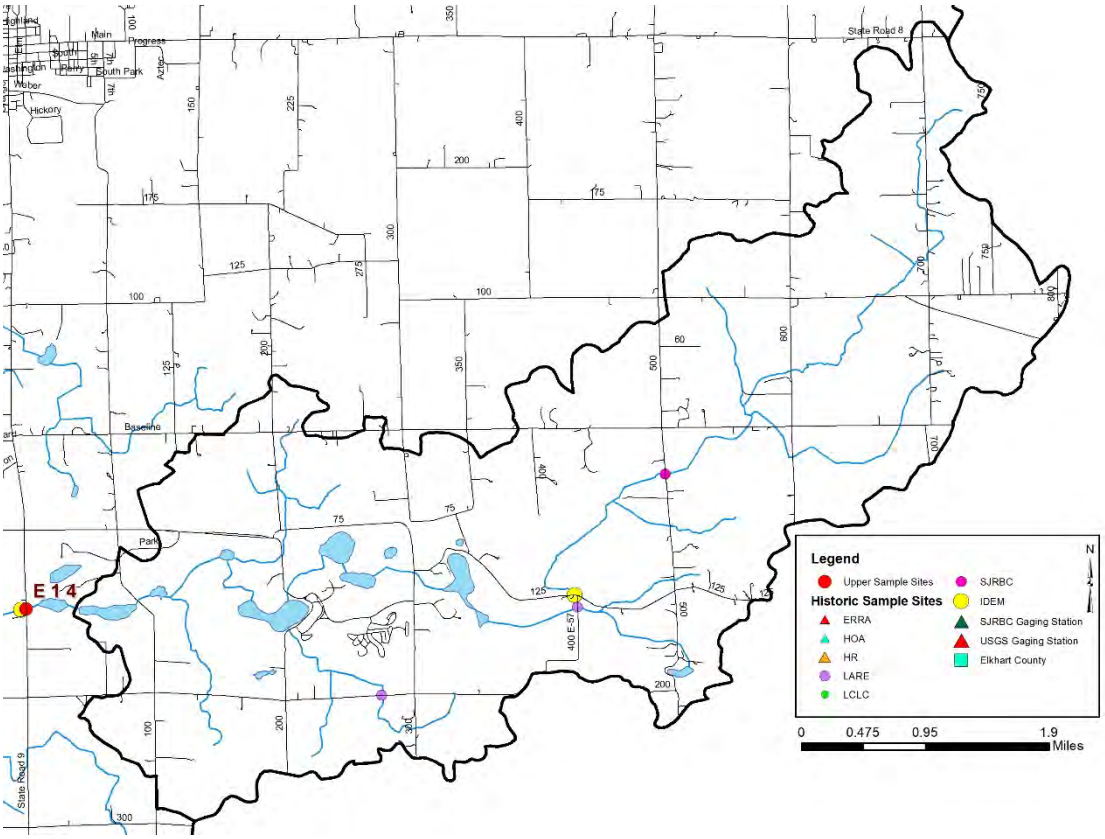


Figure 82. Locations of historic and current water quality data collection in the Rivir Lake-Forker Creek subwatershed.

Table 41 details water chemistry data. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm) in any samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 19% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 69% of samples. Total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 100% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 81% of samples. Total suspended solids exceed water quality targets (15 mg/L) in 25% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 33% of samples.

Table 41. Rivir Lake-Forker Creek subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	300	660	0	17	0%
Dissolved Oxygen	5.9	11.59	0	19	0%
E. coli	0	4,080	3	16	19%
Nitrate-Nitrogen	0.5	5.8	11	16	69%
Dissolved Phosphorus	0.02	0.25	2	4	50%
pH	7.59	8.3	0	19	0%
Total Kjeldahl Nitrogen	1.36	4.2	4	4	100%
Total Phosphorus	0.06	0.91	13	16	81%
Total Suspended Solids	2	278	4	16	25%
Turbidity	1	57	4	12	33%

Table 42 details water quality data collected in the Rivir Lake-Forker Creek Subwatershed at Rivir Lake Tributary stream (Site 14). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 8% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 25% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 0% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 17% of samples. Dissolved oxygen concentrations exceed water quality standards in 25% of samples collected from this site.

Table 42. Rivir Lake-Forker Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
14	Min	5.16	2.02	7.51	417.70	0.50	1.11	0.05	1.20	10.00
	Median	12.94	8.13	8.37	458.25	1.30	2.72	0.05	4.20	77.50
	Max	24.01	11.45	8.78	540.00	12.90	12.20	0.14	9.60	579.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		3	0	0	2	12	3	0	1
	% Exceed	0%	25%	0%	0%	17%	100%	25%	0%	8%

IDEM assessed the biological community at one site twice including macroinvertebrate community and habitat assessments. Commonwealth Biomonitoring assessed macroinvertebrates and habitat at two sites as part of the Chain of Lakes diagnostic study. One site was assessed as part of the current project. Habitat scores ranged from 22 to 66 with 20% of sites scoring below the state target (51). Macroinvertebrate assessments rated moderately impaired using the kick sampling method with all sites meeting their aquatic life use designation and scoring 24 using the multihabitat samples with 100% of sites not meeting their aquatic life use designation (Table 43).

Table 43. Rivir Lake-Forker Creek subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	22	66	1	5	20%
Fish (IBI)	--	--	--	--	--
Macroinvertebrates (mIBI, Kick)	3.3	4.0	0	4	0%
Macroinvertebrates (mIBI, Multi Habitat)	24	24	1	1	100%

4.9 Winebrenner Branch-Carrol Creek subwatershed

The Winebrenner Branch-Carrol Creek subwatershed forms the southernmost tip of the Upper Elkhart River Watershed and sits in Noble County (Figure 83). It encompasses one 12-digit HUC watershed: 040500011602. This subwatershed drains 11,799 acres (18.4 square miles) and accounts for 5% of the total watershed area. There are 24.2 miles of stream. IDEM classifies 6.23 miles of stream as impaired for E. coli.

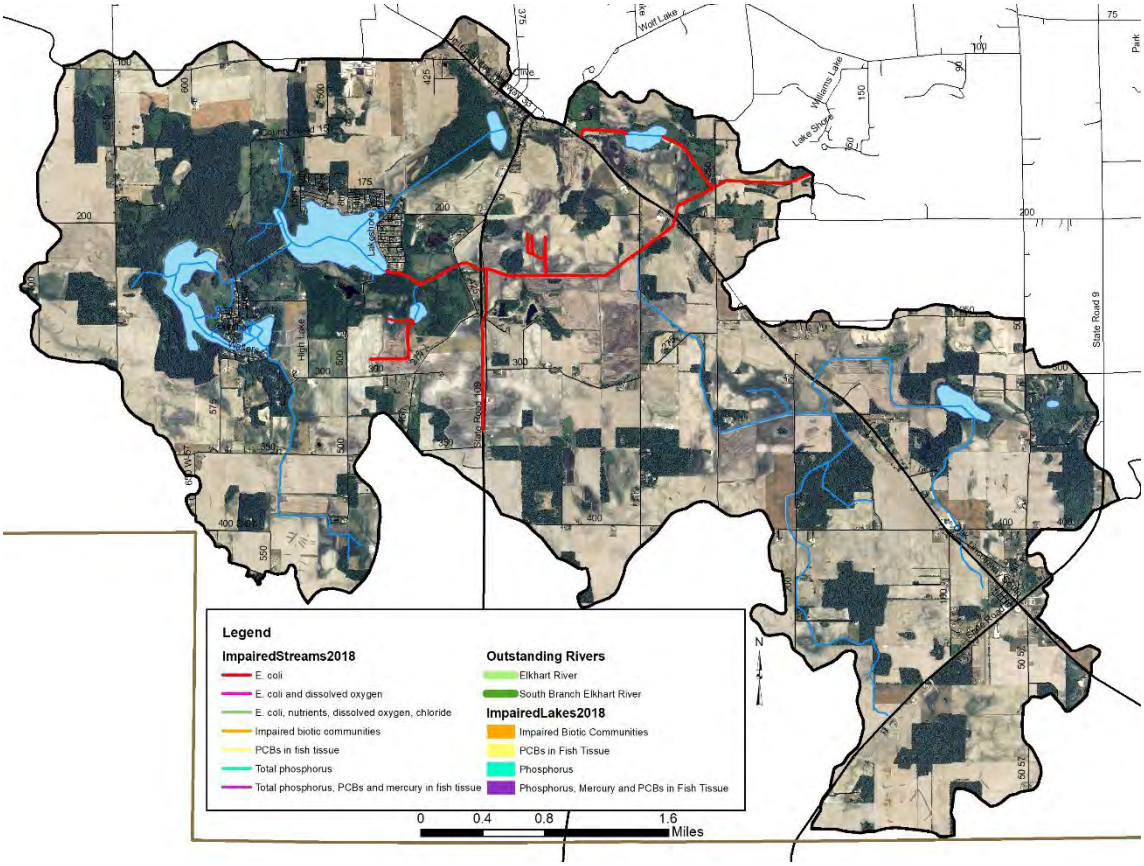


Figure 83. Winebrenner Branch-Carrol Creek subwatershed.

4.9.1 Soils

Hydric soils cover 4588.8 acres (39%) of the subwatershed. Wetlands currently cover 16% (1,870.2 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils cover 4,869.5 acres (41%) of the subwatershed. In total, 11,064.2 acres (94%) of the subwatershed are identified as very limited for septic use. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, the majority of the subwatershed is

very limited. Therefore, maintenance and inspections of septic systems in the area are important to ensure proper function and capacity.

4.9.2 Land Use

Agricultural land use dominates the Winebrenner Branch-Carrol Creek subwatershed with 68% (7,994.9 acres) in agricultural land uses, including row crop and pasture. An additional 16% (1,870.2 acres) of the subwatershed is mapped as wetlands, open water and grassland. Forest covers 1,192.3 acres, or 10%, of the subwatershed. Urban land use accounts for 6% of the subwatershed as well (746.6 acres).

4.9.3 Point Source Water Quality Issues

There are three leaking underground storage tank sites (Figure 84) and one NPDES-permitted facility in the subwatershed, the Bear-High-Wolf Lake RSD. There are no open dumps, brownfields, corrective action sites, voluntary remediation sites or industrial waste facilities located within the Winebrenner Branch-Carrol Creek subwatershed.

4.9.4 Non-Point Source Water Quality Issues

Agricultural land use is the predominant land use in the Winebrenner Branch-Carrol Creek subwatershed. Additionally, a number of small animal operations and pastures are also present (Figure 84). In total, five unregulated animal operations housing more than 95 cows and horses which were identified during the windshield survey. No active confined feeding operations are located within the Winebrenner Branch-Carrol Creek subwatershed. In total, manure from small animal operations total over 2,068 tons per year, which contains almost 997 pounds of nitrogen, almost 491 pounds of phosphorus and 5.74E+13 colonies of E. coli. Livestock do not appear to have access to the subwatershed streams based on windshield survey observations. Lack of buffer is a concern in the subwatershed. Approximately 5.7 miles (24%) of narrow buffer were identified within the subwatershed (Figure 84).

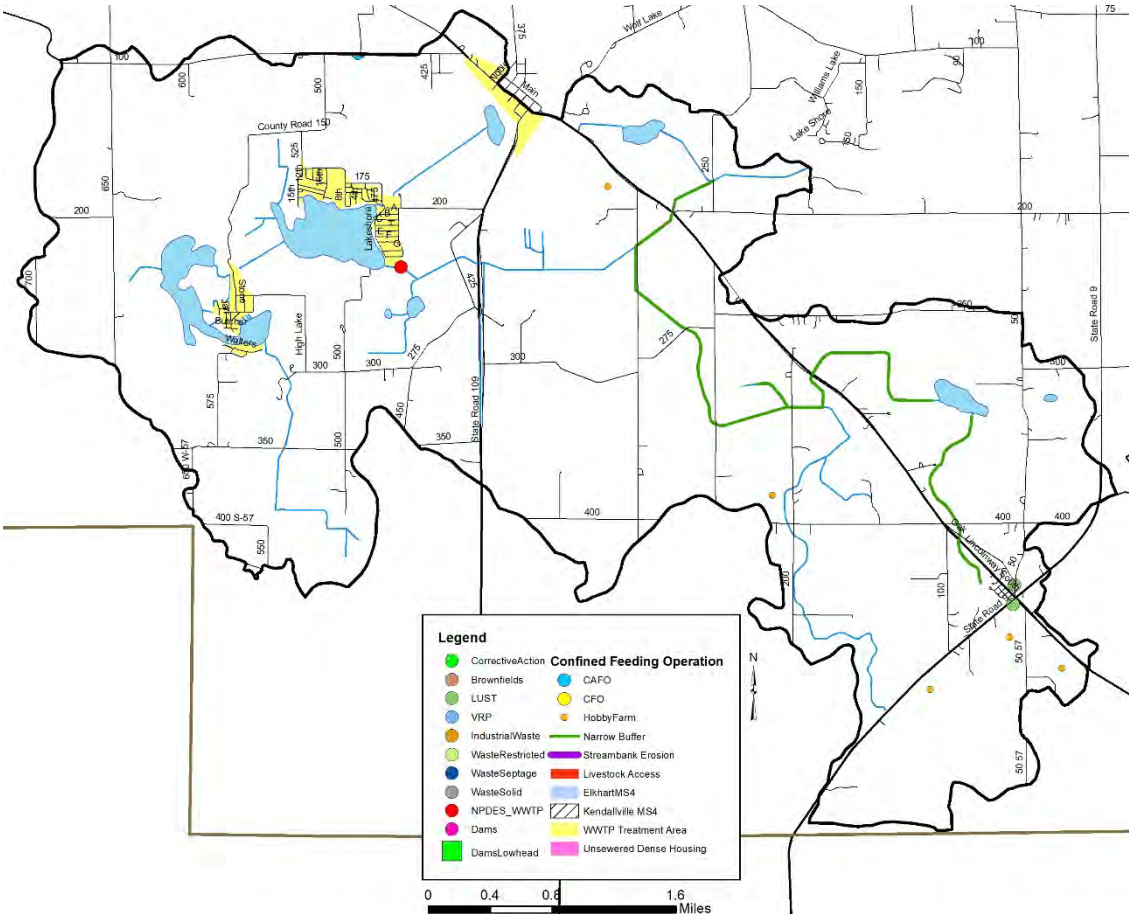


Figure 84. Potential point and non-point sources of pollution and suggested solutions in the Winebrenner Branch-Carrol Creek subwatershed.

4.9.5 Water Quality Assessment

Waterbodies within the Winebrenner Branch-Carrol Creek subwatershed have been sampled at four locations (Figure 85). Assessments include collection of water chemistry data by IDEM (3 sites) and by SJRBC (1 site). One site in the Winebrenner Branch-Carrol Creek subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are in the Winebrenner Branch-Carrol Creek subwatershed.

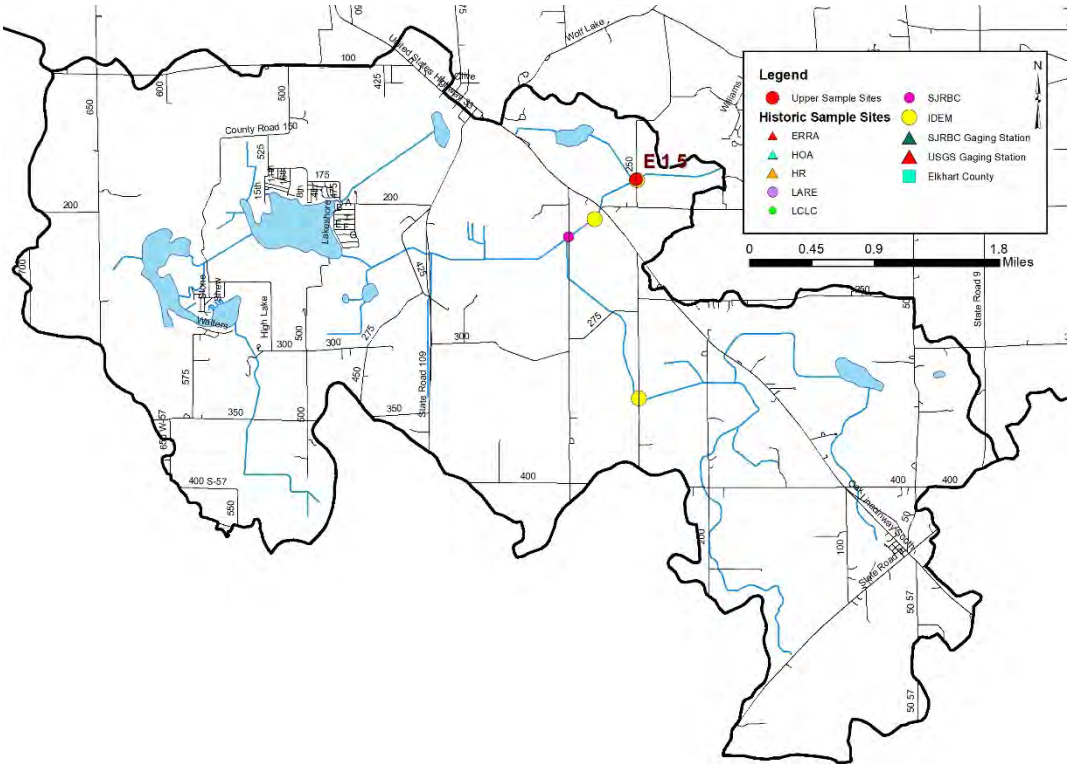


Figure 85. Locations of historic and current water quality data collection in the Winebrenner Branch-Carrol Creek subwatershed.

Table 44 details water chemistry data in the Winebrenner Branch-Carrol Creek subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm) in any samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 16% of samples collected. Dissolved oxygen measure higher than the upper (12 mg/L) or lower than the lower (4 mg/L) state standards in 11% of samples. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 81% of samples. Total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 33% collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 75% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 13% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 26% of samples.

Table 44. Winebrenner Branch-Carrol Creek subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	30	766	0	75	0%
Dissolved Oxygen	2.47	14.83	10	89	11%
E. coli	50	500	9	55	16%
Ammonia-Nitrogen	BDL	0.24	1	3	33%
Nitrate-Nitrogen	0.1	13.4	13	16	81%
pH	7.22	8.64	0	32	0%
Total Kjeldahl Nitrogen	BDL	0.7	1	3	33%
Total Phosphorus	0.06	1.13	12	16	75%
Total Suspended Solids	BDL	73	2	16	13%
Turbidity	0	56	6	23	26%

BDL = Below Detection Limit

Table 45 details water quality data collected in the Winebrenner Branch-Carrol Creek Subwatershed at Carrol Creek stream (Site 15). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 33% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 92% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 8% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 8% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 17% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 45. Winebrenner Branch-Carrol Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
15	Min	4.13	4.57	7.17	418.50	0.70	0.30	0.05	0.80	11.00
	Median	12.92	9.19	8.26	668.20	1.20	3.57	0.05	6.20	138.50
	Max	21.03	20.78	8.62	802.00	18.70	4.90	0.13	26.40	866.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	2	11	1	1	4
	% Exceed	0%	0%	0%	0%	17%	92%	8%	8%	33%

IDEM assessed the biological community at three sites including three sites assessed for macroinvertebrates, one site assessed for fish and three sites assessed for habitat. One site was assessed as part of the current project. Habitat scores ranged from 24 to 31 with 100% of sites scoring below the state target (51). Fish community assessments rated poor with all assessments not meeting the aquatic life use designation. Macroinvertebrate assessments rated moderately impaired using the kick sampling method with all sites meeting their aquatic life use designation and scoring 32 to 34 using the multihabitat samples with 100% of sites not meeting their aquatic life use designation (Table 46).

Table 46. Winebrenner Branch-Carrol Creek Subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	24	31	4	4	100%
Fish (IBI)	33	33	1	1	100%
Macroinvertebrates (mIBI, Kick)	2.4	2.4	0	1	0%
Macroinvertebrates (mIBI, Multi Habitat)	32	34	3	3	100%

4.10 Skinner Lake-Croft Ditch subwatershed

The Skinner Lake-Croft Ditch subwatershed is in the southern half of the watershed and forms a portion of the eastern border of the watershed. The Skinner Lake-Croft Ditch subwatershed lies entirely within Noble County (Figure 86). It encompasses one 12-digit HUC watershed: 040500011603. This subwatershed drains 15,890 acres or 24.8 square miles and accounts for 6% of the total watershed area. There are 25.3 miles of stream. IDEM has classified 17.1 miles of stream as impaired for E. coli.

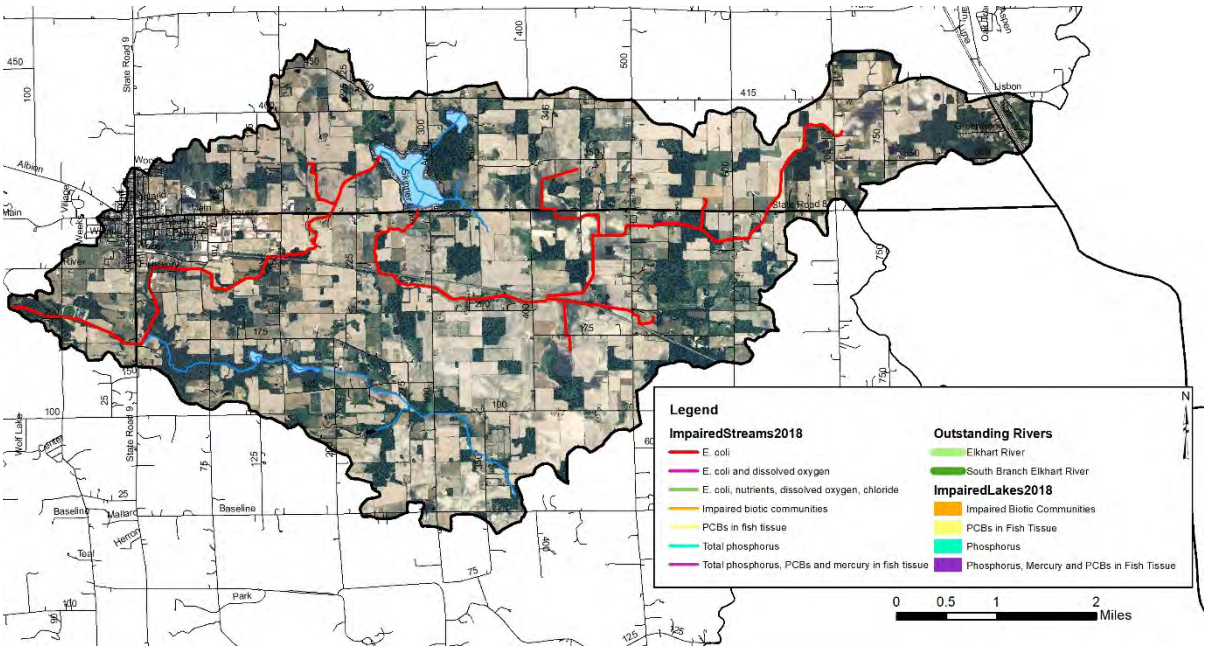


Figure 86. Skinner Lake-Croft Ditch subwatershed.

4.10.1 Soils

Hydric soils cover 4,736.6 acres or 30% of the subwatershed; wetlands currently cover 11% (1,784.2 acres) of the subwatershed. Highly erodible soils are found throughout the subwatershed covering 8,912.9 acres or 56% of the subwatershed. Nearly all of the subwatershed, 97% (15,464 acres), has soils which are very limited for septic use.

4.10.2 Land Use

Agricultural land use dominates the Skinner Lake-Croft Ditch subwatershed at 70% (11,169.2 acres) of the watershed mapped with row crops and pastureland. Wetlands, open water and grassland is the next largest use of the subwatershed, but only accounts for 11% (1,784.2 acres) of use. Forest land makes up

just 10% (1,658.9 acres) of the subwatershed. Urban land uses cover just 1,282.8 acres, or 8%, of the subwatershed with the town of Albion residing in the subwatershed.

4.10.3 Point Source Water Quality Issues

There are 17 leaking underground storage tanks listed in this watershed and two NPDES-permitted facility: the Town of Albion and the Skinner Lake wastewater treatment plant. Over the course of the first quarter of 2022, the town's ammonia-nitrogen levels were higher than is allowed by their NPDES permit. There was also an instance of effluent limitation violation in January of 2022. No open dumps, superfund sites, corrective action sites or voluntary remediation sites are located within the Skinner Lake-Croft Ditch subwatershed (Figure 87).

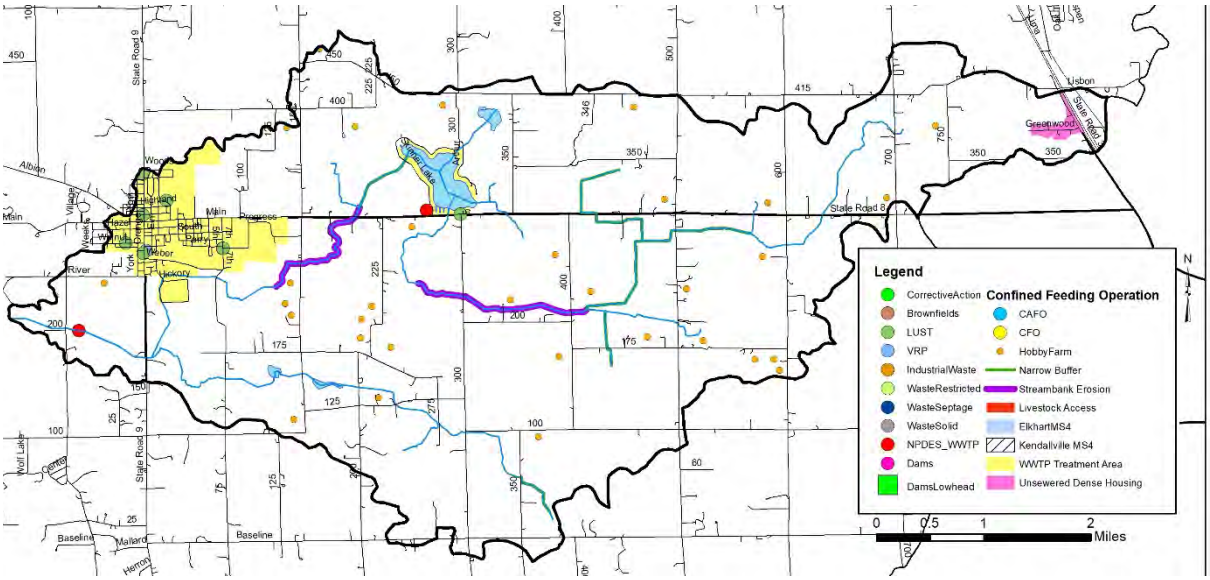


Figure 87. Potential point and non-point sources of pollution and suggested solutions in the Skinner Lake-Croft Ditch subwatershed.

4.10.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Skinner Lake-Croft Ditch subwatershed. As a result, various small animal operations and pastures are also present (Figure 87). There are 32 unregulated animal operations housing more than 514 cows, goats and horses which were identified during the windshield survey. Livestock do not have access to the Skinner Lake-Croft Ditch subwatershed streams based on observations during the windshield survey. There are no active CFOs in the subwatershed. In total, manure from small animal operations total over 10,163 tons per year, which contains almost 5,626 pounds of nitrogen, 2,960 pounds of phosphorus and 3.24E+14 colonies of E. coli. Streambank erosion and lack of buffers are a concern in the subwatershed. Approximately 5.4 miles (21%) of insufficient stream buffers and 3.1 miles (12%) of streambank erosion were identified within the subwatershed (Figure 87).

4.10.5 Water Quality Assessment

Waterbodies within the Skinner Lake-Croft Ditch subwatershed have been sampled at 26 locations (Figure 88). Assessments include collection of water chemistry data by IDEM (10 sites), by the Skinner Lake HOA (4 sites), by the SJRBC (2 sites) and at 10 sites as part of the LARE-funded Skinner Lake Diagnostic Study. One site in the Skinner Lake-Croft Ditch subwatershed is being sampled as part of the

current project (shown as Upper sample sites). No USGS stream gages are located in the Skinner Lake-Croft Ditch subwatershed.

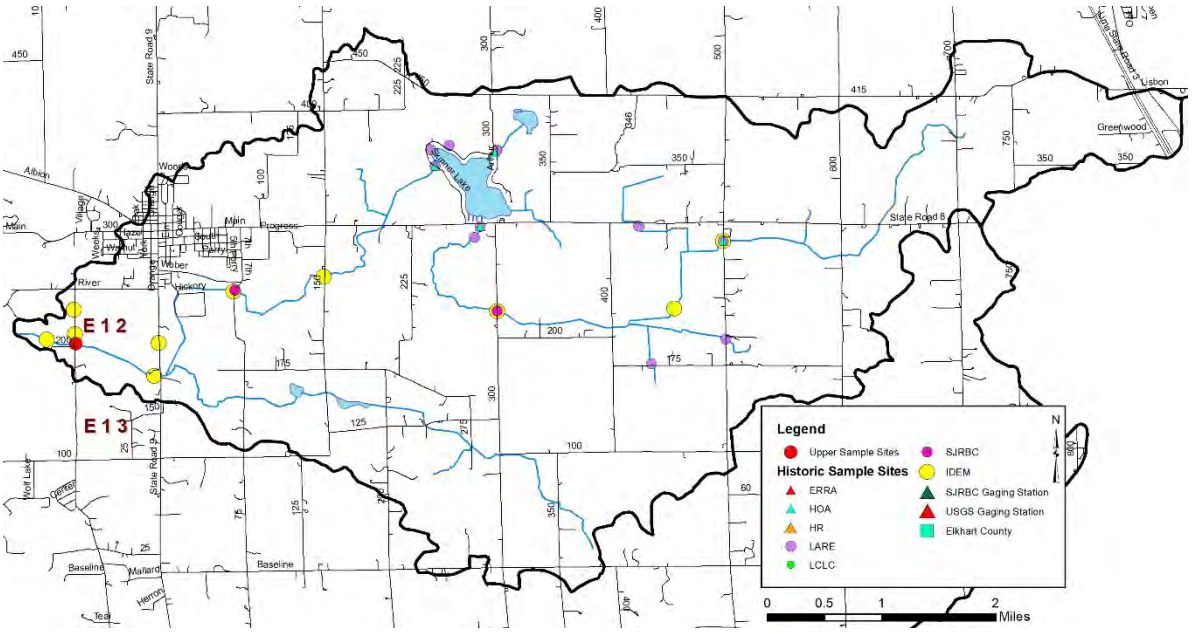


Figure 88. Locations of historic and current water quality data collection in the Skinner Lake-Croft Ditch subwatershed.

Table 47 details water chemistry data collected in the Skinner Lake-Croft Ditch subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm) in any samples collected. Dissolved oxygen concentrations measure above the upper (12 mg/L) or below the lower (4 mg/L) state standard in 18% of samples. E. coli samples exceed state grab sample standards (235 col/100 ml) in 59% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 76% of samples. Total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 92% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 84% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 36% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 60% of samples.

Table 47. Skinner Lake-Croft Ditch subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	226	893	0	64	0%
Dissolved Oxygen	2.84	14.33	15	84	18%
E. coli	BDL	8,100	34	58	59%
Ammonia-Nitrogen	0.01	0.75	1	26	4%
Nitrate-Nitrogen	BDL	14	41	54	76%
Dissolved Phosphorus	0.02	0.05	3	20	15%
pH	6.58	8.47	0	84	0%
Total Kjeldahl Nitrogen	0.5	40.9	24	26	92%
Total Phosphorus	0.05	1.7	42	50	84%
Total Suspended Solids	BDL	215	18	50	36%
Turbidity	1	190	37	62	60%

BDL = Below Detection Limit

Table 48 details water quality data collected in the Skinner Lake-Croft Ditch Subwatershed at Croft Ditch stream (Site 12). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 67% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 92% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 58% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 0% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 8% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 48. Skinner Lake-Croft Ditch Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
12	Min	5.57	6.21	7.38	419.40	0.30	0.40	0.05	2.80	26.00
	Median	13.27	8.17	8.41	640.55	1.80	2.85	0.12	5.60	413.00
	Max	20.69	10.92	8.84	851.00	26.10	11.40	0.26	12.80	1990.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	1	11	7	0	8
	% Exceed	0%	0%	0%	0%	8%	92%	58%	0%	67%

IDEM assessed the biological community at three sites, while Arion Consultants assessed the biological community at four sites. One site was assessed as part of the current project. Assessments included six sites assessed for macroinvertebrates (10 assessments), one site assessed for fish and six sites assessed for habitat (nine assessments). Habitat scores ranged from 32 to 60 with 90% of sites scoring below the state target (51). Fish community assessments rated fair with the only assessment meeting the aquatic life use designation. Macroinvertebrate assessments rated moderately impaired using the kick sampling method with all sites meeting their aquatic life use designation and scoring 28 to 42 using the multihabitat samples with 67% of sites not meeting their aquatic life use designation (Table 49).

Table 49. Skinner Lake-Croft Ditch subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	32	60	9	10	90%
Fish (IBI)	37	37	0	1	0%
Macroinvertebrates (mIBI, Kick)	2.3	4.4	0	7	0%
Macroinvertebrates (mIBI, Multi Habitat)	28	42	2	3	67%

4.11 Muncie Lake-South Branch Elkhart River subwatershed

The Muncie Lake-South Branch Elkhart River subwatershed is in the southern half of the watershed with a portion of it making up the eastern border of the watershed. The Muncie Lake-South Branch Elkhart River subwatershed lies entirely within Noble County (Figure 89). It encompasses one 12-digit HUC watershed: 040500011604. This subwatershed drains 10,527 acres or 16.4 square miles. The Muncie Lake-South Branch Elkhart River subwatershed accounts for 4% of the total watershed area. There are 25.3 miles of stream. IDEM has classified 2.59 miles as impaired for E. coli. In the Muncie Lake-South Branch Elkhart River subwatershed, 1.99 miles of the South Branch of the Elkhart River is designated as an outstanding river. IDEM classified Miller and Port Mitchell lakes as impaired for phosphorus.

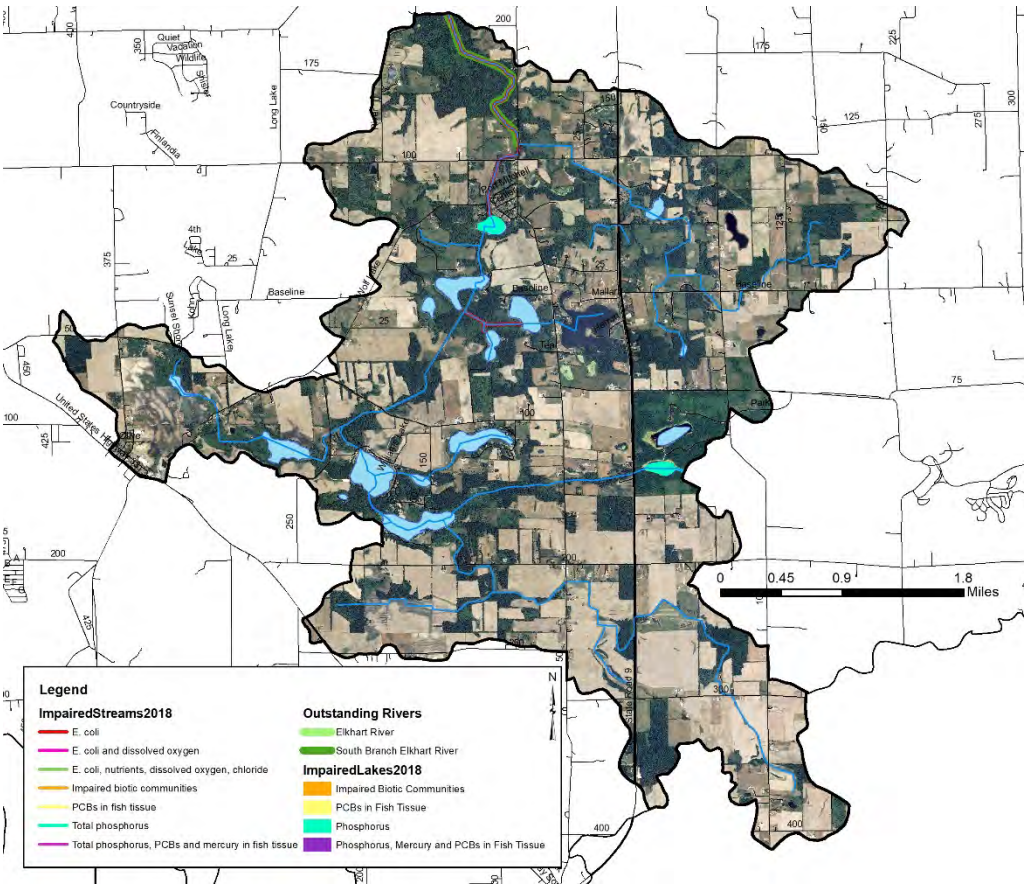


Figure 89. Muncie Lake-South Branch Elkhart River subwatershed.

4.11.1 Soils

Hydric soils cover 2,732.0 acres or 26% of the subwatershed. Wetlands currently cover 16% (1,639.6 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils cover just over two-thirds of the subwatershed (65%) or 6,822.9 acres. In total, 9,953.2 acres or 95% of the subwatershed is identified as very limited for septic use. The majority of the Muncie Lake-South Branch Elkhart River subwatershed is rural indicating many homes utilize on-site septic systems. Based on the soil septic suitability, maintenance and inspection of septic systems is important to ensure proper function and capacity.

4.11.2 Land Use

Agricultural land use dominates the Muncie Lake-South Branch Elkhart River subwatershed with 63% (6,595 acres) mapped in row crop and pastureland. Forested land use accounts for 16% (1,667 acres) of the subwatershed land use. Wetlands, open water and grassland also cover 16% (1,784.2 acres) of the subwatershed. Wetlands, open water, and grassland cover just 628.3 acres, or 6%, of the subwatershed.

4.11.3 Point Source Water Quality Issues

There is one potential source of water pollution in the subwatershed: one underground storage tank. No open dumps, superfund sites, corrective action sites, NPDES facilities or voluntary remediation sites are located within the Muncie Lake-South Branch Elkhart River subwatershed (Figure 90).

4.11.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Muncie Lake-South Branch Elkhart River subwatershed. Additionally, a number of small animal operations and pastures are also present. In total, 14 unregulated animal operations housing more than 110 cows and horses which were identified during the windshield survey (Figure 90). Based on windshield survey observations, livestock do not appear to have access to streams in the Muncie Lake-South Branch Elkhart River subwatershed. There are no active confined feeding operations in the subwatershed. Small animal operations produce more than 2,382 tons of manure annually which contains more than 1,163 pounds of nitrogen, 574 pounds of phosphorus and more than 6.48E+13 colonies of E. coli. Lack of buffer is also a concern in the subwatershed. Approximately 3.4 miles (14%) of narrow buffer were identified within the subwatershed (Figure 90).

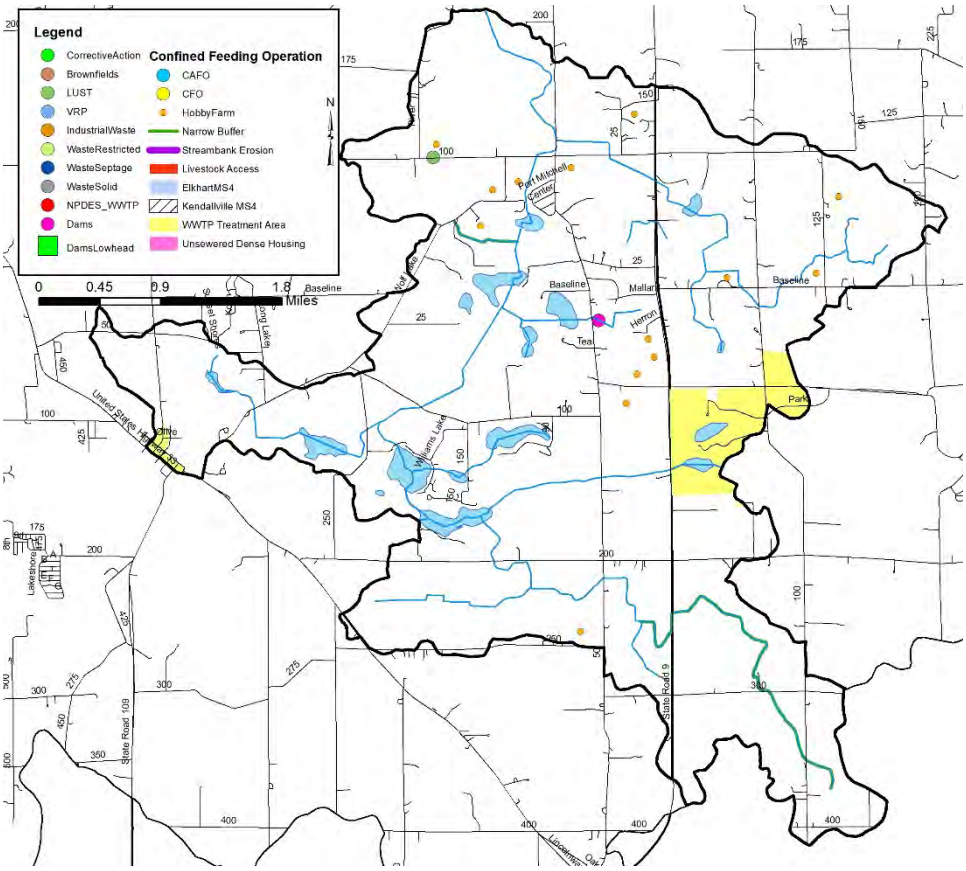


Figure 90. Potential point and non-point sources of pollution and suggested solutions in the Muncie Lake-South Branch Elkhart River subwatershed.

4.11.5 Water Quality Assessment

Waterbodies within the Muncie Lake-South Branch Elkhart River subwatershed have been sampled at 10 locations (Figure 91). Assessments include collection of water chemistry data by IDEM (6 sites) and the SJRBC (2 sites). One site in the Muncie Lake-South Branch Elkhart River subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are in the Muncie Lake-South Branch Elkhart River subwatershed.

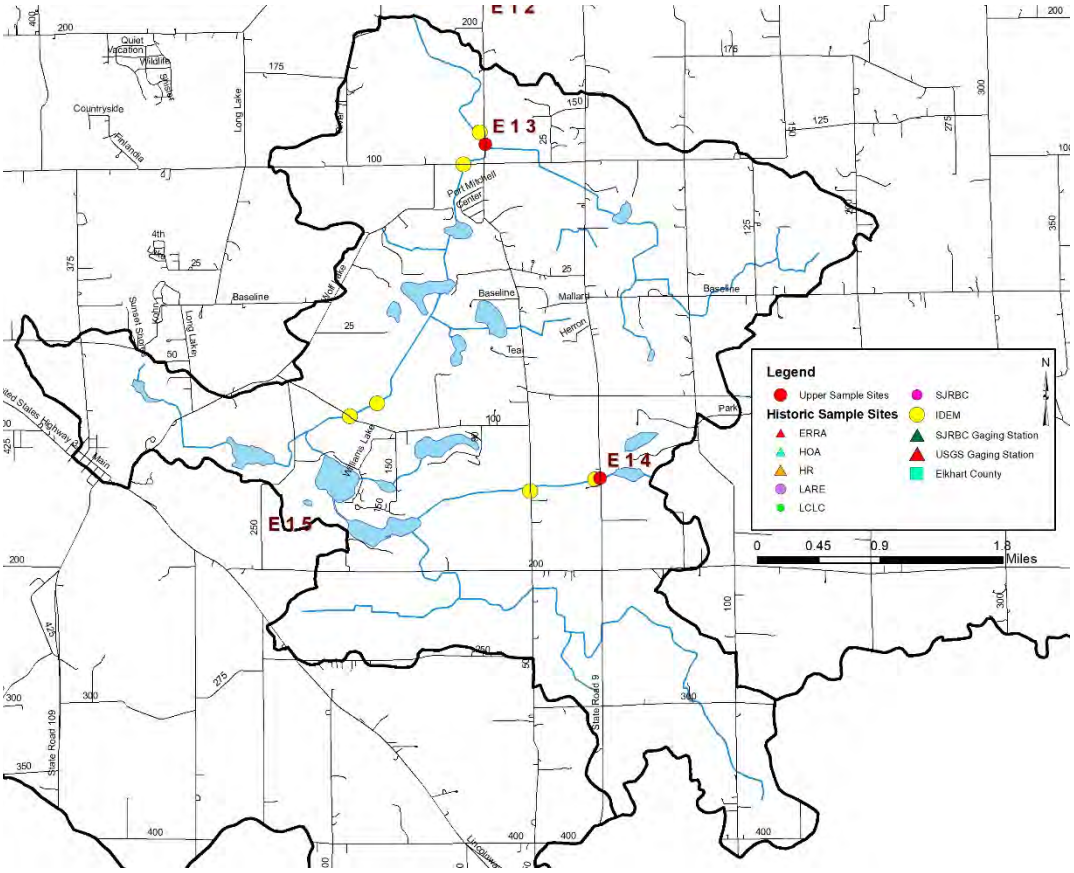


Figure 91. Locations of historic and current water quality data collection in the Muncie Lake-South Branch Elkhart River subwatershed.

Table 50 details water chemistry data collected in the Muncie Lake-South Branch Elkhart River subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm) in any samples collected. Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 9% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 20% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 50% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 83% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 33% of samples. Total suspended solids samples exceed water quality targets (15 mg/L) in 17% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 80% of samples.

Table 50. Muncie Lake-South Branch Elkhart River subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	448	604	0	20	0%
Dissolved Oxygen	3.7	13.29	3	32	9%
E. coli	5.2	435.2	2	10	20%
Ammonia-Nitrogen	BDL	0.1	0	6	0%
Nitrate-Nitrogen	BDL	1.6	3	6	50%
pH	5.14	8.17	1	32	3%
Total Kjeldahl Nitrogen	BDL	1.4	5	6	83%
Total Phosphorus	BDL	0.12	2	6	33%
Total Suspended Solids	BDL	16	1	6	17%
Turbidity	3.34	29.1	16	20	80%

BDL = Below Detection Limit

Table 51 details water quality data collected in the Muncie Lake-SB Elkhart River Subwatershed at South Branch Elkhart River stream (Site 13). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 17% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 17% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 50% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 50% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 51. Muncie Lake-South Branch Elkhart River Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
13	Min	3.41	5.46	7.31	343.40	0.30	1.17	0.05	6.40	4.00
	Median	13.34	8.94	8.49	474.80	4.25	2.72	0.05	13.80	84.00
	Max	22.97	11.61	8.88	729.20	33.60	4.90	0.12	39.20	299.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	6	12	2	6	2
	% Exceed	0%	0%	0%	0%	50%	100%	17%	50%	17%

IDEM assessed the biological community at two sites with both sites assessed for fish and macroinvertebrate communities and habitat. One site was assessed as part of the current project. Habitat scores ranged from 41 to 69 with 67% of sites scoring below the state target (51). Fish community assessments rated fair to good with all assessments meeting the aquatic life use designation. Macroinvertebrate assessments scored 34 to 40 using the multihabitat samples with 28% of sites not meeting their aquatic life use designation (Table 52).

Table 52. Muncie Lake-South Branch Elkhart River subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	41	69	2	3	67%
Fish (IBI)	45	48	0	3	0%
Macroinvertebrates (mIBI, Kick)	--	--	--	--	--
Macroinvertebrates (mIBI, Multi Habitat)	34	40	2	7	28%

4.12 Diamond Lake-South Branch Elkhart River subwatershed

The Diamond Lake-South Branch Elkhart River subwatershed sits in the center of the Upper Elkhart River Watershed and lies entirely in Noble County (Figure 92). It encompasses one 12-digit HUC watershed: 040500011605. This subwatershed drains 22,904 acres or 35.8 square miles. The Diamond Lake-South Branch Elkhart River subwatershed accounts for 9% of the total watershed area. There are 50.5 miles of stream. IDEM has classified 25.81 miles as impaired for E. coli and 3.14 miles between Upper and Lower Long lakes as impaired for nutrients. In the Diamond Lake-South Branch Elkhart River subwatershed, 12.82 miles of the South Branch of the Elkhart River is designated as an outstanding river. IDEM classified Upper and Lower Long lakes as impaired for phosphorus.

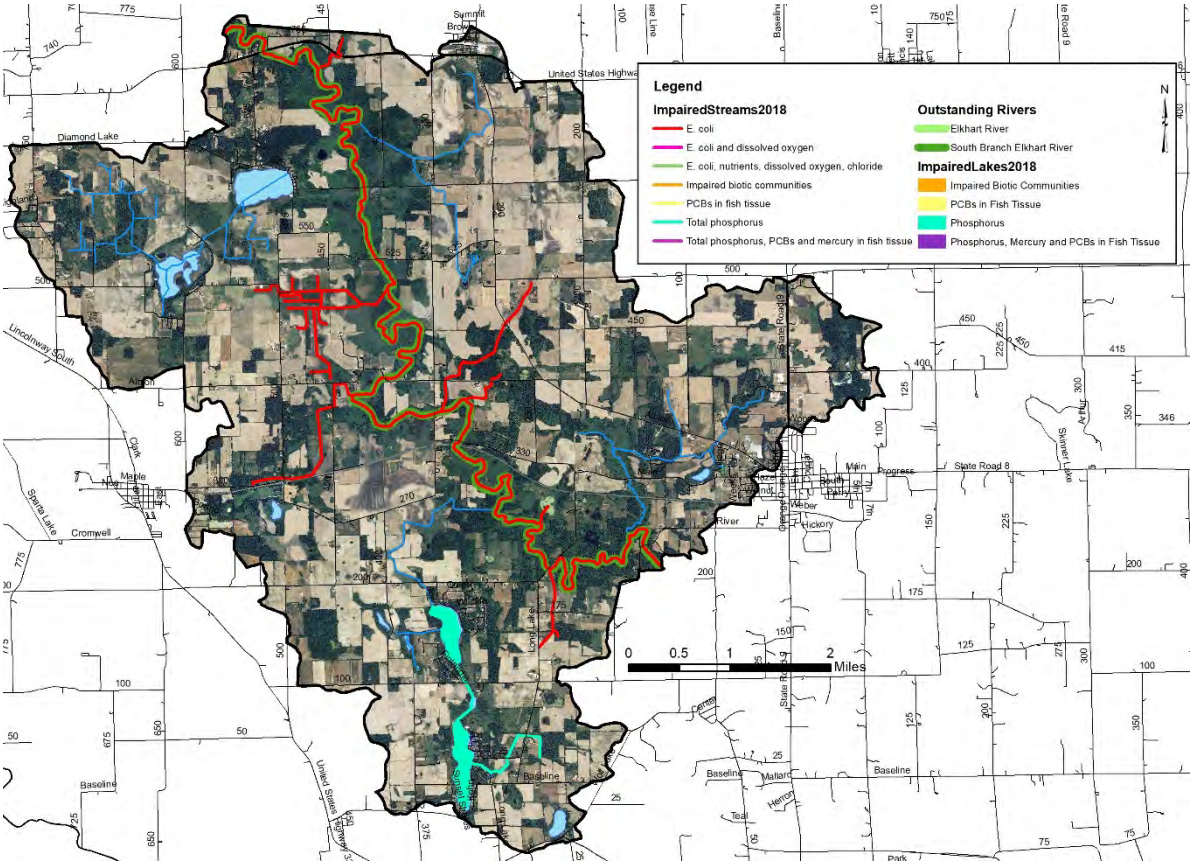


Figure 92. Diamond Lake-South Branch Elkhart River subwatershed.

4.12.1 Soils

Hydric soils cover 7,507.8 acres (33%) of the subwatershed. Wetlands currently cover 21% (4,754.4 acres) of the subwatershed. Hydric soils totals do not include land covered by lakes. Highly erodible soils cover 52% of the subwatershed (11,907 acres). Nearly the entire subwatershed, 21,710 acres (95%) is identified as very limited for septic use. The majority of the Diamond Lake-South Branch Elkhart River subwatershed is rural, indicating homes pump to an on-site wastewater system. Maintenance and inspection of these septic systems are important to ensure proper function and capacity.

4.12.2 Land Use

Agricultural land use covers more than half of the Diamond Lake-South Branch Elkhart River subwatershed with 61% (14,051.1 acres) in row crop and pasture. The next largest land use in the subwatershed is wetlands, open water and grassland, which makes up 21% (4,754.4 acres) of the Diamond Lake-South Branch Elkhart River subwatershed. Forested land use covers 2,868.7 acres (13%) of the subwatershed. Urban land use covers just 5% of the subwatershed (1,239.4 acres).

4.12.3 Point Source Water Quality Issues

There are two underground storage tanks in the Diamond Lake-South Branch Elkhart River subwatershed. There are no open dumps, superfund sites, corrective action sites or voluntary remediation sites located within the Diamond Lake-South Branch Elkhart River subwatershed (Figure 93).

4.12.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Diamond Lake-South Branch Elkhart River subwatershed. There is one active CFO and one active CAFO housing up to 8,573 pigs and cows in the subwatershed. Additionally, 57 unregulated animal operations housing more than 730 goats, sheep, horses and cows, which were identified during the windshield survey. In total, manure from these animal operations total over 49,215 tons per year, which contains almost 113,798 pounds of nitrogen, 83,797 pounds of phosphorus and 1.01E+15 colonies of E. coli. Based on windshield survey observations, livestock have access to 0.5 miles (0.9%) of Diamond Lake-South Branch Elkhart River subwatershed streams. Streambank erosion and lack of buffers are a concern in the subwatershed. Approximately 2.4 miles (5%) of insufficient stream buffers and 0.5 miles (0.9%) of streambank erosion were identified within the subwatershed as part of the windshield survey. These are likely underestimates of these issues (Figure 93).

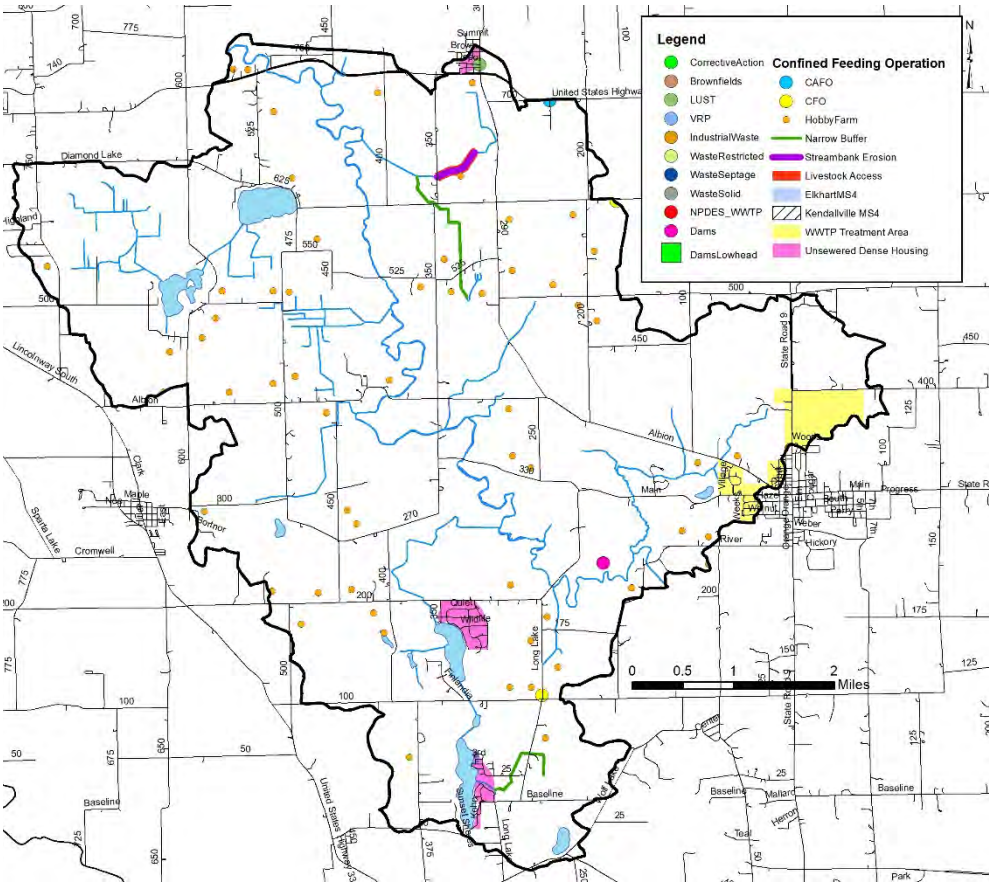


Figure 93. Potential point and non-point sources of pollution and suggested solutions in the Diamond Lake-South Branch Elkhart River subwatershed.

4.12.5 Water Quality Assessment

Waterbodies within the Diamond Lake-South Branch Elkhart River subwatershed have been sampled at 16 locations (Figure 94). Assessments include collection of water chemistry data by IDEM (10 sites), the SJRBC (3 sites), as part of the 2008 ERRA Elkhart River WMP (1 site) and as part of the LARE-funded Upper Long Lake Feasibility Study (2 sites). One site in the Diamond Lake-South Branch Elkhart River subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are located in the Diamond Lake-South Branch Elkhart River subwatershed.

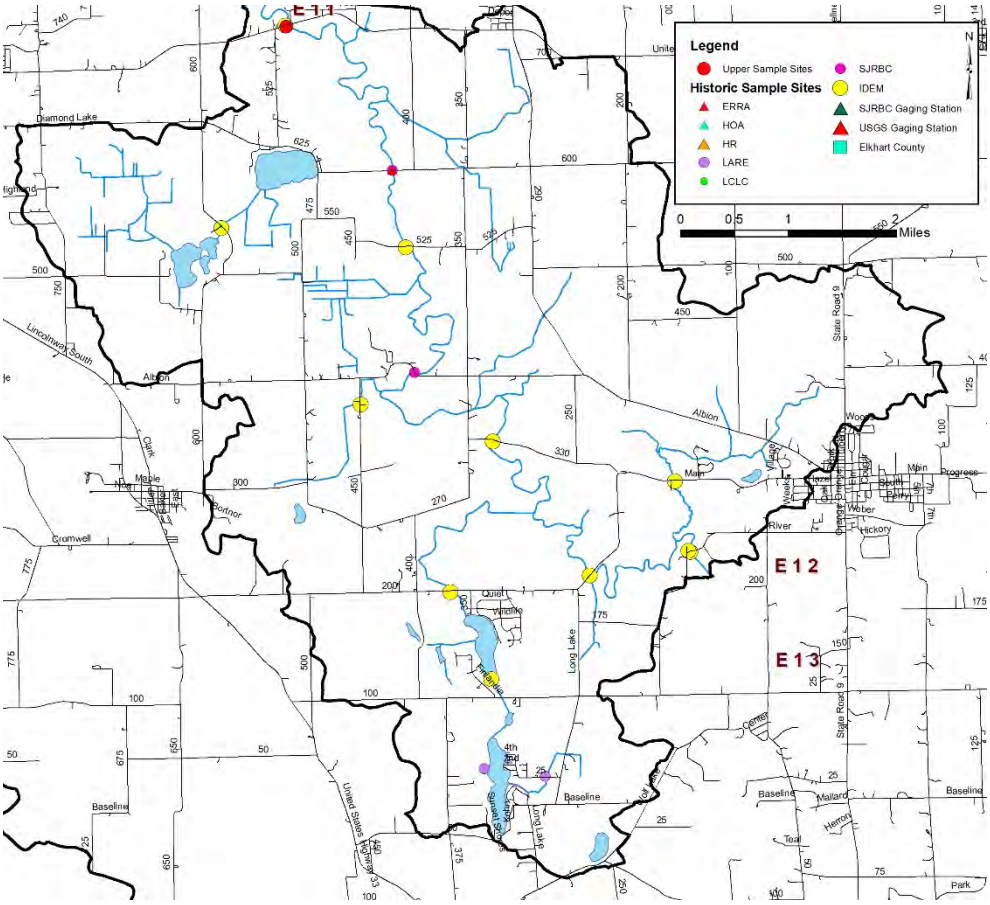


Figure 94. Locations of historic and current water quality data collection in the Diamond Lake-South Branch Elkhart River subwatershed.

Table 53 details water chemistry data for the Diamond Lake-South Branch Elkhart River subwatershed. As shown in the table, conductivity samples do not exceed state standards (1050 µmhos/cm) in any samples collected. Dissolved oxygen measures above the upper (12 mg/L) or below the lower (4 mg/L) state standard in 19% of samples. E. coli samples exceed state grab sample standards (235 col/100 ml) in 17% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 36% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 100% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 47% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 10% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 23% of samples.

Table 53. Diamond Lake-South Branch Elkhart River subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	451	683	0	43	0%
Dissolved Oxygen	2.16	12.49	14	75	19%
E. coli	0.00	1,203.31	7	41	17%
Ammonia-Nitrogen	BDL	0.11	0	2	0%
Nitrate-Nitrogen	0.1	5.2	10	28	36%
pH	6.56	8.7	0	75	0%
Total Kjeldahl Nitrogen	1	9	4	4	100%
Total Phosphorus	BDL	0.76	14	30	47%
Total Suspended Solids	BDL	34	3	29	10%
Turbidity	0	42	10	43	23%

BDL = Below Detection Limit

Table 54 details water quality data collected in the Diamond Lake-SB Elkhart River Subwatershed at South Branch Elkhart River stream (Site 11). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 17% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 42% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 0% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 25% of samples. Dissolved oxygen concentrations exceed water quality standards in 33% of samples collected from this site.

Table 54. Diamond Lake-South Branch Elkhart River Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
11	Min	4.01	0.83	7.37	407.20	0.40	1.87	0.05	2.40	5.00
	Median	13.14	4.71	8.36	518.20	1.90	2.35	0.07	4.40	27.50
	Max	21.40	10.94	8.75	701.20	20.50	4.00	0.29	8.00	1730.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		4	0	0	3	12	5	0	2
	% Exceed	0%	33%	0%	0%	25%	100%	42%	0%	17%

V3 assessed the macroinvertebrate community and habitat quality once as part of the 2008 Elkhart River WMP development. Habitat scored 55.5 rating above the state target (51). The macroinvertebrate community rated as moderately impaired scoring 2.2 meeting the site's aquatic life use designation (Table 55).

Table 55. Diamond Lake-South Branch Elkhart River subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	55.5	55.5	0	1	0%
Fish (IBI)	--	--	--	--	--
Macroinvertebrates (mIBI, Kick)	2.2	2.2	0	1	0%
Macroinvertebrates (mIBI, Multi Habitat)	--	--	--	--	--

4.13 Phillips Ditch-Stony Creek subwatershed

The Phillips Ditch-Stony Creek subwatershed is in the northern portion of the Upper Elkhart River Watershed and lies within Elkhart, LaGrange, and Noble counties (Figure 95). It encompasses one 12-digit HUC watershed: 040500011801. This subwatershed drains 13,017 acres or 20.3 square miles and accounts for 5% of the total watershed area. There are 26.4 miles of stream in the Phillips Ditch-Stony Creek subwatershed. IDEM has classified 17.1 miles of stream as impaired for E. coli.

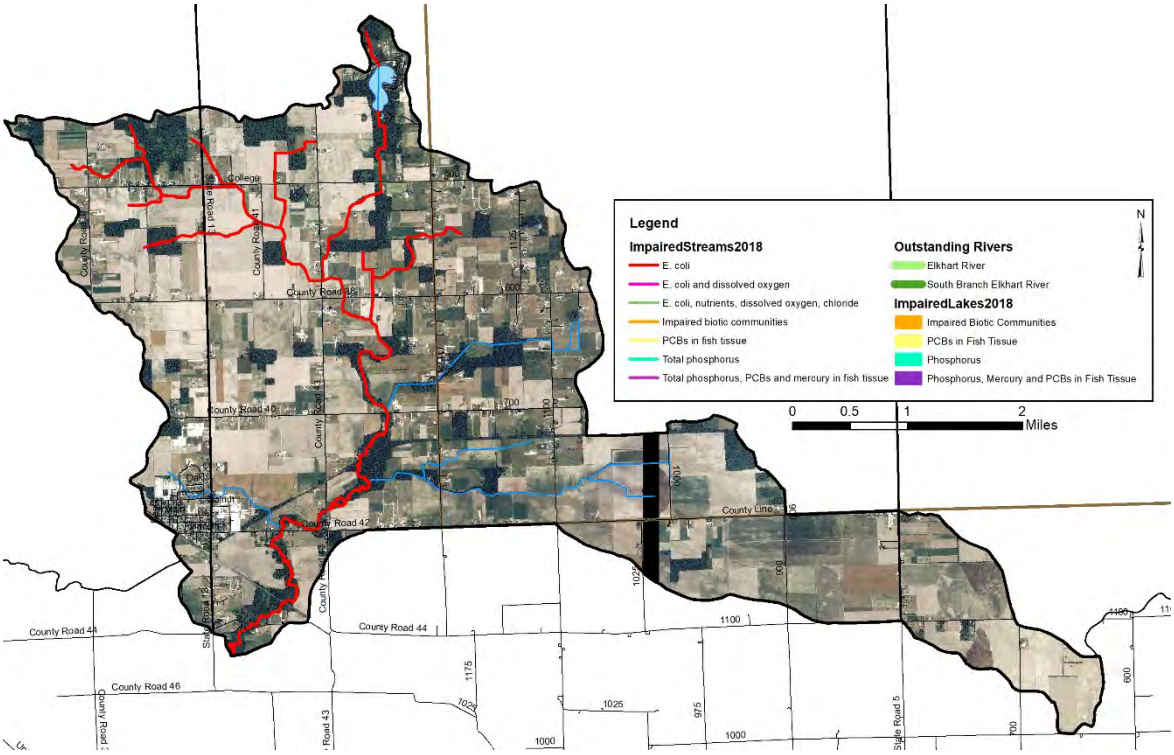


Figure 95. Phillips Ditch-Stony Creek subwatershed.

4.13.1 Soils

Hydric soils cover 2,843.1 acres or 22% of the subwatershed. Wetlands currently cover 9% (1,210.9 acres) of the subwatershed. Highly erodible soils cover 27% of the subwatershed or 3,461.1 acres. In total, 12,979.1 acres or nearly 100% of the subwatershed is identified as very limited for septic use. Maintenance and inspections of septic systems in the Phillips Ditch-Stony Creek subwatershed is important to ensure proper function and capacity.

4.13.2 Land Use

Agricultural land use dominates the Phillips Ditch-Stony Creek subwatershed with 80% (10,433.5 acres) mapped in row crops and pastureland. Wetlands, open water and grassland are the next largest use of the subwatershed, accounting for 9% (1,210.9 acres) of use. Urban land uses account for 7% (917.9 acres). Forest covers just 461.3 acres, or 4%, of the subwatershed.

4.13.3 Point Source Water Quality Issues

There are eight underground storage tanks and one NPDES-permitted facility, the Millersburg WWTP. The Millersburg WWTP was cited with a compliance issue in May of 2021 when it was found that their flow meter had not been calibrated since November 2019. Normal operations require flow meter calibration every 12 months. There are no open dumps, superfund sites, corrective action sites or voluntary remediation sites located within the Phillips Ditch-Stony Creek subwatershed (Figure 96).

4.13.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land uses in the Phillips Ditch-Stony Creek subwatershed. There are five active CFOs and two CAFOs housing up to 68,456 cows, chickens, horses, bison and pigs in the subwatershed. Additionally, a number of small animal operations and pastures are also present. Surveyors observed 158 unregulated animal operations housing more than 2,084 cows, goats, horses and sheep during the windshield survey (Figure 96). Animals produce more than 119,367 tons of manure annually which contains more than 1,569,535 pounds of nitrogen, 1,248,895 pounds of phosphorus and more than 1.05E+19 colonies of E. coli. Based on windshield survey observations, livestock have access to 1.4 miles (5%) of the Phillips Ditch-Stony Creek subwatershed streams. Streambank erosion and lack of buffers are a concern in the subwatershed. Approximately 1.4 miles (5%) of insufficient stream buffers and 1.8 miles (7%) of streambank erosion were identified within the Phillips Ditch-Stony Creek subwatershed (Figure 96).

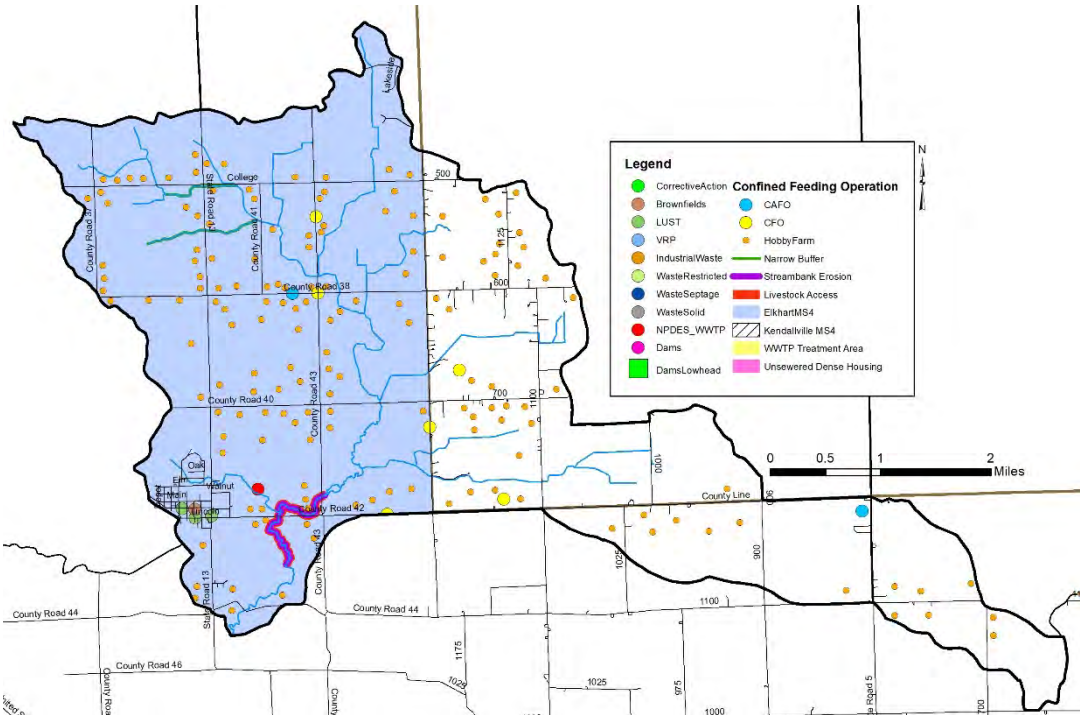


Figure 96. Potential point and non-point sources of pollution and suggested solutions in the Phillips Ditch-Stony Creek subwatershed.

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4.13.5 Water Quality Assessment

Waterbodies within the Phillips Ditch-Stony Creek subwatershed have been sampled at 3 locations by IDEM (Figure 97). One site in the Phillips Ditch-Stony Creek subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are located in the Phillips Ditch-Stony Creek subwatershed.

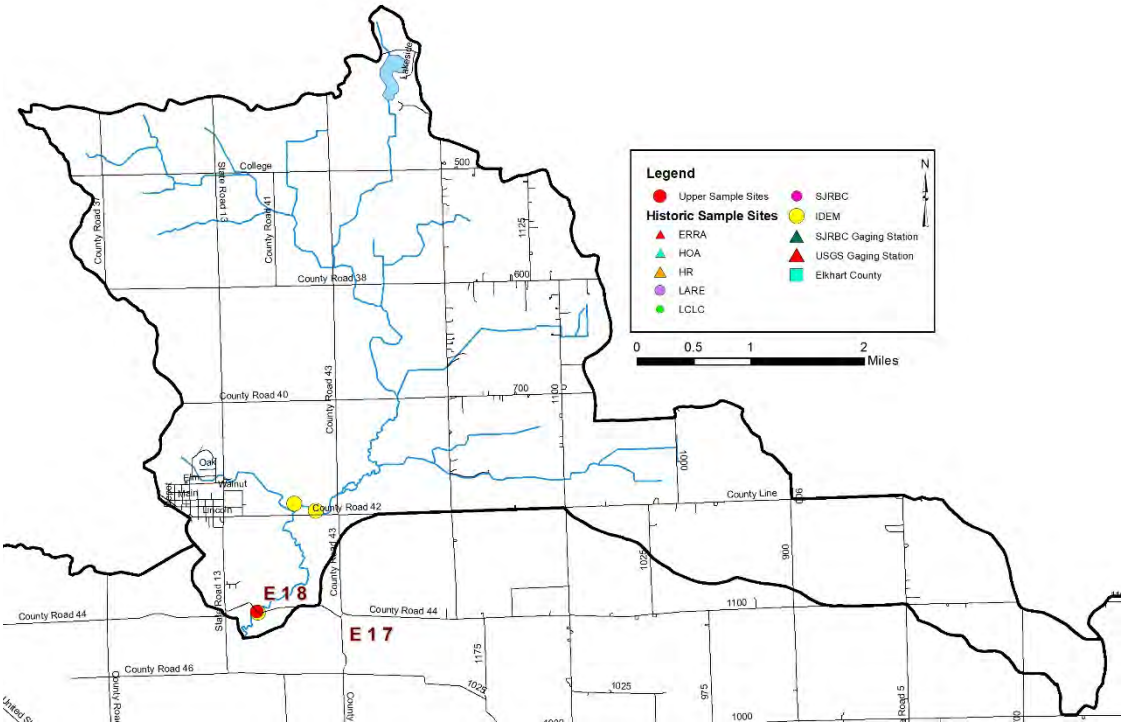

Figure 97. Locations of historic and current water quality data collection in the Phillips Ditch-Stony Creek subwatershed.

Table 56 details water chemistry data collected in the Phillips Ditch-Stoney Creek subwatershed. As shown in the table, conductivity samples exceeded state standards (1050 µmhos/cm) in 12% of samples collected. Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 16% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 60% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 83% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57mg/L) in 50% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 67% of samples. Total suspended solids no not exceed water quality targets (15 mg/L), while turbidity levels exceed water quality targets (5.7 NTU) in 52% of samples.

Table 56. Phillips Ditch-Stony Creek subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	358	1,484	3	25	12%
Dissolved Oxygen	5.93	18.07	4	25	16%
E. coli	BDL	15,531	9	15	60%
Ammonia-Nitrogen	BDL	0.11	0	6	0%
Nitrate-Nitrogen	BDL	14.2	5	6	83%
pH	7.06	9.08	1	25	4%
Total Kjeldahl Nitrogen	BDL	0.78	3	6	50%
Total Phosphorus	0.052	0.1	4	6	67%
Total Suspended Solids	BDL	11	0	6	0%
Turbidity	2	1,000	13	25	52%

BDL = Below Detection Limit

Table 57 details water quality data collected in the Philips Ditch-Stony Creek Subwatershed at Stony Creek Outlet stream (Site 18). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 58% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 92% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 83% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 0% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 17% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 57. Philips Ditch-Stony Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (mg/L)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
18	Min	6.94	5.23	7.45	362.80	0.50	0.50	0.05	1.20	28.00
	Median	13.07	8.69	8.45	657.30	2.30	2.80	0.18	3.60	504.50
	Max	23.01	11.21	8.75	777.00	25.80	4.61	0.63	8.00	1200.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	2	11	10	0	7
	% Exceed	0%	0%	0%	0%	17%	92%	83%	0%	58%

IDEM assessed the biological community at two sites including assessing macroinvertebrates, fish and habitat at both sites. One site was assessed as part of the current project. Habitat scores ranged from 46 to 63 with 33% of sites scoring below the state target (51). Fish community assessments rated good to excellent with all assessments meeting the aquatic life use designation. Macroinvertebrate assessments scored 26 to 42 using the multihabitat samples with 67% of samples not meeting their aquatic life use designation (Table 58).

Table 58. Philips Ditch-Stony Creek subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	46	63	1	3	33%
Fish (IBI)	54	68	0	3	0%
Macroinvertebrates (mIBI, Kick)	--	--	--	--	--
Macroinvertebrates (mIBI, Multi Habitat)	26	42	4	6	67%

4.14 Indian Lake-Elkhart River subwatershed

The Indian Lake-Elkhart River subwatershed lies within Noble and Elkhart counties (Figure 98). It encompasses one 12-digit HUC watershed: 040500011802. This subwatershed drains 20,182 acres or 31.5 square miles and accounts for 8% of the total watershed area. There are 31.7 miles of stream. IDEM has classified 20.9 miles of stream as impaired for E. coli. In the Indian Lake-Elkhart River subwatershed, 12.47 miles of the Elkhart River is designated as an outstanding river.

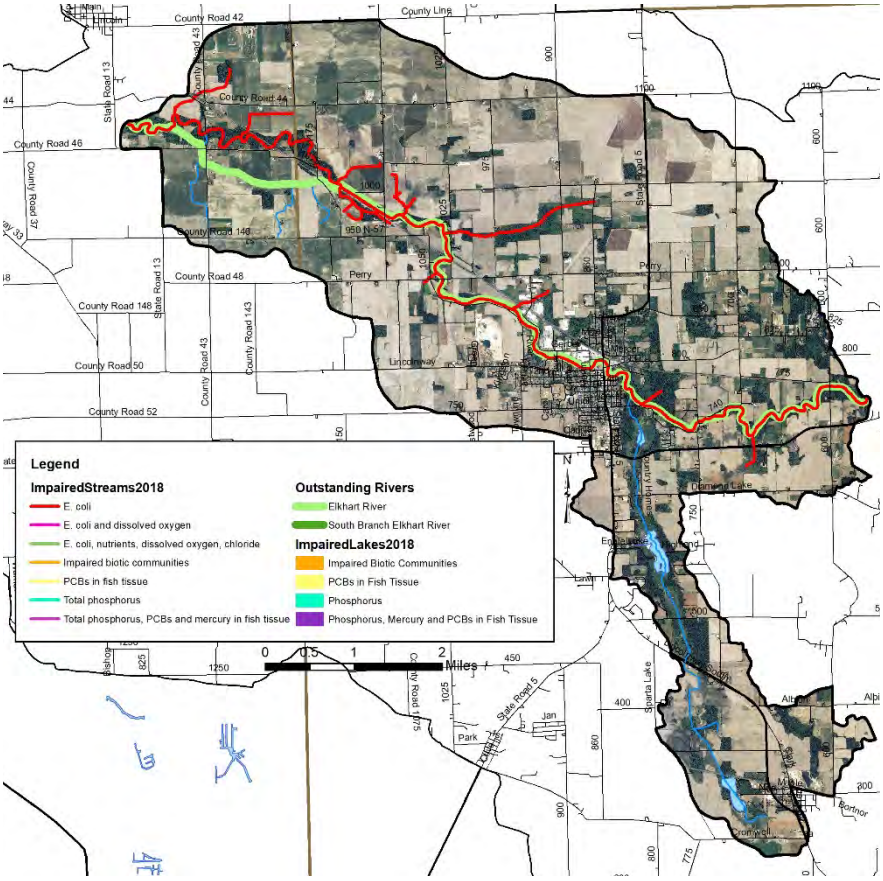

Figure 98. Indian Lake-Elkhart River subwatershed.

4.14.1 Soils

Hydric soils cover 4,431 acres (22%) of the subwatershed. Wetlands currently cover 11% (2,280.7 acres) of the subwatershed. Highly erodible soils cover over a third of the subwatershed (37%). In total, 19,780.5 miles (98%) of the subwatershed are identified as very limited for septic use. The majority of the

subwatershed is rural indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, the majority of the subwatershed is very limited. Therefore, maintenance and inspections of septic systems in the area are important to ensure proper function and capacity.

4.14.2 Land Use

Agricultural land use covers the majority of the Indian Lake-Elkhart River subwatershed with 75% (15,0881 acres) in row crop and pasture. Wetlands, open water and grassland cover 2,280.7 acres, or 11%, of the subwatershed. Urban land use makes up the next largest use of land with 2,107.3 acres, or 10% with the town of Ligonier sitting in this subwatershed. Lastly, forested land use makes up just 4% (715.3 acres) of the subwatershed.

4.14.3 Point Source Water Quality Issues

There are 21 underground storage tank sites (Figure 99) in the subwatershed, 13 industrial waste facilities and one NPDES-permitted site (Ligonier WWTP). There are no open dumps, brownfields, corrective action sites or voluntary remediation sites located within the Indian Lake-Elkhart River subwatershed (Figure 99).

4.14.4 Non-Point Source Water Quality Issues

Agricultural land use is the predominant land use in the Indian Lake-Elkhart River subwatershed. During the windshield survey, 75 unregulated animal operations housing more than 579 cows, horses, goats and sheep were identified. Based on observations during the windshield survey, livestock do not have access to Indian Lake-Elkhart River streams. There are three active CFOs and one active CAFOs located within the Indian Lake-Elkhart River subwatershed which are permitted to house 62,166 cows, chickens, horses and pigs. In total, manure from small animal operations and CFOs total over 117,999 tons per year, which contains almost 1,331,535 pounds of nitrogen, 1,059,893 pounds of phosphorus and 8.38E+18 colonies of E. coli. Streambank erosion is a concern in the subwatershed. Approximately 1.5 miles (5%) of streambank erosion was identified within the subwatershed (Figure 99).

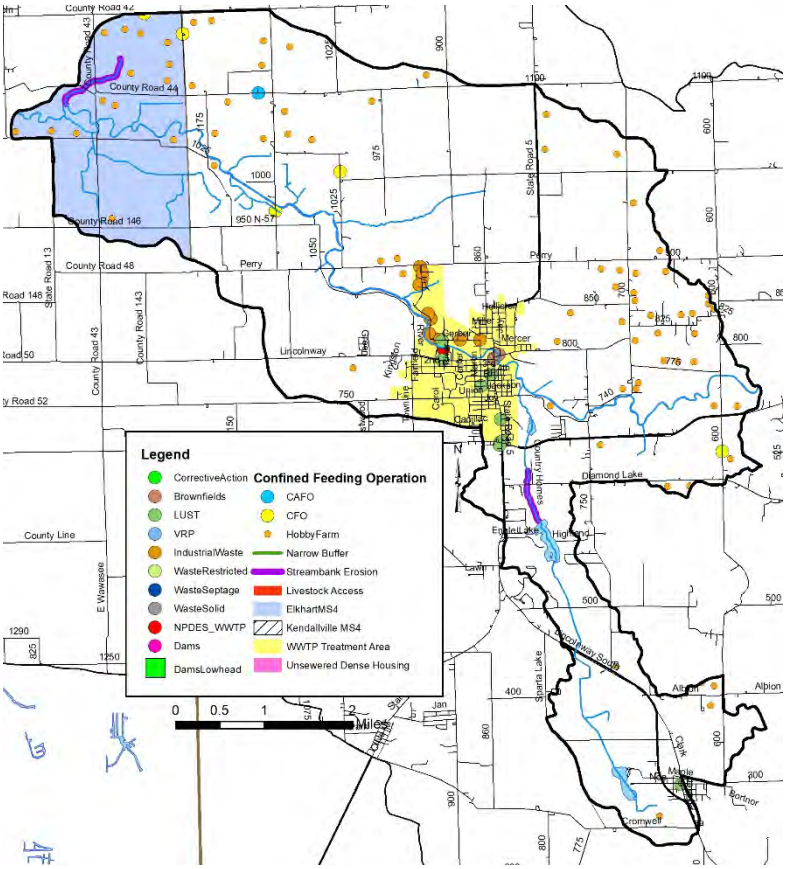

Figure 99. Potential point and non-point sources of pollution and suggested solutions in the Indian Lake-Elkhart River subwatershed.

4.14.5 Water Quality Assessment

Waterbodies within the Indian Lake-Elkhart River subwatershed have been sampled at nine locations (Figure 100). Assessments include collection of water chemistry data by IDEM (6 sites), by SJRBC (2 sites) and by Elkhart County (1 site). One site in the Indian Lake-Elkhart River subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are located in the Indian Lake-Elkhart River subwatershed.

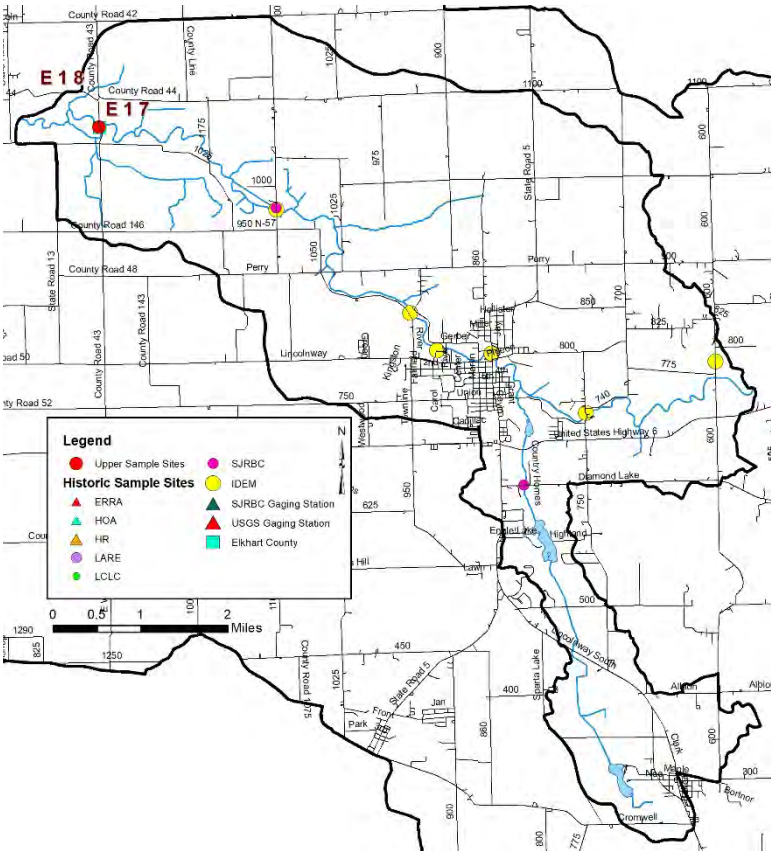

Figure 100. Locations of historic and current water quality data collection in the Indian Lake-Elkhart River subwatershed.

Table 59Table 56 details water chemistry data collected in the Indian Lake-Elkhart River subwatershed. As shown in the table, conductivity samples exceed state standards (1050 µmhos/cm) in 4% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 28% of samples collected. Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 5% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 59% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57mg/L) in 50% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 86% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 6% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 48% of samples.

Table 59. Indian Lake-Elkhart River subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	78	1,360	10	248	4%
Dissolved Oxygen	3.94	14.79	14	256	5%
E. coli	5	7,000	66	237	28%
Ammonia-Nitrogen	BDL	0.61	3	5	60%
Nitrate-Nitrogen	0.023	14.4	127	215	59%
pH	6.56	8.69	0	256	0%
Total Kjeldahl Nitrogen	BDL	1.7	3	6	50%
Total Phosphorus	0.01	9.48	187	218	86%
Total Suspended Solids	BDL	40	6	100	6%
Turbidity	1	74.3	29	60	48%

BDL = Below Detection Limit

Table 60details water quality data collected in the Indian Lake-Elkhart River Subwatershed at Elkhart River stream (Site 17). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 8% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 0% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 25% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 8% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 60. Indian Lake-Elkhart River Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (mg/L)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
17	Min	**4.42**	**5.07**	**7.63**	**323.20**	**1**	**1.72**	**0.05**	**1.20**	**40.00**
	Median	13.50	8.24	8.47	574.45	1.80	3.29	0.06	4.40	85.50
	Max	22.50	11.16	8.73	762.20	24.70	4.30	0.38	12.40	548.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	1	12	3	0	1
	% Exceed	0%	0%	0%	0%	8%	100%	25%	0%	8%

IDEM assessed the biological community at two sites including assessments for macroinvertebrates, fish and habitat at both sites. One site was assessed as part of the current project. Habitat scores ranged from 71 to 72 with 0% of sites scoring below the state target (51). Fish community assessments rated excellent with all assessments meeting the aquatic life use designation. Macroinvertebrate assessments rated slightly impaired using the kick sampling method with all sites meeting their aquatic life use designation and scoring 34 to 56 using the multihabitat samples with 25% of samples not meeting their aquatic life use designation (Table 61).

Table 61. Indian Lake-Elkhart River subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	71	73	0	3	0%
Fish (IBI)	67	72	0	2	0%
Macroinvertebrates (mIBI, Kick)	4.2	4.2	0	1	0%
Macroinvertebrates (mIBI, Multi Habitat)	34	56	1	4	25%

4.15 Headwaters Solomon Creek subwatershed

The Headwaters Solomon Creek subwatershed sits in the western half of the Upper Elkhart River Watershed and lies in Noble, Elkhart, and Kosciusko counties (Figure 101). It encompasses one 12-digit HUC watershed: 040500011803. This subwatershed drains 15,158 acres or 23.7 square miles. The Headwaters Solomon Creek subwatershed accounts for 6% of the total watershed area. There are 22.7 miles of stream. IDEM has classified 18.2 miles as impaired for E. coli.

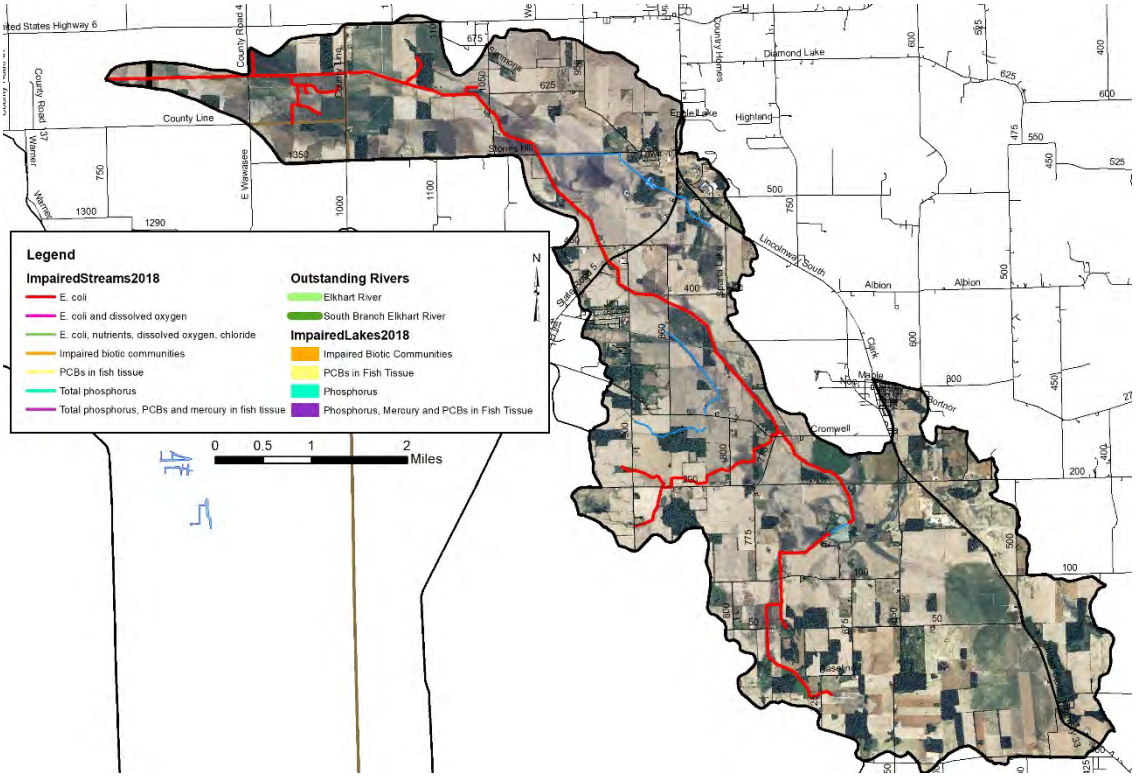

Figure 101. Headwaters Solomon Creek subwatershed.

4.15.1 Soils

Hydric soils cover 4,712.4 acres (31%) of the subwatershed. Currently, wetlands cover 5% (700.7 acres) of the subwatershed. Highly erodible soils cover 41% of the subwatershed (6,232.9 acres). Nearly all subwatershed soils, 14,896.8 acres (98%) are identified as very limited for septic use. The majority of the Headwaters Solomon Creek subwatershed is rural, indicating homes pump to an on-site wastewater system. Maintenance and inspection of these septic systems are important to ensure proper function and capacity.

4.15.2 Land Use

Agricultural land use makes up a majority of the Headwaters Solomon Creek subwatershed with 84% (12,756.9 acres) in row crop and pasture. The next largest land use in the subwatershed is forest, which covers 6% (895.7 acres) of the Headwaters Solomon Creek subwatershed. Urban land use makes up 812 acres (5%) of the subwatershed. Wetland, open water and grassland also cover 5% of the subwatershed (700.7 acres).

4.15.3 Point Source Water Quality Issues

There are two underground storage tanks, one NPDES facility (Cromwell WWTP) and one waste facility in the Headwaters Solomon Creek subwatershed. There are no open dumps, superfund sites, corrective action sites or voluntary remediation sites are located within the Headwaters Solomon Creek subwatershed (Figure 102).

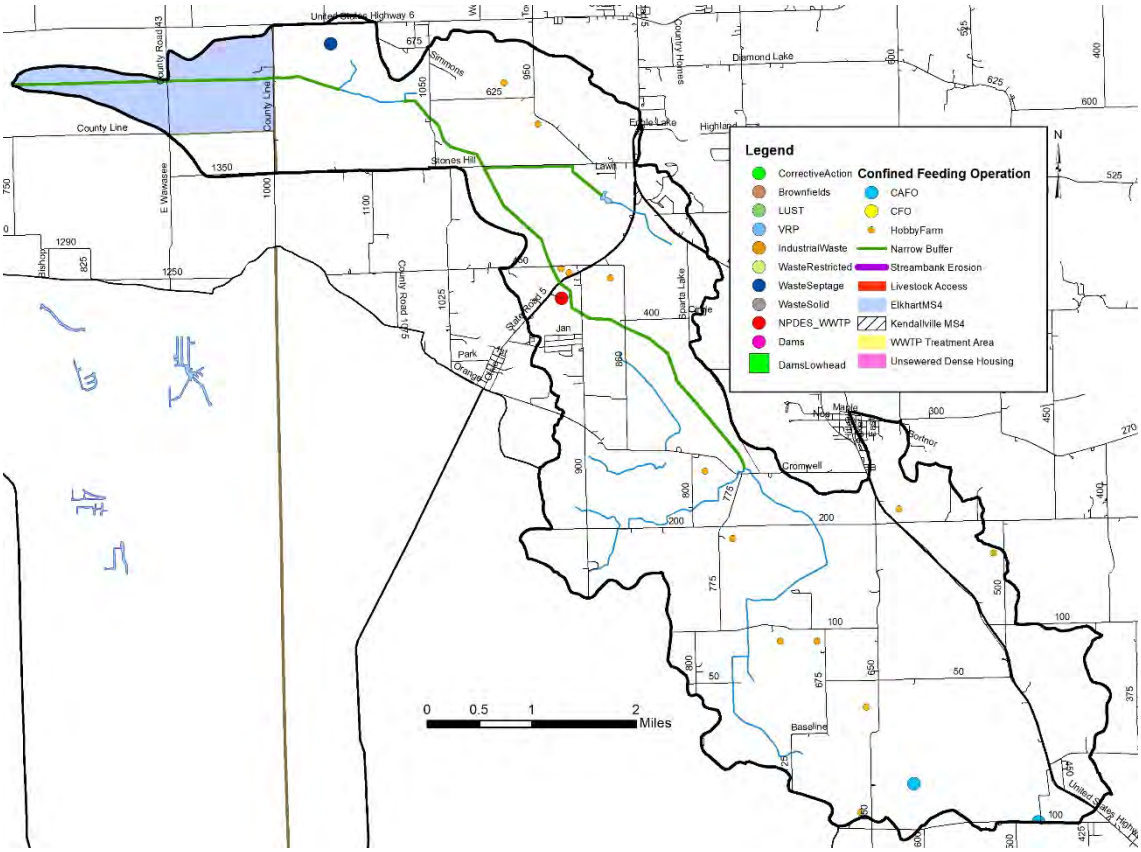

Figure 102. Potential point and non-point sources of pollution and suggested solutions in the Headwaters Solomon Creek subwatershed.

4.15.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Headwaters Solomon Creek subwatershed. There are two active CAFOs housing up to 20,305 pigs and cows in the subwatershed. Additionally, 13 unregulated animal operations housing more than 181 horses and cows which were identified during the windshield survey. In total, manure from these animal operations total over 131,036 tons per year, which contains almost 246,988 pounds of nitrogen, 179,433 pounds of phosphorus and 1.64E+15 colonies of E. coli. Based on windshield survey observations, livestock do not have access to Headwaters Solomon

Creek subwatershed streams. Lack of buffers are a concern in the subwatershed. Approximately 9.5 miles (42%) of insufficient stream buffers were identified within the subwatershed (Figure 102).

4.15.5 Water Quality Assessment

Waterbodies within the Headwaters Solomon Creek subwatershed have been sampled at five locations (Figure 103). Assessments include collection of water chemistry data by IDEM (2 sites), by the SJRBC (2 sites) and as part of the LARE-funded Whetten Ditch, Solomon Creek, Dry Run Diagnostic study (1 site). One site in the Headwaters Solomon Creek subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are located in the Headwaters Solomon Creek subwatershed.

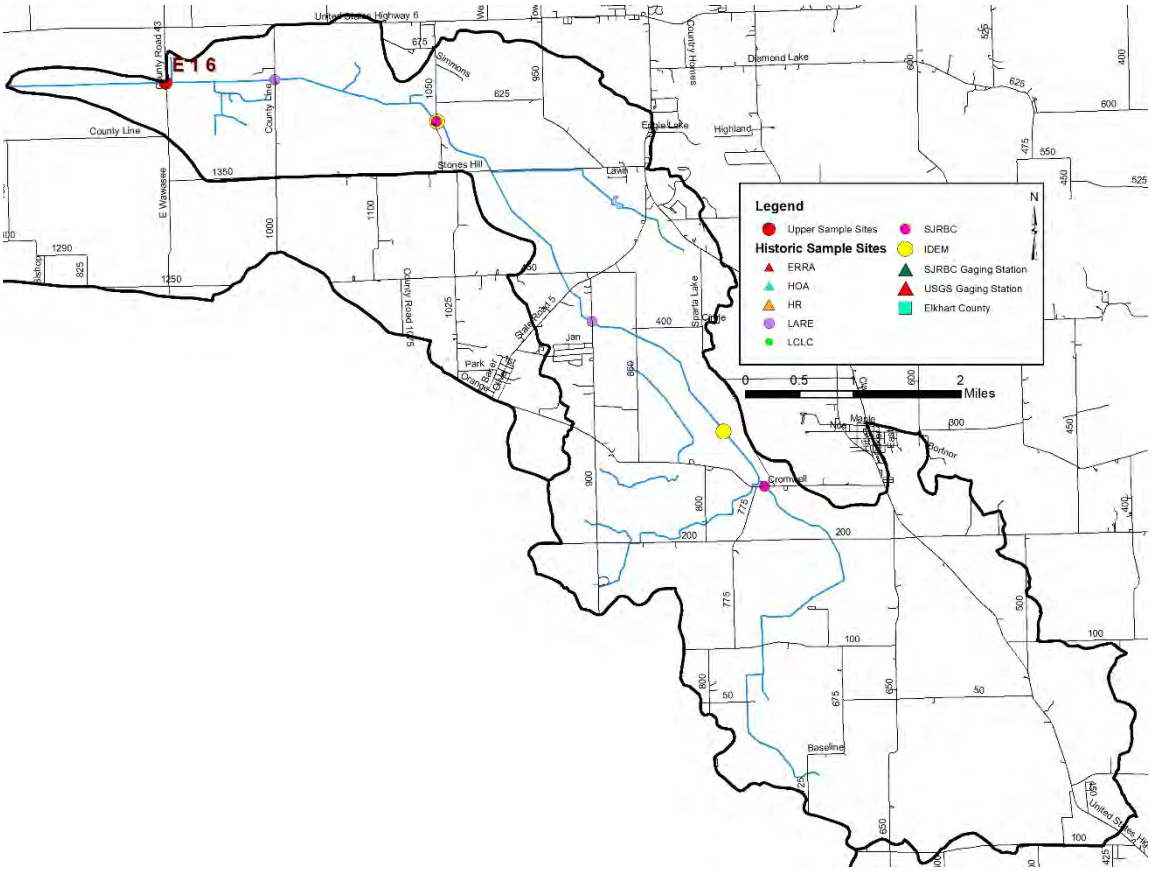

Figure 103. Locations of historic and current water quality data collection in the Headwaters Solomon Creek subwatershed.

Table 62 details water chemistry data collected in the Headwaters Solomon Creek subwatershed. As shown in the table, conductivity samples exceed state standards (1050 µmhos/cm) in 2% of samples collected. Dissolved oxygen measures above the upper (12 mg/L) or below the lower (4 mg/L) state standards in 22% of samples. E. coli samples exceed state grab sample standards (235 col/100 ml) in 33% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 34% of samples. Total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 38% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 31% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 19% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 44% of samples.

Table 62. Headwaters Solomon Creek subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	524	1,950	1	50	2%
Dissolved Oxygen	5.5	14.97	11	50	22%
E. coli	38.4	2,419.6	12	36	33%
Ammonia-Nitrogen	BDL	0.1	0	6	0%
Nitrate-Nitrogen	BDL	1.9	11	32	34%
Dissolved Phosphorus	0.01	0.05	1	2	50%
pH	6.97	8.24	0	50	0%
Total Kjeldahl Nitrogen	BDL	1.2	3	8	38%
Total Phosphorus	BDL	0.18	10	32	31%
Total Suspended Solids	BDL	28	6	32	19%
Turbidity	1	31.7	22	50	44%

BDL = Below Detection Limit

Table 63 details water quality data collected in the Headwaters Solomon Ditch Subwatershed at Solomon Creek stream (Site 16). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 75% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 0% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 50% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 58% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 63. Headwaters Solomon Ditch Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm)	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
16	Min	6.32	5.19	7.05	427.10	1.10	2.06	0.05	2.80	46.00
	Median	13.40	6.73	8.30	751.30	6.80	3.43	0.05	14.40	299.50
	Max	21.44	11.02	8.53	794.60	15.49	5.30	0.06	38.80	613.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	7	12	0	6	9
	% Exceed	0%	0%	0%	0%	58%	100%	0%	50%	75%

IDEM assessed the biological community at three sites including three sites assessed for macroinvertebrates, two sites assessed for fish and one site assessed for habitat. JFNew assessed one site for macroinvertebrates and habitat. One site was assessed as part of the current project. Habitat scores ranged from 31 to 41 with 100% of sites scoring below the state target (51). Fish community assessments rated poor to fair with 50% of assessments meeting the aquatic life use designation. Macroinvertebrate assessments rated moderately impaired using the kick sampling method with all sites meeting their aquatic life use designation and scoring 18 to 30 using the multihabitat samples with 100% of sites not meeting their aquatic life use designation (Table 64).

Table 64. Headwaters Solomon Creek subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	28	41	3	3	100%
Fish (IBI)	26	41	1	2	50%
Macroinvertebrates (mIBI, Kick)	4	4	0	1	0%
Macroinvertebrates (mIBI, Multi Habitat)	18	31	4	4	100%

4.16 Hire Ditch-Solomon Creek subwatershed

The Hire Ditch-Solomon Creek forms part of the west border of the watershed and lies within Elkhart, Kosciusko, and Noble counties (Figure 104). It encompasses one 12-digit HUC watershed: 040500011804. This subwatershed drains 14,189 acres or 22.2 square miles and accounts for 5% of the total watershed area. There are 31.5 miles of stream. IDEM has classified 17.9 miles of stream as impaired for E. coli and 10.2 miles of stream as impaired for nutrients, E. coli, dissolved oxygen and chloride.

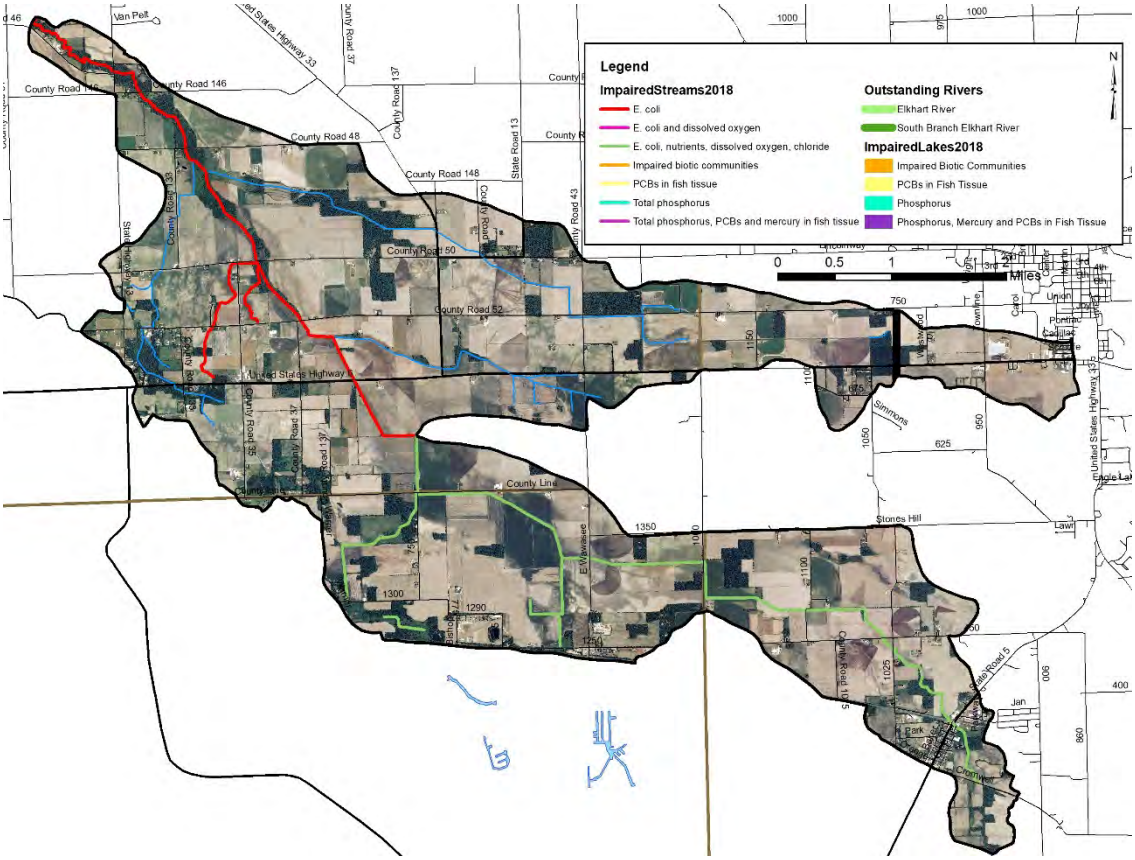

Figure 104. Hire Ditch-Solomon Creek subwatershed.

4.16.1 Soils

Hydric soils cover 5,254.6 acres or 37% of the subwatershed; wetlands currently cover 8% (1,099.9 acres) of the subwatershed. Highly erodible soils are found throughout the subwatershed covering 2,844.4 acres or 20% of the subwatershed. Nearly all of the subwatershed, 100% (14,114.6 acres), has soils which are very limited for septic use.

4.16.2 Land Use

Agricultural land use, including row crop and pasture, dominates the Hire Ditch-Solomon Creek subwatershed (82% or 11,661.3 acres). Wetlands, open water and grassland is the next largest use of the subwatershed, but only account for 8% (1,099.9 acres) of use. Urban land covers 7% (937.3 acres) of the subwatershed. Forested land uses cover just 497.3 acres, or 4%, of the subwatershed.

4.16.3 Point Source Water Quality Issues

There are two underground storage tanks listed in this watershed, one industrial waste site and one NPDES-permitted facility: the Turkey Creek WWTP. No open dumps, superfund sites, corrective action sites or voluntary remediation sites are located within the Hire Ditch-Solomon Creek subwatershed (Figure 105).

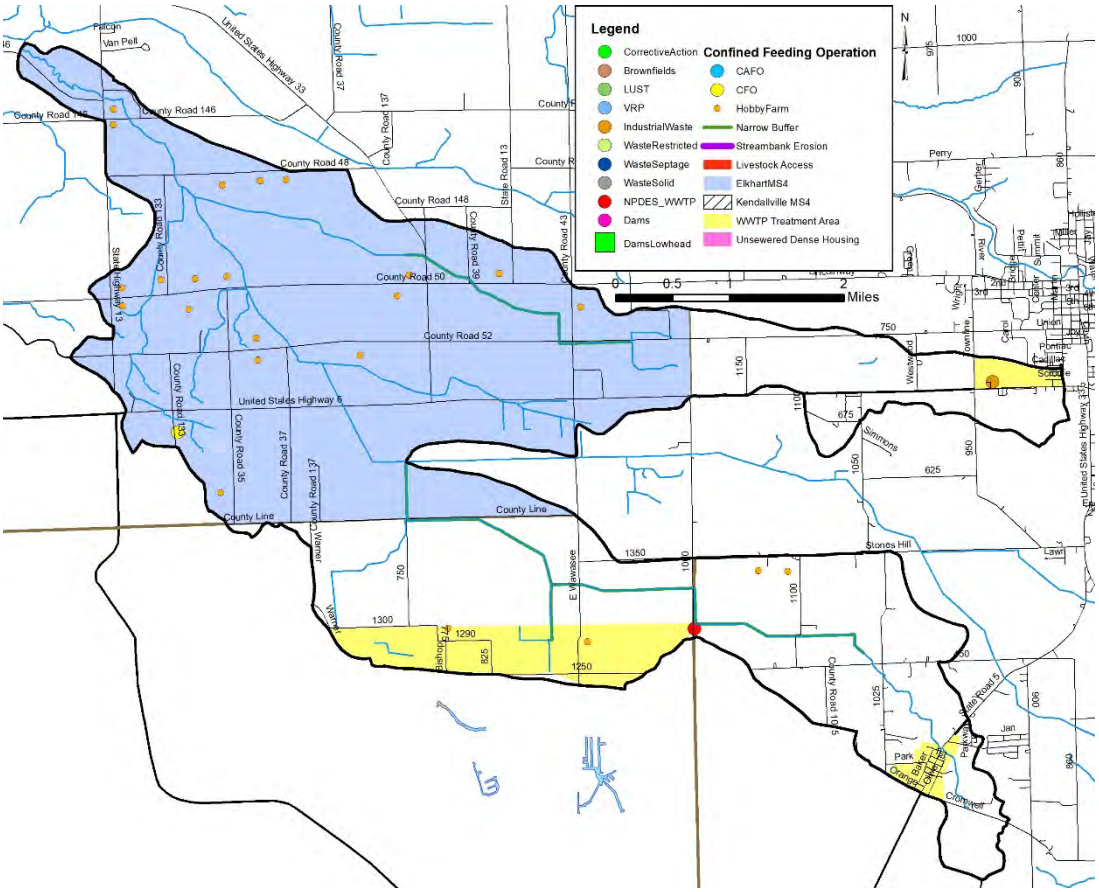

Figure 105. Potential point and non-point sources of pollution and suggested solutions in the Hire Ditch-Solomon Creek subwatershed.

4.16.4 Non-Point Source Water Quality Issues

Agricultural land uses are the predominant land use in the Hire Ditch-Solomon Creek subwatershed. As a result, various small animal operations and pastures are also present (Figure 105). There are 23 unregulated animal operations housing more than 133 cows, goats and horses which were identified during the windshield survey. There is one active CFO in the subwatershed, which houses up to 2,280 pigs. In total, manure produced from small animal operations and the CFO total more than 11,951 tons per year, which contains almost 29,436 pounds of nitrogen, 21,906 pounds of phosphorus and 5.97E+13

colonies of E. coli. Lack of buffers are a concern in the subwatershed; however, livestock do not have access to the Hire Ditch-Solomon Creek subwatershed streams based on observations during the windshield survey. Approximately 8.1 miles (26%) of insufficient stream buffers were identified within the subwatershed (Figure 105).

4.16.5 Water Quality Assessment

Waterbodies within the Hire Ditch-Solomon Creek subwatershed have been sampled at 14 locations (Figure 106). Assessments include collection of water chemistry data by IDEM (2 sites), by the SJRBC (1 site), by Elkhart County (2 sites), as part of the LARE-funded Whetten Ditch, Solomon Creek, Dry Run Diagnostic Study (JFNew, 7 sites) and by Hoosier Riverwatch volunteers (2 sites). One site in the Hire Ditch-Solomon Creek subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are located in the Hire Ditch-Solomon Creek subwatershed.

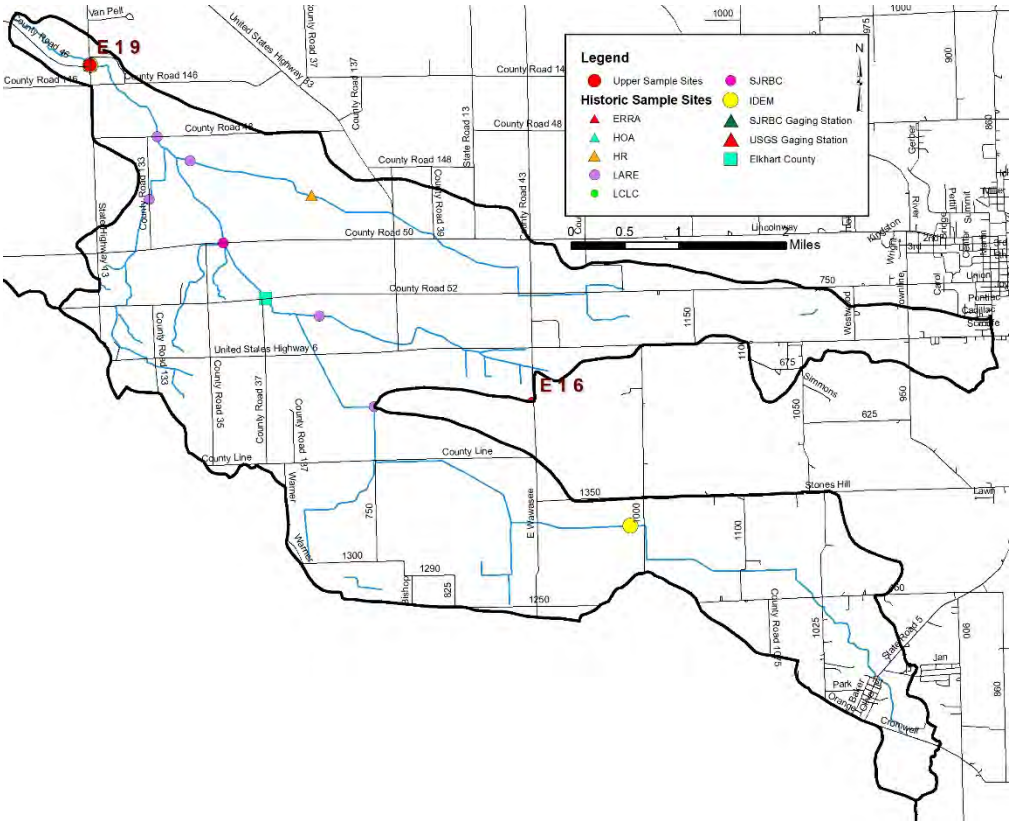

Figure 106. Locations of historic and current water quality data collection in the Hire Ditch-Solomon Creek subwatershed.

Table 65 details water chemistry data collected in the Hire Ditch-Solomon Creek subwatershed. As shown in the table, conductivity exceed state standards (1050 µmhos/cm) in 11% of samples collected. Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 6% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 42% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 88% of samples, while total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 41% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 60% of samples. Total suspended solids concentrations exceed water quality

targets (15 mg/L) in 12% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 38% of samples.

Table 65. Hire Ditch-Solomon Creek subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	150	2,720	15	136	11%
Dissolved Oxygen	3.74	14.94	8	138	6%
E. coli	30	9,400	63	149	42%
Ammonia-Nitrogen	BDL	0.33	1	3	33%
Nitrate-Nitrogen	0.15	24	108	123	88%
Dissolved Phosphorus	0	0.079	8	15	53%
pH	7.2	9.13	2	137	1%
Total Kjeldahl Nitrogen	BDL	2.9	7	17	41%
Total Phosphorus	0.03	7.68	73	121	60%
Total Suspended Solids	BDL	91	9	74	12%
Turbidity	0.55	290	24	63	38%

BDL = Below Detection Limit

Table 66 details water quality data collected in the Hire Ditch-Solomon Creek Subwatershed at Solomon Creek Outlet stream (Site 19). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 50% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 8% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 17% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 33% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 66. Hire Ditch-Solomon Creek Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
19	Min	5.93	7.19	7.34	611.00	1.20	1.99	0.05	1.60	82.00
	Median	13.62	8.31	8.36	759.65	4.15	3.53	0.05	7.40	224.50
	Max	18.94	11.10	8.65	951.10	16.80	6.20	0.13	24.00	921.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	4	12	1	2	6
	% Exceed	0%	0%	0%	0%	33%	100%	8%	17%	50%

IDEM assessed the biological community at two sites while JFNew assessed the biological community at seven sites. Assessments included nine sites assessed for macroinvertebrates, one site assessed for fish and nine sites assessed for habitat. One site was assessed as part of the current project. Habitat scores ranged from 25.5 to 63 with 70% of sites scoring below the state target (51). Fish community assessments rated fair with all assessments meeting the aquatic life use designation. Macroinvertebrate assessments rated severely impaired to not impaired using the kick sampling method with 77% sites meeting their aquatic life use designation and scoring 20 to 36 using the multihabitat samples with 67% of sites not meeting their aquatic life use designation (Table 67).

Table 67. Hire Ditch-Solomon Creek subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	25.5	63	7	10	70%
Fish (IBI)	40	40	0	1	0%
Macroinvertebrates (mIBI, Kick)	1	6	2	9	23%
Macroinvertebrates (mIBI, Multi Habitat)	20	36	2	3	67%

4.17 Whetten Ditch-Elkhart River subwatershed

The Whetten Ditch-Elkhart River subwatershed forms the northwestern tip of the Upper Elkhart River Watershed and sits in Elkhart and Noble counties (Figure 107). It encompasses one 12-digit HUC watershed: 040500011805. This subwatershed drains 18,207 acres or 28.4 square miles and accounts for 7% of the total watershed area. There are 49.8 miles of stream. IDEM has classified 28.3 miles of stream impaired for E.coli. In the Whetten Ditch-Elkhart River subwatershed, 7.04 miles of the Elkhart River is designated as an outstanding river.

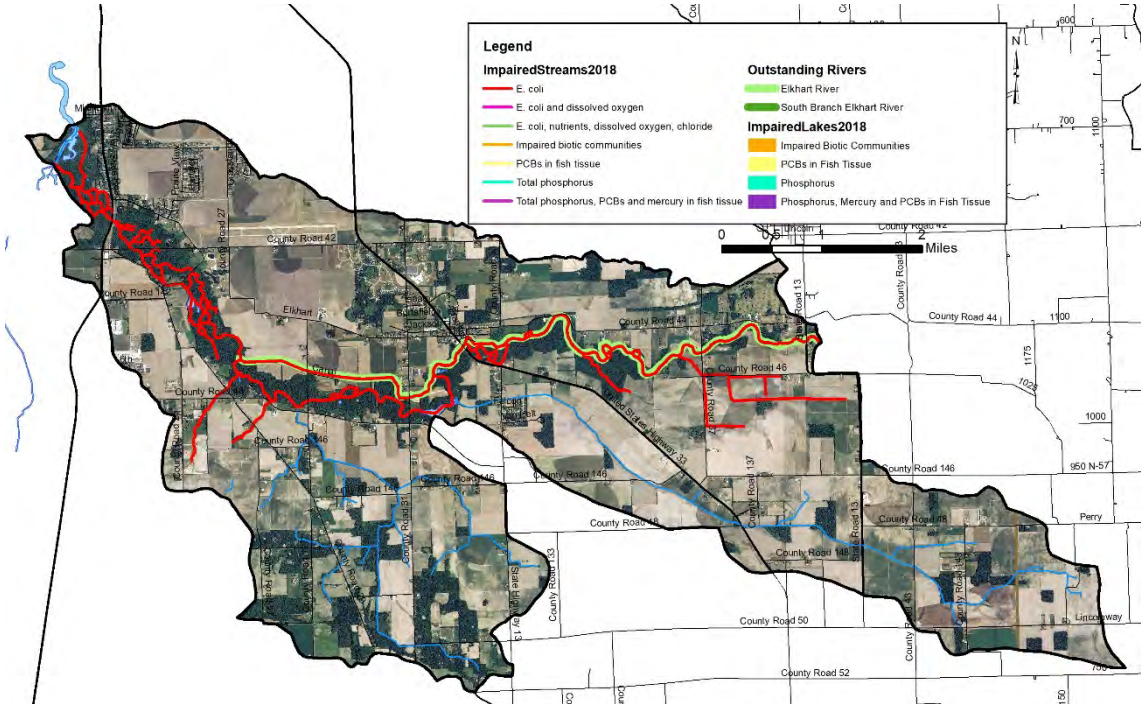

Figure 107. Whetten Ditch-Elkhart River subwatershed.

4.17.1 Soils

Hydric soils cover 3,699.2 acres (20%) of the Whetten Ditch-Elkhart River subwatershed. Wetlands currently cover 14% (2,461.6 acres) of the subwatershed. Highly erodible soils cover 20% of the subwatershed (3,688.1 acres). In total, 17,978.6 acres (99%) of the subwatershed are identified as very limited for septic use. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, the majority of the subwatershed is very limited. Therefore, maintenance and inspections of septic systems in the area are important to ensure proper function and capacity.

4.17.2 Land Use

Agricultural land use makes up 70% of the Whetten Ditch-Elkhart River subwatershed with 12,826.3 acres in agricultural land uses, including row crop and pasture. An additional 14% (2,461.6 acres) of the subwatershed is in wetlands, open water and grassland. Urban land use covers 2,270.1 acres, or 13%, of the subwatershed. Forest land use accounts for 4% of the subwatershed (659 acres).

4.17.3 Point Source Water Quality Issues

There are six underground storage tanks and one NPDES-permitted site: The New Paris Conservancy WWTP. There are no open dumps, brownfields, corrective action sites, voluntary remediation sites or industrial waste facilities located within the Whetten Ditch-Elkhart River subwatershed (Figure 108).

4.17.4 Non-Point Source Water Quality Issues

Agricultural land use is the predominant land uses in the Whetten Ditch-Elkhart River subwatershed. Additionally, a number of small animal operations and pastures are present (Figure 108). In total, 65 unregulated animal operation housing more than 521 cows, goats, horses and sheep were identified during the windshield survey. There are two active CFOs located within the Whetten Ditch-Elkhart River subwatershed which house up to 114,016 chickens and horses. In total, manure from small animal operations and the CFO/CAFO total over 28,253 tons per year, which contains almost 3,004,598 pounds of nitrogen, almost 2,431,426 pounds of phosphorus and 2.39E+19 colonies of E. coli. Livestock do not appear to have access to the subwatershed streams based on windshield survey observations. Streambank erosion and lack of buffer are concerns in the subwatershed, with streambank erosion present in 0.9 miles (2%) of stream, and narrow buffers found along 7.8 miles (16%) of Whetten Ditch-Elkhart River subwatershed streams (Figure 108).

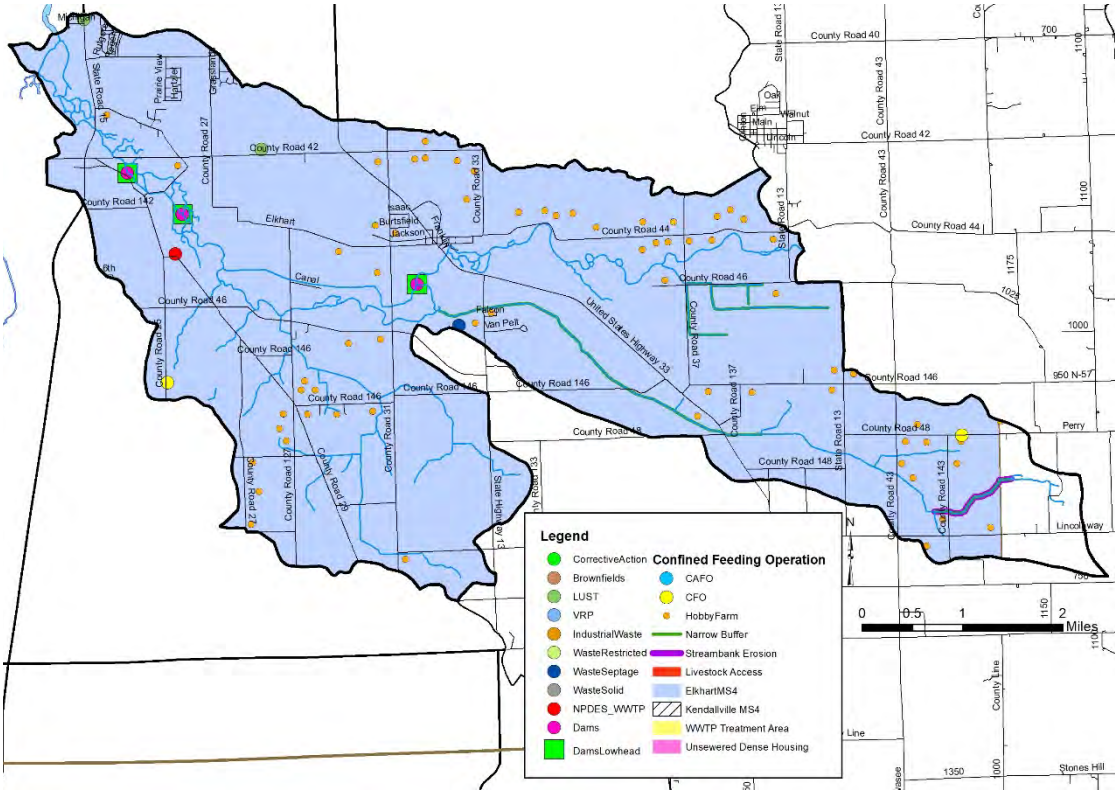

Figure 108. Potential point and non-point sources of pollution and suggested solutions in the Whetten Ditch-Elkhart River subwatershed.

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4.17.5 Water Quality Assessment

Waterbodies within the Whetten Ditch-Elkhart River subwatershed have been sampled at 13 locations (Figure 109). Assessments include collection of water chemistry data by IDEM (7 sites), by the SJRBC (2 sites), by Elkhart County (2 sites), as part of the LARE-funded Whetten Ditch, Solomon Creek, Dry Run Diagnostic Study (1 site) and as part of the 2008 ERRA Elkhart River WMP (1 site). The only IDEM fixed monitoring station in the Upper Elkhart River Watershed is located in the Whetten Ditch-Elkhart River subwatershed. One site in the Whetten Ditch-Elkhart River subwatershed is being sampled as part of the current project (shown as Upper sample sites). No USGS stream gages are located in the Whetten Ditch-Elkhart River subwatershed.

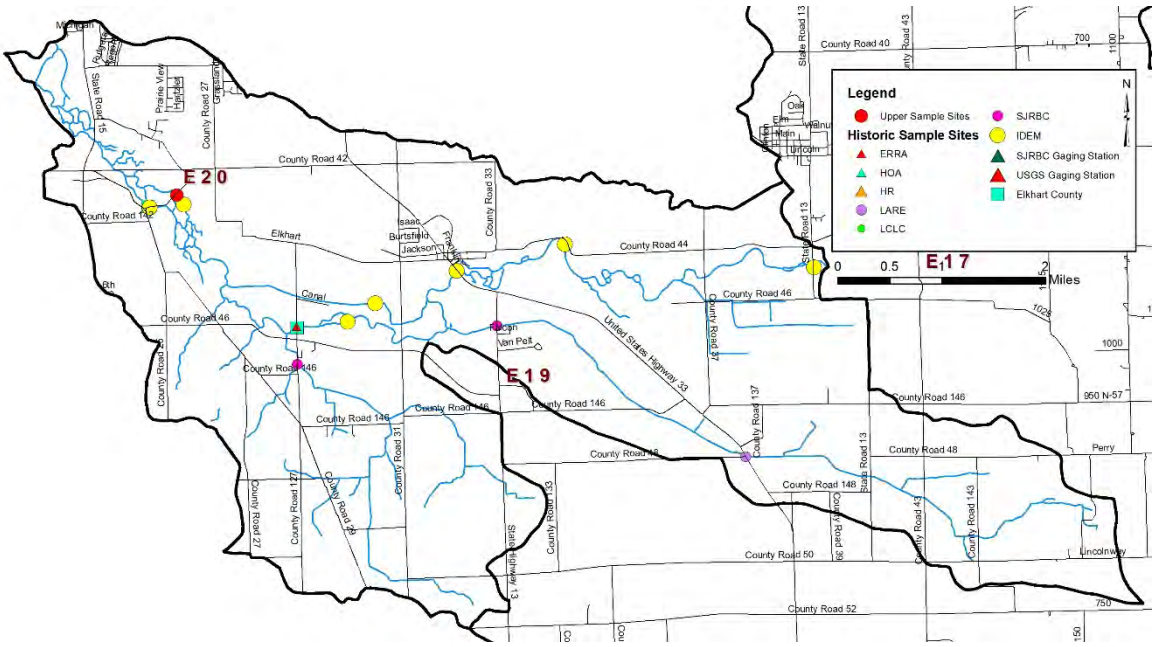

Figure 109. Locations of historic and current water quality data collection in the Whetten Ditch-Elkhart River subwatershed.

Table 68 details water chemistry data collected in the Whetten Ditch-Elkhart River subwatershed. As shown in the table, conductivity levels exceed state standards (1050 µmhos/cm) in 1% samples collected. Dissolved oxygen concentrations measure higher than the upper (12 mg/L) and lower than the lower (4 mg/L) state standards in 21% of samples collected. E. coli samples exceed state grab sample standards (235 col/100 ml) in 29% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 82% of samples. Total Kjeldahl nitrogen concentrations exceed water quality targets (0.57 mg/L) in 84% of collected samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 79% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 18% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 67% of samples.

Table 68. Whetten Ditch-Elkhart River subwatershed historic water quality data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Conductivity	106	1,516	4	405	1%
Dissolved Oxygen	0.32	14.5	85	404	21%
E. coli	BDL	2,100	39	134	29%
Ammonia-Nitrogen	BDL	0.28	1	258	0%
Nitrate-Nitrogen	0.19	28	300	366	82%
Dissolved Phosphorus	0.02	0.12	1	2	50%
pH	6.19	9.45	4	555	1%
Total Kjeldahl Nitrogen	BDL	13.09	221	262	84%
Total Phosphorus	BDL	14.1	289	364	79%
Total Suspended Solids	BDL	408	59	337	18%
Turbidity	0.09	163	215	322	67%

BDL = Below Detection Limit

Table 69 details water quality data collected in the Whetten Ditch-Elkhart River Subwatershed at Elkhart River stream (Site 20). As shown in the table, *E. coli* samples exceed state standards (235 col/100 ml) in 8% of samples collected. Nitrate-nitrogen concentrations exceed water quality targets (1 mg/L) in 100% of samples. Total phosphorus concentrations exceed water quality targets (0.08 mg/L) in 25% of samples. Total suspended solids concentrations exceed water quality targets (15 mg/L) in 8% of samples, while turbidity levels exceed water quality targets (5.7 NTU) in 25% of samples. Dissolved oxygen concentrations did not exceed water quality standards in samples collected from this site.

Table 69. Whetten Ditch-Elkhart River Subwatershed water quality data summary.

Site		Temp (C)	DO (mg/L)	pH	Cond (µmhos/cm	Turb (NTU)	Nitrate (mg/L)	TP (mg/L)	TSS (mg/L)	*E. coli* (col/100 ml)
20	Min	5.88	6.84	7.56	450.00	1.20	1.60	0.05	0.80	60.00
	Median	13.77	8.48	8.53	583.65	3.15	3.65	0.05	5.40	101.50
	Max	22.33	11.25	8.72	711.00	22.50	4.52	0.13	18.40	326.00
	Count	12	12	12	12	12	12	12	12	12
	Exceed		0	0	0	3	12	3	1	1
	% Exceed	0%	0%	0%	0%	25%	100%	25%	8%	8%

IDEM assessed the biological community at five sites, JFNew assessed the biological community at one site and V3 assessed the biological community at one site. One site was assessed as part of the current project. Assessments included seven sites assessed for macroinvertebrates, four sites assessed for fish and seven sites assessed for habitat. Habitat scores ranged from 34.5 to 79 with 10% of sites scoring below the state target (51). Fish community assessments rated as good to excellent with all assessments meeting the aquatic life use designation. Macroinvertebrate assessments rated severely impaired to not impaired using the kick sampling method with 25% of sites meeting their aquatic life use designation and scoring 16 to 52 using the multihabitat samples with 36% of sites not meeting their aquatic life use designation (Table 70).

Table 70. Whetten Ditch-Elkhart River subwatershed biological assessment data summary.

Parameter	Minimum	Maximum	Number Exceeding Target	Number of Samples	Percent Exceeding
Habitat (QHEI)	34.5	79	1	10	10%
Fish (IBI)	51	80	0	5	0%
Macroinvertebrates (mIBI, Kick)	0.8	5.0	1	4	25%
Macroinvertebrates (mIBI, Multi Habitat)	16	52	4	11	36%

5.0 WATERSHED INVENTORY III: WATERSHED INVENTORY SUMMARY

Several important factors and relationships become apparent when the Upper Elkhart River Watershed is observed both as a whole and in part. Many of these were discussed in the individual subwatershed discussions above. An overall summary of water quality impairments and a review of stakeholder concerns and any data which support these concerns are included below.

5.1 Water Quality Summary

Several water quality impairments were identified during the watershed inventory process, based on historic data collected by the Indiana Department of Environmental Management (IDEM), St. Joseph River Basin Commission (SJRBC), Lagrange County Lakes Council (LCLC), Elkhart County, several consulting firms which used DNR Lake and River Enhancement Program and/or IDEM Section 319 grant funded projects and Hoosier Riverwatch volunteers as well as current water quality assessments conducted during the current project. These impairments include elevated nutrient, sediment and *E. coli* concentrations. Based on historic data, Table 71 highlights those locations within the Upper Elkhart River Watershed where concentrations of these parameters measured higher than the target concentrations or those locations where impaired waterbodies were identified by IDEM. Table 71 summarizes where historic samples were outside the target values and are grouped by subwatershed. Figure 110 shows the locations of historical sites that exceeded target values. Sample sites are mapped only if 50% or more of samples collected at those sites were outside the target values.

Table 71. Percent of samples historically collected in Upper Elkhart River subwatersheds which measured outside target values.

Subwatershed	Cond	pH	Turb	DO	E coli	TKN	Nitrate	OP	TP	TSS
Tamarack Lake-Little Elkhart Creek	0%	0%	100%	0%	--	100%	80%	--	80%	20%
Dallas Lake-Little Elkhart Creek	0%	0%	--	7%	100%	54%	13%	53%	67%	19%
Oliver Lake-Little Elkhart Creek	0%	0%	33%	8%	80%	42%	48%	44%	66%	17%
Waterhouse-Henderson Lake Ditch	14%	0%	36%	10%	6%	100%	60%	50%	80%	25%
Oviate Ditch-MB Elkhart River	0%	0%	30%	26%	60%	100%	0%	--	33%	0%
Jones Lake-NB Elkhart River	0%	0%	28%	10%	29%	83%	79%	--	65%	15%
Huston Ditch-NB Elkhart River	0%	0%	43%	6%	21%	100%	80%	--	78%	30%
Rivir Lake-Forker Creek	0%	0%	33%	0%	19%	100%	69%	50%	81%	25%
Winebrenner Branch-Carrol Creek	0%	0%	26%	11%	16%	33%	81%	--	75%	13%
Skinner Lake-Croft Ditch	0%	0%	60%	18%	59%	92%	76%	15%	84%	36%
Muncie Lake-SB Elkhart River	0%	3%	80%	9%	20%	83%	50%	--	33%	17%
Diamond Lake-SB Elkhart River	0%	0%	23%	22%	19%	100%	36%	--	47%	10%
Phillips Ditch-Stony Creek	12%	4%	52%	16%	60%	50%	83%	--	67%	0%
Indian Lake-Elkhart River	4%	0%	48%	5%	28%	50%	59%	--	86%	6%
Headwaters Solomon Creek	2%	0%	44%	22%	33%	38%	34%	50%	31%	19%
Hire Ditch-Solomon Creek	11%	1%	38%	6%	42%	41%	88%	53%	60%	12%
Whetten Ditch-Elkhart River	1%	1%	67%	21%	29%	84%	82%	50%	79%	18%

Historic nitrate-nitrogen concentrations sampled in the Tamarack Lake-Little Elkhart Creek, Waterhouse Ditch-Henderson Lake Ditch, Jones Lake-North Branch Elkhart River, Huston Ditch-North Branch Elkhart River, Rivir Lake-Forker Creek, Winebrenner Branch-Carrol Creek, Skinner Lake-Croft Ditch, Phillips Ditch-Stony Creek, Indian Lake-Elkhart River, Hire Ditch-Solomon Creek, and Whetten Ditch-Elkhart River subwatersheds exceeded targets in more than 50% of samples collected. Total phosphorus concentrations in the Tamarack Lake-Little Elkhart Creek, Dallas Lake-Little Elkhart Creek, Oliver Lake-Little Elkhart Creek, Waterhouse Ditch-Henderson Lake Ditch, Jones Lake-North Branch Elkhart River, Huston Ditch-North Branch Elkhart River, Rivir Lake-Forker Creek, Winebrenner Branch-Carrol Creek, Skinner Lake-Croft Ditch, Philips Ditch-Stony Creek, Indian Lake-Elkhart River, Hire Ditch-Solomon Creek and Whetten Ditch-Elkhart River exceeded water quality targets in more than 50% of samples collected. Total Kjeldahl nitrogen concentrations in Tamarack Lake-Little Elkhart Creek, Dallas Lake-Little Elkhart Creek, Waterhouse-Henderson Lake Ditch, Oviate Ditch-Middle Branch Elkhart River, Jones Lake-North Branch Elkhart River, Huston Ditch-North Branch Elkhart River, Rivir Lake-Forker Creek, Skinner Lake-Croft Ditch, Muncie Lake-South Branch Elkhart River, Diamond Lake-South Branch Elkhart River and Whetten Ditch-Elkhart River exceeded water quality targets in more than 50% of samples collected. E. coli concentrations measured in Dallas Lake-Little Elkhart Creek, Oliver Lake-Little Elkhart Creek, Oviate Ditch-Middle Branch Elkhart River, Skinner Lake-Croft Ditch and Phillips Ditch-Stony Creek exceeded state standards in more than 50% of samples collected. A limited number of pH exceedances occurred in the Muncie Lake-South Branch Elkhart River, Philips Ditch-Stony Creek, Hire Ditch-Solomon Creek and Whetten Ditch-Elkhart River subwatershed all of which measured above the upper level and suggest an algal bloom occurred at the time of sample collection. Dissolved oxygen exceedances occurred in all but the Tamarack Lake-Little Elkhart Creek and Rivir Lake-Forker Creek subwatersheds with all exceedances measuring both lower than the lower and higher than the upper dissolved oxygen state standard at the time of sampling. Conductivity exceedances occurred a limited

number of times in the Waterhouse Ditch-Henderson Lake Ditch, Philips Ditch-Stony Creek, Indian Lake-Elkhart River, Headwaters Solomon Creek, Hire Ditch-Solomon Creek and Whetten Ditch-Elkhart River subwatersheds.

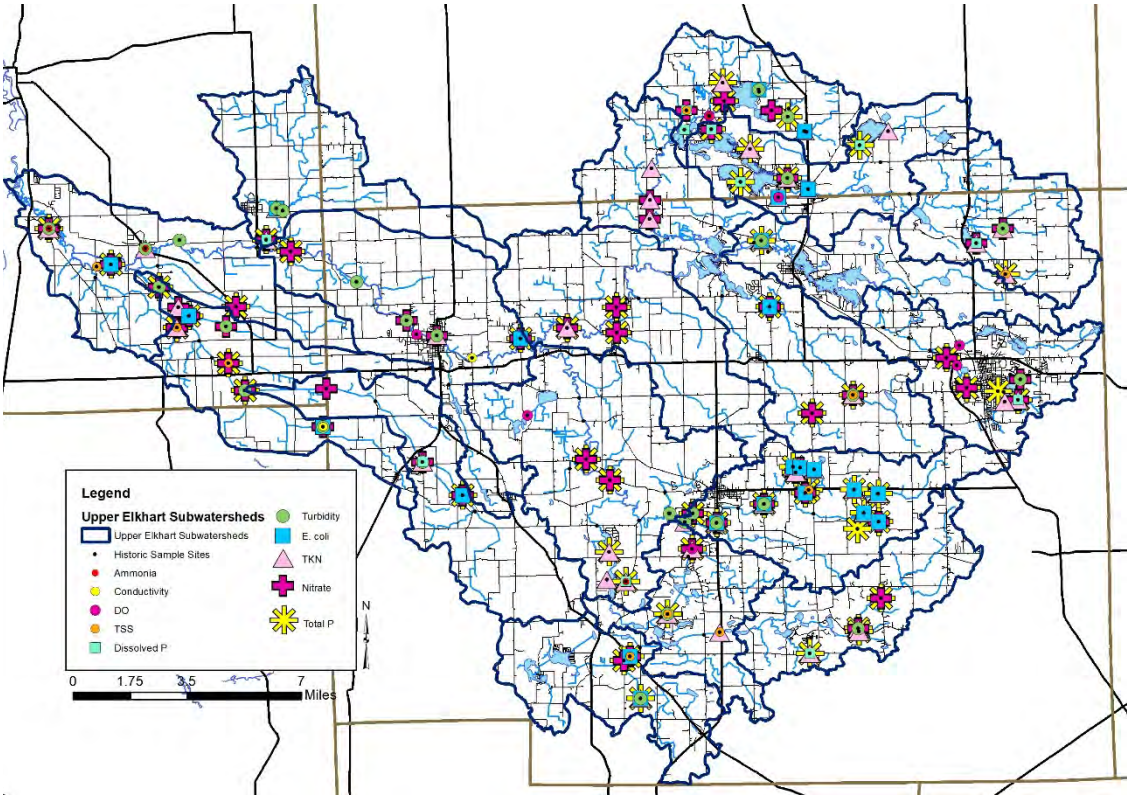

Figure 110. Upper Elkhart River Watershed historical sampling sites that exceed target values.

Table 72 summarizes current samples which measured outside the target values during the current assessment. Figure 111 provides a map of current sampling sites that exceed target values. Elevated nitrate-nitrogen concentrations were observed at all sample sites with 12 sample sites exceeding nitrate-nitrogen target concentrations during all sampling events. In total, 96% of collected samples throughout the watershed exceeded nitrate-nitrogen target concentrations. Elevated total phosphorus concentrations were observed at all sample sites except the sites in the Oviate Ditch-Middle Branch Elkhart River and Headwaters Solomon Creek subwatersheds with concentrations exceeding total phosphorus targets in 26% of collected samples. Elevated total suspended solids concentrations were observed at a majority of sites with 19% of all samples exceeding targets. Four sites exceeded target TSS concentrations in half or more than half of collected samples. TSS concentrations generally measured low then increased to concentrations higher than targets during storm flow events. *E. coli* concentrations that exceeded the state grab sample standard were measured at a majority of sites. Exceedances were most common at Headwaters Solomon Creek, Philips Ditch-Stony Creek and Skinner Lake-Croft Ditch sites. In total, 33% of samples exceed state standards.

Only five sample sites exceeded dissolved oxygen state standards – these occurred in the Oliver Lake-Little Elkhart Creek, Tamarack Lake-Little Elkhart Creek, Jones Lake-North Branch Elkhart River, Diamond Lake-South Branch Elkhart River and Rivir Lake-Forker Creek subwatersheds. Specific conductivity exceeded targets at one site in the Waterhouse Ditch-Henderson Lake Ditch subwatershed. pH concentrations did not exceed targets during the sampling events.

Table 72. Percent of samples collected in the Upper Elkhart River Watershed during the 2022-2023 sample collection which measured outside target values.

Site	Subwatershed	DO (mg/L)	Turb (NTU)	Cond (µmhos/cm)	TP (mg/L)	Nitrate (mg/L)	TSS (mg/L)	Ecoli (col/100 ml)
1	Oliver Lake-Little Elkhart Creek	0%	0%	0%	8%	100%	17%	0%
2	Oliver Lake-Little Elkhart Creek	33%	33%	0%	83%	100%	75%	58%
3	Dallas Lake-Little Elkhart Creek	0%	25%	0%	25%	92%	0%	33%
4	Tamarack Lake-L Elkhart Creek	8%	17%	0%	17%	92%	25%	25%
5	Oviate Ditch-MB Elkhart River	0%	8%	0%	0%	83%	25%	0%
6	Waterhouse-Henderson Lake	0%	33%	8%	42%	92%	58%	50%
7	Jones Lake-NB Elkhart River	0%	8%	0%	17%	100%	0%	50%
8	Jones Lake-NB Elkhart River	0%	17%	0%	8%	100%	0%	58%
9	Jones Lake-NB Elkhart River	8%	33%	0%	8%	83%	25%	0%
10	Huston Ditch-NB Elkhart River	0%	17%	0%	25%	100%	17%	42%
11	Diamond Lake-SB Elkhart River	33%	25%	0%	42%	100%	0%	17%
12	Skinner Lake-Croft Ditch	0%	8%	0%	58%	92%	0%	67%
13	Muncie Lake-SB Elkhart River	0%	50%	0%	17%	100%	50%	17%
14	Rivir Lake-Forker Creek	25%	17%	0%	25%	100%	0%	8%
15	Winebrenner Branch-Carrol Creek	0%	17%	0%	8%	92%	8%	33%
16	Headwaters Solomon Creek	0%	58%	0%	0%	100%	50%	75%
17	Indian Lake-Elkhart River	0%	8%	0%	25%	100%	0%	8%
18	Philips Ditch-Stony Creek	0%	17%	0%	83%	92%	0%	58%
19	Hire Ditch-Solomon Creek	0%	33%	0%	8%	100%	17%	50%
20	Whetten Ditch-Elkhart River	0%	25%	0%	25%	100%	8%	8%

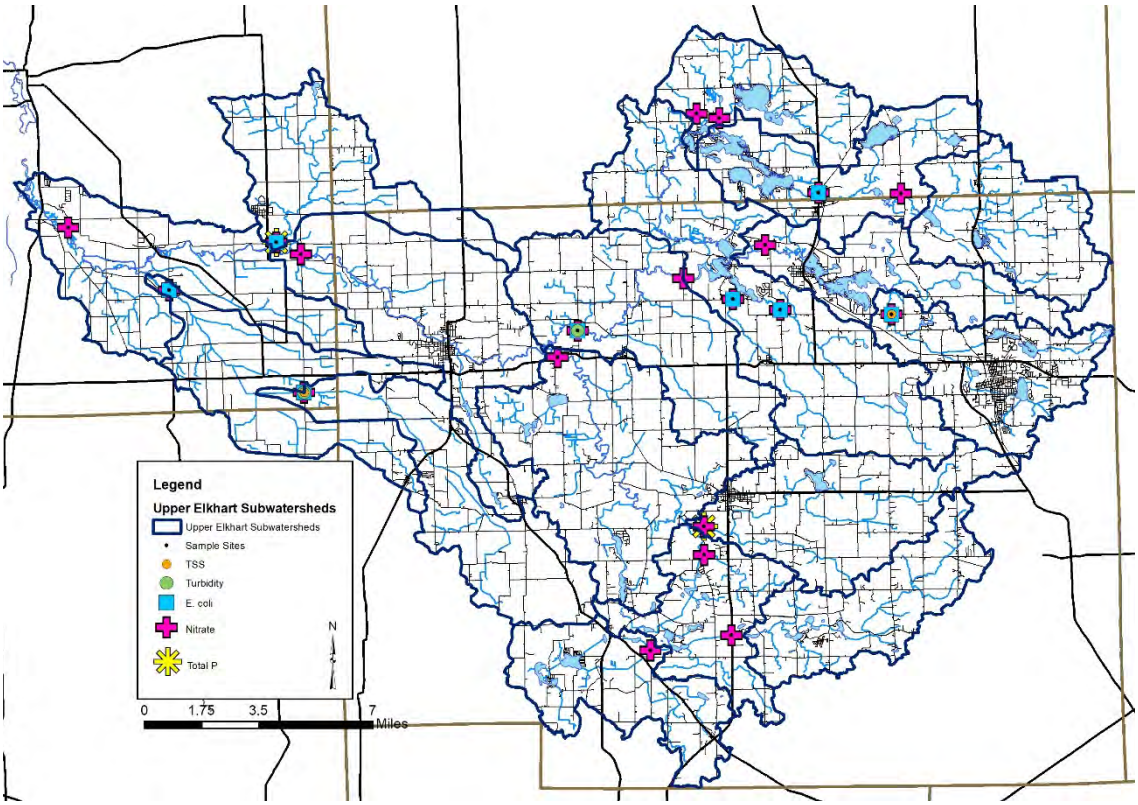

Figure 111. Upper Elkhart River Watershed sampling sites that exceed target values during the current sampling period.

Biological assessments of the macroinvertebrate community and an associated habitat assessment occurred once during the project. There is no pattern between habitat and macroinvertebrate community ratings for most sites (Table 73). A majority of sites – 11 sites – possessed mIBI scores which rated as poor or very poor. Oliver Lake-Little Elkhart Creek (Site 2) rated as very poor while Rivir Lake-Forker Creek (Site 14), Philips Ditch-Stony Creek (Site 18), Headwaters Solomon Ditch (Site 16), Oviate Ditch-Middle Branch Elkhart River (Site 5), Waterhouse Ditch-Henderson Lake (Site 6), Clock Creek (Site 7), Jones Lake-North Branch Elkhart River (Site 8), Huston Ditch-North Branch Elkhart River (Site 10), Winebrenner Branch-Carrol Creek (Site 15), Tamarack Lake-Little Elkhart Creek (Site 4) and Whetten Ditch-Elkhart River Site 20) rated as poor. In total, six stream sites' habitat scored above the QHEI target (51). The Elkhart River (Site 17) rated as excellent, while North Branch-Elkhart River (Site 3), South Branch Elkhart River (Site 13), Stony Creek (Site 18), Solomon Creek (Site 19) and the Elkhart River (Site 20) rated as good.

Table 73. Biological and habitat assessment summary for Upper Elkhart River Watershed streams. Green shading indicates the highest rated stream reaches, while red indicates the poorest rated reaches.

Site	Subwatershed	QHEI Rating and Score		mIBI Rating and Score	
1	Oliver Lake-Little Elkhart Creek	Not assessed			
2	Oliver Lake-Little Elkhart Creek	Very Poor	15	Very poor	22
3	Dallas Lake-Little Elkhart Creek	Good	58	Fair	38
4	Tamarack Lake-L Elkhart Creek	Poor	39	Poor	34
5	Oviate Ditch-MB Elkhart River	Poor	43	Poor	30
6	Waterhouse-Henderson Lake	Poor	31	Poor	30
7	Jones Lake-NB Elkhart River	Poor	50	Fair	44
8	Jones Lake-NB Elkhart River	Poor	49	Poor	30
9	Jones Lake-NB Elkhart River	Not assessed			
10	Huston Ditch-NB Elkhart River	Fair	52	Poor	30
11	Diamond Lake-SB Elkhart River	Not assessed			
12	Skinner Lake-Croft Ditch	Poor	32.5	Fair	42
13	Muncie Lake-SB Elkhart River	Good	69	Fair	40
14	Rivir Lake-Forker Creek	Very Poor	22	Poor	24
15	Winebrenner Branch-Carrol Creek	Very Poor	27	Poor	32
16	Headwaters Solomon Creek	Poor	31	Poor	28
17	Indian Lake-Elkhart River	Excellent	73	Fair	42
18	Philips Ditch-Stony Creek	Good	65	Poor	26
19	Hire Ditch-Solomon Creek	Good	63	Fair	36
20	Whetten Ditch-Elkhart River	Good	57.5	Poor	34

Agricultural Conservation Planning Framework (ACPF) Summary

The Agricultural Conservation Planning Framework (ACPF) was developed by the USDA's Agricultural Research Service in partnership with the USDA Natural Resources Conservation Service. ACPF supports agricultural watershed management by using high-resolution elevation data and an ArcGIS toolbox to identify site-specific opportunities for installing conservation practices across watersheds. This non-prescriptive approach provides a menu of conservation options to facilitate conservation discussions. The framework is used in conjunction with local knowledge of water and soil resource concerns, landscape features, and producer conservation preferences. Together, these provide a better understanding of the options available to develop and implement a watershed management plan.

Sediment delivered from watershed erosion can cause substantial damage and degradation to waterways and water quality. Controlling sediment loading requires knowledge about soil erosion and sedimentation. Drainage area, basin slope, climate, land use and land cover affect the sediment delivery process. Problems caused by soil erosion and sediments include losses of soil productivity, water quality degradation, and less capacity to prevent natural disasters such as floods. Sediments may carry pollutants into water systems and cause significant water quality problems. Sediment yields are also associated with waterway damages. Sediment deposition in streams reduces channel capacity and result in flooding damages. The water storage capacity of a reservoirs can be depleted by accumulated

sediment deposition. Sediment yield is a critical factor in identifying non-point source pollution as well as in the design of the construction such as dams and reservoirs. However, sediment yield is usually not available as a direct measurement but estimated by using a sediment delivery ratio (SDR). Figure 112 details the sediment delivery ratio for each agricultural field in the Upper Elkhart River Watershed. Sediment delivery ratio utilizes both the distance from the stream and the field's steepness to calculate the rating. Coarser texture sediment and sediment from sheet and rill erosion have more chances to be deposited or to be trapped, compared to fine sediment and sediment from channel erosion. Therefore, the delivery ratio of sediment with coarser texture or from sheet and rill erosion are relatively lower than the fine sediment or sediment from channel erosion. A small watershed with a higher channel density has a higher sediment delivery ratio compared to a large watershed with a low channel density. Conversely, a watershed with steep slopes has a higher sediment delivery ratio than a watershed with flat and wide valleys.

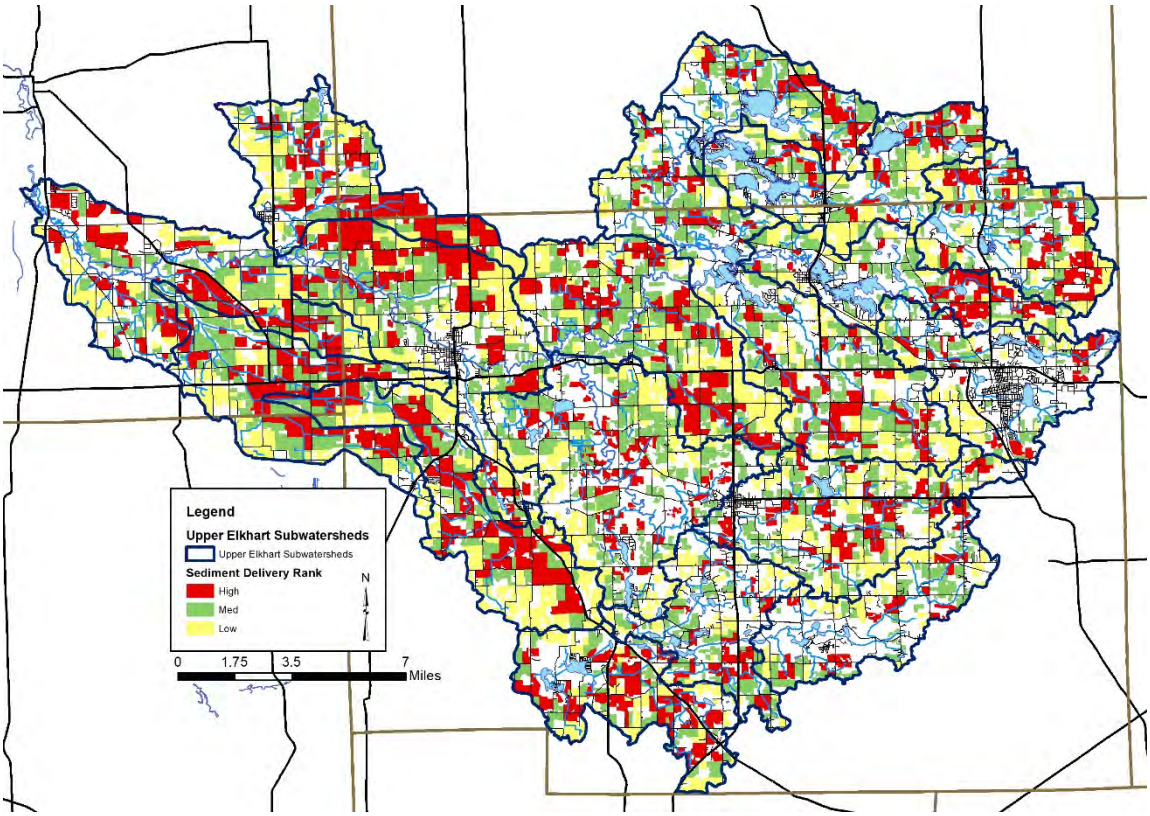

Figure 112. Sediment delivery ratio developed using ACPF for the Upper Elkhart River Watershed.

Similarly, runoff risk calculates the direct runoff contribution to stream channels in the watershed. Runoff risk prioritize fields where multiple erosion control practices are most needed. Fields that are closer in proximity to a stream and are steeper in slope have a higher runoff risk. Those that are further away, or flatter, have a lower runoff risk. Because sediment and phosphorus are not lost evenly from all parts of a fields but rather are lost from a few critical source areas these are the most limiting areas of significant extent or are generally those areas of the field that have the steepest slope. Figure 113 details the runoff risk for farm fields in the Upper Elkhart River Watershed. Runoff risk is categorized into low, moderate, high and very high. It should be noted that even fields rated as low will benefit from runoff control-based conservation practices; however, fields which rank moderate, high or very high will likely benefit more.

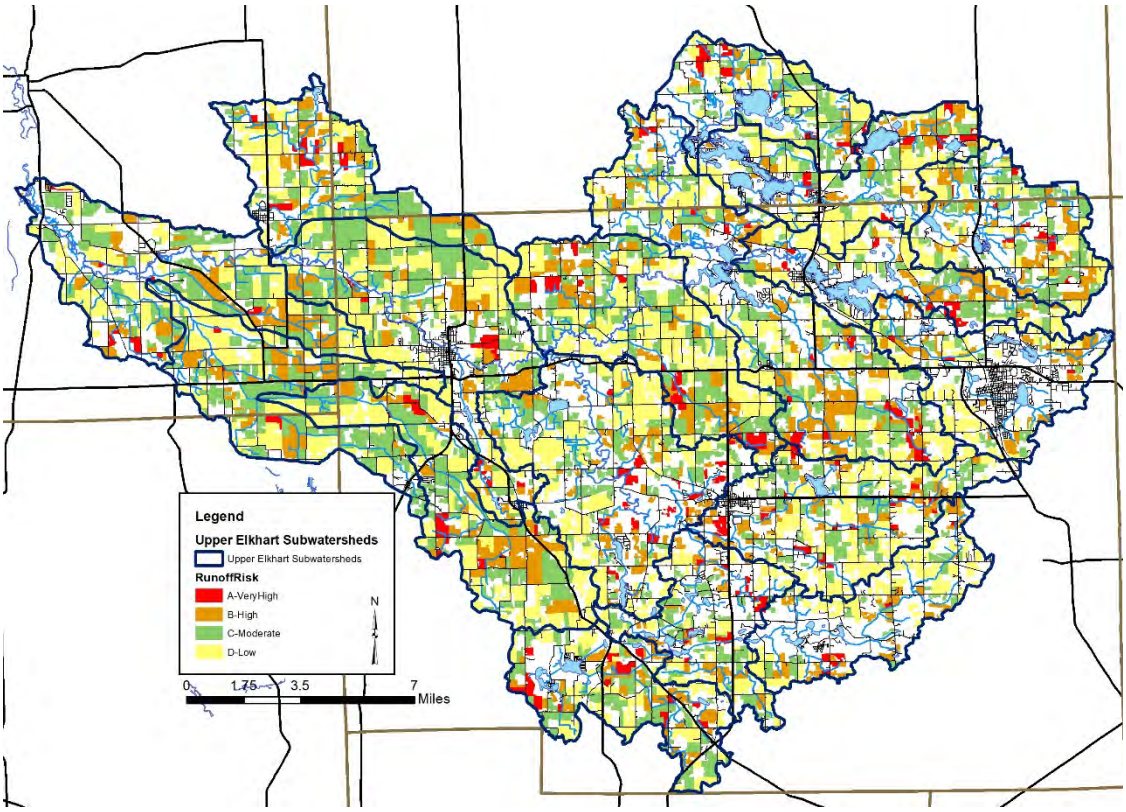

Figure 113. Runoff risk ratio developed using ACPF for the Upper Elkhart River Watershed.

5.2 Stakeholder Concern Analysis

All identified concerns generated both from stakeholder input and through water quality and watershed inventory efforts are detailed in Table 74. This list represents a work in progress and additional concerns may be added as the steering and monitoring committees work through data analysis. The steering committee rated each concern as to whether it is supported by watershed-based data, what evidence does or does not support the concern, whether the concern is quantifiable, whether it is in the scope of the watershed management plan, and if it is something on which the committee wants to focus. Nearly all concerns were quantifiable, and many were rated as being within the scope and items on which the committee wants to focus.

Following a review of the stakeholder concerns, the steering committee determined the following concerns identified by the public to be outside of this project's approach:

- Property value impacts to lakeside residents (poor water quality).
- Growing Canada goose, mute swan population.
- Fish kills after heavy rains (pollutants in the runoff).
- The Wolcottville town dam provided historic recreation opportunities with pond, beach and more post failure in the 1950s – maintain and manage as it was historically.
- Combined Sewer Overflows – E. coli, nutrients – long term control- concern noted that Kendallville may have CSOs however their CSOs have been mitigated.
- Concerned over attempts to make the Elkhart River a legal drain: concern over drainage policy in general.
- Heavy metal accumulation in lake bottom sediments – more data are needed to determine if this is an issue on which the committee should focus.

Table 74. Analysis of stakeholder concerns identified in the Upper Elkhart River Watershed.

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Poor water quality (sediment, nutrients, pathogens)	Yes	18% of TSS, 29% of TP, 99% of nitrate and 35% of E. coli samples collected (Feb-Sept) during the WMP monitoring exceed water quality targets. 33% of E. coli, 18% of TSS samples, 62% of TP, 71% of nitrate samples collected historically exceed water quality targets. 13.3 miles of stream are impaired for nutrients, 184.3 miles are impaired for E. coli, 5.3 miles are impaired for biotic communities, 17 miles are impaired for DO.	Yes	No	Yes
Excessive sediment load					
Elevated turbidity, phosphorus and E. coli and impacts on water quality					
Sediment accumulation in river and lakes	Yes	While data have not been collected for all lakes, sediment removal plans developed for the Goshen Dam Pond (downstream of the Upper watershed), Adams, Bixler, West & Five Lakes and others indicate more than 62 ac of dredging to remove more than 975,000 cu yds of accumulated sediment are needed. This sediment originated from the watershed.	Yes	No	Yes
In lake water quality – poor transparency, elevated nutrient levels	Yes	ICLP data collected in the last 10 years indicate that 35% of transparency, 15% of TP, 19% of chlorophyll α and 87% of nitrate samples exceed the average level for Indiana lakes. Poor DO levels	Yes	No	Yes
Property value impacts to lakeside residents (poor water quality)	No	Local data are not available. However, research indicates that values for lake property increase when water quality is better (deeper transparency, lower nutrient levels).	No	Yes	No

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Vegetation growth due to eutrophication in lakes and streams	Yes	Adams, Atwood, Cree, Five Lakes, Oliver-Olin, Sylvan and West Lakes completed an aquatic vegetation management plan since 2009. All plans note the increase in aquatic plant growth and presence of invasive species (Eurasian watermilfoil, curly leaf pondweed) and need to vegetation control. Sylvan Lake shows low plant growth in areas which is of concern. Seeking advice from DNR.	Yes	No	Yes
Blue green algae blooms on lakes	Yes	HAB data have not been collected; however, regional data indicate algal blooms are increasing in rate and duration. ICLP data indicate that 65% of lakes sampled possess plankton communities which are dominated by blue-green algae.	Yes	No	Yes
Nutrient loading due to the use of (lawn, agriculture) fertilizers	Yes	NASS estimates (2005) indicates that approximately 22,000 tons of atrazine and 10,800 tons of glyphosate are applied to cropland in the Upper Elkhart Watershed counties annually. IN state chemists office documents 136,090 tons of fertilizer used in 2015 (most recent data). No data are available for residential use.	Yes	No	Yes
Illicit Discharge	Yes	The City of Kendallville and Elkhart County MS4s maintain illicit discharge lists for locations within their jurisdiction. City of Kendallville working to compile data related to IDDE. Data not available as of November 2023.	Yes	No	Yes
Livestock access to surface waters within the watershed	Yes	Livestock have access to 3.5 miles of stream. Additional access is likely present but was not observed during the windshield survey.	Yes	No	Yes

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Non-point source pollution (agricultural row crop, yard waste, animal runoff & septic)	Yes	67% of the watershed is covered by row crop or pastureland. 94% of the watershed is covered by soils which rate as very limited for septic use. Anecdotal information suggests that straight pipes and facility maintenance is an issue in the watershed. Livestock have access to approximately 3.5 miles of watershed streams. Additional access is likely present but was not observed during the windshield survey. 397,000 animals are permitted on CFOs in the watershed producing more than 716,764 tons of manure annually.	Yes	No	Yes
Confined feeding operations, concentrated animal feeding operation impacts					
Manure volume produced from unregulated, animal operations and CFO/CAFO in the watershed					
Impacts of City of Kendallville WWTP impacts on Henderson Lake and Sylvan Lake	Yes	As recently as April 2022, the Kendallville WWTP had an unsatisfactory rating due to effluent discharge. Multiple violations occurred in 2021-2022 including high flow events, unhealthy biomass dating. IDEM and the City of Kendallville are working to formulate a plan to minimize loading, increase treatment capacities to treat the wastewater stream and remain in consistent compliance with the City of Kendallville NPDES permit.	Yes	No	Yes
Streambank and bed erosion	Yes	20.6 miles of stream were noted to have streambank erosion in the windshield survey. Additional erosion is likely present but was not observed during the windshield survey.	Yes	No	Yes
Concerns about unregulated drain erosion, working with private landowners					
Streambank deterioration, especially along legal drains, caused by severe erosion.					
Henderson Lake – very high nutrient levels/dead lake – suggested no swimming/bodily contact by City of Kendallville	Yes	ICLP data indicate transparency measures 1.3 feet, elevated conductivity (1600 µmhos/cm), nitrate concentrations more than	Yes	No	Yes

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Combined Sewer Overflows – E. coli, nutrients – long term control- Kendallville may have CSOs.	Yes	500 times that average for IN lakes, TP concentrations 6 times the level at which eutrophication occurs and elevated plankton density and chlorophyll α concentrations. The City of Kendallville notes that one CSO remains on their system which overflows to Henderson Lake. This outfall discharges into the stream that runs directly into Henderson Lake. This Lake is designated a no contact body of water. Swimming is not permitted, and it is NOT a source of drinking water.	Yes	No	Yes
Growing Canada goose, mute swan population	No	Population density data are not available. Anecdotal evidence based on communication with lake residents. Committee would like to source assess E.coli to determine if birds are an issue. Current project does not allow for this as a fund allocation.	No	Yes	No, unless E. Coli source tracking indicates geese are an issue
Septic systems, maintenance needed, density, straight pipes, small leach beds	Yes	94% of the watershed is covered by soils that are considered very limited for use in septic tank absorption fields. Maintenance data are not available but anecdotal information suggests that straight pipes and facility maintenance is an issue in the watershed.	Yes	No	Yes
Increases in impervious surface in the watershed	Yes	Current estimates indicate 8% urban land cover in the Upper Elkhart, which contains mostly small-medium sized towns and cities.	Yes	No	Yes

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Stormwater impacts	Yes	Urban land use covers 8% of the watershed. Two MS4 communities, City of Kendallville and Elkhart County, are present. Approximately 36% of the watershed uses tile drains to move water off of agricultural land. 39% of historic wetlands have been modified based on hydric soils coverage. CBBEL noted a 4.2 inch/year increase in precipitation in the NBER 1895-2019 and notes an increase in heavy rain events from 1 day/yr to 3 days/year exceeding the 99th percentile OR more frequent extreme events and larger annual precipitation totals.	Yes	No	Yes
Increased intensity and duration of rain events					
Fish community impacts of poor water quality (streams)	Yes	Only 2 of 21 fish community assessments indicate that the fish community does not meet its aquatic life use designation. However, anecdotal information suggests a decline in fish community.	Yes	No	Yes
Fish consumption advisories	Yes	Consumption advisories for sensitive populations are in place for Skinner Lake, Sylvan Lake, Oliver Lake and the Elkhart River in Elkhart County. 9.7 stream miles and 1,173 lake acres are listed as impaired for PCBs in fish tissue and 0.5 stream miles and 24 lake acres are listed for mercury in fish tissue.	Yes	Yes	Yes, education only
Mercury and PCBs in fish tissue					
Fish kills after heavy rains (pollutants in the runoff)	No	Kendallville fish kills 2020, 2021 – caused by water quantity not quality as fish moved into an area and died due to dropping water level.	Yes	Yes	No
Floodplain development	Yes	Floodplain covers 8% of the watershed. 73% of floodplain is mapped in forest, wetland or open water; 3% is developed and 22% is used for agricultural row crop or pastureland.	Yes	No	Yes
Development/encroachment on the floodplain					

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Flooding Too much water received in waterbodies during storm events; inability of the watershed to absorb additional quantities of water Maintaining drainage and floodplain Water quantity Drainage for agricultural production (both the positive aspect of achieving appropriate drainage for agriculture and the negative aspect of alteration of the hydrologic system were discussed)	Yes	CBBEL noted a 4.2 inch/year increase in precipitation in the NBER 1895-2019 and notes an increase in heavy rain events from 1 day/yr to 3 days/year exceeding the 99th percentile OR more frequent extreme events and larger annual precipitation totals. Soils drained by tile drains cover approximately 36% of the watershed. Nearly 200 miles of regulated drains are located in the watershed.	Yes	No	Yes
Continue sewer development on pace with development; Areas that are developed but are not sewered needs to be mapped	Yes	14 WWTP/RSDs provide treatment including Adams Lake RSD, Albion WWTP, Bear High Wolf Lake RSD, Cromwell WWTP, Kendallville WWTP, Lagrange County Regional Sewer District, Ligonier WWTP, Millersburg WWTP, New Paris Conservancy WWTP, Rome City WWTP, Skinner Lake RSD, Turkey Creek RSD, West Lakes RSD, Wolcottville WWTP and Chain-O-Lakes State Park	Yes	No	Yes
The Wolcottville town dam provided historic recreation opportunities with pond, beach and more post failure in the 1950s – maintain and manage as it was historically	No	Anecdotal data indicates historic recreational activity was prevalent at this location.	No	Yes	No
Explore the need for dam removal – Elkhart County Parks Baintertown and Benton dam Evaluate dam removal or dam modifications to assist with upstream and downstream fish passage	Yes	Benton and Baintertown Dam Feasibility Study identifies options for dam removal and structure replacement. ECP is working through funding sources at this time which will likely focus on partial removal and rock riffle placement at Baintertown and full removal at Benton.	Yes	No	Yes

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Interest in making drains more natural, install buffer strips between agricultural land	Yes	63.8 miles of streams with narrow buffer and 20.8 miles of streambank erosion were observed during the windshield survey.	Yes	No	Yes
Managing drains to reduce sediment loading (two stage, buffer strip incentives)	Combine with above	Local and regional data indicate that drain management can reduce sediment loading to adjacent waterbodies.			
Maintain discharge for drains to keep the Elkhart River healthy (keep the river clean by keeping the tributaries clean)	No	Perception among the drainage community that more instream flow, less downed wood improves instream condition.	No	Yes	Yes, education
Concerned over attempts to make the Elkhart River a legal drain: concern over drainage policy in general	Yes	Efforts to regulate portions of the Elkhart River as a legal drain occurred in 2009. More recent data or efforts could not be identified.	Yes	No	Yes
Look at irrigation data/well sensitivity, runoff from irrigated areas	Yes	Data from the IN Chamber indicates that 56.8 MGD of water is used for irrigation in Upper Elkhart River Counties. Interest in completing a water study for the Upper Elkhart (St Joe) River.	Yes	No	Yes
Long-term viability of the watershed as an irrigation source (both surface and ground water quantity issues)					
Recreational use of the river and lakes	Yes	The DNR, TNC, ACRES, Lagrange County, Cromwell, Kendallville, Rome City and Ligonier Park Boards and Goshen College maintain, preserve and protect natural areas in the watershed. 16 river and lake public access sites are located within the watershed.	Yes	No	Yes
Loss of habitat for ETR species					
Maintaining natural areas and providing access to local residents					
Wetland loss	Yes	Wetlands cover 17% of the watershed. It is estimated that 39% of wetlands have been modified or lost over time. More than 198 miles of surface drains have been constructed in the watershed.	Yes	No	Yes
Loss of habitat with increased development					
Preservation of wetlands to protect floodplain areas					
Eve Lake still has a cisco population - how can we protect this, are there other lakes with cisco still present?	Yes	ETR data indicate cisco populations resided in Eve, Martin, Olin, Oliver, Hackenburg, Messick, Atwood and Witmer Lakes. The most recent ETR data (1990) indicated cisco were present in Eve Lake.	Yes	No	Consider when prioritizing critical /priority areas

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Preserve a natural buffer along the water. Need proper planning of developments	Yes	63.8 miles of streams with narrow buffer.	Yes	No	Yes
Maintaining natural areas and providing access to local residents		55 terrestrial high quality natural terrestrial communities including Mesic Floodplain Forest, wet Floodplain Forest, Wet-mesic Floodplain Forest, Northern Lakes Dry-mesic Upland Forest, Northern Lakes Dry Upland Forest, Lake, Pond, Marl Beach, Acid Bog, Circumneutral Bog, Fen, Forested Fen, Marsh, Sedge Meadow, Forested Swamp, and Shrub Swamp were identified as part of the ETR database search. Access sites, trails data needs added – interest in adding access in Pettite Park in Ligonier			
Logjams	Yes	Logjams were identified during the windshield inventory. Ash trees continue to die and fall into rivers and streams. Anecdotal information documents the presence of logjams.	Yes	No	Yes
Addressing beaver dams and logjams for recreation, flood storage and flow conveyance		Anecdotal information documents the impacts of beavers in the watershed. No data have been collected on their impacts.			
Invasive species	Yes	Anecdotal information documents the presence of invasive species. However, lists have not been generated.	Yes	No	Yes
Agricultural BMP implementation is needed	Yes	ICP data indicate that agricultural BMP adoption is occurring within the watershed.	Yes	No	Yes
Engaging agricultural and urban landowners to implement BMPs	Yes	Anecdotal evidence based on communication with stakeholders.	Yes	No	Yes
Maintenance of previously installed best management practices					

Concern	Supported by our data?	Evidence	Able to Quantify?	Outside Scope?	Group wants to focus on?
Be holistic and work across the watershed with the goal of no negative impact to any other area of the basin	Yes	Supporting efforts across the basin is a necessary part of watershed planning	Yes	No	Yes
Building cohesion with groups across the basin					
Perception of health of river, lakes and streams - E coli, cryptosporidium, harmful algal blooms other aquatic health concerns.	No	Anecdotal evidence based on communication with stakeholders.	No	No	Yes, education
Watershed lake overuse (bass tournaments, boat density, lack of facilities as access points)	Yes	Five Lakes, West Lakes, Sylvan Lake and others host multiple BASS tournaments per summer with 18 listed on these lakes in July 2023 alone.	Yes	No	Yes
Impediments to navigation (barbed wire, low head dams)	Yes	Anecdotal evidence based on personal observation/communication with stakeholders	Yes	No	Yes
Limited recreation access points	Yes	Public access sites are readily available for most public freshwater lakes in the watershed; however, stream access points are limited.	Yes	No	Yes
In lake boating/shallow boating impacts	Yes	Anecdotal information indicates shallow lake boating resuspends sediment and increases nutrient levels.	Yes	No	Yes
Heavy metal release from in lake treatment.	No	A better understanding of heavy metal accumulation in lake sediment and its potential impact is needed.	No	Yes	More data needed

6.0 PROBLEM AND CAUSE IDENTIFICATION

After evaluation of stakeholder concerns and completion of the watershed inventory, watershed problems can be summarized as shown in Table 75. Problems represent the condition that exists due to a particular concern or group of concerns, then details potential causes of problems identified.

Table 75. Problems and causes identified for the Upper Elkhart River watershed based on stakeholder and inventory concerns.

Concern(s)	
• Poor water quality (sediment, nutrients, pathogens) • Elevated turbidity, phosphorus and E. coli and impacts on water quality • In lake water quality – poor transparency, elevated nutrient levels • Livestock access to surface waters within the Watershed • Streambank and bed erosion • Concerns about unregulated drain erosion, working with private landowners • Stream bank deterioration, especially along legal drains, caused by severe erosion. • Stormwater impacts • Increases in impervious surface in the watershed • Drainage for agricultural production (both the positive aspect of achieving appropriate drainage for agriculture and the negative aspect of alteration of the hydrologic system were discussed) • Development/encroachment on the floodplain • Perception of health of river, lakes and streams - E coli, cryptosporidium, harmful algal blooms other aquatic health concerns. • Excessive sediment load • Sediment accumulation in river and lakes • Managing regulated drains to reduce sediment loading (two stage, buffer strip incentives) • In lake/shallow lake boating impacts • Maintain outfall for regulated drains to keep the Elkhart River healthy (keep the river clean by keeping the tributaries clean)	**Problem** Sediment: area streams are cloudy/turbid **Cause(s)**: Suspended Sediment concentration levels exceed the target set by this project
• Poor water quality (sediment, nutrients, pathogens) • Elevated turbidity, phosphorus and E. coli and impacts on water quality • In lake water quality – poor transparency, elevated nutrient levels • Vegetation growth due to eutrophication in lakes and streams • Blue green algae blooms on lakes	**Problem** Nutrients: Area streams have nutrient levels exceeding the target set by this project **Cause(s)**: Nutrient levels exceed the target set by this project Targeted nutrient reduction education does not exist

Concern(s)	
• Non-point source pollution (agricultural row crop and animal runoff & septic) • Nutrient loading due to the use of (lawn, agriculture) fertilizers • Impacts of City of Kendallville WWTP impacts on Henderson Lake and Sylvan Lake • Henderson Lake – very high nutrient levels/dead lake – suggested no swimming/bodily contact by City of Kendallville • Illicit Discharge • Livestock access to surface waters within the Watershed • Streambank and bed erosion • Concerns about unregulated drain erosion, working with private landowners • Stream bank deterioration, especially along legal drains, caused by severe erosion. • Septic systems, maintenance needed, density, straight pipes, small leach beds • Stormwater impacts • Increases in impervious surface in the watershed • Drainage for agricultural production (both the positive aspect of achieving appropriate drainage for agriculture and the negative aspect of alteration of the hydrologic system were discussed) • Development/encroachment on the floodplain • Continue sewer development on pace with development- areas that are developed but are not sewered needs to be mapped • Perception of health of river, lakes and streams - E coli, cryptosporidium, harmful algal blooms other aquatic health concerns. • Confined feeding operations, concentrated animal feeding operation impacts • Manure volume produced from unregulated, animal operations and CFO/CAFO in the watershed • In lake/shallow lake impacts • Nutrient impacts from yard waste • Maintain outfall for regulated drains to keep the Elkhart River healthy (keep the river clean by keeping the tributaries clean)	

Concern(s)	
• Poor water quality (sediment, nutrients, pathogens) • Elevated turbidity, phosphorus and E. coli and impacts on water quality • In lake water quality – poor transparency, elevated nutrient levels • Livestock access to surface waters within the Watershed • Confined feeding operations, concentrated animal feeding operation impacts • Manure volume produced from unregulated, animal operations and CFO/CAFO in the watershed • Drainage for agricultural production (both the positive aspect of achieving appropriate drainage for agriculture and the negative aspect of alteration of the hydrologic system were discussed) • Perception of health of river, lakes and streams - E coli, cryptosporidium, harmful algal blooms other aquatic health concerns. • Non-point source pollution (agricultural row crop and animal runoff & septic) • Impacts of City of Kendallville WWTP impacts on Henderson Lake and Sylvan Lake • Illicit Discharge • Septic systems, maintenance needed, density, straight pipes, small leach beds • Continue sewer development on pace with development- areas that are developed but are not sewered needs to be mapped	**Problem**: E. coli: Area streams are impaired for recreational contact by IDEM's 303(d) list **Cause(s)**: E.coli levels exceed the water quality standard
• Flooding • Too much water received in Rome City during storm events • Water quantity • Maintaining drainage and floodplain • Wetland loss • Preservation of wetlands upstream, to protect floodplain areas • Floodplain and riparian development • Loss of habitat with increased development • Increased intensity and duration of rain events • Look at irrigation data/well sensitivity, runoff from irrigated areas	**Problem**: Reduced water storage, retention and infiltration **Cause(s)**: Potential Cause(s): -Land use changes are impacting the ability to store, retain and infiltrate water. -Local regulations are key to minimizing impacts from development in the watershed.

<table>
<tr><th>Concern(s)</th><th></th></tr>
<tr><td>• Long-term viability of the Watershed as an irrigation source (both surface and ground water quantity issues)</td><td>-Deregulation, including proposed state regulations that would take away local control, poses a threat to the watershed.
-Lack of cohesive regulations and governance across the watershed makes funding and implementation of a watershed plan challenging.
-There is no uniform drainage ordinance for the watershed. There is no single government body that oversees the watershed.</td></tr>
<tr><td rowspan="2">• Loss of habitat with increased development
• Explore the need for dam removal – Elkhart County Parks Baintertown and Benton dam
• Evaluate dam removal or dam modifications to assist with upstream and downstream fish passage
• Recreational use of the river and lakes
• Interest in making legal drains more natural, install buffer strips between agricultural
• Loss of habitat for ETR species
• Maintaining natural areas and providing access to local residence
• Preserve a natural buffer along the water. Need proper planning of developments
• Eve Lake still has a cisco population - how can we protect this population as well as any other lakes where cisco are still present
• Invasive species
• Addressing beaver dams and logjams for recreation, flood storage and flow conveyance
• Logjams
• Watershed lake overuse (bass tournaments, boat density, lack of facilities as access points)
• Impediments to navigation (barbed wire, low head dams)
• Limited recreation access points</td><td>Problem: Need to promote and maintain recreation on lakes and rivers; preserve natural areas and access to parks</td></tr>
<tr><td>Cause(s):
-Unsafe water for swimming and boating
-Concern for long term negative impacts to recreation</td></tr>
</table>

Concern(s)	
• Building cohesion with groups across the basin Agricultural and urban BMP implementation is needed • Engaging agricultural and urban landowners to implement BMPs for land use and construction • Maintenance of previously installed best management practices • Be holistic and work across the watershed with the goal of no negative impact to any other area of the basin Heavy metal releases from in lake treatment – need a better understanding of heavy metal accumulation in lake sediment and potential impacts	**Problems:** - Unified group for the entire watershed does not exist - Education and outreach is needed **Cause(s):** -No effort to educate local officials, foundations, and other funding sources on the importance of watershed protection -Lack of public awareness of watershed issues and opportunities to implement agricultural and urban BMPs -Lack of unified government strategy about watershed management

7.0 SOURCE IDENTIFICATION AND LOAD CALCULATION

7.1 Source Identification: Key Pollutants of Concern

Nonpoint pollution sources are varied, yet common throughout almost any watershed. Several earlier sections of this document identify potential sources of the pollutants of concern in the Upper Elkhart River Watershed. These and other potential sources of these causes are discussed in further detail in subsequent sections. A summary of potential sources identified in the Upper Elkhart River Watershed for each of our concerns is listed below:

Sediment:

- Conventional tillage cropping practices
- Streambank and bed erosion
- Poor riparian buffers
- Poor forest management
- Gully or ephemeral erosion
- Cropped floodplains
- Livestock access to streams
- Altered hydrology (ditching and draining, altered stream courses)
- Urban land use and development impacts (diffuse, disorganized, lack of proper stabilization technique use)
- Invasive species impacts to land cover/soil stability
- Stormwater from municipal sources (MS4s)

Nutrients (Nitrogen and Phosphorus):

- Conventional tillage cropping practices
- Wastewater treatment discharges
- Agricultural fertilizer
- Poor riparian buffers
- Poor forest management
- Streambank and bed erosion

- Animal waste (livestock in streams, poor manure management, domestic and wildlife runoff)
- Confined feeding operations
- Human waste (failing septic systems, sanitary sewer overflows, inadequately treated wastewater)
- Development impacts (diffuse, disorganized, lack of proper stabilization technique use)
- Invasive species impacts to land cover/soil stability
- Stormwater from municipal sources (MS4s)

E. coli:

- Human waste (failing septic systems, sanitary sewer overflows, inadequately treated wastewater)
- Animal waste (livestock in streams, poor manure management, domestic and wildlife runoff)

7.1.1 Potential Sources of Pollution

The steering committee used GIS data, water quality data, watershed inventory observations and anecdotal information as available to evaluate the potential sources of nonpoint pollution in the Upper Elkhart River Watershed. Appendix D contains tables detailing each potential source within each subwatershed. Table 76 through Table 81 summarizes the magnitude of potential sources of pollution for each problem identified in the Upper Elkhart River Watershed. Several sources listed above are not included below as specific data for each concern is not available: conventional tillage by subwatershed; gully or ephemeral erosion (none identified during the watershed inventory but likely present); poor forest management (not assessed); animal waste (domestic and wildlife runoff numbers not identified on the subwatershed level); cropped floodplains (they occur but density and distribution was not mapped); development impacts; invasive species (a list was developed but the volume was not assessed).

Table 76. Potential sources causing sediment problems.

Problems:	Area streams are cloudy and turbid.
Potential Causes:	Suspended sediments and/or turbidity exceed target values set by this project.
Potential Sources:	• 20.6 miles of stream lack adequate stabilization, with the highest percent of stream miles lacking stabilization found Skinner Lake-Croft Ditch, Rivir Lake-Forker Creek, Huston Ditch-North Branch Elkhart River, Waterhouse Ditch-Henderson Lake Ditch and Jones Lake-North Branch Elkhart River subwatersheds. • Livestock access (3.5 miles of streams) was observed in the Huston Ditch-North Branch Elkhart River, Rivir Lake-Forker Creek, Diamond Lake-South Branch Elkhart River and Philips Ditch-Stony Creek Subwatersheds. This does not mean livestock do not have access at other locations, but rather they were not observed during the windshield survey. • 63.8 miles of stream lack adequate buffers with the highest percent of stream miles lacking buffer Headwaters Solomon Creek, Huston Ditch-North Branch Elkhart River, Hire Ditch-Solomon Creek, Winebrenner Branch-Carrol Creek, Skinner Lake-Croft Ditch and Whetten Ditch-Elkhart River subwatersheds. • 52-92% of soybean fields and 33-83% of corn fields are under conservation tillage on a county-wide basis. • Nearly 13,175 animals were observed on unregulated animal operations throughout the watershed. The highest density of animals was identified in the Huston Ditch-North Branch Elkhart River, Oliver Lake-Little Elkhart Creek and Philips Ditch-Stony Creek subwatersheds. These operations can be sources due to livestock defecating in or near streams, soil compaction, streambank erosion, and improper manure storage and spreading. • 116,889 acres (45%) of highly erodible land occur within the watershed. The highest density of HES occurs in Rivir Lake-Forker Creek, Muncie Lake-South Branch Elkhart River, Waterhouse Ditch-Henderson Lake Ditch, Tamarack Lake-Little Elkhart Creek, Skinner Lake-Croft Ditch, Oviate Ditch-Middle Branch Elkhart River, Oliver Lake-Little Elkhart Creek, Diamond Lake-South Branch Elkhart River and Dallas Lake-Little Elkhart Creek subwatersheds. • The City of Kendallville and Elkhart County MS4s lie partially within the Upper Elkhart River Watershed.

Table 77. Potential sources causing nutrient problems.

Problems:	Area streams have nutrient levels exceeding the target set by this project.
Potential Causes:	Nutrient concentrations exceed target values set by this project. Targeted nutrient reduction education does not exist.
Potential Sources:	• 20.6 miles of stream lack adequate stabilization, with the highest percent of stream miles lacking stabilization found Skinner Lake-Croft Ditch, Rivir Lake-Forker Creek, Huston Ditch-North Branch Elkhart River, Waterhouse Ditch-Henderson Lake Ditch and Jones Lake-North Branch Elkhart River subwatersheds. • Livestock access (3.5 miles of streams) was observed in the Huston Ditch-North Branch Elkhart River, Rivir Lake-Forker Creek, Diamond Lake-South Branch Elkhart River and Philips Ditch-Stony Creek Subwatersheds. This does not mean livestock do not have access at other locations, but rather they were not observed during the windshield survey. • 63.8 miles of stream lack adequate buffers with the highest percent of stream miles lacking buffer Headwaters Solomon Creek, Huston Ditch-North Branch Elkhart River, Hire Ditch-Solomon Creek, Winebrenner Branch-Carrol Creek, Skinner Lake-Croft Ditch and Whetten Ditch-Elkhart River subwatersheds. • 52-92% of soybean fields and 33-83% of corn fields are under conservation tillage on a county-wide basis. • Nearly 13,175 animals were observed on unregulated animal operations throughout the watershed. The highest density of animals was identified in the Huston Ditch-North Branch Elkhart River, Oliver Lake-Little Elkhart Creek and Philips Ditch-Stony Creek subwatersheds. These operations can be sources due to livestock defecating in or near streams, soil compaction, streambank erosion, and improper manure storage and spreading. • More than 397,015 animals are permitted on confined feeding and concentrated animal feeding operations in the watershed. Animals are most dense in the Whetten Ditch-Elkhart River, Philips Ditch-Stony Creek, Jones Lake-North Branch Elkhart River, Huston Ditch-North Branch Elkhart River and Indian Lake-Elkhart River subwatersheds. • Animals in the watershed produce more than 963,282 tons of manure annually which produces 8,694,744 tons of nitrogen, 6,884,748 tons of phosphorus and 5.49xE19 colonies of E. coli annually. • 116,889 acres (45%) of highly erodible land occur within the watershed. The highest density of HES occurs in Rivir Lake-Forker Creek, Muncie Lake-South Branch Elkhart River, Waterhouse Ditch-Henderson Lake Ditch, Tamarack Lake-Little Elkhart Creek, Skinner Lake-Croft Ditch, Oviate Ditch-Middle Branch Elkhart River, Oliver Lake-Little Elkhart Creek, Diamond Lake-South Branch Elkhart River and Dallas Lake-Little Elkhart Creek subwatersheds. • Soils which are severely limited for septic use cover 241,951 or 94% of the Upper Elkhart River Watershed. Failing septic systems could contribute *E. coli* to the system within the rural portion of the watershed. • The City of Kendallville and Elkhart County MS4s lie partially within the Upper Elkhart River Watershed.

Table 78. Potential sources causing *E. coli* problems.

Problems:	Area streams are listed by IDEM as impaired for recreational contact by IDEM's 303(d) list.
Potential Causes:	*E. coli* concentrations exceed target values and the state standard.
Potential Sources:	• 20.6 miles of stream lack adequate stabilization, with the highest percent of stream miles lacking stabilization found Skinner Lake-Croft Ditch, Rivir Lake-Forker Creek, Huston Ditch-North Branch Elkhart River, Waterhouse Ditch-Henderson Lake Ditch and Jones Lake-North Branch Elkhart River subwatersheds. • Livestock access (3.5 miles of streams) was observed in the Huston Ditch-North Branch Elkhart River, Rivir Lake-Forker Creek, Diamond Lake-South Branch Elkhart River and Philips Ditch-Stony Creek Subwatersheds. This does not mean livestock do not have access at other locations, but rather they were not observed during the windshield survey. • 63.8 miles of stream lack adequate buffers with the highest percent of stream miles lacking buffer Headwaters Solomon Creek, Huston Ditch-North Branch Elkhart River, Hire Ditch-Solomon Creek, Winebrenner Branch-Carrol Creek, Skinner Lake-Croft Ditch and Whetten Ditch-Elkhart River subwatersheds. • Nearly 13,175 animals were observed on unregulated animal operations throughout the watershed. The highest density of animals was identified in the Huston Ditch-North Branch Elkhart River, Oliver Lake-Little Elkhart Creek and Philips Ditch-Stony Creek subwatersheds. These operations can be sources due to livestock defecating in or near streams, soil compaction, streambank erosion, and improper manure storage and spreading. • More than 397,015 animals are permitted on confined feeding and concentrated animal feeding operations in the watershed. Animals are most dense in the Whetten Ditch-Elkhart River, Philips Ditch-Stony Creek, Jones Lake-North Branch Elkhart River, Huston Ditch-North Branch Elkhart River and Indian Lake-Elkhart River subwatersheds. • Animals in the watershed produce more than 963,282 tons of manure annually which produces 8,694,744 tons of nitrogen, 6,884,748 tons of phosphorus and 5.49xE19 colonies of E. coli annually. • Soils which are severely limited for septic use cover 241,951 or 94% of the Upper Elkhart River Watershed. Failing septic systems could contribute *E. coli* to the system within the rural portion of the watershed.

Table 79. Potential sources causing recreation and access problems.

Problems:	Need to promote and maintain recreation on lakes and rivers; preserve natural areas and access to parks.
Potential Causes:	Unsafe water for swimming and boating. Concern for long term negative impacts to recreation.
Potential Sources:	N/A

Table 80. Potential sources causing flooding problems.

Problems:	Reduced water storage, retention and infiltration.
Potential Causes:	Land use changes are impacting the ability to store, retain and infiltrate water. Local regulations are key to minimizing impacts from development in the watershed. Deregulation, including proposed state regulations that would take away local control, poses a threat to the watershed. Lack of cohesive regulations and governance across the watershed makes funding and implementation of a watershed plan challenging. There is no uniform drainage ordinance for the watershed. There is no single government body that oversees the watershed.
Potential Sources:	Riparian habitat alterations; disconnection and development of the floodplain; ditching, draining and tiling; stormwater runoff.

Table 81. Potential sources causing education and cohesion problems.

Problems:	Unified group for the entire watershed does not exist. Education and outreach is needed.
Potential Causes:	No effort to educate local officials, foundations, and other funding sources on the importance of watershed protection. Lack of public awareness of watershed issues and opportunities to implement agricultural and urban BMPs. Lack of unified government strategy about watershed management.
Potential Sources:	N/A

7.2 Load Estimates

Nonpoint source pollution is generated from a variety of sources found on public and private lands. The US EPA notes that sources of nonpoint source pollution include stormwater runoff, construction activities, solid waste disposal, atmospheric deposition, streambank erosion, and more. Inventory data in Table 76 to Table 81 potential sources of nonpoint pollution within the watershed. These tables – generated using GIS, water quality data, windshield surveys, local knowledge, and other sources of data – are useful for generally identifying water quality problems. Two methods could be used to understand the loading of nutrients, sediment, and pathogens in waterbodies in the Upper Elkhart River Watershed: 1) measured results from the monitoring regime completed as part of the current watershed planning project and 2) modeled results. Each method can estimate both the current load and the reduction in load needed to reach target concentrations. These methods each present advantages and disadvantages for understanding the loading in this watershed. The steering committee considered the monitoring data to draft long term goals and critical areas. The fixed station data were used to calculate potential draft goals and then after discussion, were used to set long term and interim term goals as well as determine critical areas.

As discussed in Section 3.4, 20 monitoring sites were sampled monthly from February 2022 to January 2023. There is clear value in using these measurements from the Upper Elkhart River Watershed to estimate loads and load reductions. However, there are some limitations in the measured dataset. Sampling methods did not allow for continuous flow measurements at each site, so data from three USGS gages were used to approximate flow. The Shatto Ditch near Mentone (USGS 03331224) was used to scale the flow for the Oliver Lake-Little Elkhart Creek sites (Site 1 and 2), the North Branch Elkhart River Cosperville (USGS 04100222) gage was used to scale flow for all other tributary stream sites (Sites

3-16, 18-19), while the Elkhart River at Goshen (USGS 04100500) was used to scale flow for the mainstem Elkhart River sites (Sites 17 and 20). Appendix C details loading rate calculations. As discussed in Section 3.1, the steering committee selected water quality benchmarks that will significantly improve water quality in Upper Elkhart River (Table 15). However, due drought conditions observed across the watershed which resulted in low volumes of surface and groundwater runoff, average concentrations for most parameters at most sites already meet the target concentrations originally selected by the steering committee. With this in mind, the steering committee set revised target concentrations (Table 82).

Table 82. Revised water quality benchmarks used to assess water quality from historic and current water quality assessments.

Parameter	Water Quality Target
E. coli	<125 colonies/100 mL
Nitrate-nitrogen	<1 mg/L
Total phosphorus	<0.05 mg/L
Total suspended solids	<5 mg/L

Target loads needed to meet these revised benchmarks were calculated for each subwatershed for each parameter. Sample site data from the subwatershed's pour point sampling site was used to calculate annual loading rates and load reductions. The load reduction needed was then calculated for each subwatershed, which corresponds to each sample site, in pounds or colonies per year and as a percent of the current load (Table 83 to Table 86). It should be noted that sample sites and subwatershed names shown represent the loading rate to that point inclusive of drainage upstream of the subwatershed. To calculate the loading rate for the Oliver Lake-Little Elkhart Creek subwatershed, two watershed streams were sampled – the outlet of Hackenburg Lake and the outlet of Oliver Lake – and thus the loading rates for these two sampling locations were added to calculate the subwatershed's loading rate. As the loading rates are calculated based on the full drainage area to the sample point, Site 20 in the Whetten Ditch-Elkhart River subwatershed represents the total watershed loading rates.

Table 83. Estimated nitrogen load reduction by subwatershed needed to meet water quality target concentrations in the Upper Elkhart River Watershed.

Subwatershed	Sample Site	Current Loading Rate (lb/year)	Target Loading Rate (lb/year)	Load Reduction (lb/year)	Percent Reduction
Tamarack Lake-Little Elkhart Creek	E04	106,572	43,416	63,156	59%
Dallas Lake-Little Elkhart Creek	E03	191,290	63,529	127,760	67%
Oliver Lake-Little Elkhart Creek	E01+E02	61,021	25,450	35,571	58%
Waterhouse Ditch-Henderson Lake	E06	105,783	40,010	65,773	62%
Oviate Ditch-MB Elkhart River	E05	164,575	75,543	89,032	54%
Jones Lake-NB Elkhart River	E09	535,390	280,201	255,189	48%
Huston Ditch-NB Elkhart River	E10	887,265	335,232	552,033	62%
Rivir Lake-Forker Creek	E14	117,813	40,600	77,212	66%
Winebrenner Branch-Carrol Creek	E15	118,508	37,983	80,524	68%
Skinner Lake-Croft Ditch	E12	160,574	23,097	137,477	86%
Muncie Lake-SB Elkhart River	E13	252,284	102,252	150,031	59%
Diamond Lake-SB Elkhart River	E11	638,377	238,160	400,217	63%
Philips Ditch-Stony Creek	E18	123,905	42,368	81,537	66%
Indian Lake-Elkhart River	E17	1,872,355	609,104	1,263,251	67%
Headwaters Solomon Ditch	E16	166,061	48,616	117,445	71%
Hire Ditch-Solomon Creek	E19	340,484	95,247	245,238	72%
Whetten Ditch-Elkhart River	E20	2,951,983	793,549	2,158,434	73%
Upper Elkhart River Watershed		**2,951,983**	**793,549**	**2,158,434**	**73%**

Table 84. Estimated phosphorus load reduction by subwatershed needed to meet water quality target concentrations in the Upper Elkhart River Watershed.

Subwatershed	Sample Site	Current Loading Rate (lb/year)	Target Loading Rate (lb/year)	Load Reduction (lb/year)	Percent Reduction
Tamarack Lake-Little Elkhart Creek	E04	3,678	2,171	1,507	41%
Dallas Lake-Little Elkhart Creek	E03	4,669	3,176	1,493	32%
Oliver Lake-Little Elkhart Creek	E01+E02	2,488	1,273	1,216	49%
Waterhouse Ditch-Henderson Lake	E06	4,362	2,001	2,361	54%
Oviate Ditch-MB Elkhart River	E05	3,872	3,777	95	2%
Jones Lake-NB Elkhart River	E09	15,661	14,010	1,651	11%
Huston Ditch-NB Elkhart River	E10	26,587	16,762	9,825	37%
Rivir Lake-Forker Creek	E14	3,007	2,030	977	32%
Winebrenner Branch-Carrol Creek	E15	2,402	1,899	503	21%
Skinner Lake-Croft Ditch	E12	6,594	1,155	5,439	82%
Muncie Lake-SB Elkhart River	E13	6,750	5,113	1,637	24%
Diamond Lake-SB Elkhart River	E11	24,997	11,908	13,089	52%
Philips Ditch-Stony Creek	E18	9,073	2,118	6,954	77%
Indian Lake-Elkhart River	E17	91,349	30,455	60,894	67%
Headwaters Solomon Ditch	E16	2,450	2,431	19	1%
Hire Ditch-Solomon Creek	E19	6,108	4,762	1,346	22%
Whetten Ditch-Elkhart River	E20	58,220	39,677	18,542	32%
Upper Elkhart River Watershed		**58,220**	**39,677**	**18,542**	**32%**

Table 85. Estimated total suspended solids load reduction by subwatershed needed to meet water quality target concentrations in the Upper Elkhart River Watershed. NRN=No reduction needed

Subwatershed	Sample Site	Current Loading Rate (lb/year)	Target Loading Rate (lb/year)	Load Reduction (lb/year)	Percent Reduction
Tamarack Lake-Little Elkhart Creek	E04	409,887	217,080	192,807	47%
Dallas Lake-Little Elkhart Creek	E03	498,375	317,647	180,728	36%
Oliver Lake-Little Elkhart Creek	E01+E02	201,121	127,251	73,870	37%
Waterhouse Ditch-Henderson Lake	E06	827,783	200,052	627,731	76%
Oviate Ditch-MB Elkhart River	E05	991,156	377,716	613,441	62%
Jones Lake-NB Elkhart River	E09	3,227,459	1,401,004	1,826,456	57%
Huston Ditch-NB Elkhart River	E10	4,278,674	1,676,160	2,602,515	61%
Rivir Lake-Forker Creek	E14	242,823	203,002	39,821	16%
Winebrenner Branch-Carrol Creek	E15	255,380	189,917	65,463	26%
Skinner Lake-Croft Ditch	E12	457,041	115,483	341,558	75%
Muncie Lake-SB Elkhart River	E13	1,376,503	511,262	865,241	63%
Diamond Lake-SB Elkhart River	E11	1,025,069	1,190,800	NRN	NA
Philips Ditch-Stony Creek	E18	177,035	211,840	NRN	NA
Indian Lake-Elkhart River	E17	3,209,840	3,045,520	164,320	5%
Headwaters Solomon Ditch	E16	586,223	243,082	343,141	59%
Hire Ditch-Solomon Creek	E19	1,024,765	476,233	548,531	54%
Whetten Ditch-Elkhart River	E20	4,836,336	3,967,746	868,590	18%
Upper Elkhart River Watershed		**4,836,336**	**3,967,746**	**868,590**	**18%**

Table 86. Estimated E. coli load reduction by subwatershed needed to meet water quality target concentrations in the Upper Elkhart River Watershed. NRN=No reduction needed

Subwatershed	Sample Site	Current Loading Rate (col/year)	Target Loading Rate (col/year)	Load Reduction (col/year)	Percent Reduction
Tamarack Lake-Little Elkhart Creek	E04	2.21E+13	2.46E+13	NRN	NA
Dallas Lake-Little Elkhart Creek	E03	2.32E+13	3.60E+13	NRN	NA
Oliver Lake-Little Elkhart Creek	E01+E02	1.93E+13	1.44E+13	4.82E+12	25%
Waterhouse Ditch-Henderson Lake	E06	7.09E+13	2.27E+13	4.82E+13	68%
Oviate Ditch-MB Elkhart River	E05	2.40E+13	4.29E+13	NRN	NA
Jones Lake-NB Elkhart River	E09	4.76E+13	1.59E+14	NRN	NA
Huston Ditch-NB Elkhart River	E10	3.35E+14	1.90E+14	1.45E+14	43%
Rivir Lake-Forker Creek	E14	1.13E+13	2.30E+13	NRN	NA
Winebrenner Branch-Carrol Creek	E15	2.35E+13	2.16E+13	1.99E+12	8%
Skinner Lake-Croft Ditch	E12	9.30E+13	1.31E+13	7.99E+13	86%
Muncie Lake-SB Elkhart River	E13	2.55E+13	5.80E+13	NRN	NA
Diamond Lake-SB Elkhart River	E11	1.41E+14	1.35E+14	5.49E+12	4%
Philips Ditch-Stony Creek	E18	6.83E+13	2.40E+13	4.43E+13	65%
Indian Lake-Elkhart River	E17	3.72E+14	3.46E+14	2.62E+13	7%
Headwaters Solomon Ditch	E16	5.32E+13	2.76E+13	2.56E+13	48%
Hire Ditch-Solomon Creek	E19	1.17E+14	5.40E+13	6.32E+13	54%
Whetten Ditch-Elkhart River	E20	5.51E+14	4.50E+14	1.01E+14	18%
Upper Elkhart River Watershed		**5.51E+14**	**4.50E+14**	**1.01E+14**	**18%**

8.0 CRITICAL AND PRIORITY AREA DETERMINATION

Critical areas are defined as the areas where sources of water quality problems occur in the highest densities and where restoration measures can improve water quality. These areas indicate locations where best management practices should be targeted to address nonpoint sources of pollution. Priority areas are those areas of the watershed where high quality habitat is found, and the aquatic biological community is classified as good or excellent. Best management practices to protect the higher quality conditions should be targeted to these areas.

Using the list of potential sources developed for each parameter of concern as a base, the steering committee developed a mechanism for determining critical areas for each parameter. GIS-based mapping data from desktop and windshield survey efforts, loading calculations, and current and historic water quality data were used as a basis for decision-making. Data for each subwatershed are detailed in Appendix E. The steering committee divided into teams to review subwatershed data and develop a criteria list for each parameter. For each parameter, each subwatershed was evaluated to determine whether it met each criterion developed by each steering committee team. Teams presented their suggested criteria for each parameter to the entire steering committee and the steering committee reviewed, modified, if needed, and finalized criteria for each parameter. Each parameter team reviewed available data and selected a suite of data they considered most useful for their parameter. Each parameter's criterion is detailed in subsequent sections. Each subwatershed was scored based on the

total number of criteria that were met (1=yes, 0=no) and the subwatersheds with the highest scores were prioritized as critical areas for each parameter. Appendix E includes these scoring details.

8.1 Critical Areas for Nitrate-Nitrogen and Total Phosphorus

Nitrate-nitrogen and total Kjeldahl nitrogen were the nitrogen form used to determine our critical areas. Total phosphorus was the form of phosphorus used to determine phosphorus critical areas. Nitrate-nitrogen and total phosphorus are readily available in watershed, entering surface water via; human and animal waste, fertilizer use, and tile drains on agricultural lands. Phosphorus enters the watershed through streambank and bed erosion, unfiltered runoff, agricultural land use in floodplains, stormwater runoff, and livestock access. Based on the data reviewed by the steering committee, the following datasets were priorities for nutrients critical areas:

- Manure N >100,000 lb/yr and manure P >20,000 lb/yr
- Nutrient impairments (303(d) listing) - any
- Historic nitrate >50% exceedance
- Historic TKN >50% exceedance
- Historic TP >50% exceedance
- Current Nitrate >50% exceedance
- Current TP>50% exceedance
- Agricultural land percentage >70%
- Urban land >10% of total

Critical subwatersheds were determined as follows: Tamarack Lake-Little Elkhart Creek (501), Waterhouse Ditch-Henderson Lake Ditch (504), Jones Lake-North Branch Elkhart River (506), Huston Ditch-North Branch Elkhart River (507), Skinner Lake-Croft Ditch (603), Diamond Lake-South Branch Elkhart River (605), Phillips Ditch-Stony Creek (801), Indian Lake-Elkhart River (802), Headwaters Solomon Creek (803), Hire Ditch-Solomon Creek (804), and Whetten Ditch-Elkhart River (802; Figure 114).

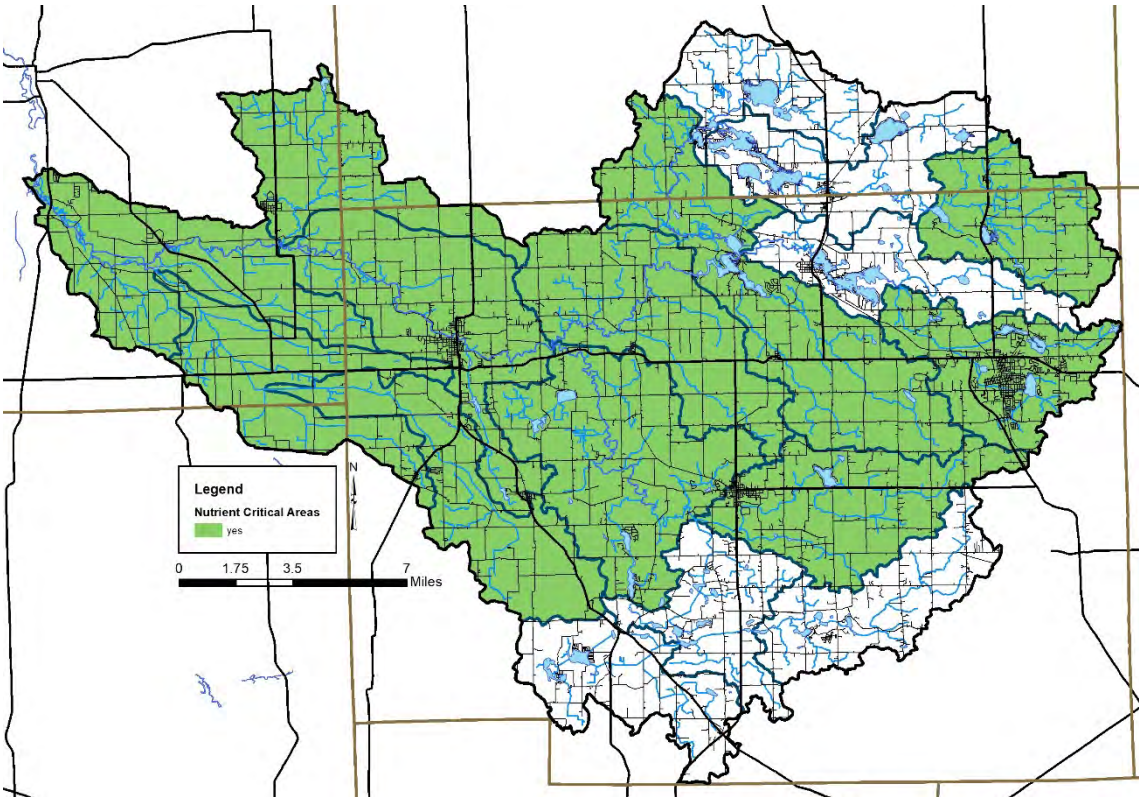

Figure 114. Critical areas for nutrients in the Upper Elkhart River Watershed.

8.2 Critical Areas for Sediment

Total suspended solids concentrations were used to determine sediment-based critical areas (Figure 115). Total suspended solids enter streams the watershed through streambank and bed erosion, unfiltered runoff, agricultural land use in floodplains, stormwater runoff, and livestock access. Based on the data reviewed by the steering committee the following datasets were priorities for sediment critical areas:

- HEL >50%
- Ag production >70%
- Streambank erosion >2%
- Narrow buffer >20%
- Historic TSS >30% exceedance
- Historic turbidity >50% exceedance
- Current TSS >25% exceedance
- Current turbidity >25% exceedance
- Urban land >10%

Critical subwatersheds were determined as follows: Waterhouse Ditch-Henderson Lake Ditch (504), Oviate Ditch-Middle Branch Elkhart River (505), Huston Ditch-North Branch Elkhart River (507), Skinner Lake-Croft Ditch (603), Muncie Lake-South Branch Elkhart River (604), Phillips Ditch-Stony Creek (801), Indian Lake-Elkhart River (802), Headwaters Solomon Creek (803), Hire Ditch-Solomon Creek (804), and Whetten Ditch-Elkhart River (805; Figure 115).

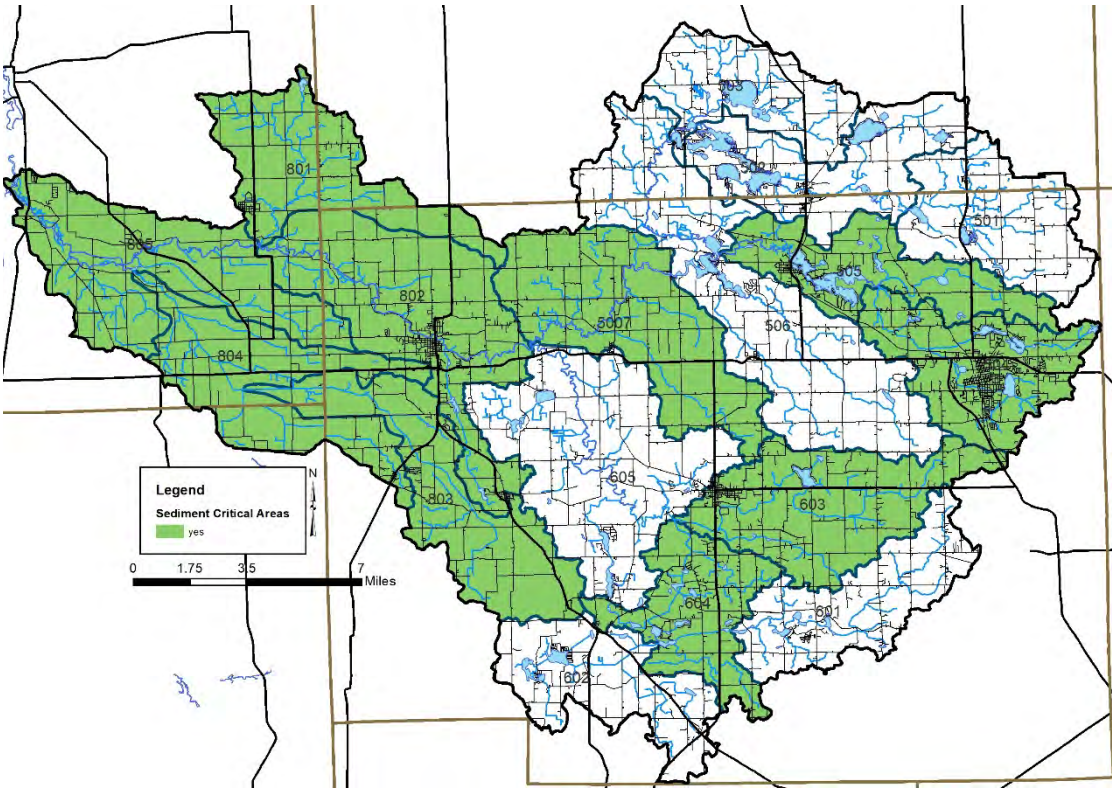

Figure 115. Critical areas for sediment in the Upper Elkhart River Watershed.

8.3 Critical Areas for *E. coli*

E. coli concentrations were used to determine *E. coli*-based critical areas (Figure 116). *E. coli* enters streams in the watershed through human and animal waste, livestock access, and infrastructure issues. Additional areas of concern, such as areas with manure management issues or failing septic systems, may also be included. While those areas have not been quantified, dense unsewered areas were included as a method for identifying these areas. Based on the data reviewed by the steering committee the following datasets were priorities for sediment critical areas:

- E. coli impairment (303(d) listing) -any
- Manure volume>20,000 lb/year
- Historic E. coli >40% exceedance
- Current E. coli exceedance >50%
- Lack of sanitary sewer (number of address points not sewered/acre of subwatershed)>0.05 points/acre

Critical subwatersheds were determined as follows: Indian Dallas Lake-Little Elkhart Creek (502), Oliver Lake-Little Elkhart Creek (503), Waterhouse Ditch-Henderson Lake Ditch (504), Oviate Ditch-Middle Branch Elkhart River (505), Jones Lake-North Branch Elkhart River (506), Skinner Lake-Croft Ditch (603), Phillips Ditch-Stony Creek (801), Lake-Elkhart River (802), Solomon Creek (803), Hire Ditch-Solomon Creek (804) and Whetten Ditch-Elkhart River (805; Figure 116).

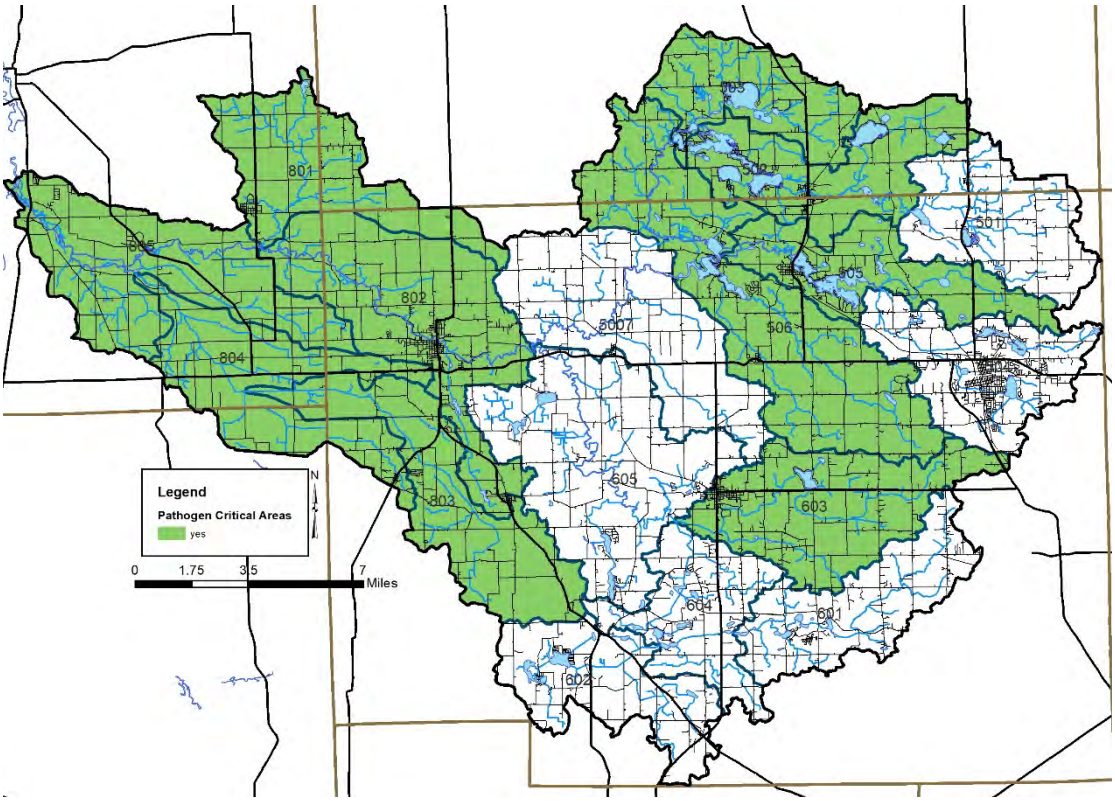

Figure 116. Critical areas for *E. coli* in the Upper Elkhart River Watershed.

8.4 Critical Areas Summary

The subwatersheds identified as critical areas for each parameter are summarized in Figure 114 to Figure 116 identify the highest priority subwatersheds, the steering committee decided to divide them into three tiers (high, medium and low priority), based on the number of parameters that were determined to be critical. The highest priority subwatersheds are those that were determined to be critical for three of the three potential parameters (nutrients, sediment, *E. coli*). The medium priority subwatersheds are those that were determined to be critical for two of three potential parameters. The lowest priority subwatersheds were critical for one of three potential parameters (Figure 117). Subwatersheds were prioritized as follows:

- High Priority: Skinner Lake-Croft Ditch (603), Phillips Ditch-Stony Creek (801), Indian Lake-Elkhart River (802), Headwaters Solomon Creek (803), Hire Ditch-Solomon Creek (804), Whetten Ditch-Elkhart River (805)
- Medium Priority: Waterhouse Ditch-Henderson Lake Ditch (504), Oviate Ditch-Middle Branch Elkhart River (505), Jones Lake-North Branch Elkhart River (506) and Huston Ditch-North Branch Elkhart River (507)
- Low Priority: Tamarack Lake-Little Elkhart Creek (501), Dallas Lake-Little Elkhart Creek (502), Oliver Lake-Little Elkhart Creek (503), Muncie Lake-South Branch Elkhart River (604) and Diamond Lake-South Branch Elkhart River (605)

Two subwatershed, Rivir Lake-Forker Creek (601) and Winebrenner Branch-Carrol Creek were not prioritized as critical areas meaning they were not identified as the areas of highest concern for any of the three parameters (nutrients, sediment, pathogen). Implementation efforts will target high priority critical areas first, followed by medium priority then low priority areas. It is anticipated that

implementation efforts will be targeted in medium and low priority subwatersheds as part of EPA-funded implementation efforts only after implementation efforts are exhausted in higher priority areas. Implementation via other funding sources, via landowner interest in NRCS-based federal funding programs will occur as landowners are interested. The Upper Elkhart River stakeholder group will continue volunteer monitoring efforts to continue to assess the quality of these subwatersheds and identify any changes in water quality as they occur.

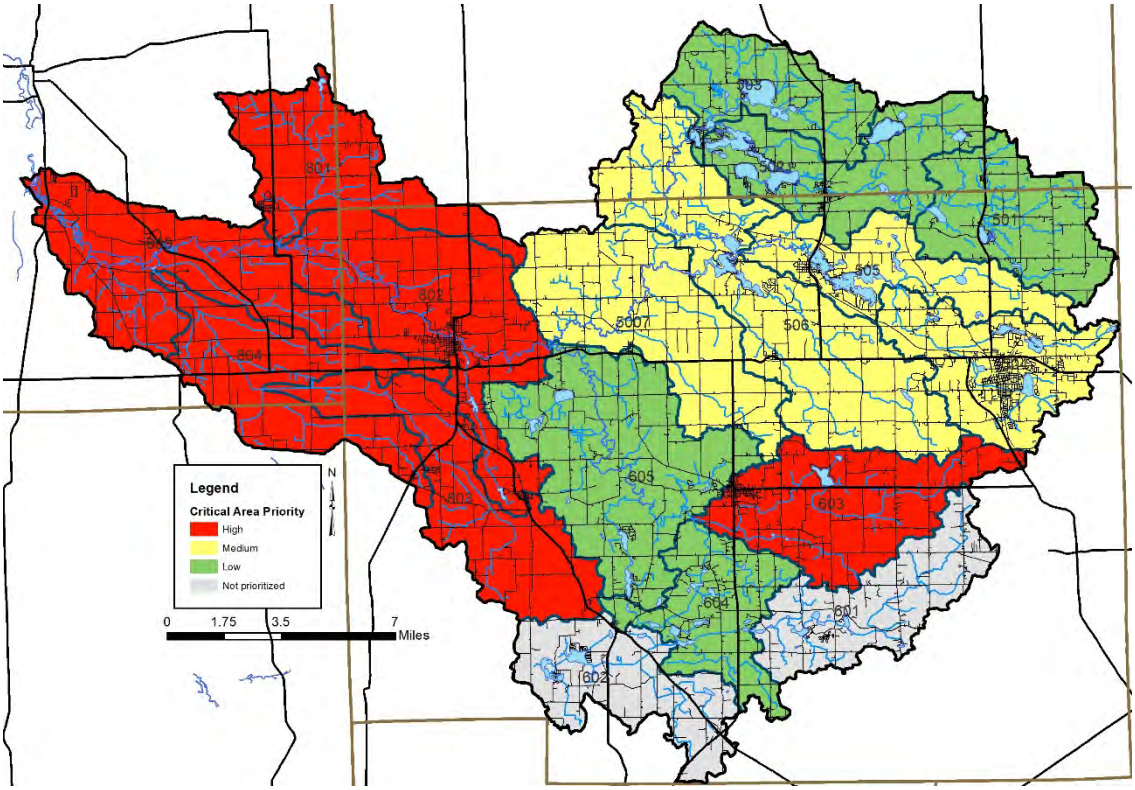

Figure 117. Prioritized critical areas in the Upper Elkhart River Watershed.

After setting initial goals, the steering committee reviewed the critical area map in light of the load reduction calculations which show that Headwaters Solomon Creek, Indian Lake-Elkhart River, Phillips Ditch-Stony Creek and Whetten Ditch-Elkhart River do not require sediment load reductions to meet water quality targets and Dallas Lake-Little Elkhart Creek, Headwaters Solomon Creek, Indian Lake-Elkhart River, Jones Lake-North Branch Elkhart River, Oliver Lake-Little Elkhart Creek and Whetten Ditch-Elkhart River do not require E. coli load reductions to meet the state standard and to determine if any areas might be missing from the critical areas map and/or if priority or protection areas needed to be established.

1. The steering committee reviewed historic water quality for sediment and E. coli and discussed resource concerns that were identified during initial critical area prioritization to determine whether critical area prioritization or loading rates should be the deciding factor for these critical areas.

   For sediment critical areas, the committee noted that streambank erosion, narrow buffers, agricultural land use and historic water quality data dominated prioritization of sediment critical areas for Philips Creek-Stony Creek, Indian Lake-Elkhart River and Whetten Ditch-Elkhart River. Additionally, current turbidity data exceeded targets for Headwaters Solomon Creek and

Whetten Ditch-Elkhart River and current TSS data exceeded targets for Headwaters Solomon Creek. The committee determined that these resource concerns are still present whether the sediment loading rates reflect these conditions or not and decided that these subwatersheds would rank as critical.

The committee further noted that E. coli impairments, lack of sanitary sewers, manure volumes estimated from CAFO/CFO and hobby farm counts and historic water quality data indicate that there are E. coli resource concerns present in Dallas Lake-Little Elkhart Creek, Headwaters Solomon Creek, Indian Lake-Elkhart River, Jones Lake-North Branch Elkhart River, Oliver Lake-Little Elkhart Creek and Whetten Ditch-Elkhart River subwatersheds. In total, more than 96 miles of streams are impaired for E. coli in these subwatersheds indicating that E. coli is reaching watershed streams but may have not been collected during the current monitoring effort. The committee determined that these resource concerns and impairments are still present whether E. coli loading rates reflect these conditions and decided that these subwatersheds would rank as critical.

2. The steering committee noted that the largest urban community in the watershed, the City of Kendallville, was located outside of the high priority critical areas. Committee members stressed the need to work with the predominantly urban community residents to address stormwater and wastewater concerns was imperative in the short term. Based on this input, the steering committee added the City of Kendallville as a high priority critical area. While the current city boundary is included to represent this critical area, the committee expressed a need to expand the critical area boundary with any changes to the City of Kendallville's boundaries in the future.

3. Additionally, the steering committee identified the need to protect current floodplains, natural areas and wetlands within the watershed. The committee stressed the need to protect these areas as little positive impact can occur to the Upper Elkhart Watershed if improvements to other areas occur but these areas are lost. Figure 118 shows the updated critical and priority areas highlighted by the Upper Elkhart River steering committee.

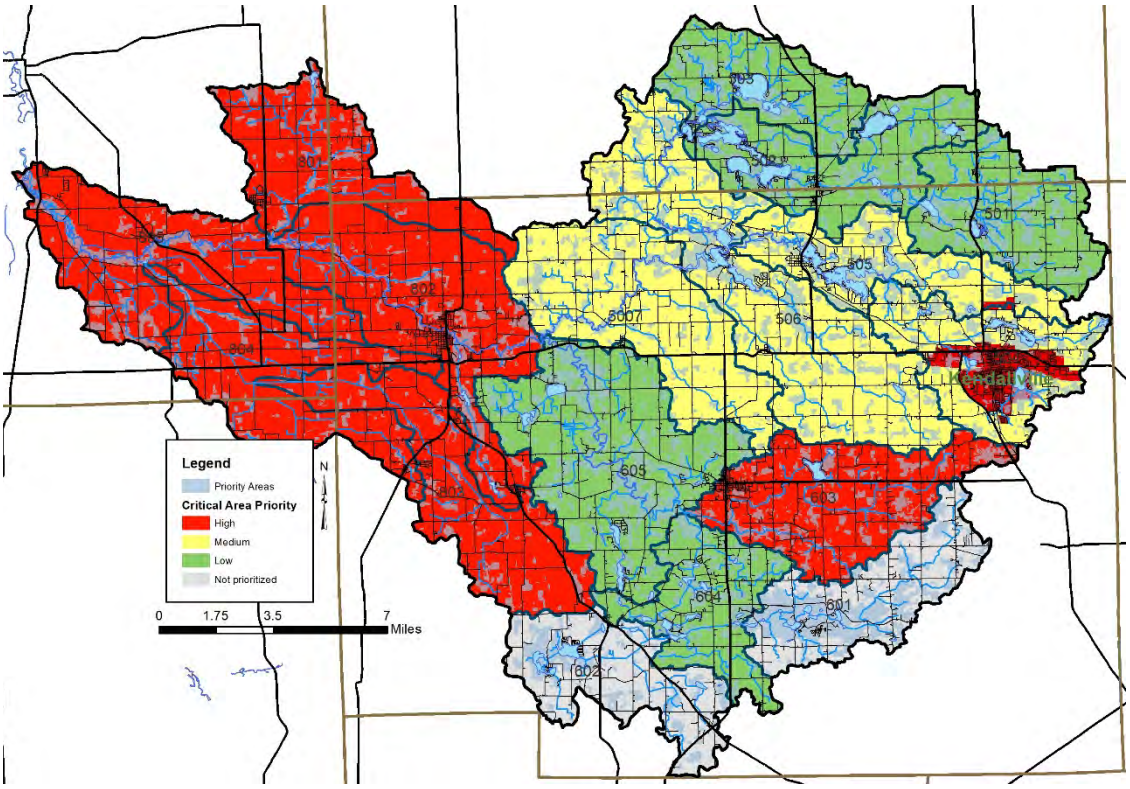

Figure 118. Critical areas prioritized via adaptive management in the Upper Elkhart River Watershed.

8.5 Reduced Water Storage, Retention and Infiltration

The Upper Elkhart River steering committee identified reduced water storage, retention and infiltration as a problem in the Upper Elkhart River Watershed. The causes associated with this problem include:

- Land use changes are impacting the ability to store, retain and infiltrate water.
- Local regulations are key to minimizing impacts from development in the watershed.
- Deregulation, including proposed state regulations that would take away local control, poses a threat to the watershed.
- Lack of cohesive regulations and governance across the watershed makes funding and implementation of a watershed plan challenging.
- Lack of uniform drainage ordinance for the watershed.
- Lack of single government body that oversees the watershed.

The steering committee identified these items as problems across the watershed. Rather than tie quantity issues to a specific location within the watershed, these issues will be addressed in two manners: Where storage, retention and infiltration can be improved on the land, activities and BMP installation with target sediment, nutrient and/or pathogen reductions will be utilized. Based on the fact that these issues occur across the watershed, a specific critical areas map will not be utilized for these concerns. Implementation of water quantity projects will focus on problems at their source, as identified, and will not be targeted or limited to a specific subwatershed. Deregulation, cohesive regulation and cohesive drainage ordinances will be a focus for the entire Upper Elkhart River Watershed.

8.6 Critical Acre Determination

To be eligible for National Water Quality Initiative (NWQI) Funding, the Upper Elkhart River Watershed steering committee considered options for targeting all agricultural acreage within the watershed rather

than limiting implementation efforts to specific 12-digit HUC subwatersheds. Table 87 details critical acres by subwatershed based on the criteria selected for nutrient, sediment and *E. coli* critical areas. The steering committee will target hot spots or problem areas identified within each subwatershed including but not limited to 1) ensuring that all highly erodible soils are protected or covered; 2) targeting livestock restriction, streambank erosion and buffer strip installation in areas where erosion, livestock access and/or narrow buffers were identified; and 3) working with producers to reduce the impacts from manure production within the Upper Elkhart River Watershed (Figure 119). Upper Elkhart River Watershed stakeholders identified the need for soils with septic limitation to be targeted for septic treatment; however, this is not an NWQI targeted practice and is therefore not included in Table 87. Note that manure application acres have not been mapped as these application areas are only identified as potential areas for manure application for each permitted confined feeding operation.

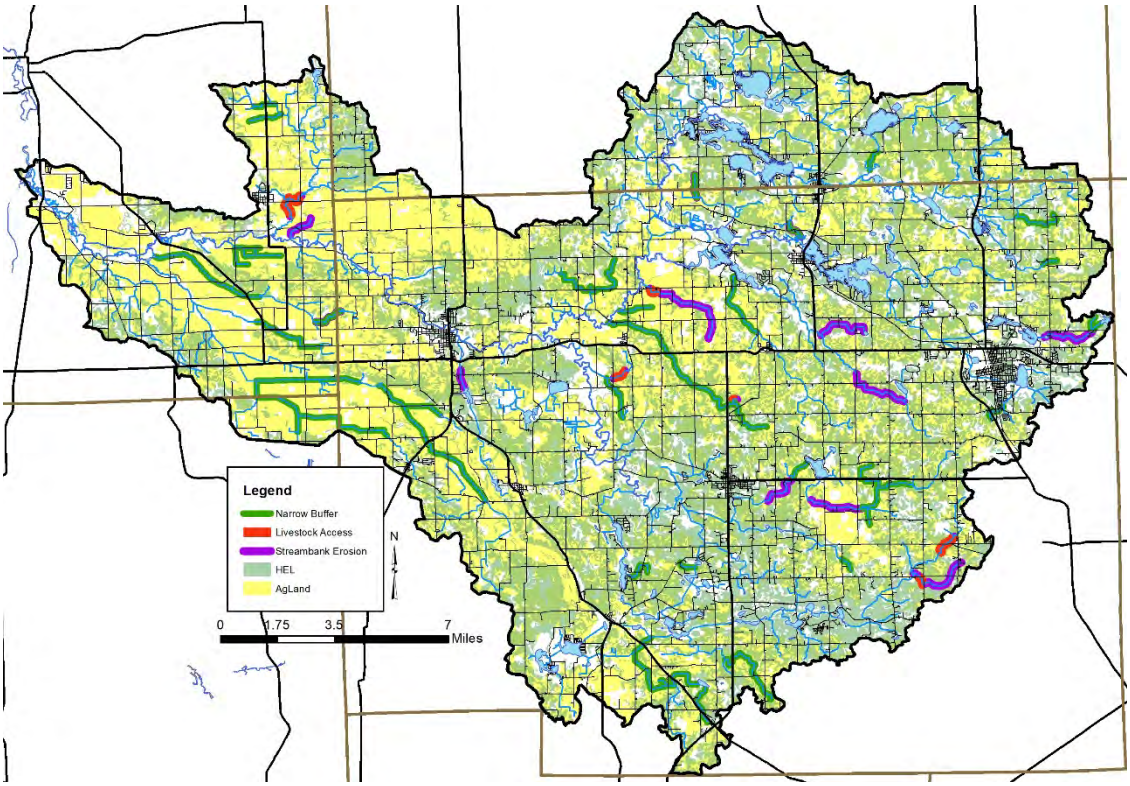

Figure 119. Critical acres in the Upper Elkhart River Watershed.

Table 87. Critical acres by subwatershed in the Upper Elkhart River Watershed.

Subwatershed Name	HUC	Ag Land (acres)	HEL (acres)	Manure Estimate (tons)	Livestock Access (miles)	Streambank Erosion (miles)	Narrow Buffer (miles)
Tamarack Lake-Little Elkhart Creek	040500011501	7,813.5	7,107.0	431	--	--	2.2
Dallas Lake-Little Elkhart Creek	040500011502	7,312.0	6,899.2	30,179	--	--	0.7
Oliver Lake-Little Elkhart Creek	040500011503	6,156.3	5,268.7	21,692	--	--	
Waterhouse Ditch-Henderson Lake Ditch	040500011504	5,767.7	7,524.2	4,305	--	1.8	1.6
Oviate Ditch-Middle Branch Elkhart River	040500011505	6,113.8	5,910.3	33,050	--	0.6	0.6
Jones Lake-North Branch Elkhart River	040500011506	17,110.1	12,847.3	109,397	--	4.6	3.1
Huston Ditch-North Branch Elkhart River	040500011507	14,549.6	6,877.4	287,891	0.6	3.3	11.4
Rivir Lake-Forker Creek	040500011601	6,162.2	8,296.3	3,903	1.0	2.9	--
Winebrenner Branch-Carrol Creek	040500011602	7,994.9	4,869.5	2,068	--	--	5.7
Skinner Lake-Croft Ditch	040500011603	11,169.2	8,912.9	10,163	--	3.1	5.4
Muncie Lake-South Branch Elkhart River	040500011604	6,595.0	6,822.9	2,382	--	--	3.4
Diamond Lake-South Branch Elkhart River	040500011605	14,051.1	11,907.1	49,215	0.5	0.5	2.4
Phillips Ditch-Stony Creek	040500011801	10,433.5	3,461.1	119,367	1.4	1.4	1.8
Indian Lake-Elkhart River	040500011802	15,088.1	7,419.8	117,999	--	1.5	--
Headwaters Solomon Creek	040500011803	12,756.9	6,232.9	131,036	--	--	9.5
Hire Ditch-Solomon Creek	040500011804	11,661.3	2,844.4	11,951	--	--	8.1
Whetten Ditch-Elkhart River	040500011805	12,826.3	3,688.1	28,253	--	0.9	7.8

8.7 Current Level of Treatment

Based on data from the Indiana Conservation Partnership, more than 27,500 acres of best management practices including but not limited to cover crops, conservation cover, fencing, firebreak installation, forage and biomass planting, residue tillage, water facility and heavy use protection area construction and more have been implemented over the last 5 years in the Upper Elkhart River Watershed. Table 88 details practices by acre.

Table 88. Practices installed from 2019-2021 in the Upper Elkhart River Watershed based on Indiana Conservation Partner data in acres.

Practice	501	502	503	504	505	506	507	601	602	603	604	605	801	802	803	804	805	Total
Conservation Cover	20.4	--	--	18.8	6.1	78.8	54.1	5.0	102.5	36.7	16.7	91.4	--	0.5	24.3	5.7	1,979	2,440.2
Cover Crop	1,127	1,502	1,086	959	651	2,417	607	469	644	506	714	1,542	660	493	1,584	4,895	--	19,587.0
Early Successional Habitat Dev-Mgmt	35.7	--	--	24.5	81.0	42.5	0.3	10.9	24.0	--	24.1	64.4	--	0.7	9.5	0.6	1.2	319.4
Fence	--	--	--	--	--	--	--	--	--	0.0	0.9	--	--	--	--	--	--	0.9
Field Border	0.4	--	--	7.3	--	3.7	1.3	6.9	--	5.7	--	--	--	--	--	--	--	25.3
Firebreak		--	--		1.1	--	--	--	1.2	--	--	--	--	--	--	--	--	2.3
Forage and Biomass Planting	36.4	6.0	--	--	17.5	48.3	113.1	25.8	34.2	62.2	76.4	183.2	--	17.0	--	--	--	620.1
Grassed Waterway	2.1	--	--	4.3	--	--	--	0.7	--	--	--	--	--	--	2.6	--	0.4	10.1
Heavy Use Area Protection	--	--	--	--	0.0	0.1	--	--	--	--	--	--	--	--	--	--	--	0.1
Residue and Tillage Management, No Till	6.0	389.5	546.0	113.8	--	875.7	--	--	24.7	--	--	--	176.4	--	--	1,512	243.9	3,887.8
Tree/Shrub Establishment	4.0	7.3	--	--	--	0.9	35.8	50.7	--	--	47.1	13.2		12.3	82.7	--	0.8	254.8
Upland Wildlife Habitat Management	2.6	20.7	--	12.0	8.5	4.0			5.0					1.4				54.2
Wetland Creation	4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9
Wetland Restoration	63.0	--	--	--	4.6	8.6	--	--	--	--	10.0	--	--	--	--	--	--	86.2
Wildlife Habitat Planting	--	--	--	--	--	--	--	--	3.0	--	--	--	--	--	--	--	--	3.0
Windbreak/Shelterbelt Establishment	--	--	--	--	--	0.8	--	--	0.2	--	1.1	--	--	--	--	--	--	2.0

9.0 GOAL SETTING

Based on watershed inventory efforts; stakeholder input for concerns, problems, and sources; and watershed loading information, the following goals and strategies were developed.

9.1 Goal Statements

The steering committee wrote goals for each parameter or area of concern based on a goal of meeting the target concentrations identified by the committee The current loading rate was calculated using water chemistry data collected monthly at each of the twenty sample sites and flow data from the North Branch Elkhart River Cosperville (USGS 04100222) gage for tributary stream sites and the Elkhart River at Goshen (USGS 04100500) for the mainstem Elkhart River sites. Flow data from the USGS gage was scaled to the drainage area for Upper Elkhart River sample sites. In an effort to scale goals to manageable levels, short term (10 year), medium term (20 year), and long term (30 year) goals were generated. The calculation process is described below:

1. Current and target loading rates were determined for the Upper Elkhart River sample sites. Loading rates and target reductions for the entire watershed were calculated using data generated for the most downstream Elkhart River mainstem site (Site 20).
2. Additionally, drainage basin outlet loading rates were calculated for each of the other 12-digit HUC watershed outlets. This allows for calculation of loading rates within each 12-digit HUC.
3. The steering committee chose to utilize the watershed outlet's loading rates to calculate current and target loading rates and to set goals.
4. The steering committee selected a generational timeframe of 30 years. Once set, the ability to reach long term goals which will result in water quality nutrient, sediment and E. coli targets being met throughout the watershed in 30 years will be reviewed and adjusted as needed.
5. The steering committee set short term and medium-term goals for one-third of that timeframe or 10 years for each phased goal. With this in mind, short term goals will be met in 10 years (2033) and medium-term goals will be met in 20 years (2043). Current and target loading rates for each phase of implementation are based on the subwatershed loading rates calculated for each subwatershed (ie subwatersheds determined to be high priority were used to high priority, short term goals, medium priority subwatershed were used for medium priority, medium term goals and low priority subwatersheds were used for low priority, long term goals).
6. As some of the subwatershed sampling locations already meet water quality target concentrations, any negative loading rates were removed from the calculation.

Reduce Nutrient Loading

Based on collected water quality data summarized for Upper Elkhart River, the committee set the following goals for nitrate-nitrogen and total phosphorus: Reduce nitrate-nitrogen loading from 2,951,983 pounds per year to 793,549 pounds per year (73%) by 2053 and reduce total phosphorus loading from 58,220 pounds per year to 39,677 pounds per year (32%) by 2053 (Table 89 and Table 90).

Short term goal: Reduce total phosphorus inputs from 58,220 pounds per year to 52,039 pounds per year (11% reduction) and nitrate-nitrogen from 2,951,983 pounds per year to 2,232,505 pounds per year (24% reduction) in the Upper Elkhart River in 10 years (2033).

Medium term goal: Reduce total phosphorus inputs from 52,039 pounds per year to 45,858 pounds per year (12% reduction) and nitrate-nitrogen from 2,232,505 pounds per year to 1,513,027 pounds per year (32% reduction) in Upper Elkhart River in 10 years (2043).

Long term goal: Reduce total phosphorus inputs from 45,858 pounds per year to 39,677 pounds per year (13% reduction) and nitrate-nitrogen from 1,513,027 pounds per year to 793,549 pounds per year (48% reduction) in Upper Elkhart River in 10 years (2053).

Table 89. Nitrate-nitrogen short, medium, and long-term goal calculations for prioritized critical areas in Upper Elkhart River.

Goal Timeframe	Current Load (lb/yr)	Load Reduction (lb/yr)	Target Load (lb/yr)	Percent Reduction
Short Term (10 years)	2,951,983	2,232,505	719,478	24%
Medium Term (20 years)	2,232,505	1,513,027	719,478	32%
Long Term (30 years)	1,513,027	793,549	719,478	48%

Table 90. Total phosphorus short, medium, and long-term goal calculations for prioritized critical areas in Upper Elkhart River.

Goal Timeframe	Current Load (lb/yr)	Load Reduction (lb/yr)	Target Load (lb/yr)	Percent Reduction
Short Term (10 years)	58,220	52,039	6,181	11%
Medium Term (20 years)	52,039	45,858	6,181	12%
Long Term (30 years)	45,858	39,677	6,181	13%

Reduce Sediment Loading

Based on collected water quality data summarized for Upper Elkhart River, the committee set the following goal for total suspended solids: reduce total suspended solids loading from 4,836,336 pounds per year to 3,967,746 pounds year (18%) by 2053 (Table 91).

Short term goal: Reduce total suspended solids inputs from 4,836,336 pounds per year to 4,546,806 pounds per year (6% reduction) in Upper Elkhart River in 10 years (2033).

Medium term goal: Reduce total suspended solids inputs from 4,546,806 pounds per year to 4,257,276 pounds per year (6% reduction) in Upper Elkhart River in 10 years (2043).

Long term goal: Reduce total suspended solids inputs from 4,257,276 pounds per year to 3,967,746 pounds per year (7% reduction) in Upper Elkhart River in 10 years (2053).

Table 91. Total suspended solids short, medium, and long-term goal calculations for prioritized critical areas in Upper Elkhart River.

Goal Timeframe	Current Load (lb/yr)	Load Reduction (lb/yr)	Target Load (lb/yr)	Percent Reduction
Short Term (10 years)	4,836,336	4,546,806	289,530	6%
Medium Term (20 years)	4,546,806	4,257,276	289,530	6%
Long Term (30 years)	4,257,276	3,967,746	289,530	7%

Reduce *E. coli* Loading

Based on collected water quality data summarized for Upper Elkhart River, the committee set the following goal for *E. coli*: reduce E. coli loading from 5.51E+14 to 4.50E+14 (18%) by 2053 (Table 92).

Short term goal: Reduce E. coli inputs from 5.51E+14 colonies per year to 5.18E+14 colonies per year (6% reduction) in Upper Elkhart River in 10 years (2033).

Medium term goal: Reduce E. coli inputs from 5.18E+14 per year to 4.84E+14 colonies per year (7% reduction) in Upper Elkhart River in 10 years (2043).

Long term goal: Reduce E. coli inputs from 4.84E+14 per year to 4.50E+14 colonies per year (7% reduction) in Upper Elkhart River in 10 years (2053).

Table 92. E. coli short, medium, and long-term goal calculations for prioritized critical areas in Upper Elkhart River.

Goal Timeframe	Current Load (lb/yr)	Load Reduction (lb/yr)	Target Load (lb/yr)	Percent Reduction
Short Term (10 years)	5.51E+14	5.18E+14	3.37E+13	6%
Medium Term (20 years)	5.18E+14	4.84E+14	3.37E+13	7%
Long Term (30 years)	4.84E+14	4.50E+14	3.37E+13	7%

Reduce Flooding Impacts

Long term: Reduce flooding impacts by increasing storage and infiltration across the watershed within 30 years.

Baseline in 2023 - Wetland acreage (NWI): 34,630.7 acres; floodplain land cover acreage: 19,858 acres; and coverage of poorly drained and very poorly drained soils: 72,591 acres.

Recreational Access

Long term: Increase recreational access through increased river access points, ability to paddle from the North Branch-South Branch confluence to the watershed outlet to the Lower Elkhart River and improve habitat connectivity/natural land preservation across the watershed within 30 years.

Increase Public Awareness and Education

Long term: By 2053, 70% of watershed households will be informed about practices that can be implemented to positively impact Upper Elkhart River and no less than 25% of individuals living and farming in the watershed will be engaged in the project within 30 years.

Baseline in 2023 - Property owners: 26,210 parcel addresses; Producers: 988 based on DTN contact list and producers who identified as such at public events for the Upper Elkhart River Watershed.

10.0 IMPROVEMENT MEASURE SELECTION

A wide variety of practices are available for on-the-ground implementation to reduce sediment, nutrient, and *E. coli* loading within the Upper Elkhart River Watershed. A list of potential best management practices was reviewed by the project steering committee. From this list, the practices which were deemed most appropriate to remediate the sources of pollution in the watershed and most likely to

successfully meet loading reduction targets were identified. It should be noted that no practice list is exhaustive and that additional techniques may be both possible and necessary to reach water quality goals.

10.1 Best Management Practices Descriptions

A list of potential BMPs were reviewed by the Upper Elkhart River steering committee. Committee members reviewed potential practices taking into account the identified resource concerns, watershed land uses, and Upper Elkhart River Watershed Project goals. From the potential practice list, the most appropriate BMPs to remediate sources of pollution and address resource concerns in the Upper Elkhart River Watershed was developed. This practice list is not exhaustive and new and emerging technologies and techniques should be considered as possible and necessary options to meet water quality targets within the Upper Elkhart River Watershed. A combination of practices detailed below aimed at avoiding, controlling and trapping nutrients and sediment and the implementation of a conservation system could be necessary to make lasting, measurable changes in Upper Elkhart River water quality. Selected practices are appropriate for all critical areas since they predominantly contain agriculture land use and pasture, and crop resource concerns were identified in all subwatersheds. Several urban practices were also identified. These should be targeted at residential and commercial areas throughout the watershed including Kendallville, Wolcottville, Rome City, Albion and other small towns as well as lakes and reservoirs present throughout the watershed. Selected practices with descriptions are listed below. Potential best management practices include the following:

- Access Control
- Alternate Watering System
- Animal Mortality Facility
- Bioreactor
- Bioretention – Rain Garden, Bioswale
- Composting Facility
- Conservation Tillage: Residue and Tillage Management, No till/Strip till/Direct Seed
- Consider soil characteristics to minimize runoff
- Cover Crop
- Curb Openings/Curbless Design
- Dam Removal
- Diversion structures
- Drainage Water Management
- Drivable Grass
- Fencing
- Field Border or Filter Strip
- Flow Splitter
- Forage and Biomass Planting
- Grade Stabilization Structure
- Grassed Waterway
- Green Roof
- Greenways and Trails
- Habitat Corridor Identification and Improvement
- Heavy Use Area Protection
- Infrastructure Retrofits
- Lined Waterway or Outlet
- Livestock Pipeline
- Livestock Restriction/Prescribed Grazing
- Manure Management Planning
- Mulching
- Nutrient and/or Pest Management
- Pervious Pavement
- Phosphorus Free Fertilizer Usage
- Point Source Discharge Reduction
- Pollinator Planting
- Rain Barrels
- Regular Soil Tests
- Septic System Care and Maintenance
- Streambank Stabilization
- Subsurface Drain (Agricultural)
- Subsurface Infiltration (urban)
- Threatened and Endangered Species Protection
- Tree Box Filter
- Tree/Shrub Establishment
- Two Stage Ditch
- University fertilization recommendations
- Variable rate application
- Vegetated Swale
- Waste Storage Facility
- Waste Utilization
- Water and Sediment Control Basin
- Wetland Creation, Wetland Enhancement, Wetland Restoration

Access Control
Access control involves the temporary or permanent exclusion of animals, people, vehicles, and/or equipment from an area. Access control is used to achieve and maintain desired resource conditions by monitoring and managing the intensity of use by animals, people, vehicles, and/or equipment in coordination with the application schedule of practices, measures and activities specified in the conservation plan.

Animal Morality Facility
An animal mortality facility is an on-farm facility for the treatment or disposal of animal carcasses due to routine mortality. This standard applies to livestock and poultry operations where routine animal carcass storage, treatment, or disposal is needed. This standard does not apply to catastrophic animal mortality.

Bioreactors
Bioreactors use bacteria to digest organic materials including manure, remnant plant material, and woody debris. Bioreactors typically generate energy, water, and fertilizer. Bioreactors use a series of tanks and treatment processes to separate cellulose-based materials from oils and gases. Materials are then broken down into carbon dioxide or methane gas and ethanol.

Bioretention
Bioretention practices use biofiltration or bioinfiltration to filter runoff by storing it in shallow depressions. Bioretention uses plant uptake and soil permeability mechanisms in a variety of manners typically in combination. Potential practices include sand beds, pea gravel overflow structures, organic mulch layers, plant materials, gravel underdrains, and an overflow system to promote infiltration. Bioinfiltration can also be used to treat runoff from parking lots, roads, driveways and other areas in the urban environment. Bioretention should not be used in highly urbanized areas rather, it should be used in areas where on-site storage space is available.

Composting Facility
A composting facility is a structure to facilitate the controlled anaerobic decomposition of manure or other organic material by microorganisms into a biologically stable organic material that is suitable for use as a soil amendment. It can reduce the pollution potential and improve the handling characteristics of organic waste solids and produce a soil amendment that adds organic matter and beneficial organisms, provides slow-release plant-available nutrients, and improves soil conditions (FOTG Code 317, NRCS, 2011).

Conservation Tillage (No-till)
Conservation tillage refers to several different tillage methods or systems that leave at least 30% of the soil covered with crop residue after planting (Holdren et al., 2001). Tillage methods encompassed by conservation tillage include no-till, mulch-till, ridge-till, and strip till. The purpose of conservation tillage is to reduce sheet and rill erosion, maintain or improve soil organic matter content, conserve soil moisture, increase available moisture, reduce plant damage, and provide habitat and cover for wildlife. The remaining crop residue helps reduce soil erosion and runoff volume.

Several researchers have demonstrated the benefits of conservation tillage in reducing pollutant loading to streams and lakes. A comprehensive comparison of tillage systems showed that no-till results in 70% less herbicide runoff, 93% less erosion, and 69% less water runoff volume when compared to conventional tillage (Conservation Technology Information Center, 2000). Reductions in pesticide loading have also been reported (Olem and Flock, 1990).

Cover Crops/Critical Area Planting/Conservation Cover

Cover crops include legumes, such as clover, hairy vetch, field peas, alfalfa, and soybean, and non-legumes, such as rye, oats, wheat, radishes, turnips, and buckwheat which are planted prior to or following crop harvest. Cover crops typically grow for one season to one year and are typically grown in non-cropping seasons. Cover crops are used to improve soil quality and future crop harvest by improving soil tilth, reducing wind and water erosion, increasing available nitrogen, suppressing weed cover, and encouraging beneficial insect growth. Cover crops reduce phosphorus transport by reducing soil erosion and runoff. Both wind and water erosion move soil particles that have phosphorus attached. Sediment that reaches water bodies may release phosphorus into the water. Runoff water can wash soluble phosphorus from the surface soil and crop residue and carry it off the field. The cover crop vegetation recovers plant-available nutrients in the soil and recycles them through the plant biomass for succeeding crops.

Diversion Structures

A diversion structure is a channel generally constructed across the slope with a supporting ridge on the lower side. This practice may be applied to support various purposes including breaking up concentrations of water on long slopes, on undulating land surfaces, and on land that is generally considered too flat or irregular for terracing. Diverting water away from farmsteads, agricultural waste systems, and other improvements. Collecting or directing water for storage, water- spreading or water-harvesting systems. Protecting terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above. Intercept surface and shallow subsurface flow. Reducing runoff damages from upland runoff. Reducing erosion and runoff on urban or developing areas and at construction or mining sites. Diverting water away from active gullies or critically eroding areas. Supplementing water management on conservation cropping or strip cropping systems. Diversion structures can be applied to all land uses where surface runoff water control and/or management are needed and where soils and topography are such that the diversion can be constructed, and a suitable outlet is available or can be provided.

Drainage Water Management/Subirrigation

Subsurface tile drainage is an essential water management practice on highly productive fields. As a result of tile drainage, nitrate carried in drainage water enters adjacent surface waterbodies. Drainage water management is necessary to reduce nitrate loads entering adjacent surface waterbodies from tile drainage networks. Drainage water management uses water control structures within lateral drains to vary the depth of tile outlets. Typically, the outlet is raised after harvest to limit outflow from the tile and reduce nitrate transport to adjacent waterbodies; lowered in the spring and fall to allow tile water to flow freely from the field to adjacent waterbodies; and raised in the summer to help store water making it available for crops (Frankenberger et al., 2006). Drainage water management can be used in concert with a suite of other conservation practices including subirrigation, cover crops and conservation tillage to promote a systems approach and be better stewards of water quantity.

Fencing/Alternate Watering Systems

Fencing livestock out of stream systems allows for the restoration of the stream channel. Alternative watering systems provide an alternate location for livestock to seek water rather than using a surface water source. This removes the negative impacts of livestock access to streams including direct deposit of manure and bank erosion and destabilization, while improving the health of livestock by providing a clean water source and better footing while drinking. This results in less *E. coli*, phosphorus, nitrogen, and sediment entering a surface waterbody. Alternative watering systems may include pump systems or gravity systems connected to a well, or running pipe from a pond or spring.

Field Border/Buffer Strip/Filter Strip

Installing natural buffers or filters along major and minor drainages in the watershed helps reduce the nutrient and sediment loads reaching surface waterbodies. Buffers provide many benefits including restoring hydrologic connectivity, reducing nutrient and sediment transport, improving recreational opportunities and aesthetics, and providing wildlife habitat. Sediment, phosphorus, nitrogen, and *E. coli* are at least partly removed from water passing through a naturally vegetated buffer. The percentage of pollutants removed depends on the pollutant load, the type of vegetation, the amount of runoff, and the character of the buffer area. The most effective buffer width can vary along the length of a channel. Adjacent land uses, topography, runoff velocity, and soil and vegetation types are all factors used to determine the optimum buffer width.

Many researchers have verified the effectiveness of filter strips in removing sediment from runoff with reductions ranging from 56-97% (Arora et al., 1996; Mickelson and Baker, 1993; Schmitt et al., 1999; Lee et al, 2000; Lee et al., 2003). Most of the reduction in sediment load occurs within the first 15 feet of installed buffer. Smaller additional amounts of sediment are retained and infiltration is increased by increasing the width of the strip (Dillaha et al., 1989). Filter strips have been found to reduce sediment-bound nutrients like total phosphorus but to a lesser extent than they reduce sediment load itself. Phosphorus predominately associates with finer particles like silt and clay that remain suspended longer and are more likely to reach the strip's outfall (Hayes et al., 1984). Filter strips are least effective at reducing dissolved nutrients like those of nitrate and phosphorus, and atrazine and alachlor, although reductions of dissolved phosphorus, atrazine, and alachlor of up to 50% have been documented (Conservation Technology Information Center, 2000). Simpkins et al. (2003) demonstrated 20-93% nitrate-nitrogen removal in multispecies riparian buffers. Short groundwater flow paths, long residence times, and contact with fine-textured sediments favorably increased nitrate-nitrogen removal rates. Additionally, up to 60% of pathogens contained in runoff may be effectively removed. Computer modeling also indicates that over the long run (30 years), filter strips significantly reduce amounts of pollutants entering waterways.

Filter strips should be designed as permanent plantings to treat runoff and should not be considered part of the annual rotation of adjacent cropland. Filter strips should receive only sheet flow and should be installed on stable banks. A mixture of grasses, forbs, and herbaceous plants should be used. In more permanent plantings, shrubs and trees should be intermingled to form a stable riparian community.

Flow Splitter

A flow splitter is an engineered structure used to divide flow into two or more parts and divert these parts to different places. The design of a flow splitter uses specifically designed structures, pipes, orifices, and weirs set at specific elevations to control the direction of flow. An illustration of a simple type of flow splitter is provided in the accompanying figure. Typically, when managing storm water flows, a flow splitter is used to direct initial storm water flows to an off-line BMP. The splitter is placed at an elevation coordinated with the elevation of the treatment BMP, so that the elevation of water in the BMP governs the elevation in the flow splitter. As shown in the example illustration, storm water flows to the BMP until it reaches a pre-determined elevation. Once storm water reaches that elevation, a weir (or other hydraulic feature) directs additional flow to an alternative outlet. This simple type of flow splitter works on hydraulic principles and requires no mechanical components or instrumentation.

Forage and Biomass Planting

Forage and biomass plantings establish adapted and/or compatible species, varieties, or cultivars of herbaceous species suitable for pasture, hay or biomass production. Purposes include: Improve or

maintain livestock nutrition and/or health; provide or increase forage supply during periods of low forage production; reduce soil erosion; improve soil and water quality; produce feedstock for biofuel or energy production.

Grade Stabilization
A grade stabilization structure is used to stabilize and control soil erosion in natural and artificial channels. It can prevent the formation or advance of gullies, enhance environmental quality, and reduce pollution hazards. Special attention is given to maintaining or improving habitat for fish and wildlife.

Grassed Waterway
Grassed waterways are natural or constructed channels established for transport of concentrated flow at safe velocities using adequate channel dimensions and proper vegetation. They are generally broad and shallow by design to move surface water across farmland without causing soil erosion. Grassed waterways are used as outlets to prevent rill and gully formation. The vegetative cover slows the water flow, minimizing channel surface erosion. When properly constructed, grassed waterways can safely transport large water flows downslope. These waterways can also be used as outlets for water released from contoured and terraced systems and from diverted channels. The amount of precipitation that runs off the soil surface rather than infiltrating down into the soil profile is increased by tillage and other farming activities that increase soil compaction and decrease soil organic matter and macro-pore content. For these reasons, the establishment or refurbishing of a grassed waterway should, when possible, be coupled with other practices that aim to increase the rate of water infiltration into the soil. This BMP can reduce sediment concentrations of nearby waterbodies and pollutants in runoff. The vegetation improves the soil aeration and water quality due to its nutrient removal through plant uptake and absorption by soil. The waterways can also provide wildlife corridors and allows more land to be natural areas.

Green Roof
A green roof system is an extension of the existing roof which involves, at a minimum, high quality waterproofing, root repellent system, drainage system, filter cloth, a lightweight growing medium, and plants.

Green roof systems may be modular, with drainage layers, filter cloth, growing media, and plants already prepared in movable, often interlocking grids, or loose laid/built-up whereby each component of the system may be installed separately. Green roof development involves the creation of "contained" green space on top of a human-made structure. This green space could be below, at, or above grade, but in all cases, it exists separate from the ground.

Green roofs can provide a wide range of public and private benefits and have been successfully installed in countries around the world. Green roofs provide a variety of environmental benefits to aesthetic improvements, waste diversion, moderation of the heat island effect, improved air quality, and stormwater benefits. Some of the water benefits include; water is stored by the substrate and then taken up by the plants from where it is returned to the atmosphere through transpiration and evaporation, in summer, green roofs can retain 70-90% of the precipitation that falls on them, in winter, green roofs can retain between 25-40% of the precipitation that falls on them, green roofs not only retain rainwater, but also moderate the temperature of the water and act as natural filters for any of the water that happens to run off, and green roofs reduce the amount of stormwater runoff and also delay the time at which runoff occurs, resulting in decreased stress on sewer systems at peak flow periods.

Greenways and Trails
Greenways can provide a large number of functions and benefits to nature and the public. For plants and animals, greenways provide habitat, a buffer from development, and a corridor for migration. Greenways located along streams include riparian buffers that protect water quality by filtering sediments and nutrients from surface runoff and stabilizing streambanks. By buffering the stream from adjacent developed land use, riparian greenways offset some of the impacts associated with increased impervious surface in a watershed. Maintaining a good riparian buffer can mitigate the negative impacts of approximately 5% additional impervious surface in the watershed.

Habitat Corridor Identification and Improvement
Protection of habitat corridors requires a multi-phase program including identification of appropriate habitat corridors, development of a corridor management plan, and creation of an improvement plan. Most long-term corridor protection will require land transfer into protected status. There are several options for land transfer ranging from donation to fee simple land purchase. Donations can be solicited and encouraged through incentive programs. Outright purchase of property offers a secondary option and is frequently the least complicated and most permanent protection technique but is also the most costly. A conservation easement is a less expensive technique than outright purchase that does not require the transfer of land ownership but rather a transfer of use rights. Conservation easements might be attractive to property owners who do not want to sell their land at the present time but would support perpetual protection from further development. Conservation easements can be donated or purchased.

Several techniques can be used for protecting natural areas and open space in both public and private ownership. The first step in the process is to identify and prioritize properties for protection. The highest priority natural areas should be permanently protected by the ownership or under the management of public agencies or private organizations dedicated to land conservation. Other open space can be protected using conservation design development techniques and is more likely to be managed by homeowner associations.

Heavy Use Area Protection
HUAP is used to stabilize a ground surface that is frequently used by people, animals, or vehicles and to protect water quality.

Infrastructure Retrofits
Typical stormwater infrastructure includes pipe and storm drains, or hard infrastructure, to convey water away from hard surfaces and into the stormwater system. Retrofitting these structures to implement low impact development techniques, use green practices, and introduce plants and filters to reduce sediment and nutrient concentrations contained in stormwater.

Livestock Restriction/Prescribed (Rotational) Grazing/Lined Waterway or Outlet
Livestock that have unrestricted access to a stream or wetland have the potential to degrade the waterbody's water quality and biotic integrity. Livestock can deliver nutrients and pathogens directly to a waterbody through defecation. Livestock also degrade stream ecosystems indirectly. Trampling and removal of vegetation through grazing of riparian zones can weaken banks and increase the potential for bank erosion. Trampling can also compact soils in a wetland or riparian zone decreasing the area's ability to infiltrate water runoff. Removal of vegetation in a wetland or riparian zone also limits the area's ability to filter pollutants in runoff. The degradation of a waterbody's water quality and habitat typically results in the impairment of the biota living in the waterbody.

Restoring areas impacted by livestock grazing often involves several steps. First, the livestock in these areas should be restricted from the wetland or stream to which they currently have access. If necessary, an alternate source of water should be created for the livestock. Second, the wetland or riparian zone where the livestock have grazed should be restored. This may include stabilizing or reconstructing the banks using bioengineering techniques. Minimally, it involves installing filter strips along banks or wetland edge and replanting any denuded areas. Finally, if possible, drainage from the land where the livestock are pastured should be directed to flow through a constructed wetland to reduce pollutant loading, particularly nitrate-nitrogen loading, to the adjacent waterbody. Complete restoration of aquatic areas impacted by livestock will help reduce pollutant loading, particularly nitrate-nitrogen, sediment, and pathogens.

A livestock exclusion system is a system of permanent fencing (board, barbed, etc) installed to exclude livestock from streams and areas not intended for grazing. This will reduce erosion, sediment, and nutrient loading, and improve the quality of surface water. Landowners can additionally section off the pastureland and move the animals from one paddock to the next, ensuring adequate vegetation growth for nutrient removal. Using this system of rotational grazing no one piece of land gets overgrazed and ensures a high-quality food for the livestock and adequate ground cover for nutrient and sediment retention. Education and outreach programs focusing on rotational grazing and exclusionary fencing are important in the success of this BMP.

Manure Management Planning

Large volumes of manure are generated by both small, unregulated animal operations and by confined feeding operations located throughout the Big Pine watershed. Many entities have manure management plans in place and are currently using these plans to manage the volume of manure produced on their facility. Manure management planning includes consideration of the volume and type of manure produced annually, crop rotations by field, the volume of manure and nutrients needed for each crop, field slope, soil type, and manure collection, transportation, storage, and distribution methods. Manure management planning uses similar techniques to nutrient management planning with regards to nutrient budgets.

Animal waste is a major source of pollution to waterbodies. To protect the health of aquatic ecosystems and meet water quality standards, manure must be safely managed. Good management of manure keeps livestock healthy, returns nutrients to the soil, improves pastures and gardens, and protects the environment, specifically water quality. Poor manure management may lead to sick livestock, unsanitary and unhealthy conditions for humans and other organisms, and increased insect and parasite populations. Proper management of animal waste can be done by implementing BMPs, through safe storage, by application as a fertilizer, and through composting. Proper manure management can effectively reduce *E.coli* concentrations, nutrient levels and sedimentation. Manure management can also be addressed in education and outreach to encourage farmers to participate in this BMP.

Mulching

Mulching is the application of plant residues to the land surface. This can help conserve soil moisture, moderate soil temperature, provide erosion control, facilitate the establishment of vegetative cover, improve soil quality, and reduce airborne particulates. This practice can be used alone or in combination with other practices (FOTG Code 484, NRCS, 2011).

Nutrient/Pest Management Planning including Variable Rate Application and Waste Storage Facility
Nutrient management is the management of the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments to minimize the transport of applied nutrients into surface water or groundwater and can be in commercial/non-manure fertilizer or manure-based fertilizers. Nutrient management seeks to supply adequate nutrients for optimum crop yield and quantity, while also helping to sustain the physical, biological, and chemical properties of the soil. A nutrient budget for nitrogen, phosphorus, and potassium is developed considering all potential sources of nutrients including, but not limited to, animal manure, commercial fertilizer, crop residue, and legume credits. Realistic yields are based on soil productivity information, potential yield, or historical yield data based on a 5-year average. Nutrient management plans specify the form, source, amount, timing, and method of application of nutrients on each field in order to achieve realistic production levels while minimizing transport of nutrients to surface and/or groundwater.

Pervious Pavement
Pervious pavement comes in many forms including porous pavement and modular block pavement. Both types of pervious pavement can be installed on most any travel surface with a slope of 5% or less. Pervious pavement has the approximate strength characteristics of traditional pavement with the ability to percolate water into the groundwater system. The pavement reduces sediment and nutrient transmission into the groundwater as water moves through the pores in the pavement. When installed, porous pavement includes a stone layer, filter fabric, and a filter layer covered by porous pavement. Correctly mixed porous pavement eliminates fine aggregates found in typical pavements. Porous asphalt is a type of porous pavement which includes a mix of Portland cement, coarse aggregates, and water that results in the formation of interconnected voids.

Modular pavement consists of individual blocks made of pervious material such as sand, gravel, or sod interspersed with strong structural material such as concrete. The blocks are typically placed on a sand or gravel base and designed to provide a load-bearing surface that is adequate to support personal vehicles, while allowing infiltration of surface water into the underlying soils. They usually are used in low-volume traffic areas such as overflow parking lots and lightly used access roads. An alternative to pervious and modular pavement for parking areas is a geotextile material installed as a framework to provide structural strength. Filled with sand and sodded, it provides a completely grassed parking area.

Phosphorus Free Fertilizer Usage
Phosphorus-free fertilizers are those fertilizers that supply nitrogen and minor nutrients without the addition of phosphorus. Phosphorus increases algae and plant growth which can cause negative impacts on water quality within aquatic systems. The Clear Choices, Clean Water program estimates that a one acre lawn fertilized with traditional fertilizer supplies 7.8 pounds of phosphorus to local waterbodies annually. Given that 75% of urban residents within the Region of the Great Bend of the Wabash River Watershed indicate either limited knowledge or that they don't use phosphorus free fertilizers, there is great potential for reducing urban sources of phosphorus by targeting this practice. Established lawns take their nutrients from the soil in which they grow and need little additional nutrients to continue plant growth. Fertilizers are manufactured in a variety of forms including that without phosphorus. Phosphorus-free fertilizer should be considered for use in areas where grass is already established.

Prescribed Grazing
This practice where grazing and/or browsing animals are managed on a prescribed schedule. Removal of herbage by the grazing animals is in accordance with production limitations, plant sensitivities and management goals. Frequency of defoliations and season of grazing is based on the rate of growth and

physiological condition of the plants. Duration and intensity of grazing is based on desired plant health and expected productivity of the forage species to meet management objectives. In all cases enough vegetation is left to prevent accelerated soil erosion. Application of this practice will manipulate the intensity, frequency, duration, and season of grazing to: Improve water infiltration, maintain or improve riparian and upland area vegetation, protect stream banks from erosion, manage for deposition of fecal material way from water bodies and promote ecological and economically stable plant communities which meet landowner objectives. (FOTG Code 528, NRCS, 2010)

Rain Barrel

A rain barrel is a container that collects and stores rainwater from your rooftop (via your home's disconnected downspouts) for later use on your lawn, garden, or other outdoor uses. Rainwater stored in rain barrels can be useful for watering landscapes, gardens, lawns, and trees. Rain is a naturally soft water and devoid of minerals, chlorine, fluoride, and other chemicals. In addition, rain barrels help to reduce peak volume and velocity of stormwater runoff to streams and storm sewer systems. Although rain barrels don't specifically reduce nutrient or sediment loading to waterbodies, their presence can reduce the first flush of water reaching storm drains. This impact is great especially in portions of the watershed where combined sewers are still in operation. Although a high percentage of urban residents indicated a general knowledge of rain barrels, only 3% of survey respondents indicate that they have installed a rain barrel. Furthermore, 75% of respondents indicate a willingness to consider installing a rain barrel.

Septic System Care, Maintenance, and Upgrades

Septic, or on-site waste disposal systems, are the primary means of sanitary flow treatment outside of incorporated areas including most of the small towns and unincorporated areas in the Upper Elkhart River Watershed. Because of the prohibitive cost of providing centralized sewer systems to many areas, septic tank systems will remain the primary means of treatment into the future. Annual maintenance of septic systems is crucial for their operation, particularly the annual removal of accumulated sludge. The cost of replacing failed septic tanks is about $5,000-$15,000 per unit based on industry standards.

Property owners are responsible for their septic systems under the regulation of the County Health Department. When septic systems fail, untreated sanitary flows are discharged into open watercourses that pollute the water and pose a potential public health risk. Septic systems discharging to the ground surface are a risk to public health directly through body contact or contamination of drinking water sources. Additionally, septic systems can contribute significant amounts of nitrogen and phosphorus to the watershed. Therefore, it is imperative for homeowners not to ignore septic failures. If plumbing fixtures back up or will not drain, the system is failing. Funding for this practice is limited. Our efforts will include developing an education plan for homeowners in the watershed, and hosting a series of septic system care and maintenance workshops.

Soil testing - Consider soil characteristics to minimize runoff

Soil testing can be used to determine Determines nutrient levels in the soil, determine pH levels and thus, lime needs; provides a decision-making tool to determine what nutrients to apply, how much, and when. Regular soil testing and the application of fertilizers at or below university fertilizer recommendations provides the potential for higher yielding, high quality crops with more targeted fertilizer use.

Streambank Stabilization

Streambank stabilization or stream restoration techniques are used to improve stream conditions so they more closely mimic natural conditions. The most feasible restoration options return many of the stream's natural functions (flood storage, nutrient removal, etc.) without restoring the stream completely to its

original condition. However, even a partial restoration of this type is extremely expensive, takes quite a bit of land to accomplish, and is likely unrealistic as a large scale strategy in this watershed. Our efforts will focus primarily on two-stage ditch construction, which is a cheaper way to incorporate a small floodplain into the ditch itself in the form of benches on either side of the main channel that allow for increased capacity in the ditch resulting in slower moving water along the banks resulting in reduced bank slumping and failure. Restoration and stabilization options are limited by available floodplain, modifications to natural flows, and development structure locations. Reestablishment of riparian buffers, restoration of stream channels, stabilization of eroding stream banks, installation of riffle-pool complexes, and general maintenance can all improve stream function while reducing sediment and nutrient transport into and within the system.

T&E Species Protection (Habitat Improvement)
Threatened and endangered species are those plant and animal species whose survival is in peril. Federally and state listed species identified within the Upper Elkhart River Watershed are highlighted in the Watershed Inventory. Threatened species are those that are likely to become endangered in the foreseeable future. Federally endangered species are those that are in danger of extinction throughout all or a significant portion of their range. A state-endangered species is any species that is in danger of extinction as a breeding species in Indiana.

Protecting threatened and endangered species requires consideration of their habitat including food, water, and nesting and roosting living space for animals and preferred substrate for plants and mussels. Corridors for species movement are also necessary for long-term protection of these species. Protection of habitat can include providing clean water and available food but likely requires protection of the physical living space and associated corridor. Conservation management plans should be developed for each species, if they are not already in place. Such plans should consider habitat needs including purchase or protection of adjacent properties to current habitat locations, hydrologic needs, pollution reduction, outside impacts, and other techniques necessary to protect threatened and endangered species.

Tree Box Filters
Tree box filters are a proprietary biotreatment device that is designed to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes. Tree box filters are installed at curb level and consist of an open bottom concrete barrel filled with a porous soil media, an underdrain in crushed gravel, and a tree. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to ultra-urban areas.

Tree/Shrub Establishment
Reforestation is the establishment of forests, usually accomplished through the planting of tree seedlings. It is important to match the species being planted to the site chosen for reforestation. Control of competing vegetation and invasive plants is often necessary to ensure establishment and survival of planted trees. This is usually done through mowing and/or herbicide application. Reforestation can provide many benefits to the landscape. Increasing the amount of forest through tree planting provides more habitat for forest dependent species, improves water quality by reducing erosion, decreases nutrient loading and lowers floodwater velocity.

Two-Stage Ditch
When water is confined to stream or ditch channel it has the potential to cause bank erosion and channel down-cutting. Current ditch design generates narrow channels with steep sides. Water flowing through these systems often result in bank erosion, channel scour and flooding. A relatively new technique

focuses on mitigating these issues through an in-stream restoration called a two-stage ditch. The design of a two-stage ditch incorporates a floodplain zone, called benches, into the ditch by removing the ditch banks roughly 2-3 feet above the bottom for a width of about 10 feet on each side depending on the size of the channel. This allows the water to have more area to spread out on and decreases the velocity of the water. This not only improves the water quality, but also improves the biological conditions of the ditches where this is located.

The benefits of a two-stage ditch over the typical agricultural ditch include both improved drainage function and ecological function. The two-stage design improves ditch stability by reducing water flow and the need for maintenance, saving both labor and money. It also has the potential to create and maintain better habitat conditions. Better habitats for both terrestrial and aquatic species are a great plus when it comes to the two-stage ditch design. The transportation of sediment and nutrients is decreased considerably because the design allows the sorting of sediment, with finer silt depositing on the benches and coarser material forming the bed. A recent study by the University of Notre Dame found that the average two-stage ditch reduces the amount of sediment transported annually by over 100,000 pounds per half mile of two-stage (Tank, unpublished data).

University fertilization recommendations/Soil testing
Soil Testing can be used to determine Determines nutrient levels in the soil, determine pH levels and thus, lime needs; provides a decision-making tool to determine what nutrients to apply, how much, and when. Regular soil testing and the application of fertilizers at or below university fertilizer recommendations provides the potential for higher yielding, high quality crops with more targeted fertilizer use.

Variable Rate Application/Technologies
Precision agriculture is defined as a management system that uses information, technology, and site-specific data to manage variability within fields for optimum profitability, sustainability, and environmental protection. This method also includes guidance systems for agricultural equipment. The purposes of using precision agriculture are: To improve water quality by targeting pesticide or soil amendment applications to meet field-specific cropland yield capabilities; reduce the potential off-site impacts of fertilizer and pesticide applications; improve water quality by reducing pesticide and fertilizer inputs through avoidance of overlapping and end row/turn row applications; reduce surface runoff and through precisely controlled cropping equipment, resulting in less fuel being used; reduce compaction by limiting traffic to specified travel lane; and increase opportunity to operate equipment after dark.

Vegetated Swale
Vegetated swales are used in agricultural areas and are often considered landscape features. Swales are graded to be linear with a shallow, open channel of a trapezoidal or parabolic shape. Vegetation which is water tolerant is planted within the channel which promotes the slowing of water flow through the system. Swales reduce sediment and nutrients as water moves through the swale and water infiltrates into the groundwater.

Waste Utilization
Large volumes of manure are generated by small, unregulated animal operations located throughout the Lower Salt Creek watershed. Many entities have manure management plans in place and are currently using these plans to manage the volume of manure produced on their facility. Manure management planning includes consideration of the volume and type of manure produced annually, crop rotations by field, the volume of manure and nutrients needed for each crop, field slope, soil type, and manure

collection, transportation, storage, and distribution methods. Manure management planning uses similar techniques to nutrient management planning with regards to nutrient budgets. Specific technical practices that can be included in manure management planning can include waste storage facilities and waste utilization.

Animal waste is a major source of pollution to waterbodies. To protect the health of aquatic ecosystems and meet water quality standards, manure must be safely managed. Good management of manure keeps livestock healthy, returns nutrients to the soil, improves pastures and gardens, and protects the environment, specifically water quality. Poor manure management may lead to sick livestock, unsanitary and unhealthy conditions for humans and other organisms, and increased insect and parasite populations. Proper management of animal waste can be done by implementing BMPs, through safe storage, by application as a fertilizer, and through composting. Proper manure management can effectively reduce E. coli concentrations, nutrient levels and sedimentation. Manure management can also be addressed in education and outreach to encourage farmers to participate in this BMP.

Water and Sediment Control Basin
A water and sediment control basin is an earthen embankment constructed across the slope of a minor watercourse to form a sediment trap and water detention basin with a stable outlet. This practice can reduce watercourse and gully erosion, trap sediment, and reduce downstream runoff. It is particularly applicable where watercourse or gully erosion is a problem and where sheet and rill erosion is controlled by other conservation practices. It can help in areas where sediment in runoff is severe, though it needs to be placed where adequate outlets can be provided (FOTG Code 638, NRCS, 2011).

Wetland Construction or Restoration
Visual observation and historical records indicate at least a portion of the Upper Elkhart River Watershed has been altered to increase its drainage capacity. Riser tiles in low spots on the landscape and tile outlets along the waterways in the watershed confirm the fact that the landscape has been hydrologically altered. This hydrological alteration and subsequent loss of wetlands has implications for the watershed's water quality. Wetlands serve a vital role in storing water and recharging the groundwater. When wetlands are drained with tiles, the stormwater reaching these wetlands is directed immediately to nearby ditches and streams. This increases the peak flow velocities and volumes in the ditch. The increase in flow velocities and volumes can in turn lead to increased stream bed and bank erosion, ultimately increasing sediment delivery to downstream water bodies. Wetlands also serve as nutrient sinks at times. The loss of wetlands can increase pollutant loads reaching nearby streams and downstream waterbodies.

Restoring wetlands in the watershed could return many of the functions that were lost when these wetlands were drained. Through this process, a historic wetland site is restored to its historic status. These restored systems store nutrients, sediment, and *E. coli* while also increasing water storage and reducing flooding. Wetlands also provide additional habitat, stormwater mitigation, and recreational opportunities.

10.2 Best Management Practice Selection and Load Reduction Calculations

Table 93 details selected agricultural and urban best management practices and reflect those parameters which NRCS eFOTG, if appropriate, indicate can be utilized to impact each parameter. The critical area and the selected best management practices are based on subwatershed characteristics and available water quality data. Table 94 outlines suggested BMPs, estimated load reduction for nutrients and sediment (if available), and the target volume (area, length) of each practice, while Table 95 details estimated costs for implementing each practice based on the target volume. The steering committee

identified BMPs that would be of interest to local producers, while the project coordinator calculated volume of BMPs necessary to meet project goals.

Table 93. Suggested Best Management Practices to address Upper Elkhart River critical areas. Note: BMPs were selected by the steering committee.

Practice	Nutrients	Sediment	Pathogens
Access Control/Fencing	X	X	X
Alternative Watering System	X		X
Animal Mortality Facility			X
Bioreactor	X		
Bioretention	X	X	X
Composting Facility			
Conservation Tillage	X	X	X
Cover Crop/Critical Area Planting/Conservation Cover	X	X	X
Diversion Structures	X	X	
Drainage Water Management	X	X	
Fencing	X	X	X
Field Border/Buffer Strip	X	X	X
Flow Splitter	X	X	X
Forage/Biomass Planting	X	X	X
Grade Stabilization Structure	X	X	
Grassed Waterway/Mulching/Subsurface Drain	X	X	X
Green Roof	X		
Greenways and Trails	X	X	
Habitat Corridor Identification and Improvement	X	X	
Heavy Use Area Protection	X	X	X
Lined Waterway or Outlet	X	X	X
Livestock Restriction/Pipeline; Prescribed Grazing	X	X	X
Manure Management Planning	X		X
Mulching	X	X	X
Nutrient/Pest Management	X		
Pervious Pavement	X	X	
Phosphorus Free Fertilizer	X		
Point Source Discharge Reduction			
Rain Barrel	X	X	
Septic System Care/Maintenance	X		X
Soil Testing	X	X	X
Streambank Stabilization	X	X	
Subsurface Drain (agricultural)			
Subsurface Infiltration (Urban)			
Tree Box Filter	X	X	
T&E Species Protection (Habitat Improvement)	X	X	
Tree/Shrub Establishment	X	X	
Two Stage Ditch	X	X	X
University Fertilization Recommendations/Soil Testing	X		
Variable Rate Application	X		

Practice	Nutrients	Sediment	Pathogens
Vegetated Swale	X	X	
Waste Storage Facility	X		X
Waste Utilization	X		X
Water and Sediment Control Basin	X	X	
Wetland Creation/Enhancement/Restoration	X	X	X

The Region V model was used to estimate the approximate load reductions for BMPs unless otherwise noted. BMPs with dashes (-) do not have load reductions available using the Region V Model or other identifiable source. The target volumes of BMPs proposed to be installed are not required to be implemented as the quantities suggest. These targets are simply guidelines for achieving goals. Load reductions solely using this model meet the project targets for nitrogen, phosphorus and sediment goals for short, medium, and long-term goals. If the volume of practices specific in Table 94 is met, then the target loading rates detailed in Table 89 through Table 92 will be achieved for high priority critical areas (Headwaters Solomon Creek, Hire Ditch-Solomon Creek, Huston Ditch-North Branch Elkhart River, Indian Lake-Elkhart River, Phillips Ditch-Stony Creek, Skinner Lake-Croft Ditch, Whetten Ditch-Elkhart River and City of Kendallville); medium priority critical areas (Jones Lake-North Branch Elkhart River, Oviate Ditch-Middle Branch Elkhart River, Tamarack Lake-Little Elkhart Creek and Waterhouse Ditch-Henderson Lake Ditch); and low priority critical areas (Dallas Lake-Little Elkhart Creek, Diamond Lake-South Branch Elkhart River, Muncie Lake-South Branch Elkhart River and Oliver Lake-Little Elkhart Creek). The steering committee realizes that the model's calculations are only an estimate, and actual reductions could be beyond the model's estimation. The Region V model does not provide estimated reductions for all suggested BMPs; these load reductions cannot be included in the calculations. The steering committee acknowledges that they have set the bar high by establishing ambitious water quality targets that may be difficult to obtain. The group is committed to improve water quality the best that they can, even in the event that the original load reduction goals are not met.

Table 94. Suggested Best Management Practices, target volumes, and their combined estimated load reduction per practice unit to meet high priority, medium priority and low priority goals for each 10 year implementation phase.

Suggested BMPs:	High priority BMP Targets	Medium priority BMP Targets	Low priority BMP Targets	Unit	Nitrogen (lb/year)	Phosphorus (lb/year)	Sediment (t/year)
Conservation Cover (327)	5,000	5,000	5,000	acre	345,000	165,000	540,150
Cover Crop (340)	30,000	30,000	30,000	acre	1,350,000	630,000	18,000,000
Drainage Water Management (554)	100	100	100	feet	3,120		
Filter Strip (393)	500	500	500	acre	36,000	18,000	87,765
Forage and Biomass Planting (512)	2,000	2,000	2,000	acre	138,000	66,000	60,000
Grassed Waterway (412)	500	500	500	acre	349,350	174,600	151,950
Livestock Restriction (Alt Watering System, Access Control)	1,000	1,000	1,000	Feet; units	8,400	2,490	202,560
Nutrient/Pest Management (590)^	10,000	10,000	10,000	Acre	124,800	187,200	
Pollinator planting (CP42)	500	500	500	acres	34,500	16,500	54,015
Prescribed Grazing (528)	2,000	2,000	2,000	acre	102,000	54,000	136,860
Residue and Tillage Management (329)	10,000	10,000	10,000	acres	630,000	300,000	60,000,000
Streambank Stabilization*	100	100	100	feet	0	249	20,256
Two Stage Ditch (582)	300	300	300	acre	0	747	60,768
Wetland Creation/Restoration	5	5	5	acre	123	44	1,047
Urban BMPs (bioretention, rain barrel, rain garden, pervious pavement, treatments vaults, green roof)	100	100	100	unit	150	60	60
				Total Load Reduction Targeted	3,121,443	1,614,890	79,315,431

^Assumes all nutrient management is non-manure based. Increase to 6.24 lb/ac/yr for N and 8.77 lb/ac/yr P for manure-based nutrient management.
*Assumes average width of 5 feet.

Table 95. Estimated cost for selected Best Management Practices to meet high priority, medium priority and low priority goals.

Suggested BMPs:	Estimated Cost per Unit	Short-term Estimated Cost	Medium-term Estimated Cost	Long-term Estimated Cost
Conservation Cover (327)	75	$375,000	$375,000	$375,000
Cover Crop (340)	25	$750,000	$750,000	$750,000
Drainage Water Management (554)	$50	$5,000	$5,000	$5,000
Filter Strip (393)	75	$37,500	$37,500	$37,500
Forage and Biomass Planting (512)	75	$150,000	$150,000	$150,000
Grassed Waterway (412)	$5,000	$2,500,000	$2,500,000	$2,500,000
Livestock Restriction (Alt Watering System, Access Control)	$1,000	$1,000,000	$1,000,000	$1,000,000
Nutrient/Pest Management (590)	$4.00	$40,000	$40,000	$40,000
Pollinator planting (CP42)	$75	$37,500	$37,500	$37,500
Prescribed Grazing (528)	$15.00	$30,000	$30,000	$30,000
Residue and Tillage Management (329)	$15	$150,000	$150,000	$150,000
Streambank Stabilization	$1,000	$100,000	$100,000	$100,000
Two Stage Ditch (582)	$50	$15,000	$15,000	$15,000
Wetland Creation/Restoration	$5,000	$25,000	$25,000	$25,000
Urban BMPs (bioretention, rain barrel, rain garden, pervious pavement, treatments vaults, green roof)	varies	$84,000	$84,000	$84,000
Total Cost		**$5,299,000**	**$5,299,000**	**$5,299,000**

10.3 Action Register

All activities to be completed as part of the Upper Elkhart River Watershed management plan are identified in Table 96. The goals set by the steering committee are listed below. Each objective in the action register corresponds to one or more goals and reflects the estimated amount of each BMP that will be needed in order to achieve the target load reductions. Nutrient and sediment removal efficiencies were not available for all BMPs, so the estimated number of BMPs needed was calculated based only on those BMPs that had load reduction estimates. For those BMPs that did not have associated load reduction estimates, the objective was developed with an amount of each BMP that the steering committee determined to be reasonably achievable. Therefore, if all the BMPs listed in all objectives are implemented, the total load reductions achieved will far exceed the load reductions needed to meet the water quality benchmarks.

Table 96. Action Register.

Project Goals	Objective	Target Audience	Milestone	Cost	Possible Partners (PP) & Technical Assistance (TA)
Nutrients, Sediment, *E. coli*	Coordinate on-the-ground cost-share program starting in 2024.	Producers, homeowners, developers	Develop a cost-share program (2024).	$25,000 annually staffing	PP/TA: NRCS, SWCD, surveyors, ICP partner agencies
			Implement cost-share program (2024-2053).		
			Review more than 100 potential projects identified in previous studies/projects and determine if they still need to be implemented or if these concern areas have been addressed in another way (2025).		
			Annually, identify and apply for potential funding sources to augment cost-share program including NWQI, RCPP, LARE, CWI and others. Once received, implement cost-share program per program guidance (annually).		
Nutrients, Sediment, *E. coli*	Promote and fund conservation practices which emphasize, soil health, livestock and manure management, natural resources restoration and management and target urban BMP implementation (Table 93).	Contractors, builders, homeowners, producers, lake associations	Meet BMP targets detailed above (Table 93).	$2.3 million annually for 30 years for BMP implementation	PP: Planning and zoning staff, DNR, cities and towns, IDEM TA: NRCS, SWCD, FSA
			Annually increase adoption of conservation plans and nutrient (including manure management) plans.		
			Work with Kendallville and Elkhart County and any future MS4 communities, cities/towns and lakeshore residences to ensure that urban BMPs are implemented on new construction and retrofits are included as possible on lands already developed. Initiate annual review starting in 2025.		
			Achieve short-term load reductions: 74% reduction in nitrate loading, 47% reduction in total phosphorus loading, 65% reduction in total suspended solids loading and 64% reduction in E. coli loading by 2033.		
			Achieve medium-term load reductions: 76% reduction in nitrate loading, 68% reduction in total phosphorus loading, 53% reduction in total suspended solids loading and 40% reduction in E. coli loading by 2043.		
			Achieve long-term load reductions: 92% reduction in nitrate loading, 75% reduction in total phosphorus loading, 48% reduction in total suspended solids loading and 40% reduction in E. coli loading by 2053.		
			Reduce, or at a minimum, maintain nearshore impervious development in lake and stream riparian areas.		

Project Goals	Objective	Target Audience	Milestone	Cost	Possible Partners (PP) & Technical Assistance (TA)
Education; E. coli	Work with contractors and Health Depts to increase septic system maintenance and installation awareness	Homeowners, builders, Health Dept,RSDs, elected officials	Produce and distribute septic maintenance brochure at MS4 contractor workshops, local events, field days, city festivals and county fairs. Develop annual event list starting in 2024.	$5,000 annually	PP/TA: Contractors, IDEM, lake associations, local and state health dept, Purdue extension
			Offer cost-share incentives to producers providing voluntary septic maintenance as possible.		
			Explore options for future septic system maintenance or upgrade assistance funding starting in 2025.		
Education	Work with local entities to establish a (trash, sediment, microplastics) pollution education program	Local citizens, watershed visitors, lake associations	Continue to promote trash pick up, annual clean up events and identify new opportunities (adopt a road, community corrections clean up events, student engagement, trash traps) to reduce trash pollution.	$5,000 annually	PP/TA: Parks departments, cities and towns, local nonprofits, lake associations
			In 2025, establish an annual reporting mechanism to determine how much trash/sediment was saved from entering and removed from Upper Elkhart River streams.		
Flooding, Recreation access	Protect and restore floodplains and stream buffers	Producers, riparian landowners	By 2026, develop and implement a floodplain maintenance and reforestation program targeting urban residential and commercial and row crop agricultural areas.	$50,000 annually	PP/TA: surveyors, floodplain managers, DNR, Army Corps, SJRBC, cities and towns
			In 2026, identify high quality riparian lands and their owners.		
			Work with riparian landowners to protect high quality riparian lands via conservation easements, reforestation and/or restoration.		
			Conserve and protect open space networks and implement stormwater management and low impact development.		
Flooding; Nutrients, Sediment, *E. coli*	Increase storage and filtration	Surveyors, landowners, producers, landowners	Implement findings from the NBER West Lakes Task Report and the NBER Corridor Flood Risk Management Plan as possible.	$150,000 annually	PP/TA: surveyors, floodplain managers, DNR, Army Corps, SJRBC, cities and towns, local/state land trusts, farm bureau, planning and zoning
			Increase tree canopy cover across the watershed. Create annual review process in 2025.		
			Increase stormwater storage capacity through agricultural storage, wetland restoration and reforestation efforts.		
			Continue efforts to implement the Benton and Baintertown Dam Feasibility Study.		
			Develop and deploy recommendations for nearshore lake construction and runoff infiltration.		

Project Goals	Objective	Target Audience	Milestone	Cost	Possible Partners (PP) & Technical Assistance (TA)
Education	Educate Upper Elkhart River Project stakeholders about soil erosion, increase awareness about applicable BMPs, inorganic pollution and cost share opportunities	Lake associations, homeowners, producers	Develop an education and ERRA/project branding plan targeting each practice identified above by 2024 (Table 93).	$5,000 annually	PP/TA: lake associations, SWCDs, Purdue extension, schools, conservancy districts, MS4s, SJRBC, local government ICP partner agencies
			In 2024, create mechanism to promote each practice using methods including but not limited to press releases; workshops; field days; stream clean up; float trip; stream, field or pasture walk; website creation; social media posts and ads; digital ads, videos; local events; county fair booth; educational booth; and public meetings.		
			Develop funding mechanism for education efforts (2025).		
			The education program should include educational efforts which includes but is not limited to the following: all practices identified by the steering committee and noted in tables above; septic system use, maintenance and care; high quality natural areas; wetland protection and preservation and general stream processes.		
			Continue to maintain a project-based website and social media to promote events, cost share fund availability and build project awareness.		
Education	Create a cohesive education and outreach program focused on increasing public awareness and building a sense of place and watershed connectivity.	Lake property owners, residents, producers, users	In 2025, identify opportunities to highlight where you live, where your water flows, connection from Kendallville/ Wolcottville/Rome City to Goshen/Elkhart and all areas in between.	$5,000 annually	PP/TA: Parks departments, SWCDs, school systems, community learning center (adult ed centers), MS4s, DNR
			Implement sense of place and watershed connectivity education programming.		
			Promote local natural areas which provide access to Upper Elkhart River and its tributaries. Highlight options to engage with or get out onto water.		
			Consider options for establishing a water-based trail (blueway).		

Project Goals	Objective	Target Audience	Milestone	Cost	Possible Partners (PP) & Technical Assistance (TA)
Education; Recreation Access; Flooding	Work with partners to identify and promote hands-on opportunities to improve natural areas and habitat in the watershed.	Citizens, recreation users (lakes, parks, natural areas)	In 2024, identify partner organizations which host field days, work days, and clean-up events.	$5,000 annually	PP/TA: MS4s, SWCD, NRCS, DU, PF, parks departments, lake associations
			Annually, identify partners for river clean-ups, float trips, invasive species control, trash removal, illegal dumping or habitat restoration opportunities and promote throughout the watershed.		
Nutrients, Sediment, *E. coli*	Monitor annual loading rates volunteer and professional monitoring programs and consider options for delisting streams currently on IDEM's 303(d) list for E. coli and nutrients	Local residents, producers, lake associations, cities and towns	In 2025, establish a Hoosier Riverwatch-based monitoring corps to collected data across the watershed. Monitoring may include snapshot (one day) event, monthly or quarterly monitoring and no less than annual training/refresher provided to volunteers.	$5,000 annually volunteer-based monitoring; additional cost for professional or snapshot monitoring	PP/TA: Lake associations, local residents, Hoosier Riverwatch trainers and volunteers, SWCDs, parks departments, SJRBC
			Establish an annual volunteer or professional monitoring program to assess nutrient and sediment impacts to the Upper Elkhart River Watershed.		
			Collect E. coli samples no less than every 5 years with the goal of calculating the geometric mean (5 samples over 30 days).		
			Maintain current and install additional stream flow monitoring gages throughout the watershed.		
Flooding, Nutrients, Sediment	Improve water quality and habitat to obtain passing mIBI, IBI, and QHEI scores and delist streams currently on IDEM's 303(d) list for IBC	Local residents, producers, lake associations, cities and towns	Implement BMPs noted above targeting sediment, nutrients and E. coli reductions, flood mitigation and riparian habitat improvement.	$20,000 for each fish/ macroinvertebrate assessment	PP: Lake associations, local residents, Hoosier Riverwatch volunteers, SWCDs, parks departments, SJRBC TA: Data collectors and owners.
			Monitor fish and macroinvertebrate populations every five years and habitat annually. Start monitoring in 2024.		
			Create mechanism for annual collection of water chemistry, fish and macroinvertebrate data. Collect, store and share data with target audience. Start monitoring in 2024.		

11.0 FUTURE ACTIVITIES

The next steps for the project include starting implementation of the Upper Elkhart River Watershed Management Plan. The Elkhart River Restoration Association in partnership with the project steering committee and other regional partners will consider options for submitting implementation-focused grant applications for IDEM Section 319 funds, National Water Quality Initiative Funds, DNR LARE, Clean Water Indiana and other funds. If funded, this grant would provide funds for a cost-share program to install BMPs, promotion of the cost-share program, and an education and outreach program. If the grant is awarded, the steering committee will develop a cost-share program that will include steps to meeting the goals and management strategies of this plan. The anticipated cost-share program will use a ranking system to fund applications that will have the most impact in improving water quality. Factors such as location within watershed (priority areas), distance from streams, number of resource concerns addressed, and number of practices planned will be considered as part of the ranking process to further prioritize BMPs. It is anticipated that implementation efforts will target high priority critical areas and focus on the implementation of short-term goals.

11.1 Tracking Effectiveness

Implementation of policies, programs, and practices will improve water quality and watershed conditions within the Upper Elkhart River Watershed, helping reach goal statements by 2053 (Table 97). For each practice identified which the committee deemed familiar and routinely utilized in the Upper Elkhart River Watershed and for which a load reduction calculation is readily available, an annual target for the acres or number of each BMP implemented is included in Table 98. Measurement of the success of implementation is a necessary part of any watershed project (Table 97). Both social indicator and water quality data will be used to measure observable changes following implementation. In order to track the project's progress of reaching goals and improving water quality, information and data will need to be continually collected during implementation.

The tracking strategies illustrated in Table 97 will be used to document changes and aid in the plan re-evaluation. The steering committee listed potential partners and technical assistance provides as both unless otherwise noted. Activities to be completed as part of this watershed management plan are identified in the action register (
Table **96**). Table 98 identifies the annual target for the number or acres of BMPs to be installed during each implementation phase. Work completed towards each goal/objective documented will include scheduled and completed activities, numbers of individuals attending or efforts completed toward each objective, and load calculations for each goal, objective, and strategy. Overall, project progress will be tracked by measurable items such as workshops held, BMPs installed, meetings held, number of attendees, etc. Load reductions will be calculated for each BMP installed. These values and associated project details including BMP type, location, dimensions, load reductions, and more will be tracked over time and documented on the Indiana State Department of Agriculture Conservation Tracking sheet. Individual landowner contacts and information will be tracked for both identified and installed BMPs. The Elkhart River Restoration Association or their designee will be responsible for keeping the mentioned records.

Table 97. Strategies for and indicators of tracking goals and effectiveness of implementation.

Tracking Strategy	Frequency	Total Estimated Cost (Staff Time Included)	Partners/Technical Assistance
BMP Count	Continuous	$5,000	SWCDs, NRCS, ISDA, MS4
BMP Load Reductions	Continuous	$5,000	SWCDs, NRCS, ISDA, MS4
Attendance at Workshops/Field Days	Yearly	$500/workshop	N/A
Post Workshop Surveys for Effectiveness	Yearly	$250/workshop	SWCD, NRCS, Purdue Extension
Number of Educational Programs/students reached	Yearly	$250/program	N/A
Windshield Surveys	Every 4-5 years	$2,500 annually	SWCDs, Committee, ISDA
Tillage/Cover Crop Transects	Yearly	$20,000 in SWCD and ISDA staff time	SWCDs, NRCS, ISDA Staff
Number of educational publications/press releases	Yearly	$500/release	SWCD
IDEM Probabilistic Monitoring	Every 9 years	N/A (IDEM provides staff and funding)	IDEM

Table 98. Annual targets for best management practices.

Suggested BMPs:	Annual High Priority Targets	Annual Medium Priority Targets	Annual Low Priority Targets	Units
Conservation Cover (327)	500	500	500	acre
Cover Crop (340)	3,000	3,000	3,000	acre
Drainage Water Management (554)	10	10	10	Feet
Filter Strip (393)	50	50	50	Acre
Forage and Biomass Planting (512)	200	200	200	Acre
Grassed Waterway (412)	50	50	50	Feet
Livestock Restriction (Alt Watering System, Access Control)	100	0	100	Feet, unit
Nutrient/Pest Management (590)	1,000	1,000	1,000	acres
Pollinator planting (CP42)	50	50	50	acres
Prescribed Grazing (528)	200	200	200	acres
Residue and Tillage Management (329)	1,000	1,000	1,000	acres
Streambank Stabilization	10	10	10	Feet
Two Stage Ditch (582)	30	30	30	acres
Wetland Creation/Restoration	1	1	1	Acres
Urban BMPs (bioretention, rain barrel, rain garden, pervious pavement, treatments vaults, green roof)	10	10	10	Unit

11.2 Indicators of Success

Water quality, social, and administrative indicators will be used to monitor progress towards successful achievement of the goals for the high and medium priority critical areas. Water quality indicators will include monitoring total phosphorus, nitrate-nitrogen, total suspended solids and *E. coli*. Monitoring will occur as part of the Hoosier Riverwatch volunteer program, at a minimum. If local laboratory partners will continue to analyze collected samples as an in-kind service, laboratory data will be utilized as an indicator for each parameter. Administrative indicators will be listed with each strategy included in the action register.

Reduce Nutrient Loading

- Water Quality Indicator: Nitrate-nitrogen and total phosphorus will be measured no less than annually at the Upper Elkhart River outlet to the Lower Elkhart River. After five years of implementation, water quality samples will show a decreasing trend, with more samples annually meeting the target level for nitrate-nitrogen of 1.0 mg/L and for total phosphorus of 0.08 mg/L.
- Administrative Indicator: The number of BMPs that can reduce nitrate-nitrogen and total phosphorus will be tracked annually. The total number of acreage will be compared against annual targets identified in Table 98Table 98. Individual load reductions calculated for each BMP will be reviewed to determine if cumulative loading rates for nitrate-nitrogen and phosphorus are sufficient to meet the target reductions.

Reduce Sediment Loading

- Water Quality Indicator: Total suspended solids or turbidity will be no measured less than annually at the Upper Elkhart River outlet to the Lower Elkhart River. After five years of implementation, water quality samples will show a decreasing trend, with more samples annually meeting the target level for total suspended solids of 15 mg/L or for turbidity of 6.36NTU.
- Administrative Indicator: The number of BMPs that can reduce total suspended solids will be tracked annually. The total number of acreage will be compared against annual targets identified in Table 98. Individual load reductions calculated for each BMP will be reviewed to determine if the cumulative loading rate for total suspended solids is sufficient to meet the target reduction.

Reduce *E. coli* Loading

- Water Quality Indicator: *E. coli* will be measured no less than annually at the Upper Elkhart River outlet to the Lower Elkhart River After ten years of implementation, water quality samples will show a decreasing trend, with more samples annually meeting the state standard (235 col/100 ml).
- Administrative Indicator: The number of BMPs that can reduce *E. coli* will be tracked annually. The total number of acres will be compared against annual targets identified in Table 98.

Increase Public Awareness and Participation

- Administrative Indicator: The number of people who attend education and outreach events will be tracked. The percent of targeted households reached will increase annually.
- Social Indicator: Pre and post surveys of attendees will be conducted at workshops to determine changes in individuals' knowledge of the topic as a result of attending the workshop. It would be expected that 75% of workshop attendees would have a better understanding of the topic after the workshop.

Reduce Flooding Impacts

- Administrative Indicator: Wetland acreage, floodplain land cover acreage and coverage of poorly drained and very poorly drained soils will be calculated using each new National Land Cover Dataset, which is released approximately every six years. After six years of implementation, wetland, floodplain land cover and poorly drained/very poorly drained cover acreage will measure higher than the measurement which occurred during the previous assessment. Total acreage of wetland, floodplain land cover and poorly drained/very poorly drained cover will be compared with previous total. If LIDAR data is available, this calculation will occur using these data.

Recreational Access

- Administrative Indicator: The number of people who annually recreate on the Elkhart River and its tributaries will be tracked. A baseline paddler count will be established in 2024. River and lake access points and the acreage of natural land will be mapped annually in the project GIS database. After five years, the number of access points and acreage protected will show an increasing trend with more access points available for public use and more land protected for recreation purposes.

11.3 NEPA Concerns and Compliance

The National Environmental Policy Act (NEPA) was signed into law in 1970. The law requires federal agencies to assess the environmental impacts of their proposed actions prior to making decisions. This law also applies to watershed planning activities. As part of the planning process the NRCS is required to evaluate the individual and cumulative effects of proposed actions. Any project that has significant environmental impacts must be evaluated with an Environmental Assessment (EA) or Environmental Impact Statement (EIS) unless the activities are eligible under a categorical exclusion or already covered by an existing EA or EIS. The NRCS utilizes a planning process that incorporates an evaluation of potential environmental impacts using an Environmental Evaluation Worksheet. There are several NRCS conservation practices and activities that fall under a categorical exclusion. A categorical exclusion is a category of actions that do not normally create a significant individual or cumulative effects on the human environment. There are 21 NRCS approved conservation or restoration categorical exclusions identified in GM190 §410.6. These categorical exemptions include practices that reduce soil erosion, involve planting vegetation and restoring areas to natural ecological systems.

This watershed plan calls for conservation practices that control soil erosion and runoff from agricultural fields and structural practices to address runoff and waste management issues. Many of these practices are covered by either a categorical exclusion or may be included in an existing environmental assessment. A list of practices likely to be used to implement the plan is listed in Table 93.

Prior to practice implementation with USDA NRCS assistance, an NRCS CPA 52 Environmental Evaluation form will be completed for each practice. Using this form, each planned practice and practices system will be evaluated to determine if it meets the criteria of categorical exclusions and any existing Environmental assessments. Any adverse impacts from practices will first try to be avoided then minimized or mitigated as necessary. If resource concerns are found, NRCS will contact the agency with responsibility for the resource. Agencies will include but are not limited to US Fish and Wildlife Service and the State Historic Preservation Office. It is not anticipated that the practices planned for the Upper Elkhart River Watershed will require an Environmental Assessment or an Environmental Impact Statement.

12.0 OUTREACH PLAN

Based on steering committee knowledge, a multi-tiered strategy will be required to fully implement the Upper Elkhart River Watershed Management Plan. The plan will use targeted outreach to agricultural producers which will encourage the adoption of conservation practices to avoid, control and trap nutrients and sediment. Additional associated landowners will receive information about the project with the goal of raising awareness and informing the local community. For the targeted producers, outreach methods will include but not be limited to the following:

- Targeted landowner and producer mailings to announce the program and encourage the adoption of conservation practices. Mailings will occur no less than once but may occur annually, as needed.
- Practice specific field days and workshops. No less than 2 workshops or field days will occur annually.
- Newsletters. The Upper Elkhart River steering committee will work with partners to distribute information on a quarterly basis within partner newsletters including SWCD, county extension, FSA, and others.
- Post information at public locations such as farm and garden centers.
- Work with regional CCAs to provide information about the program.
- Maintain a project website which will be used to promote project events, announce fund availability and detail funding deadlines. Updates will be made to the project website no less than monthly or when education and engagement events occur, cost share funds are available or project-based meetings or other activities can be highlighted.
- Social media posts will occur on project social media no less than monthly and will be shared across partner social media as well.
- Radio announcements (PSAs) and news releases will occur no less than quarterly to local media.
- Additional options such as billboards, videos, tabling at community events, and others will be considered by the technical committee.
- Connect people with the Elkhart River to create a sense of place including getting people on the river no less than twice annually.
- Continue to engage local youth via targeted educational field trips, classroom education and local events.
- Work with local partners including land trusts, farm bureau, MS4s and others to create cohesive educational messaging and deploy these messages across the Upper Elkhart Watershed.

The following partners will be engaged as part of the outreach efforts:

- Natural resources conservation service (NRCS) conservationists provide technical assistance and expertise, coordinate conservation planning and distribute financial assistance for local producers. The Elkhart, Lagrange, Kosciusko and Noble County service centers provide assistance for Upper Elkhart River Watershed.
- Elkhart, Lagrange, Kosciusko and Noble County SWCD offices assist producers with conservation choices via farm planning assistance as well as targeted education and outreach.
- Indiana State Department of Agricultural staff provides technical assistance and expertise with conservation practice design and assessment.
- The Upper Elkhart River Watershed Project will provide education and outreach assistance and assist with program promotion.

12.1 Adapting Strategies in the Future

Due to the uncertainty of the watershed management planning, an adaptive management strategy will be implemented to improve the project's success. While much thought and expertise has been put into the planning process, not all scenarios can be foreseen. Oftentimes there are changes such as a shift in community attitude/behavior, changes in resource concerns, development of new information or accomplishing a goal sooner or later than expected. By implementing an adaptive management strategy, the Upper Elkhart River Project Steering Committee can adjust the watershed management plan to ensure project success. A four-step adaptive management strategy has been outlined for the Upper Elkhart River Watershed Project and can be found below.

Step 1: Planning The planning process used to develop the Upper Elkhart River WMP follows the IDEM 2009 Watershed Management Checklist. The project coordinator worked in concert with and was guided by the Upper Elkhart River Project Steering Committee to develop the WMP using knowledge of the watershed, inputs from stakeholders, new data from water monitoring and windshield surveys, and historical data. This plan includes goals, action register, and schedule outlining how and when to achieve the defined goals.

Step 2: Implementation The action register and schedule will be implemented to achieve the goals of the Upper Elkhart River Watershed Project objectives and goals. Partnering agencies such as NRCS, SWCD, ISDA, and IDEM will carry out the implementation. Implementation will include a cost-share program and education events targeting both youth and adults. Practices implemented through the cost-share program will follow the NRCS Field Office Technical Guide (FOTG) Practice Standards or other technical standards as detailed in the cost-share program, once developed. The cost-share program will include but will not be limited to practices such as cover crops, watering facilities, fencing, conservation buffers, grassed waterways, and nutrient and pest management plans. Cost-share funding will be implemented in priority areas. A ranking system will be used to prioritize applications that will have the greatest impact on water quality improvement.

Step 3: Evaluate & Learn Evaluations of indicators identified above and in Table 97 will occur often to check the progress being made toward the project goals. The steering committee will annually review progress and determine if the project is on track to meet interim and project end goals outlined in the Action Plan (Table 96) and goals. Factors evaluated will include but will not be limited to numbers of BMPs installed, calculated/estimated load reductions of installed BMPs, number of individuals reach through outreach, etc. The evaluations will be conducted by the Upper Elkhart River Project Steering Committee. The group will then provide recommendations that will improve project success. Progress against the watershed management plan will be reviewed no less than every two years (i.e. 2025, 2027, etc).

Step 4: Alter Strategy The project's implementation and management strategy will be adjusted to improve the project's success. If progress is not made proportionate to the time into the project (i.e. at the end of year 3, approximately 30% (3/10) of 10 year goals should be met), the steering committee will have the opportunity to alter their strategy in order to meet the goals of the project. Adjustments will be based off of recommendations from the Evaluate and Learn step. Once the adjustments are agreed upon by the steering committee, the project will revert back to Implementation (Step 2) to continue with the Adaptive Management strategy (steps 2-4) until all goals have been met or all conservation opportunities have been exhausted.

The Upper Elkhart River Project coordinated by the Elkhart River Restoration Association, are responsible for maintaining records for the project including tracking plan successes and failures and any necessary watershed management plan revisions. The plan will be re-evaluated at the end of Year 5 and every 5 years after that. For updates and information, contact the Elkhart River Restoration Association president. Their contact information is available at www.elkhartriver.org.

Appendix A: Endangered, Threatened, and Rare Species Data

February 11, 2022

INDIANA HERITAGE DATA WITHIN:

Upper Elkhart River Watershed Management Plan, Elkhart, Lagrange, Noble, and Kosciusko Counties

Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Amphibian						
Ambystoma laterale	blue-spotted salamander	SSC		1988		
Ambystoma laterale	blue-spotted salamander	SSC		1990		
Hemidactylium scutatum	four-toed salamander	SSC		2013		
Hemidactylium scutatum	four-toed salamander	SSC		2007	SYLVAN LAKE	
Necturus maculosus	common mudpuppy	SSC		1990	BEAR LAKE	
Bird						
Antigone canadensis	sandhill crane	SSC		1996	DALLAS LAKE COUNTY PARK	NEST SITE
Antigone canadensis	sandhill crane	SSC		1992	SE OF ADAMS LAKE	
Aythya collaris	Ring-necked Duck			1957		
Bartramia longicauda	Upland Sandpiper	SE		1992		
Botaurus lentiginosus	American Bittern	SE		1930		
Buteo platypterus	Broad-winged Hawk	SSC		2000		
Centronyx henslowii	Henslow's sparrow	SE		1997		
Centronyx henslowii	Henslow's sparrow	SE		2004	MERRY LEA ENVIRONMENTAL CENTER	
Certhia americana	Brown Creeper			2001		
Certhia americana	Brown Creeper			2001	ELKHART COUNTY RIVER PRESERVE COUNTY PARK	
Certhia americana	Brown Creeper			2000		
Certhia americana	Brown Creeper			2000	BIXLER LAKE	

Fed: E = Federal endangered; T = Federal threatened; C = Federal candidate species

State: SE = State endangered; ST= State threatened; SR = State rare; SSC = State species of special concern; SG = State significant; WL = watch list; no rank - not ranked but tracked to monitor status

Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Certhia americana	Brown Creeper			2001	ELKHART COUNTY RIVER PRESERVE COUNTY PARK	
Certhia americana	Brown Creeper			2002		
Chlidonias niger	Black Tern	SE		1994		
Cistothorus palustris	marsh wren	SE		2000	FISH LAKE	
Cistothorus palustris	marsh wren	SE		1997		
Cistothorus palustris	marsh wren	SE		1986	LAGRANGE COUNTY NOTABLE #73A	
Cistothorus platensis	sedge wren	SE		2000		
Haliaeetus leucocephalus	bald eagle			2015	OLIN LAKE	NEST SITE
Ixobrychus exilis	Least Bittern	SE		1994	CEDAR SWAMP	
Ixobrychus exilis	Least Bittern	SE		1930		
Ixobrychus exilis	Least Bittern	SE		1997		
Nycticorax nycticorax	Black-crowned Night-heron	SE		1986	OLIVER LAKE	
Nycticorax nycticorax	Black-crowned Night-heron	SE		1984		
Pandion haliaetus	Osprey	SSC		2015	WALDRON LAKE	NEST SITE
Pandion haliaetus	Osprey	SSC		2014	CAMP LUTHERHAVEN	NEST SITE
Pandion haliaetus	Osprey	SSC		2016	LITTLE ELKHART RIVER	NEST SITE
Pandion haliaetus	Osprey	SSC		2016	WOLF LAKE - GRAIN STORAGE SITE	NEST SITE
Rallus limicola	Virginia Rail	SE		2000	FISH LAKE	
Rallus limicola	Virginia Rail	SE		1997		
Setophaga citrina	Hooded Warbler	SSC		2004		
Setophaga citrina	Hooded Warbler	SSC		2004		

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Sturnella neglecta	Western Meadowlark	SSC		1997		
Tyto alba	Barn Owl	SE		1986		
Fish						
Coregonus artedi	cisco	SE		1988	MARTIN LAKE	
Coregonus artedi	cisco	SE		1975	MESSICK LAKE	
Coregonus artedi	cisco	SE		1990	EVE LAKE	
Coregonus artedi	cisco	SE		1955	WHITMER (WITMER) LAKE	
Coregonus artedi	cisco	SE		1955	ATWOOD LAKE	
Coregonus artedi	cisco	SE		1988	OLIN LAKE	
Coregonus artedi	cisco	SE		1975	HACKENBERG LAKE	
Coregonus artedi	cisco	SE		1975	DALLAS LAKE	
Coregonus artedi	cisco	SE		1988	OLIVER LAKE	
High Quality Natural Community						
Forest - floodplain mesic	Mesic Floodplain Forest	SG		2009	LEACOCK WOODS	
Forest - floodplain wet	Wet Floodplain Forest	SG		2009	ART HAMMER WETLANDS	
Forest - floodplain wet	Wet Floodplain Forest	SG		1981	NOBLE COUNTY PNA #66	
Forest - floodplain wet	Wet Floodplain Forest	SG		1995		
Forest - floodplain wet-mesic	Wet-mesic Floodplain Forest	SG		1980		
Forest - upland dry-mesic Northern Lakes	Northern Lakes Dry-mesic Upland Forest	SG		1980		
Forest - upland dry-mesic Northern Lakes	Northern Lakes Dry-mesic Upland Forest	SG		1980		
Forest - upland dry-mesic Northern	Northern Lakes Dry-mesic Upland	SG		1980		

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Lakes	Forest					
Forest - upland dry-mesic Northern Lakes	Northern Lakes Dry-mesic Upland Forest	SG		1980		
Forest - upland dry Northern Lakes	Northern Lakes Dry Upland Forest	SG		1967	QUOG LAKE SLOPE FOREST	
Forest - upland mesic Northern Lakes	Northern Lakes Mesic Upland Forest	SG		1984	NOBLE CO. PNA #67	
Forest - upland mesic Northern Lakes	Northern Lakes Mesic Upland Forest	SG		1980		
Forest - upland mesic Northern Lakes	Northern Lakes Mesic Upland Forest	SG		1986	KENDALLVILLE WOODS	
Forest - upland mesic Northern Lakes	Northern Lakes Mesic Upland Forest	SG		1980		
Forest - upland mesic Northern Lakes	Northern Lakes Mesic Upland Forest	SG		2020	Spurgeon Nature Preserve	
Forest - upland mesic Northern Lakes	Northern Lakes Mesic Upland Forest	SG		1995	ELKHART COUNTY NOTABLE #69	
Forest - upland mesic Northern Lakes	Northern Lakes Mesic Upland Forest	SG		1980	OLIN LAKE NATURE PRESERVE	
Lake - lake	Lake	SG		1993	OLIN LAKE	
Lake - pond	Pond	SG		1979	POYSER LAKE	
Wetland - beach marl	Marl Beach	SG		1985	DEEP LAKE	
Wetland - beach marl	Marl Beach	SG		1983	EAGLE LAKE	
Wetland - beach marl	Marl Beach	SG		1982		
Wetland - bog acid	Acid Bog	SG		1978	DUTCH STREET BOG	
Wetland - bog acid	Acid Bog	SG		2009	PAUL THOMAS MEMORIAL BOG SITE	
Wetland - bog circumneutral	Circumneutral Bog	SG		1979		
Wetland - bog circumneutral	Circumneutral Bog	SG		1979	LAGRANGE PNA #61	
Wetland - fen	Fen	SG		0	OLIN LAKE NATURE PRESERVE	
Wetland - fen	Fen	SG		1979	NOBLE COUNTY NOTABLE #43	

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Wetland - fen	Fen	SG		1984	NOBLE CO. NOTABLE #23	
Wetland - fen	Fen	SG		1988	EAGLE LAKE	
Wetland - fen	Fen	SG		2009	SWAMP ANGEL	
Wetland - fen	Fen	SG		1985	MARL LAKE	
Wetland - fen	Fen	SG		1984		
Wetland - fen forested	Forested Fen	SG		1984	LAGRANGE COUNTY NOTABLE #20	
Wetland - fen forested	Forested Fen	SG		1985	NOBLE CO. NOTABLE #44D	
Wetland - fen forested	Forested Fen	SG		1985	NOBLE CO. NOTABLE #65	
Wetland - marsh	Marsh	SG		1985	NEWMAN LAKE	
Wetland - marsh	Marsh	SG		1993	NOBLE CO. NOTABLE #49	
Wetland - marsh	Marsh	SG		1979		
Wetland - marsh	Marsh	SG		1979	POYSER LAKE	
Wetland - marsh	Marsh	SG		2009	MERRY LEA NATURE PRESERVE	
Wetland - marsh	Marsh	SG		0		
Wetland - marsh	Marsh	SG		2009	HAMMER WETLANDS ADDITION	
Wetland - marsh	Marsh	SG		1980		
Wetland - marsh	Marsh	SG		1985	MUD LAKE	
Wetland - marsh	Marsh	SG		1967	LUCKY TRACT	
Wetland - marsh	Marsh	SG		1981	NOBLE CO. NOTABLE #66	
Wetland - marsh	Marsh	SG		1984		
Wetland - meadow	Sedge Meadow	SG		1992	LAGRANGE	

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State: SE = State endangered; ST= State threatened; SR = State rare; SSC = State species of special concern; SG = State significant; WL = watch list; no rank - not ranked but tracked to monitor status

Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
sedge					COUNTY PNA #63B	
Wetland - meadow sedge	Sedge Meadow	SG		1979	ENGLE LAKE	
Wetland - swamp forest	Forested Swamp	SG		1995	KING TRACT	
Wetland - swamp forest	Forested Swamp	SG		2009	OLIN LAKE NATURE PRESERVE	
Wetland - swamp shrub	Shrub Swamp	SG		1979		
Wetland - swamp shrub	Shrub Swamp	SG		1980	OLIN LAKE NATURE PRESERVE	
Wetland - swamp shrub	Shrub Swamp	SG		1980		
Insect Coleoptera						
Nicrophorus americanus	American Burying Beetle	SX	E	1917		
Insect Lepidoptera						
Hemileuca nevadensis ssp. 3	midwestern fen buckmoth	SR		2020	SAUGA NP	
Lycaena dorcas dorcas	Dorcas Copper	SE		1987		
Mammal						
Condylura cristata	Star-nosed Mole	SSC		1993		
Condylura cristata	Star-nosed Mole	SSC		2020	DALLAS LAKE PARK POND LIL	
Condylura cristata	Star-nosed Mole	SSC		1975		
Condylura cristata	Star-nosed Mole	SSC		1985		
Condylura cristata	Star-nosed Mole	SSC		1998	DALLAS LAKE PARK	
Mustela nivalis	Least Weasel	SSC		1961		
Mustela nivalis	Least Weasel	SSC		1995		
Myotis sodalis	Indiana Bat	SE	E	2017	GLACIAL ESKER NATURE PRESERVE	BAT SUMMER CAPTURE
Myotis sodalis	Indiana Bat	SE	E	2018	SW OF ALBION	BAT SUMMER CAPTURE

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Myotis sodalis	Indiana Bat	SE	E	2018	ROOST TREES	BAT ROOST SITE
Nycticeius humeralis	Evening Bat	SE		2018	SW OF ALBION	BAT SUMMER CAPTURE
Taxidea taxus	American Badger	SSC		1985		
Taxidea taxus	American Badger	SSC		1999		
Taxidea taxus	American Badger	SSC		1998		
Taxidea taxus	American Badger	SSC		1988		
Taxidea taxus	American Badger	SSC		1983		
Taxidea taxus	American Badger	SSC		1982		
Taxidea taxus	American Badger	SSC		1997		
Taxidea taxus	American Badger	SSC		1989		
Taxidea taxus	American Badger	SSC		1985		
Taxidea taxus	American Badger	SSC		1983		
Taxidea taxus	American Badger	SSC		1990		
Taxidea taxus	American Badger	SSC		1992	SE OF ADAMS LAKE	
Taxidea taxus	American Badger	SSC		1999		
Taxidea taxus	American Badger	SSC		1998		
Mollusk						
Venustaconcha ellipsiformis	Ellipse			2012	ELKHART RIVER	2012: LIVE. (FISHER AND DAVIS)
Venustaconcha ellipsiformis	Ellipse			2014	FORKER CREEK	2014: WEATHERED DEAD (FISHER AND DAVIS)
Venustaconcha ellipsiformis	Ellipse			2015	NORTH BRANCH ELKHART RIVER	2012: WEATHERED DEAD (FISHER AND DAVIS)

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Venustaconcha ellipsiformis	Ellipse			2014	CROFT DITCH	2014: WEATHERED DEAD (FISHER AND DAVIS)
Reptile						
Clemmys guttata	spotted turtle	SE	C	1989		
Clemmys guttata	spotted turtle	SE	C	1954	MUD LAKE	
Clemmys guttata	spotted turtle	SE	C	1892		
Clemmys guttata	spotted turtle	SE	C	1953	LAKE WAWASEE	
Clemmys guttata	spotted turtle	SE	C	1954	ADAMS LAKE	
Emydoidea blandingii	Blanding's turtle	SE	C	1986		
Emydoidea blandingii	Blanding's turtle	SE	C	1979	NOBLE CO. NOTABLE #43	
Emydoidea blandingii	Blanding's turtle	SE	C	2016	BENDER NP	
Emydoidea blandingii	Blanding's turtle	SE	C	2008	EAGLE LAKE	
Emydoidea blandingii	Blanding's turtle	SE	C	2015		
Emydoidea blandingii	Blanding's turtle	SE	C	2021	MERRY LEA ENVIRONMENTAL CENTER	
Emydoidea blandingii	Blanding's turtle	SE	C	2021	WOLLCOTTVILLE PRIVATE PROPERTY	
Emydoidea blandingii	Blanding's turtle	SE	C	1990		
Emydoidea blandingii	Blanding's turtle	SE	C	0	MUD LAKE	
Emydoidea blandingii	Blanding's turtle	SE	C	1970		
Emydoidea blandingii	Blanding's turtle	SE	C	2002		
Emydoidea blandingii	Blanding's turtle	SE	C	2002	ADAMS LAKE	
Emydoidea blandingii	Blanding's turtle	SE	C	1907	ROME CITY	
Nerodia erythrogaster	copperbelly water	SE	PS:LT	1941	ELKHART RIVER	COLLECTED

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
neglecta	snake					
Sistrurus catenatus	eastern massasauga	SE	T	1994		
Sistrurus catenatus	eastern massasauga	SE	T	1983		
Sistrurus catenatus	eastern massasauga	SE	T	1992		
Sistrurus catenatus	eastern massasauga	SE	T	2014	THE SPREADS	
Sistrurus catenatus	eastern massasauga	SE	T	2019	2019: PRIVATE RESIDENCE	
Sistrurus catenatus	eastern massasauga	SE	T	1985	CREE LAKE	
Sistrurus catenatus	eastern massasauga	SE	T	2009		
Sistrurus catenatus	eastern massasauga	SE	T	2012		
Sistrurus catenatus	eastern massasauga	SE	T	2001	CHALMER WELLS PRIVATE PROPERTY	
Sistrurus catenatus	eastern massasauga	SE	T	1954		
Sistrurus catenatus	eastern massasauga	SE	T	1986		
Sistrurus catenatus	eastern massasauga	SE	T	1987	WOLF LAKE	
Sistrurus catenatus	eastern massasauga	SE	T	2000	DALLAS LAKE	
Terrapene carolina carolina	woodland box turtle	SSC		2016	MERRY LEA NP	
Thamnophis butleri	Butler's garter snake	SE		1973		
Thamnophis butleri	Butler's garter snake	SE		1988	S OF KENDALLVILLE	
Thamnophis proximus proximus	western ribbon snake	SSC		2010	LONG LAKE	
Vascular Plant						
Actaea rubra ssp. rubra	red baneberry	ST		1985	NOBLE CO. NOTABLE #44D	
Actaea rubra ssp. rubra	red baneberry	ST		2017	QUOG LAKE	
Actaea rubra ssp. rubra	red baneberry	ST		1982	OLIN LAKE NATURE	

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
					PRESERVE	
Andromeda glaucophylla	bog rosemary	ST		1993		
Andromeda glaucophylla	bog rosemary	ST		1995	DUTCH STREET BOG	
Andromeda glaucophylla	bog rosemary	ST		1920		
Anticlea elegans var. glaucus	white camas	ST		1986		
Anticlea elegans var. glaucus	white camas	ST		1895		
Aralia hispida	bristly sarsaparilla	SE		1935	HIGH LAKE	
Aristida longespica var. geniculata	slim-spike three-awn grass	WL		1988	EAGLE LAKE	
Aristida longespica var. geniculata	slim-spike three-awn grass	WL		1967	MERRY LEA SITE	
Calla palustris	wild calla	SE		1938		
Calla palustris	wild calla	SE		1900		
Calla palustris	wild calla	SE		1900	W OF WOLCOTTVILLE	
Cardamine pratensis var. palustris	cuckoo flower	ST		2011	SVOBODA BOG	
Cardamine pratensis var. palustris	cuckoo flower	ST		2017	QUOG LAKE NP	
Cardamine pratensis var. palustris	cuckoo flower	ST		2020	SAUGA NP	
Carex alata	broadwing sedge	WL		2017	QUOG LAKE NP	
Carex alata	broadwing sedge	WL		2020	SAUGA NP	
Carex bebbii	Bebb's sedge	ST		2017	QUOG LAKE	
Carex bebbii	Bebb's sedge	ST		2020	SAUGA SWAMP NP	
Carex bebbii	Bebb's sedge	ST		1924		
Carex cephaloidea	thinleaf sedge	ST		1982	OLIN LAKE NATURE PRESERVE	
Carex cephaloidea	thinleaf sedge	ST		2017	QUOG LAKE NP	

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Carex disperma	softleaf sedge	SE		2017	QUOG LAKE	
Carex leptalea	bristlystalked sedge	WL		2017	QUOG LAKE NP	
Carex leptalea	bristlystalked sedge	WL		2020	SAUGA NP	
Carex limosa	mud sedge	SE		1915	QUOG LAKE	
Ceratophyllum echinatum	prickly hornwort	WL		2020	SAUGA SWAMP NATURE PRESERVE	
Crataegus coccinea var. coccinea	scarlet hawthorn	ST		2014	ART HAMMER WETLAND NATURE PRESERVE	
Cypripedium candidum	small white lady's-slipper	ST		1985	MARL LAKE	
Cypripedium candidum	small white lady's-slipper	ST		1994	OLIN LAKE	
Cypripedium parviflorum var. makasin	small yellow lady's-slipper	ST		2021	OLIN LAKE NP	
Dendrolycopodium hickeyi	Hickey's clubmoss	ST		1986	LUCKEY TRACT	
Dendrolycopodium obscurum	tree clubmoss	ST		1993	TAMARACK BOG	
Dichanthelium leibergii	Leiberg's witchgrass	ST		1939		
Dichanthelium leibergii	Leiberg's witchgrass	ST		1946		
Drosera intermedia	spoon-leaved sundew	ST		2014	DUTCH STREET BOG	
Drosera intermedia	spoon-leaved sundew	ST		1916	BEAR LAKE	
Drosera rotundifolia	roundleaf sundew	WL		2017	QUOG LAKE NP	
Dryopteris clintoniana	Clinton's woodfern	SE		2014	ART HAMMER WETLANDS NATURE PRESERVE	
Dryopteris clintoniana	Clinton's woodfern	SE		1939	N OF KENDALLVILLE	
Eleocharis equisetoides	horse-tail spikerush	SE		1941	EVE LAKE	

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Eleocharis equisetoides	horse-tail spikerush	SE		1934	ADAMS LAKE	
Eleocharis robbinsii	Robbins' spikerush	ST		1934	ADAMS LAKE	
Eriophorum gracile	slender cotton-grass	ST		2011	SVOBODA BOG	
Eriophorum gracile	slender cotton-grass	ST		1910	NW OF ROME CITY	
Eriophorum viridicarinatum	green-keeled cotton-grass	ST		1984		
Eriophorum viridicarinatum	green-keeled cotton-grass	ST		1917		
Galium labradoricum	bog bedstraw	ST		2017	MARSH WREN NATURE PRESERVE	
Galium labradoricum	bog bedstraw	ST		2020	SAUGA NP	
Gentiana alba	yellow gentian	ST		1900		
Geum rivale	purple avens	SE		1900		
Hesperostipa comata	sewing needlegrass	SX		1924		
Hydrocotyle americana	American water-pennywort	SE		2017	QUOG LAKE NP	
Hydrocotyle americana	American water-pennywort	SE		1933	QUOG LAKE	
Hypericum pyramidatum	great St. John's-wort	ST		1933		
Larix laricina	tamarack	ST		2017	QUOG LAKE NP	
Larix laricina	tamarack	ST		2020	SAUGA NP	
Lathyrus ochroleucus	pale vetchling peavine	SE		1920		
Lathyrus venosus	smooth veiny pea	SE		1945		
Lemna perpusilla	minute duckweed	SX		1929	BEAR LAKE	
Linum striatum	ridged yellow flax	WL		1945		
Liparis loeselii	Loesel's twayblade	WL		2017	QUOG LAKE NP	

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Liparis loeselii	Loesel's twayblade	WL		2020	SAUGA NP	
Malaxis unifolia	green adder's-mouth orchid	SE		1895	PLEASANT LAKE	
Menyanthes trifoliata	buckbean	WL		2020	SAUGA NP	
Menyanthes trifoliata	buckbean	WL		2011	SVOBODA BOG	
Menyanthes trifoliata	buckbean	WL		2017	QUOG LAKE NP	
Milium effusum	tall millet-grass	ST		1985	NOBLE CO. NOTABLE #44D	
Myriophyllum verticillatum	whorled water-milfoil	ST		1985	LITTLE MARTIN LAKE	
Myriophyllum verticillatum	whorled water-milfoil	ST		1982	OLIN LAKE	
Myriophyllum verticillatum	whorled water-milfoil	ST		1985	JOHNSON BAY LAKE WAWASEE	
Platanthera aquilonis	leafy northern green orchid	ST		2020	SAUGA NP	
Platanthera ciliaris	yellow-fringe orchid	SE		1895	WOLF LAKE	
Platanthera clavellata	small green woodland orchid	WL		2017	QUOG LAKE NP	
Platanthera lacera	green-fringe orchid	WL		2017	QUOG LAKE NP	
Platanthera leucophaea	Eastern Prairie White-fringed Orchid	SE	T	1916	QUOG LAKE	
Platanthera leucophaea	Eastern Prairie White-fringed Orchid	SE	T	1884	PLEASANT LAKE	
Platanthera leucophaea	Eastern Prairie White-fringed Orchid	SE	T	1886		
Platanthera psycodes	small purple-fringe orchid	ST		1905		
Platanthera psycodes	small purple-fringe orchid	ST		2014	ART HAMMER WETLAND NATURE PRESERVE	
Platanthera psycodes	small purple-fringe orchid	ST		1908	KENDALLVILLE CITY PARK	
Poa paludigena	bog bluegrass	ST		2017	QUOG LAKE NP	
Potamogeton oakesianus	Oakes' pondweed	SE		1985	JOHNSON BAY LAKE WAWASEE	

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Potamogeton praelongus	white-stem pondweed	ST		1968	OLIN LAKE	
Potamogeton pusillus	slender pondweed	WL		2000	Waldron Lake	
Potamogeton pusillus	slender pondweed	WL		1999	OLIVER LAKE	
Potamogeton richardsonii	redheadgrass	ST		1985	JOHNSON BAY LAKE WAWASEE	
Potamogeton strictifolius	straight-leaf pondweed	ST		2000	WALDRON LAKE	
Prunus pensylvanica	fire cherry	ST		1967	MERRY LEA SITE	
Rhamnus alnifolia	alderleaf buckthorn	ST		2017	QUOG LAKE NP	
Ribes hirtellum	smooth gooseberry	WL		2017	QUOG LAKE NP	
Ribes hirtellum	smooth gooseberry	WL		2020	SAUGA NP	
Salix serissima	autumn willow	ST		1995		
Salix serissima	autumn willow	ST		1922		
Sarracenia purpurea ssp. purpurea	purple pitcher-plant	ST		2017	QUOG LAKE NP	
Scheuchzeria palustris ssp. americana	American scheuchzeria	SX		1916	QUOG LAKE	
Spiranthes lucida	shining ladies'-tresses	ST		2020	OLIN LAKE NATURE PRESERVE	
Spiranthes romanzoffiana	hooded ladies'-tresses	SE		1986		
Symphyotrichum boreale	rushlike aster	ST		2017	QUOG LAKE	
Symphyotrichum boreale	rushlike aster	ST		2020	SAUGA NP	
Symphyotrichum boreale	rushlike aster	ST		1933		
Symphyotrichum boreale	rushlike aster	ST		1914		
Symphyotrichum boreale	rushlike aster	ST		1933	LITTLE LONG LAKE	
Symphyotrichum boreale	rushlike aster	ST		1916	HIGH LAKE	

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Sci. Name	Com. Name	State	Fed.	Date	Site	Comments
Triantha glutinosa	false asphodel	ST		1986		
Triantha glutinosa	false asphodel	ST		1986	OLIN LAKE NATURE PRESERVE	
Triantha glutinosa	false asphodel	ST		1941		
Triantha glutinosa	false asphodel	ST		0		
Triantha glutinosa	false asphodel	ST		1900		
Turritis glabra	tower-mustard	WL		2017	QUOG LAKE NP	
Utricularia cornuta	horned bladderwort	SE		1985		
Utricularia cornuta	horned bladderwort	SE		1962	OLIN LAKE	
Utricularia intermedia	flatleaf bladderwort	WL		2020	SAUGA NP	
Utricularia minor	lesser bladderwort	ST		2017	QUOG LAKE NP	
Utricularia resupinata	northeastern bladderwort	SE		1916	EAGLE LAKE	
Utricularia resupinata	northeastern bladderwort	SE		2008	OLIVER LAKE	
Utricularia resupinata	northeastern bladderwort	SE		1941	ADAMS LAKE	
Vaccinium oxycoccos	small cranberry	ST		1935		
Vaccinium oxycoccos	small cranberry	ST		1993		
Viburnum cassinoides	northern wild-raisin	SE		1967	HIGH LAKE	
Viburnum opulus var. americanum	highbush-cranberry	SE		1915		
Viola blanda	smooth white violet	WL		2017	QUOG LAKE NP	

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Appendix B1: Water Chemistry Data

Date	SITE	Temp (C)	DO	pH	TURB	Conductivity	Phos.	Nitrate	TSS	E.coli (MPN)
2/22/2022	1	11.31	10.06	8.46	3.1	457	0.054	1.67	0	52
2/22/2022	2	10.26	10.67	8.47	6.4	420.9	0.692	6.11	6.4	2419.6
2/22/2022	3	11.57	8.05	8.41	6.7	375.5	0.147	2.61	0.4	64.4
2/22/2022	4	11.81	8.97	8.31	7.4	379.5	0.213	1.83	1.2	209
2/22/2022	5	13.88	8.57	8.31	3.3	612	0.05	1.67	4	181
2/22/2022	6	12.77	9.58	8.14	8.4	545	0.154	1.61	7.6	517
2/22/2022	7	14.11	9.89	8.38	6.3	383.4	0.115	2.21	5.2	437
2/22/2022	8	12.11	8.91	8.41	10.4	453	0.208	2.22	12	1730
2/22/2022	9	10.72	3.55	8.33	3.1	498	0.079	1.69	4.4	193
2/22/2022	10	11.94	9.56	8.29	14.3	468.1	0.132	1.85	5.2	488
2/22/2022	11	11.87	6.69	8.44	20.5	407.2	0.059	2.01	4.4	30.5
2/22/2022	12	13.16	9.62	7.89	26.1	419.4	0.112	2.18	12.8	461
2/22/2022	13	12.93	9.62	8.2	33.6	402.1	0.118	2.04	7.2	41
2/22/2022	14	12.45	9.74	8.14	12.9	421.4	0.143	2.07	8	21.3
2/22/2022	15	12.77	9.62	8.25	18.7	418.5	0.126	2.77	10.8	83.9
2/22/2022	16	14.26	5.52	8.04	12.3	783	0.05	2.43	13.2	78.4
2/22/2022	17	14.17	9.38	8.06	24.70	438	0.380	2.08	3.2	115.0
2/22/2022	18	13.52	9.51	8.11	25.80	363	0.631	2.63	8	613.0
2/22/2022	19	13.74	9.45	7.94	16.80	611	0.131	2.57	24	172.0
2/22/2022	20	13.54	9.09	8.23	22.50	450	0.102	3.77	0.8	326.0
3/15/2022	1	7.73	10.18	8.47	1.9	434.5	0.05	2.20	4.8	1
3/15/2022	2	10.01	12.24	7.93	2.1	557.1	0.05	3.40	3.6	11
3/15/2022	3	11.7	9.74	8.34	2	417.2	0.05	3.91	8	3
3/15/2022	4	10.88	10.34	8.38	2.6	447.3	0.05	1.77	7.2	8
3/15/2022	5	11.73	10.15	7.88	4.3	564.8	0.05	2.11	8.4	12
3/15/2022	6	6.47	10.99	8.36	4.3	709.4	0.05	1.74	9.6	130
3/15/2022	7	5.5	11.57	8.42	3.4	531.4	0.05	2.21	6	26
3/15/2022	8	9.32	11.97	8.51	2.8	497.7	0.05	2.45	3.2	4
3/15/2022	9	10.92	10.25	8.25	3.5	326.9	0.05	1.45	5.2	1
3/15/2022	10	8.48	9.97	8.53	3.3	408.4	0.05	2.21	5.2	17
3/15/2022	11	10.97	10.36	7.95	1.5	422.6	0.05	2.10	2.8	8
3/15/2022	12	8.62	9.56	8.39	4.7	591.7	0.171	3.24	9.6	26
3/15/2022	13	5.89	11.58	8.45	1.7	361.9	0.05	1.84	7.2	4
3/15/2022	14	6.39	11.05	8.43	1.7	455.9	0.05	2.11	9.2	49
3/15/2022	15	6.72	9.35	8.16	2.1	575.5	0.05	2.41	10	11
3/15/2022	16	10.61	8.48	8.32	1.9	726.9	0.05	3.41	8.4	46
3/15/2022	17	8.82	10.32	8.49	4.70	377	0.05	2.14	4.8	40.0
3/15/2022	18	6.94	11.21	8.39	3.80	660	0.073	2.70	2.8	28.0
3/15/2022	19	8.37	9.75	8.32	3.10	951	0.05	2.67	4.4	105.0
3/15/2022	20	5.88	11.25	8.54	4.00	533	0.05	3.84	3.2	80.0
4/19/2022	1	6.07	11.04	8.62	1.6	464.5	0.05	1.57	9.6	14
4/19/2022	2	5.61	9.51	8.32	1.6	605.4	0.054	2.20	4	1300
4/19/2022	3	5.96	11.52	8.71	5.4	422.1	0.05	2.40	10	25
4/19/2022	4	8.25	11.31	8.74	1.7	476.4	0.05	2.67	14	6
4/19/2022	5	8.75	10.4	8.75	4.1	547.2	0.05	2.09	21.2	11
4/19/2022	6	7.71	11.02	8.46	1.5	437.3	0.05	2.12	25.2	816
4/19/2022	7	9.78	11.5	8.62	2.7	512.5	0.05	3.65	4.4	101
4/19/2022	8	6.91	11.95	8.61	2.6	414.4	0.05	3.46	1.2	50
4/19/2022	9	7.19	11.04	7.93	6	494.4	0.05	1.69	11.6	3
4/19/2022	10	7.27	10.98	7.61	2	494.6	0.05	2.60	8.8	166
4/19/2022	11	7.83	10.94	7.61	1.5	483.9	0.05	3.20	2.4	11
4/19/2022	12	6.85	10.92	8.43	2.2	601.8	0.122	1.96	12	79
4/19/2022	13	6.5	11.61	8.34	0.3	419	0.05	2.11	6.4	10
4/19/2022	14	5.79	11.45	8.73	1.2	471.6	0.05	3.14	5.2	25
4/19/2022	15	7.29	11.38	8.58	1.2	608.2	0.05	3.54	0.8	60
4/19/2022	16	7.64	11.02	7.05	6.6	427.1	0.05	3.44	7.6	365
4/19/2022	17	7.03	11.16	8.05	1.50	442	0.05	3.10	1.6	96.0
4/19/2022	18	8.52	10.18	8.18	1.40	626	0.092	3.12	3.2	206.0
4/19/2022	19	7.91	10.66	8.39	1.60	739	0.05	4.10	4.8	326.0
4/19/2022	20	7.85	10.89	8.33	2.70	553	0.05	4.21	0.8	77.0
5/24/2022	1	12.86	10.34	7.41	5.70	414	0.05	4.83	8.8	55.0
5/24/2022	2	15.30	6.58	7.46	3.90	664	0.196	4.83	32	33.0
5/24/2022	3	15.09	8.76	7.66	1.10	511	0.05	4.72	14	115.0
5/24/2022	4	15.31	10.01	7.83	6.40	359	0.05	4.56	16	47.0
5/24/2022	5	17.78	7.09	7.69	7.10	610	0.05	4.58	12.8	104.0
5/24/2022	6	14.08	6.36	7.67	1.00	801	0.05	4.95	10.8	457.0
5/24/2022	7	13.99	8.91	7.52	1.40	580	0.05	4.70	6	111.0
5/24/2022	8	18.22	8.11	7.81	6.10	602	0.05	4.99	3.6	55.0

Date	SITE	Temp (C)	DO	pH	TURB	Conductivity	Phos.	Nitrate	TSS	E.coli (MPN)
5/24/2022	9	14.69	10.89	7.84	1.50	523	0.05	4.43	18.8	4.0
5/24/2022	10	14.80	7.94	7.50	2.10	552	0.188	4.40	40.4	78.0
5/24/2022	11	17.25	0.83	7.37	1.00	507	0.186	4.00	3.2	5.0
5/24/2022	12	14.08	7.71	7.38	1.00	663	0.262	4.31	9.2	105.0
5/24/2022	13	16.48	5.46	7.31	1.50	574	0.05	2.73	22.4	66.0
5/24/2022	14	13.62	8.14	7.51	1.10	434	0.05	3.18	9.6	71.0
5/24/2022	15	13.51	5.97	7.17	1.10	671	0.05	4.58	5.2	99.0
5/24/2022	16	12.69	7.34	7.46	1.20	752	0.05	4.88	7.2	126.0
5/24/2022	17	15.95	7.19	7.63	1.50	323	0.064	4.18	9.2	68.0
5/24/2022	18	12.61	9.42	7.45	1.30	618	0.09	4.61	1.2	62.0
5/24/2022	19	12.71	8.39	7.34	6.40	761	0.05	5.04	9.6	248.0
5/24/2022	20	15.98	8.53	7.56	6.10	590	0.056	4.52	10.4	60.0
6/21/2022	1	23.83	5.26	8.24	0.60	446	0.05	3.41	19.2	102.0
6/21/2022	2	20.27	0.22	7.94	14.90	681	1.5	5.56	292	1990.0
6/21/2022	3	23.38	6.48	8.47	0.50	496	0.096	3.95	7.2	112.0
6/21/2022	4	22.71	3.57	8.48	2.00	481	0.078	3.84	15.2	219.0
6/21/2022	5	23.73	5.99	8.56	1.20	593	0.068	3.59	41.2	150.0
6/21/2022	6	25.20	7.44	8.51	0.50	796	0.245	4.27	57.2	199.0
6/21/2022	7	24.09	7.36	8.58	0.70	632	0.05	3.95	8	770.0
6/21/2022	8	23.70	7.43	7.52	0.60	692	0.05	4.40	5.6	613.0
6/21/2022	9	21.67	9.96	8.61	9.50	493	0.05	3.68	27.6	8.0
6/21/2022	10	22.47	6.49	8.48	0.70	741	0.09	3.77	44.4	187.0
6/21/2022	11	21.40	5.20	8.28	0.90	532	0.293	3.88	7.6	238.0
6/21/2022	12	20.69	6.44	8.37	5.40	661	0.149	4.47	2.8	921.0
6/21/2022	13	22.97	7.11	8.45	1.40	343	0.075	4.09	39.2	102.0
6/21/2022	14	22.00	3.00	8.37	2.90	435	0.059	3.43	2.4	84.0
6/21/2022	15	21.03	20.78	8.23	3.60	665	0.05	4.49	8.8	225.0
6/21/2022	16	21.44	5.34	8.23	1.30	751	0.05	4.63	5.2	411.0
6/21/2022	17	22.50	5.07	8.47	1.30	551	0.145	3.86	12.4	75.0
6/21/2022	18	18.11	7.60	8.58	6.70	746	0.25	4.31	6	770.0
6/21/2022	19	18.34	7.19	8.34	5.30	752	0.05	4.47	10	308.0
6/21/2022	20	20.21	7.15	8.51	1.20	577	0.132	4.02	12.8	172.0
7/19/2022	1	23.66	6.05	8.34	1.30	419	0.05	2.69	11.2	127.0
7/19/2022	2	22.01	0.27	8.27	2.90	653	1.5	3.64	196	2420.0
7/19/2022	3	23.68	7.17	8.51	0.20	735	0.067	3.32	7.2	272.0
7/19/2022	4	23.95	7.82	8.44	0.60	734	0.057	3.93	12	111.0
7/19/2022	5	24.30	4.74	8.57	0.10	558	0.054	2.87	25.2	114.0
7/19/2022	6	25.71	6.81	8.46	0.50	763	0.05	3.64	12.8	179.0
7/19/2022	7	20.56	7.74	8.56	0.20	674	0.05	3.64	2.8	326.0
7/19/2022	8	21.22	8.21	8.62	4.60	735	0.05	3.55	7.6	579.0
7/19/2022	9	25.64	8.91	8.75	1.10	483	0.058	2.60	31.6	6.0
7/19/2022	10	23.89	5.04	8.45	0.90	514	0.05	2.75	11.6	248.0
7/19/2022	11	20.42	7.53	8.47	2.30	499	0.252	2.98	6.4	1730.0
7/19/2022	12	18.44	6.21	8.11	1.40	483	0.059	4.88	6.8	1730.0
7/19/2022	13	20.64	8.41	8.54	11.30	473	0.069	2.75	30.4	121.0
7/19/2022	14	24.01	2.02	8.37	1.00	418	0.091	2.66	4	91.0
7/19/2022	15	19.78	4.57	8.42	1.20	649	0.05	3.59	6.4	488.0
7/19/2022	16	18.65	5.84	8.28	7.00	765	0.06	3.79	2.8	613.0
7/19/2022	17	19.86	7.41	8.46	1.00	762	0.257	3.66	8	548.0
7/19/2022	18	23.01	5.23	8.51	4.40	530	0.05	2.87	6.8	78.0
7/19/2022	19	18.94	7.54	8.51	7.80	759	0.05	3.55	8.4	866.0
7/19/2022	20	22.33	6.84	8.58	7.40	555	0.09	2.85	13.6	167.0
8/23/2022	1	19.96	4.15	8.49	0.60	405	0.05	2.96	3.2	41.0
8/23/2022	2	19.01	1.28	8.44	1.20	631	0.772	3.32	206	248.0
8/23/2022	3	19.72	8.62	8.56	0.40	453	0.05	3.43	8.8	238.0
8/23/2022	4	19.81	8.56	8.61	1.10	438	0.05	3.34	9.6	291.0
8/23/2022	5	20.35	7.68	8.72	0.80	534	0.05	3.12	8.4	60.0
8/23/2022	6	20.09	5.66	8.66	0.70	444	0.05	4.25	5.6	60.0
8/23/2022	7	18.36	6.86	8.68	3.40	616	0.05	3.52	2.8	613.0
8/23/2022	8	19.66	7.51	8.67	1.20	696	0.05	4.00	3.6	387.0
8/23/2022	9	19.25	8.14	8.74	14.60	463	0.05	0.25	11.6	12.0
8/23/2022	10	18.89	8.94	8.61	7.50	487	0.05	3.30	14.8	231.0
8/23/2022	11	18.20	2.11	8.61	6.20	529	0.196	3.68	3.6	93.0
8/23/2022	12	17.15	7.25	8.84	0.70	726	0.053	3.95	5.6	921.0
8/23/2022	13	17.91	8.97	8.88	2.40	471	0.05	3.27	19.6	155.0
8/23/2022	14	17.94	3.18	8.78	0.90	477	0.053	3.30	1.2	104.0
8/23/2022	15	17.56	9.02	8.54	1.10	735	0.05	4.54	2.8	345.0
8/23/2022	16	16.19	5.19	8.48	11.80	750	0.05	4.43	37.6	291.0

Date	SITE	Temp (C)	DO	pH	TURB	Conductivity	Phos.	Nitrate	TSS	E.coli (MPN)
8/23/2022	17	17.60	7.21	8.73	3.90	519	0.062	3.48	4.4	104.0
8/23/2022	18	17.47	7.82	8.66	1.20	734	0.216	4.11	4.8	1050.0
8/23/2022	19	16.94	7.81	8.62	1.40	769	0.05	4.45	10.8	921.0
8/23/2022	20	16.92	9.12	8.63	4.50	556	0.069	3.52	5.6	172.0
9/20/2022	1	19.95	8.25	8.47	1.30	464	0.311	1.97	42.4	15.0
9/20/2022	2	20.06	8.53	8.31	5.10	608	1.610	2.53	83.6	866.0
9/20/2022	3	20.02	8.51	8.39	2.40	484	0.063	2.80	8.4	261.0
9/20/2022	4	20.40	8.42	8.42	2.90	474	0.050	2.19	9.6	133.0
9/20/2022	5	21.52	4.48	8.51	0.70	571	0.05	2.15	5.6	16.0
9/20/2022	6	20.57	8.58	8.21	0.80	931	0.188	3.37	29.2	248.0
9/20/2022	7	21.89	7.36	8.54	4.30	602	0.050	2.51	3.6	980.0
9/20/2022	8	21.74	8.03	8.33	0.50	740	0.050	3.37	3.6	579.0
9/20/2022	9	22.41	6.74	8.64	1.30	513	0.050	2.30	14.2	8.0
9/20/2022	10	19.51	6.73	8.56	0.70	582	0.050	2.28	6.0	261.0
9/20/2022	11	19.44	3.24	8.51	0.40	580	0.226	2.60	4.4	14.0
9/20/2022	12	16.11	9.14	8.61	1.00	703	0.050	2.46	3.2	649.0
9/20/2022	13	19.63	6.73	8.76	11.30	476	0.104	2.78	20.0	260.0
9/20/2022	14	17.51	8.01	8.66	1.40	540	0.050	2.78	6.0	579.0
9/20/2022	15	17.16	8.99	8.15	1.10	776	0.050	3.70	4.4	687.0
9/20/2022	16	17.71	6.11	8.45	1.40	715	0.050	3.19	38.8	548.0
9/20/2022	17	19.59	7.01	8.65	2.10	615	0.062	2.85	1.2	99.0
9/20/2022	18	19.05	8.12	8.61	3.60	711	0.217	2.73	3.6	548.0
9/20/2022	19	17.64	8.86	8.38	5.20	771	0.050	3.05	6.4	411.0
9/20/2022	20	19.05	8.12	8.61	3.60	711	0.051	2.73	2.4	119.0
10/26/2022	1	13.15	7.55	8.77	1.00	437	0.050	1.22	10.0	38.0
10/26/2022	2	12.52	9.89	8.73	10.20	682	0.532	1.85	100.0	727.0
10/26/2022	3	12.32	8.02	8.62	7.60	542	0.050	1.31	9.6	727.0
10/26/2022	4	12.64	6.73	8.61	1.70	535	0.125	1.87	20.0	517.0
10/26/2022	5	9.96	5.97	8.66	3.10	571	0.050	1.47	2.8	105.0
10/26/2022	6	12.42	6.87	8.58	12.20	821	0.118	2.46	22.0	2420.0
10/26/2022	7	12.23	9.73	8.44	1.50	612	0.098	1.69	9.2	770.0
10/26/2022	8	12.39	8.35	8.55	1.40	756	0.050	2.39	7.2	980.0
10/26/2022	9	13.45	10.32	8.78	7.40	523	0.093	1.27	8.6	12.0
10/26/2022	10	13.80	6.84	8.66	1.30	560	0.050	1.42	5.2	1730.0
10/26/2022	11	14.40	3.69	8.62	2.90	701	0.050	1.87	3.2	25.0
10/26/2022	12	13.37	6.95	8.77	0.70	630	0.195	1.60	4.8	1990.0
10/26/2022	13	13.75	6.12	8.54	8.60	729	0.050	1.40	7.6	299.0
10/26/2022	14	13.42	5.54	8.54	0.50	474	0.050	1.36	2.0	122.0
10/26/2022	15	13.07	6.43	8.32	0.70	729	0.050	2.48	26.4	866.0
10/26/2022	16	11.88	8.52	8.50	9.00	762	0.050	2.17	16.8	308.0
10/26/2022	17	12.82	9.55	8.55	1.40	598	0.050	1.72	4.4	206.0
10/26/2022	18	13.56	7.49	8.67	0.50	654	0.256	1.78	3.6	1200.0
10/26/2022	19	13.49	7.65	8.53	6.50	744	0.050	1.99	4.4	201.0
10/26/2022	20	13.99	7.45	8.65	2.50	621	0.050	1.60	6.0	155.0
11/8/2022	1	7.11	8.30	7.94	0.50	478	0.050	1.29	3.6	18.0
11/8/2022	2	6.90	8.10	7.81	6.60	751	0.933	1.94	100.8	6.0
11/8/2022	3	10.40	8.70	7.81	6.20	317	0.125	1.81	14.0	39.0
11/8/2022	4	11.11	6.70	7.66	3.10	622	0.050	2.08	6.4	488.0
11/8/2022	5	8.80	5.41	8.02	1.20	592	0.050	1.78	7.2	43.0
11/8/2022	6	7.40	7.81	8.11	6.20	1074	0.050	2.69	16.8	56.0
11/8/2022	7	7.10	7.88	7.79	4.20	671	0.050	1.85	4.4	81.0
11/8/2022	8	11.40	8.00	8.73	2.10	754	0.050	2.39	2.4	921.0
11/8/2022	9	10.40	8.84	7.93	3.20	544	0.050	1.72	14.4	6.0
11/8/2022	10	11.10	8.80	7.93	3.20	544	0.050	1.72	3.2	132.0
11/8/2022	11	11.42	4.21	7.94	8.11	659	0.050	2.01	4.4	15.0
11/8/2022	12	9.34	8.20	8.64	4.50	851	0.177	1.63	4.8	201.0
11/8/2022	13	8.06	10.78	8.14	2.20	539	0.050	1.17	16.0	119.0
11/8/2022	14	8.29	10.88	8.34	1.70	505	0.050	1.11	4.4	114.0
11/8/2022	15	7.62	11.11	8.27	6.60	802	0.050	2.26	3.6	172.0
11/8/2022	16	14.11	7.72	8.43	15.49	773	0.050	2.06	15.6	411.0
11/8/2022	17	11.02	8.21	7.91	4.20	631	0.050	1.79	1.2	73.0
11/8/2022	18	11.40	7.56	7.87	3.20	777	0.315	2.33	1.6	687.0
11/8/2022	19	15.20	8.11	7.91	2.10	791	0.050	2.10	1.6	120.0
11/8/2022	20	11.41	7.59	7.87	1.20	660	0.050	1.83	0.8	84.0
12/13/2022	1	4.50	5.71	7.88	1.20	472	0.050	4.40	2.4	6.0
12/13/2022	2	4.10	5.26	7.81	5.20	619	0.163	4.40	65.2	133.0
12/13/2022	3	3.90	8.81	7.91	1.20	450	0.050	4.00	6.0	35.0
12/13/2022	4	6.11	7.26	7.91	0.40	467	0.078	2.80	12.4	127.0

Date	SITE	Temp (C)	DO	pH	TURB	Conductivity	Phos.	Nitrate	TSS	E.coli (MPN)
12/13/2022	5	4.20	6.11	8.06	0.40	496	0.050	0.70	6.8	20.0
12/13/2022	6	8.77	5.26	7.84	33.60	772	0.561	6.10	103.2	261.0
12/13/2022	7	4.30	7.12	7.86	0.40	673	0.050	4.60	10.4	228.0
12/13/2022	8	6.20	7.78	7.83	0.50	644	0.050	6.60	3.6	41.0
12/13/2022	9	4.31	6.24	7.93	0.40	436	0.050	2.30	7.2	1.0
12/13/2022	10	6.21	7.26	7.87	0.80	463	0.050	4.10	4.8	93.0
12/13/2022	11	4.72	4.11	7.98	2.40	638	0.054	1.90	6.8	53.0
12/13/2022	12	6.22	8.14	8.11	2.20	651	0.050	11.40	5.2	365.0
12/13/2022	13	6.42	8.91	8.74	6.40	657	0.050	4.90	11.6	43.0
12/13/2022	14	6.54	8.11	7.77	7.20	460	0.116	12.20	2.8	25.0
12/13/2022	15	8.17	7.21	7.62	2.20	640	0.050	4.90	6.4	105.0
12/13/2022	16	6.41	6.11	7.75	1.10	669	0.050	5.30	16.0	236.0
12/13/2022	17	8.42	8.26	7.98	1.20	619	0.050	4.30	2.4	62.0
12/13/2022	18	8.42	9.26	7.93	0.90	643	0.102	3.40	1.6	138.0
12/13/2022	19	9.14	8.22	7.86	1.20	675	0.050	6.20	4.0	82.0
12/13/2022	20	11.41	8.42	8.01	1.20	639	0.050	2.50	5.2	77.0
1/18/2023	1	2.38	11.62	8.71	1.50	464	0.050	4.60	3.2	31.0
1/18/2023	2	7.73	7.16	8.51	1.30	773	0.144	1.80	78.0	91.0
1/18/2023	3	4.89	10.82	8.69	1.20	551	0.050	0.70	10.8	29.0
1/18/2023	4	7.27	11.11	8.75	4.30	563	0.071	0.30	6.8	61.0
1/18/2023	5	5.21	10.64	8.12	1.20	622	0.050	0.10	7.2	20.0
1/18/2023	6	5.51	11.05	8.72	1.50	825	0.073	0.90	15.6	122.0
1/18/2023	7	4.33	10.49	8.14	2.40	610	0.050	1.30	8.4	119.0
1/18/2023	8	11.11	5.12	8.74	3.60	744	0.050	1.80	6.0	179.0
1/18/2023	9	5.59	11.01	8.81	1.40	552	0.050	0.20	7.6	3.0
1/18/2023	10	3.42	11.54	8.85	3.40	578	0.050	2.20	10.0	248.0
1/18/2023	11	4.01	10.45	8.75	1.10	442	0.079	2.00	8.0	30.0
1/18/2023	12	5.57	10.51	8.83	0.30	626	0.050	0.40	5.6	308.0
1/18/2023	13	3.41	9.55	8.53	6.10	694	0.050	2.70	10.8	33.0
1/18/2023	14	5.16	11.42	8.33	1.20	456	0.074	1.50	2.4	10.0
1/18/2023	15	4.13	10.55	8.62	1.10	683	0.050	0.30	6.0	49.0
1/18/2023	16	6.32	9.17	8.53	8.80	795	0.050	2.10	18.0	291.0
1/18/2023	17	4.42	10.83	8.72	5	609.1	0.056	3.80	9.6	62.0
1/18/2023	18	7.36	9.97	8.75	1.20	743	0.148	0.50	3.6	461.0
1/18/2023	19	5.93	11.10	8.65	3.10	808	0.050	3.50	22.0	104.0
1/18/2023	20	6.69	10.36	8.72	1.40	658	0.050	4.30	18.4	66.0

Appendix B2: Macroinverebrates List

			2	3	4	5	6	7
Ephemeroptera	Baetidae	Baetis intercalaris						
		B. flavistriga						
		Baetis brunneicolor						
		Baetis sp.		2				1
		Heterocloeon sp.		16			3	
	Baetiscidae	Baetisca sp.						2
	Caenidae	Caenis sp.			5	4	6	7
	Leptohyphidae	Tricorythodes sp.						
	Heptageniidae	Stenonema mediopunctatum		2				
		S. femoratum						3
		S. terminatum		4				
		Stenacron interpunctatum						1
Plecoptera	Perlidae	Acroneuria sp.						
		Perlesta sp.						
	Helicopsychidae	Helicopsyche borealis						
Tricoptera	Hydropsychidae	Cheumatopsyche sp.		31			9	3
		Ceratopsyche bifida						
		C. sparna		2				
		Hydropsyche betteni		2				
		H. hageni						
		H.simulans						
	Brachycentridae	Brachycentrus sp.						
	Philopotamidae	Chimarra obscura						
	Polycentropodidae	Cyrnellus fraternus						
		Polycentropus sp.						
	Limnephilidae							
		Pycnopsyche sp.						3
Coleoptera	Elmidae	Ancyronyx variegatus						1
		Dubiraphia sp.			2		1	8
		Macronychus glabratus						
		Stenelmis sp.		3				10
		Optioservus fastidus						4
	Psephenidae	Psephenus herricki						

			2	3	4	5	6	7
	Hydrophilidae			2				
		Berosus sp.			1		10	
	Helodidae			1	1			7
	Gyrinidae	Gyrinus sp.						
Odonata	Coenagrionidae	Argia sp.			1	1	1	
		Enallagma sp.				3		
		Ischnura sp.	4	5	11	23	9	1
	Calopterygidae	Calopteryx sp.						
		Hetaerina sp.		7				3
	Aeshnidae	Boyeria sp.						
	Gomphidae	Hylogomphus sp.						
		Stylurus sp.						
	Libellulidae	Libellula sp.		1			2	
		Pachydiplax sp.						
Hemiptera	Belostomatidae	Belostoma sp.						
	Veliidae	Microvella sp.		1				
	Gerridae							
	Corixidae							
Lepidoptera	Pyralidae							
		Paraponyx sp.						
Megaloptera	Sialidae	Sialis sp.			1			
Diptera	Simuliidae	Simulium sp.		5			3	
	Empididae							
	Tabanidae	Tabanus sp.		1				1
	Tipulidae	Tipula sp.						1
	Chironomidae-Tanypodinae	Ablabesmyia mallochi				2		
		Nilotanypus sp.						
		Procladius subllettei			6		12	7
		Thienemannimyia sp.						
			2	3	4	5	6	7

	Chironomidae-Orthocladiinae	Cricotopus sp.						3
		Cricotopus bicinctus		5	9			16
		Brillia sp.						
		Eukiefferiella pseudomontana						
		Orthocladius obumbratus				2	2	
		Rheocricotopus robacki		1				2
		Nanocladius sp.						1
		Thienemanniella xena						1
	Chironomidae-Chironominae	Chironomus sp.						
		Cryptochironomus fulvus					4	
		Dicrotendipes neomodestus						
		Microtendipes sp.						1
		Endochironomus sp.			1			
		Glyptotendipes lobiferus				1		
		Paralauterborniella sp.						1
		Polypedilum convictum		4	7			3
		Stictochironomus sp.			6	7		2
	Chironomidae-Tanytarsini	Paratanytarsus sp.						
		Rheotanytarsus sp.			4		4	
		Tanytarus guerlus			8		29	2
Amphipoda		Hyalella azteca		3	25	56		
		Gammarus sp.						2
Isopoda		Caecidotea sp.		2				
		Lirceus sp.			11			
Annelida		Oligochaeta			1		2	1
		Hirudinea				1	3	
Mollusca	Gastropoda	Physidae	20					
		Ancylidae						1
		Lymnaeidae	5					1
		Planorbidae	7					
	Bivalvia	Sphaeriidae	5					
		Corbicula fluminea						
Total			45	106	108	110	112	114

		Metrics Data	2	3	4	5	6	7
		Total Taxa						
		Total # Individuals	7	23	19	12	18	33
		#EPT Taxa	41	>258	>258	>258	>258	>258
		% Orthoclads &Tanytarsids	0	7	1	1	3	7
		% Non-Insects	0	6	21	2	35	25
		# Dipteran Taxa	90.2	5	37	57	5	5
		% Intolerant	1	6	8	5	7	14
		% Tolerant	0	18	0	0	3	0
		%Predators	59	10	61	91	30	12
		%Shredders & Scrapers	10	17	20	30	41	12
		% Collector-Filterers	78	36	30	1	4	55
		% Sprawlers	12	40	12	0	45	6
			0	0	11	6	22	14
		Metrics Scoring						
		Total Taxa						
		Total # Individuals	1	3	1	1	1	3
		#EPT Taxa	1	5	5	5	5	5
		% Orthoclads &Tanytarsids	1	3	1	1	1	3
		% Non-Insects	5	5	5	5	3	3
		# Dipteran Taxa	1	5	1	1	5	5
		% Intolerant	1	1	3	1	1	3
		% Tolerant	1	3	1	1	1	1
		%Predators	1	5	1	1	1	5
		%Shredders & Scrapers	1	1	3	3	5	1
		% Collector-Filterers	5	5	5	1	1	5
		% Sprawlers	3	1	3	5	1	5
			1	1	5	5	5	5
		Total						
			22	38	34	30	30	44

			8	10	12	13	14	15	16	17
Ephemeroptera	Baetidae	Baetis intercalaris		4						
		B. flavistriga		1						8
		Baetis brunneicolor							16	
		Baetis sp.					1			
		Heterocloeon sp.								32
	Baetiscidae	Baetisca sp.		1						
	Caenidae	Caenis sp.			1	5	4	1		1
	Leptohyphidae	Tricorythodes sp.		7			1			5
	Heptageniidae	Stenonema mediopunctatum								
		S. femoratum		2						
		S. terminatum		11						7
		Stenacron interpunctatum		4						
Plecoptera	Perlidae	Acroneuria sp.								1
		Perlesta sp.								1
	Helicopsychidae	Helicopsyche borealis	2							
Tricoptera	Hydropsychidae	Cheumatopsyche sp.			6		23	2	2	2
		Ceratopsyche bifida								1
		C. sparna								
		Hydropsyche betteni								
		H. hageni			2					
		H.simulans								1
	Brachycentridae	Brachycentrus sp.		5						
	Philopotamidae	Chimarra obscura								1
	Polycentropodidae	Cyrnellus fraternus				1				
		Polycentropus sp.		1						
	Limnephilidae									
		Pycnopsyche sp.				1		1		
Coleoptera	Elmidae	Ancyronyx variegatus								
		Dubiraphia sp.	1	1	15	25	4	4	5	
		Macronychus glabratus			1					
		Stenelmis sp.	1	4	2					6
		Optioservus fastidus	4							2
	Psephenidae	Psephenus herricki								5

			8	10	12	13	14	15	16	17
	Hydrophilidae									
		Berosus sp.			1			1		
	Helodidae			6		3		1	3	
	Gyrinidae	Gyrinus sp.						1		
Odonata	Coenagrionidae	Argia sp.			3		1		1	1
		Enallagma sp.	3			15	6			
		Ischnura sp.		1	22		1	4	4	2
	Calopterygidae	Calopteryx sp.	2							1
		Hetaerina sp.					1			
	Aeshnidae	Boyeria sp.			1				1	
	Gomphidae	Hylogomphus sp.								
		Stylurus sp.								
	Libellulidae	Libellula sp.				1				
		Pachydiplax sp.						1		
Hemiptera	Belostomatidae	Belostoma sp.				2		1	1	
	Veliidae	Microvella sp.	1							
	Gerridae		1							
	Corixidae									
Lepidoptera	Pyralidae				5					
		Paraponyx sp.					1		1	1
Megaloptera	Sialidae	Sialis sp.								
Diptera	Simuliidae	Simulium sp.			1		1			1
	Empididae		3					1		
	Tabanidae	Tabanus sp.			7	1		11		
	Tipulidae	Tipula sp.	6	1					1	
	Chironomidae-Tanypodinae	Ablabesmyia mallochi								
		Nilotanypus sp.					1			
		Procladius subllettei			8			18	1	
		Thienemannimyia sp.	2					2		
			8	10	12	13	14	15	16	17

	Chironomidae-Orthocladiinae	Cricotopus sp.								
		Cricotopus bicinctus	8		1	2				
		Brillia sp.								
		Eukiefferiella pseudomontana								
		Orthocladius obumbratus	4		1		1	2	5	
		Rheocricotopus robacki								
		Nanocladius sp.				2				
		Thienemanniella xena				2				
	Chironomidae-Chironominae	Chironomus sp.								
		Cryptochironomus fulvus			1				1	
		Dicrotendipes neomodestus			1					
		Microtendipes sp.	10							4
		Endochironomus sp.	2							
		Glyptotendipes lobiferus				22				
		Paralauterborniella sp.								
		Polypedilum convictum	6	3	11	6		2		
		Stictochironomus sp.	21	1		2				
	Chironomidae-Tanytarsini	Paratanytarsus sp.			3	4		4		
		Rheotanytarsus sp.						2		
		Tanytarus guerlus			2			10		
Amphipoda		Hyalella azteca	6	45		6	49	28		
		Gammarus sp.			1				54	15
Isopoda		Caecidotea sp.		1						1
		Lirceus sp.					1			
Annelida		Oligochaeta						1	2	
		Hirudinea					4		2	
Mollusca	Gastropoda	Physidae	1		3			1		
		Ancylidae	2							
		Lymnaeidae								
		Planorbidae	1		1			1		
	Bivalvia	Sphaeriidae								
		Corbicula fluminea		1						1
Total			103	120	124	126	128	130	132	134

		Metrics Data	8	10	12	13	14	15	16	17
		Total Taxa								
		Total # Individuals	23	21	26	19	18	25	18	25
		#EPT Taxa	87	>258	>258	>258	>258	>258	>258	>258
		% Orthoclads &Tanytarsids	1	9	3	3	4	3	2	11
		% Non-Insects	14	0	7	10	1	18	5	0
		# Dipteran Taxa	11.5	47	5	6	54	31	58	17
		% Intolerant	10	4	11	9	4	10	5	3
		% Tolerant	2	5	0	0	0	0	0	33
		%Predators	38	48	35	46	61	52	10	3
		%Shredders & Scrapers	10	2	43	19	14	39	11	6
		% Collector-Filterers	39	27	34	56	5	9	6	53
		% Sprawlers	11	6	14	5	24	18	2	11
			2	0	13	9	5	25	2	1
		Metrics Scoring								
		Total Taxa								
		Total # Individuals	3	1	3	1	1	3	1	3
		#EPT Taxa	1	5	5	5	5	5	5	5
		% Orthoclads &Tanytarsids	1	3	1	1	3	1	1	3
		% Non-Insects	5	5	5	5	5	5	5	5
		# Dipteran Taxa	5	1	5	5	1	3	1	5
		% Intolerant	3	1	3	3	1	3	1	1
		% Tolerant	1	1	1	1	1	1	1	5
		%Predators	1	1	1	1	1	1	5	5
		%Shredders & Scrapers	1	1	5	3	1	1	1	1
		% Collector-Filterers	5	5	5	5	1	1	1	5
		% Sprawlers	3	5	3	5	1	3	5	3
			1	1	5	5	3	5	1	1
		Total								
			30	30	42	40	24	32	28	42

			18	19	20
Ephemeroptera	Baetidae	Baetis intercalaris	4		30
		B. flavistriga	5	1	1
		Baetis brunneicolor			
		Baetis sp.			
		Heterocloeon sp.			5
	Baetiscidae	Baetisca sp.			
	Caenidae	Caenis sp.			
	Leptohyphidae	Tricorythodes sp.			1
	Heptageniidae	Stenonema mediopunctatum			
		S. femoratum			
		S. terminatum			
		Stenacron interpunctatum	3		
Plecoptera	Perlidae	Acroneuria sp.			
		Perlesta sp.			
	Helicopsychidae	Helicopsyche borealis			
Tricoptera	Hydropsychidae	Cheumatopsyche sp.	5	27	4
		Ceratopsyche bifida	10	9	
		C. sparna			
		Hydropsyche betteni	2		
		H. hageni			
		H.simulans	2	11	2
	Brachycentridae	Brachycentrus sp.			
	Philopotamidae	Chimarra obscura			
	Polycentropodidae	Cyrnellus fraternus			
		Polycentropus sp.			2
	Limnephilidae				2
		Pycnopsyche sp.			
Coleoptera	Elmidae	Ancyronyx variegatus			
		Dubiraphia sp.			
		Macronychus glabratus			
		Stenelmis sp.	1		1
		Optioservus fastidus	4		
	Psephenidae	Psephenus herricki			

			18	19	20
	Hydrophilidae				
		Berosus sp.			
	Helodidae				
	Gyrinidae	Gyrinus sp.			
Odonata	Coenagrionidae	Argia sp.			
		Enallagma sp.			
		Ischnura sp.			
	Calopterygidae	Calopteryx sp.		3	
		Hetaerina sp.			1
	Aeshnidae	Boyeria sp.			
	Gomphidae	Hylogomphus sp.			
		Stylurus sp.		1	
	Libellulidae	Libellula sp.			
		Pachydiplax sp.			
Hemiptera	Belostomatidae	Belostoma sp.			
	Veliidae	Microvella sp.			
	Gerridae				
	Corixidae		1		
Lepidoptera	Pyralidae				
		Paraponyx sp.			
Megaloptera	Sialidae	Sialis sp.			
Diptera	Simuliidae	Simulium sp.		1	9
	Empididae				
	Tabanidae	Tabanus sp.			
	Tipulidae	Tipula sp.		33	1
	Chironomidae-Tanypodinae	Ablabesmyia mallochi			
		Nilotanypus sp.			
		Procladius subllettei			
		Thienemannimyia sp.			
			18	19	20

	Chironomidae-Orthocladiinae	Cricotopus sp.			
		Cricotopus bicinctus			3
		Brillia sp.		1	
		Eukiefferiella pseudomontana	1		
		Orthocladius obumbratus	4		2
		Rheocricotopus robacki			
		Nanocladius sp.			
		Thienemanniella xena			
	Chironomidae-Chironominae	Chironomus sp.		4	4
		Cryptochironomus fulvus			2
		Dicrotendipes neomodestus			
		Microtendipes sp.	3	2	
		Endochironomus sp.	1		1
		Glyptotendipes lobiferus			
		Paralauterborniella sp.			
		Polypedilum convictum		2	
		Stictochironomus sp.	2		
	Chironomidae-Tanytarsini	Paratanytarsus sp.			
		Rheotanytarsus sp.			
		Tanytarus guerlus	1	2	4
Amphipoda		Hyalella azteca			
		Gammarus sp.	51	3	25
Isopoda		Caecidotea sp.			
		Lirceus sp.			
Annelida		Oligochaeta			
		Hirudinea			
Mollusca	Gastropoda	Physidae			
		Ancylidae			
		Lymnaeidae			
		Planorbidae			
	Bivalvia	Sphaeriidae			
		Corbicula fluminea			
Total			136	138	140

		Metrics Data	18	19	20
		Total Taxa			
		Total # Individuals	19	16	21
		#EPT Taxa	>258	>258	>258
		% Orthoclads &Tanytarsids	7	4	8
		% Non-Insects	6	3	9
		# Dipteran Taxa	51	3	25
		% Intolerant	7	8	9
		% Tolerant	0	0	5
		%Predators	3	4	7
		%Shredders & Scrapers	1	4	5
		% Collector-Filterers	9	36	13
		% Sprawlers	23	52	19
			0	0	2
		Metrics Scoring			
		Total Taxa			
		Total # Individuals	1	1	1
		#EPT Taxa	5	5	5
		% Orthoclads &Tanytarsids	3	3	3
		% Non-Insects	5	5	5
		# Dipteran Taxa	1	5	3
		% Intolerant	1	3	3
		% Tolerant	1	1	1
		%Predators	5	5	5
		%Shredders & Scrapers	1	1	1
		% Collector-Filterers	1	5	3
		% Sprawlers	1	1	3
			1	1	1
		Total			
			26	36	34

Appendix B3: QHEI Data

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 15

Stream & Location: E02 RM: __ . __ Date: 01 07 2022

Jay Brealy Scorers Full Name & Affiliation: GoSmith Consulting

River Code: __ - __ - __ STORET #: __ Lat./Long.: (NAD 83 - decimal °) __ . __ /8 __ . __ Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☒☒ MUCK [2]	100	100
☐☐ GRAVEL [7]			☐☐ SILT [2]		
☐☐ SAND [6]			☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☐ LIMESTONE [1]
- ☐ TILLS [1]
- ☒ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☒ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☒ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate Maximum 20: 0

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 0 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 0 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 0 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 1 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

AMOUNT
Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☒ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 3

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☒ LOW [1]
☒ NONE [1]	☒ POOR [1]	☒ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 4

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☒☒ NONE / LITTLE [3]
- ☐☐ MODERATE [2]
- ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐☐ WIDE > 50m [4]
- ☐☐ MODERATE 10-50m [3]
- ☐☐ NARROW 5-10m [2]
- ☐☐ VERY NARROW < 5m [1]
- ☒☒ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐☐ FOREST, SWAMP [3]
- ☐☐ SHRUB OR OLD FIELD [2]
- ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐☐ FENCED PASTURE [1]
- ☒☒ OPEN PASTURE, ROWCROP [0]
- ☐☐ CONSERVATION TILLAGE [1]
- ☐☐ URBAN OR INDUSTRIAL [0]
- ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 3

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH
Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7-<1m [4]
- ☒ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH
Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☒ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY
Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☐ MODERATE [1]
- ☒ SLOW [1]
- ☒ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 3

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:
Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☒ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☒ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☒ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 0

6] GRADIENT (ft/mi)
DRAINAGE AREA (mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: 100
%RUN: ___ %RIFFLE: ___

Gradient Maximum 10: 2

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 58

Stream & Location: F03 RM: ___._ Date: 10/07/2022

Jay Beagly Scorers Full Name & Affiliation: Go South Consulting

River Code: __-___-___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) __.____ /8_.____ Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]	10	5
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☐☐ MUCK [2]	10	0
☒☐ GRAVEL [7]	20	50	☐☐ SILT [2]	15	15
☐☒ SAND [6]	45	30	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☒ 4 or more [2] ☐ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN: ☐ LIMESTONE [1] ☒ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☒ RIP/RAP [0] ☐ LACUSTRINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☒ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☒ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate Maximum 20: 14

Comments

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]
2 POOLS > 70cm [2]
0 ROOTWADS [1]
0 BOULDERS [1]
1 OXBOWS, BACKWATERS [1]
2 AQUATIC MACROPHYTES [1]
0 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☒ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Cover Maximum 20: 12

Comments

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☒ MODERATE [3] ☐ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☒ FAIR [3] ☐ POOR [1]

CHANNELIZATION: ☒ NONE [6] ☐ RECOVERED [4] ☐ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]

STABILITY: ☐ HIGH [3] ☒ MODERATE [2] ☐ LOW [1]

Channel Maximum 20: 14

Comments

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☒☒ NONE / LITTLE [3] ☐☐ MODERATE [2] ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4] ☐☐ MODERATE 10-50m [3] ☐☐ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☒☒ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☒☒ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☐☐ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum 10: 4

Comments

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☐ > 1m [6] ☐ 0.7-<1m [4] ☒ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☒ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☒ MODERATE [1] ☒ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☒ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Pool / Current Maximum 12: 7

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☒ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☒ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2] ☒ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☐ LOW [1] ☒ MODERATE [0] ☐ EXTENSIVE [-1]

Riffle / Run Maximum 8: 3

Comments

6] GRADIENT (ft/mi)

DRAINAGE AREA (mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: 35 %GLIDE: 15
%RUN: 35 %RIFFLE: 15

Gradient Maximum 10: 4

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 39

Stream & Location: E04   RM: _ _ . _   Date: 10/07/2022

Jay Beugly   *Scorers Full Name & Affiliation:* Gosfort Consulting

River Code: _ _ - _ _ _ - _ _ _   *STORET #:* ______   Lat./Long.: (NAD 83 - decimal °) _ _ . _ _ _ _ _ /8_ . _ _ _ _ _   Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]			☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]	10	
☐ ☐ COBBLE [8]			☐ ☐ MUCK [2]		
☐ ☐ GRAVEL [7]			☑ ☐ SILT [2]	25	
☐ ☑ SAND [6]	65		☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☐ LIMESTONE [1]
- ☑ TILLS [1]
- ☑ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☑ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☑ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate: 4.5 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 1 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 1 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 0 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 2 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

AMOUNT
Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☑ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 8 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☑ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 13 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	
☑ ☑ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☑ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☑ ☐ NONE [0]	☑ ☑ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3.5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☑ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☐ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 8 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☑ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☑ EXTENSIVE [-1]

Comments

Riffle / Run: 0 (Maximum 8)

6] GRADIENT (ft/mi)
DRAINAGE AREA (mi²)
- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: 20   %GLIDE: 10
%RUN: 65   %RIFFLE: 5

Gradient: 2 (Maximum 10)

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 43

Stream & Location: E05 *RM:* ___ . ___ *Date:* 01 07 2022

Jay Beagley *Scorers Full Name & Affiliation:* Goforth Consulting

River Code: __ - ___ - ___ *STORET #:* ______ *Lat./Long.:* (NAD 83 - decimal °) __ . ____ /8_ . ____ Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE	ORIGIN	QUALITY
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]			☐ LIMESTONE [1]	☒ HEAVY [-2] (SILT)
☐☐ BOULDER [9]			☐☐ DETRITUS [3]	10		☐ TILLS [1]	☐ MODERATE [-1] (SILT)
☐☐ COBBLE [8]			☐☐ MUCK [2]	15		☒ WETLANDS [0]	☐ NORMAL [0] (SILT)
☐☐ GRAVEL [7]		10	☒☐ SILT [2]	35	80	☐ HARDPAN [0]	☐ FREE [1] (SILT)
☐☒ SAND [6]		10	☐☐ ARTIFICIAL [0]			☐ SANDSTONE [0]	☒ EXTENSIVE [-2] (EMBEDDEDNESS)
☐☐ BEDROCK [5]						☐ RIP/RAP [0]	☐ MODERATE [-1] (EMBEDDEDNESS)
						☐ LACUSTURINE [0]	☐ NORMAL [0] (EMBEDDEDNESS)
						☐ SHALE [-1]	☐ NONE [1] (EMBEDDEDNESS)
						☐ COAL FINES [-2]	

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☒ 4 or more [2] ☐ 3 or less [0]

Comments

Substrate Maximum 20: 4

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 1 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 1 SHALLOWS (IN SLOW WATER) [1]
- 1 ROOTMATS [1]
- 1 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 0 BOULDERS [1]
- 1 OXBOWS, BACKWATERS [1]
- 2 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)

- ☐ EXTENSIVE >75% [11]
- ☒ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 15

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☒ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☒ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☒ LOW [1]
☐ NONE [1]	☒ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 10

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☒☒ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☒☒ NONE [0]	☒☒ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 3

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☒ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☒ SLOW [1]
☐ 0.7-<1m [4]	☒ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☒ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 9

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☒ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☒ BEST AREAS < 5cm [metric=0]		☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☒ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 0

6] GRADIENT (ft/mi)

DRAINAGE AREA (mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ☐ %GLIDE: ☐
%RUN: ☐ %RIFFLE: ☐

Gradient Maximum 10: 2

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 31

Stream & Location: E06 RM: ____ Date: 01/07/2022

Scorers Full Name & Affiliation: Jay Brady GeoSurth Consulting

River Code: ___-___-___ STORET #: _____ Lat./Long.: (NAD 83 - decimal °) ___.____ /8_.____ Office verified location ☐

1] SUBSTRATE Check *ONLY* **Two** substrate *TYPE BOXES*; estimate % or note every type present

Check ONE (*Or 2 & average*)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	___	___	☐ ☐ HARDPAN [4]	___	___
☐ ☐ BOULDER [9]	___	___	☐ ☐ DETRITUS [3]	___	15
☐ ☐ COBBLE [8]	___	___	☐ ☐ MUCK [2]	___	40
☐ ☐ GRAVEL [7]	___	___	☑ ☐ SILT [2]	___	___
☐ ☑ SAND [6]	45	___	☐ ☐ ARTIFICIAL [0]	___	___
☐ ☐ BEDROCK [5]	___	___	(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

ORIGIN	QUALITY
☐ LIMESTONE [1]	☑ HEAVY [-2]
☑ TILLS [1]	☐ MODERATE [-1]
☑ WETLANDS [0]	☐ NORMAL [0]
☐ HARDPAN [0]	☐ FREE [1]
☐ SANDSTONE [0]	SILT
☐ RIP/RAP [0]	☑ EXTENSIVE [-2]
☐ LACUSTURINE [0]	☐ MODERATE [-1]
☐ SHALE [-1]	EMBEDDEDNESS ☐ NORMAL [0]
☐ COAL FINES [-2]	☐ NONE [1]

Comments

Substrate 5 / Maximum 20

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

2 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	2 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]
0 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☑ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 7

3] CHANNEL MORPHOLOGY Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☑ LOW [1]
☑ NONE [1]	☑ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 4

4] BANK EROSION AND RIPARIAN ZONE Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

EROSION (L / R)	RIPARIAN WIDTH (L / R)	FLOOD PLAIN QUALITY (L / R)	
☐ ☑ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☑ ☐ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☑ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☑ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☑ ☑ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 4

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check **ONE** (*ONLY!*)
☐ > 1m [6]
☑ 0.7-<1m [4]
☐ 0.4-<0.7m [2]
☐ 0.2-<0.4m [1]
☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (*Or 2 & average*)
☐ POOL WIDTH > RIFFLE WIDTH [2]
☑ POOL WIDTH = RIFFLE WIDTH [1]
☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
☐ TORRENTIAL [-1] ☐ SLOW [1]
☐ VERY FAST [1] ☐ INTERSTITIAL [-1]
☐ FAST [1] ☐ INTERMITTENT [-2]
☑ MODERATE [1] ☐ EDDIES [1]
(Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 6

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☑ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 1

6] GRADIENT (ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 25 %GLIDE: 50 %RUN: 30 %RIFFLE: 5

Gradient Maximum 10: 4

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 50

Stream & Location: EOT RM: ___.__ Date: 10/07/2022

Jay Beagly Scorers Full Name & Affiliation: Ecofish

River Code: ___-___-___ STORET #: _____ Lat./Long.: (NAD 83 - decimal °) ___.____ / 8_.____ Office verified location ☐

1] SUBSTRATE Check *ONLY* **Two** substrate *TYPE BOXES*; estimate % or note every type present

Check ONE (*Or 2 & average*)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	___	___	☐☐ HARDPAN [4]	___	___
☐☐ BOULDER [9]	___	___	☐☐ DETRITUS [3]	___	___
☐☐ COBBLE [8]	___	___	☐☐ MUCK [2]	10	___
☐☐ GRAVEL [7]	___	20	☑☐ SILT [2]	30	10
☑☐ SAND [6]	60	70	☐☐ ARTIFICIAL [0]	___	___
☐☐ BEDROCK [5]	___	___	(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

ORIGIN		QUALITY	
☐ LIMESTONE [1]		☐ HEAVY [-2]	
☑ TILLS [1]	SILT	☑ MODERATE [-1]	
☑ WETLANDS [0]		☐ NORMAL [0]	
☐ HARDPAN [0]		☐ FREE [1]	
☐ SANDSTONE [0]		☑ EXTENSIVE [-2]	
☐ RIP/RAP [0]	EMBEDDEDNESS	☐ MODERATE [-1]	
☐ LACUSTURINE [0]		☐ NORMAL [0]	
☐ SHALE [-1]		☐ NONE [1]	
☐ COAL FINES [-2]			

Substrate Maximum 20: 15.5

Comments

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	1 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]
1 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 14

3] CHANNEL MORPHOLOGY Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☑ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☑ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 12

4] BANK EROSION AND RIPARIAN ZONE Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

EROSION (L / R)	RIPARIAN WIDTH (L / R)	FLOOD PLAIN QUALITY (L / R)
☑ ☑ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]
☐ ☐ MODERATE [2]	☑ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]
☐ ☐ HEAVY / SEVERE [1]	☐ ☑ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]
	☐ ☐ NONE [0]	☑ ☑ OPEN PASTURE, ROWCROP [0]

(L / R)	
☐ ☐	CONSERVATION TILLAGE [1]
☐ ☐	URBAN OR INDUSTRIAL [0]
☐ ☐	MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 5.5

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check **ONE** (*ONLY!*)

☑ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (*Or 2 & average*)

☐ POOL WIDTH > RIFFLE WIDTH [2] ☑ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply

☐ TORRENTIAL [-1] ☑ SLOW [1] ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] ☐ FAST [1] ☐ INTERMITTENT [-2] ☑ MODERATE [1] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 9

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☑ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0] ☑ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 2

6] GRADIENT (ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: ___ %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient Maximum 10: 2

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 49

Stream & Location: E908 RM: ___ Date: 10/7/2022

Scorers Full Name & Affiliation: Jay Brady, GeoSmith Consulting

River Code: ___-___-___ STORET #: ___ Lat./Long.: (NAD 83 - decimal °) ___.____ /8___.____ Office verified location ☐

1] SUBSTRATE

Check *ONLY* **Two** substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]			☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☐ ☐ COBBLE [8]			☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]		40	☐ ☐ SILT [2]	30	5
☐ ☐ SAND [6]			☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]					

(Score natural substrates, ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (*Or 2 & average*)

ORIGIN	QUALITY
☐ LIMESTONE [1]	☐ HEAVY [-2]
☑ TILLS [1]	☑ MODERATE [-1]
☐ WETLANDS [0]	☐ NORMAL [0]
☐ HARDPAN [0]	☐ FREE [1]
☐ SANDSTONE [0]	☐ EXTENSIVE [-2]
☐ RIP/RAP [0]	☑ MODERATE [-1]
☐ LACUSTURINE [0]	☐ NORMAL [0]
☐ SHALE [-1]	☐ NONE [1]
☐ COAL FINES [-2]	

SILT / EMBEDDEDNESS

Substrate: 12 (Maximum 20)

Comments

2] INSTREAM COVER

Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	2 POOLS > 70cm [2]	1 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]
1 SHALLOWS (IN SLOW WATER) [1]	2 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
2 ROOTMATS [1]		

AMOUNT

Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 11

3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☑ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 9

4] BANK EROSION AND RIPARIAN ZONE

Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)
☑ ☑ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]
☐ ☐ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
	☑ ☑ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]
	☐ ☐ NONE [0]	☑ ☑ OPEN PASTURE, ROWCROP [0]
		☐ ☐ CONSERVATION TILLAGE [1]
		☐ ☐ URBAN OR INDUSTRIAL [0]
		☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 4

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check **ONE** (*ONLY!*))

☐ > 1m [6]
☑ 0.7-<1m [4]
☐ 0.4-<0.7m [2]
☐ 0.2-<0.4m [1]
☐ < 0.2m [0]

CHANNEL WIDTH (Check ONE (*Or 2 & average*))

☐ POOL WIDTH > RIFFLE WIDTH [2]
☑ POOL WIDTH = RIFFLE WIDTH [1]
☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY (Check ALL that apply)

☐ TORRENTIAL [-1] ☑ SLOW [1]
☐ VERY FAST [1] ☐ INTERSTITIAL [-1]
☐ FAST [1] ☐ INTERMITTENT [-2]
☑ MODERATE [1] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 7

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 2

6] GRADIENT (ft/mi)

DRAINAGE AREA (mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient Maximum 10: 4

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 52

Stream & Location: F10 RM: ___ Date: __/__/__

Scorers Full Name & Affiliation: ____

River Code: __-___-___ STORET #: ____ Lat./Long.: (NAD 83 - decimal °) __.______ /8__.______ Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]			☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☐ ☐ COBBLE [8]			☐ ☐ MUCK [2]	15	
☒ ☐ GRAVEL [7]		40	☐ ☐ SILT [2]	20	10
☐ ☒ SAND [6]	65	50	☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [6]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☐ LIMESTONE [1]
- ☒ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☒ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☒ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate: 10 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 1 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 1 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 2 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 0 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☒ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 9 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☒ NONE [6]	☐ HIGH [3]
☒ MODERATE [3]	☒ GOOD [5]	☐ RECOVERED [4]	☒ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 16 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☒ ☒ NONE / LITTLE [3]
- ☐ ☐ MODERATE [2]
- ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☒ ☐ WIDE > 50m [4]
- ☐ ☐ MODERATE 10-50m [3]
- ☐ ☒ NARROW 5-10m [2]
- ☐ ☐ VERY NARROW < 5m [1]
- ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐ ☐ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☒ ☒ OPEN PASTURE, ROWCROP [0]
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☐ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 6 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☒ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☒ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☒ MODERATE [1]
- ☐ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 7 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☒ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☒ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☒ EXTENSIVE [-1]

Comments

Riffle / Run: 2 Maximum 8

6] GRADIENT (ft/mi)
DRAINAGE AREA (mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: 15 %GLIDE: 15
%RUN: 65 %RIFFLE: 5

Gradient: 2 Maximum 10

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 325

Stream & Location: E 12 Jay Baugh RM: ___.___ Date: 10/07/2022

Scorers Full Name & Affiliation: _____

River Code: ___-___-___ STORET #: _____ Lat./Long.: (NAD 83 - decimal °) ___.____ /8 ___.____ Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	___	___
☐☐ BOULDER [9]	___	___
☐☐ COBBLE [8]	___	___
☐☐ GRAVEL [7]	___	5
☒☐ SAND [6]	15	80
☐☐ BEDROCK [5]	___	___

OTHER TYPES	POOL	RIFFLE
☐☐ HARDPAN [4]	___	___
☐☐ DETRITUS [3]	___	___
☐☐ MUCK [2]	10	___
☒☐ SILT [2]	15	15
☐☐ ARTIFICIAL [0]	___	___

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN
- ☐ LIMESTONE [1]
- ☒ TILLS [1]
- ☒ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☒ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☒ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate: 5.5 Maximum 20

Comments

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	2 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]
0 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT

Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☒ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Cover Maximum 20: 7

Comments

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY
- ☐ HIGH [4]
- ☐ MODERATE [3]
- ☐ LOW [2]
- ☒ NONE [1]

DEVELOPMENT
- ☐ EXCELLENT [7]
- ☐ GOOD [5]
- ☒ FAIR [3]
- ☐ POOR [1]

CHANNELIZATION
- ☐ NONE [6]
- ☐ RECOVERED [4]
- ☐ RECOVERING [3]
- ☒ RECENT OR NO RECOVERY [1]

STABILITY
- ☐ HIGH [3]
- ☐ MODERATE [2]
- ☒ LOW [1]

Channel Maximum 20: 6

Comments

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION

L	R	
☐	☐	NONE / LITTLE [3]
☒	☒	MODERATE [2]
☐	☐	HEAVY / SEVERE [1]

RIPARIAN WIDTH

L	R	
☐	☐	WIDE > 50m [4]
☒	☐	MODERATE 10-50m [3]
☐	☐	NARROW 5-10m [2]
☐	☒	VERY NARROW < 5m [1]
☐	☐	NONE [0]

FLOOD PLAIN QUALITY

L	R	
☐	☐	FOREST, SWAMP [3]
☐	☐	SHRUB OR OLD FIELD [2]
☐	☐	RESIDENTIAL, PARK, NEW FIELD [1]
☐	☐	FENCED PASTURE [1]
☒	☒	OPEN PASTURE, ROWCROP [0]

L	R	
☐	☐	CONSERVATION TILLAGE [1]
☐	☐	URBAN OR INDUSTRIAL [0]
☐	☐	MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum 10: 4

Comments

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH

Check ONE (ONLY!)
- ☐ > 1m [6]
- ☒ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH

Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☒ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY

Check ALL that apply

☐ TORRENTIAL [-1]	☐ SLOW [1]
☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ FAST [1]	☐ INTERMITTENT [-2]
☒ MODERATE [1]	☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Pool / Current Maximum 12: 6

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☒ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☒ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☒ EXTENSIVE [-1]

Riffle / Run Maximum 8: 0

Comments

6] GRADIENT (ft/mi)

DRAINAGE AREA (mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___

%RUN: ___ %RIFFLE: ___

Gradient Maximum 10: 4

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 69

Stream & Location: E 13 RM: ____ Date: 8/07/2022

Scorers Full Name & Affiliation: Jay Beagly / GoSerth

River Code: ____ STORET #: ____ Lat./Long.: (NAD 83 - decimal °) ____ . ____ / 8 . ____ Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	____	____	☐ ☐ HARDPAN [4]	____	____
☐ ☐ BOULDER [9]	____	____	☐ ☐ DETRITUS [3]	____	____
☐ ☐ COBBLE [8]	____	____	☐ ☐ MUCK [2]	5	____
☐ ☒ GRAVEL [7]	50	75	☐ ☐ SILT [2]	15	10
☒ ☐ SAND [6]	30	15	☐ ☐ ARTIFICIAL [0]	____	____
☐ ☐ BEDROCK [5]	____	____	(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☒ 4 or more [2] ☐ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN	SILT / EMBEDDEDNESS	QUALITY
☐ LIMESTONE [1]		☐ HEAVY [-2]
☒ TILLS [1]		☒ MODERATE [-1]
☐ WETLANDS [0]		☐ NORMAL [0]
☐ HARDPAN [0]		☐ FREE [1]
☐ SANDSTONE [0]		☐ EXTENSIVE [-2]
☐ RIP/RAP [0]		☒ MODERATE [-1]
☐ LACUSTURINE [0]		☐ NORMAL [0]
☐ SHALE [-1]		☐ NONE [1]
☐ COAL FINES [-2]		

Comments

Substrate: 14 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	2 POOLS > 70cm [2]	1 OXBOWS, BACKWATERS [1]	AMOUNT (Check ONE (Or 2 & average))
2 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]	☒ EXTENSIVE >75% [11]
1 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	2 LOGS OR WOODY DEBRIS [1]	☐ MODERATE 25-75% [7]
0 ROOTMATS [1]			☐ SPARSE 5-<25% [3]
			☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☒ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☒ MODERATE [2]
☒ LOW [2]	☒ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 13

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L / R)	RIPARIAN WIDTH (L / R)	FLOOD PLAIN QUALITY (L / R)	
☒ ☒ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☒ ☒ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☒ ☒ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 4

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	
Check ONE (ONLY!)	Check ONE (Or 2 & average)	Check ALL that apply	
☒ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☒ SLOW [1]
☐ 0.7-<1m [4]	☒ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☒ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 9

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☒ BEST AREAS > 10cm [2]	☒ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☒ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☒ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 5

6] GRADIENT
DRAINAGE AREA (ft/mi) (mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: %GLIDE:
%RUN: %RIFFLE:

Gradient Maximum 10: 4

Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: **22**

Stream & Location: EH   *RM:* __ . __   *Date:* 0/ 01 / 2022

Jay Bau...   *Scorers Full Name & Affiliation:* Gearth Consult...

River Code: __ - __ - __   *STORET #:* ______   *Lat./Long.:* (NAD 83 - decimal °) __ . ____ /8 __ . ____   Office verified location ☐

1] *SUBSTRATE* Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]			☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☐ ☐ COBBLE [8]			☐ ☒ MUCK [2]	50	50
☐ ☐ GRAVEL [7]			☒ ☐ SILT [2]	50	40
☐ ☐ SAND [6]		10	☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [6]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Comments

Check ONE (*Or 2 & average*)

ORIGIN
- ☐ LIMESTONE [1]
- ☒ TILLS [1]
- ☒ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☒ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☒ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate **0.5** Maximum 20

2] *INSTREAM COVER*

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 1 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 1 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 0 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 1 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (*Or 2 & average*)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☒ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20 **8**

3] *CHANNEL MORPHOLOGY* Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☒ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☒ NONE [1]	☒ POOR [1]	☒ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20 **5**

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

EROSION (L R)
- ☒ ☒ NONE / LITTLE [3]
- ☐ ☐ MODERATE [2]
- ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐ ☐ WIDE > 50m [4]
- ☐ ☐ MODERATE 10-50m [3]
- ☐ ☐ NARROW 5-10m [2]
- ☒ ☐ VERY NARROW < 5m [1]
- ☐ ☒ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐ ☐ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☒ ☒ OPEN PASTURE, ROWCROP [0]
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☐ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10 **3.5**

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check ONE (*ONLY!*)
- ☒ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (*Or 2 & average*)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☒ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☐ MODERATE [1]
- ☒ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12 **3**

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☒ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☒ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☒ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8 **0**

6] *GRADIENT* (ft/mi)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 45   %GLIDE: 5
%RUN: 45   %RIFFLE: 5

Gradient Maximum 10 **2**

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 27

Stream & Location: E15 RM: ___ . ___ Date: 07/ /2022

Scorers Full Name & Affiliation: Gosforth Consulting

River Code: ___ - ___ - ___ STORET #: ___ Lat./Long.: (NAD 83 - decimal °) ___ . ___ /8 ___ . ___ Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☒☐ MUCK [2]	20	20
☐☐ GRAVEL [7]			☐☒ SILT [2]	80	75
☐☐ SAND [6]		5	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN	QUALITY
☐ LIMESTONE [1]	SILT: ☒ HEAVY [-2]
☒ TILLS [1]	☐ MODERATE [-1]
☒ WETLANDS [0]	☐ NORMAL [0]
☐ HARDPAN [0]	☐ FREE [1]
☐ SANDSTONE [0]	EMBEDDEDNESS: ☒ EXTENSIVE [-2]
☐ RIP/RAP [0]	☐ MODERATE [-1]
☐ LACUSTURINE [0]	☐ NORMAL [0]
☐ SHALE [-1]	☐ NONE [1]
☐ COAL FINES [-2]	

Substrate: 0.5 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	2 AQUATIC MACROPHYTES [1]
0 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
2 ROOTMATS [1]		

AMOUNT — Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☒ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 7 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☒ LOW [1]
☒ NONE [1]	☒ POOR [1]	☒ RECENT OR NO RECOVERY [1]	

Comments

Channel: 4 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☒☒ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☒☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☒☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☒ NONE [0]	☒☒ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3.5 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☐ SLOW [1]
☒ 0.7-<1m [4]	☒ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☒ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 6 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☒ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☒ BEST AREAS < 5cm [metric=0]		☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☒ EXTENSIVE [-1]

Comments

Riffle / Run: 0 Maximum 8

6] GRADIENT (ft/mi)

DRAINAGE AREA (mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: 10 %GLIDE: 10

%RUN: 80 %RIFFLE: 0

Gradient: 6 Maximum 10

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 31

Stream & Location: [illegible] RM: ___ Date: 7/1/__

Scorers Full Name & Affiliation: Jay Beagly GeoSearch Consulting

River Code: ___-___-___ STORET #: ___ Lat./Long.: (NAD 83 - decimal °) ___.___ 18 .___ Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☒☐ MUCK [2]	85	85
☐☐ GRAVEL [7]			☐☒ SILT [2]	12	12
☐☐ SAND [6]	3	3	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

ORIGIN: ☐ LIMESTONE [1] ☒ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY: SILT: ☒ HEAVY [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☒ EXTENSIVE [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Comments

Substrate: 1 (Maximum 20)

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	2 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	2 AQUATIC MACROPHYTES [1]
0 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT (Check ONE (Or 2 & average))

☐ EXTENSIVE >75% [11] ☐ MODERATE 25-75% [7] ☒ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 8

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☒ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☒ NONE [1]	☒ POOR [1]	☒ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 5

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☒☒ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☒☒ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☒☒ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 3

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!)): ☒ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH (Check ONE (Or 2 & average)): ☐ POOL WIDTH > RIFFLE WIDTH [2] ☒ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY (Check ALL that apply): ☐ TORRENTIAL [-1] ☐ SLOW [1] ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] ☐ FAST [1] ☐ INTERMITTENT [-2] ☒ MODERATE [1] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact, Secondary Contact (circle one and comment on back)

Comments

Pool / Current Maximum 12: 8

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☒ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☒ BEST AREAS < 5cm [metric=0]		☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0] ☒ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 0

6] GRADIENT

DRAINAGE AREA (ft/mi) (mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: 5 %GLIDE: 10 %RUN: 84 %RIFFLE: 1

Gradient Maximum 10: 6

EPA 4520 06/16/06

along some banks current created little riffles

Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 73

Stream & Location: E17 — RM: ____ Date: 10/06/2022

Scorers Full Name & Affiliation: Jay Beuglet — GeoSouth Consulting

River Code: ____ - ____ - ____ STORET #: ____ Lat./Long.: (NAD 83 - decimal °) ____ . ____ 18 . ____ Office verified location ☐

1] *SUBSTRATE* Check *ONLY* **Two** substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]			☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☐ ☐ COBBLE [8]			☐ ☐ MUCK [2]		
☐ ☒ GRAVEL [7]	46	50	☐ ☐ SILT [2]	10	10
☒ ☐ SAND [6]	50	4	☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [6]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Check ONE (*Or 2 & average*)

ORIGIN		QUALITY	
☐ LIMESTONE [1]	SILT	☐ HEAVY [-2]	Substrate
☒ TILLS [1]		☐ MODERATE [-1]	13
☐ WETLANDS [0]		☒ NORMAL [0]	
☐ HARDPAN [0]		☐ FREE [1]	
☐ SANDSTONE [0]	EMBEDDEDNESS	☐ EXTENSIVE [-2]	Maximum 20
☐ RIP/RAP [0]		☒ MODERATE [-1]	
☐ LACUSTURINE [0]		☐ NORMAL [0]	
☐ SHALE [-1]		☐ NONE [1]	
☐ COAL FINES [-2]			

Comments

2] *INSTREAM COVER* Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	1 OXBOWS, BACKWATERS [1]	AMOUNT (Check ONE (*Or 2 & average*))
1 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]	☐ EXTENSIVE >75% [11]
1 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	2 LOGS OR WOODY DEBRIS [1]	☒ MODERATE 25-75% [7]
1 ROOTMATS [1]			☐ SPARSE 5-<25% [3]
			☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 17

3] *CHANNEL MORPHOLOGY* Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☒ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☒ GOOD [5]	☐ RECOVERED [4]	☒ MODERATE [2]
☒ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 15

4] *BANK EROSION AND RIPARIAN ZONE* Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

EROSION (L / R)	RIPARIAN WIDTH (L / R)	FLOOD PLAIN QUALITY (L / R)
☒ ☒ NONE / LITTLE [3]	☒ ☐ WIDE > 50m [4]	☒ ☒ FOREST, SWAMP [3]
☐ ☐ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]
☐ ☐ HEAVY / SEVERE [1]	☐ ☒ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]
		☐ ☐ CONSERVATION TILLAGE [1]
		☐ ☐ URBAN OR INDUSTRIAL [0]
		☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: ~~9~~

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH (Check ONE (*ONLY!*))	CHANNEL WIDTH (Check ONE (*Or 2 & average*))	CURRENT VELOCITY (Check ALL that apply)
☒ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1] ☐ SLOW [1]
☐ 0.7-<1m [4]	☒ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1] ☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☒ FAST [1] ☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☐ MODERATE [1] ☐ EDDIES [1]
☐ < 0.2m [0]		*Indicate for reach - pools and riffles.*

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 8

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☒ BEST AREAS > 10cm [2]	☒ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☒ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☒ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 5

6] *GRADIENT* (ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 20 %GLIDE: 30 %RUN: 45 %RIFFLE: 15

Gradient Maximum 10: 6

Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 65

Stream & Location: E18 RM: ___ Date: [illegible]

Jay [illegible] Scorers Full Name & Affiliation: [illegible] Consulting

River Code: __-__-__ STORET #: ____ Lat./Long.: (NAD 83 - decimal °) ____ /8____ Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☑ COBBLE [8]	25	20	☐☐ MUCK [2]	10	
☑☐ GRAVEL [7]	30	40	☐☐ SILT [2]	15	10
☐☐ SAND [6]	30	10	☐☐ ARTIFICIAL [0]	10	15
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ■ 3 or less [0]

Comments

ORIGIN: ☐ LIMESTONE [1] ■ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTRINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ■ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ■ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate: 15 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
1 POOLS > 70cm [2]
0 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
1 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ■ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 14 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	■ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	■ GOOD [5]	☐ RECOVERED [4]	■ MODERATE [2]
■ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 15 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ■■ NONE / LITTLE [3] ☐☐ MODERATE [2] ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐■ WIDE > 50m [4] ☐☐ MODERATE 10-50m [3] ■☐ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ■☑ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☐☐ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 6 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ■ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ■ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ■ MODERATE [1] ☐ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 9 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ■ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ■ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2] ■ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☐ LOW [1] ■ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 4 (Maximum 8)

6] GRADIENT (ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 30 %GLIDE: 20
%RUN: 40 %RIFFLE: 10

Gradient: 2 (Maximum 10)

Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 63

Stream & Location: E19 RM: ____ Date: 10/26/2022

Scorers Full Name & Affiliation: ____

River Code: ____ STORET #: ____ Lat./Long.: (NAD83 - decimal °) ____ . ____ / 8 . ____ Office verified location ☐

1] SUBSTRATE

Check ONE substrate TYPE BOXES; estimate % or note every type present

Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR / SLABS [10]	____	____	☐ ☐ HARDPAN [4]	____	5
☐ ☐ BOULDER [9]	____	____	☐ ☐ DETRITUS [3]	15	____
☐ ☐ COBBLE [8]	____	20	☐ ☐ MUCK [2]	30	____
☐ ☐ GRAVEL [7]	15	____	☐ ☐ SILT [2]	____	____
☐ ☐ SAND [6]	40	45	☐ ☐ ARTIFICIAL [0]	____	____
☐ ☐ BEDROCK [9]	____	____			

NUMBER BEST TYPES: ☐ 4 or more [2] ☐ 3 or less [0] (Score natural substrates; ignore sludge from point-sources)

ORIGIN: ☐ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY: SILT ☐ HEAVY [-2] ☐ MODERATE [-1] ☒ NORMAL [0] ☐ FREE [1]; EMBEDDEDNESS ☐ EXTENSIVE [-2] ☒ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate: 15 Maximum 20

Comments

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	0 BOULDERS [1]	1 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]
2 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]
1 ROOTMATS [1]		

AMOUNT (Check ONE (Or 2 & average))

☐ EXTENSIVE >75% [11] ☒ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 13

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☒ NONE [6]	☐ HIGH [3]
☒ MODERATE [3]	☒ GOOD [5]	☐ RECOVERED [4]	☒ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 16

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L / R)	RIPARIAN WIDTH (L / R)	FLOOD PLAIN QUALITY (L / R)
☒ ☒ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]
☐ ☐ MODERATE [2]	☒ ☒ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]
	☐ ☐ NONE [0]	☒ ☒ OPEN PASTURE, ROWCROP [0]
		☐ ☐ CONSERVATION TILLAGE [1]
		☐ ☐ URBAN OR INDUSTRIAL [0]
		☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 6

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))

☐ > 1m [6] ☐ 0.7-<1m [4] ☒ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH (Check ONE (Or 2 & average))

☒ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY (Check ALL that apply)

☐ TORRENTIAL [-1] ☐ SLOW [1] ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] ☐ FAST [1] ☐ INTERMITTENT [-2] ☒ MODERATE [1] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 5

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☒ BEST AREAS > 10cm [2]	☒ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☒ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☒ MODERATE [-1] ☐ EXTENSIVE [-2]

Comments

Riffle / Run Maximum 8: 4

6] GRADIENT (ft/mi)

DRAINAGE AREA (mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: 30 %GLIDE: 15 %RUN: 40 %RIFFLE: 15

Gradient Maximum 10: 4

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 57.5

Stream & Location: E20 RM: ___ Date: 10/06/2022

Jay Beagle Scorers Full Name & Affiliation: GeoSouth Consulting

River Code: ___-___-___ STORET #: ___ Lat./Long.: (NAD 83 - decimal °) ___.___ /8 ___.___ Office verified location ☐

1] SUBSTRATE Check *ONLY* Two substrate *TYPE* BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE
☐☐ BLDR/SLABS [10]		
☐☐ BOULDER [9]		
☐☐ COBBLE [8]		
☐☐ GRAVEL [7]		30
☑☐ SAND [6]	50	60
☐☐ BEDROCK [5]		

OTHER TYPES	POOL	RIFFLE
☐☐ HARDPAN [4]		
☐☐ DETRITUS [3]		
☐☐ MUCK [2]	10	
☒☐ SILT [2]	40	10
☐☐ ARTIFICIAL [0]		

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Check ONE (*Or 2 & average*)

ORIGIN		QUALITY	
☐ LIMESTONE [1]	SILT	☐ HEAVY [-2]	Substrate
☒ TILLS [1]		☒ MODERATE [-1]	6
☐ WETLANDS [0]		☐ NORMAL [0]	
☐ HARDPAN [0]		☐ FREE [1]	
☐ SANDSTONE [0]	EMBEDDEDNESS	☒ EXTENSIVE [-2]	Maximum 20
☐ RIP/RAP [0]		☐ MODERATE [-1]	
☐ LACUSTURINE [0]		☐ NORMAL [0]	
☐ SHALE [-1]		☐ NONE [1]	
☐ COAL FINES [-2]			

Comments No Riffles within 100m of bridge - Pools, Runs, Glides exclusively

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	2 POOLS > 70cm [2]	2 OXBOWS, BACKWATERS [1]	AMOUNT (Check ONE (*Or 2 & average*))
1 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	2 AQUATIC MACROPHYTES [1]	☐ EXTENSIVE >75% [11]
1 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]	☒ MODERATE 25-75% [7]
1 ROOTMATS [1]			☐ SPARSE 5-<25% [3]
			☐ NEARLY ABSENT <5% [1]

Comments Cover Maximum 20: 17

3] CHANNEL MORPHOLOGY Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☒ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☒ MODERATE [2]
☒ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments Channel Maximum 20: 13

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

EROSION (L / R)	RIPARIAN WIDTH (L / R)	FLOOD PLAIN QUALITY (L / R)	
☑ ☑ NONE / LITTLE [3]	☒ ☐ WIDE > 50m [4]	☒ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2]	☐ ☒ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☒ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments Riparian Maximum 10: 8.5

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (*ONLY!*))	CHANNEL WIDTH (Check ONE (*Or 2 & average*))	CURRENT VELOCITY (Check ALL that apply)	
☑ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☐ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☒ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		*Indicate for reach - pools and riffles.*	

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments Pool / Current Maximum 12: 9

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☑ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☒ EXTENSIVE [-1]

Comments Riffle / Run Maximum 8: 0

6] GRADIENT (ft/mi) ☐ VERY LOW - LOW [2-4]

DRAINAGE AREA (mi²) ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: 30 %GLIDE: 40 %RUN: 20 %RIFFLE: 10

Gradient Maximum 10: 4

Appendix C: Load Duration Curve Calculations

Site 1 Date	E1 flow (cfs)	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	46.23	1	0.273	249.17	12.46	1245.87	1.41E+11	1.41E+11
2/24/22	46.68	2	0.546	251.61	12.58	1258.05	1.43E+11	1.43E+11
2/22/22	44.08	3	0.820	237.58	11.88	1187.92	1.35E+11	1.35E+11
2/25/22	45.44	4	1.093	244.92	12.25	1224.58	1.39E+11	1.39E+11
2/26/22	43.59	5	1.366	234.93	11.75	1174.67	1.33E+11	1.33E+11
2/21/22	42.68	6	1.639	230.05	11.50	1150.25	1.31E+11	1.31E+11
2/27/22	42.78	7	1.913	230.56	11.53	1152.82	1.31E+11	1.31E+11
2/20/22	38.14	8	2.186	205.59	10.28	1027.93	1.17E+11	1.17E+11
2/19/22	40.94	9	2.459	220.69	11.03	1103.43	1.25E+11	1.25E+11
2/28/22	40.98	10	2.732	220.87	11.04	1104.34	1.25E+11	1.25E+11
3/1/22	40.67	11	3.005	219.20	10.96	1096.01	1.24E+11	1.24E+11
3/2/22	39.35	12	3.279	212.11	10.61	1060.57	1.20E+11	1.20E+11
3/3/22	39.45	13	3.552	212.63	10.63	1063.14	1.21E+11	1.21E+11
3/4/22	39.06	14	3.825	210.54	10.53	1052.70	1.19E+11	1.19E+11
3/26/22	35.78	15	4.098	192.85	9.64	964.27	1.09E+11	1.09E+11
3/27/22	35.92	16	4.372	193.59	9.68	967.96	1.10E+11	1.10E+11
3/28/22	36.12	17	4.645	194.71	9.74	973.55	1.10E+11	1.10E+11
3/25/22	34.79	18	4.918	187.53	9.38	937.65	1.06E+11	1.06E+11
3/5/22	35.71	19	5.191	192.50	9.63	962.51	1.09E+11	1.09E+11
2/18/22	33.85	20	5.464	182.43	9.12	912.14	1.04E+11	1.04E+11
3/29/22	35.81	21	5.738	193.03	9.65	965.16	1.10E+11	1.10E+11
3/24/22	33.41	22	6.011	180.08	9.00	900.39	1.02E+11	1.02E+11
3/30/22	32.88	23	6.284	177.24	8.86	886.22	1.01E+11	1.01E+11
3/7/22	34.81	24	6.557	187.62	9.38	938.09	1.06E+11	1.06E+11
3/6/22	34.37	25	6.831	185.27	9.26	926.33	1.05E+11	1.05E+11
3/8/22	35.48	26	7.104	191.25	9.56	956.23	1.09E+11	1.09E+11
3/31/22	31.33	27	7.377	168.85	8.44	844.24	9.58E+10	9.58E+10
3/9/22	34.78	28	7.650	187.45	9.37	937.25	1.06E+11	1.06E+11
4/1/22	31.89	29	7.923	171.89	8.59	859.47	9.75E+10	9.75E+10
4/2/22	32.17	30	8.197	173.40	8.67	867.01	9.84E+10	9.84E+10
3/10/22	34.46	31	8.470	185.72	9.29	928.58	1.05E+11	1.05E+11
3/23/22	30.28	32	8.743	163.22	8.16	816.12	9.26E+10	9.26E+10
4/3/22	31.57	33	9.016	170.17	8.51	850.83	9.65E+10	9.65E+10
5/8/22	30.38	34	9.290	163.74	8.19	818.70	9.29E+10	9.29E+10
3/11/22	30.96	35	9.563	166.85	8.34	834.25	9.47E+10	9.47E+10
5/9/22	29.69	36	9.836	160.01	8.00	800.04	9.08E+10	9.08E+10
5/7/22	30.51	37	10.109	164.42	8.22	822.12	9.33E+10	9.33E+10
4/4/22	29.94	38	10.383	161.35	8.07	806.77	9.16E+10	9.16E+10
5/10/22	29.52	39	10.656	159.12	7.96	795.59	9.03E+10	9.03E+10
4/5/22	31.24	40	10.929	168.40	8.42	841.98	9.55E+10	9.55E+10
4/7/22	29.82	41	11.202	160.72	8.04	803.58	9.12E+10	9.12E+10
5/11/22	30.12	42	11.475	162.36	8.12	811.79	9.21E+10	9.21E+10
4/6/22	29.45	43	11.749	158.73	7.94	793.65	9.01E+10	9.01E+10
4/8/22	27.67	44	12.022	149.13	7.46	745.65	8.46E+10	8.46E+10
3/12/22	30.32	45	12.295	163.42	8.17	817.10	9.27E+10	9.27E+10
4/15/22	29.03	46	12.568	156.48	7.82	782.41	8.88E+10	8.88E+10
4/16/22	28.79	47	12.842	155.20	7.76	776.02	8.81E+10	8.81E+10
4/9/22	29.37	48	13.115	158.30	7.92	791.51	8.98E+10	8.98E+10
5/12/22	28.41	49	13.388	153.14	7.66	765.68	8.69E+10	8.69E+10
3/22/22	28.57	50	13.661	154.01	7.70	770.07	8.74E+10	8.74E+10
4/17/22	29.44	51	13.934	158.70	7.94	793.50	9.00E+10	9.00E+10
4/14/22	27.39	52	14.208	147.62	7.38	738.09	8.38E+10	8.38E+10
3/21/22	29.11	53	14.481	156.92	7.85	784.60	8.90E+10	8.90E+10
5/6/22	26.69	54	14.754	143.87	7.19	719.35	8.16E+10	8.16E+10
4/10/22	28.66	55	15.027	154.47	7.72	772.33	8.76E+10	8.76E+10
3/13/22	28.39	56	15.301	153.05	7.65	765.23	8.68E+10	8.68E+10
4/18/22	27.07	57	15.574	145.88	7.29	729.42	8.28E+10	8.28E+10
5/13/22	27.03	58	15.847	145.68	7.28	728.42	8.27E+10	8.27E+10
4/19/22	27.76	59	16.120	149.62	7.48	748.11	8.49E+10	8.49E+10
3/20/22	27.20	60	16.393	146.61	7.33	733.03	8.32E+10	8.32E+10

4/20/22	26.64	61	16.667	143.57	7.18	717.85	8.15E+10	8.15E+10
4/11/22	28.32	62	16.940	152.63	7.63	763.17	8.66E+10	8.66E+10
5/14/22	26.15	63	17.213	140.95	7.05	704.74	8.00E+10	8.00E+10
3/14/22	28.24	64	17.486	152.24	7.61	761.18	8.64E+10	8.64E+10
4/13/22	23.94	65	17.760	129.04	6.45	645.22	7.32E+10	7.32E+10
4/21/22	25.27	66	18.033	136.19	6.81	680.95	7.73E+10	7.73E+10
4/12/22	26.97	67	18.306	145.39	7.27	726.97	8.25E+10	8.25E+10
2/17/22	24.12	68	18.579	130.02	6.50	650.10	7.38E+10	7.38E+10
4/22/22	26.90	69	18.852	145.00	7.25	725.00	8.23E+10	8.23E+10
5/15/22	25.47	70	19.126	137.30	6.86	686.48	7.79E+10	7.79E+10
5/5/22	25.63	71	19.399	138.13	6.91	690.64	7.84E+10	7.84E+10
3/15/22	27.28	72	19.672	147.01	7.35	735.07	8.34E+10	8.34E+10
4/23/22	24.52	73	19.945	132.18	6.61	660.88	7.50E+10	7.50E+10
4/25/22	25.62	74	20.219	138.12	6.91	690.59	7.84E+10	7.84E+10
4/24/22	23.39	75	20.492	126.06	6.30	630.32	7.15E+10	7.15E+10
5/4/22	25.32	76	20.765	136.50	6.82	682.48	7.74E+10	7.74E+10
4/26/22	25.00	77	21.038	134.74	6.74	673.69	7.64E+10	7.64E+10
3/16/22	25.84	78	21.311	139.28	6.96	696.41	7.90E+10	7.90E+10
5/16/22	24.27	79	21.585	130.79	6.54	653.95	7.42E+10	7.42E+10
3/19/22	23.91	80	21.858	128.89	6.44	644.45	7.31E+10	7.31E+10
4/27/22	24.89	81	22.131	134.15	6.71	670.76	7.61E+10	7.61E+10
3/17/22	25.33	82	22.404	136.53	6.83	682.65	7.75E+10	7.75E+10
4/28/22	23.37	83	22.678	125.95	6.30	629.75	7.15E+10	7.15E+10
5/17/22	22.79	84	22.951	122.86	6.14	614.29	6.97E+10	6.97E+10
3/18/22	22.80	85	23.224	122.87	6.14	614.33	6.97E+10	6.97E+10
5/3/22	22.68	86	23.497	122.26	6.11	611.32	6.94E+10	6.94E+10
4/29/22	22.48	87	23.770	121.17	6.06	605.84	6.87E+10	6.87E+10
5/18/22	21.66	88	24.044	116.76	5.84	583.81	6.62E+10	6.62E+10
5/1/22	21.63	89	24.317	116.59	5.83	582.95	6.62E+10	6.62E+10
6/11/22	22.20	90	24.590	119.67	5.98	598.34	6.79E+10	6.79E+10
6/12/22	22.00	91	24.863	118.57	5.93	592.83	6.73E+10	6.73E+10
4/30/22	21.03	92	25.137	113.34	5.67	566.70	6.43E+10	6.43E+10
5/2/22	22.22	93	25.410	119.75	5.99	598.74	6.79E+10	6.79E+10
6/10/22	21.87	94	25.683	117.86	5.89	589.32	6.69E+10	6.69E+10
5/19/22	21.01	95	25.956	113.24	5.66	566.21	6.43E+10	6.43E+10
6/13/22	21.79	96	26.230	117.44	5.87	587.21	6.66E+10	6.66E+10
6/9/22	21.51	97	26.503	115.96	5.80	579.79	6.58E+10	6.58E+10
6/14/22	21.70	98	26.776	116.95	5.85	584.73	6.64E+10	6.64E+10
5/20/22	20.22	99	27.049	108.99	5.45	544.95	6.18E+10	6.18E+10
6/15/22	21.03	100	27.322	113.35	5.67	566.75	6.43E+10	6.43E+10
6/8/22	19.80	101	27.596	106.70	5.34	533.51	6.05E+10	6.05E+10
6/2/22	20.08	102	27.869	108.24	5.41	541.19	6.14E+10	6.14E+10
5/21/22	19.67	103	28.142	106.00	5.30	530.00	6.01E+10	6.01E+10
6/1/22	19.50	104	28.415	105.08	5.25	525.42	5.96E+10	5.96E+10
5/30/22	19.84	105	28.689	106.95	5.35	534.74	6.07E+10	6.07E+10
7/28/22	18.41	106	28.962	99.26	4.96	496.28	5.63E+10	5.63E+10
6/3/22	19.56	107	29.235	105.42	5.27	527.09	5.98E+10	5.98E+10
7/27/22	18.39	108	29.508	99.14	4.96	495.68	5.62E+10	5.62E+10
5/31/22	19.87	109	29.781	107.11	5.36	535.54	6.08E+10	6.08E+10
7/29/22	18.35	110	30.055	98.92	4.95	494.62	5.61E+10	5.61E+10
5/29/22	19.21	111	30.328	103.52	5.18	517.62	5.87E+10	5.87E+10
7/26/22	17.68	112	30.601	95.27	4.76	476.37	5.41E+10	5.41E+10
5/22/22	18.91	113	30.874	101.95	5.10	509.74	5.78E+10	5.78E+10
6/7/22	19.18	114	31.148	103.38	5.17	516.90	5.87E+10	5.87E+10
6/16/22	19.78	115	31.421	106.59	5.33	532.97	6.05E+10	6.05E+10
6/4/22	18.86	116	31.694	101.68	5.08	508.40	5.77E+10	5.77E+10
7/30/22	17.55	117	31.967	94.58	4.73	472.88	5.37E+10	5.37E+10
7/25/22	17.26	118	32.240	93.03	4.65	465.15	5.28E+10	5.28E+10
5/23/22	17.79	119	32.514	95.89	4.79	479.47	5.44E+10	5.44E+10
6/5/22	17.93	120	32.787	96.66	4.83	483.32	5.48E+10	5.48E+10
7/31/22	16.76	121	33.060	90.35	4.52	451.74	5.13E+10	5.13E+10

6/17/22	18.24	122	33.333	98.30	4.91	491.50	5.58E+10	5.58E+10
6/6/22	17.04	123	33.607	91.85	4.59	459.26	5.21E+10	5.21E+10
5/28/22	17.61	124	33.880	94.92	4.75	474.62	5.39E+10	5.39E+10
5/24/22	16.75	125	34.153	90.27	4.51	451.36	5.12E+10	5.12E+10
7/24/22	16.08	126	34.426	86.67	4.33	433.36	4.92E+10	4.92E+10
8/1/22	15.93	127	34.699	85.86	4.29	429.31	4.87E+10	4.87E+10
2/16/22	14.07	128	34.973	75.82	3.79	379.10	4.30E+10	4.30E+10
5/27/22	17.16	129	35.246	92.50	4.63	462.52	5.25E+10	5.25E+10
5/25/22	16.53	130	35.519	89.12	4.46	445.58	5.06E+10	5.06E+10
5/26/22	17.00	131	35.792	91.64	4.58	458.18	5.20E+10	5.20E+10
6/18/22	16.95	132	36.066	91.37	4.57	456.87	5.18E+10	5.18E+10
8/2/22	14.98	133	36.339	80.74	4.04	403.69	4.58E+10	4.58E+10
2/13/22	15.52	134	36.612	83.66	4.18	418.32	4.75E+10	4.75E+10
2/14/22	15.40	135	36.885	83.03	4.15	415.13	4.71E+10	4.71E+10
2/15/22	15.13	136	37.158	81.53	4.08	407.65	4.63E+10	4.63E+10
8/3/22	13.98	137	37.432	75.33	3.77	376.65	4.27E+10	4.27E+10
7/8/22	15.20	138	37.705	81.95	4.10	409.75	4.65E+10	4.65E+10
7/9/22	15.16	139	37.978	81.74	4.09	408.68	4.64E+10	4.64E+10
6/19/22	15.16	140	38.251	81.73	4.09	408.66	4.64E+10	4.64E+10
2/12/22	14.86	141	38.525	80.12	4.01	400.60	4.55E+10	4.55E+10
8/4/22	13.65	142	38.798	73.56	3.68	367.79	4.17E+10	4.17E+10
1/25/23	12.50	143	39.071	67.36	3.37	336.80	3.82E+10	3.82E+10
1/23/23	12.14	144	39.344	65.44	3.27	327.19	3.71E+10	3.71E+10
1/22/23	12.44	145	39.617	67.08	3.35	335.38	3.81E+10	3.81E+10
1/26/23	12.20	146	39.891	65.77	3.29	328.84	3.73E+10	3.73E+10
7/10/22	14.89	147	40.164	80.27	4.01	401.35	4.55E+10	4.55E+10
7/23/22	13.13	148	40.437	70.79	3.54	353.93	4.02E+10	4.02E+10
1/24/23	11.76	149	40.710	63.37	3.17	316.87	3.60E+10	3.60E+10
1/27/23	11.29	150	40.984	60.86	3.04	304.30	3.45E+10	3.45E+10
7/7/22	14.71	151	41.257	79.28	3.96	396.42	4.50E+10	4.50E+10
1/8/23	12.39	152	41.530	66.76	3.34	333.78	3.79E+10	3.79E+10
1/28/23	12.22	153	41.803	65.85	3.29	329.27	3.74E+10	3.74E+10
1/21/23	11.69	154	42.077	63.04	3.15	315.18	3.58E+10	3.58E+10
1/7/23	12.21	155	42.350	65.79	3.29	328.93	3.73E+10	3.73E+10
1/29/23	11.79	156	42.623	63.53	3.18	317.65	3.60E+10	3.60E+10
1/6/23	11.91	157	42.896	64.21	3.21	321.05	3.64E+10	3.64E+10
8/5/22	12.35	158	43.169	66.56	3.33	332.79	3.78E+10	3.78E+10
1/9/23	12.05	159	43.443	64.93	3.25	324.65	3.68E+10	3.68E+10
7/11/22	14.32	160	43.716	77.17	3.86	385.85	4.38E+10	4.38E+10
1/30/23	11.98	161	43.989	64.59	3.23	322.97	3.66E+10	3.66E+10
1/10/23	12.01	162	44.262	64.76	3.24	323.79	3.67E+10	3.67E+10
1/5/23	11.62	163	44.536	62.61	3.13	313.04	3.55E+10	3.55E+10
2/7/22	13.16	164	44.809	70.93	3.55	354.67	4.02E+10	4.02E+10
1/20/23	11.43	165	45.082	61.59	3.08	307.96	3.49E+10	3.49E+10
1/31/23	11.33	166	45.355	61.08	3.05	305.39	3.47E+10	3.47E+10
2/8/22	12.69	167	45.628	68.42	3.42	342.11	3.88E+10	3.88E+10
6/20/22	14.02	168	45.902	75.57	3.78	377.83	4.29E+10	4.29E+10
2/6/22	11.63	169	46.175	62.67	3.13	313.35	3.56E+10	3.56E+10
1/12/23	11.68	170	46.448	62.94	3.15	314.68	3.57E+10	3.57E+10
2/3/22	13.37	171	46.721	72.09	3.60	360.43	4.09E+10	4.09E+10
8/6/22	11.87	172	46.995	63.95	3.20	319.77	3.63E+10	3.63E+10
7/12/22	13.38	173	47.268	72.12	3.61	360.60	4.09E+10	4.09E+10
2/4/22	11.83	174	47.541	63.76	3.19	318.81	3.62E+10	3.62E+10
2/5/22	12.76	175	47.814	68.75	3.44	343.77	3.90E+10	3.90E+10
1/4/23	11.06	176	48.087	59.63	2.98	298.15	3.38E+10	3.38E+10
1/13/23	11.18	177	48.361	60.26	3.01	301.31	3.42E+10	3.42E+10
2/11/22	11.02	178	48.634	59.37	2.97	296.87	3.37E+10	3.37E+10
1/19/23	10.89	179	48.907	58.72	2.94	293.61	3.33E+10	3.33E+10
1/14/23	10.98	180	49.180	59.17	2.96	295.83	3.36E+10	3.36E+10
2/9/22	12.01	181	49.454	64.75	3.24	323.73	3.67E+10	3.67E+10
8/7/22	11.24	182	49.727	60.60	3.03	303.02	3.44E+10	3.44E+10

1/15/23	10.57	183	50.000	56.97	2.85	284.87	3.23E+10	3.23E+10
8/8/22	10.77	184	50.273	58.05	2.90	290.26	3.29E+10	3.29E+10
2/2/22	12.60	185	50.546	67.89	3.39	339.45	3.85E+10	3.85E+10
7/13/22	12.30	186	50.820	66.32	3.32	331.62	3.76E+10	3.76E+10
2/10/22	12.18	187	51.093	65.65	3.28	328.27	3.73E+10	3.73E+10
8/9/22	10.53	188	51.366	56.77	2.84	283.83	3.22E+10	3.22E+10
6/21/22	12.50	189	51.639	67.37	3.37	336.83	3.82E+10	3.82E+10
1/16/23	10.37	190	51.913	55.88	2.79	279.40	3.17E+10	3.17E+10
1/3/23	9.55	191	52.186	51.47	2.57	257.36	2.92E+10	2.92E+10
1/17/23	9.86	192	52.459	53.14	2.66	265.70	3.02E+10	3.02E+10
7/14/22	11.44	193	52.732	61.67	3.08	308.36	3.50E+10	3.50E+10
1/18/23	9.52	194	53.005	51.29	2.56	256.45	2.91E+10	2.91E+10
7/22/22	9.61	195	53.279	51.78	2.59	258.91	2.94E+10	2.94E+10
8/10/22	10.07	196	53.552	54.27	2.71	271.33	3.08E+10	3.08E+10
8/22/22	9.63	197	53.825	51.90	2.59	259.50	2.94E+10	2.94E+10
12/2/22	6.99	198	54.098	37.68	1.88	188.42	2.14E+10	2.14E+10
12/1/22	8.24	199	54.372	44.43	2.22	222.15	2.52E+10	2.52E+10
7/15/22	10.25	200	54.645	55.23	2.76	276.17	3.13E+10	3.13E+10
7/6/22	10.63	201	54.918	57.27	2.86	286.35	3.25E+10	3.25E+10
12/4/22	8.33	202	55.191	44.91	2.25	224.54	2.55E+10	2.55E+10
1/2/23	9.13	203	55.464	49.20	2.46	246.01	2.79E+10	2.79E+10
12/3/22	8.54	204	55.738	46.05	2.30	230.25	2.61E+10	2.61E+10
11/30/22	8.22	205	56.011	44.30	2.21	221.49	2.51E+10	2.51E+10
6/22/22	10.95	206	56.284	59.05	2.95	295.23	3.35E+10	3.35E+10
7/16/22	9.68	207	56.557	52.17	2.61	260.86	2.96E+10	2.96E+10
8/21/22	9.15	208	56.831	49.29	2.46	246.46	2.80E+10	2.80E+10
12/5/22	8.17	209	57.104	44.03	2.20	220.14	2.50E+10	2.50E+10
11/29/22	6.62	210	57.377	35.66	1.78	178.32	2.02E+10	2.02E+10
8/11/22	9.17	211	57.650	49.42	2.47	247.08	2.80E+10	2.80E+10
1/1/23	8.23	212	57.923	44.38	2.22	221.92	2.52E+10	2.52E+10
12/6/22	8.45	213	58.197	45.53	2.28	227.64	2.58E+10	2.58E+10
8/23/22	8.51	214	58.470	45.87	2.29	229.34	2.60E+10	2.60E+10
7/17/22	9.58	215	58.743	51.61	2.58	258.07	2.93E+10	2.93E+10
1/11/23	11.03	216	59.016	59.44	2.97	297.20	3.37E+10	3.37E+10
12/7/22	7.91	217	59.290	42.65	2.13	213.26	2.42E+10	2.42E+10
7/18/22	9.34	218	59.563	50.35	2.52	251.73	2.86E+10	2.86E+10
12/8/22	7.73	219	59.836	41.66	2.08	208.32	2.36E+10	2.36E+10
8/31/22	7.61	220	60.109	41.01	2.05	205.05	2.33E+10	2.33E+10
12/9/22	6.54	221	60.383	35.24	1.76	176.20	2.00E+10	2.00E+10
8/30/22	7.77	222	60.656	41.87	2.09	209.36	2.38E+10	2.38E+10
12/10/22	6.91	223	60.929	37.23	1.86	186.14	2.11E+10	2.11E+10
12/31/22	7.56	224	61.202	40.77	2.04	203.85	2.31E+10	2.31E+10
2/1/22	8.51	225	61.475	45.89	2.29	229.46	2.60E+10	2.60E+10
8/12/22	7.90	226	61.749	42.56	2.13	212.79	2.41E+10	2.41E+10
7/19/22	8.21	227	62.022	44.24	2.21	221.18	2.51E+10	2.51E+10
8/24/22	7.20	228	62.295	38.83	1.94	194.15	2.20E+10	2.20E+10
11/28/22	6.08	229	62.568	32.76	1.64	163.81	1.86E+10	1.86E+10
12/11/22	7.03	230	62.842	37.87	1.89	189.34	2.15E+10	2.15E+10
6/23/22	9.32	231	63.115	50.23	2.51	251.14	2.85E+10	2.85E+10
8/15/22	7.20	232	63.388	38.82	1.94	194.11	2.20E+10	2.20E+10
9/1/22	6.66	233	63.661	35.87	1.79	179.37	2.04E+10	2.04E+10
12/12/22	7.18	234	63.934	38.72	1.94	193.59	2.20E+10	2.20E+10
8/14/22	7.31	235	64.208	39.38	1.97	196.92	2.23E+10	2.23E+10
12/16/22	6.13	236	64.481	33.03	1.65	165.13	1.87E+10	1.87E+10
12/13/22	6.07	237	64.754	32.72	1.64	163.59	1.86E+10	1.86E+10
12/15/22	5.72	238	65.027	30.84	1.54	154.22	1.75E+10	1.75E+10
12/17/22	6.38	239	65.301	34.40	1.72	172.02	1.95E+10	1.95E+10
8/13/22	7.08	240	65.574	38.18	1.91	190.91	2.17E+10	2.17E+10
7/20/22	7.30	241	65.847	39.34	1.97	196.69	2.23E+10	2.23E+10
8/16/22	6.76	242	66.120	36.42	1.82	182.08	2.07E+10	2.07E+10
12/14/22	6.32	243	66.393	34.06	1.70	170.32	1.93E+10	1.93E+10

12/24/22	4.16	244	66.667	22.42	1.12	112.08	1.27E+10	1.27E+10
8/25/22	6.66	245	66.940	35.91	1.80	179.57	2.04E+10	2.04E+10
9/2/22	6.32	246	67.213	34.07	1.70	170.36	1.93E+10	1.93E+10
12/18/22	6.32	247	67.486	34.08	1.70	170.40	1.93E+10	1.93E+10
12/23/22	4.11	248	67.760	22.18	1.11	110.89	1.26E+10	1.26E+10
12/20/22	6.37	249	68.033	34.32	1.72	171.59	1.95E+10	1.95E+10
10/23/22	5.93	250	68.306	31.97	1.60	159.83	1.81E+10	1.81E+10
12/19/22	6.30	251	68.579	33.95	1.70	169.77	1.93E+10	1.93E+10
12/27/22	3.35	252	68.852	18.04	0.90	90.18	1.02E+10	1.02E+10
12/26/22	4.26	253	69.126	22.94	1.15	114.71	1.30E+10	1.30E+10
12/30/22	5.53	254	69.399	29.81	1.49	149.07	1.69E+10	1.69E+10
7/21/22	6.85	255	69.672	36.93	1.85	184.67	2.10E+10	2.10E+10
8/17/22	6.21	256	69.945	33.48	1.67	167.41	1.90E+10	1.90E+10
6/24/22	7.95	257	70.219	42.83	2.14	214.17	2.43E+10	2.43E+10
12/21/22	6.37	258	70.492	34.33	1.72	171.66	1.95E+10	1.95E+10
12/28/22	3.05	259	70.765	16.45	0.82	82.23	9.33E+09	9.33E+09
12/25/22	3.61	260	71.038	19.48	0.97	97.38	1.11E+10	1.11E+10
9/3/22	6.01	261	71.311	32.42	1.62	162.09	1.84E+10	1.84E+10
8/26/22	5.94	262	71.585	32.00	1.60	159.98	1.82E+10	1.82E+10
12/22/22	6.18	263	71.858	33.31	1.67	166.53	1.89E+10	1.89E+10
8/29/22	5.41	264	72.131	29.18	1.46	145.90	1.66E+10	1.66E+10
8/27/22	6.02	265	72.404	32.46	1.62	162.32	1.84E+10	1.84E+10
9/4/22	5.75	266	72.678	31.00	1.55	154.99	1.76E+10	1.76E+10
8/18/22	5.95	267	72.951	32.05	1.60	160.27	1.82E+10	1.82E+10
12/29/22	3.44	268	73.224	18.55	0.93	92.76	1.05E+10	1.05E+10
10/24/22	5.04	269	73.497	27.15	1.36	135.76	1.54E+10	1.54E+10
8/19/22	5.71	270	73.770	30.77	1.54	153.83	1.75E+10	1.75E+10
8/28/22	5.65	271	74.044	30.48	1.52	152.39	1.73E+10	1.73E+10
8/20/22	5.42	272	74.317	29.19	1.46	145.96	1.66E+10	1.66E+10
9/5/22	5.58	273	74.590	30.07	1.50	150.33	1.71E+10	1.71E+10
6/25/22	7.17	274	74.863	38.62	1.93	193.11	2.19E+10	2.19E+10
9/6/22	5.32	275	75.137	28.65	1.43	143.26	1.63E+10	1.63E+10
10/25/22	4.32	276	75.410	23.31	1.17	116.55	1.32E+10	1.32E+10
10/26/22	4.67	277	75.683	25.20	1.26	125.98	1.43E+10	1.43E+10
10/27/22	4.62	278	75.956	24.93	1.25	124.63	1.41E+10	1.41E+10
11/27/22	4.18	279	76.230	22.53	1.13	112.66	1.28E+10	1.28E+10
10/28/22	4.64	280	76.503	25.02	1.25	125.11	1.42E+10	1.42E+10
9/7/22	5.34	281	76.776	28.80	1.44	143.99	1.63E+10	1.63E+10
9/27/22	5.52	282	77.049	29.74	1.49	148.70	1.69E+10	1.69E+10
10/29/22	4.40	283	77.322	23.70	1.18	118.48	1.34E+10	1.34E+10
6/26/22	6.51	284	77.596	35.07	1.75	175.37	1.99E+10	1.99E+10
9/28/22	5.25	285	77.869	28.27	1.41	141.36	1.60E+10	1.60E+10
10/30/22	4.34	286	78.142	23.37	1.17	116.86	1.33E+10	1.33E+10
11/1/22	4.09	287	78.415	22.07	1.10	110.33	1.25E+10	1.25E+10
10/31/22	4.13	288	78.689	22.25	1.11	111.26	1.26E+10	1.26E+10
11/2/22	4.31	289	78.962	23.23	1.16	116.17	1.32E+10	1.32E+10
11/4/22	4.09	290	79.235	22.06	1.10	110.29	1.25E+10	1.25E+10
11/3/22	4.33	291	79.508	23.35	1.17	116.74	1.32E+10	1.32E+10
9/26/22	5.24	292	79.781	28.27	1.41	141.34	1.60E+10	1.60E+10
9/8/22	4.98	293	80.055	26.84	1.34	134.21	1.52E+10	1.52E+10
11/5/22	3.86	294	80.328	20.82	1.04	104.10	1.18E+10	1.18E+10
10/19/22	4.05	295	80.601	21.81	1.09	109.04	1.24E+10	1.24E+10
9/29/22	4.96	296	80.874	26.74	1.34	133.70	1.52E+10	1.52E+10
10/22/22	4.18	297	81.148	22.55	1.13	112.77	1.28E+10	1.28E+10
11/7/22	4.05	298	81.421	21.82	1.09	109.10	1.24E+10	1.24E+10
11/6/22	4.01	299	81.694	21.60	1.08	108.01	1.23E+10	1.23E+10
11/8/22	4.38	300	81.967	23.59	1.18	117.94	1.34E+10	1.34E+10
10/20/22	4.03	301	82.240	21.70	1.08	108.48	1.23E+10	1.23E+10
11/9/22	4.01	302	82.514	21.60	1.08	107.98	1.23E+10	1.23E+10
9/9/22	4.50	303	82.787	24.26	1.21	121.30	1.38E+10	1.38E+10
9/30/22	4.92	304	83.060	26.50	1.32	132.48	1.50E+10	1.50E+10

11/10/22	3.65	305	83.333	19.65	0.98	98.23	1.11E+10	1.11E+10
9/12/22	5.00	306	83.607	26.97	1.35	134.86	1.53E+10	1.53E+10
11/11/22	4.08	307	83.880	22.01	1.10	110.05	1.25E+10	1.25E+10
10/18/22	3.62	308	84.153	19.51	0.98	97.54	1.11E+10	1.11E+10
6/27/22	5.63	309	84.426	30.36	1.52	151.78	1.72E+10	1.72E+10
10/21/22	3.83	310	84.699	20.66	1.03	103.30	1.17E+10	1.17E+10
9/11/22	3.76	311	84.973	20.26	1.01	101.29	1.15E+10	1.15E+10
11/12/22	3.64	312	85.246	19.60	0.98	98.01	1.11E+10	1.11E+10
11/13/22	3.72	313	85.519	20.07	1.00	100.35	1.14E+10	1.14E+10
9/13/22	4.73	314	85.792	25.48	1.27	127.41	1.45E+10	1.45E+10
11/14/22	3.98	315	86.066	21.46	1.07	107.28	1.22E+10	1.22E+10
9/10/22	3.98	316	86.339	21.43	1.07	107.15	1.22E+10	1.22E+10
10/1/22	4.73	317	86.612	25.51	1.28	127.57	1.45E+10	1.45E+10
11/15/22	3.85	318	86.885	20.78	1.04	103.88	1.18E+10	1.18E+10
9/14/22	4.37	319	87.158	23.57	1.18	117.85	1.34E+10	1.34E+10
11/16/22	3.38	320	87.432	18.21	0.91	91.07	1.03E+10	1.03E+10
11/17/22	3.37	321	87.705	18.18	0.91	90.90	1.03E+10	1.03E+10
9/15/22	4.22	322	87.978	22.74	1.14	113.69	1.29E+10	1.29E+10
11/26/22	3.45	323	88.251	18.60	0.93	92.98	1.06E+10	1.06E+10
9/25/22	3.89	324	88.525	20.97	1.05	104.83	1.19E+10	1.19E+10
9/21/22	4.31	325	88.798	23.23	1.16	116.16	1.32E+10	1.32E+10
11/18/22	3.33	326	89.071	17.95	0.90	89.73	1.02E+10	1.02E+10
11/25/22	3.50	327	89.344	18.85	0.94	94.25	1.07E+10	1.07E+10
11/19/22	3.25	328	89.617	17.50	0.88	87.50	9.93E+09	9.93E+09
9/22/22	4.49	329	89.891	24.21	1.21	121.06	1.37E+10	1.37E+10
9/16/22	4.03	330	90.164	21.74	1.09	108.68	1.23E+10	1.23E+10
11/24/22	3.20	331	90.437	17.26	0.86	86.32	9.80E+09	9.80E+09
10/2/22	4.47	332	90.710	24.07	1.20	120.37	1.37E+10	1.37E+10
11/22/22	3.29	333	90.984	17.73	0.89	88.64	1.01E+10	1.01E+10
11/21/22	3.00	334	91.257	16.16	0.81	80.78	9.17E+09	9.17E+09
11/23/22	3.16	335	91.530	17.05	0.85	85.23	9.67E+09	9.67E+09
9/20/22	3.96	336	91.803	21.33	1.07	106.63	1.21E+10	1.21E+10
6/28/22	4.61	337	92.077	24.82	1.24	124.12	1.41E+10	1.41E+10
11/20/22	3.17	338	92.350	17.09	0.85	85.47	9.70E+09	9.70E+09
9/17/22	3.69	339	92.623	19.90	1.00	99.51	1.13E+10	1.13E+10
9/23/22	4.11	340	92.896	22.16	1.11	110.81	1.26E+10	1.26E+10
9/19/22	4.07	341	93.169	21.93	1.10	109.66	1.24E+10	1.24E+10
9/18/22	3.87	342	93.443	20.88	1.04	104.42	1.18E+10	1.18E+10
10/3/22	4.10	343	93.716	22.09	1.10	110.47	1.25E+10	1.25E+10
9/24/22	3.66	344	93.989	19.74	0.99	98.68	1.12E+10	1.12E+10
7/5/22	4.09	345	94.262	22.02	1.10	110.09	1.25E+10	1.25E+10
10/4/22	3.72	346	94.536	20.04	1.00	100.22	1.14E+10	1.14E+10
6/29/22	4.12	347	94.809	22.18	1.11	110.92	1.26E+10	1.26E+10
10/5/22	3.83	348	95.082	20.66	1.03	103.29	1.17E+10	1.17E+10
10/17/22	2.34	349	95.355	12.61	0.63	63.05	7.15E+09	7.15E+09
10/6/22	3.13	350	95.628	16.88	0.84	84.40	9.58E+09	9.58E+09
6/30/22	3.65	351	95.902	19.67	0.98	98.36	1.12E+10	1.12E+10
10/7/22	3.56	352	96.175	19.21	0.96	96.07	1.09E+10	1.09E+10
7/1/22	3.61	353	96.448	19.45	0.97	97.26	1.10E+10	1.10E+10
7/2/22	3.67	354	96.721	19.76	0.99	98.82	1.12E+10	1.12E+10
10/8/22	3.01	355	96.995	16.22	0.81	81.08	9.20E+09	9.20E+09
10/16/22	1.97	356	97.268	10.60	0.53	52.99	6.01E+09	6.01E+09
10/9/22	2.29	357	97.541	12.36	0.62	61.82	7.02E+09	7.02E+09
7/3/22	3.19	358	97.814	17.18	0.86	85.89	9.75E+09	9.75E+09
10/13/22	2.97	359	98.087	16.03	0.80	80.13	9.09E+09	9.09E+09
10/10/22	2.20	360	98.361	11.84	0.59	59.18	6.72E+09	6.72E+09
10/15/22	1.84	361	98.634	9.89	0.49	49.46	5.61E+09	5.61E+09
10/14/22	1.88	362	98.907	10.16	0.51	50.79	5.76E+09	5.76E+09
10/11/22	2.11	363	99.180	11.39	0.57	56.93	6.46E+09	6.46E+09
10/12/22	2.06	364	99.454	11.12	0.56	55.60	6.31E+09	6.31E+09
7/4/22	3.15	365	99.727	16.99	0.85	84.96	9.64E+09	9.64E+09

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 1 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	80.22	1.67	0.054	0	52	0.819672131	722.0428076	23.347492	0	1.02E+11	21	15162.89896	490.2973316	0	2.14E+12
3/15/22	15.84	2.20	0.05	4.8	1	19.67213115	187.8756962	4.26990219	409.91061	3.88E+08	35	6575.649368	149.4465766	14346.87135	1.36E+10
4/19/22	18.64	1.57	0.05	9.6	14	16.12021858	157.6998662	5.02228873	964.2794367	6.38E+09	35	5519.495317	175.7801057	33749.78029	2.23E+11
5/24/22	6.97	4.83	0.05	8.8	55.0	34.15300546	181.4217505	1.87807195	330.5406634	9.38E+09	28	5079.809014	52.58601464	9255.138576	2.63E+11
6/21/22	5.65	3.41	0.05	19.2	102.0	51.63934426	103.8428184	1.52262197	584.6868368	1.41E+10	28	2907.598915	42.63341518	16371.23143	3.95E+11
7/19/22	7.36	2.69	0.05	11.2	127.0	62.02185792	106.6764486	1.98283362	444.1547303	2.29E+10	35	3733.675701	69.3991766	15545.41556	8.00E+11
8/23/22	2.42	2.96	0.05	3.2	41.0	58.46994536	38.59641675	0.6519665	41.72585594	2.43E+09	28	1080.699669	18.25506198	1168.323966	6.79E+10
9/20/22	2.04	1.97	0.311	2.4	15.0	91.80327869	21.60040918	3.41811668	26.3777493	7.48E+08	36	777.6147303	123.0522005	949.5989746	2.69E+10
10/26/22	3.73	1.22	0.050	10.0	38.0	75.68306011	24.55264127	1.00637128	201.274255	3.47E+09	13	319.1843365	13.08282658	2616.565315	4.51E+10
11/8/22	2.71	1.29	0.050	3.6	18.0	81.96721311	18.77752998	0.72915084	52.49886065	1.19E+09	35	657.2135494	25.52027948	1837.460123	4.17E+10
12/13/22	3.52	4.40	0.050	2.4	6.0	64.75409836	83.49480648	0.94880462	45.54262172	5.17E+08	36	3005.813033	34.15696629	1639.534382	1.86E+10
1/18/23	6.85	4.60	0.050	3.2	31.0	53.00546448	169.7425212	1.8450274	118.0817539	5.19E+09	37	6280.473285	68.26601396	4369.024894	1.92E+11
2/24/23															

Conversion Factor	5.39	5.39	5.39	2.45E+07						TOTAL	51,100.1	1,262.5	101,848.9	4.23E+12
										TARGET	28,279.1	1,414.0	141,395.6	1.60E+13

Site 2 Date	E2	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	132.69	1	0.273	715.21	35.76	3576.05	4.06E+11	4.06E+11
2/24/22	133.99	2	0.546	722.20	36.11	3611.02	4.10E+11	4.10E+11
2/22/22	126.52	3	0.820	681.94	34.10	3409.71	3.87E+11	3.87E+11
2/25/22	130.42	4	1.093	702.99	35.15	3514.95	3.99E+11	3.99E+11
2/26/22	125.11	5	1.366	674.33	33.72	3371.67	3.83E+11	3.83E+11
2/21/22	122.51	6	1.639	660.32	33.02	3301.60	3.75E+11	3.75E+11
2/27/22	122.78	7	1.913	661.79	33.09	3308.97	3.75E+11	3.75E+11
2/20/22	109.48	8	2.186	590.10	29.50	2950.50	3.35E+11	3.35E+11
2/19/22	117.52	9	2.459	633.44	31.67	3167.20	3.59E+11	3.59E+11
2/28/22	117.62	10	2.732	633.97	31.70	3169.83	3.60E+11	3.60E+11
3/1/22	116.73	11	3.005	629.18	31.46	3145.91	3.57E+11	3.57E+11
3/2/22	112.96	12	3.279	608.84	30.44	3044.19	3.45E+11	3.45E+11
3/3/22	113.23	13	3.552	610.31	30.52	3051.56	3.46E+11	3.46E+11
3/4/22	112.12	14	3.825	604.32	30.22	3021.59	3.43E+11	3.43E+11
3/26/22	102.70	15	4.098	553.56	27.68	2767.78	3.14E+11	3.14E+11
3/27/22	103.09	16	4.372	555.67	27.78	2778.35	3.15E+11	3.15E+11
3/28/22	103.69	17	4.645	558.88	27.94	2794.40	3.17E+11	3.17E+11
3/25/22	99.87	18	4.918	538.27	26.91	2691.37	3.05E+11	3.05E+11
3/5/22	102.51	19	5.191	552.54	27.63	2762.70	3.14E+11	3.14E+11
2/18/22	97.15	20	5.464	523.63	26.18	2618.15	2.97E+11	2.97E+11
3/29/22	102.79	21	5.738	554.06	27.70	2770.32	3.14E+11	3.14E+11
3/24/22	95.90	22	6.011	516.88	25.84	2584.41	2.93E+11	2.93E+11
3/30/22	94.39	23	6.284	508.75	25.44	2543.75	2.89E+11	2.89E+11
3/7/22	99.91	24	6.557	538.52	26.93	2692.62	3.06E+11	3.06E+11
3/6/22	98.66	25	6.831	531.77	26.59	2658.86	3.02E+11	3.02E+11
3/8/22	101.84	26	7.104	548.94	27.45	2744.69	3.11E+11	3.11E+11
3/31/22	89.92	27	7.377	484.65	24.23	2423.23	2.75E+11	2.75E+11
3/9/22	99.82	28	7.650	538.04	26.90	2690.22	3.05E+11	3.05E+11
4/1/22	91.54	29	7.923	493.39	24.67	2466.95	2.80E+11	2.80E+11
4/2/22	92.34	30	8.197	497.72	24.89	2488.59	2.82E+11	2.82E+11
3/10/22	98.90	31	8.470	533.07	26.65	2665.33	3.02E+11	3.02E+11
3/23/22	86.92	32	8.743	468.51	23.43	2342.54	2.66E+11	2.66E+11
4/3/22	90.62	33	9.016	488.43	24.42	2442.15	2.77E+11	2.77E+11
5/8/22	87.20	34	9.290	469.99	23.50	2349.93	2.67E+11	2.67E+11
3/11/22	88.85	35	9.563	478.91	23.95	2394.55	2.72E+11	2.72E+11
5/9/22	85.21	36	9.836	459.27	22.96	2296.37	2.61E+11	2.61E+11
5/7/22	87.56	37	10.109	471.95	23.60	2359.76	2.68E+11	2.68E+11
4/4/22	85.93	38	10.383	463.14	23.16	2315.69	2.63E+11	2.63E+11
5/10/22	84.73	39	10.656	456.72	22.84	2283.59	2.59E+11	2.59E+11
4/5/22	89.68	40	10.929	483.35	24.17	2416.76	2.74E+11	2.74E+11
4/7/22	85.59	41	11.202	461.31	23.07	2306.53	2.62E+11	2.62E+11
5/11/22	86.46	42	11.475	466.02	23.30	2330.11	2.64E+11	2.64E+11
4/6/22	84.53	43	11.749	455.61	22.78	2278.03	2.59E+11	2.59E+11
4/8/22	79.42	44	12.022	428.05	21.40	2140.25	2.43E+11	2.43E+11
3/12/22	87.03	45	12.295	469.07	23.45	2345.35	2.66E+11	2.66E+11
4/15/22	83.33	46	12.568	449.15	22.46	2245.76	2.55E+11	2.55E+11
4/16/22	82.65	47	12.842	445.49	22.27	2227.44	2.53E+11	2.53E+11
4/9/22	84.30	48	13.115	454.38	22.72	2271.88	2.58E+11	2.58E+11
5/12/22	81.55	49	13.388	439.55	21.98	2197.76	2.49E+11	2.49E+11
3/22/22	82.02	50	13.661	442.07	22.10	2210.34	2.51E+11	2.51E+11
4/17/22	84.51	51	13.934	455.52	22.78	2277.62	2.58E+11	2.58E+11
4/14/22	78.61	52	14.208	423.71	21.19	2118.57	2.40E+11	2.40E+11
3/21/22	83.56	53	14.481	450.41	22.52	2252.06	2.56E+11	2.56E+11
5/6/22	76.61	54	14.754	412.95	20.65	2064.76	2.34E+11	2.34E+11
4/10/22	82.26	55	15.027	443.37	22.17	2216.85	2.52E+11	2.52E+11
3/13/22	81.50	56	15.301	439.29	21.96	2196.45	2.49E+11	2.49E+11
4/18/22	77.69	57	15.574	418.73	20.94	2093.67	2.38E+11	2.38E+11
5/13/22	77.58	58	15.847	418.16	20.91	2090.80	2.37E+11	2.37E+11
4/19/22	79.68	59	16.120	429.46	21.47	2147.31	2.44E+11	2.44E+11
3/20/22	78.07	60	16.393	420.81	21.04	2104.04	2.39E+11	2.39E+11

4/20/22	76.45	61	16.667	412.09	20.60	2060.45	2.34E+11	2.34E+11
4/11/22	81.28	62	16.940	438.11	21.91	2190.56	2.49E+11	2.49E+11
5/14/22	75.06	63	17.213	404.57	20.23	2022.83	2.30E+11	2.30E+11
3/14/22	81.07	64	17.486	436.96	21.85	2184.82	2.48E+11	2.48E+11
4/13/22	68.72	65	17.760	370.40	18.52	1852.00	2.10E+11	2.10E+11
4/21/22	72.53	66	18.033	390.91	19.55	1954.55	2.22E+11	2.22E+11
4/12/22	77.43	67	18.306	417.33	20.87	2086.63	2.37E+11	2.37E+11
2/17/22	69.24	68	18.579	373.20	18.66	1866.01	2.12E+11	2.12E+11
4/22/22	77.22	69	18.852	416.20	20.81	2080.98	2.36E+11	2.36E+11
5/15/22	73.11	70	19.126	394.08	19.70	1970.41	2.24E+11	2.24E+11
5/5/22	73.56	71	19.399	396.47	19.82	1982.37	2.25E+11	2.25E+11
3/15/22	78.29	72	19.672	421.98	21.10	2109.89	2.39E+11	2.39E+11
4/23/22	70.39	73	19.945	379.39	18.97	1896.95	2.15E+11	2.15E+11
4/25/22	73.55	74	20.219	396.44	19.82	1982.21	2.25E+11	2.25E+11
4/24/22	67.13	75	20.492	361.85	18.09	1809.24	2.05E+11	2.05E+11
5/4/22	72.69	76	20.765	391.79	19.59	1958.95	2.22E+11	2.22E+11
4/26/22	71.75	77	21.038	386.74	19.34	1933.72	2.19E+11	2.19E+11
3/16/22	74.17	78	21.311	399.78	19.99	1998.91	2.27E+11	2.27E+11
5/16/22	69.65	79	21.585	375.41	18.77	1877.05	2.13E+11	2.13E+11
3/19/22	68.64	80	21.858	369.95	18.50	1849.77	2.10E+11	2.10E+11
4/27/22	71.44	81	22.131	385.06	19.25	1925.29	2.18E+11	2.18E+11
3/17/22	72.71	82	22.404	391.89	19.59	1959.44	2.22E+11	2.22E+11
4/28/22	67.07	83	22.678	361.52	18.08	1807.60	2.05E+11	2.05E+11
5/17/22	65.43	84	22.951	352.64	17.63	1763.21	2.00E+11	2.00E+11
3/18/22	65.43	85	23.224	352.66	17.63	1763.32	2.00E+11	2.00E+11
5/3/22	65.11	86	23.497	350.94	17.55	1754.69	1.99E+11	1.99E+11
4/29/22	64.53	87	23.770	347.79	17.39	1738.96	1.97E+11	1.97E+11
5/18/22	62.18	88	24.044	335.15	16.76	1675.74	1.90E+11	1.90E+11
5/1/22	62.09	89	24.317	334.65	16.73	1673.27	1.90E+11	1.90E+11
6/11/22	63.73	90	24.590	343.49	17.17	1717.43	1.95E+11	1.95E+11
6/12/22	63.14	91	24.863	340.32	17.02	1701.62	1.93E+11	1.93E+11
4/30/22	60.36	92	25.137	325.32	16.27	1626.60	1.85E+11	1.85E+11
5/2/22	63.77	93	25.410	343.71	17.19	1718.57	1.95E+11	1.95E+11
6/10/22	62.77	94	25.683	338.31	16.92	1691.55	1.92E+11	1.92E+11
5/19/22	60.30	95	25.956	325.04	16.25	1625.21	1.84E+11	1.84E+11
6/13/22	62.54	96	26.230	337.10	16.85	1685.48	1.91E+11	1.91E+11
6/9/22	61.75	97	26.503	332.84	16.64	1664.19	1.89E+11	1.89E+11
6/14/22	62.28	98	26.776	335.67	16.78	1678.36	1.90E+11	1.90E+11
5/20/22	58.04	99	27.049	312.84	15.64	1564.19	1.78E+11	1.78E+11
6/15/22	60.36	100	27.322	325.35	16.27	1626.76	1.85E+11	1.85E+11
6/8/22	56.82	101	27.596	306.27	15.31	1531.36	1.74E+11	1.74E+11
6/2/22	57.64	102	27.869	310.68	15.53	1553.38	1.76E+11	1.76E+11
5/21/22	56.45	103	28.142	304.26	15.21	1521.28	1.73E+11	1.73E+11
6/1/22	55.96	104	28.415	301.62	15.08	1508.11	1.71E+11	1.71E+11
5/30/22	56.95	105	28.689	306.97	15.35	1534.87	1.74E+11	1.74E+11
7/28/22	52.86	106	28.962	284.89	14.24	1424.47	1.62E+11	1.62E+11
6/3/22	56.14	107	29.235	302.58	15.13	1512.92	1.72E+11	1.72E+11
7/27/22	52.79	108	29.508	284.55	14.23	1422.75	1.61E+11	1.61E+11
5/31/22	57.04	109	29.781	307.43	15.37	1537.17	1.74E+11	1.74E+11
7/29/22	52.68	110	30.055	283.94	14.20	1419.72	1.61E+11	1.61E+11
5/29/22	55.13	111	30.328	297.15	14.86	1485.73	1.69E+11	1.69E+11
7/26/22	50.74	112	30.601	273.46	13.67	1367.32	1.55E+11	1.55E+11
5/22/22	54.29	113	30.874	292.63	14.63	1463.13	1.66E+11	1.66E+11
6/7/22	55.05	114	31.148	296.74	14.84	1483.69	1.68E+11	1.68E+11
6/16/22	56.76	115	31.421	305.96	15.30	1529.79	1.74E+11	1.74E+11
6/4/22	54.15	116	31.694	291.86	14.59	1459.28	1.66E+11	1.66E+11
7/30/22	50.36	117	31.967	271.46	13.57	1357.31	1.54E+11	1.54E+11
7/25/22	49.54	118	32.240	267.02	13.35	1335.12	1.52E+11	1.52E+11
5/23/22	51.07	119	32.514	275.25	13.76	1376.23	1.56E+11	1.56E+11
6/5/22	51.48	120	32.787	277.46	13.87	1387.29	1.57E+11	1.57E+11
7/31/22	48.11	121	33.060	259.33	12.97	1296.63	1.47E+11	1.47E+11

6/17/22	52.35	122	33.333	282.15	14.11	1410.75	1.60E+11	1.60E+11
6/6/22	48.91	123	33.607	263.64	13.18	1318.22	1.50E+11	1.50E+11
5/28/22	50.55	124	33.880	272.46	13.62	1362.31	1.55E+11	1.55E+11
5/24/22	48.07	125	34.153	259.11	12.96	1295.56	1.47E+11	1.47E+11
7/24/22	46.16	126	34.426	248.78	12.44	1243.88	1.41E+11	1.41E+11
8/1/22	45.72	127	34.699	246.45	12.32	1232.25	1.40E+11	1.40E+11
2/16/22	40.38	128	34.973	217.63	10.88	1088.14	1.23E+11	1.23E+11
5/27/22	49.26	129	35.246	265.52	13.28	1327.59	1.51E+11	1.51E+11
5/25/22	47.46	130	35.519	255.79	12.79	1278.97	1.45E+11	1.45E+11
5/26/22	48.80	131	35.792	263.03	13.15	1315.14	1.49E+11	1.49E+11
6/18/22	48.66	132	36.066	262.27	13.11	1311.37	1.49E+11	1.49E+11
8/2/22	42.99	133	36.339	231.74	11.59	1158.71	1.31E+11	1.31E+11
2/13/22	44.55	134	36.612	240.14	12.01	1200.72	1.36E+11	1.36E+11
2/14/22	44.21	135	36.885	238.31	11.92	1191.55	1.35E+11	1.35E+11
2/15/22	43.42	136	37.158	234.02	11.70	1170.09	1.33E+11	1.33E+11
8/3/22	40.12	137	37.432	216.22	10.81	1081.12	1.23E+11	1.23E+11
7/8/22	43.64	138	37.705	235.22	11.76	1176.10	1.33E+11	1.33E+11
7/9/22	43.53	139	37.978	234.61	11.73	1173.04	1.33E+11	1.33E+11
6/19/22	43.53	140	38.251	234.60	11.73	1173.00	1.33E+11	1.33E+11
2/12/22	42.67	141	38.525	229.97	11.50	1149.86	1.30E+11	1.30E+11
8/4/22	39.17	142	38.798	211.14	10.56	1055.68	1.20E+11	1.20E+11
1/25/23	35.87	143	39.071	193.35	9.67	966.74	1.10E+11	1.10E+11
1/23/23	34.85	144	39.344	187.83	9.39	939.14	1.07E+11	1.07E+11
1/22/23	35.72	145	39.617	192.53	9.63	962.64	1.09E+11	1.09E+11
1/26/23	35.02	146	39.891	188.78	9.44	943.89	1.07E+11	1.07E+11
7/10/22	42.75	147	40.164	230.40	11.52	1151.99	1.31E+11	1.31E+11
7/23/22	37.70	148	40.437	203.18	10.16	1015.88	1.15E+11	1.15E+11
1/24/23	33.75	149	40.710	181.90	9.10	909.52	1.03E+11	1.03E+11
1/27/23	32.41	150	40.984	174.69	8.73	873.43	9.91E+10	9.91E+10
7/7/22	42.22	151	41.257	227.57	11.38	1137.85	1.29E+11	1.29E+11
1/8/23	35.55	152	41.530	191.61	9.58	958.06	1.09E+11	1.09E+11
1/28/23	35.07	153	41.803	189.02	9.45	945.12	1.07E+11	1.07E+11
1/21/23	33.57	154	42.077	180.93	9.05	904.66	1.03E+11	1.03E+11
1/7/23	35.03	155	42.350	188.83	9.44	944.13	1.07E+11	1.07E+11
1/29/23	33.83	156	42.623	182.35	9.12	911.75	1.03E+11	1.03E+11
1/6/23	34.19	157	42.896	184.31	9.22	921.53	1.05E+11	1.05E+11
8/5/22	35.44	158	43.169	191.04	9.55	955.22	1.08E+11	1.08E+11
1/9/23	34.58	159	43.443	186.37	9.32	931.85	1.06E+11	1.06E+11
7/11/22	41.10	160	43.716	221.50	11.08	1107.52	1.26E+11	1.26E+11
1/30/23	34.40	161	43.989	185.40	9.27	927.02	1.05E+11	1.05E+11
1/10/23	34.49	162	44.262	185.88	9.29	929.38	1.05E+11	1.05E+11
1/5/23	33.34	163	44.536	179.71	8.99	898.53	1.02E+11	1.02E+11
2/7/22	37.77	164	44.809	203.60	10.18	1018.01	1.16E+11	1.16E+11
1/20/23	32.80	165	45.082	176.79	8.84	883.95	1.00E+11	1.00E+11
1/31/23	32.53	166	45.355	175.31	8.77	876.57	9.95E+10	9.95E+10
2/8/22	36.44	167	45.628	196.39	9.82	981.95	1.11E+11	1.11E+11
6/20/22	40.24	168	45.902	216.90	10.85	1084.51	1.23E+11	1.23E+11
2/6/22	33.37	169	46.175	179.88	8.99	899.42	1.02E+11	1.02E+11
1/12/23	33.52	170	46.448	180.65	9.03	903.24	1.02E+11	1.02E+11
2/3/22	38.39	171	46.721	206.91	10.35	1034.55	1.17E+11	1.17E+11
8/6/22	34.06	172	46.995	183.57	9.18	917.86	1.04E+11	1.04E+11
7/12/22	38.41	173	47.268	207.01	10.35	1035.04	1.17E+11	1.17E+11
2/4/22	33.95	174	47.541	183.02	9.15	915.08	1.04E+11	1.04E+11
2/5/22	36.61	175	47.814	197.34	9.87	986.72	1.12E+11	1.12E+11
1/4/23	31.75	176	48.087	171.16	8.56	855.78	9.71E+10	9.71E+10
1/13/23	32.09	177	48.361	172.97	8.65	864.86	9.81E+10	9.81E+10
2/11/22	31.62	178	48.634	170.43	8.52	852.13	9.67E+10	9.67E+10
1/19/23	31.27	179	48.907	168.55	8.43	842.76	9.56E+10	9.56E+10
1/14/23	31.51	180	49.180	169.83	8.49	849.13	9.64E+10	9.64E+10
2/9/22	34.48	181	49.454	185.84	9.29	929.22	1.05E+11	1.05E+11
8/7/22	32.27	182	49.727	173.95	8.70	869.76	9.87E+10	9.87E+10

1/15/23	30.34	183	50.000	163.54	8.18	817.68	9.28E+10	9.28E+10
8/8/22	30.91	184	50.273	166.63	8.33	833.14	9.45E+10	9.45E+10
2/2/22	36.15	185	50.546	194.87	9.74	974.34	1.11E+11	1.11E+11
7/13/22	35.32	186	50.820	190.37	9.52	951.85	1.08E+11	1.08E+11
2/10/22	34.96	187	51.093	188.45	9.42	942.25	1.07E+11	1.07E+11
8/9/22	30.23	188	51.366	162.93	8.15	814.67	9.24E+10	9.24E+10
6/21/22	35.87	189	51.639	193.36	9.67	966.82	1.10E+11	1.10E+11
1/16/23	29.76	190	51.913	160.39	8.02	801.96	9.10E+10	9.10E+10
1/3/23	27.41	191	52.186	147.74	7.39	738.71	8.38E+10	8.38E+10
1/17/23	28.30	192	52.459	152.53	7.63	762.65	8.65E+10	8.65E+10
7/14/22	32.84	193	52.732	177.02	8.85	885.08	1.00E+11	1.00E+11
1/18/23	27.31	194	53.005	147.22	7.36	736.08	8.35E+10	8.35E+10
7/22/22	27.58	195	53.279	148.63	7.43	743.16	8.43E+10	8.43E+10
8/10/22	28.90	196	53.552	155.76	7.79	778.80	8.84E+10	8.84E+10
8/22/22	27.64	197	53.825	148.97	7.45	744.85	8.45E+10	8.45E+10
12/2/22	20.07	198	54.098	108.17	5.41	540.84	6.14E+10	6.14E+10
12/1/22	23.66	199	54.372	127.53	6.38	637.64	7.24E+10	7.24E+10
7/15/22	29.41	200	54.645	158.54	7.93	792.68	9.00E+10	9.00E+10
7/6/22	30.50	201	54.918	164.38	8.22	821.92	9.33E+10	9.33E+10
12/4/22	23.91	202	55.191	128.90	6.44	644.49	7.31E+10	7.31E+10
1/2/23	26.20	203	55.464	141.23	7.06	706.14	8.01E+10	8.01E+10
12/3/22	24.52	204	55.738	132.18	6.61	660.89	7.50E+10	7.50E+10
11/30/22	23.59	205	56.011	127.15	6.36	635.75	7.21E+10	7.21E+10
6/22/22	31.44	206	56.284	169.48	8.47	847.39	9.62E+10	9.62E+10
7/16/22	27.78	207	56.557	149.75	7.49	748.74	8.50E+10	8.50E+10
8/21/22	26.25	208	56.831	141.48	7.07	707.42	8.03E+10	8.03E+10
12/5/22	23.45	209	57.104	126.37	6.32	631.87	7.17E+10	7.17E+10
11/29/22	18.99	210	57.377	102.37	5.12	511.83	5.81E+10	5.81E+10
8/11/22	26.32	211	57.650	141.84	7.09	709.19	8.05E+10	8.05E+10
1/1/23	23.64	212	57.923	127.40	6.37	636.99	7.23E+10	7.23E+10
12/6/22	24.24	213	58.197	130.68	6.53	653.40	7.41E+10	7.41E+10
8/23/22	24.43	214	58.470	131.66	6.58	658.29	7.47E+10	7.47E+10
7/17/22	27.49	215	58.743	148.15	7.41	740.74	8.41E+10	8.41E+10
1/11/23	31.65	216	59.016	170.61	8.53	853.06	9.68E+10	9.68E+10
12/7/22	22.71	217	59.290	122.42	6.12	612.11	6.95E+10	6.95E+10
7/18/22	26.81	218	59.563	144.51	7.23	722.55	8.20E+10	8.20E+10
12/8/22	22.19	219	59.836	119.59	5.98	597.95	6.79E+10	6.79E+10
8/31/22	21.84	220	60.109	117.71	5.89	588.57	6.68E+10	6.68E+10
12/9/22	18.77	221	60.383	101.15	5.06	505.76	5.74E+10	5.74E+10
8/30/22	22.30	222	60.656	120.19	6.01	600.93	6.82E+10	6.82E+10
12/10/22	19.82	223	60.929	106.86	5.34	534.28	6.06E+10	6.06E+10
12/31/22	21.71	224	61.202	117.02	5.85	585.12	6.64E+10	6.64E+10
2/1/22	24.44	225	61.475	131.73	6.59	658.63	7.47E+10	7.47E+10
8/12/22	22.66	226	61.749	122.16	6.11	610.78	6.93E+10	6.93E+10
7/19/22	23.56	227	62.022	126.97	6.35	634.86	7.20E+10	7.20E+10
8/24/22	20.68	228	62.295	111.45	5.57	557.26	6.32E+10	6.32E+10
11/28/22	17.45	229	62.568	94.04	4.70	470.18	5.34E+10	5.34E+10
12/11/22	20.17	230	62.842	108.69	5.43	543.47	6.17E+10	6.17E+10
6/23/22	26.75	231	63.115	144.17	7.21	720.84	8.18E+10	8.18E+10
8/15/22	20.67	232	63.388	111.43	5.57	557.16	6.32E+10	6.32E+10
9/1/22	19.10	233	63.661	102.97	5.15	514.85	5.84E+10	5.84E+10
12/12/22	20.62	234	63.934	111.13	5.56	555.67	6.31E+10	6.31E+10
8/14/22	20.97	235	64.208	113.05	5.65	565.24	6.41E+10	6.41E+10
12/16/22	17.59	236	64.481	94.80	4.74	473.98	5.38E+10	5.38E+10
12/13/22	17.42	237	64.754	93.91	4.70	469.57	5.33E+10	5.33E+10
12/15/22	16.43	238	65.027	88.53	4.43	442.66	5.02E+10	5.02E+10
12/17/22	18.32	239	65.301	98.75	4.94	493.75	5.60E+10	5.60E+10
8/13/22	20.33	240	65.574	109.60	5.48	547.99	6.22E+10	6.22E+10
7/20/22	20.95	241	65.847	112.91	5.65	564.56	6.41E+10	6.41E+10
8/16/22	19.39	242	66.120	104.53	5.23	522.63	5.93E+10	5.93E+10
12/14/22	18.14	243	66.393	97.77	4.89	488.86	5.55E+10	5.55E+10

12/24/22	11.94	244	66.667	64.34	3.22	321.72	3.65E+10	3.65E+10
8/25/22	19.13	245	66.940	103.09	5.15	515.43	5.85E+10	5.85E+10
9/2/22	18.14	246	67.213	97.80	4.89	489.00	5.55E+10	5.55E+10
12/18/22	18.15	247	67.486	97.82	4.89	489.09	5.55E+10	5.55E+10
12/23/22	11.81	248	67.760	63.66	3.18	318.29	3.61E+10	3.61E+10
12/20/22	18.28	249	68.033	98.51	4.93	492.53	5.59E+10	5.59E+10
10/23/22	17.02	250	68.306	91.75	4.59	458.76	5.21E+10	5.21E+10
12/19/22	18.08	251	68.579	97.46	4.87	487.29	5.53E+10	5.53E+10
12/27/22	9.61	252	68.852	51.77	2.59	258.86	2.94E+10	2.94E+10
12/26/22	12.22	253	69.126	65.85	3.29	329.26	3.74E+10	3.74E+10
12/30/22	15.88	254	69.399	85.57	4.28	427.87	4.86E+10	4.86E+10
7/21/22	19.67	255	69.672	106.02	5.30	530.08	6.02E+10	6.02E+10
8/17/22	17.83	256	69.945	96.11	4.81	480.53	5.45E+10	5.45E+10
6/24/22	22.81	257	70.219	122.95	6.15	614.75	6.98E+10	6.98E+10
12/21/22	18.28	258	70.492	98.54	4.93	492.71	5.59E+10	5.59E+10
12/28/22	8.76	259	70.765	47.20	2.36	236.02	2.68E+10	2.68E+10
12/25/22	10.37	260	71.038	55.90	2.80	279.51	3.17E+10	3.17E+10
9/3/22	17.26	261	71.311	93.05	4.65	465.26	5.28E+10	5.28E+10
8/26/22	17.04	262	71.585	91.84	4.59	459.20	5.21E+10	5.21E+10
12/22/22	17.74	263	71.858	95.60	4.78	477.99	5.42E+10	5.42E+10
8/29/22	15.54	264	72.131	83.76	4.19	418.79	4.75E+10	4.75E+10
8/27/22	17.29	265	72.404	93.18	4.66	465.92	5.29E+10	5.29E+10
9/4/22	16.51	266	72.678	88.98	4.45	444.88	5.05E+10	5.05E+10
8/18/22	17.07	267	72.951	92.00	4.60	460.02	5.22E+10	5.22E+10
12/29/22	9.88	268	73.224	53.25	2.66	266.24	3.02E+10	3.02E+10
10/24/22	14.46	269	73.497	77.94	3.90	389.68	4.42E+10	4.42E+10
8/19/22	16.38	270	73.770	88.31	4.42	441.53	5.01E+10	5.01E+10
8/28/22	16.23	271	74.044	87.48	4.37	437.41	4.96E+10	4.96E+10
8/20/22	15.55	272	74.317	83.79	4.19	418.96	4.75E+10	4.75E+10
9/5/22	16.01	273	74.590	86.30	4.32	431.51	4.90E+10	4.90E+10
6/25/22	20.57	274	74.863	110.86	5.54	554.29	6.29E+10	6.29E+10
9/6/22	15.26	275	75.137	82.24	4.11	411.22	4.67E+10	4.67E+10
10/25/22	12.41	276	75.410	66.91	3.35	334.54	3.80E+10	3.80E+10
10/26/22	13.42	277	75.683	72.32	3.62	361.61	4.10E+10	4.10E+10
10/27/22	13.27	278	75.956	71.54	3.58	357.72	4.06E+10	4.06E+10
11/27/22	12.00	279	76.230	64.67	3.23	323.36	3.67E+10	3.67E+10
10/28/22	13.33	280	76.503	71.82	3.59	359.12	4.08E+10	4.08E+10
9/7/22	15.34	281	76.776	82.66	4.13	413.30	4.69E+10	4.69E+10
9/27/22	15.84	282	77.049	85.36	4.27	426.82	4.84E+10	4.84E+10
10/29/22	12.62	283	77.322	68.02	3.40	340.08	3.86E+10	3.86E+10
6/26/22	18.68	284	77.596	100.68	5.03	503.38	5.71E+10	5.71E+10
9/28/22	15.06	285	77.869	81.15	4.06	405.76	4.60E+10	4.60E+10
10/30/22	12.45	286	78.142	67.08	3.35	335.41	3.81E+10	3.81E+10
11/1/22	11.75	287	78.415	63.34	3.17	316.68	3.59E+10	3.59E+10
10/31/22	11.85	288	78.689	63.87	3.19	319.35	3.62E+10	3.62E+10
11/2/22	12.37	289	78.962	66.69	3.33	333.45	3.78E+10	3.78E+10
11/4/22	11.75	290	79.235	63.32	3.17	316.58	3.59E+10	3.59E+10
11/3/22	12.43	291	79.508	67.02	3.35	335.09	3.80E+10	3.80E+10
9/26/22	15.05	292	79.781	81.14	4.06	405.69	4.60E+10	4.60E+10
9/8/22	14.29	293	80.055	77.05	3.85	385.24	4.37E+10	4.37E+10
11/5/22	11.09	294	80.328	59.76	2.99	298.79	3.39E+10	3.39E+10
10/19/22	11.61	295	80.601	62.60	3.13	312.99	3.55E+10	3.55E+10
9/29/22	14.24	296	80.874	76.75	3.84	383.75	4.35E+10	4.35E+10
10/22/22	12.01	297	81.148	64.74	3.24	323.70	3.67E+10	3.67E+10
11/7/22	11.62	298	81.421	62.63	3.13	313.17	3.55E+10	3.55E+10
11/6/22	11.50	299	81.694	62.01	3.10	310.04	3.52E+10	3.52E+10
11/8/22	12.56	300	81.967	67.71	3.39	338.53	3.84E+10	3.84E+10
10/20/22	11.55	301	82.240	62.27	3.11	311.37	3.53E+10	3.53E+10
11/9/22	11.50	302	82.514	61.99	3.10	309.94	3.52E+10	3.52E+10
9/9/22	12.92	303	82.787	69.63	3.48	348.17	3.95E+10	3.95E+10
9/30/22	14.11	304	83.060	76.05	3.80	380.27	4.32E+10	4.32E+10

11/10/22	10.46	305	83.333	56.39	2.82	281.96	3.20E+10	3.20E+10
9/12/22	14.36	306	83.607	77.42	3.87	387.08	4.39E+10	4.39E+10
11/11/22	11.72	307	83.880	63.18	3.16	315.89	3.58E+10	3.58E+10
10/18/22	10.39	308	84.153	55.99	2.80	279.97	3.18E+10	3.18E+10
6/27/22	16.17	309	84.426	87.13	4.36	435.66	4.94E+10	4.94E+10
10/21/22	11.00	310	84.699	59.30	2.97	296.52	3.36E+10	3.36E+10
9/11/22	10.79	311	84.973	58.15	2.91	290.75	3.30E+10	3.30E+10
11/12/22	10.44	312	85.246	56.26	2.81	281.32	3.19E+10	3.19E+10
11/13/22	10.69	313	85.519	57.61	2.88	288.05	3.27E+10	3.27E+10
9/13/22	13.57	314	85.792	73.14	3.66	365.71	4.15E+10	4.15E+10
11/14/22	11.43	315	86.066	61.59	3.08	307.94	3.49E+10	3.49E+10
9/10/22	11.41	316	86.339	61.51	3.08	307.56	3.49E+10	3.49E+10
10/1/22	13.59	317	86.612	73.23	3.66	366.15	4.16E+10	4.16E+10
11/15/22	11.06	318	86.885	59.63	2.98	298.17	3.38E+10	3.38E+10
9/14/22	12.55	319	87.158	67.65	3.38	338.27	3.84E+10	3.84E+10
11/16/22	9.70	320	87.432	52.28	2.61	261.39	2.97E+10	2.97E+10
11/17/22	9.68	321	87.705	52.18	2.61	260.91	2.96E+10	2.96E+10
9/15/22	12.11	322	87.978	65.26	3.26	326.32	3.70E+10	3.70E+10
11/26/22	9.90	323	88.251	53.37	2.67	266.87	3.03E+10	3.03E+10
9/25/22	11.17	324	88.525	60.18	3.01	300.91	3.41E+10	3.41E+10
9/21/22	12.37	325	88.798	66.69	3.33	333.43	3.78E+10	3.78E+10
11/18/22	9.56	326	89.071	51.51	2.58	257.55	2.92E+10	2.92E+10
11/25/22	10.04	327	89.344	54.11	2.71	270.53	3.07E+10	3.07E+10
11/19/22	9.32	328	89.617	50.23	2.51	251.15	2.85E+10	2.85E+10
9/22/22	12.89	329	89.891	69.49	3.47	347.47	3.94E+10	3.94E+10
9/16/22	11.57	330	90.164	62.39	3.12	311.95	3.54E+10	3.54E+10
11/24/22	9.19	331	90.437	49.55	2.48	247.77	2.81E+10	2.81E+10
10/2/22	12.82	332	90.710	69.10	3.45	345.49	3.92E+10	3.92E+10
11/22/22	9.44	333	90.984	50.89	2.54	254.44	2.89E+10	2.89E+10
11/21/22	8.60	334	91.257	46.37	2.32	231.86	2.63E+10	2.63E+10
11/23/22	9.08	335	91.530	48.93	2.45	244.64	2.78E+10	2.78E+10
9/20/22	11.36	336	91.803	61.21	3.06	306.06	3.47E+10	3.47E+10
6/28/22	13.22	337	92.077	71.26	3.56	356.28	4.04E+10	4.04E+10
11/20/22	9.10	338	92.350	49.06	2.45	245.32	2.78E+10	2.78E+10
9/17/22	10.60	339	92.623	57.13	2.86	285.63	3.24E+10	3.24E+10
9/23/22	11.80	340	92.896	63.61	3.18	318.07	3.61E+10	3.61E+10
9/19/22	11.68	341	93.169	62.95	3.15	314.77	3.57E+10	3.57E+10
9/18/22	11.12	342	93.443	59.94	3.00	299.71	3.40E+10	3.40E+10
10/3/22	11.77	343	93.716	63.42	3.17	317.09	3.60E+10	3.60E+10
9/24/22	10.51	344	93.989	56.65	2.83	283.24	3.21E+10	3.21E+10
7/5/22	11.73	345	94.262	63.20	3.16	316.00	3.59E+10	3.59E+10
10/4/22	10.67	346	94.536	57.53	2.88	287.67	3.26E+10	3.26E+10
6/29/22	11.81	347	94.809	63.68	3.18	318.38	3.61E+10	3.61E+10
10/5/22	11.00	348	95.082	59.30	2.96	296.48	3.36E+10	3.36E+10
10/17/22	6.71	349	95.355	36.19	1.81	180.96	2.05E+10	2.05E+10
10/6/22	8.99	350	95.628	48.45	2.42	242.25	2.75E+10	2.75E+10
6/30/22	10.48	351	95.902	56.46	2.82	282.32	3.20E+10	3.20E+10
10/7/22	10.23	352	96.175	55.15	2.76	275.75	3.13E+10	3.13E+10
7/1/22	10.36	353	96.448	55.83	2.79	279.16	3.17E+10	3.17E+10
7/2/22	10.53	354	96.721	56.73	2.84	283.65	3.22E+10	3.22E+10
10/8/22	8.64	355	96.995	46.55	2.33	232.73	2.64E+10	2.64E+10
10/16/22	5.64	356	97.268	30.42	1.52	152.11	1.73E+10	1.73E+10
10/9/22	6.58	357	97.541	35.49	1.77	177.45	2.01E+10	2.01E+10
7/3/22	9.15	358	97.814	49.31	2.47	246.54	2.80E+10	2.80E+10
10/13/22	8.53	359	98.087	46.00	2.30	229.99	2.61E+10	2.61E+10
10/10/22	6.30	360	98.361	33.97	1.70	169.87	1.93E+10	1.93E+10
10/15/22	5.27	361	98.634	28.39	1.42	141.96	1.61E+10	1.61E+10
10/14/22	5.41	362	98.907	29.16	1.46	145.79	1.65E+10	1.65E+10
10/11/22	6.06	363	99.180	32.68	1.63	163.41	1.85E+10	1.85E+10
10/12/22	5.92	364	99.454	31.92	1.60	159.59	1.81E+10	1.81E+10
7/4/22	9.05	365	99.727	48.78	2.44	243.88	2.77E+10	2.77E+10

TOTAL NUMBI	365					
	365					
		1.00	0.05	5.00	125.00	125.00
		5.39	5.39	5.39	24465758.40	24465758.40

Site 2 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	8.17	6.11	0.692	6.4	2419.6	0.819672131	269.0972028	30.47713	281.8694105	4.84E+11	21	5651.04126	640.0197302	5919.257621	1.02E+13
3/15/22	1.61	3.40	0.05	3.6	11	19.67213115	29.5766061	0.43495009	31.31640645	4.34E+08	35	1035.181213	15.22325314	1096.074226	1.52E+10
4/19/22	1.90	2.20	0.054	4	1300	16.12021858	22.51001848	0.55251864	40.92730632	6.04E+10	35	787.8506466	19.33815224	1432.455721	2.11E+12
5/24/22	0.71	4.83	0.196	32	33.0	34.15300546	18.48037805	0.74992838	122.4372873	5.73E+08	28	517.4505853	20.99799477	3428.244043	1.60E+10
6/21/22	0.58	5.56	1.5	292	1990.0	51.63934426	17.24719119	4.6530192	905.7877385	2.80E+10	28	482.9213532	130.2845377	25362.05668	7.85E+11
7/19/22	0.75	3.64	1.5	196	2420.0	62.02185792	14.70412381	6.05939168	791.7605128	4.44E+10	35	514.6443333	212.0787088	27711.61795	1.55E+12
8/23/22	0.25	3.32	0.772	206	248.0	58.46994536	4.409759027	1.0254018	273.6175782	1.50E+09	28	123.4732527	28.71125034	7661.292189	4.19E+10
9/20/22	0.21	2.53	1.610	83.6	866.0	91.80327869	2.832580403	1.80249417	93.59534945	4.40E+09	36	101.9728945	64.88979012	3369.43258	1.58E+11
10/26/22	0.38	1.85	0.532	100.0	727.0	75.68306011	3.797088402	1.0907403	205.0263716	6.77E+09	13	49.36214923	14.17962386	2665.342831	8.80E+10
11/8/22	0.28	1.94	0.933	100.8	6.0	81.96721311	2.881844914	1.38595944	149.7370966	4.05E+07	35	100.864572	48.50858024	5240.798379	1.42E+09
12/13/22	0.36	4.40	0.163	65.2	133.0	64.75409836	8.505130088	0.31507641	126.030564	1.17E+09	36	306.1846832	11.34275076	4537.100305	4.20E+10
1/18/23	0.70	1.80	0.144	78.0	91.0	53.00546448	6.765919403	0.54127355	293.1898408	1.55E+09	37	250.3390179	20.02712143	10848.02411	5.74E+10
2/24/23															

Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	9,921.3	1,225.6	99,271.7	1.50E+13
											TARGET	81,168.4	4,058.4	405,841.9	4.61E+13

Site 3 Date	E3	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	103.86	1	0.273	559.78	27.99	2798.92	3.18E+11	3.18E+11
2/24/22	104.87	2	0.546	565.26	28.26	2826.29	3.21E+11	3.21E+11
2/22/22	99.03	3	0.820	533.75	26.69	2668.73	3.03E+11	3.03E+11
2/25/22	102.08	4	1.093	550.22	27.51	2751.10	3.12E+11	3.12E+11
2/26/22	97.92	5	1.366	527.79	26.39	2638.96	2.99E+11	2.99E+11
2/21/22	95.89	6	1.639	516.82	25.84	2584.11	2.93E+11	2.93E+11
2/27/22	96.10	7	1.913	517.98	25.90	2589.88	2.94E+11	2.94E+11
2/20/22	85.69	8	2.186	461.86	23.09	2309.31	2.62E+11	2.62E+11
2/19/22	91.98	9	2.459	495.78	24.79	2478.92	2.81E+11	2.81E+11
2/28/22	92.06	10	2.732	496.19	24.81	2480.97	2.82E+11	2.82E+11
3/1/22	91.36	11	3.005	492.45	24.62	2462.26	2.79E+11	2.79E+11
3/2/22	88.41	12	3.279	476.53	23.83	2382.64	2.70E+11	2.70E+11
3/3/22	88.62	13	3.552	477.68	23.88	2388.41	2.71E+11	2.71E+11
3/4/22	87.75	14	3.825	472.99	23.65	2364.95	2.68E+11	2.68E+11
3/26/22	80.38	15	4.098	433.26	21.66	2166.30	2.46E+11	2.46E+11
3/27/22	80.69	16	4.372	434.91	21.75	2174.57	2.47E+11	2.47E+11
3/28/22	81.16	17	4.645	437.43	21.87	2187.13	2.48E+11	2.48E+11
3/25/22	78.16	18	4.918	421.30	21.06	2106.49	2.39E+11	2.39E+11
3/5/22	80.23	19	5.191	432.47	21.62	2162.33	2.45E+11	2.45E+11
2/18/22	76.04	20	5.464	409.84	20.49	2049.19	2.33E+11	2.33E+11
3/29/22	80.46	21	5.738	433.66	21.68	2168.29	2.46E+11	2.46E+11
3/24/22	75.06	22	6.011	404.56	20.23	2022.78	2.30E+11	2.30E+11
3/30/22	73.88	23	6.284	398.19	19.91	1990.95	2.26E+11	2.26E+11
3/7/22	78.20	24	6.557	421.50	21.07	2107.48	2.39E+11	2.39E+11
3/6/22	77.22	25	6.831	416.21	20.81	2081.05	2.36E+11	2.36E+11
3/8/22	79.71	26	7.104	429.64	21.48	2148.22	2.44E+11	2.44E+11
3/31/22	70.38	27	7.377	379.33	18.97	1896.63	2.15E+11	2.15E+11
3/9/22	78.13	28	7.650	421.12	21.06	2105.60	2.39E+11	2.39E+11
4/1/22	71.65	29	7.923	386.17	19.31	1930.85	2.19E+11	2.19E+11
4/2/22	72.27	30	8.197	389.56	19.48	1947.78	2.21E+11	2.21E+11
3/10/22	77.41	31	8.470	417.22	20.86	2086.11	2.37E+11	2.37E+11
3/23/22	68.03	32	8.743	366.69	18.33	1833.47	2.08E+11	2.08E+11
4/3/22	70.93	33	9.016	382.29	19.11	1911.43	2.17E+11	2.17E+11
5/8/22	68.25	34	9.290	367.85	18.39	1839.26	2.09E+11	2.09E+11
3/11/22	69.54	35	9.563	374.84	18.74	1874.18	2.13E+11	2.13E+11
5/9/22	66.69	36	9.836	359.47	17.97	1797.33	2.04E+11	2.04E+11
5/7/22	68.53	37	10.109	369.39	18.47	1846.95	2.10E+11	2.10E+11
4/4/22	67.25	38	10.383	362.49	18.12	1812.45	2.06E+11	2.06E+11
5/10/22	66.32	39	10.656	357.47	17.87	1787.33	2.03E+11	2.03E+11
4/5/22	70.19	40	10.929	378.31	18.92	1891.56	2.15E+11	2.15E+11
4/7/22	66.99	41	11.202	361.06	18.05	1805.28	2.05E+11	2.05E+11
5/11/22	67.67	42	11.475	364.75	18.24	1823.74	2.07E+11	2.07E+11
4/6/22	66.16	43	11.749	356.60	17.83	1782.98	2.02E+11	2.02E+11
4/8/22	62.16	44	12.022	335.03	16.75	1675.14	1.90E+11	1.90E+11
3/12/22	68.11	45	12.295	367.13	18.36	1835.67	2.08E+11	2.08E+11
4/15/22	65.22	46	12.568	351.54	17.58	1757.72	1.99E+11	1.99E+11
4/16/22	64.69	47	12.842	348.68	17.43	1743.38	1.98E+11	1.98E+11
4/9/22	65.98	48	13.115	355.63	17.78	1778.17	2.02E+11	2.02E+11
5/12/22	63.83	49	13.388	344.03	17.20	1720.16	1.95E+11	1.95E+11
3/22/22	64.19	50	13.661	346.00	17.30	1730.00	1.96E+11	1.96E+11
4/17/22	66.15	51	13.934	356.53	17.83	1782.66	2.02E+11	2.02E+11
4/14/22	61.53	52	14.208	331.63	16.58	1658.17	1.88E+11	1.88E+11
3/21/22	65.40	53	14.481	352.53	17.63	1762.66	2.00E+11	2.00E+11
5/6/22	59.97	54	14.754	323.21	16.16	1616.06	1.83E+11	1.83E+11
4/10/22	64.38	55	15.027	347.02	17.35	1735.09	1.97E+11	1.97E+11
3/13/22	63.79	56	15.301	343.83	17.19	1719.13	1.95E+11	1.95E+11
4/18/22	60.80	57	15.574	327.74	16.39	1638.68	1.86E+11	1.86E+11
5/13/22	60.72	58	15.847	327.29	16.36	1636.44	1.86E+11	1.86E+11
4/19/22	62.36	59	16.120	336.13	16.81	1680.67	1.91E+11	1.91E+11
3/20/22	61.11	60	16.393	329.36	16.47	1646.80	1.87E+11	1.87E+11

4/20/22	59.84	61	16.667	322.54	16.13	1612.68	1.83E+11	1.83E+11
4/11/22	63.62	62	16.940	342.90	17.15	1714.52	1.95E+11	1.95E+11
5/14/22	58.75	63	17.213	316.65	15.83	1583.24	1.80E+11	1.80E+11
3/14/22	63.45	64	17.486	342.01	17.10	1710.03	1.94E+11	1.94E+11
4/13/22	53.79	65	17.760	289.91	14.50	1449.54	1.64E+11	1.64E+11
4/21/22	56.76	66	18.033	305.96	15.30	1529.80	1.74E+11	1.74E+11
4/12/22	60.60	67	18.306	326.63	16.33	1633.17	1.85E+11	1.85E+11
2/17/22	54.19	68	18.579	292.10	14.60	1460.50	1.66E+11	1.66E+11
4/22/22	60.44	69	18.852	325.75	16.29	1628.75	1.85E+11	1.85E+11
5/15/22	57.22	70	19.126	308.44	15.42	1542.21	1.75E+11	1.75E+11
5/5/22	57.57	71	19.399	310.31	15.52	1551.57	1.76E+11	1.76E+11
3/15/22	61.28	72	19.672	330.28	16.51	1651.38	1.87E+11	1.87E+11
4/23/22	55.09	73	19.945	296.94	14.85	1484.71	1.68E+11	1.68E+11
4/25/22	57.57	74	20.219	310.29	15.51	1551.44	1.76E+11	1.76E+11
4/24/22	52.54	75	20.492	283.21	14.16	1416.06	1.61E+11	1.61E+11
5/4/22	56.89	76	20.765	306.65	15.33	1533.24	1.74E+11	1.74E+11
4/26/22	56.16	77	21.038	302.70	15.13	1513.49	1.72E+11	1.72E+11
3/16/22	58.05	78	21.311	312.90	15.65	1564.52	1.78E+11	1.78E+11
5/16/22	54.51	79	21.585	293.83	14.69	1469.14	1.67E+11	1.67E+11
3/19/22	53.72	80	21.858	289.56	14.48	1447.79	1.64E+11	1.64E+11
4/27/22	55.91	81	22.131	301.38	15.07	1506.89	1.71E+11	1.71E+11
3/17/22	56.91	82	22.404	306.72	15.34	1533.62	1.74E+11	1.74E+11
4/28/22	52.50	83	22.678	282.96	14.15	1414.78	1.61E+11	1.61E+11
5/17/22	51.21	84	22.951	276.01	13.80	1380.04	1.57E+11	1.57E+11
3/18/22	51.21	85	23.224	276.02	13.80	1380.12	1.57E+11	1.57E+11
5/3/22	50.96	86	23.497	274.67	13.73	1373.37	1.56E+11	1.56E+11
4/29/22	50.50	87	23.770	272.21	13.61	1361.06	1.54E+11	1.54E+11
5/18/22	48.67	88	24.044	262.32	13.12	1311.58	1.49E+11	1.49E+11
5/1/22	48.60	89	24.317	261.93	13.10	1309.64	1.49E+11	1.49E+11
6/11/22	49.88	90	24.590	268.84	13.44	1344.20	1.53E+11	1.53E+11
6/12/22	49.42	91	24.863	266.37	13.32	1331.83	1.51E+11	1.51E+11
4/30/22	47.24	92	25.137	254.62	12.73	1273.11	1.44E+11	1.44E+11
5/2/22	49.91	93	25.410	269.02	13.45	1345.10	1.53E+11	1.53E+11
6/10/22	49.13	94	25.683	264.79	13.24	1323.95	1.50E+11	1.50E+11
5/19/22	47.20	95	25.956	254.40	12.72	1272.02	1.44E+11	1.44E+11
6/13/22	48.95	96	26.230	263.84	13.19	1319.20	1.50E+11	1.50E+11
6/9/22	48.33	97	26.503	260.51	13.03	1302.54	1.48E+11	1.48E+11
6/14/22	48.74	98	26.776	262.73	13.14	1313.63	1.49E+11	1.49E+11
5/20/22	45.43	99	27.049	244.85	12.24	1224.27	1.39E+11	1.39E+11
6/15/22	47.24	100	27.322	254.65	12.73	1273.24	1.44E+11	1.44E+11
6/8/22	44.47	101	27.596	239.71	11.99	1198.57	1.36E+11	1.36E+11
6/2/22	45.11	102	27.869	243.16	12.16	1215.81	1.38E+11	1.38E+11
5/21/22	44.18	103	28.142	238.14	11.91	1190.68	1.35E+11	1.35E+11
6/1/22	43.80	104	28.415	236.08	11.80	1180.38	1.34E+11	1.34E+11
5/30/22	44.58	105	28.689	240.26	12.01	1201.32	1.36E+11	1.36E+11
7/28/22	41.37	106	28.962	222.98	11.15	1114.91	1.27E+11	1.27E+11
6/3/22	43.94	107	29.235	236.83	11.84	1184.14	1.34E+11	1.34E+11
7/27/22	41.32	108	29.508	222.71	11.14	1113.57	1.26E+11	1.26E+11
5/31/22	44.64	109	29.781	240.62	12.03	1203.12	1.37E+11	1.37E+11
7/29/22	41.23	110	30.055	222.24	11.11	1111.19	1.26E+11	1.26E+11
5/29/22	43.15	111	30.328	232.57	11.63	1162.86	1.32E+11	1.32E+11
7/26/22	39.71	112	30.601	214.04	10.70	1070.18	1.21E+11	1.21E+11
5/22/22	42.49	113	30.874	229.03	11.45	1145.17	1.30E+11	1.30E+11
6/7/22	43.09	114	31.148	232.25	11.61	1161.26	1.32E+11	1.32E+11
6/16/22	44.43	115	31.421	239.47	11.97	1197.35	1.36E+11	1.36E+11
6/4/22	42.38	116	31.694	228.43	11.42	1142.16	1.30E+11	1.30E+11
7/30/22	39.42	117	31.967	212.47	10.62	1062.35	1.21E+11	1.21E+11
7/25/22	38.77	118	32.240	209.00	10.45	1044.98	1.19E+11	1.19E+11
5/23/22	39.97	119	32.514	215.43	10.77	1077.16	1.22E+11	1.22E+11
6/5/22	40.29	120	32.787	217.16	10.86	1085.81	1.23E+11	1.23E+11
7/31/22	37.66	121	33.060	202.97	10.15	1014.85	1.15E+11	1.15E+11

6/17/22	40.97	122	33.333	220.84	11.04	1104.18	1.25E+11	1.25E+11
6/6/22	38.28	123	33.607	206.35	10.32	1031.75	1.17E+11	1.17E+11
5/28/22	39.56	124	33.880	213.25	10.66	1066.26	1.21E+11	1.21E+11
5/24/22	37.63	125	34.153	202.80	10.14	1014.02	1.15E+11	1.15E+11
7/24/22	36.13	126	34.426	194.71	9.74	973.57	1.10E+11	1.10E+11
8/1/22	35.79	127	34.699	192.89	9.64	964.46	1.09E+11	1.09E+11
2/16/22	31.60	128	34.973	170.33	8.52	851.67	9.66E+10	9.66E+10
5/27/22	38.56	129	35.246	207.82	10.39	1039.08	1.18E+11	1.18E+11
5/25/22	37.14	130	35.519	200.21	10.01	1001.03	1.14E+11	1.14E+11
5/26/22	38.19	131	35.792	205.87	10.29	1029.34	1.17E+11	1.17E+11
6/18/22	38.08	132	36.066	205.28	10.26	1026.39	1.16E+11	1.16E+11
8/2/22	33.65	133	36.339	181.38	9.07	906.90	1.03E+11	1.03E+11
2/13/22	34.87	134	36.612	187.96	9.40	939.79	1.07E+11	1.07E+11
2/14/22	34.61	135	36.885	186.52	9.33	932.61	1.06E+11	1.06E+11
2/15/22	33.98	136	37.158	183.16	9.16	915.81	1.04E+11	1.04E+11
8/3/22	31.40	137	37.432	169.24	8.46	846.18	9.60E+10	9.60E+10
7/8/22	34.16	138	37.705	184.10	9.21	920.52	1.04E+11	1.04E+11
7/9/22	34.07	139	37.978	183.62	9.18	918.12	1.04E+11	1.04E+11
6/19/22	34.07	140	38.251	183.62	9.18	918.09	1.04E+11	1.04E+11
2/12/22	33.39	141	38.525	180.00	9.00	899.98	1.02E+11	1.02E+11
8/4/22	30.66	142	38.798	165.25	8.26	826.26	9.38E+10	9.38E+10
1/25/23	28.08	143	39.071	151.33	7.57	756.65	8.59E+10	8.59E+10
1/23/23	27.27	144	39.344	147.01	7.35	735.05	8.34E+10	8.34E+10
1/22/23	27.96	145	39.617	150.69	7.53	753.45	8.55E+10	8.55E+10
1/26/23	27.41	146	39.891	147.75	7.39	738.77	8.38E+10	8.38E+10
7/10/22	33.46	147	40.164	180.33	9.02	901.65	1.02E+11	1.02E+11
7/23/22	29.50	148	40.437	159.02	7.95	795.12	9.02E+10	9.02E+10
1/24/23	26.41	149	40.710	142.37	7.12	711.87	8.08E+10	8.08E+10
1/27/23	25.37	150	40.984	136.72	6.84	683.62	7.76E+10	7.76E+10
7/7/22	33.05	151	41.257	178.12	8.91	890.58	1.01E+11	1.01E+11
1/8/23	27.82	152	41.530	149.97	7.50	749.86	8.51E+10	8.51E+10
1/28/23	27.45	153	41.803	147.95	7.40	739.73	8.39E+10	8.39E+10
1/21/23	26.27	154	42.077	141.61	7.08	708.06	8.03E+10	8.03E+10
1/7/23	27.42	155	42.350	147.79	7.39	738.96	8.39E+10	8.39E+10
1/29/23	26.48	156	42.623	142.72	7.14	713.61	8.10E+10	8.10E+10
1/6/23	26.76	157	42.896	144.25	7.21	721.27	8.18E+10	8.18E+10
8/5/22	27.74	158	43.169	149.53	7.48	747.64	8.48E+10	8.48E+10
1/9/23	27.06	159	43.443	145.87	7.29	729.34	8.28E+10	8.28E+10
7/11/22	32.16	160	43.716	173.37	8.67	866.84	9.84E+10	9.84E+10
1/30/23	26.92	161	43.989	145.11	7.26	725.56	8.23E+10	8.23E+10
1/10/23	26.99	162	44.262	145.48	7.27	727.41	8.25E+10	8.25E+10
1/5/23	26.10	163	44.536	140.65	7.03	703.26	7.98E+10	7.98E+10
2/7/22	29.57	164	44.809	159.36	7.97	796.78	9.04E+10	9.04E+10
1/20/23	25.67	165	45.082	138.37	6.92	691.85	7.85E+10	7.85E+10
1/31/23	25.46	166	45.355	137.22	6.86	686.08	7.79E+10	7.79E+10
2/8/22	28.52	167	45.628	153.71	7.69	768.56	8.72E+10	8.72E+10
6/20/22	31.50	168	45.902	169.77	8.49	848.83	9.63E+10	9.63E+10
2/6/22	26.12	169	46.175	140.79	7.04	703.96	7.99E+10	7.99E+10
1/12/23	26.23	170	46.448	141.39	7.07	706.95	8.02E+10	8.02E+10
2/3/22	30.05	171	46.721	161.95	8.10	809.73	9.19E+10	9.19E+10
8/6/22	26.66	172	46.995	143.68	7.18	718.39	8.15E+10	8.15E+10
7/12/22	30.06	173	47.268	162.02	8.10	810.11	9.19E+10	9.19E+10
2/4/22	26.58	174	47.541	143.24	7.16	716.22	8.13E+10	8.13E+10
2/5/22	28.66	175	47.814	154.46	7.72	772.29	8.76E+10	8.76E+10
1/4/23	24.85	176	48.087	133.96	6.70	669.81	7.60E+10	7.60E+10
1/13/23	25.12	177	48.361	135.38	6.77	676.91	7.68E+10	7.68E+10
2/11/22	24.75	178	48.634	133.39	6.67	666.95	7.57E+10	7.57E+10
1/19/23	24.48	179	48.907	131.92	6.60	659.61	7.49E+10	7.49E+10
1/14/23	24.66	180	49.180	132.92	6.65	664.60	7.54E+10	7.54E+10
2/9/22	26.99	181	49.454	145.46	7.27	727.29	8.25E+10	8.25E+10
8/7/22	25.26	182	49.727	136.15	6.81	680.74	7.72E+10	7.72E+10

1/15/23	23.75	183	50.000	128.00	6.40	639.99	7.26E+10	7.26E+10
8/8/22	24.20	184	50.273	130.42	6.52	652.09	7.40E+10	7.40E+10
2/2/22	28.30	185	50.546	152.52	7.63	762.60	8.65E+10	8.65E+10
7/13/22	27.64	186	50.820	149.00	7.45	745.00	8.45E+10	8.45E+10
2/10/22	27.36	187	51.093	147.50	7.37	737.48	8.37E+10	8.37E+10
8/9/22	23.66	188	51.366	127.53	6.38	637.63	7.24E+10	7.24E+10
6/21/22	28.08	189	51.639	151.34	7.57	756.72	8.59E+10	8.59E+10
1/16/23	23.29	190	51.913	125.54	6.28	627.68	7.12E+10	7.12E+10
1/3/23	21.45	191	52.186	115.64	5.78	578.18	6.56E+10	6.56E+10
1/17/23	22.15	192	52.459	119.38	5.97	596.91	6.77E+10	6.77E+10
7/14/22	25.70	193	52.732	138.55	6.93	692.74	7.86E+10	7.86E+10
1/18/23	21.38	194	53.005	115.22	5.76	576.12	6.54E+10	6.54E+10
7/22/22	21.58	195	53.279	116.33	5.82	581.66	6.60E+10	6.60E+10
8/10/22	22.62	196	53.552	121.91	6.10	609.55	6.92E+10	6.92E+10
8/22/22	21.63	197	53.825	116.60	5.83	582.98	6.62E+10	6.62E+10
12/2/22	15.71	198	54.098	84.66	4.23	423.31	4.80E+10	4.80E+10
12/1/22	18.52	199	54.372	99.81	4.99	499.07	5.66E+10	5.66E+10
7/15/22	23.02	200	54.645	124.08	6.20	620.42	7.04E+10	7.04E+10
7/6/22	23.87	201	54.918	128.66	6.43	643.31	7.30E+10	7.30E+10
12/4/22	18.72	202	55.191	100.89	5.04	504.43	5.72E+10	5.72E+10
1/2/23	20.51	203	55.464	110.54	5.53	552.69	6.27E+10	6.27E+10
12/3/22	19.19	204	55.738	103.45	5.17	517.26	5.87E+10	5.87E+10
11/30/22	18.46	205	56.011	99.52	4.98	497.59	5.65E+10	5.65E+10
6/22/22	24.61	206	56.284	132.65	6.63	663.24	7.53E+10	7.53E+10
7/16/22	21.75	207	56.557	117.21	5.86	586.03	6.65E+10	6.65E+10
8/21/22	20.54	208	56.831	110.74	5.54	553.68	6.28E+10	6.28E+10
12/5/22	18.35	209	57.104	98.91	4.95	494.55	5.61E+10	5.61E+10
11/29/22	14.86	210	57.377	80.12	4.01	400.60	4.55E+10	4.55E+10
8/11/22	20.60	211	57.650	111.01	5.55	555.07	6.30E+10	6.30E+10
1/1/23	18.50	212	57.923	99.71	4.99	498.56	5.66E+10	5.66E+10
12/6/22	18.98	213	58.197	102.28	5.11	511.41	5.80E+10	5.80E+10
8/23/22	19.12	214	58.470	103.05	5.15	515.23	5.85E+10	5.85E+10
7/17/22	21.51	215	58.743	115.95	5.80	579.77	6.58E+10	6.58E+10
1/11/23	24.77	216	59.016	133.54	6.68	667.68	7.58E+10	7.58E+10
12/7/22	17.78	217	59.290	95.82	4.79	479.09	5.44E+10	5.44E+10
7/18/22	20.98	218	59.563	113.11	5.66	565.53	6.42E+10	6.42E+10
12/8/22	17.37	219	59.836	93.60	4.68	468.00	5.31E+10	5.31E+10
8/31/22	17.09	220	60.109	92.13	4.61	460.66	5.23E+10	5.23E+10
12/9/22	14.69	221	60.383	79.17	3.96	395.85	4.49E+10	4.49E+10
8/30/22	17.45	222	60.656	94.07	4.70	470.34	5.34E+10	5.34E+10
12/10/22	15.52	223	60.929	83.63	4.18	418.17	4.75E+10	4.75E+10
12/31/22	16.99	224	61.202	91.59	4.58	457.96	5.20E+10	5.20E+10
2/1/22	19.13	225	61.475	103.10	5.16	515.50	5.85E+10	5.85E+10
8/12/22	17.74	226	61.749	95.61	4.78	478.05	5.42E+10	5.42E+10
7/19/22	18.44	227	62.022	99.38	4.97	496.90	5.64E+10	5.64E+10
8/24/22	16.18	228	62.295	87.23	4.36	436.16	4.95E+10	4.95E+10
11/28/22	13.66	229	62.568	73.60	3.68	368.01	4.18E+10	4.18E+10
12/11/22	15.78	230	62.842	85.07	4.25	425.36	4.83E+10	4.83E+10
6/23/22	20.93	231	63.115	112.84	5.64	564.19	6.40E+10	6.40E+10
8/15/22	16.18	232	63.388	87.22	4.36	436.08	4.95E+10	4.95E+10
9/1/22	14.95	233	63.661	80.59	4.03	402.97	4.57E+10	4.57E+10
12/12/22	16.14	234	63.934	86.98	4.35	434.91	4.94E+10	4.94E+10
8/14/22	16.42	235	64.208	88.48	4.42	442.40	5.02E+10	5.02E+10
12/16/22	13.77	236	64.481	74.20	3.71	370.98	4.21E+10	4.21E+10
12/13/22	13.64	237	64.754	73.50	3.68	367.52	4.17E+10	4.17E+10
12/15/22	12.86	238	65.027	69.29	3.46	346.46	3.93E+10	3.93E+10
12/17/22	14.34	239	65.301	77.29	3.86	386.45	4.39E+10	4.39E+10
8/13/22	15.91	240	65.574	85.78	4.29	428.90	4.87E+10	4.87E+10
7/20/22	16.40	241	65.847	88.38	4.42	441.88	5.01E+10	5.01E+10
8/16/22	15.18	242	66.120	81.81	4.09	409.06	4.64E+10	4.64E+10
12/14/22	14.20	243	66.393	76.52	3.83	382.62	4.34E+10	4.34E+10

12/24/22	9.34	244	66.667	50.36	2.52	251.80	2.86E+10	2.86E+10
8/25/22	14.97	245	66.940	80.68	4.03	403.42	4.58E+10	4.58E+10
9/2/22	14.20	246	67.213	76.55	3.83	382.73	4.34E+10	4.34E+10
12/18/22	14.20	247	67.486	76.56	3.83	382.81	4.34E+10	4.34E+10
12/23/22	9.24	248	67.760	49.82	2.49	249.12	2.83E+10	2.83E+10
12/20/22	14.30	249	68.033	77.10	3.85	385.49	4.37E+10	4.37E+10
10/23/22	13.32	250	68.306	71.81	3.59	359.06	4.07E+10	4.07E+10
12/19/22	14.15	251	68.579	76.28	3.81	381.40	4.33E+10	4.33E+10
12/27/22	7.52	252	68.852	40.52	2.03	202.60	2.30E+10	2.30E+10
12/26/22	9.56	253	69.126	51.54	2.58	257.71	2.92E+10	2.92E+10
12/30/22	12.43	254	69.399	66.98	3.35	334.88	3.80E+10	3.80E+10
7/21/22	15.39	255	69.672	82.98	4.15	414.88	4.71E+10	4.71E+10
8/17/22	13.96	256	69.945	75.22	3.76	376.10	4.27E+10	4.27E+10
6/24/22	17.85	257	70.219	96.23	4.81	481.16	5.46E+10	5.46E+10
12/21/22	14.31	258	70.492	77.13	3.86	385.64	4.38E+10	4.38E+10
12/28/22	6.85	259	70.765	36.95	1.85	184.73	2.10E+10	2.10E+10
12/25/22	8.12	260	71.038	43.75	2.19	218.77	2.48E+10	2.48E+10
9/3/22	13.51	261	71.311	72.83	3.64	364.15	4.13E+10	4.13E+10
8/26/22	13.34	262	71.585	71.88	3.59	359.41	4.08E+10	4.08E+10
12/22/22	13.88	263	71.858	74.82	3.74	374.12	4.25E+10	4.25E+10
8/29/22	12.16	264	72.131	65.56	3.28	327.78	3.72E+10	3.72E+10
8/27/22	13.53	265	72.404	72.93	3.65	364.67	4.14E+10	4.14E+10
9/4/22	12.92	266	72.678	69.64	3.48	348.20	3.95E+10	3.95E+10
8/18/22	13.36	267	72.951	72.01	3.60	360.05	4.09E+10	4.09E+10
12/29/22	7.73	268	73.224	41.68	2.08	208.38	2.36E+10	2.36E+10
10/24/22	11.32	269	73.497	61.00	3.05	304.99	3.46E+10	3.46E+10
8/19/22	12.82	270	73.770	69.12	3.46	345.58	3.92E+10	3.92E+10
8/28/22	12.70	271	74.044	68.47	3.42	342.36	3.88E+10	3.88E+10
8/20/22	12.17	272	74.317	65.58	3.28	327.91	3.72E+10	3.72E+10
9/5/22	12.53	273	74.590	67.55	3.38	337.74	3.83E+10	3.83E+10
6/25/22	16.10	274	74.863	86.77	4.34	433.83	4.92E+10	4.92E+10
9/6/22	11.94	275	75.137	64.37	3.22	321.85	3.65E+10	3.65E+10
10/25/22	9.72	276	75.410	52.37	2.62	261.84	2.97E+10	2.97E+10
10/26/22	10.50	277	75.683	56.61	2.83	283.03	3.21E+10	3.21E+10
10/27/22	10.39	278	75.956	56.00	2.80	279.98	3.18E+10	3.18E+10
11/27/22	9.39	279	76.230	50.62	2.53	253.09	2.87E+10	2.87E+10
10/28/22	10.43	280	76.503	56.22	2.81	281.08	3.19E+10	3.19E+10
9/7/22	12.00	281	76.776	64.70	3.23	323.48	3.67E+10	3.67E+10
9/27/22	12.40	282	77.049	66.81	3.34	334.07	3.79E+10	3.79E+10
10/29/22	9.88	283	77.322	53.23	2.66	266.17	3.02E+10	3.02E+10
6/26/22	14.62	284	77.596	78.80	3.94	393.99	4.47E+10	4.47E+10
9/28/22	11.78	285	77.869	63.52	3.18	317.58	3.60E+10	3.60E+10
10/30/22	9.74	286	78.142	52.50	2.63	262.52	2.98E+10	2.98E+10
11/1/22	9.20	287	78.415	49.57	2.48	247.86	2.81E+10	2.81E+10
10/31/22	9.27	288	78.689	49.99	2.50	249.95	2.84E+10	2.84E+10
11/2/22	9.68	289	78.962	52.20	2.61	260.99	2.96E+10	2.96E+10
11/4/22	9.19	290	79.235	49.56	2.48	247.78	2.81E+10	2.81E+10
11/3/22	9.73	291	79.508	52.45	2.62	262.27	2.98E+10	2.98E+10
9/26/22	11.78	292	79.781	63.51	3.18	317.53	3.60E+10	3.60E+10
9/8/22	11.19	293	80.055	60.30	3.02	301.52	3.42E+10	3.42E+10
11/5/22	8.68	294	80.328	46.77	2.34	233.86	2.65E+10	2.65E+10
10/19/22	9.09	295	80.601	48.99	2.45	244.97	2.78E+10	2.78E+10
9/29/22	11.15	296	80.874	60.07	3.00	300.36	3.41E+10	3.41E+10
10/22/22	9.40	297	81.148	50.67	2.53	253.35	2.87E+10	2.87E+10
11/7/22	9.10	298	81.421	49.02	2.45	245.11	2.78E+10	2.78E+10
11/6/22	9.00	299	81.694	48.53	2.43	242.66	2.75E+10	2.75E+10
11/8/22	9.83	300	81.967	52.99	2.65	264.96	3.01E+10	3.01E+10
10/20/22	9.04	301	82.240	48.74	2.44	243.71	2.77E+10	2.77E+10
11/9/22	9.00	302	82.514	48.52	2.43	242.58	2.75E+10	2.75E+10
9/9/22	10.11	303	82.787	54.50	2.73	272.51	3.09E+10	3.09E+10
9/30/22	11.04	304	83.060	59.53	2.98	297.63	3.38E+10	3.38E+10

11/10/22	8.19	305	83.333	44.14	2.21	220.69	2.50E+10	2.50E+10
9/12/22	11.24	306	83.607	60.59	3.03	302.96	3.44E+10	3.44E+10
11/11/22	9.17	307	83.880	49.45	2.47	247.24	2.81E+10	2.81E+10
10/18/22	8.13	308	84.153	43.83	2.19	219.13	2.49E+10	2.49E+10
6/27/22	12.65	309	84.426	68.20	3.41	340.99	3.87E+10	3.87E+10
10/21/22	8.61	310	84.699	46.42	2.32	232.08	2.63E+10	2.63E+10
9/11/22	8.44	311	84.973	45.51	2.28	227.56	2.58E+10	2.58E+10
11/12/22	8.17	312	85.246	44.04	2.20	220.18	2.50E+10	2.50E+10
11/13/22	8.37	313	85.519	45.09	2.25	225.45	2.56E+10	2.56E+10
9/13/22	10.62	314	85.792	57.25	2.86	286.24	3.25E+10	3.25E+10
11/14/22	8.94	315	86.066	48.20	2.41	241.02	2.74E+10	2.74E+10
9/10/22	8.93	316	86.339	48.14	2.41	240.72	2.73E+10	2.73E+10
10/1/22	10.63	317	86.612	57.32	2.87	286.58	3.25E+10	3.25E+10
11/15/22	8.66	318	86.885	46.67	2.33	233.37	2.65E+10	2.65E+10
9/14/22	9.82	319	87.158	52.95	2.65	264.76	3.00E+10	3.00E+10
11/16/22	7.59	320	87.432	40.92	2.05	204.59	2.32E+10	2.32E+10
11/17/22	7.58	321	87.705	40.84	2.04	204.21	2.32E+10	2.32E+10
9/15/22	9.48	322	87.978	51.08	2.55	255.40	2.90E+10	2.90E+10
11/26/22	7.75	323	88.251	41.78	2.09	208.88	2.37E+10	2.37E+10
9/25/22	8.74	324	88.525	47.10	2.36	235.52	2.67E+10	2.67E+10
9/21/22	9.68	325	88.798	52.19	2.61	260.97	2.96E+10	2.96E+10
11/18/22	7.48	326	89.071	40.32	2.02	201.58	2.29E+10	2.29E+10
11/25/22	7.86	327	89.344	42.35	2.12	211.74	2.40E+10	2.40E+10
11/19/22	7.29	328	89.617	39.31	1.97	196.57	2.23E+10	2.23E+10
9/22/22	10.09	329	89.891	54.39	2.72	271.96	3.09E+10	3.09E+10
9/16/22	9.06	330	90.164	48.83	2.44	244.16	2.77E+10	2.77E+10
11/24/22	7.20	331	90.437	38.79	1.94	193.93	2.20E+10	2.20E+10
10/2/22	10.03	332	90.710	54.08	2.70	270.41	3.07E+10	3.07E+10
11/22/22	7.39	333	90.984	39.83	1.99	199.14	2.26E+10	2.26E+10
11/21/22	6.73	334	91.257	36.30	1.81	181.48	2.06E+10	2.06E+10
11/23/22	7.10	335	91.530	38.30	1.91	191.48	2.17E+10	2.17E+10
9/20/22	8.89	336	91.803	47.91	2.40	239.55	2.72E+10	2.72E+10
6/28/22	10.35	337	92.077	55.77	2.79	278.85	3.16E+10	3.16E+10
11/20/22	7.12	338	92.350	38.40	1.92	192.01	2.18E+10	2.18E+10
9/17/22	8.30	339	92.623	44.71	2.24	223.56	2.54E+10	2.54E+10
9/23/22	9.24	340	92.896	49.79	2.49	248.95	2.83E+10	2.83E+10
9/19/22	9.14	341	93.169	49.27	2.46	246.36	2.80E+10	2.80E+10
9/18/22	8.70	342	93.443	46.92	2.35	234.58	2.66E+10	2.66E+10
10/3/22	9.21	343	93.716	49.64	2.48	248.18	2.82E+10	2.82E+10
9/24/22	8.23	344	93.989	44.34	2.22	221.69	2.52E+10	2.52E+10
7/5/22	9.18	345	94.262	49.47	2.47	247.33	2.81E+10	2.81E+10
10/4/22	8.35	346	94.536	45.03	2.25	225.15	2.55E+10	2.55E+10
6/29/22	9.25	347	94.809	49.84	2.49	249.19	2.83E+10	2.83E+10
10/5/22	8.61	348	95.082	46.41	2.32	232.05	2.63E+10	2.63E+10
10/17/22	5.26	349	95.355	28.33	1.42	141.64	1.61E+10	1.61E+10
10/6/22	7.04	350	95.628	37.92	1.90	189.61	2.15E+10	2.15E+10
6/30/22	8.20	351	95.902	44.19	2.21	220.97	2.51E+10	2.51E+10
10/7/22	8.01	352	96.175	43.17	2.16	215.83	2.45E+10	2.45E+10
7/1/22	8.11	353	96.448	43.70	2.18	218.49	2.48E+10	2.48E+10
7/2/22	8.24	354	96.721	44.40	2.22	222.01	2.52E+10	2.52E+10
10/8/22	6.76	355	96.995	36.43	1.82	182.15	2.07E+10	2.07E+10
10/16/22	4.42	356	97.268	23.81	1.19	119.05	1.35E+10	1.35E+10
10/9/22	5.15	357	97.541	27.78	1.39	138.89	1.58E+10	1.58E+10
7/3/22	7.16	358	97.814	38.59	1.93	192.96	2.19E+10	2.19E+10
10/13/22	6.68	359	98.087	36.00	1.80	180.01	2.04E+10	2.04E+10
10/10/22	4.93	360	98.361	26.59	1.33	132.95	1.51E+10	1.51E+10
10/15/22	4.12	361	98.634	22.22	1.11	111.11	1.26E+10	1.26E+10
10/14/22	4.23	362	98.907	22.82	1.14	114.11	1.29E+10	1.29E+10
10/11/22	4.75	363	99.180	25.58	1.28	127.90	1.45E+10	1.45E+10
10/12/22	4.63	364	99.454	24.98	1.25	124.91	1.42E+10	1.42E+10
7/4/22	7.08	365	99.727	38.18	1.91	190.88	2.17E+10	2.17E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 3 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	502.89	2.61	0.147	0.4	64.4	0.819672131	7074.583197	398.453536	1084.22731	7.92E+11	21	148566.2471	8367.524264	22768.77351	1.66E+13
3/15/22	67.71	3.91	0.05	8	3	19.67213115	1427.029793	18.2484628	2919.754052	4.97E+09	35	49946.04274	638.6961988	102191.3918	1.74E+11
4/19/22	67.69	2.40	0.05	10	25	16.12021858	875.6993738	18.243737	3648.747391	4.14E+10	35	30649.47808	638.5307934	127706.1587	1.45E+12
5/24/22	46.58	4.72	0.05	14	115.0	34.15300546	1185.078068	12.5537931	3515.062065	1.31E+11	28	33182.1859	351.5062065	98421.73783	3.67E+12
6/21/22	29.02	3.95	0.096	7.2	112.0	51.63934426	617.9506823	15.0185482	1126.391117	7.95E+10	28	17302.61911	420.5193504	31538.95128	2.23E+12
7/19/22	51.14	3.32	0.067	7.2	272.0	62.02185792	915.0964695	18.4673083	1984.54656	3.40E+11	35	32028.37643	646.3557895	69459.12962	1.19E+13
8/23/22	26.10	3.43	0.05	8.8	238.0	58.46994536	482.595897	7.03492561	1238.146908	1.52E+11	28	13512.68511	196.9779171	34668.11341	4.26E+12
9/20/22	17.53	2.80	0.063	8.4	261.0	91.80327869	264.6364032	5.9518533	793.5804405	1.12E+11	36	9526.910514	214.2667189	28568.89586	4.03E+12
10/26/22	24.45	1.31	0.050	9.6	727.0	75.68306011	172.6630797	6.58908732	1265.104765	4.35E+11	13	2244.620037	85.65813515	16446.36195	5.65E+12
11/8/22	21.89	1.81	0.125	14.0	39.0	81.96721311	213.2652858	14.751085	1652.121515	2.09E+10	35	7464.285003	516.2879733	57824.25301	7.31E+11
12/13/22	16.11	4.00	0.050	6.0	35.0	64.75409836	347.3398822	4.34174853	521.0098233	1.38E+10	36	12504.23576	156.302947	18756.35364	4.97E+11
1/18/23	73.97	0.70	0.050	10.8	29.0	53.00546448	279.0718979	19.933707	4305.680711	5.25E+10	37	10325.66022	737.5471587	159310.1863	1.94E+12
2/24/23															

Conversion Factor	5.39	5.39	5.39	2.45E+07

	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
TOTAL	367,253.3	12,970.2	767,660.3	5.32E+13
TARGET	63,529.5	3,176.5	317,647.4	3.60E+13

Site 4 Date	E4	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	70.97	1	0.273	382.55	19.13	1912.76	2.17E+11	2.17E+11
2/24/22	71.67	2	0.546	386.29	19.31	1931.47	2.19E+11	2.19E+11
2/22/22	67.67	3	0.820	364.76	18.24	1823.79	2.07E+11	2.07E+11
2/25/22	69.76	4	1.093	376.02	18.80	1880.08	2.13E+11	2.13E+11
2/26/22	66.92	5	1.366	360.69	18.03	1803.45	2.05E+11	2.05E+11
2/21/22	65.53	6	1.639	353.19	17.66	1765.97	2.00E+11	2.00E+11
2/27/22	65.67	7	1.913	353.98	17.70	1769.91	2.01E+11	2.01E+11
2/20/22	58.56	8	2.186	315.63	15.78	1578.17	1.79E+11	1.79E+11
2/19/22	62.86	9	2.459	338.82	16.94	1694.08	1.92E+11	1.92E+11
2/28/22	62.91	10	2.732	339.10	16.95	1695.48	1.92E+11	1.92E+11
3/1/22	62.44	11	3.005	336.54	16.83	1682.69	1.91E+11	1.91E+11
3/2/22	60.42	12	3.279	325.66	16.28	1628.28	1.85E+11	1.85E+11
3/3/22	60.57	13	3.552	326.45	16.32	1632.23	1.85E+11	1.85E+11
3/4/22	59.97	14	3.825	323.24	16.16	1616.19	1.83E+11	1.83E+11
3/26/22	54.93	15	4.098	296.09	14.80	1480.44	1.68E+11	1.68E+11
3/27/22	55.14	16	4.372	297.22	14.86	1486.09	1.69E+11	1.69E+11
3/28/22	55.46	17	4.645	298.93	14.95	1494.67	1.70E+11	1.70E+11
3/25/22	53.42	18	4.918	287.91	14.40	1439.57	1.63E+11	1.63E+11
3/5/22	54.83	19	5.191	295.54	14.78	1477.72	1.68E+11	1.68E+11
2/18/22	51.96	20	5.464	280.08	14.00	1400.40	1.59E+11	1.59E+11
3/29/22	54.98	21	5.738	296.36	14.82	1481.80	1.68E+11	1.68E+11
3/24/22	51.29	22	6.011	276.47	13.82	1382.36	1.57E+11	1.57E+11
3/30/22	50.49	23	6.284	272.12	13.61	1360.61	1.54E+11	1.54E+11
3/7/22	53.44	24	6.557	288.05	14.40	1440.24	1.63E+11	1.63E+11
3/6/22	52.77	25	6.831	284.44	14.22	1422.18	1.61E+11	1.61E+11
3/8/22	54.47	26	7.104	293.62	14.68	1468.08	1.67E+11	1.67E+11
3/31/22	48.09	27	7.377	259.23	12.96	1296.14	1.47E+11	1.47E+11
3/9/22	53.39	28	7.650	287.79	14.39	1438.95	1.63E+11	1.63E+11
4/1/22	48.96	29	7.923	263.91	13.20	1319.53	1.50E+11	1.50E+11
4/2/22	49.39	30	8.197	266.22	13.31	1331.10	1.51E+11	1.51E+11
3/10/22	52.90	31	8.470	285.13	14.26	1425.64	1.62E+11	1.62E+11
3/23/22	46.49	32	8.743	250.60	12.53	1252.98	1.42E+11	1.42E+11
4/3/22	48.47	33	9.016	261.25	13.06	1306.26	1.48E+11	1.48E+11
5/8/22	46.64	34	9.290	251.39	12.57	1256.94	1.43E+11	1.43E+11
3/11/22	47.53	35	9.563	256.16	12.81	1280.80	1.45E+11	1.45E+11
5/9/22	45.58	36	9.836	245.66	12.28	1228.29	1.39E+11	1.39E+11
5/7/22	46.83	37	10.109	252.44	12.62	1262.19	1.43E+11	1.43E+11
4/4/22	45.96	38	10.383	247.72	12.39	1238.62	1.41E+11	1.41E+11
5/10/22	45.32	39	10.656	244.29	12.21	1221.45	1.39E+11	1.39E+11
4/5/22	47.97	40	10.929	258.54	12.93	1292.68	1.47E+11	1.47E+11
4/7/22	45.78	41	11.202	246.74	12.34	1233.72	1.40E+11	1.40E+11
5/11/22	46.25	42	11.475	249.27	12.46	1246.34	1.41E+11	1.41E+11
4/6/22	45.21	43	11.749	243.70	12.18	1218.48	1.38E+11	1.38E+11
4/8/22	42.48	44	12.022	228.96	11.45	1144.78	1.30E+11	1.30E+11
3/12/22	46.55	45	12.295	250.90	12.54	1254.48	1.42E+11	1.42E+11
4/15/22	44.57	46	12.568	240.24	12.01	1201.22	1.36E+11	1.36E+11
4/16/22	44.21	47	12.842	238.28	11.91	1191.42	1.35E+11	1.35E+11
4/9/22	45.09	48	13.115	243.04	12.15	1215.19	1.38E+11	1.38E+11
5/12/22	43.62	49	13.388	235.11	11.76	1175.55	1.33E+11	1.33E+11
3/22/22	43.87	50	13.661	236.45	11.82	1182.27	1.34E+11	1.34E+11
4/17/22	45.20	51	13.934	243.65	12.18	1218.26	1.38E+11	1.38E+11
4/14/22	42.05	52	14.208	226.64	11.33	1133.18	1.29E+11	1.29E+11
3/21/22	44.70	53	14.481	240.92	12.05	1204.59	1.37E+11	1.37E+11
5/6/22	40.98	54	14.754	220.88	11.04	1104.40	1.25E+11	1.25E+11
4/10/22	44.00	55	15.027	237.15	11.86	1185.75	1.35E+11	1.35E+11
3/13/22	43.59	56	15.301	234.97	11.75	1174.84	1.33E+11	1.33E+11
4/18/22	41.55	57	15.574	223.97	11.20	1119.86	1.27E+11	1.27E+11
5/13/22	41.50	58	15.847	223.67	11.18	1118.33	1.27E+11	1.27E+11
4/19/22	42.62	59	16.120	229.71	11.49	1148.56	1.30E+11	1.30E+11
3/20/22	41.76	60	16.393	225.08	11.25	1125.41	1.28E+11	1.28E+11

4/20/22	40.89	61	16.667	220.42	11.02	1102.10	1.25E+11	1.25E+11
4/11/22	43.48	62	16.940	234.34	11.72	1171.69	1.33E+11	1.33E+11
5/14/22	40.15	63	17.213	216.39	10.82	1081.97	1.23E+11	1.23E+11
3/14/22	43.36	64	17.486	233.72	11.69	1168.62	1.33E+11	1.33E+11
4/13/22	36.76	65	17.760	198.12	9.91	990.60	1.12E+11	1.12E+11
4/21/22	38.79	66	18.033	209.09	10.45	1045.45	1.19E+11	1.19E+11
4/12/22	41.41	67	18.306	223.22	11.16	1116.10	1.27E+11	1.27E+11
2/17/22	37.04	68	18.579	199.62	9.98	998.10	1.13E+11	1.13E+11
4/22/22	41.30	69	18.852	222.62	11.13	1113.08	1.26E+11	1.26E+11
5/15/22	39.11	70	19.126	210.79	10.54	1053.94	1.20E+11	1.20E+11
5/5/22	39.34	71	19.399	212.07	10.60	1060.33	1.20E+11	1.20E+11
3/15/22	41.88	72	19.672	225.71	11.29	1128.54	1.28E+11	1.28E+11
4/23/22	37.65	73	19.945	202.93	10.15	1014.64	1.15E+11	1.15E+11
4/25/22	39.34	74	20.219	212.05	10.60	1060.25	1.20E+11	1.20E+11
4/24/22	35.91	75	20.492	193.55	9.68	967.73	1.10E+11	1.10E+11
5/4/22	38.88	76	20.765	209.56	10.48	1047.81	1.19E+11	1.19E+11
4/26/22	38.38	77	21.038	206.86	10.34	1034.31	1.17E+11	1.17E+11
3/16/22	39.67	78	21.311	213.84	10.69	1069.18	1.21E+11	1.21E+11
5/16/22	37.25	79	21.585	200.80	10.04	1004.00	1.14E+11	1.14E+11
3/19/22	36.71	80	21.858	197.88	9.89	989.41	1.12E+11	1.12E+11
4/27/22	38.21	81	22.131	205.96	10.30	1029.80	1.17E+11	1.17E+11
3/17/22	38.89	82	22.404	209.61	10.48	1048.07	1.19E+11	1.19E+11
4/28/22	35.88	83	22.678	193.37	9.67	966.85	1.10E+11	1.10E+11
5/17/22	34.99	84	22.951	188.62	9.43	943.11	1.07E+11	1.07E+11
3/18/22	35.00	85	23.224	188.63	9.43	943.17	1.07E+11	1.07E+11
5/3/22	34.83	86	23.497	187.71	9.39	938.55	1.07E+11	1.07E+11
4/29/22	34.51	87	23.770	186.03	9.30	930.14	1.06E+11	1.06E+11
5/18/22	33.26	88	24.044	179.26	8.96	896.32	1.02E+11	1.02E+11
5/1/22	33.21	89	24.317	179.00	8.95	895.00	1.02E+11	1.02E+11
6/11/22	34.09	90	24.590	183.72	9.19	918.62	1.04E+11	1.04E+11
6/12/22	33.77	91	24.863	182.03	9.10	910.17	1.03E+11	1.03E+11
4/30/22	32.28	92	25.137	174.01	8.70	870.04	9.87E+10	9.87E+10
5/2/22	34.11	93	25.410	183.85	9.19	919.23	1.04E+11	1.04E+11
6/10/22	33.57	94	25.683	180.96	9.05	904.78	1.03E+11	1.03E+11
5/19/22	32.26	95	25.956	173.86	8.69	869.29	9.86E+10	9.86E+10
6/13/22	33.45	96	26.230	180.31	9.02	901.54	1.02E+11	1.02E+11
6/9/22	33.03	97	26.503	178.03	8.90	890.15	1.01E+11	1.01E+11
6/14/22	33.31	98	26.776	179.54	8.98	897.72	1.02E+11	1.02E+11
5/20/22	31.04	99	27.049	167.33	8.37	836.66	9.49E+10	9.49E+10
6/15/22	32.29	100	27.322	174.03	8.70	870.13	9.87E+10	9.87E+10
6/8/22	30.39	101	27.596	163.82	8.19	819.10	9.29E+10	9.29E+10
6/2/22	30.83	102	27.869	166.18	8.31	830.88	9.43E+10	9.43E+10
5/21/22	30.19	103	28.142	162.74	8.14	813.70	9.23E+10	9.23E+10
6/1/22	29.93	104	28.415	161.33	8.07	806.66	9.15E+10	9.15E+10
5/30/22	30.46	105	28.689	164.20	8.21	820.98	9.32E+10	9.32E+10
7/28/22	28.27	106	28.962	152.38	7.62	761.92	8.65E+10	8.65E+10
6/3/22	30.03	107	29.235	161.85	8.09	809.24	9.18E+10	9.18E+10
7/27/22	28.24	108	29.508	152.20	7.61	761.01	8.64E+10	8.64E+10
5/31/22	30.51	109	29.781	164.44	8.22	822.20	9.33E+10	9.33E+10
7/29/22	28.18	110	30.055	151.88	7.59	759.38	8.62E+10	8.62E+10
5/29/22	29.49	111	30.328	158.94	7.95	794.69	9.02E+10	9.02E+10
7/26/22	27.14	112	30.601	146.27	7.31	731.36	8.30E+10	8.30E+10
5/22/22	29.04	113	30.874	156.52	7.83	782.60	8.88E+10	8.88E+10
6/7/22	29.45	114	31.148	158.72	7.94	793.60	9.01E+10	9.01E+10
6/16/22	30.36	115	31.421	163.65	8.18	818.26	9.29E+10	9.29E+10
6/4/22	28.96	116	31.694	156.11	7.81	780.54	8.86E+10	8.86E+10
7/30/22	26.94	117	31.967	145.20	7.26	726.00	8.24E+10	8.24E+10
7/25/22	26.50	118	32.240	142.83	7.14	714.13	8.10E+10	8.10E+10
5/23/22	27.31	119	32.514	147.22	7.36	736.12	8.35E+10	8.35E+10
6/5/22	27.53	120	32.787	148.41	7.42	742.04	8.42E+10	8.42E+10
7/31/22	25.73	121	33.060	138.71	6.94	693.54	7.87E+10	7.87E+10

6/17/22	28.00	122	33.333	150.92	7.55	754.59	8.56E+10	8.56E+10
6/6/22	26.16	123	33.607	141.02	7.05	705.09	8.00E+10	8.00E+10
5/28/22	27.04	124	33.880	145.74	7.29	728.68	8.27E+10	8.27E+10
5/24/22	25.71	125	34.153	138.59	6.93	692.97	7.86E+10	7.86E+10
7/24/22	24.69	126	34.426	133.07	6.65	665.33	7.55E+10	7.55E+10
8/1/22	24.46	127	34.699	131.82	6.59	659.11	7.48E+10	7.48E+10
2/16/22	21.60	128	34.973	116.41	5.82	582.03	6.60E+10	6.60E+10
5/27/22	26.35	129	35.246	142.02	7.10	710.10	8.06E+10	8.06E+10
5/25/22	25.38	130	35.519	136.82	6.84	684.10	7.76E+10	7.76E+10
5/26/22	26.10	131	35.792	140.69	7.03	703.44	7.98E+10	7.98E+10
6/18/22	26.03	132	36.066	140.29	7.01	701.43	7.96E+10	7.96E+10
8/2/22	23.00	133	36.339	123.95	6.20	619.77	7.03E+10	7.03E+10
2/13/22	23.83	134	36.612	128.45	6.42	642.25	7.29E+10	7.29E+10
2/14/22	23.65	135	36.885	127.47	6.37	637.34	7.23E+10	7.23E+10
2/15/22	23.22	136	37.158	125.17	6.26	625.86	7.10E+10	7.10E+10
8/3/22	21.46	137	37.432	115.65	5.78	578.27	6.56E+10	6.56E+10
7/8/22	23.34	138	37.705	125.82	6.29	629.08	7.14E+10	7.14E+10
7/9/22	23.28	139	37.978	125.49	6.27	627.44	7.12E+10	7.12E+10
6/19/22	23.28	140	38.251	125.48	6.27	627.42	7.12E+10	7.12E+10
2/12/22	22.82	141	38.525	123.01	6.15	615.04	6.98E+10	6.98E+10
8/4/22	20.95	142	38.798	112.93	5.65	564.66	6.41E+10	6.41E+10
1/25/23	19.19	143	39.071	103.42	5.17	517.09	5.87E+10	5.87E+10
1/23/23	18.64	144	39.344	100.47	5.02	502.33	5.70E+10	5.70E+10
1/22/23	19.11	145	39.617	102.98	5.15	514.90	5.84E+10	5.84E+10
1/26/23	18.73	146	39.891	100.97	5.05	504.87	5.73E+10	5.73E+10
7/10/22	22.86	147	40.164	123.24	6.16	616.18	6.99E+10	6.99E+10
7/23/22	20.16	148	40.437	108.68	5.43	543.38	6.17E+10	6.17E+10
1/24/23	18.05	149	40.710	97.30	4.86	486.49	5.52E+10	5.52E+10
1/27/23	17.34	150	40.984	93.44	4.67	467.18	5.30E+10	5.30E+10
7/7/22	22.58	151	41.257	121.72	6.09	608.62	6.91E+10	6.91E+10
1/8/23	19.01	152	41.530	102.49	5.12	512.45	5.82E+10	5.82E+10
1/28/23	18.76	153	41.803	101.11	5.06	505.53	5.74E+10	5.74E+10
1/21/23	17.95	154	42.077	96.78	4.84	483.89	5.49E+10	5.49E+10
1/7/23	18.74	155	42.350	101.00	5.05	505.00	5.73E+10	5.73E+10
1/29/23	18.10	156	42.623	97.54	4.88	487.68	5.53E+10	5.53E+10
1/6/23	18.29	157	42.896	98.58	4.93	492.91	5.59E+10	5.59E+10
8/5/22	18.96	158	43.169	102.19	5.11	510.93	5.80E+10	5.80E+10
1/9/23	18.49	159	43.443	99.69	4.98	498.43	5.66E+10	5.66E+10
7/11/22	21.98	160	43.716	118.48	5.92	592.39	6.72E+10	6.72E+10
1/30/23	18.40	161	43.989	99.17	4.96	495.84	5.63E+10	5.63E+10
1/10/23	18.45	162	44.262	99.42	4.97	497.11	5.64E+10	5.64E+10
1/5/23	17.83	163	44.536	96.12	4.81	480.61	5.45E+10	5.45E+10
2/7/22	20.20	164	44.809	108.90	5.45	544.51	6.18E+10	6.18E+10
1/20/23	17.54	165	45.082	94.56	4.73	472.81	5.37E+10	5.37E+10
1/31/23	17.40	166	45.355	93.77	4.69	468.86	5.32E+10	5.32E+10
2/8/22	19.49	167	45.628	105.05	5.25	525.23	5.96E+10	5.96E+10
6/20/22	21.52	168	45.902	116.02	5.80	580.08	6.58E+10	6.58E+10
2/6/22	17.85	169	46.175	96.22	4.81	481.08	5.46E+10	5.46E+10
1/12/23	17.93	170	46.448	96.63	4.83	483.13	5.48E+10	5.48E+10
2/3/22	20.53	171	46.721	110.67	5.53	553.36	6.28E+10	6.28E+10
8/6/22	18.22	172	46.995	98.19	4.91	490.95	5.57E+10	5.57E+10
7/12/22	20.54	173	47.268	110.73	5.54	553.63	6.28E+10	6.28E+10
2/4/22	18.16	174	47.541	97.89	4.89	489.46	5.55E+10	5.55E+10
2/5/22	19.58	175	47.814	105.56	5.28	527.78	5.99E+10	5.99E+10
1/4/23	16.98	176	48.087	91.55	4.58	457.74	5.19E+10	5.19E+10
1/13/23	17.16	177	48.361	92.52	4.63	462.60	5.25E+10	5.25E+10
2/11/22	16.91	178	48.634	91.16	4.56	455.79	5.17E+10	5.17E+10
1/19/23	16.73	179	48.907	90.16	4.51	450.78	5.12E+10	5.12E+10
1/14/23	16.85	180	49.180	90.84	4.54	454.18	5.15E+10	5.15E+10
2/9/22	18.44	181	49.454	99.40	4.97	497.02	5.64E+10	5.64E+10
8/7/22	17.26	182	49.727	93.04	4.65	465.22	5.28E+10	5.28E+10

1/15/23	16.23	183	50.000	87.47	4.37	437.36	4.96E+10	4.96E+10
8/8/22	16.54	184	50.273	89.13	4.46	445.63	5.06E+10	5.06E+10
2/2/22	19.34	185	50.546	104.23	5.21	521.16	5.91E+10	5.91E+10
7/13/22	18.89	186	50.820	101.83	5.09	509.13	5.78E+10	5.78E+10
2/10/22	18.70	187	51.093	100.80	5.04	503.99	5.72E+10	5.72E+10
8/9/22	16.17	188	51.366	87.15	4.36	435.75	4.94E+10	4.94E+10
6/21/22	19.19	189	51.639	103.43	5.17	517.13	5.87E+10	5.87E+10
1/16/23	15.92	190	51.913	85.79	4.29	428.95	4.87E+10	4.87E+10
1/3/23	14.66	191	52.186	79.02	3.95	395.12	4.48E+10	4.48E+10
1/17/23	15.14	192	52.459	81.59	4.08	407.93	4.63E+10	4.63E+10
7/14/22	17.57	193	52.732	94.68	4.73	473.42	5.37E+10	5.37E+10
1/18/23	14.61	194	53.005	78.74	3.94	393.72	4.47E+10	4.47E+10
7/22/22	14.75	195	53.279	79.50	3.98	397.50	4.51E+10	4.51E+10
8/10/22	15.46	196	53.552	83.31	4.17	416.56	4.73E+10	4.73E+10
8/22/22	14.78	197	53.825	79.68	3.98	398.41	4.52E+10	4.52E+10
12/2/22	10.73	198	54.098	57.86	2.89	289.28	3.28E+10	3.28E+10
12/1/22	12.66	199	54.372	68.21	3.41	341.06	3.87E+10	3.87E+10
7/15/22	15.73	200	54.645	84.80	4.24	423.99	4.81E+10	4.81E+10
7/6/22	16.31	201	54.918	87.93	4.40	439.63	4.99E+10	4.99E+10
12/4/22	12.79	202	55.191	68.95	3.45	344.73	3.91E+10	3.91E+10
1/2/23	14.01	203	55.464	75.54	3.78	377.70	4.29E+10	4.29E+10
12/3/22	13.12	204	55.738	70.70	3.53	353.50	4.01E+10	4.01E+10
11/30/22	12.62	205	56.011	68.01	3.40	340.05	3.86E+10	3.86E+10
6/22/22	16.82	206	56.284	90.65	4.53	453.26	5.14E+10	5.14E+10
7/16/22	14.86	207	56.557	80.10	4.00	400.49	4.54E+10	4.54E+10
8/21/22	14.04	208	56.831	75.68	3.78	378.38	4.29E+10	4.29E+10
12/5/22	12.54	209	57.104	67.60	3.38	337.98	3.84E+10	3.84E+10
11/29/22	10.16	210	57.377	54.75	2.74	273.77	3.11E+10	3.11E+10
8/11/22	14.08	211	57.650	75.87	3.79	379.33	4.30E+10	4.30E+10
1/1/23	12.64	212	57.923	68.14	3.41	340.71	3.87E+10	3.87E+10
12/6/22	12.97	213	58.197	69.90	3.49	349.49	3.97E+10	3.97E+10
8/23/22	13.07	214	58.470	70.42	3.52	352.11	4.00E+10	4.00E+10
7/17/22	14.70	215	58.743	79.24	3.96	396.21	4.50E+10	4.50E+10
1/11/23	16.93	216	59.016	91.26	4.56	456.29	5.18E+10	5.18E+10
12/7/22	12.15	217	59.290	65.48	3.27	327.41	3.72E+10	3.72E+10
7/18/22	14.34	218	59.563	77.30	3.86	386.48	4.39E+10	4.39E+10
12/8/22	11.87	219	59.836	63.97	3.20	319.83	3.63E+10	3.63E+10
8/31/22	11.68	220	60.109	62.96	3.15	314.81	3.57E+10	3.57E+10
12/9/22	10.04	221	60.383	54.10	2.71	270.52	3.07E+10	3.07E+10
8/30/22	11.93	222	60.656	64.28	3.21	321.42	3.65E+10	3.65E+10
12/10/22	10.60	223	60.929	57.15	2.86	285.77	3.24E+10	3.24E+10
12/31/22	11.61	224	61.202	62.59	3.13	312.97	3.55E+10	3.55E+10
2/1/22	13.07	225	61.475	70.46	3.52	352.29	4.00E+10	4.00E+10
8/12/22	12.12	226	61.749	65.34	3.27	326.70	3.71E+10	3.71E+10
7/19/22	12.60	227	62.022	67.92	3.40	339.58	3.85E+10	3.85E+10
8/24/22	11.06	228	62.295	59.61	2.98	298.07	3.38E+10	3.38E+10
11/28/22	9.33	229	62.568	50.30	2.51	251.49	2.85E+10	2.85E+10
12/11/22	10.79	230	62.842	58.14	2.91	290.69	3.30E+10	3.30E+10
6/23/22	14.31	231	63.115	77.11	3.86	385.57	4.38E+10	4.38E+10
8/15/22	11.06	232	63.388	59.60	2.98	298.02	3.38E+10	3.38E+10
9/1/22	10.22	233	63.661	55.08	2.75	275.38	3.12E+10	3.12E+10
12/12/22	11.03	234	63.934	59.44	2.97	297.22	3.37E+10	3.37E+10
8/14/22	11.22	235	64.208	60.47	3.02	302.33	3.43E+10	3.43E+10
12/16/22	9.41	236	64.481	50.70	2.54	253.52	2.88E+10	2.88E+10
12/13/22	9.32	237	64.754	50.23	2.51	251.16	2.85E+10	2.85E+10
12/15/22	8.79	238	65.027	47.35	2.37	236.77	2.69E+10	2.69E+10
12/17/22	9.80	239	65.301	52.82	2.64	264.10	3.00E+10	3.00E+10
8/13/22	10.88	240	65.574	58.62	2.93	293.11	3.33E+10	3.33E+10
7/20/22	11.21	241	65.847	60.40	3.02	301.98	3.43E+10	3.43E+10
8/16/22	10.37	242	66.120	55.91	2.80	279.55	3.17E+10	3.17E+10
12/14/22	9.70	243	66.393	52.30	2.61	261.48	2.97E+10	2.97E+10

12/24/22	6.39	244	66.667	34.42	1.72	172.08	1.95E+10	1.95E+10
8/25/22	10.23	245	66.940	55.14	2.76	275.70	3.13E+10	3.13E+10
9/2/22	9.71	246	67.213	52.31	2.62	261.55	2.97E+10	2.97E+10
12/18/22	9.71	247	67.486	52.32	2.62	261.61	2.97E+10	2.97E+10
12/23/22	6.32	248	67.760	34.05	1.70	170.25	1.93E+10	1.93E+10
12/20/22	9.78	249	68.033	52.69	2.63	263.44	2.99E+10	2.99E+10
10/23/22	9.11	250	68.306	49.08	2.45	245.38	2.78E+10	2.78E+10
12/19/22	9.67	251	68.579	52.13	2.61	260.64	2.96E+10	2.96E+10
12/27/22	5.14	252	68.852	27.69	1.38	138.46	1.57E+10	1.57E+10
12/26/22	6.53	253	69.126	35.22	1.76	176.12	2.00E+10	2.00E+10
12/30/22	8.49	254	69.399	45.77	2.29	228.86	2.60E+10	2.60E+10
7/21/22	10.52	255	69.672	56.71	2.84	283.53	3.22E+10	3.22E+10
8/17/22	9.54	256	69.945	51.41	2.57	257.03	2.92E+10	2.92E+10
6/24/22	12.20	257	70.219	65.76	3.29	328.82	3.73E+10	3.73E+10
12/21/22	9.78	258	70.492	52.71	2.64	263.54	2.99E+10	2.99E+10
12/28/22	4.68	259	70.765	25.25	1.26	126.24	1.43E+10	1.43E+10
12/25/22	5.55	260	71.038	29.90	1.50	149.50	1.70E+10	1.70E+10
9/3/22	9.23	261	71.311	49.77	2.49	248.86	2.82E+10	2.82E+10
8/26/22	9.11	262	71.585	49.12	2.46	245.62	2.79E+10	2.79E+10
12/22/22	9.49	263	71.858	51.13	2.56	255.67	2.90E+10	2.90E+10
8/29/22	8.31	264	72.131	44.80	2.24	224.00	2.54E+10	2.54E+10
8/27/22	9.25	265	72.404	49.84	2.49	249.21	2.83E+10	2.83E+10
9/4/22	8.83	266	72.678	47.59	2.38	237.96	2.70E+10	2.70E+10
8/18/22	9.13	267	72.951	49.21	2.46	246.06	2.79E+10	2.79E+10
12/29/22	5.28	268	73.224	28.48	1.42	142.41	1.62E+10	1.62E+10
10/24/22	7.73	269	73.497	41.69	2.08	208.43	2.37E+10	2.37E+10
8/19/22	8.76	270	73.770	47.23	2.36	236.17	2.68E+10	2.68E+10
8/28/22	8.68	271	74.044	46.79	2.34	233.96	2.65E+10	2.65E+10
8/20/22	8.32	272	74.317	44.82	2.24	224.09	2.54E+10	2.54E+10
9/5/22	8.56	273	74.590	46.16	2.31	230.81	2.62E+10	2.62E+10
6/25/22	11.00	274	74.863	59.30	2.96	296.48	3.36E+10	3.36E+10
9/6/22	8.16	275	75.137	43.99	2.20	219.95	2.50E+10	2.50E+10
10/25/22	6.64	276	75.410	35.79	1.79	178.94	2.03E+10	2.03E+10
10/26/22	7.18	277	75.683	38.68	1.93	193.42	2.19E+10	2.19E+10
10/27/22	7.10	278	75.956	38.27	1.91	191.34	2.17E+10	2.17E+10
11/27/22	6.42	279	76.230	34.59	1.73	172.96	1.96E+10	1.96E+10
10/28/22	7.13	280	76.503	38.42	1.92	192.09	2.18E+10	2.18E+10
9/7/22	8.20	281	76.776	44.21	2.21	221.06	2.51E+10	2.51E+10
9/27/22	8.47	282	77.049	45.66	2.28	228.30	2.59E+10	2.59E+10
10/29/22	6.75	283	77.322	36.38	1.82	181.90	2.06E+10	2.06E+10
6/26/22	9.99	284	77.596	53.85	2.69	269.25	3.06E+10	3.06E+10
9/28/22	8.05	285	77.869	43.41	2.17	217.03	2.46E+10	2.46E+10
10/30/22	6.66	286	78.142	35.88	1.79	179.41	2.04E+10	2.04E+10
11/1/22	6.29	287	78.415	33.88	1.69	169.39	1.92E+10	1.92E+10
10/31/22	6.34	288	78.689	34.16	1.71	170.82	1.94E+10	1.94E+10
11/2/22	6.62	289	78.962	35.67	1.78	178.36	2.02E+10	2.02E+10
11/4/22	6.28	290	79.235	33.87	1.69	169.33	1.92E+10	1.92E+10
11/3/22	6.65	291	79.508	35.85	1.79	179.23	2.03E+10	2.03E+10
9/26/22	8.05	292	79.781	43.40	2.17	217.00	2.46E+10	2.46E+10
9/8/22	7.65	293	80.055	41.21	2.06	206.06	2.34E+10	2.34E+10
11/5/22	5.93	294	80.328	31.96	1.60	159.82	1.81E+10	1.81E+10
10/19/22	6.21	295	80.601	33.48	1.67	167.41	1.90E+10	1.90E+10
9/29/22	7.62	296	80.874	41.05	2.05	205.26	2.33E+10	2.33E+10
10/22/22	6.42	297	81.148	34.63	1.73	173.14	1.96E+10	1.96E+10
11/7/22	6.22	298	81.421	33.50	1.68	167.51	1.90E+10	1.90E+10
11/6/22	6.15	299	81.694	33.17	1.66	165.83	1.88E+10	1.88E+10
11/8/22	6.72	300	81.967	36.21	1.81	181.07	2.05E+10	2.05E+10
10/20/22	6.18	301	82.240	33.31	1.67	166.55	1.89E+10	1.89E+10
11/9/22	6.15	302	82.514	33.16	1.66	165.78	1.88E+10	1.88E+10
9/9/22	6.91	303	82.787	37.25	1.86	186.23	2.11E+10	2.11E+10
9/30/22	7.55	304	83.060	40.68	2.03	203.40	2.31E+10	2.31E+10

11/10/22	5.60	305	83.333	30.16	1.51	150.82	1.71E+10	1.71E+10
9/12/22	7.68	306	83.607	41.41	2.07	207.04	2.35E+10	2.35E+10
11/11/22	6.27	307	83.880	33.79	1.69	168.96	1.92E+10	1.92E+10
10/18/22	5.56	308	84.153	29.95	1.50	149.75	1.70E+10	1.70E+10
6/27/22	8.65	309	84.426	46.61	2.33	233.03	2.64E+10	2.64E+10
10/21/22	5.89	310	84.699	31.72	1.59	158.60	1.80E+10	1.80E+10
9/11/22	5.77	311	84.973	31.10	1.56	155.52	1.76E+10	1.76E+10
11/12/22	5.58	312	85.246	30.09	1.50	150.47	1.71E+10	1.71E+10
11/13/22	5.72	313	85.519	30.81	1.54	154.07	1.75E+10	1.75E+10
9/13/22	7.26	314	85.792	39.12	1.96	195.61	2.22E+10	2.22E+10
11/14/22	6.11	315	86.066	32.94	1.65	164.71	1.87E+10	1.87E+10
9/10/22	6.10	316	86.339	32.90	1.65	164.51	1.87E+10	1.87E+10
10/1/22	7.27	317	86.612	39.17	1.96	195.85	2.22E+10	2.22E+10
11/15/22	5.92	318	86.885	31.90	1.59	159.49	1.81E+10	1.81E+10
9/14/22	6.71	319	87.158	36.19	1.81	180.93	2.05E+10	2.05E+10
11/16/22	5.19	320	87.432	27.96	1.40	139.81	1.59E+10	1.59E+10
11/17/22	5.18	321	87.705	27.91	1.40	139.56	1.58E+10	1.58E+10
9/15/22	6.48	322	87.978	34.91	1.75	174.54	1.98E+10	1.98E+10
11/26/22	5.30	323	88.251	28.55	1.43	142.75	1.62E+10	1.62E+10
9/25/22	5.97	324	88.525	32.19	1.61	160.95	1.83E+10	1.83E+10
9/21/22	6.62	325	88.798	35.67	1.78	178.34	2.02E+10	2.02E+10
11/18/22	5.11	326	89.071	27.55	1.38	137.76	1.56E+10	1.56E+10
11/25/22	5.37	327	89.344	28.94	1.45	144.70	1.64E+10	1.64E+10
11/19/22	4.98	328	89.617	26.87	1.34	134.34	1.52E+10	1.52E+10
9/22/22	6.90	329	89.891	37.17	1.86	185.86	2.11E+10	2.11E+10
9/16/22	6.19	330	90.164	33.37	1.67	166.85	1.89E+10	1.89E+10
11/24/22	4.92	331	90.437	26.51	1.33	132.53	1.50E+10	1.50E+10
10/2/22	6.86	332	90.710	36.96	1.85	184.80	2.10E+10	2.10E+10
11/22/22	5.05	333	90.984	27.22	1.36	136.09	1.54E+10	1.54E+10
11/21/22	4.60	334	91.257	24.80	1.24	124.02	1.41E+10	1.41E+10
11/23/22	4.86	335	91.530	26.17	1.31	130.85	1.48E+10	1.48E+10
9/20/22	6.07	336	91.803	32.74	1.64	163.71	1.86E+10	1.86E+10
6/28/22	7.07	337	92.077	38.11	1.91	190.57	2.16E+10	2.16E+10
11/20/22	4.87	338	92.350	26.24	1.31	131.22	1.49E+10	1.49E+10
9/17/22	5.67	339	92.623	30.56	1.53	152.78	1.73E+10	1.73E+10
9/23/22	6.31	340	92.896	34.03	1.70	170.13	1.93E+10	1.93E+10
9/19/22	6.25	341	93.169	33.67	1.68	168.36	1.91E+10	1.91E+10
9/18/22	5.95	342	93.443	32.06	1.60	160.31	1.82E+10	1.82E+10
10/3/22	6.29	343	93.716	33.92	1.70	169.61	1.92E+10	1.92E+10
9/24/22	5.62	344	93.989	30.30	1.52	151.50	1.72E+10	1.72E+10
7/5/22	6.27	345	94.262	33.81	1.69	169.03	1.92E+10	1.92E+10
10/4/22	5.71	346	94.536	30.77	1.54	153.87	1.75E+10	1.75E+10
6/29/22	6.32	347	94.809	34.06	1.70	170.30	1.93E+10	1.93E+10
10/5/22	5.88	348	95.082	31.72	1.59	158.58	1.80E+10	1.80E+10
10/17/22	3.59	349	95.355	19.36	0.97	96.79	1.10E+10	1.10E+10
10/6/22	4.81	350	95.628	25.92	1.30	129.58	1.47E+10	1.47E+10
6/30/22	5.60	351	95.902	30.20	1.51	151.01	1.71E+10	1.71E+10
10/7/22	5.47	352	96.175	29.50	1.47	147.49	1.67E+10	1.67E+10
7/1/22	5.54	353	96.448	29.86	1.49	149.32	1.69E+10	1.69E+10
7/2/22	5.63	354	96.721	30.34	1.52	151.72	1.72E+10	1.72E+10
10/8/22	4.62	355	96.995	24.90	1.24	124.48	1.41E+10	1.41E+10
10/16/22	3.02	356	97.268	16.27	0.81	81.36	9.23E+09	9.23E+09
10/9/22	3.52	357	97.541	18.98	0.95	94.92	1.08E+10	1.08E+10
7/3/22	4.89	358	97.814	26.37	1.32	131.87	1.50E+10	1.50E+10
10/13/22	4.56	359	98.087	24.60	1.23	123.02	1.40E+10	1.40E+10
10/10/22	3.37	360	98.361	18.17	0.91	90.86	1.03E+10	1.03E+10
10/15/22	2.82	361	98.634	15.19	0.76	75.93	8.62E+09	8.62E+09
10/14/22	2.89	362	98.907	15.60	0.78	77.98	8.85E+09	8.85E+09
10/11/22	3.24	363	99.180	17.48	0.87	87.40	9.92E+09	9.92E+09
10/12/22	3.17	364	99.454	17.07	0.85	85.36	9.69E+09	9.69E+09
7/4/22	4.84	365	99.727	26.09	1.30	130.44	1.48E+10	1.48E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 4 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed
2/22/22	343.67	1.83	0.213	1.2	209	0.819672131
3/15/22	46.27	1.77	0.05	7.2	8	19.67213115
4/19/22	46.26	2.67	0.05	14	6	16.12021858
5/24/22	31.83	4.56	0.05	16	47.0	34.15300546
6/21/22	19.84	3.84	0.078	15.2	219.0	51.63934426
7/19/22	34.95	3.93	0.057	12	111.0	62.02185792
8/23/22	17.84	3.34	0.05	9.6	291.0	58.46994536
9/20/22	11.98	2.19	0.050	9.6	133.0	91.80327869
10/26/22	16.71	1.87	0.125	20.0	517.0	75.68306011
11/8/22	14.96	2.08	0.050	6.4	488.0	81.96721311
12/13/22	11.01	2.80	0.078	12.4	127.0	64.75409836
1/18/23	50.55	0.30	0.071	6.8	61.0	53.00546448
2/24/23						

Site 4 Date	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	3389.867799	394.558383	2222.86413	1.76E+12	21	71187.22377	8285.726045	46680.14673	3.69E+13
3/15/22	441.469668	12.4708946	1795.808819	9.06E+09	35	15451.43838	436.4813102	62853.30867	3.17E+11
4/19/22	665.7733082	12.4676649	3490.946185	6.79E+09	35	23302.06579	436.3682731	122183.1165	2.38E+11
5/24/22	782.4221301	8.57919002	2745.340807	3.66E+10	28	21907.81964	240.2173206	76869.5426	1.02E+12
6/21/22	410.5435806	8.33916648	1625.06834	1.06E+11	28	11495.22026	233.4966614	45501.91351	2.98E+12
7/19/22	740.2742915	10.7368027	2260.379516	9.49E+10	35	25909.6002	375.7880946	79113.28307	3.32E+12
8/23/22	321.1495315	4.80762772	923.0645217	1.27E+11	28	8992.186882	134.6135761	25845.80661	3.56E+12
9/20/22	141.4721505	3.22814471	619.8037834	3.90E+10	36	5092.997416	116.2132094	22312.9362	1.40E+12
10/26/22	168.8577129	11.257361	1801.177757	2.11E+11	13	2195.150268	146.3456927	23415.31084	2.75E+12
11/8/22	167.6059107	4.03232266	516.1373003	1.79E+11	35	5866.206875	141.1312931	18064.80551	6.25E+12
12/13/22	166.159055	4.62871653	735.8472435	3.42E+10	36	5981.725979	166.6337951	26490.50076	1.23E+12
1/18/23	81.73548453	19.3440647	1852.670983	7.54E+10	37	3024.212928	715.7303928	68548.82636	2.79E+12
2/24/23									

	NO3	TP	TSS	Ecoli
Conversion Factor	5.39	5.39	5.39	2.45E+07

	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
TOTAL	200,405.8	11,428.7	617,879.5	6.28E+13
TARGET	43,416.0	2,170.8	217,080.0	2.46E+13

Site 5 Date	E5	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	123.50	1	0.273	665.64	33.28	3328.21	3.78E+11	3.78E+11
2/24/22	124.70	2	0.546	672.15	33.61	3360.76	3.81E+11	3.81E+11
2/22/22	117.75	3	0.820	634.68	31.73	3173.40	3.60E+11	3.60E+11
2/25/22	121.39	4	1.093	654.27	32.71	3271.35	3.71E+11	3.71E+11
2/26/22	116.44	5	1.366	627.60	31.38	3138.00	3.56E+11	3.56E+11
2/21/22	114.02	6	1.639	614.56	30.73	3072.79	3.49E+11	3.49E+11
2/27/22	114.27	7	1.913	615.93	30.80	3079.65	3.49E+11	3.49E+11
2/20/22	101.89	8	2.186	549.20	27.46	2746.02	3.12E+11	3.12E+11
2/19/22	109.38	9	2.459	589.54	29.48	2947.71	3.34E+11	3.34E+11
2/28/22	109.47	10	2.732	590.03	29.50	2950.14	3.35E+11	3.35E+11
3/1/22	108.64	11	3.005	585.58	29.28	2927.89	3.32E+11	3.32E+11
3/2/22	105.13	12	3.279	566.64	28.33	2833.22	3.22E+11	3.22E+11
3/3/22	105.38	13	3.552	568.02	28.40	2840.08	3.22E+11	3.22E+11
3/4/22	104.35	14	3.825	562.44	28.12	2812.18	3.19E+11	3.19E+11
3/26/22	95.58	15	4.098	515.19	25.76	2575.96	2.92E+11	2.92E+11
3/27/22	95.95	16	4.372	517.16	25.86	2585.80	2.93E+11	2.93E+11
3/28/22	96.50	17	4.645	520.15	26.01	2600.74	2.95E+11	2.95E+11
3/25/22	92.94	18	4.918	500.97	25.05	2504.85	2.84E+11	2.84E+11
3/5/22	95.41	19	5.191	514.25	25.71	2571.24	2.92E+11	2.92E+11
2/18/22	90.42	20	5.464	487.34	24.37	2436.70	2.77E+11	2.77E+11
3/29/22	95.67	21	5.738	515.67	25.78	2578.33	2.93E+11	2.93E+11
3/24/22	89.25	22	6.011	481.06	24.05	2405.30	2.73E+11	2.73E+11
3/30/22	87.85	23	6.284	473.49	23.67	2367.46	2.69E+11	2.69E+11
3/7/22	92.99	24	6.557	501.20	25.06	2506.01	2.84E+11	2.84E+11
3/6/22	91.82	25	6.831	494.92	24.75	2474.59	2.81E+11	2.81E+11
3/8/22	94.79	26	7.104	510.89	25.54	2554.47	2.90E+11	2.90E+11
3/31/22	83.68	27	7.377	451.06	22.55	2255.29	2.56E+11	2.56E+11
3/9/22	92.90	28	7.650	500.76	25.04	2503.78	2.84E+11	2.84E+11
4/1/22	85.19	29	7.923	459.20	22.96	2295.98	2.61E+11	2.61E+11
4/2/22	85.94	30	8.197	463.22	23.16	2316.12	2.63E+11	2.63E+11
3/10/22	92.04	31	8.470	496.12	24.81	2480.61	2.81E+11	2.81E+11
3/23/22	80.90	32	8.743	436.04	21.80	2180.19	2.47E+11	2.47E+11
4/3/22	84.34	33	9.016	454.58	22.73	2272.90	2.58E+11	2.58E+11
5/8/22	81.15	34	9.290	437.41	21.87	2187.07	2.48E+11	2.48E+11
3/11/22	82.69	35	9.563	445.72	22.29	2228.60	2.53E+11	2.53E+11
5/9/22	79.30	36	9.836	427.44	21.37	2137.22	2.43E+11	2.43E+11
5/7/22	81.49	37	10.109	439.24	21.96	2196.22	2.49E+11	2.49E+11
4/4/22	79.97	38	10.383	431.04	21.55	2155.20	2.45E+11	2.45E+11
5/10/22	78.86	39	10.656	425.07	21.25	2125.33	2.41E+11	2.41E+11
4/5/22	83.46	40	10.929	449.85	22.49	2249.27	2.55E+11	2.55E+11
4/7/22	79.65	41	11.202	429.34	21.47	2146.68	2.44E+11	2.44E+11
5/11/22	80.47	42	11.475	433.73	21.69	2168.63	2.46E+11	2.46E+11
4/6/22	78.67	43	11.749	424.03	21.20	2120.15	2.41E+11	2.41E+11
4/8/22	73.91	44	12.022	398.39	19.92	1991.93	2.26E+11	2.26E+11
3/12/22	80.99	45	12.295	436.56	21.83	2182.81	2.48E+11	2.48E+11
4/15/22	77.56	46	12.568	418.02	20.90	2090.12	2.37E+11	2.37E+11
4/16/22	76.92	47	12.842	414.61	20.73	2073.07	2.35E+11	2.35E+11
4/9/22	78.46	48	13.115	422.89	21.14	2114.43	2.40E+11	2.40E+11
5/12/22	75.90	49	13.388	409.09	20.45	2045.45	2.32E+11	2.32E+11
3/22/22	76.33	50	13.661	411.43	20.57	2057.15	2.33E+11	2.33E+11
4/17/22	78.66	51	13.934	423.95	21.20	2119.77	2.41E+11	2.41E+11
4/14/22	73.16	52	14.208	394.35	19.72	1971.74	2.24E+11	2.24E+11
3/21/22	77.77	53	14.481	419.20	20.96	2095.99	2.38E+11	2.38E+11
5/6/22	71.30	54	14.754	384.33	19.22	1921.67	2.18E+11	2.18E+11
4/10/22	76.56	55	15.027	412.64	20.63	2063.21	2.34E+11	2.34E+11
3/13/22	75.85	56	15.301	408.85	20.44	2044.23	2.32E+11	2.32E+11
4/18/22	72.30	57	15.574	389.71	19.49	1948.57	2.21E+11	2.21E+11
5/13/22	72.20	58	15.847	389.18	19.46	1945.90	2.21E+11	2.21E+11
4/19/22	74.16	59	16.120	399.70	19.98	1998.50	2.27E+11	2.27E+11
3/20/22	72.66	60	16.393	391.64	19.58	1958.22	2.22E+11	2.22E+11

4/20/22	71.16	61	16.667	383.53	19.18	1917.65	2.18E+11	2.18E+11
4/11/22	75.65	62	16.940	407.75	20.39	2038.74	2.31E+11	2.31E+11
5/14/22	69.86	63	17.213	376.53	18.83	1882.64	2.14E+11	2.14E+11
3/14/22	75.45	64	17.486	406.68	20.33	2033.41	2.31E+11	2.31E+11
4/13/22	63.96	65	17.760	344.73	17.24	1723.65	1.96E+11	1.96E+11
4/21/22	67.50	66	18.033	363.82	18.19	1819.09	2.06E+11	2.06E+11
4/12/22	72.06	67	18.306	388.40	19.42	1942.02	2.20E+11	2.20E+11
2/17/22	64.44	68	18.579	347.34	17.37	1736.69	1.97E+11	1.97E+11
4/22/22	71.86	69	18.852	387.35	19.37	1936.76	2.20E+11	2.20E+11
5/15/22	68.05	70	19.126	366.77	18.34	1833.86	2.08E+11	2.08E+11
5/5/22	68.46	71	19.399	369.00	18.45	1844.98	2.09E+11	2.09E+11
3/15/22	72.86	72	19.672	392.73	19.64	1963.66	2.23E+11	2.23E+11
4/23/22	65.51	73	19.945	353.10	17.65	1765.48	2.00E+11	2.00E+11
4/25/22	68.45	74	20.219	368.97	18.45	1844.83	2.09E+11	2.09E+11
4/24/22	62.48	75	20.492	336.77	16.84	1683.85	1.91E+11	1.91E+11
5/4/22	67.65	76	20.765	364.64	18.23	1823.18	2.07E+11	2.07E+11
4/26/22	66.78	77	21.038	359.94	18.00	1799.71	2.04E+11	2.04E+11
3/16/22	69.03	78	21.311	372.08	18.60	1860.38	2.11E+11	2.11E+11
5/16/22	64.82	79	21.585	349.39	17.47	1746.96	1.98E+11	1.98E+11
3/19/22	63.88	80	21.858	344.32	17.22	1721.58	1.95E+11	1.95E+11
4/27/22	66.49	81	22.131	358.37	17.92	1791.86	2.03E+11	2.03E+11
3/17/22	67.67	82	22.404	364.73	18.24	1823.64	2.07E+11	2.07E+11
4/28/22	62.42	83	22.678	336.46	16.82	1682.32	1.91E+11	1.91E+11
5/17/22	60.89	84	22.951	328.20	16.41	1641.01	1.86E+11	1.86E+11
3/18/22	60.89	85	23.224	328.22	16.41	1641.11	1.86E+11	1.86E+11
5/3/22	60.60	86	23.497	326.62	16.33	1633.08	1.85E+11	1.85E+11
4/29/22	60.05	87	23.770	323.69	16.18	1618.45	1.84E+11	1.84E+11
5/18/22	57.87	88	24.044	311.92	15.60	1559.60	1.77E+11	1.77E+11
5/1/22	57.78	89	24.317	311.46	15.57	1557.30	1.77E+11	1.77E+11
6/11/22	59.31	90	24.590	319.68	15.98	1598.40	1.81E+11	1.81E+11
6/12/22	58.76	91	24.863	316.74	15.84	1583.69	1.80E+11	1.80E+11
4/30/22	56.17	92	25.137	302.77	15.14	1513.87	1.72E+11	1.72E+11
5/2/22	59.35	93	25.410	319.89	15.99	1599.47	1.82E+11	1.82E+11
6/10/22	58.42	94	25.683	314.86	15.74	1574.31	1.79E+11	1.79E+11
5/19/22	56.13	95	25.956	302.51	15.13	1512.57	1.72E+11	1.72E+11
6/13/22	58.21	96	26.230	313.73	15.69	1568.67	1.78E+11	1.78E+11
6/9/22	57.47	97	26.503	309.77	15.49	1548.86	1.76E+11	1.76E+11
6/14/22	57.96	98	26.776	312.41	15.62	1562.04	1.77E+11	1.77E+11
5/20/22	54.02	99	27.049	291.16	14.56	1455.79	1.65E+11	1.65E+11
6/15/22	56.18	100	27.322	302.80	15.14	1514.02	1.72E+11	1.72E+11
6/8/22	52.88	101	27.596	285.05	14.25	1425.23	1.62E+11	1.62E+11
6/2/22	53.64	102	27.869	289.15	14.46	1445.73	1.64E+11	1.64E+11
5/21/22	52.54	103	28.142	283.17	14.16	1415.85	1.61E+11	1.61E+11
6/1/22	52.08	104	28.415	280.72	14.04	1403.60	1.59E+11	1.59E+11
5/30/22	53.01	105	28.689	285.70	14.28	1428.50	1.62E+11	1.62E+11
7/28/22	49.19	106	28.962	265.15	13.26	1325.75	1.50E+11	1.50E+11
6/3/22	52.25	107	29.235	281.61	14.08	1408.07	1.60E+11	1.60E+11
7/27/22	49.13	108	29.508	264.83	13.24	1324.15	1.50E+11	1.50E+11
5/31/22	53.08	109	29.781	286.13	14.31	1430.63	1.62E+11	1.62E+11
7/29/22	49.03	110	30.055	264.27	13.21	1321.33	1.50E+11	1.50E+11
5/29/22	51.31	111	30.328	276.55	13.83	1382.77	1.57E+11	1.57E+11
7/26/22	47.22	112	30.601	254.51	12.73	1272.56	1.44E+11	1.44E+11
5/22/22	50.53	113	30.874	272.35	13.62	1361.73	1.55E+11	1.55E+11
6/7/22	51.24	114	31.148	276.17	13.81	1380.86	1.57E+11	1.57E+11
6/16/22	52.83	115	31.421	284.75	14.24	1423.77	1.62E+11	1.62E+11
6/4/22	50.40	116	31.694	271.63	13.58	1358.15	1.54E+11	1.54E+11
7/30/22	46.87	117	31.967	252.65	12.63	1263.25	1.43E+11	1.43E+11
7/25/22	46.11	118	32.240	248.52	12.43	1242.59	1.41E+11	1.41E+11
5/23/22	47.53	119	32.514	256.17	12.81	1280.86	1.45E+11	1.45E+11
6/5/22	47.91	120	32.787	258.23	12.91	1291.15	1.47E+11	1.47E+11
7/31/22	44.78	121	33.060	241.35	12.07	1206.77	1.37E+11	1.37E+11

6/17/22	48.72	122	33.333	262.60	13.13	1312.98	1.49E+11	1.49E+11
6/6/22	45.52	123	33.607	245.37	12.27	1226.87	1.39E+11	1.39E+11
5/28/22	47.05	124	33.880	253.58	12.68	1267.90	1.44E+11	1.44E+11
5/24/22	44.74	125	34.153	241.16	12.06	1205.78	1.37E+11	1.37E+11
7/24/22	42.96	126	34.426	231.54	11.58	1157.68	1.31E+11	1.31E+11
8/1/22	42.55	127	34.699	229.37	11.47	1146.85	1.30E+11	1.30E+11
2/16/22	37.58	128	34.973	202.55	10.13	1012.73	1.15E+11	1.15E+11
5/27/22	45.85	129	35.246	247.12	12.36	1235.58	1.40E+11	1.40E+11
5/25/22	44.17	130	35.519	238.07	11.90	1190.33	1.35E+11	1.35E+11
5/26/22	45.42	131	35.792	244.80	12.24	1223.99	1.39E+11	1.39E+11
6/18/22	45.29	132	36.066	244.10	12.20	1220.49	1.38E+11	1.38E+11
8/2/22	40.02	133	36.339	215.68	10.78	1078.41	1.22E+11	1.22E+11
2/13/22	41.47	134	36.612	223.50	11.18	1117.51	1.27E+11	1.27E+11
2/14/22	41.15	135	36.885	221.79	11.09	1108.97	1.26E+11	1.26E+11
2/15/22	40.41	136	37.158	217.80	10.89	1089.00	1.24E+11	1.24E+11
8/3/22	37.34	137	37.432	201.24	10.06	1006.20	1.14E+11	1.14E+11
7/8/22	40.62	138	37.705	218.92	10.95	1094.59	1.24E+11	1.24E+11
7/9/22	40.51	139	37.978	218.35	10.92	1091.75	1.24E+11	1.24E+11
6/19/22	40.51	140	38.251	218.34	10.92	1091.71	1.24E+11	1.24E+11
2/12/22	39.71	141	38.525	214.03	10.70	1070.17	1.21E+11	1.21E+11
8/4/22	36.46	142	38.798	196.50	9.83	982.52	1.11E+11	1.11E+11
1/25/23	33.39	143	39.071	179.95	9.00	899.74	1.02E+11	1.02E+11
1/23/23	32.43	144	39.344	174.81	8.74	874.05	9.92E+10	9.92E+10
1/22/23	33.24	145	39.617	179.19	8.96	895.93	1.02E+11	1.02E+11
1/26/23	32.60	146	39.891	175.69	8.78	878.47	9.97E+10	9.97E+10
7/10/22	39.78	147	40.164	214.43	10.72	1072.16	1.22E+11	1.22E+11
7/23/22	35.08	148	40.437	189.10	9.45	945.48	1.07E+11	1.07E+11
1/24/23	31.41	149	40.710	169.30	8.46	846.49	9.61E+10	9.61E+10
1/27/23	30.16	150	40.984	162.58	8.13	812.90	9.22E+10	9.22E+10
7/7/22	39.29	151	41.257	211.80	10.59	1059.00	1.20E+11	1.20E+11
1/8/23	33.09	152	41.530	178.33	8.92	891.66	1.01E+11	1.01E+11
1/28/23	32.64	153	41.803	175.92	8.80	879.62	9.98E+10	9.98E+10
1/21/23	31.24	154	42.077	168.39	8.42	841.96	9.55E+10	9.55E+10
1/7/23	32.60	155	42.350	175.74	8.79	878.70	9.97E+10	9.97E+10
1/29/23	31.49	156	42.623	169.71	8.49	848.56	9.63E+10	9.63E+10
1/6/23	31.82	157	42.896	171.53	8.58	857.66	9.73E+10	9.73E+10
8/5/22	32.99	158	43.169	177.80	8.89	889.02	1.01E+11	1.01E+11
1/9/23	32.18	159	43.443	173.45	8.67	867.27	9.84E+10	9.84E+10
7/11/22	38.25	160	43.716	206.15	10.31	1030.77	1.17E+11	1.17E+11
1/30/23	32.01	161	43.989	172.55	8.63	862.77	9.79E+10	9.79E+10
1/10/23	32.10	162	44.262	172.99	8.65	864.97	9.82E+10	9.82E+10
1/5/23	31.03	163	44.536	167.25	8.36	836.26	9.49E+10	9.49E+10
2/7/22	35.16	164	44.809	189.49	9.47	947.45	1.08E+11	1.08E+11
1/20/23	30.53	165	45.082	164.54	8.23	822.69	9.34E+10	9.34E+10
1/31/23	30.27	166	45.355	163.16	8.16	815.82	9.26E+10	9.26E+10
2/8/22	33.91	167	45.628	182.78	9.14	913.90	1.04E+11	1.04E+11
6/20/22	37.45	168	45.902	201.87	10.09	1009.35	1.15E+11	1.15E+11
2/6/22	31.06	169	46.175	167.42	8.37	837.08	9.50E+10	9.50E+10
1/12/23	31.19	170	46.448	168.13	8.41	840.64	9.54E+10	9.54E+10
2/3/22	35.73	171	46.721	192.57	9.63	962.85	1.09E+11	1.09E+11
8/6/22	31.70	172	46.995	170.85	8.54	854.25	9.69E+10	9.69E+10
7/12/22	35.74	173	47.268	192.66	9.63	963.31	1.09E+11	1.09E+11
2/4/22	31.60	174	47.541	170.33	8.52	851.67	9.66E+10	9.66E+10
2/5/22	34.08	175	47.814	183.67	9.18	918.34	1.04E+11	1.04E+11
1/4/23	29.55	176	48.087	159.29	7.96	796.47	9.04E+10	9.04E+10
1/13/23	29.87	177	48.361	160.98	8.05	804.92	9.13E+10	9.13E+10
2/11/22	29.43	178	48.634	158.61	7.93	793.07	9.00E+10	9.00E+10
1/19/23	29.10	179	48.907	156.87	7.84	784.35	8.90E+10	8.90E+10
1/14/23	29.32	180	49.180	158.06	7.90	790.28	8.97E+10	8.97E+10
2/9/22	32.09	181	49.454	172.96	8.65	864.82	9.81E+10	9.81E+10
8/7/22	30.04	182	49.727	161.90	8.09	809.48	9.19E+10	9.19E+10

1/15/23	28.24	183	50.000	152.20	7.61	761.01	8.64E+10	8.64E+10
8/8/22	28.77	184	50.273	155.08	7.75	775.40	8.80E+10	8.80E+10
2/2/22	33.65	185	50.546	181.36	9.07	906.81	1.03E+11	1.03E+11
7/13/22	32.87	186	50.820	177.18	8.86	885.88	1.01E+11	1.01E+11
2/10/22	32.54	187	51.093	175.39	8.77	876.95	9.95E+10	9.95E+10
8/9/22	28.13	188	51.366	151.64	7.58	758.21	8.60E+10	8.60E+10
6/21/22	33.39	189	51.639	179.96	9.00	899.82	1.02E+11	1.02E+11
1/16/23	27.69	190	51.913	149.28	7.46	746.38	8.47E+10	8.47E+10
1/3/23	25.51	191	52.186	137.50	6.88	687.52	7.80E+10	7.80E+10
1/17/23	26.34	192	52.459	141.96	7.10	709.79	8.05E+10	8.05E+10
7/14/22	30.57	193	52.732	164.75	8.24	823.74	9.35E+10	9.35E+10
1/18/23	25.42	194	53.005	137.01	6.85	685.07	7.77E+10	7.77E+10
7/22/22	25.66	195	53.279	138.33	6.92	691.65	7.85E+10	7.85E+10
8/10/22	26.90	196	53.552	144.96	7.25	724.82	8.23E+10	8.23E+10
8/22/22	25.72	197	53.825	138.65	6.93	693.23	7.87E+10	7.87E+10
12/2/22	18.68	198	54.098	100.67	5.03	503.36	5.71E+10	5.71E+10
12/1/22	22.02	199	54.372	118.69	5.93	593.45	6.73E+10	6.73E+10
7/15/22	27.37	200	54.645	147.55	7.38	737.75	8.37E+10	8.37E+10
7/6/22	28.38	201	54.918	152.99	7.65	764.96	8.68E+10	8.68E+10
12/4/22	22.26	202	55.191	119.96	6.00	599.82	6.81E+10	6.81E+10
1/2/23	24.39	203	55.464	131.44	6.57	657.20	7.46E+10	7.46E+10
12/3/22	22.82	204	55.738	123.02	6.15	615.08	6.98E+10	6.98E+10
11/30/22	21.96	205	56.011	118.34	5.92	591.69	6.71E+10	6.71E+10
6/22/22	29.26	206	56.284	157.73	7.89	788.67	8.95E+10	8.95E+10
7/16/22	25.86	207	56.557	139.37	6.97	696.85	7.91E+10	7.91E+10
8/21/22	24.43	208	56.831	131.68	6.58	658.39	7.47E+10	7.47E+10
12/5/22	21.82	209	57.104	117.62	5.88	588.08	6.67E+10	6.67E+10
11/29/22	17.68	210	57.377	95.27	4.76	476.35	5.41E+10	5.41E+10
8/11/22	24.49	211	57.650	132.01	6.60	660.04	7.49E+10	7.49E+10
1/1/23	22.00	212	57.923	118.57	5.93	592.84	6.73E+10	6.73E+10
12/6/22	22.56	213	58.197	121.62	6.08	608.12	6.90E+10	6.90E+10
8/23/22	22.73	214	58.470	122.53	6.13	612.67	6.95E+10	6.95E+10
7/17/22	25.58	215	58.743	137.88	6.89	689.40	7.82E+10	7.82E+10
1/11/23	29.46	216	59.016	158.79	7.94	793.94	9.01E+10	9.01E+10
12/7/22	21.14	217	59.290	113.94	5.70	569.69	6.46E+10	6.46E+10
7/18/22	24.95	218	59.563	134.49	6.72	672.47	7.63E+10	7.63E+10
12/8/22	20.65	219	59.836	111.30	5.57	556.51	6.32E+10	6.32E+10
8/31/22	20.33	220	60.109	109.56	5.48	547.78	6.22E+10	6.22E+10
12/9/22	17.47	221	60.383	94.14	4.71	470.71	5.34E+10	5.34E+10
8/30/22	20.75	222	60.656	111.86	5.59	559.28	6.35E+10	6.35E+10
12/10/22	18.45	223	60.929	99.45	4.97	497.25	5.64E+10	5.64E+10
12/31/22	20.21	224	61.202	108.91	5.45	544.57	6.18E+10	6.18E+10
2/1/22	22.75	225	61.475	122.60	6.13	612.99	6.96E+10	6.96E+10
8/12/22	21.09	226	61.749	113.69	5.68	568.45	6.45E+10	6.45E+10
7/19/22	21.92	227	62.022	118.17	5.91	590.87	6.71E+10	6.71E+10
8/24/22	19.24	228	62.295	103.73	5.19	518.64	5.89E+10	5.89E+10
11/28/22	16.24	229	62.568	87.52	4.38	437.60	4.97E+10	4.97E+10
12/11/22	18.77	230	62.842	101.16	5.06	505.80	5.74E+10	5.74E+10
6/23/22	24.89	231	63.115	134.18	6.71	670.89	7.61E+10	7.61E+10
8/15/22	19.24	232	63.388	103.71	5.19	518.55	5.88E+10	5.88E+10
9/1/22	17.78	233	63.661	95.83	4.79	479.17	5.44E+10	5.44E+10
12/12/22	19.19	234	63.934	103.43	5.17	517.16	5.87E+10	5.87E+10
8/14/22	19.52	235	64.208	105.21	5.26	526.06	5.97E+10	5.97E+10
12/16/22	16.37	236	64.481	88.23	4.41	441.13	5.01E+10	5.01E+10
12/13/22	16.22	237	64.754	87.40	4.37	437.02	4.96E+10	4.96E+10
12/15/22	15.29	238	65.027	82.40	4.12	411.98	4.68E+10	4.68E+10
12/17/22	17.05	239	65.301	91.91	4.60	459.53	5.21E+10	5.21E+10
8/13/22	18.92	240	65.574	102.00	5.10	510.01	5.79E+10	5.79E+10
7/20/22	19.50	241	65.847	105.09	5.25	525.44	5.96E+10	5.96E+10
8/16/22	18.05	242	66.120	97.28	4.86	486.41	5.52E+10	5.52E+10
12/14/22	16.88	243	66.393	91.00	4.55	454.98	5.16E+10	5.16E+10

12/24/22	11.11	244	66.667	59.88	2.99	299.42	3.40E+10	3.40E+10
8/25/22	17.80	245	66.940	95.94	4.80	479.71	5.44E+10	5.44E+10
9/2/22	16.89	246	67.213	91.02	4.55	455.11	5.16E+10	5.16E+10
12/18/22	16.89	247	67.486	91.04	4.55	455.20	5.17E+10	5.17E+10
12/23/22	10.99	248	67.760	59.25	2.96	296.24	3.36E+10	3.36E+10
12/20/22	17.01	249	68.033	91.68	4.58	458.39	5.20E+10	5.20E+10
10/23/22	15.84	250	68.306	85.39	4.27	426.96	4.85E+10	4.85E+10
12/19/22	16.83	251	68.579	90.70	4.54	453.52	5.15E+10	5.15E+10
12/27/22	8.94	252	68.852	48.18	2.41	240.92	2.73E+10	2.73E+10
12/26/22	11.37	253	69.126	61.29	3.06	306.44	3.48E+10	3.48E+10
12/30/22	14.78	254	69.399	79.64	3.98	398.21	4.52E+10	4.52E+10
7/21/22	18.31	255	69.672	98.67	4.93	493.34	5.60E+10	5.60E+10
8/17/22	16.59	256	69.945	89.44	4.47	447.22	5.07E+10	5.07E+10
6/24/22	21.23	257	70.219	114.43	5.72	572.15	6.49E+10	6.49E+10
12/21/22	17.02	258	70.492	91.71	4.59	458.57	5.20E+10	5.20E+10
12/28/22	8.15	259	70.765	43.93	2.20	219.66	2.49E+10	2.49E+10
12/25/22	9.65	260	71.038	52.03	2.60	260.14	2.95E+10	2.95E+10
9/3/22	16.07	261	71.311	86.60	4.33	433.02	4.91E+10	4.91E+10
8/26/22	15.86	262	71.585	85.47	4.27	427.37	4.85E+10	4.85E+10
12/22/22	16.51	263	71.858	88.97	4.45	444.86	5.05E+10	5.05E+10
8/29/22	14.46	264	72.131	77.95	3.90	389.77	4.42E+10	4.42E+10
8/27/22	16.09	265	72.404	86.73	4.34	433.63	4.92E+10	4.92E+10
9/4/22	15.36	266	72.678	82.81	4.14	414.04	4.70E+10	4.70E+10
8/18/22	15.89	267	72.951	85.63	4.28	428.14	4.86E+10	4.86E+10
12/29/22	9.19	268	73.224	49.56	2.48	247.79	2.81E+10	2.81E+10
10/24/22	13.46	269	73.497	72.53	3.63	362.67	4.12E+10	4.12E+10
8/19/22	15.25	270	73.770	82.19	4.11	410.93	4.66E+10	4.66E+10
8/28/22	15.11	271	74.044	81.42	4.07	407.10	4.62E+10	4.62E+10
8/20/22	14.47	272	74.317	77.98	3.90	389.92	4.42E+10	4.42E+10
9/5/22	14.90	273	74.590	80.32	4.02	401.61	4.56E+10	4.56E+10
6/25/22	19.14	274	74.863	103.17	5.16	515.87	5.85E+10	5.85E+10
9/6/22	14.20	275	75.137	76.54	3.83	382.72	4.34E+10	4.34E+10
10/25/22	11.55	276	75.410	62.27	3.11	311.35	3.53E+10	3.53E+10
10/26/22	12.49	277	75.683	67.31	3.37	336.55	3.82E+10	3.82E+10
10/27/22	12.35	278	75.956	66.59	3.33	332.93	3.78E+10	3.78E+10
11/27/22	11.17	279	76.230	60.19	3.01	300.95	3.42E+10	3.42E+10
10/28/22	12.40	280	76.503	66.85	3.34	334.23	3.79E+10	3.79E+10
9/7/22	14.27	281	76.776	76.93	3.85	384.65	4.36E+10	4.36E+10
9/27/22	14.74	282	77.049	79.45	3.97	397.24	4.51E+10	4.51E+10
10/29/22	11.74	283	77.322	63.30	3.17	316.51	3.59E+10	3.59E+10
6/26/22	17.38	284	77.596	93.70	4.68	468.49	5.32E+10	5.32E+10
9/28/22	14.01	285	77.869	75.53	3.78	377.64	4.29E+10	4.29E+10
10/30/22	11.58	286	78.142	62.43	3.12	312.17	3.54E+10	3.54E+10
11/1/22	10.94	287	78.415	58.95	2.95	294.73	3.34E+10	3.34E+10
10/31/22	11.03	288	78.689	59.44	2.97	297.22	3.37E+10	3.37E+10
11/2/22	11.52	289	78.962	62.07	3.10	310.34	3.52E+10	3.52E+10
11/4/22	10.93	290	79.235	58.93	2.95	294.64	3.34E+10	3.34E+10
11/3/22	11.57	291	79.508	62.37	3.12	311.87	3.54E+10	3.54E+10
9/26/22	14.01	292	79.781	75.51	3.78	377.57	4.28E+10	4.28E+10
9/8/22	13.30	293	80.055	71.71	3.59	358.54	4.07E+10	4.07E+10
11/5/22	10.32	294	80.328	55.62	2.78	278.08	3.16E+10	3.16E+10
10/19/22	10.81	295	80.601	58.26	2.91	291.30	3.31E+10	3.31E+10
9/29/22	13.25	296	80.874	71.43	3.57	357.16	4.05E+10	4.05E+10
10/22/22	11.18	297	81.148	60.25	3.01	301.26	3.42E+10	3.42E+10
11/7/22	10.81	298	81.421	58.29	2.91	291.46	3.31E+10	3.31E+10
11/6/22	10.71	299	81.694	57.71	2.89	288.55	3.27E+10	3.27E+10
11/8/22	11.69	300	81.967	63.01	3.15	315.07	3.58E+10	3.58E+10
10/20/22	10.75	301	82.240	57.96	2.90	289.79	3.29E+10	3.29E+10
11/9/22	10.70	302	82.514	57.69	2.88	288.46	3.27E+10	3.27E+10
9/9/22	12.02	303	82.787	64.81	3.24	324.04	3.68E+10	3.68E+10
9/30/22	13.13	304	83.060	70.78	3.54	353.91	4.02E+10	4.02E+10

11/10/22	9.74	305	83.333	52.48	2.62	262.42	2.98E+10	2.98E+10
9/12/22	13.37	306	83.607	72.05	3.60	360.25	4.09E+10	4.09E+10
11/11/22	10.91	307	83.880	58.80	2.94	293.99	3.34E+10	3.34E+10
10/18/22	9.67	308	84.153	52.11	2.61	260.57	2.96E+10	2.96E+10
6/27/22	15.05	309	84.426	81.09	4.05	405.47	4.60E+10	4.60E+10
10/21/22	10.24	310	84.699	55.19	2.76	275.97	3.13E+10	3.13E+10
9/11/22	10.04	311	84.973	54.12	2.71	270.60	3.07E+10	3.07E+10
11/12/22	9.71	312	85.246	52.36	2.62	261.82	2.97E+10	2.97E+10
11/13/22	9.95	313	85.519	53.62	2.68	268.08	3.04E+10	3.04E+10
9/13/22	12.63	314	85.792	68.07	3.40	340.37	3.86E+10	3.86E+10
11/14/22	10.63	315	86.066	57.32	2.87	286.60	3.25E+10	3.25E+10
9/10/22	10.62	316	86.339	57.25	2.86	286.24	3.25E+10	3.25E+10
10/1/22	12.64	317	86.612	68.16	3.41	340.78	3.87E+10	3.87E+10
11/15/22	10.30	318	86.885	55.50	2.78	277.51	3.15E+10	3.15E+10
9/14/22	11.68	319	87.158	62.96	3.15	314.82	3.57E+10	3.57E+10
11/16/22	9.03	320	87.432	48.65	2.43	243.27	2.76E+10	2.76E+10
11/17/22	9.01	321	87.705	48.57	2.43	242.83	2.76E+10	2.76E+10
9/15/22	11.27	322	87.978	60.74	3.04	303.70	3.45E+10	3.45E+10
11/26/22	9.22	323	88.251	49.68	2.48	248.38	2.82E+10	2.82E+10
9/25/22	10.39	324	88.525	56.01	2.80	280.05	3.18E+10	3.18E+10
9/21/22	11.51	325	88.798	62.06	3.10	310.32	3.52E+10	3.52E+10
11/18/22	8.89	326	89.071	47.94	2.40	239.70	2.72E+10	2.72E+10
11/25/22	9.34	327	89.344	50.36	2.52	251.78	2.86E+10	2.86E+10
11/19/22	8.67	328	89.617	46.75	2.34	233.75	2.65E+10	2.65E+10
9/22/22	12.00	329	89.891	64.68	3.23	323.39	3.67E+10	3.67E+10
9/16/22	10.77	330	90.164	58.07	2.90	290.33	3.29E+10	3.29E+10
11/24/22	8.56	331	90.437	46.12	2.31	230.60	2.62E+10	2.62E+10
10/2/22	11.93	332	90.710	64.31	3.22	321.55	3.65E+10	3.65E+10
11/22/22	8.79	333	90.984	47.36	2.37	236.80	2.69E+10	2.69E+10
11/21/22	8.01	334	91.257	43.16	2.16	215.79	2.45E+10	2.45E+10
11/23/22	8.45	335	91.530	45.54	2.28	227.69	2.58E+10	2.58E+10
9/20/22	10.57	336	91.803	56.97	2.85	284.85	3.23E+10	3.23E+10
6/28/22	12.30	337	92.077	66.32	3.32	331.59	3.76E+10	3.76E+10
11/20/22	8.47	338	92.350	45.66	2.28	228.32	2.59E+10	2.59E+10
9/17/22	9.86	339	92.623	53.17	2.66	265.84	3.02E+10	3.02E+10
9/23/22	10.98	340	92.896	59.21	2.96	296.03	3.36E+10	3.36E+10
9/19/22	10.87	341	93.169	58.59	2.93	292.95	3.32E+10	3.32E+10
9/18/22	10.35	342	93.443	55.79	2.79	278.94	3.17E+10	3.17E+10
10/3/22	10.95	343	93.716	59.02	2.95	295.11	3.35E+10	3.35E+10
9/24/22	9.78	344	93.989	52.72	2.64	263.61	2.99E+10	2.99E+10
7/5/22	10.91	345	94.262	58.82	2.94	294.10	3.34E+10	3.34E+10
10/4/22	9.93	346	94.536	53.55	2.68	267.73	3.04E+10	3.04E+10
6/29/22	11.00	347	94.809	59.26	2.96	296.32	3.36E+10	3.36E+10
10/5/22	10.24	348	95.082	55.19	2.76	275.94	3.13E+10	3.13E+10
10/17/22	6.25	349	95.355	33.68	1.68	168.42	1.91E+10	1.91E+10
10/6/22	8.37	350	95.628	45.09	2.25	225.47	2.56E+10	2.56E+10
6/30/22	9.75	351	95.902	52.55	2.63	262.75	2.98E+10	2.98E+10
10/7/22	9.52	352	96.175	51.33	2.57	256.64	2.91E+10	2.91E+10
7/1/22	9.64	353	96.448	51.96	2.60	259.81	2.95E+10	2.95E+10
7/2/22	9.80	354	96.721	52.80	2.64	263.99	3.00E+10	3.00E+10
10/8/22	8.04	355	96.995	43.32	2.17	216.60	2.46E+10	2.46E+10
10/16/22	5.25	356	97.268	28.31	1.42	141.56	1.61E+10	1.61E+10
10/9/22	6.13	357	97.541	33.03	1.65	165.16	1.87E+10	1.87E+10
7/3/22	8.51	358	97.814	45.89	2.29	229.45	2.60E+10	2.60E+10
10/13/22	7.94	359	98.087	42.81	2.14	214.05	2.43E+10	2.43E+10
10/10/22	5.87	360	98.361	31.62	1.58	158.09	1.79E+10	1.79E+10
10/15/22	4.90	361	98.634	26.42	1.32	132.12	1.50E+10	1.50E+10
10/14/22	5.03	362	98.907	27.14	1.36	135.69	1.54E+10	1.54E+10
10/11/22	5.64	363	99.180	30.42	1.52	152.08	1.73E+10	1.73E+10
10/12/22	5.51	364	99.454	29.71	1.49	148.53	1.69E+10	1.69E+10
7/4/22	8.42	365	99.727	45.39	2.27	226.97	2.58E+10	2.58E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 5 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	597.99	1.67	0.05	4	181	0.819672131	5382.671453	161.157828	12892.62624	2.65E+12	21	113036.1005	3384.314387	270745.151	5.56E+13
3/15/22	80.52	2.11	0.05	8.4	12	19.67213115	915.7138613	21.6993806	3645.495941	2.36E+10	35	32049.98515	759.478321	127592.3579	8.27E+11
4/19/22	80.50	2.09	0.05	21.2	11	16.12021858	906.7992113	21.693761	9198.15468	2.17E+10	35	31737.9724	759.2816363	321935.4138	7.58E+11
5/24/22	55.39	4.58	0.05	12.8	104.0	34.15300546	1367.387137	14.9278072	3821.518637	1.41E+11	28	38286.83984	417.9786009	107002.5218	3.95E+12
6/21/22	34.51	3.59	0.068	41.2	150.0	51.63934426	667.8396799	12.6498881	7664.343959	1.27E+11	28	18699.51104	354.1968665	214601.6309	3.55E+12
7/19/22	60.81	2.87	0.054	25.2	114.0	62.02185792	940.6579776	17.6987912	8259.435901	1.70E+11	35	32923.02922	619.4576926	289080.2565	5.94E+12
8/23/22	31.04	3.12	0.05	8.4	60.0	58.46994536	521.9935652	8.36528149	1405.367291	4.56E+10	28	14615.81983	234.2278818	39350.28415	1.28E+12
9/20/22	20.84	2.15	0.05	5.6	16.0	91.80327869	241.0863131	5.61697801	629.101537	8.16E+09	36	8679.107273	202.2112083	22647.65533	2.94E+11
10/26/22	29.07	1.47	0.050	2.8	105.0	75.68306011	230.0943191	7.83513192	438.7673875	7.47E+10	13	2991.226148	101.856715	5703.976038	9.71E+11
11/8/22	26.03	1.78	0.050	7.2	43.0	81.96721311	250.4253696	7.0162492	1010.339885	2.74E+10	35	8764.887937	245.5687219	35361.89596	9.59E+11
12/13/22	19.16	0.70	0.050	6.8	20.0	64.75409836	72.27926898	5.16280493	702.14147	9.37E+09	36	2602.053683	185.8609774	25277.09292	3.37E+11
1/18/23	87.95	0.10	0.050	7.2	20.0	53.00546448	47.40663354	23.7033168	3413.277615	4.30E+10	37	1754.045441	877.0227204	126291.2717	1.59E+12
2/24/23															

Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	306,140.6	8,141.5	1,585,589.5	7.61E+13
											TARGET	75,543.2	3,777.2	377,715.9	4.29E+13

Site 6 Date	E6	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	65.41	1	0.273	352.54	17.63	1762.72	2.00E+11	2.00E+11
2/24/22	66.05	2	0.546	355.99	17.80	1779.96	2.02E+11	2.02E+11
2/22/22	62.36	3	0.820	336.15	16.81	1680.73	1.91E+11	1.91E+11
2/25/22	64.29	4	1.093	346.52	17.33	1732.60	1.97E+11	1.97E+11
2/26/22	61.67	5	1.366	332.40	16.62	1661.98	1.89E+11	1.89E+11
2/21/22	60.39	6	1.639	325.49	16.27	1627.44	1.85E+11	1.85E+11
2/27/22	60.52	7	1.913	326.21	16.31	1631.07	1.85E+11	1.85E+11
2/20/22	53.97	8	2.186	290.87	14.54	1454.37	1.65E+11	1.65E+11
2/19/22	57.93	9	2.459	312.24	15.61	1561.19	1.77E+11	1.77E+11
2/28/22	57.98	10	2.732	312.50	15.62	1562.49	1.77E+11	1.77E+11
3/1/22	57.54	11	3.005	310.14	15.51	1550.70	1.76E+11	1.76E+11
3/2/22	55.68	12	3.279	300.11	15.01	1500.56	1.70E+11	1.70E+11
3/3/22	55.81	13	3.552	300.84	15.04	1504.19	1.71E+11	1.71E+11
3/4/22	55.27	14	3.825	297.88	14.89	1489.42	1.69E+11	1.69E+11
3/26/22	50.62	15	4.098	272.86	13.64	1364.31	1.55E+11	1.55E+11
3/27/22	50.82	16	4.372	273.90	13.70	1369.52	1.55E+11	1.55E+11
3/28/22	51.11	17	4.645	275.49	13.77	1377.43	1.56E+11	1.56E+11
3/25/22	49.23	18	4.918	265.33	13.27	1326.64	1.51E+11	1.51E+11
3/5/22	50.53	19	5.191	272.36	13.62	1361.81	1.55E+11	1.55E+11
2/18/22	47.89	20	5.464	258.11	12.91	1290.55	1.46E+11	1.46E+11
3/29/22	50.67	21	5.738	273.11	13.66	1365.56	1.55E+11	1.55E+11
3/24/22	47.27	22	6.011	254.78	12.74	1273.92	1.45E+11	1.45E+11
3/30/22	46.53	23	6.284	250.78	12.54	1253.88	1.42E+11	1.42E+11
3/7/22	49.25	24	6.557	265.45	13.27	1327.26	1.51E+11	1.51E+11
3/6/22	48.63	25	6.831	262.12	13.11	1310.62	1.49E+11	1.49E+11
3/8/22	50.20	26	7.104	270.58	13.53	1352.92	1.54E+11	1.54E+11
3/31/22	44.32	27	7.377	238.89	11.94	1194.47	1.36E+11	1.36E+11
3/9/22	49.21	28	7.650	265.22	13.26	1326.08	1.50E+11	1.50E+11
4/1/22	45.12	29	7.923	243.20	12.16	1216.02	1.38E+11	1.38E+11
4/2/22	45.52	30	8.197	245.34	12.27	1226.69	1.39E+11	1.39E+11
3/10/22	48.75	31	8.470	262.76	13.14	1313.81	1.49E+11	1.49E+11
3/23/22	42.85	32	8.743	230.94	11.55	1154.70	1.31E+11	1.31E+11
4/3/22	44.67	33	9.016	240.76	12.04	1203.80	1.37E+11	1.37E+11
5/8/22	42.98	34	9.290	231.67	11.58	1158.34	1.31E+11	1.31E+11
3/11/22	43.80	35	9.563	236.07	11.80	1180.34	1.34E+11	1.34E+11
5/9/22	42.00	36	9.836	226.39	11.32	1131.94	1.28E+11	1.28E+11
5/7/22	43.16	37	10.109	232.64	11.63	1163.18	1.32E+11	1.32E+11
4/4/22	42.35	38	10.383	228.29	11.41	1141.46	1.30E+11	1.30E+11
5/10/22	41.77	39	10.656	225.13	11.26	1125.64	1.28E+11	1.28E+11
4/5/22	44.20	40	10.929	238.26	11.91	1191.28	1.35E+11	1.35E+11
4/7/22	42.19	41	11.202	227.39	11.37	1136.94	1.29E+11	1.29E+11
5/11/22	42.62	42	11.475	229.71	11.49	1148.57	1.30E+11	1.30E+11
4/6/22	41.67	43	11.749	224.58	11.23	1122.89	1.27E+11	1.27E+11
4/8/22	39.15	44	12.022	211.00	10.55	1054.98	1.20E+11	1.20E+11
3/12/22	42.90	45	12.295	231.22	11.56	1156.08	1.31E+11	1.31E+11
4/15/22	41.08	46	12.568	221.40	11.07	1106.99	1.26E+11	1.26E+11
4/16/22	40.74	47	12.842	219.59	10.98	1097.96	1.25E+11	1.25E+11
4/9/22	41.55	48	13.115	223.97	11.20	1119.87	1.27E+11	1.27E+11
5/12/22	40.20	49	13.388	216.67	10.83	1083.33	1.23E+11	1.23E+11
3/22/22	40.43	50	13.661	217.91	10.90	1089.53	1.24E+11	1.24E+11
4/17/22	41.66	51	13.934	224.54	11.23	1122.69	1.27E+11	1.27E+11
4/14/22	38.75	52	14.208	208.86	10.44	1044.29	1.19E+11	1.19E+11
3/21/22	41.19	53	14.481	222.02	11.10	1110.10	1.26E+11	1.26E+11
5/6/22	37.77	54	14.754	203.55	10.18	1017.77	1.15E+11	1.15E+11
4/10/22	40.55	55	15.027	218.55	10.93	1092.74	1.24E+11	1.24E+11
3/13/22	40.17	56	15.301	216.54	10.83	1082.69	1.23E+11	1.23E+11
4/18/22	38.29	57	15.574	206.40	10.32	1032.02	1.17E+11	1.17E+11
5/13/22	38.24	58	15.847	206.12	10.31	1030.61	1.17E+11	1.17E+11
4/19/22	39.28	59	16.120	211.69	10.58	1058.46	1.20E+11	1.20E+11
3/20/22	38.48	60	16.393	207.43	10.37	1037.13	1.18E+11	1.18E+11

4/20/22	37.69	61	16.667	203.13	10.16	1015.65	1.15E+11	1.15E+11
4/11/22	40.07	62	16.940	215.96	10.80	1079.78	1.23E+11	1.23E+11
5/14/22	37.00	63	17.213	199.42	9.97	997.10	1.13E+11	1.13E+11
3/14/22	39.96	64	17.486	215.39	10.77	1076.95	1.22E+11	1.22E+11
4/13/22	33.87	65	17.760	182.58	9.13	912.90	1.04E+11	1.04E+11
4/21/22	35.75	66	18.033	192.69	9.63	963.45	1.09E+11	1.09E+11
4/12/22	38.17	67	18.306	205.71	10.29	1028.55	1.17E+11	1.17E+11
2/17/22	34.13	68	18.579	183.96	9.20	919.80	1.04E+11	1.04E+11
4/22/22	38.06	69	18.852	205.15	10.26	1025.76	1.16E+11	1.16E+11
5/15/22	36.04	70	19.126	194.25	9.71	971.26	1.10E+11	1.10E+11
5/5/22	36.26	71	19.399	195.43	9.77	977.16	1.11E+11	1.11E+11
3/15/22	38.59	72	19.672	208.00	10.40	1040.02	1.18E+11	1.18E+11
4/23/22	34.70	73	19.945	187.01	9.35	935.05	1.06E+11	1.06E+11
4/25/22	36.26	74	20.219	195.42	9.77	977.08	1.11E+11	1.11E+11
4/24/22	33.09	75	20.492	178.36	8.92	891.82	1.01E+11	1.01E+11
5/4/22	35.83	76	20.765	193.12	9.66	965.61	1.10E+11	1.10E+11
4/26/22	35.37	77	21.038	190.64	9.53	953.18	1.08E+11	1.08E+11
3/16/22	36.56	78	21.311	197.06	9.85	985.31	1.12E+11	1.12E+11
5/16/22	34.33	79	21.585	185.05	9.25	925.24	1.05E+11	1.05E+11
3/19/22	33.83	80	21.858	182.36	9.12	911.80	1.03E+11	1.03E+11
4/27/22	35.21	81	22.131	189.80	9.49	949.02	1.08E+11	1.08E+11
3/17/22	35.84	82	22.404	193.17	9.66	965.86	1.10E+11	1.10E+11
4/28/22	33.06	83	22.678	178.20	8.91	891.01	1.01E+11	1.01E+11
5/17/22	32.25	84	22.951	173.83	8.69	869.13	9.86E+10	9.86E+10
3/18/22	32.25	85	23.224	173.84	8.69	869.18	9.86E+10	9.86E+10
5/3/22	32.09	86	23.497	172.99	8.65	864.93	9.82E+10	9.82E+10
4/29/22	31.81	87	23.770	171.44	8.57	857.18	9.73E+10	9.73E+10
5/18/22	30.65	88	24.044	165.20	8.26	826.01	9.37E+10	9.37E+10
5/1/22	30.60	89	24.317	164.96	8.25	824.79	9.36E+10	9.36E+10
6/11/22	31.41	90	24.590	169.31	8.47	846.56	9.61E+10	9.61E+10
6/12/22	31.12	91	24.863	167.75	8.39	838.77	9.52E+10	9.52E+10
4/30/22	29.75	92	25.137	160.36	8.02	801.79	9.10E+10	9.10E+10
5/2/22	31.43	93	25.410	169.43	8.47	847.13	9.61E+10	9.61E+10
6/10/22	30.94	94	25.683	166.76	8.34	833.80	9.46E+10	9.46E+10
5/19/22	29.73	95	25.956	160.22	8.01	801.10	9.09E+10	9.09E+10
6/13/22	30.83	96	26.230	166.16	8.31	830.82	9.43E+10	9.43E+10
6/9/22	30.44	97	26.503	164.06	8.20	820.32	9.31E+10	9.31E+10
6/14/22	30.70	98	26.776	165.46	8.27	827.30	9.39E+10	9.39E+10
5/20/22	28.61	99	27.049	154.21	7.71	771.03	8.75E+10	8.75E+10
6/15/22	29.75	100	27.322	160.37	8.02	801.87	9.10E+10	9.10E+10
6/8/22	28.01	101	27.596	150.97	7.55	754.85	8.57E+10	8.57E+10
6/2/22	28.41	102	27.869	153.14	7.66	765.70	8.69E+10	8.69E+10
5/21/22	27.82	103	28.142	149.97	7.50	749.87	8.51E+10	8.51E+10
6/1/22	27.58	104	28.415	148.68	7.43	743.39	8.44E+10	8.44E+10
5/30/22	28.07	105	28.689	151.32	7.57	756.58	8.59E+10	8.59E+10
7/28/22	26.05	106	28.962	140.43	7.02	702.16	7.97E+10	7.97E+10
6/3/22	27.67	107	29.235	149.15	7.46	745.76	8.46E+10	8.46E+10
7/27/22	26.02	108	29.508	140.26	7.01	701.31	7.96E+10	7.96E+10
5/31/22	28.12	109	29.781	151.54	7.58	757.71	8.60E+10	8.60E+10
7/29/22	25.97	110	30.055	139.96	7.00	699.82	7.94E+10	7.94E+10
5/29/22	27.17	111	30.328	146.47	7.32	732.35	8.31E+10	8.31E+10
7/26/22	25.01	112	30.601	134.80	6.74	673.99	7.65E+10	7.65E+10
5/22/22	26.76	113	30.874	144.24	7.21	721.21	8.18E+10	8.18E+10
6/7/22	27.14	114	31.148	146.27	7.31	731.35	8.30E+10	8.30E+10
6/16/22	27.98	115	31.421	150.81	7.54	754.07	8.56E+10	8.56E+10
6/4/22	26.69	116	31.694	143.86	7.19	719.31	8.16E+10	8.16E+10
7/30/22	24.83	117	31.967	133.81	6.69	669.05	7.59E+10	7.59E+10
7/25/22	24.42	118	32.240	131.62	6.58	658.11	7.47E+10	7.47E+10
5/23/22	25.17	119	32.514	135.68	6.78	678.38	7.70E+10	7.70E+10
6/5/22	25.37	120	32.787	136.77	6.84	683.83	7.76E+10	7.76E+10
7/31/22	23.72	121	33.060	127.83	6.39	639.14	7.25E+10	7.25E+10

6/17/22	25.80	122	33.333	139.08	6.95	695.40	7.89E+10	7.89E+10
6/6/22	24.11	123	33.607	129.96	6.50	649.78	7.37E+10	7.37E+10
5/28/22	24.92	124	33.880	134.30	6.72	671.52	7.62E+10	7.62E+10
5/24/22	23.70	125	34.153	127.72	6.39	638.61	7.25E+10	7.25E+10
7/24/22	22.75	126	34.426	122.63	6.13	613.14	6.96E+10	6.96E+10
8/1/22	22.54	127	34.699	121.48	6.07	607.41	6.89E+10	6.89E+10
2/16/22	19.90	128	34.973	107.27	5.36	536.37	6.09E+10	6.09E+10
5/27/22	24.28	129	35.246	130.88	6.54	654.40	7.43E+10	7.43E+10
5/25/22	23.39	130	35.519	126.09	6.30	630.43	7.15E+10	7.15E+10
5/26/22	24.05	131	35.792	129.65	6.48	648.26	7.36E+10	7.36E+10
6/18/22	23.99	132	36.066	129.28	6.46	646.41	7.34E+10	7.34E+10
8/2/22	21.19	133	36.339	114.23	5.71	571.16	6.48E+10	6.48E+10
2/13/22	21.96	134	36.612	118.37	5.92	591.87	6.72E+10	6.72E+10
2/14/22	21.79	135	36.885	117.47	5.87	587.34	6.67E+10	6.67E+10
2/15/22	21.40	136	37.158	115.35	5.77	576.77	6.55E+10	6.55E+10
8/3/22	19.77	137	37.432	106.58	5.33	532.91	6.05E+10	6.05E+10
7/8/22	21.51	138	37.705	115.95	5.80	579.73	6.58E+10	6.58E+10
7/9/22	21.46	139	37.978	115.64	5.78	578.22	6.56E+10	6.56E+10
6/19/22	21.45	140	38.251	115.64	5.78	578.20	6.56E+10	6.56E+10
2/12/22	21.03	141	38.525	113.36	5.67	566.80	6.43E+10	6.43E+10
8/4/22	19.31	142	38.798	104.07	5.20	520.37	5.91E+10	5.91E+10
1/25/23	17.68	143	39.071	95.31	4.77	476.53	5.41E+10	5.41E+10
1/23/23	17.18	144	39.344	92.58	4.63	462.92	5.25E+10	5.25E+10
1/22/23	17.61	145	39.617	94.90	4.75	474.51	5.38E+10	5.38E+10
1/26/23	17.26	146	39.891	93.05	4.65	465.27	5.28E+10	5.28E+10
7/10/22	21.07	147	40.164	113.57	5.68	567.85	6.44E+10	6.44E+10
7/23/22	18.58	148	40.437	100.15	5.01	500.75	5.68E+10	5.68E+10
1/24/23	16.64	149	40.710	89.66	4.48	448.32	5.09E+10	5.09E+10
1/27/23	15.98	150	40.984	86.11	4.31	430.54	4.89E+10	4.89E+10
7/7/22	20.81	151	41.257	112.18	5.61	560.88	6.36E+10	6.36E+10
1/8/23	17.52	152	41.530	94.45	4.72	472.25	5.36E+10	5.36E+10
1/28/23	17.29	153	41.803	93.17	4.66	465.87	5.29E+10	5.29E+10
1/21/23	16.55	154	42.077	89.19	4.46	445.93	5.06E+10	5.06E+10
1/7/23	17.27	155	42.350	93.08	4.65	465.39	5.28E+10	5.28E+10
1/29/23	16.68	156	42.623	89.88	4.49	449.42	5.10E+10	5.10E+10
1/6/23	16.86	157	42.896	90.85	4.54	454.24	5.15E+10	5.15E+10
8/5/22	17.47	158	43.169	94.17	4.71	470.85	5.34E+10	5.34E+10
1/9/23	17.04	159	43.443	91.87	4.59	459.33	5.21E+10	5.21E+10
7/11/22	20.26	160	43.716	109.19	5.46	545.93	6.20E+10	6.20E+10
1/30/23	16.96	161	43.989	91.39	4.57	456.95	5.19E+10	5.19E+10
1/10/23	17.00	162	44.262	91.62	4.58	458.12	5.20E+10	5.20E+10
1/5/23	16.43	163	44.536	88.58	4.43	442.91	5.03E+10	5.03E+10
2/7/22	18.62	164	44.809	100.36	5.02	501.80	5.69E+10	5.69E+10
1/20/23	16.17	165	45.082	87.14	4.36	435.72	4.94E+10	4.94E+10
1/31/23	16.03	166	45.355	86.42	4.32	432.08	4.90E+10	4.90E+10
2/8/22	17.96	167	45.628	96.81	4.84	484.03	5.49E+10	5.49E+10
6/20/22	19.84	168	45.902	106.92	5.35	534.58	6.07E+10	6.07E+10
2/6/22	16.45	169	46.175	88.67	4.43	443.34	5.03E+10	5.03E+10
1/12/23	16.52	170	46.448	89.05	4.45	445.23	5.05E+10	5.05E+10
2/3/22	18.92	171	46.721	101.99	5.10	509.96	5.79E+10	5.79E+10
8/6/22	16.79	172	46.995	90.49	4.52	452.43	5.13E+10	5.13E+10
7/12/22	18.93	173	47.268	102.04	5.10	510.20	5.79E+10	5.79E+10
2/4/22	16.74	174	47.541	90.21	4.51	451.07	5.12E+10	5.12E+10
2/5/22	18.05	175	47.814	97.28	4.86	486.38	5.52E+10	5.52E+10
1/4/23	15.65	176	48.087	84.37	4.22	421.84	4.79E+10	4.79E+10
1/13/23	15.82	177	48.361	85.26	4.26	426.31	4.84E+10	4.84E+10
2/11/22	15.59	178	48.634	84.01	4.20	420.03	4.77E+10	4.77E+10
1/19/23	15.41	179	48.907	83.08	4.15	415.42	4.71E+10	4.71E+10
1/14/23	15.53	180	49.180	83.71	4.19	418.56	4.75E+10	4.75E+10
2/9/22	17.00	181	49.454	91.61	4.58	458.04	5.20E+10	5.20E+10
8/7/22	15.91	182	49.727	85.74	4.29	428.72	4.87E+10	4.87E+10

1/15/23	14.96	183	50.000	80.61	4.03	403.06	4.57E+10	4.57E+10
8/8/22	15.24	184	50.273	82.14	4.11	410.68	4.66E+10	4.66E+10
2/2/22	17.82	185	50.546	96.05	4.80	480.27	5.45E+10	5.45E+10
7/13/22	17.41	186	50.820	93.84	4.69	469.19	5.32E+10	5.32E+10
2/10/22	17.23	187	51.093	92.89	4.64	464.46	5.27E+10	5.27E+10
8/9/22	14.90	188	51.366	80.31	4.02	401.57	4.56E+10	4.56E+10
6/21/22	17.68	189	51.639	95.31	4.77	476.57	5.41E+10	5.41E+10
1/16/23	14.67	190	51.913	79.06	3.95	395.30	4.49E+10	4.49E+10
1/3/23	13.51	191	52.186	72.83	3.64	364.13	4.13E+10	4.13E+10
1/17/23	13.95	192	52.459	75.19	3.76	375.93	4.27E+10	4.27E+10
7/14/22	16.19	193	52.732	87.26	4.36	436.28	4.95E+10	4.95E+10
1/18/23	13.46	194	53.005	72.57	3.63	362.83	4.12E+10	4.12E+10
7/22/22	13.59	195	53.279	73.26	3.66	366.32	4.16E+10	4.16E+10
8/10/22	14.24	196	53.552	76.78	3.84	383.89	4.36E+10	4.36E+10
8/22/22	13.62	197	53.825	73.43	3.67	367.15	4.17E+10	4.17E+10
12/2/22	9.89	198	54.098	53.32	2.67	266.59	3.03E+10	3.03E+10
12/1/22	11.66	199	54.372	62.86	3.14	314.31	3.57E+10	3.57E+10
7/15/22	14.50	200	54.645	78.15	3.91	390.73	4.43E+10	4.43E+10
7/6/22	15.03	201	54.918	81.03	4.05	405.15	4.60E+10	4.60E+10
12/4/22	11.79	202	55.191	63.54	3.18	317.68	3.61E+10	3.61E+10
1/2/23	12.92	203	55.464	69.62	3.48	348.08	3.95E+10	3.95E+10
12/3/22	12.09	204	55.738	65.15	3.26	325.77	3.70E+10	3.70E+10
11/30/22	11.63	205	56.011	62.68	3.13	313.38	3.56E+10	3.56E+10
6/22/22	15.50	206	56.284	83.54	4.18	417.70	4.74E+10	4.74E+10
7/16/22	13.69	207	56.557	73.81	3.69	369.07	4.19E+10	4.19E+10
8/21/22	12.94	208	56.831	69.74	3.49	348.70	3.96E+10	3.96E+10
12/5/22	11.56	209	57.104	62.29	3.11	311.46	3.53E+10	3.53E+10
11/29/22	9.36	210	57.377	50.46	2.52	252.29	2.86E+10	2.86E+10
8/11/22	12.97	211	57.650	69.92	3.50	349.58	3.97E+10	3.97E+10
1/1/23	11.65	212	57.923	62.80	3.14	313.99	3.56E+10	3.56E+10
12/6/22	11.95	213	58.197	64.42	3.22	322.08	3.65E+10	3.65E+10
8/23/22	12.04	214	58.470	64.90	3.24	324.49	3.68E+10	3.68E+10
7/17/22	13.55	215	58.743	73.03	3.65	365.13	4.14E+10	4.14E+10
1/11/23	15.60	216	59.016	84.10	4.20	420.50	4.77E+10	4.77E+10
12/7/22	11.20	217	59.290	60.35	3.02	301.73	3.42E+10	3.42E+10
7/18/22	13.22	218	59.563	71.23	3.56	356.16	4.04E+10	4.04E+10
12/8/22	10.94	219	59.836	58.95	2.95	294.74	3.34E+10	3.34E+10
8/31/22	10.77	220	60.109	58.02	2.90	290.12	3.29E+10	3.29E+10
12/9/22	9.25	221	60.383	49.86	2.49	249.30	2.83E+10	2.83E+10
8/30/22	10.99	222	60.656	59.24	2.96	296.21	3.36E+10	3.36E+10
12/10/22	9.77	223	60.929	52.67	2.63	263.36	2.99E+10	2.99E+10
12/31/22	10.70	224	61.202	57.68	2.88	288.42	3.27E+10	3.27E+10
2/1/22	12.05	225	61.475	64.93	3.25	324.66	3.68E+10	3.68E+10
8/12/22	11.17	226	61.749	60.21	3.01	301.07	3.42E+10	3.42E+10
7/19/22	11.61	227	62.022	62.59	3.13	312.94	3.55E+10	3.55E+10
8/24/22	10.19	228	62.295	54.94	2.75	274.69	3.12E+10	3.12E+10
11/28/22	8.60	229	62.568	46.35	2.32	231.76	2.63E+10	2.63E+10
12/11/22	9.94	230	62.842	53.58	2.68	267.89	3.04E+10	3.04E+10
6/23/22	13.18	231	63.115	71.06	3.55	355.32	4.03E+10	4.03E+10
8/15/22	10.19	232	63.388	54.93	2.75	274.64	3.12E+10	3.12E+10
9/1/22	9.42	233	63.661	50.76	2.54	253.78	2.88E+10	2.88E+10
12/12/22	10.16	234	63.934	54.78	2.74	273.90	3.11E+10	3.11E+10
8/14/22	10.34	235	64.208	55.72	2.79	278.62	3.16E+10	3.16E+10
12/16/22	8.67	236	64.481	46.73	2.34	233.64	2.65E+10	2.65E+10
12/13/22	8.59	237	64.754	46.29	2.31	231.46	2.63E+10	2.63E+10
12/15/22	8.10	238	65.027	43.64	2.18	218.20	2.48E+10	2.48E+10
12/17/22	9.03	239	65.301	48.68	2.43	243.38	2.76E+10	2.76E+10
8/13/22	10.02	240	65.574	54.02	2.70	270.12	3.07E+10	3.07E+10
7/20/22	10.33	241	65.847	55.66	2.78	278.29	3.16E+10	3.16E+10
8/16/22	9.56	242	66.120	51.52	2.58	257.62	2.92E+10	2.92E+10
12/14/22	8.94	243	66.393	48.19	2.41	240.97	2.73E+10	2.73E+10

12/24/22	5.88	244	66.667	31.72	1.59	158.58	1.80E+10	1.80E+10
8/25/22	9.43	245	66.940	50.81	2.54	254.07	2.88E+10	2.88E+10
9/2/22	8.94	246	67.213	48.21	2.41	241.04	2.74E+10	2.74E+10
12/18/22	8.95	247	67.486	48.22	2.41	241.09	2.74E+10	2.74E+10
12/23/22	5.82	248	67.760	31.38	1.57	156.90	1.78E+10	1.78E+10
12/20/22	9.01	249	68.033	48.56	2.43	242.78	2.75E+10	2.75E+10
10/23/22	8.39	250	68.306	45.23	2.26	226.13	2.57E+10	2.57E+10
12/19/22	8.91	251	68.579	48.04	2.40	240.20	2.73E+10	2.73E+10
12/27/22	4.73	252	68.852	25.52	1.28	127.60	1.45E+10	1.45E+10
12/26/22	6.02	253	69.126	32.46	1.62	162.30	1.84E+10	1.84E+10
12/30/22	7.83	254	69.399	42.18	2.11	210.91	2.39E+10	2.39E+10
7/21/22	9.70	255	69.672	52.26	2.61	261.29	2.97E+10	2.97E+10
8/17/22	8.79	256	69.945	47.37	2.37	236.86	2.69E+10	2.69E+10
6/24/22	11.24	257	70.219	60.61	3.03	303.03	3.44E+10	3.44E+10
12/21/22	9.01	258	70.492	48.57	2.43	242.87	2.76E+10	2.76E+10
12/28/22	4.32	259	70.765	23.27	1.16	116.34	1.32E+10	1.32E+10
12/25/22	5.11	260	71.038	27.56	1.38	137.78	1.56E+10	1.56E+10
9/3/22	8.51	261	71.311	45.87	2.29	229.34	2.60E+10	2.60E+10
8/26/22	8.40	262	71.585	45.27	2.26	226.35	2.57E+10	2.57E+10
12/22/22	8.74	263	71.858	47.12	2.36	235.61	2.67E+10	2.67E+10
8/29/22	7.66	264	72.131	41.29	2.06	206.43	2.34E+10	2.34E+10
8/27/22	8.52	265	72.404	45.93	2.30	229.67	2.61E+10	2.61E+10
9/4/22	8.14	266	72.678	43.86	2.19	219.29	2.49E+10	2.49E+10
8/18/22	8.41	267	72.951	45.35	2.27	226.75	2.57E+10	2.57E+10
12/29/22	4.87	268	73.224	26.25	1.31	131.24	1.49E+10	1.49E+10
10/24/22	7.13	269	73.497	38.42	1.92	192.08	2.18E+10	2.18E+10
8/19/22	8.08	270	73.770	43.53	2.18	217.64	2.47E+10	2.47E+10
8/28/22	8.00	271	74.044	43.12	2.16	215.61	2.45E+10	2.45E+10
8/20/22	7.66	272	74.317	41.30	2.07	206.51	2.34E+10	2.34E+10
9/5/22	7.89	273	74.590	42.54	2.13	212.70	2.41E+10	2.41E+10
6/25/22	10.14	274	74.863	54.64	2.73	273.22	3.10E+10	3.10E+10
9/6/22	7.52	275	75.137	40.54	2.03	202.70	2.30E+10	2.30E+10
10/25/22	6.12	276	75.410	32.98	1.65	164.90	1.87E+10	1.87E+10
10/26/22	6.61	277	75.683	35.65	1.78	178.25	2.02E+10	2.02E+10
10/27/22	6.54	278	75.956	35.27	1.76	176.33	2.00E+10	2.00E+10
11/27/22	5.91	279	76.230	31.88	1.59	159.39	1.81E+10	1.81E+10
10/28/22	6.57	280	76.503	35.40	1.77	177.02	2.01E+10	2.01E+10
9/7/22	7.56	281	76.776	40.74	2.04	203.72	2.31E+10	2.31E+10
9/27/22	7.81	282	77.049	42.08	2.10	210.39	2.39E+10	2.39E+10
10/29/22	6.22	283	77.322	33.53	1.68	167.63	1.90E+10	1.90E+10
6/26/22	9.21	284	77.596	49.63	2.48	248.13	2.82E+10	2.82E+10
9/28/22	7.42	285	77.869	40.00	2.00	200.01	2.27E+10	2.27E+10
10/30/22	6.13	286	78.142	33.07	1.65	165.33	1.88E+10	1.88E+10
11/1/22	5.79	287	78.415	31.22	1.56	156.10	1.77E+10	1.77E+10
10/31/22	5.84	288	78.689	31.48	1.57	157.42	1.79E+10	1.79E+10
11/2/22	6.10	289	78.962	32.87	1.64	164.37	1.87E+10	1.87E+10
11/4/22	5.79	290	79.235	31.21	1.56	156.05	1.77E+10	1.77E+10
11/3/22	6.13	291	79.508	33.03	1.65	165.17	1.87E+10	1.87E+10
9/26/22	7.42	292	79.781	39.99	2.00	199.97	2.27E+10	2.27E+10
9/8/22	7.05	293	80.055	37.98	1.90	189.89	2.15E+10	2.15E+10
11/5/22	5.47	294	80.328	29.46	1.47	147.28	1.67E+10	1.67E+10
10/19/22	5.72	295	80.601	30.86	1.54	154.28	1.75E+10	1.75E+10
9/29/22	7.02	296	80.874	37.83	1.89	189.16	2.15E+10	2.15E+10
10/22/22	5.92	297	81.148	31.91	1.60	159.56	1.81E+10	1.81E+10
11/7/22	5.73	298	81.421	30.87	1.54	154.37	1.75E+10	1.75E+10
11/6/22	5.67	299	81.694	30.57	1.53	152.83	1.73E+10	1.73E+10
11/8/22	6.19	300	81.967	33.37	1.67	166.87	1.89E+10	1.89E+10
10/20/22	5.70	301	82.240	30.70	1.53	153.48	1.74E+10	1.74E+10
11/9/22	5.67	302	82.514	30.56	1.53	152.78	1.73E+10	1.73E+10
9/9/22	6.37	303	82.787	34.32	1.72	171.62	1.95E+10	1.95E+10
9/30/22	6.96	304	83.060	37.49	1.87	187.44	2.13E+10	2.13E+10

11/10/22	5.16	305	83.333	27.80	1.39	138.99	1.58E+10	1.58E+10
9/12/22	7.08	306	83.607	38.16	1.91	190.80	2.17E+10	2.17E+10
11/11/22	5.78	307	83.880	31.14	1.56	155.71	1.77E+10	1.77E+10
10/18/22	5.12	308	84.153	27.60	1.38	138.00	1.57E+10	1.57E+10
6/27/22	7.97	309	84.426	42.95	2.15	214.75	2.44E+10	2.44E+10
10/21/22	5.42	310	84.699	29.23	1.46	146.16	1.66E+10	1.66E+10
9/11/22	5.32	311	84.973	28.66	1.43	143.32	1.63E+10	1.63E+10
11/12/22	5.15	312	85.246	27.73	1.39	138.67	1.57E+10	1.57E+10
11/13/22	5.27	313	85.519	28.40	1.42	141.99	1.61E+10	1.61E+10
9/13/22	6.69	314	85.792	36.05	1.80	180.27	2.05E+10	2.05E+10
11/14/22	5.63	315	86.066	30.36	1.52	151.79	1.72E+10	1.72E+10
9/10/22	5.63	316	86.339	30.32	1.52	151.60	1.72E+10	1.72E+10
10/1/22	6.70	317	86.612	36.10	1.80	180.49	2.05E+10	2.05E+10
11/15/22	5.45	318	86.885	29.40	1.47	146.98	1.67E+10	1.67E+10
9/14/22	6.19	319	87.158	33.35	1.67	166.74	1.89E+10	1.89E+10
11/16/22	4.78	320	87.432	25.77	1.29	128.85	1.46E+10	1.46E+10
11/17/22	4.77	321	87.705	25.72	1.29	128.61	1.46E+10	1.46E+10
9/15/22	5.97	322	87.978	32.17	1.61	160.85	1.83E+10	1.83E+10
11/26/22	4.88	323	88.251	26.31	1.32	131.55	1.49E+10	1.49E+10
9/25/22	5.50	324	88.525	29.67	1.48	148.33	1.68E+10	1.68E+10
9/21/22	6.10	325	88.798	32.87	1.64	164.35	1.87E+10	1.87E+10
11/18/22	4.71	326	89.071	25.39	1.27	126.95	1.44E+10	1.44E+10
11/25/22	4.95	327	89.344	26.67	1.33	133.35	1.51E+10	1.51E+10
11/19/22	4.59	328	89.617	24.76	1.24	123.80	1.40E+10	1.40E+10
9/22/22	6.36	329	89.891	34.26	1.71	171.28	1.94E+10	1.94E+10
9/16/22	5.71	330	90.164	30.75	1.54	153.77	1.74E+10	1.74E+10
11/24/22	4.53	331	90.437	24.43	1.22	122.13	1.39E+10	1.39E+10
10/2/22	6.32	332	90.710	34.06	1.70	170.30	1.93E+10	1.93E+10
11/22/22	4.65	333	90.984	25.08	1.25	125.42	1.42E+10	1.42E+10
11/21/22	4.24	334	91.257	22.86	1.14	114.29	1.30E+10	1.30E+10
11/23/22	4.47	335	91.530	24.12	1.21	120.59	1.37E+10	1.37E+10
9/20/22	5.60	336	91.803	30.17	1.51	150.86	1.71E+10	1.71E+10
6/28/22	6.52	337	92.077	35.12	1.76	175.62	1.99E+10	1.99E+10
11/20/22	4.49	338	92.350	24.19	1.21	120.93	1.37E+10	1.37E+10
9/17/22	5.22	339	92.623	28.16	1.41	140.79	1.60E+10	1.60E+10
9/23/22	5.82	340	92.896	31.36	1.57	156.79	1.78E+10	1.78E+10
9/19/22	5.76	341	93.169	31.03	1.55	155.16	1.76E+10	1.76E+10
9/18/22	5.48	342	93.443	29.55	1.48	147.73	1.68E+10	1.68E+10
10/3/22	5.80	343	93.716	31.26	1.56	156.30	1.77E+10	1.77E+10
9/24/22	5.18	344	93.989	27.92	1.40	139.62	1.58E+10	1.58E+10
7/5/22	5.78	345	94.262	31.15	1.56	155.77	1.77E+10	1.77E+10
10/4/22	5.26	346	94.536	28.36	1.42	141.80	1.61E+10	1.61E+10
6/29/22	5.82	347	94.809	31.39	1.57	156.94	1.78E+10	1.78E+10
10/5/22	5.42	348	95.082	29.23	1.46	146.14	1.66E+10	1.66E+10
10/17/22	3.31	349	95.355	17.84	0.89	89.20	1.01E+10	1.01E+10
10/6/22	4.43	350	95.628	23.88	1.19	119.41	1.36E+10	1.36E+10
6/30/22	5.16	351	95.902	27.83	1.39	139.16	1.58E+10	1.58E+10
10/7/22	5.04	352	96.175	27.18	1.36	135.92	1.54E+10	1.54E+10
7/1/22	5.11	353	96.448	27.52	1.38	137.60	1.56E+10	1.56E+10
7/2/22	5.19	354	96.721	27.96	1.40	139.82	1.59E+10	1.59E+10
10/8/22	4.26	355	96.995	22.94	1.15	114.72	1.30E+10	1.30E+10
10/16/22	2.78	356	97.268	15.00	0.75	74.98	8.51E+09	8.51E+09
10/9/22	3.25	357	97.541	17.49	0.87	87.47	9.93E+09	9.93E+09
7/3/22	4.51	358	97.814	24.30	1.22	121.52	1.38E+10	1.38E+10
10/13/22	4.21	359	98.087	22.67	1.13	113.37	1.29E+10	1.29E+10
10/10/22	3.11	360	98.361	16.75	0.84	83.73	9.50E+09	9.50E+09
10/15/22	2.60	361	98.634	13.99	0.70	69.97	7.94E+09	7.94E+09
10/14/22	2.67	362	98.907	14.37	0.72	71.86	8.16E+09	8.16E+09
10/11/22	2.99	363	99.180	16.11	0.81	80.55	9.14E+09	9.14E+09
10/12/22	2.92	364	99.454	15.73	0.79	78.66	8.93E+09	8.93E+09
7/4/22	4.46	365	99.727	24.04	1.20	120.21	1.36E+10	1.36E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 6 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	113.49	1.61	0.154	7.6	517	0.819672131	984.881683	94.206074	4649.130926	1.44E+12	21	20682.51534	1978.327555	97631.74945	3.01E+13
3/15/22	22.42	1.74	0.05	9.6	130	19.67213115	210.2368689	6.04128934	1159.927552	7.13E+10	35	7358.29041	211.4451267	40597.46433	2.50E+12
4/19/22	26.37	2.12	0.05	25.2	816	16.12021858	301.286202	7.10580665	3581.326552	5.26E+11	35	10545.01707	248.7032328	125346.4293	1.84E+13
5/24/22	9.86	4.95	0.05	10.8	457.0	34.15300546	263.0626136	2.65719812	573.9547932	1.10E+11	28	7365.753179	74.40154727	16070.73421	3.09E+12
6/21/22	7.99	4.27	0.245	57.2	199.0	51.63934426	183.9762118	10.5560122	2464.505694	3.89E+10	28	5151.333931	295.5683403	69006.15944	1.09E+12
7/19/22	10.41	3.64	0.05	12.8	179.0	62.02185792	204.2346202	2.80542061	718.1876753	4.56E+10	35	7148.211706	98.18972124	25136.56864	1.60E+12
8/23/22	3.42	4.25	0.05	5.6	60.0	58.46994536	78.40719465	0.92243758	103.3130094	5.02E+09	28	2195.40145	25.82825236	2892.764264	1.41E+11
9/20/22	2.89	3.37	0.188	29.2	248.0	91.80327869	52.34084181	2.92345258	454.068166	1.75E+10	36	1884.270305	105.2442927	16346.45398	6.30E+11
10/26/22	5.28	2.46	0.118	22.0	2420.0	75.68306011	70.12012249	3.36033012	626.5022254	3.13E+11	13	911.5615923	43.68429154	8144.52893	4.07E+12
11/8/22	3.83	2.69	0.050	16.8	56.0	81.96721311	55.46541658	1.03164218	346.631773	5.24E+09	35	1941.28958	36.10747636	12132.11206	1.84E+11
12/13/22	4.98	6.10	0.561	103.2	261.0	64.75409836	163.7752724	15.0619554	2770.755427	3.18E+10	36	5895.909805	542.2303935	99747.19539	1.15E+12
1/18/23	9.69	0.90	0.073	15.6	122.0	53.00546448	46.98800817	3.81124955	814.4588083	2.89E+10	37	1738.556302	141.0162334	30134.97591	1.07E+12
2/24/23															

Conversion Factor	5.39	5.39	5.39	2.45E+07		TOTAL	72,818.1	3,800.7	543,187.1	6.41E+13
						TARGET	40,010.4	2,000.5	200,052.0	2.27E+13

Site 7 Date	E7	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	51.01	1	0.273	274.92	13.75	1374.62	1.56E+11	1.56E+11
2/24/22	51.51	2	0.546	277.61	13.88	1388.06	1.58E+11	1.58E+11
2/22/22	48.63	3	0.820	262.14	13.11	1310.68	1.49E+11	1.49E+11
2/25/22	50.13	4	1.093	270.23	13.51	1351.13	1.53E+11	1.53E+11
2/26/22	48.09	5	1.366	259.21	12.96	1296.06	1.47E+11	1.47E+11
2/21/22	47.09	6	1.639	253.82	12.69	1269.12	1.44E+11	1.44E+11
2/27/22	47.20	7	1.913	254.39	12.72	1271.96	1.44E+11	1.44E+11
2/20/22	42.08	8	2.186	226.83	11.34	1134.16	1.29E+11	1.29E+11
2/19/22	45.17	9	2.459	243.49	12.17	1217.46	1.38E+11	1.38E+11
2/28/22	45.21	10	2.732	243.69	12.18	1218.47	1.38E+11	1.38E+11
3/1/22	44.87	11	3.005	241.86	12.09	1209.28	1.37E+11	1.37E+11
3/2/22	43.42	12	3.279	234.04	11.70	1170.18	1.33E+11	1.33E+11
3/3/22	43.53	13	3.552	234.60	11.73	1173.01	1.33E+11	1.33E+11
3/4/22	43.10	14	3.825	232.30	11.61	1161.49	1.32E+11	1.32E+11
3/26/22	39.48	15	4.098	212.79	10.64	1063.93	1.21E+11	1.21E+11
3/27/22	39.63	16	4.372	213.60	10.68	1067.99	1.21E+11	1.21E+11
3/28/22	39.86	17	4.645	214.83	10.74	1074.16	1.22E+11	1.22E+11
3/25/22	38.39	18	4.918	206.91	10.35	1034.55	1.17E+11	1.17E+11
3/5/22	39.41	19	5.191	212.39	10.62	1061.97	1.21E+11	1.21E+11
2/18/22	37.34	20	5.464	201.28	10.06	1006.41	1.14E+11	1.14E+11
3/29/22	39.51	21	5.738	212.98	10.65	1064.90	1.21E+11	1.21E+11
3/24/22	36.86	22	6.011	198.69	9.93	993.44	1.13E+11	1.13E+11
3/30/22	36.28	23	6.284	195.56	9.78	977.81	1.11E+11	1.11E+11
3/7/22	38.41	24	6.557	207.01	10.35	1035.04	1.17E+11	1.17E+11
3/6/22	37.92	25	6.831	204.41	10.22	1022.06	1.16E+11	1.16E+11
3/8/22	39.15	26	7.104	211.01	10.55	1055.05	1.20E+11	1.20E+11
3/31/22	34.56	27	7.377	186.30	9.31	931.48	1.06E+11	1.06E+11
3/9/22	38.37	28	7.650	206.82	10.34	1034.11	1.17E+11	1.17E+11
4/1/22	35.19	29	7.923	189.66	9.48	948.29	1.08E+11	1.08E+11
4/2/22	35.50	30	8.197	191.32	9.57	956.61	1.09E+11	1.09E+11
3/10/22	38.02	31	8.470	204.91	10.25	1024.54	1.16E+11	1.16E+11
3/23/22	33.41	32	8.743	180.09	9.00	900.46	1.02E+11	1.02E+11
4/3/22	34.83	33	9.016	187.75	9.39	938.75	1.07E+11	1.07E+11
5/8/22	33.52	34	9.290	180.66	9.03	903.31	1.03E+11	1.03E+11
3/11/22	34.15	35	9.563	184.09	9.20	920.46	1.04E+11	1.04E+11
5/9/22	32.75	36	9.836	176.54	8.83	882.72	1.00E+11	1.00E+11
5/7/22	33.66	37	10.109	181.42	9.07	907.08	1.03E+11	1.03E+11
4/4/22	33.03	38	10.383	178.03	8.90	890.14	1.01E+11	1.01E+11
5/10/22	32.57	39	10.656	175.56	8.78	877.81	9.96E+10	9.96E+10
4/5/22	34.47	40	10.929	185.80	9.29	929.00	1.05E+11	1.05E+11
4/7/22	32.90	41	11.202	177.32	8.87	886.62	1.01E+11	1.01E+11
5/11/22	33.24	42	11.475	179.14	8.96	895.69	1.02E+11	1.02E+11
4/6/22	32.49	43	11.749	175.13	8.76	875.67	9.94E+10	9.94E+10
4/8/22	30.53	44	12.022	164.54	8.23	822.71	9.34E+10	9.34E+10
3/12/22	33.45	45	12.295	180.31	9.02	901.54	1.02E+11	1.02E+11
4/15/22	32.03	46	12.568	172.65	8.63	863.26	9.80E+10	9.80E+10
4/16/22	31.77	47	12.842	171.24	8.56	856.22	9.72E+10	9.72E+10
4/9/22	32.40	48	13.115	174.66	8.73	873.30	9.91E+10	9.91E+10
5/12/22	31.35	49	13.388	168.96	8.45	844.81	9.59E+10	9.59E+10
3/22/22	31.53	50	13.661	169.93	8.50	849.65	9.64E+10	9.64E+10
4/17/22	32.49	51	13.934	175.10	8.76	875.51	9.94E+10	9.94E+10
4/14/22	30.22	52	14.208	162.87	8.14	814.37	9.24E+10	9.24E+10
3/21/22	32.12	53	14.481	173.14	8.66	865.69	9.82E+10	9.82E+10
5/6/22	29.45	54	14.754	158.74	7.94	793.69	9.01E+10	9.01E+10
4/10/22	31.62	55	15.027	170.43	8.52	852.15	9.67E+10	9.67E+10
3/13/22	31.33	56	15.301	168.86	8.44	844.31	9.58E+10	9.58E+10
4/18/22	29.86	57	15.574	160.96	8.05	804.80	9.13E+10	9.13E+10
5/13/22	29.82	58	15.847	160.74	8.04	803.70	9.12E+10	9.12E+10
4/19/22	30.63	59	16.120	165.08	8.25	825.42	9.37E+10	9.37E+10
3/20/22	30.01	60	16.393	161.76	8.09	808.79	9.18E+10	9.18E+10

4/20/22	29.39	61	16.667	158.41	7.92	792.03	8.99E+10	8.99E+10
4/11/22	31.24	62	16.940	168.41	8.42	842.04	9.56E+10	9.56E+10
5/14/22	28.85	63	17.213	155.51	7.78	777.57	8.82E+10	8.82E+10
3/14/22	31.16	64	17.486	167.97	8.40	839.84	9.53E+10	9.53E+10
4/13/22	26.42	65	17.760	142.38	7.12	711.90	8.08E+10	8.08E+10
4/21/22	27.88	66	18.033	150.26	7.51	751.32	8.53E+10	8.53E+10
4/12/22	29.76	67	18.306	160.42	8.02	802.09	9.10E+10	9.10E+10
2/17/22	26.62	68	18.579	143.46	7.17	717.29	8.14E+10	8.14E+10
4/22/22	29.68	69	18.852	159.98	8.00	799.92	9.08E+10	9.08E+10
5/15/22	28.10	70	19.126	151.48	7.57	757.42	8.60E+10	8.60E+10
5/5/22	28.28	71	19.399	152.40	7.62	762.02	8.65E+10	8.65E+10
3/15/22	30.09	72	19.672	162.21	8.11	811.03	9.20E+10	9.20E+10
4/23/22	27.06	73	19.945	145.84	7.29	729.18	8.27E+10	8.27E+10
4/25/22	28.27	74	20.219	152.39	7.62	761.95	8.65E+10	8.65E+10
4/24/22	25.81	75	20.492	139.09	6.95	695.46	7.89E+10	7.89E+10
5/4/22	27.94	76	20.765	150.60	7.53	753.01	8.55E+10	8.55E+10
4/26/22	27.58	77	21.038	148.66	7.43	743.32	8.43E+10	8.43E+10
3/16/22	28.51	78	21.311	153.68	7.68	768.38	8.72E+10	8.72E+10
5/16/22	26.77	79	21.585	144.31	7.22	721.53	8.19E+10	8.19E+10
3/19/22	26.38	80	21.858	142.21	7.11	711.05	8.07E+10	8.07E+10
4/27/22	27.46	81	22.131	148.01	7.40	740.07	8.40E+10	8.40E+10
3/17/22	27.95	82	22.404	150.64	7.53	753.20	8.55E+10	8.55E+10
4/28/22	25.78	83	22.678	138.97	6.95	694.83	7.88E+10	7.88E+10
5/17/22	25.15	84	22.951	135.55	6.78	677.77	7.69E+10	7.69E+10
3/18/22	25.15	85	23.224	135.56	6.78	677.81	7.69E+10	7.69E+10
5/3/22	25.03	86	23.497	134.90	6.74	674.50	7.65E+10	7.65E+10
4/29/22	24.80	87	23.770	133.69	6.68	668.45	7.59E+10	7.59E+10
5/18/22	23.90	88	24.044	128.83	6.44	644.15	7.31E+10	7.31E+10
5/1/22	23.87	89	24.317	128.64	6.43	643.20	7.30E+10	7.30E+10
6/11/22	24.50	90	24.590	132.03	6.60	660.17	7.49E+10	7.49E+10
6/12/22	24.27	91	24.863	130.82	6.54	654.10	7.42E+10	7.42E+10
4/30/22	23.20	92	25.137	125.05	6.25	625.26	7.10E+10	7.10E+10
5/2/22	24.51	93	25.410	132.12	6.61	660.61	7.50E+10	7.50E+10
6/10/22	24.13	94	25.683	130.04	6.50	650.22	7.38E+10	7.38E+10
5/19/22	23.18	95	25.956	124.94	6.25	624.72	7.09E+10	7.09E+10
6/13/22	24.04	96	26.230	129.58	6.48	647.89	7.35E+10	7.35E+10
6/9/22	23.74	97	26.503	127.94	6.40	639.71	7.26E+10	7.26E+10
6/14/22	23.94	98	26.776	129.03	6.45	645.16	7.32E+10	7.32E+10
5/20/22	22.31	99	27.049	120.25	6.01	601.27	6.82E+10	6.82E+10
6/15/22	23.20	100	27.322	125.06	6.25	625.32	7.10E+10	7.10E+10
6/8/22	21.84	101	27.596	117.73	5.89	588.65	6.68E+10	6.68E+10
6/2/22	22.16	102	27.869	119.42	5.97	597.11	6.78E+10	6.78E+10
5/21/22	21.70	103	28.142	116.95	5.85	584.77	6.64E+10	6.64E+10
6/1/22	21.51	104	28.415	115.94	5.80	579.71	6.58E+10	6.58E+10
5/30/22	21.89	105	28.689	118.00	5.90	590.00	6.70E+10	6.70E+10
7/28/22	20.32	106	28.962	109.51	5.48	547.56	6.21E+10	6.21E+10
6/3/22	21.58	107	29.235	116.31	5.82	581.56	6.60E+10	6.60E+10
7/27/22	20.29	108	29.508	109.38	5.47	546.90	6.21E+10	6.21E+10
5/31/22	21.93	109	29.781	118.18	5.91	590.88	6.71E+10	6.71E+10
7/29/22	20.25	110	30.055	109.15	5.46	545.74	6.19E+10	6.19E+10
5/29/22	21.19	111	30.328	114.22	5.71	571.11	6.48E+10	6.48E+10
7/26/22	19.50	112	30.601	105.12	5.26	525.59	5.96E+10	5.96E+10
5/22/22	20.87	113	30.874	112.48	5.62	562.42	6.38E+10	6.38E+10
6/7/22	21.16	114	31.148	114.06	5.70	570.32	6.47E+10	6.47E+10
6/16/22	21.82	115	31.421	117.61	5.88	588.05	6.67E+10	6.67E+10
6/4/22	20.81	116	31.694	112.19	5.61	560.94	6.37E+10	6.37E+10
7/30/22	19.36	117	31.967	104.35	5.22	521.75	5.92E+10	5.92E+10
7/25/22	19.04	118	32.240	102.64	5.13	513.22	5.82E+10	5.82E+10
5/23/22	19.63	119	32.514	105.80	5.29	529.02	6.00E+10	6.00E+10
6/5/22	19.79	120	32.787	106.65	5.33	533.27	6.05E+10	6.05E+10
7/31/22	18.49	121	33.060	99.68	4.98	498.42	5.66E+10	5.66E+10

6/17/22	20.12	122	33.333	108.46	5.42	542.29	6.15E+10	6.15E+10
6/6/22	18.80	123	33.607	101.34	5.07	506.72	5.75E+10	5.75E+10
5/28/22	19.43	124	33.880	104.73	5.24	523.67	5.94E+10	5.94E+10
5/24/22	18.48	125	34.153	99.60	4.98	498.01	5.65E+10	5.65E+10
7/24/22	17.74	126	34.426	95.63	4.78	478.15	5.43E+10	5.43E+10
8/1/22	17.58	127	34.699	94.73	4.74	473.67	5.38E+10	5.38E+10
2/16/22	15.52	128	34.973	83.66	4.18	418.28	4.75E+10	4.75E+10
5/27/22	18.94	129	35.246	102.06	5.10	510.32	5.79E+10	5.79E+10
5/25/22	18.24	130	35.519	98.33	4.92	491.63	5.58E+10	5.58E+10
5/26/22	18.76	131	35.792	101.11	5.06	505.53	5.74E+10	5.74E+10
6/18/22	18.70	132	36.066	100.82	5.04	504.09	5.72E+10	5.72E+10
8/2/22	16.53	133	36.339	89.08	4.45	445.40	5.05E+10	5.05E+10
2/13/22	17.13	134	36.612	92.31	4.62	461.55	5.24E+10	5.24E+10
2/14/22	17.00	135	36.885	91.61	4.58	458.03	5.20E+10	5.20E+10
2/15/22	16.69	136	37.158	89.96	4.50	449.78	5.10E+10	5.10E+10
8/3/22	15.42	137	37.432	83.12	4.16	415.58	4.72E+10	4.72E+10
7/8/22	16.78	138	37.705	90.42	4.52	452.09	5.13E+10	5.13E+10
7/9/22	16.73	139	37.978	90.18	4.51	450.91	5.12E+10	5.12E+10
6/19/22	16.73	140	38.251	90.18	4.51	450.90	5.12E+10	5.12E+10
2/12/22	16.40	141	38.525	88.40	4.42	442.00	5.02E+10	5.02E+10
8/4/22	15.06	142	38.798	81.16	4.06	405.80	4.60E+10	4.60E+10
1/25/23	13.79	143	39.071	74.32	3.72	371.61	4.22E+10	4.22E+10
1/23/23	13.40	144	39.344	72.20	3.61	361.00	4.10E+10	4.10E+10
1/22/23	13.73	145	39.617	74.01	3.70	370.04	4.20E+10	4.20E+10
1/26/23	13.46	146	39.891	72.57	3.63	362.83	4.12E+10	4.12E+10
7/10/22	16.43	147	40.164	88.56	4.43	442.82	5.03E+10	5.03E+10
7/23/22	14.49	148	40.437	78.10	3.91	390.50	4.43E+10	4.43E+10
1/24/23	12.97	149	40.710	69.92	3.50	349.62	3.97E+10	3.97E+10
1/27/23	12.46	150	40.984	67.15	3.36	335.74	3.81E+10	3.81E+10
7/7/22	16.23	151	41.257	87.48	4.37	437.39	4.96E+10	4.96E+10
1/8/23	13.67	152	41.530	73.65	3.68	368.27	4.18E+10	4.18E+10
1/28/23	13.48	153	41.803	72.66	3.63	363.30	4.12E+10	4.12E+10
1/21/23	12.90	154	42.077	69.55	3.48	347.75	3.95E+10	3.95E+10
1/7/23	13.47	155	42.350	72.58	3.63	362.92	4.12E+10	4.12E+10
1/29/23	13.00	156	42.623	70.09	3.50	350.47	3.98E+10	3.98E+10
1/6/23	13.14	157	42.896	70.85	3.54	354.23	4.02E+10	4.02E+10
8/5/22	13.62	158	43.169	73.44	3.67	367.18	4.17E+10	4.17E+10
1/9/23	13.29	159	43.443	71.64	3.58	358.20	4.06E+10	4.06E+10
7/11/22	15.80	160	43.716	85.15	4.26	425.73	4.83E+10	4.83E+10
1/30/23	13.22	161	43.989	71.27	3.56	356.34	4.04E+10	4.04E+10
1/10/23	13.26	162	44.262	71.45	3.57	357.25	4.05E+10	4.05E+10
1/5/23	12.82	163	44.536	69.08	3.45	345.39	3.92E+10	3.92E+10
2/7/22	14.52	164	44.809	78.26	3.91	391.32	4.44E+10	4.44E+10
1/20/23	12.61	165	45.082	67.96	3.40	339.79	3.86E+10	3.86E+10
1/31/23	12.50	166	45.355	67.39	3.37	336.95	3.82E+10	3.82E+10
2/8/22	14.01	167	45.628	75.49	3.77	377.46	4.28E+10	4.28E+10
6/20/22	15.47	168	45.902	83.38	4.17	416.88	4.73E+10	4.73E+10
2/6/22	12.83	169	46.175	69.15	3.46	345.73	3.92E+10	3.92E+10
1/12/23	12.88	170	46.448	69.44	3.47	347.20	3.94E+10	3.94E+10
2/3/22	14.76	171	46.721	79.54	3.98	397.68	4.51E+10	4.51E+10
8/6/22	13.09	172	46.995	70.56	3.53	352.82	4.00E+10	4.00E+10
7/12/22	14.76	173	47.268	79.57	3.98	397.87	4.51E+10	4.51E+10
2/4/22	13.05	174	47.541	70.35	3.52	351.76	3.99E+10	3.99E+10
2/5/22	14.07	175	47.814	75.86	3.79	379.29	4.30E+10	4.30E+10
1/4/23	12.21	176	48.087	65.79	3.29	328.96	3.73E+10	3.73E+10
1/13/23	12.34	177	48.361	66.49	3.32	332.45	3.77E+10	3.77E+10
2/11/22	12.15	178	48.634	65.51	3.28	327.55	3.72E+10	3.72E+10
1/19/23	12.02	179	48.907	64.79	3.24	323.95	3.68E+10	3.68E+10
1/14/23	12.11	180	49.180	65.28	3.26	326.40	3.70E+10	3.70E+10
2/9/22	13.25	181	49.454	71.44	3.57	357.19	4.05E+10	4.05E+10
8/7/22	12.41	182	49.727	66.87	3.34	334.33	3.79E+10	3.79E+10

1/15/23	11.66	183	50.000	62.86	3.14	314.31	3.57E+10	3.57E+10
8/8/22	11.88	184	50.273	64.05	3.20	320.26	3.63E+10	3.63E+10
2/2/22	13.90	185	50.546	74.91	3.75	374.53	4.25E+10	4.25E+10
7/13/22	13.58	186	50.820	73.18	3.66	365.89	4.15E+10	4.15E+10
2/10/22	13.44	187	51.093	72.44	3.62	362.20	4.11E+10	4.11E+10
8/9/22	11.62	188	51.366	62.63	3.13	313.16	3.55E+10	3.55E+10
6/21/22	13.79	189	51.639	74.33	3.72	371.64	4.22E+10	4.22E+10
1/16/23	11.44	190	51.913	61.65	3.08	308.27	3.50E+10	3.50E+10
1/3/23	10.54	191	52.186	56.79	2.84	283.96	3.22E+10	3.22E+10
1/17/23	10.88	192	52.459	58.63	2.93	293.16	3.33E+10	3.33E+10
7/14/22	12.62	193	52.732	68.04	3.40	340.22	3.86E+10	3.86E+10
1/18/23	10.50	194	53.005	56.59	2.83	282.95	3.21E+10	3.21E+10
7/22/22	10.60	195	53.279	57.13	2.86	285.67	3.24E+10	3.24E+10
8/10/22	11.11	196	53.552	59.87	2.99	299.37	3.40E+10	3.40E+10
8/22/22	10.62	197	53.825	57.26	2.86	286.32	3.25E+10	3.25E+10
12/2/22	7.71	198	54.098	41.58	2.08	207.90	2.36E+10	2.36E+10
12/1/22	9.09	199	54.372	49.02	2.45	245.11	2.78E+10	2.78E+10
7/15/22	11.31	200	54.645	60.94	3.05	304.71	3.46E+10	3.46E+10
7/6/22	11.72	201	54.918	63.19	3.16	315.94	3.59E+10	3.59E+10
12/4/22	9.19	202	55.191	49.55	2.48	247.74	2.81E+10	2.81E+10
1/2/23	10.07	203	55.464	54.29	2.71	271.44	3.08E+10	3.08E+10
12/3/22	9.43	204	55.738	50.81	2.54	254.04	2.88E+10	2.88E+10
11/30/22	9.07	205	56.011	48.88	2.44	244.38	2.77E+10	2.77E+10
6/22/22	12.09	206	56.284	65.15	3.26	325.74	3.70E+10	3.70E+10
7/16/22	10.68	207	56.557	57.56	2.88	287.81	3.27E+10	3.27E+10
8/21/22	10.09	208	56.831	54.39	2.72	271.93	3.09E+10	3.09E+10
12/5/22	9.01	209	57.104	48.58	2.43	242.89	2.76E+10	2.76E+10
11/29/22	7.30	210	57.377	39.35	1.97	196.74	2.23E+10	2.23E+10
8/11/22	10.12	211	57.650	54.52	2.73	272.61	3.09E+10	3.09E+10
1/1/23	9.09	212	57.923	48.97	2.45	244.86	2.78E+10	2.78E+10
12/6/22	9.32	213	58.197	50.23	2.51	251.16	2.85E+10	2.85E+10
8/23/22	9.39	214	58.470	50.61	2.53	253.04	2.87E+10	2.87E+10
7/17/22	10.57	215	58.743	56.95	2.85	284.74	3.23E+10	3.23E+10
1/11/23	12.17	216	59.016	65.58	3.28	327.91	3.72E+10	3.72E+10
12/7/22	8.73	217	59.290	47.06	2.35	235.29	2.67E+10	2.67E+10
7/18/22	10.31	218	59.563	55.55	2.78	277.74	3.15E+10	3.15E+10
12/8/22	8.53	219	59.836	45.97	2.30	229.85	2.61E+10	2.61E+10
8/31/22	8.39	220	60.109	45.25	2.26	226.24	2.57E+10	2.57E+10
12/9/22	7.21	221	60.383	38.88	1.94	194.41	2.21E+10	2.21E+10
8/30/22	8.57	222	60.656	46.20	2.31	230.99	2.62E+10	2.62E+10
12/10/22	7.62	223	60.929	41.07	2.05	205.37	2.33E+10	2.33E+10
12/31/22	8.35	224	61.202	44.98	2.25	224.92	2.55E+10	2.55E+10
2/1/22	9.39	225	61.475	50.64	2.53	253.18	2.87E+10	2.87E+10
8/12/22	8.71	226	61.749	46.96	2.35	234.78	2.66E+10	2.66E+10
7/19/22	9.06	227	62.022	48.81	2.44	244.04	2.77E+10	2.77E+10
8/24/22	7.95	228	62.295	42.84	2.14	214.21	2.43E+10	2.43E+10
11/28/22	6.71	229	62.568	36.15	1.81	180.74	2.05E+10	2.05E+10
12/11/22	7.75	230	62.842	41.78	2.09	208.91	2.37E+10	2.37E+10
6/23/22	10.28	231	63.115	55.42	2.77	277.09	3.14E+10	3.14E+10
8/15/22	7.95	232	63.388	42.83	2.14	214.17	2.43E+10	2.43E+10
9/1/22	7.34	233	63.661	39.58	1.98	197.91	2.25E+10	2.25E+10
12/12/22	7.93	234	63.934	42.72	2.14	213.60	2.42E+10	2.42E+10
8/14/22	8.06	235	64.208	43.45	2.17	217.27	2.47E+10	2.47E+10
12/16/22	6.76	236	64.481	36.44	1.82	182.20	2.07E+10	2.07E+10
12/13/22	6.70	237	64.754	36.10	1.80	180.50	2.05E+10	2.05E+10
12/15/22	6.31	238	65.027	34.03	1.70	170.16	1.93E+10	1.93E+10
12/17/22	7.04	239	65.301	37.96	1.90	189.79	2.15E+10	2.15E+10
8/13/22	7.82	240	65.574	42.13	2.11	210.64	2.39E+10	2.39E+10
7/20/22	8.05	241	65.847	43.40	2.17	217.02	2.46E+10	2.46E+10
8/16/22	7.45	242	66.120	40.18	2.01	200.90	2.28E+10	2.28E+10
12/14/22	6.97	243	66.393	37.58	1.88	187.92	2.13E+10	2.13E+10

12/24/22	4.59	244	66.667	24.73	1.24	123.67	1.40E+10	1.40E+10
8/25/22	7.35	245	66.940	39.63	1.98	198.13	2.25E+10	2.25E+10
9/2/22	6.97	246	67.213	37.59	1.88	187.97	2.13E+10	2.13E+10
12/18/22	6.98	247	67.486	37.60	1.88	188.01	2.13E+10	2.13E+10
12/23/22	4.54	248	67.760	24.47	1.22	122.35	1.39E+10	1.39E+10
12/20/22	7.03	249	68.033	37.87	1.89	189.33	2.15E+10	2.15E+10
10/23/22	6.54	250	68.306	35.27	1.76	176.35	2.00E+10	2.00E+10
12/19/22	6.95	251	68.579	37.46	1.87	187.31	2.13E+10	2.13E+10
12/27/22	3.69	252	68.852	19.90	1.00	99.50	1.13E+10	1.13E+10
12/26/22	4.70	253	69.126	25.31	1.27	126.57	1.44E+10	1.44E+10
12/30/22	6.10	254	69.399	32.89	1.64	164.47	1.87E+10	1.87E+10
7/21/22	7.56	255	69.672	40.75	2.04	203.76	2.31E+10	2.31E+10
8/17/22	6.85	256	69.945	36.94	1.85	184.71	2.10E+10	2.10E+10
6/24/22	8.77	257	70.219	47.26	2.36	236.31	2.68E+10	2.68E+10
12/21/22	7.03	258	70.492	37.88	1.89	189.40	2.15E+10	2.15E+10
12/28/22	3.37	259	70.765	18.15	0.91	90.73	1.03E+10	1.03E+10
12/25/22	3.99	260	71.038	21.49	1.07	107.44	1.22E+10	1.22E+10
9/3/22	6.64	261	71.311	35.77	1.79	178.84	2.03E+10	2.03E+10
8/26/22	6.55	262	71.585	35.30	1.77	176.51	2.00E+10	2.00E+10
12/22/22	6.82	263	71.858	36.75	1.84	183.74	2.09E+10	2.09E+10
8/29/22	5.97	264	72.131	32.20	1.61	160.98	1.83E+10	1.83E+10
8/27/22	6.65	265	72.404	35.82	1.79	179.10	2.03E+10	2.03E+10
9/4/22	6.35	266	72.678	34.20	1.71	171.01	1.94E+10	1.94E+10
8/18/22	6.56	267	72.951	35.37	1.77	176.83	2.01E+10	2.01E+10
12/29/22	3.80	268	73.224	20.47	1.02	102.34	1.16E+10	1.16E+10
10/24/22	5.56	269	73.497	29.96	1.50	149.79	1.70E+10	1.70E+10
8/19/22	6.30	270	73.770	33.94	1.70	169.72	1.93E+10	1.93E+10
8/28/22	6.24	271	74.044	33.63	1.68	168.14	1.91E+10	1.91E+10
8/20/22	5.98	272	74.317	32.21	1.61	161.05	1.83E+10	1.83E+10
9/5/22	6.15	273	74.590	33.17	1.66	165.87	1.88E+10	1.88E+10
6/25/22	7.91	274	74.863	42.61	2.13	213.07	2.42E+10	2.42E+10
9/6/22	5.87	275	75.137	31.61	1.58	158.07	1.79E+10	1.79E+10
10/25/22	4.77	276	75.410	25.72	1.29	128.60	1.46E+10	1.46E+10
10/26/22	5.16	277	75.683	27.80	1.39	139.00	1.58E+10	1.58E+10
10/27/22	5.10	278	75.956	27.50	1.38	137.51	1.56E+10	1.56E+10
11/27/22	4.61	279	76.230	24.86	1.24	124.30	1.41E+10	1.41E+10
10/28/22	5.12	280	76.503	27.61	1.38	138.04	1.57E+10	1.57E+10
9/7/22	5.89	281	76.776	31.77	1.59	158.87	1.80E+10	1.80E+10
9/27/22	6.09	282	77.049	32.81	1.64	164.07	1.86E+10	1.86E+10
10/29/22	4.85	283	77.322	26.14	1.31	130.72	1.48E+10	1.48E+10
6/26/22	7.18	284	77.596	38.70	1.93	193.50	2.20E+10	2.20E+10
9/28/22	5.79	285	77.869	31.19	1.56	155.97	1.77E+10	1.77E+10
10/30/22	4.78	286	78.142	25.79	1.29	128.93	1.46E+10	1.46E+10
11/1/22	4.52	287	78.415	24.35	1.22	121.73	1.38E+10	1.38E+10
10/31/22	4.56	288	78.689	24.55	1.23	122.76	1.39E+10	1.39E+10
11/2/22	4.76	289	78.962	25.64	1.28	128.18	1.45E+10	1.45E+10
11/4/22	4.52	290	79.235	24.34	1.22	121.69	1.38E+10	1.38E+10
11/3/22	4.78	291	79.508	25.76	1.29	128.81	1.46E+10	1.46E+10
9/26/22	5.79	292	79.781	31.19	1.56	155.94	1.77E+10	1.77E+10
9/8/22	5.49	293	80.055	29.62	1.48	148.08	1.68E+10	1.68E+10
11/5/22	4.26	294	80.328	22.97	1.15	114.85	1.30E+10	1.30E+10
10/19/22	4.46	295	80.601	24.06	1.20	120.31	1.37E+10	1.37E+10
9/29/22	5.47	296	80.874	29.50	1.48	147.51	1.67E+10	1.67E+10
10/22/22	4.62	297	81.148	24.89	1.24	124.43	1.41E+10	1.41E+10
11/7/22	4.47	298	81.421	24.08	1.20	120.38	1.37E+10	1.37E+10
11/6/22	4.42	299	81.694	23.84	1.19	119.18	1.35E+10	1.35E+10
11/8/22	4.83	300	81.967	26.03	1.30	130.13	1.48E+10	1.48E+10
10/20/22	4.44	301	82.240	23.94	1.20	119.69	1.36E+10	1.36E+10
11/9/22	4.42	302	82.514	23.83	1.19	119.14	1.35E+10	1.35E+10
9/9/22	4.97	303	82.787	26.77	1.34	133.84	1.52E+10	1.52E+10
9/30/22	5.42	304	83.060	29.23	1.46	146.17	1.66E+10	1.66E+10

11/10/22	4.02	305	83.333	21.68	1.08	108.39	1.23E+10	1.23E+10
9/12/22	5.52	306	83.607	29.76	1.49	148.79	1.69E+10	1.69E+10
11/11/22	4.51	307	83.880	24.29	1.21	121.43	1.38E+10	1.38E+10
10/18/22	3.99	308	84.153	21.52	1.08	107.62	1.22E+10	1.22E+10
6/27/22	6.21	309	84.426	33.49	1.67	167.47	1.90E+10	1.90E+10
10/21/22	4.23	310	84.699	22.80	1.14	113.98	1.29E+10	1.29E+10
9/11/22	4.15	311	84.973	22.35	1.12	111.76	1.27E+10	1.27E+10
11/12/22	4.01	312	85.246	21.63	1.08	108.14	1.23E+10	1.23E+10
11/13/22	4.11	313	85.519	22.14	1.11	110.72	1.26E+10	1.26E+10
9/13/22	5.22	314	85.792	28.12	1.41	140.58	1.60E+10	1.60E+10
11/14/22	4.39	315	86.066	23.67	1.18	118.37	1.34E+10	1.34E+10
9/10/22	4.39	316	86.339	23.64	1.18	118.22	1.34E+10	1.34E+10
10/1/22	5.22	317	86.612	28.15	1.41	140.75	1.60E+10	1.60E+10
11/15/22	4.25	318	86.885	22.92	1.15	114.62	1.30E+10	1.30E+10
9/14/22	4.82	319	87.158	26.01	1.30	130.03	1.48E+10	1.48E+10
11/16/22	3.73	320	87.432	20.10	1.00	100.48	1.14E+10	1.14E+10
11/17/22	3.72	321	87.705	20.06	1.00	100.29	1.14E+10	1.14E+10
9/15/22	4.65	322	87.978	25.09	1.25	125.44	1.42E+10	1.42E+10
11/26/22	3.81	323	88.251	20.52	1.03	102.59	1.16E+10	1.16E+10
9/25/22	4.29	324	88.525	23.13	1.16	115.67	1.31E+10	1.31E+10
9/21/22	4.76	325	88.798	25.63	1.28	128.17	1.45E+10	1.45E+10
11/18/22	3.67	326	89.071	19.80	0.99	99.00	1.12E+10	1.12E+10
11/25/22	3.86	327	89.344	20.80	1.04	103.99	1.18E+10	1.18E+10
11/19/22	3.58	328	89.617	19.31	0.97	96.54	1.10E+10	1.10E+10
9/22/22	4.96	329	89.891	26.71	1.34	133.57	1.52E+10	1.52E+10
9/16/22	4.45	330	90.164	23.98	1.20	119.91	1.36E+10	1.36E+10
11/24/22	3.53	331	90.437	19.05	0.95	95.24	1.08E+10	1.08E+10
10/2/22	4.93	332	90.710	26.56	1.33	132.81	1.51E+10	1.51E+10
11/22/22	3.63	333	90.984	19.56	0.98	97.80	1.11E+10	1.11E+10
11/21/22	3.31	334	91.257	17.83	0.89	89.13	1.01E+10	1.01E+10
11/23/22	3.49	335	91.530	18.81	0.94	94.04	1.07E+10	1.07E+10
9/20/22	4.37	336	91.803	23.53	1.18	117.65	1.34E+10	1.34E+10
6/28/22	5.08	337	92.077	27.39	1.37	136.95	1.55E+10	1.55E+10
11/20/22	3.50	338	92.350	18.86	0.94	94.30	1.07E+10	1.07E+10
9/17/22	4.07	339	92.623	21.96	1.10	109.80	1.25E+10	1.25E+10
9/23/22	4.54	340	92.896	24.45	1.22	122.27	1.39E+10	1.39E+10
9/19/22	4.49	341	93.169	24.20	1.21	121.00	1.37E+10	1.37E+10
9/18/22	4.27	342	93.443	23.04	1.15	115.21	1.31E+10	1.31E+10
10/3/22	4.52	343	93.716	24.38	1.22	121.89	1.38E+10	1.38E+10
9/24/22	4.04	344	93.989	21.78	1.09	108.88	1.24E+10	1.24E+10
7/5/22	4.51	345	94.262	24.29	1.21	121.47	1.38E+10	1.38E+10
10/4/22	4.10	346	94.536	22.12	1.11	110.58	1.25E+10	1.25E+10
6/29/22	4.54	347	94.809	24.48	1.22	122.39	1.39E+10	1.39E+10
10/5/22	4.23	348	95.082	22.79	1.14	113.97	1.29E+10	1.29E+10
10/17/22	2.58	349	95.355	13.91	0.70	69.56	7.89E+09	7.89E+09
10/6/22	3.46	350	95.628	18.62	0.93	93.12	1.06E+10	1.06E+10
6/30/22	4.03	351	95.902	21.70	1.09	108.52	1.23E+10	1.23E+10
10/7/22	3.93	352	96.175	21.20	1.06	106.00	1.20E+10	1.20E+10
7/1/22	3.98	353	96.448	21.46	1.07	107.31	1.22E+10	1.22E+10
7/2/22	4.05	354	96.721	21.81	1.09	109.03	1.24E+10	1.24E+10
10/8/22	3.32	355	96.995	17.89	0.89	89.46	1.02E+10	1.02E+10
10/16/22	2.17	356	97.268	11.69	0.58	58.47	6.63E+09	6.63E+09
10/9/22	2.53	357	97.541	13.64	0.68	68.21	7.74E+09	7.74E+09
7/3/22	3.52	358	97.814	18.95	0.95	94.77	1.08E+10	1.08E+10
10/13/22	3.28	359	98.087	17.68	0.88	88.41	1.00E+10	1.00E+10
10/10/22	2.42	360	98.361	13.06	0.65	65.30	7.41E+09	7.41E+09
10/15/22	2.02	361	98.634	10.91	0.55	54.57	6.19E+09	6.19E+09
10/14/22	2.08	362	98.907	11.21	0.56	56.04	6.36E+09	6.36E+09
10/11/22	2.33	363	99.180	12.56	0.63	62.81	7.13E+09	7.13E+09
10/12/22	2.28	364	99.454	12.27	0.61	61.34	6.96E+09	6.96E+09
7/4/22	3.48	365	99.727	18.75	0.94	93.74	1.06E+10	1.06E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 7 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	88.51	2.21	0.115	5.2	437	0.819672131	1054.264455	54.8599151	2480.622247	9.46E+11	21	22139.55356	1152.058217	52093.06719	1.99E+13
3/15/22	17.48	2.21	0.05	6	26	19.67213115	208.2336979	4.71116963	565.3403562	1.11E+10	35	7288.179425	164.8909372	19786.91247	3.89E+11
4/19/22	20.56	3.65	0.05	4.4	101	16.12021858	404.5156725	5.54131058	487.6353312	5.08E+10	35	14158.04854	193.9458704	17067.23659	1.78E+12
5/24/22	7.69	4.70	0.05	6	111.0	34.15300546	194.7829306	2.07215884	248.6590604	2.09E+10	28	5453.922058	58.02044743	6962.453691	5.85E+11
6/21/22	6.23	3.95	0.05	8	770.0	51.63934426	132.7180521	1.67997534	268.796055	1.17E+11	28	3716.10546	47.03930962	7526.289539	3.29E+12
7/19/22	8.12	3.64	0.05	2.8	326.0	62.02185792	159.2679787	2.18774696	122.5138297	6.47E+10	35	5574.379253	76.57114359	4287.984041	2.27E+12
8/23/22	2.67	3.52	0.05	2.8	613.0	58.46994536	50.64175585	0.71934312	40.28321488	4.00E+10	28	1417.969164	20.14160744	1127.930017	1.12E+12
9/20/22	2.25	2.51	0.050	3.6	980.0	91.80327869	30.40720624	0.60632757	43.65558486	5.39E+10	36	1094.659425	21.82779243	1571.601055	1.94E+12
10/26/22	4.12	1.69	0.098	9.2	770.0	75.68306011	37.61945066	2.17633186	204.3087049	7.76E+10	13	489.0528586	28.29231413	2656.013163	1.01E+12
11/8/22	2.99	1.85	0.050	4.4	81.0	81.96721311	29.80494168	0.80450398	70.79635032	5.92E+09	35	1043.172959	28.15763933	2477.872261	2.07E+11
12/13/22	3.88	4.60	0.050	10.4	228.0	64.75409836	96.31089823	1.04685759	217.7463786	2.17E+10	36	3467.192336	37.68687322	7838.86963	7.80E+11
1/18/23	7.55	1.30	0.050	8.4	119.0	53.00546448	52.92818295	2.03569934	341.9974898	2.20E+10	37	1958.342769	75.32087574	12653.90712	8.14E+11
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	67,800.6	1,904.0	136,050.1	3.41E+13
											TARGET	31,201.5	1,560.1	156,007.4	1.77E+13

Site 8 Date	E8	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	65.41	1	0.273	352.54	17.63	1762.72	2.00E+11	2.00E+11
2/24/22	66.05	2	0.546	355.99	17.80	1779.96	2.02E+11	2.02E+11
2/22/22	62.36	3	0.820	336.15	16.81	1680.73	1.91E+11	1.91E+11
2/25/22	64.29	4	1.093	346.52	17.33	1732.60	1.97E+11	1.97E+11
2/26/22	61.67	5	1.366	332.40	16.62	1661.98	1.89E+11	1.89E+11
2/21/22	60.39	6	1.639	325.49	16.27	1627.44	1.85E+11	1.85E+11
2/27/22	60.52	7	1.913	326.21	16.31	1631.07	1.85E+11	1.85E+11
2/20/22	53.97	8	2.186	290.87	14.54	1454.37	1.65E+11	1.65E+11
2/19/22	57.93	9	2.459	312.24	15.61	1561.19	1.77E+11	1.77E+11
2/28/22	57.98	10	2.732	312.50	15.62	1562.49	1.77E+11	1.77E+11
3/1/22	57.54	11	3.005	310.14	15.51	1550.70	1.76E+11	1.76E+11
3/2/22	55.68	12	3.279	300.11	15.01	1500.56	1.70E+11	1.70E+11
3/3/22	55.81	13	3.552	300.84	15.04	1504.19	1.71E+11	1.71E+11
3/4/22	55.27	14	3.825	297.88	14.89	1489.42	1.69E+11	1.69E+11
3/26/22	50.62	15	4.098	272.86	13.64	1364.31	1.55E+11	1.55E+11
3/27/22	50.82	16	4.372	273.90	13.70	1369.52	1.55E+11	1.55E+11
3/28/22	51.11	17	4.645	275.49	13.77	1377.43	1.56E+11	1.56E+11
3/25/22	49.23	18	4.918	265.33	13.27	1326.64	1.51E+11	1.51E+11
3/5/22	50.53	19	5.191	272.36	13.62	1361.81	1.55E+11	1.55E+11
2/18/22	47.89	20	5.464	258.11	12.91	1290.55	1.46E+11	1.46E+11
3/29/22	50.67	21	5.738	273.11	13.66	1365.56	1.55E+11	1.55E+11
3/24/22	47.27	22	6.011	254.78	12.74	1273.92	1.45E+11	1.45E+11
3/30/22	46.53	23	6.284	250.78	12.54	1253.88	1.42E+11	1.42E+11
3/7/22	49.25	24	6.557	265.45	13.27	1327.26	1.51E+11	1.51E+11
3/6/22	48.63	25	6.831	262.12	13.11	1310.62	1.49E+11	1.49E+11
3/8/22	50.20	26	7.104	270.58	13.53	1352.92	1.54E+11	1.54E+11
3/31/22	44.32	27	7.377	238.89	11.94	1194.47	1.36E+11	1.36E+11
3/9/22	49.21	28	7.650	265.22	13.26	1326.08	1.50E+11	1.50E+11
4/1/22	45.12	29	7.923	243.20	12.16	1216.02	1.38E+11	1.38E+11
4/2/22	45.52	30	8.197	245.34	12.27	1226.69	1.39E+11	1.39E+11
3/10/22	48.75	31	8.470	262.76	13.14	1313.81	1.49E+11	1.49E+11
3/23/22	42.85	32	8.743	230.94	11.55	1154.70	1.31E+11	1.31E+11
4/3/22	44.67	33	9.016	240.76	12.04	1203.80	1.37E+11	1.37E+11
5/8/22	42.98	34	9.290	231.67	11.58	1158.34	1.31E+11	1.31E+11
3/11/22	43.80	35	9.563	236.07	11.80	1180.34	1.34E+11	1.34E+11
5/9/22	42.00	36	9.836	226.39	11.32	1131.94	1.28E+11	1.28E+11
5/7/22	43.16	37	10.109	232.64	11.63	1163.18	1.32E+11	1.32E+11
4/4/22	42.35	38	10.383	228.29	11.41	1141.46	1.30E+11	1.30E+11
5/10/22	41.77	39	10.656	225.13	11.26	1125.64	1.28E+11	1.28E+11
4/5/22	44.20	40	10.929	238.26	11.91	1191.28	1.35E+11	1.35E+11
4/7/22	42.19	41	11.202	227.39	11.37	1136.94	1.29E+11	1.29E+11
5/11/22	42.62	42	11.475	229.71	11.49	1148.57	1.30E+11	1.30E+11
4/6/22	41.67	43	11.749	224.58	11.23	1122.89	1.27E+11	1.27E+11
4/8/22	39.15	44	12.022	211.00	10.55	1054.98	1.20E+11	1.20E+11
3/12/22	42.90	45	12.295	231.22	11.56	1156.08	1.31E+11	1.31E+11
4/15/22	41.08	46	12.568	221.40	11.07	1106.99	1.26E+11	1.26E+11
4/16/22	40.74	47	12.842	219.59	10.98	1097.96	1.25E+11	1.25E+11
4/9/22	41.55	48	13.115	223.97	11.20	1119.87	1.27E+11	1.27E+11
5/12/22	40.20	49	13.388	216.67	10.83	1083.33	1.23E+11	1.23E+11
3/22/22	40.43	50	13.661	217.91	10.90	1089.53	1.24E+11	1.24E+11
4/17/22	41.66	51	13.934	224.54	11.23	1122.69	1.27E+11	1.27E+11
4/14/22	38.75	52	14.208	208.86	10.44	1044.29	1.19E+11	1.19E+11
3/21/22	41.19	53	14.481	222.02	11.10	1110.10	1.26E+11	1.26E+11
5/6/22	37.77	54	14.754	203.55	10.18	1017.77	1.15E+11	1.15E+11
4/10/22	40.55	55	15.027	218.55	10.93	1092.74	1.24E+11	1.24E+11
3/13/22	40.17	56	15.301	216.54	10.83	1082.69	1.23E+11	1.23E+11
4/18/22	38.29	57	15.574	206.40	10.32	1032.02	1.17E+11	1.17E+11
5/13/22	38.24	58	15.847	206.12	10.31	1030.61	1.17E+11	1.17E+11
4/19/22	39.28	59	16.120	211.69	10.58	1058.46	1.20E+11	1.20E+11
3/20/22	38.48	60	16.393	207.43	10.37	1037.13	1.18E+11	1.18E+11

4/20/22	37.69	61	16.667	203.13	10.16	1015.65	1.15E+11	1.15E+11
4/11/22	40.07	62	16.940	215.96	10.80	1079.78	1.23E+11	1.23E+11
5/14/22	37.00	63	17.213	199.42	9.97	997.10	1.13E+11	1.13E+11
3/14/22	39.96	64	17.486	215.39	10.77	1076.95	1.22E+11	1.22E+11
4/13/22	33.87	65	17.760	182.58	9.13	912.90	1.04E+11	1.04E+11
4/21/22	35.75	66	18.033	192.69	9.63	963.45	1.09E+11	1.09E+11
4/12/22	38.17	67	18.306	205.71	10.29	1028.55	1.17E+11	1.17E+11
2/17/22	34.13	68	18.579	183.96	9.20	919.80	1.04E+11	1.04E+11
4/22/22	38.06	69	18.852	205.15	10.26	1025.76	1.16E+11	1.16E+11
5/15/22	36.04	70	19.126	194.25	9.71	971.26	1.10E+11	1.10E+11
5/5/22	36.26	71	19.399	195.43	9.77	977.16	1.11E+11	1.11E+11
3/15/22	38.59	72	19.672	208.00	10.40	1040.02	1.18E+11	1.18E+11
4/23/22	34.70	73	19.945	187.01	9.35	935.05	1.06E+11	1.06E+11
4/25/22	36.26	74	20.219	195.42	9.77	977.08	1.11E+11	1.11E+11
4/24/22	33.09	75	20.492	178.36	8.92	891.82	1.01E+11	1.01E+11
5/4/22	35.83	76	20.765	193.12	9.66	965.61	1.10E+11	1.10E+11
4/26/22	35.37	77	21.038	190.64	9.53	953.18	1.08E+11	1.08E+11
3/16/22	36.56	78	21.311	197.06	9.85	985.31	1.12E+11	1.12E+11
5/16/22	34.33	79	21.585	185.05	9.25	925.24	1.05E+11	1.05E+11
3/19/22	33.83	80	21.858	182.36	9.12	911.80	1.03E+11	1.03E+11
4/27/22	35.21	81	22.131	189.80	9.49	949.02	1.08E+11	1.08E+11
3/17/22	35.84	82	22.404	193.17	9.66	965.86	1.10E+11	1.10E+11
4/28/22	33.06	83	22.678	178.20	8.91	891.01	1.01E+11	1.01E+11
5/17/22	32.25	84	22.951	173.83	8.69	869.13	9.86E+10	9.86E+10
3/18/22	32.25	85	23.224	173.84	8.69	869.18	9.86E+10	9.86E+10
5/3/22	32.09	86	23.497	172.99	8.65	864.93	9.82E+10	9.82E+10
4/29/22	31.81	87	23.770	171.44	8.57	857.18	9.73E+10	9.73E+10
5/18/22	30.65	88	24.044	165.20	8.26	826.01	9.37E+10	9.37E+10
5/1/22	30.60	89	24.317	164.96	8.25	824.79	9.36E+10	9.36E+10
6/11/22	31.41	90	24.590	169.31	8.47	846.56	9.61E+10	9.61E+10
6/12/22	31.12	91	24.863	167.75	8.39	838.77	9.52E+10	9.52E+10
4/30/22	29.75	92	25.137	160.36	8.02	801.79	9.10E+10	9.10E+10
5/2/22	31.43	93	25.410	169.43	8.47	847.13	9.61E+10	9.61E+10
6/10/22	30.94	94	25.683	166.76	8.34	833.80	9.46E+10	9.46E+10
5/19/22	29.73	95	25.956	160.22	8.01	801.10	9.09E+10	9.09E+10
6/13/22	30.83	96	26.230	166.16	8.31	830.82	9.43E+10	9.43E+10
6/9/22	30.44	97	26.503	164.06	8.20	820.32	9.31E+10	9.31E+10
6/14/22	30.70	98	26.776	165.46	8.27	827.30	9.39E+10	9.39E+10
5/20/22	28.61	99	27.049	154.21	7.71	771.03	8.75E+10	8.75E+10
6/15/22	29.75	100	27.322	160.37	8.02	801.87	9.10E+10	9.10E+10
6/8/22	28.01	101	27.596	150.97	7.55	754.85	8.57E+10	8.57E+10
6/2/22	28.41	102	27.869	153.14	7.66	765.70	8.69E+10	8.69E+10
5/21/22	27.82	103	28.142	149.97	7.50	749.87	8.51E+10	8.51E+10
6/1/22	27.58	104	28.415	148.68	7.43	743.39	8.44E+10	8.44E+10
5/30/22	28.07	105	28.689	151.32	7.57	756.58	8.59E+10	8.59E+10
7/28/22	26.05	106	28.962	140.43	7.02	702.16	7.97E+10	7.97E+10
6/3/22	27.67	107	29.235	149.15	7.46	745.76	8.46E+10	8.46E+10
7/27/22	26.02	108	29.508	140.26	7.01	701.31	7.96E+10	7.96E+10
5/31/22	28.12	109	29.781	151.54	7.58	757.71	8.60E+10	8.60E+10
7/29/22	25.97	110	30.055	139.96	7.00	699.82	7.94E+10	7.94E+10
5/29/22	27.17	111	30.328	146.47	7.32	732.35	8.31E+10	8.31E+10
7/26/22	25.01	112	30.601	134.80	6.74	673.99	7.65E+10	7.65E+10
5/22/22	26.76	113	30.874	144.24	7.21	721.21	8.18E+10	8.18E+10
6/7/22	27.14	114	31.148	146.27	7.31	731.35	8.30E+10	8.30E+10
6/16/22	27.98	115	31.421	150.81	7.54	754.07	8.56E+10	8.56E+10
6/4/22	26.69	116	31.694	143.86	7.19	719.31	8.16E+10	8.16E+10
7/30/22	24.83	117	31.967	133.81	6.69	669.05	7.59E+10	7.59E+10
7/25/22	24.42	118	32.240	131.62	6.58	658.11	7.47E+10	7.47E+10
5/23/22	25.17	119	32.514	135.68	6.78	678.38	7.70E+10	7.70E+10
6/5/22	25.37	120	32.787	136.77	6.84	683.83	7.76E+10	7.76E+10
7/31/22	23.72	121	33.060	127.83	6.39	639.14	7.25E+10	7.25E+10

6/17/22	25.80	122	33.333	139.08	6.95	695.40	7.89E+10	7.89E+10
6/6/22	24.11	123	33.607	129.96	6.50	649.78	7.37E+10	7.37E+10
5/28/22	24.92	124	33.880	134.30	6.72	671.52	7.62E+10	7.62E+10
5/24/22	23.70	125	34.153	127.72	6.39	638.61	7.25E+10	7.25E+10
7/24/22	22.75	126	34.426	122.63	6.13	613.14	6.96E+10	6.96E+10
8/1/22	22.54	127	34.699	121.48	6.07	607.41	6.89E+10	6.89E+10
2/16/22	19.90	128	34.973	107.27	5.36	536.37	6.09E+10	6.09E+10
5/27/22	24.28	129	35.246	130.88	6.54	654.40	7.43E+10	7.43E+10
5/25/22	23.39	130	35.519	126.09	6.30	630.43	7.15E+10	7.15E+10
5/26/22	24.05	131	35.792	129.65	6.48	648.26	7.36E+10	7.36E+10
6/18/22	23.99	132	36.066	129.28	6.46	646.41	7.34E+10	7.34E+10
8/2/22	21.19	133	36.339	114.23	5.71	571.16	6.48E+10	6.48E+10
2/13/22	21.96	134	36.612	118.37	5.92	591.87	6.72E+10	6.72E+10
2/14/22	21.79	135	36.885	117.47	5.87	587.34	6.67E+10	6.67E+10
2/15/22	21.40	136	37.158	115.35	5.77	576.77	6.55E+10	6.55E+10
8/3/22	19.77	137	37.432	106.58	5.33	532.91	6.05E+10	6.05E+10
7/8/22	21.51	138	37.705	115.95	5.80	579.73	6.58E+10	6.58E+10
7/9/22	21.46	139	37.978	115.64	5.78	578.22	6.56E+10	6.56E+10
6/19/22	21.45	140	38.251	115.64	5.78	578.20	6.56E+10	6.56E+10
2/12/22	21.03	141	38.525	113.36	5.67	566.80	6.43E+10	6.43E+10
8/4/22	19.31	142	38.798	104.07	5.20	520.37	5.91E+10	5.91E+10
1/25/23	17.68	143	39.071	95.31	4.77	476.53	5.41E+10	5.41E+10
1/23/23	17.18	144	39.344	92.58	4.63	462.92	5.25E+10	5.25E+10
1/22/23	17.61	145	39.617	94.90	4.75	474.51	5.38E+10	5.38E+10
1/26/23	17.26	146	39.891	93.05	4.65	465.27	5.28E+10	5.28E+10
7/10/22	21.07	147	40.164	113.57	5.68	567.85	6.44E+10	6.44E+10
7/23/22	18.58	148	40.437	100.15	5.01	500.75	5.68E+10	5.68E+10
1/24/23	16.64	149	40.710	89.66	4.48	448.32	5.09E+10	5.09E+10
1/27/23	15.98	150	40.984	86.11	4.31	430.54	4.89E+10	4.89E+10
7/7/22	20.81	151	41.257	112.18	5.61	560.88	6.36E+10	6.36E+10
1/8/23	17.52	152	41.530	94.45	4.72	472.25	5.36E+10	5.36E+10
1/28/23	17.29	153	41.803	93.17	4.66	465.87	5.29E+10	5.29E+10
1/21/23	16.55	154	42.077	89.19	4.46	445.93	5.06E+10	5.06E+10
1/7/23	17.27	155	42.350	93.08	4.65	465.39	5.28E+10	5.28E+10
1/29/23	16.68	156	42.623	89.88	4.49	449.42	5.10E+10	5.10E+10
1/6/23	16.86	157	42.896	90.85	4.54	454.24	5.15E+10	5.15E+10
8/5/22	17.47	158	43.169	94.17	4.71	470.85	5.34E+10	5.34E+10
1/9/23	17.04	159	43.443	91.87	4.59	459.33	5.21E+10	5.21E+10
7/11/22	20.26	160	43.716	109.19	5.46	545.93	6.20E+10	6.20E+10
1/30/23	16.96	161	43.989	91.39	4.57	456.95	5.19E+10	5.19E+10
1/10/23	17.00	162	44.262	91.62	4.58	458.12	5.20E+10	5.20E+10
1/5/23	16.43	163	44.536	88.58	4.43	442.91	5.03E+10	5.03E+10
2/7/22	18.62	164	44.809	100.36	5.02	501.80	5.69E+10	5.69E+10
1/20/23	16.17	165	45.082	87.14	4.36	435.72	4.94E+10	4.94E+10
1/31/23	16.03	166	45.355	86.42	4.32	432.08	4.90E+10	4.90E+10
2/8/22	17.96	167	45.628	96.81	4.84	484.03	5.49E+10	5.49E+10
6/20/22	19.84	168	45.902	106.92	5.35	534.58	6.07E+10	6.07E+10
2/6/22	16.45	169	46.175	88.67	4.43	443.34	5.03E+10	5.03E+10
1/12/23	16.52	170	46.448	89.05	4.45	445.23	5.05E+10	5.05E+10
2/3/22	18.92	171	46.721	101.99	5.10	509.96	5.79E+10	5.79E+10
8/6/22	16.79	172	46.995	90.49	4.52	452.43	5.13E+10	5.13E+10
7/12/22	18.93	173	47.268	102.04	5.10	510.20	5.79E+10	5.79E+10
2/4/22	16.74	174	47.541	90.21	4.51	451.07	5.12E+10	5.12E+10
2/5/22	18.05	175	47.814	97.28	4.86	486.38	5.52E+10	5.52E+10
1/4/23	15.65	176	48.087	84.37	4.22	421.84	4.79E+10	4.79E+10
1/13/23	15.82	177	48.361	85.26	4.26	426.31	4.84E+10	4.84E+10
2/11/22	15.59	178	48.634	84.01	4.20	420.03	4.77E+10	4.77E+10
1/19/23	15.41	179	48.907	83.08	4.15	415.42	4.71E+10	4.71E+10
1/14/23	15.53	180	49.180	83.71	4.19	418.56	4.75E+10	4.75E+10
2/9/22	17.00	181	49.454	91.61	4.58	458.04	5.20E+10	5.20E+10
8/7/22	15.91	182	49.727	85.74	4.29	428.72	4.87E+10	4.87E+10

1/15/23	14.96	183	50.000	80.61	4.03	403.06	4.57E+10	4.57E+10
8/8/22	15.24	184	50.273	82.14	4.11	410.68	4.66E+10	4.66E+10
2/2/22	17.82	185	50.546	96.05	4.80	480.27	5.45E+10	5.45E+10
7/13/22	17.41	186	50.820	93.84	4.69	469.19	5.32E+10	5.32E+10
2/10/22	17.23	187	51.093	92.89	4.64	464.46	5.27E+10	5.27E+10
8/9/22	14.90	188	51.366	80.31	4.02	401.57	4.56E+10	4.56E+10
6/21/22	17.68	189	51.639	95.31	4.77	476.57	5.41E+10	5.41E+10
1/16/23	14.67	190	51.913	79.06	3.95	395.30	4.49E+10	4.49E+10
1/3/23	13.51	191	52.186	72.83	3.64	364.13	4.13E+10	4.13E+10
1/17/23	13.95	192	52.459	75.19	3.76	375.93	4.27E+10	4.27E+10
7/14/22	16.19	193	52.732	87.26	4.36	436.28	4.95E+10	4.95E+10
1/18/23	13.46	194	53.005	72.57	3.63	362.83	4.12E+10	4.12E+10
7/22/22	13.59	195	53.279	73.26	3.66	366.32	4.16E+10	4.16E+10
8/10/22	14.24	196	53.552	76.78	3.84	383.89	4.36E+10	4.36E+10
8/22/22	13.62	197	53.825	73.43	3.67	367.15	4.17E+10	4.17E+10
12/2/22	9.89	198	54.098	53.32	2.67	266.59	3.03E+10	3.03E+10
12/1/22	11.66	199	54.372	62.86	3.14	314.31	3.57E+10	3.57E+10
7/15/22	14.50	200	54.645	78.15	3.91	390.73	4.43E+10	4.43E+10
7/6/22	15.03	201	54.918	81.03	4.05	405.15	4.60E+10	4.60E+10
12/4/22	11.79	202	55.191	63.54	3.18	317.68	3.61E+10	3.61E+10
1/2/23	12.92	203	55.464	69.62	3.48	348.08	3.95E+10	3.95E+10
12/3/22	12.09	204	55.738	65.15	3.26	325.77	3.70E+10	3.70E+10
11/30/22	11.63	205	56.011	62.68	3.13	313.38	3.56E+10	3.56E+10
6/22/22	15.50	206	56.284	83.54	4.18	417.70	4.74E+10	4.74E+10
7/16/22	13.69	207	56.557	73.81	3.69	369.07	4.19E+10	4.19E+10
8/21/22	12.94	208	56.831	69.74	3.49	348.70	3.96E+10	3.96E+10
12/5/22	11.56	209	57.104	62.29	3.11	311.46	3.53E+10	3.53E+10
11/29/22	9.36	210	57.377	50.46	2.52	252.29	2.86E+10	2.86E+10
8/11/22	12.97	211	57.650	69.92	3.50	349.58	3.97E+10	3.97E+10
1/1/23	11.65	212	57.923	62.80	3.14	313.99	3.56E+10	3.56E+10
12/6/22	11.95	213	58.197	64.42	3.22	322.08	3.65E+10	3.65E+10
8/23/22	12.04	214	58.470	64.90	3.24	324.49	3.68E+10	3.68E+10
7/17/22	13.55	215	58.743	73.03	3.65	365.13	4.14E+10	4.14E+10
1/11/23	15.60	216	59.016	84.10	4.20	420.50	4.77E+10	4.77E+10
12/7/22	11.20	217	59.290	60.35	3.02	301.73	3.42E+10	3.42E+10
7/18/22	13.22	218	59.563	71.23	3.56	356.16	4.04E+10	4.04E+10
12/8/22	10.94	219	59.836	58.95	2.95	294.74	3.34E+10	3.34E+10
8/31/22	10.77	220	60.109	58.02	2.90	290.12	3.29E+10	3.29E+10
12/9/22	9.25	221	60.383	49.86	2.49	249.30	2.83E+10	2.83E+10
8/30/22	10.99	222	60.656	59.24	2.96	296.21	3.36E+10	3.36E+10
12/10/22	9.77	223	60.929	52.67	2.63	263.36	2.99E+10	2.99E+10
12/31/22	10.70	224	61.202	57.68	2.88	288.42	3.27E+10	3.27E+10
2/1/22	12.05	225	61.475	64.93	3.25	324.66	3.68E+10	3.68E+10
8/12/22	11.17	226	61.749	60.21	3.01	301.07	3.42E+10	3.42E+10
7/19/22	11.61	227	62.022	62.59	3.13	312.94	3.55E+10	3.55E+10
8/24/22	10.19	228	62.295	54.94	2.75	274.69	3.12E+10	3.12E+10
11/28/22	8.60	229	62.568	46.35	2.32	231.76	2.63E+10	2.63E+10
12/11/22	9.94	230	62.842	53.58	2.68	267.89	3.04E+10	3.04E+10
6/23/22	13.18	231	63.115	71.06	3.55	355.32	4.03E+10	4.03E+10
8/15/22	10.19	232	63.388	54.93	2.75	274.64	3.12E+10	3.12E+10
9/1/22	9.42	233	63.661	50.76	2.54	253.78	2.88E+10	2.88E+10
12/12/22	10.16	234	63.934	54.78	2.74	273.90	3.11E+10	3.11E+10
8/14/22	10.34	235	64.208	55.72	2.79	278.62	3.16E+10	3.16E+10
12/16/22	8.67	236	64.481	46.73	2.34	233.64	2.65E+10	2.65E+10
12/13/22	8.59	237	64.754	46.29	2.31	231.46	2.63E+10	2.63E+10
12/15/22	8.10	238	65.027	43.64	2.18	218.20	2.48E+10	2.48E+10
12/17/22	9.03	239	65.301	48.68	2.43	243.38	2.76E+10	2.76E+10
8/13/22	10.02	240	65.574	54.02	2.70	270.12	3.07E+10	3.07E+10
7/20/22	10.33	241	65.847	55.66	2.78	278.29	3.16E+10	3.16E+10
8/16/22	9.56	242	66.120	51.52	2.58	257.62	2.92E+10	2.92E+10
12/14/22	8.94	243	66.393	48.19	2.41	240.97	2.73E+10	2.73E+10

12/24/22	5.88	244	66.667	31.72	1.59	158.58	1.80E+10	1.80E+10
8/25/22	9.43	245	66.940	50.81	2.54	254.07	2.88E+10	2.88E+10
9/2/22	8.94	246	67.213	48.21	2.41	241.04	2.74E+10	2.74E+10
12/18/22	8.95	247	67.486	48.22	2.41	241.09	2.74E+10	2.74E+10
12/23/22	5.82	248	67.760	31.38	1.57	156.90	1.78E+10	1.78E+10
12/20/22	9.01	249	68.033	48.56	2.43	242.78	2.75E+10	2.75E+10
10/23/22	8.39	250	68.306	45.23	2.26	226.13	2.57E+10	2.57E+10
12/19/22	8.91	251	68.579	48.04	2.40	240.20	2.73E+10	2.73E+10
12/27/22	4.73	252	68.852	25.52	1.28	127.60	1.45E+10	1.45E+10
12/26/22	6.02	253	69.126	32.46	1.62	162.30	1.84E+10	1.84E+10
12/30/22	7.83	254	69.399	42.18	2.11	210.91	2.39E+10	2.39E+10
7/21/22	9.70	255	69.672	52.26	2.61	261.29	2.97E+10	2.97E+10
8/17/22	8.79	256	69.945	47.37	2.37	236.86	2.69E+10	2.69E+10
6/24/22	11.24	257	70.219	60.61	3.03	303.03	3.44E+10	3.44E+10
12/21/22	9.01	258	70.492	48.57	2.43	242.87	2.76E+10	2.76E+10
12/28/22	4.32	259	70.765	23.27	1.16	116.34	1.32E+10	1.32E+10
12/25/22	5.11	260	71.038	27.56	1.38	137.78	1.56E+10	1.56E+10
9/3/22	8.51	261	71.311	45.87	2.29	229.34	2.60E+10	2.60E+10
8/26/22	8.40	262	71.585	45.27	2.26	226.35	2.57E+10	2.57E+10
12/22/22	8.74	263	71.858	47.12	2.36	235.61	2.67E+10	2.67E+10
8/29/22	7.66	264	72.131	41.29	2.06	206.43	2.34E+10	2.34E+10
8/27/22	8.52	265	72.404	45.93	2.30	229.67	2.61E+10	2.61E+10
9/4/22	8.14	266	72.678	43.86	2.19	219.29	2.49E+10	2.49E+10
8/18/22	8.41	267	72.951	45.35	2.27	226.75	2.57E+10	2.57E+10
12/29/22	4.87	268	73.224	26.25	1.31	131.24	1.49E+10	1.49E+10
10/24/22	7.13	269	73.497	38.42	1.92	192.08	2.18E+10	2.18E+10
8/19/22	8.08	270	73.770	43.53	2.18	217.64	2.47E+10	2.47E+10
8/28/22	8.00	271	74.044	43.12	2.16	215.61	2.45E+10	2.45E+10
8/20/22	7.66	272	74.317	41.30	2.07	206.51	2.34E+10	2.34E+10
9/5/22	7.89	273	74.590	42.54	2.13	212.70	2.41E+10	2.41E+10
6/25/22	10.14	274	74.863	54.64	2.73	273.22	3.10E+10	3.10E+10
9/6/22	7.52	275	75.137	40.54	2.03	202.70	2.30E+10	2.30E+10
10/25/22	6.12	276	75.410	32.98	1.65	164.90	1.87E+10	1.87E+10
10/26/22	6.61	277	75.683	35.65	1.78	178.25	2.02E+10	2.02E+10
10/27/22	6.54	278	75.956	35.27	1.76	176.33	2.00E+10	2.00E+10
11/27/22	5.91	279	76.230	31.88	1.59	159.39	1.81E+10	1.81E+10
10/28/22	6.57	280	76.503	35.40	1.77	177.02	2.01E+10	2.01E+10
9/7/22	7.56	281	76.776	40.74	2.04	203.72	2.31E+10	2.31E+10
9/27/22	7.81	282	77.049	42.08	2.10	210.39	2.39E+10	2.39E+10
10/29/22	6.22	283	77.322	33.53	1.68	167.63	1.90E+10	1.90E+10
6/26/22	9.21	284	77.596	49.63	2.48	248.13	2.82E+10	2.82E+10
9/28/22	7.42	285	77.869	40.00	2.00	200.01	2.27E+10	2.27E+10
10/30/22	6.13	286	78.142	33.07	1.65	165.33	1.88E+10	1.88E+10
11/1/22	5.79	287	78.415	31.22	1.56	156.10	1.77E+10	1.77E+10
10/31/22	5.84	288	78.689	31.48	1.57	157.42	1.79E+10	1.79E+10
11/2/22	6.10	289	78.962	32.87	1.64	164.37	1.87E+10	1.87E+10
11/4/22	5.79	290	79.235	31.21	1.56	156.05	1.77E+10	1.77E+10
11/3/22	6.13	291	79.508	33.03	1.65	165.17	1.87E+10	1.87E+10
9/26/22	7.42	292	79.781	39.99	2.00	199.97	2.27E+10	2.27E+10
9/8/22	7.05	293	80.055	37.98	1.90	189.89	2.15E+10	2.15E+10
11/5/22	5.47	294	80.328	29.46	1.47	147.28	1.67E+10	1.67E+10
10/19/22	5.72	295	80.601	30.86	1.54	154.28	1.75E+10	1.75E+10
9/29/22	7.02	296	80.874	37.83	1.89	189.16	2.15E+10	2.15E+10
10/22/22	5.92	297	81.148	31.91	1.60	159.56	1.81E+10	1.81E+10
11/7/22	5.73	298	81.421	30.87	1.54	154.37	1.75E+10	1.75E+10
11/6/22	5.67	299	81.694	30.57	1.53	152.83	1.73E+10	1.73E+10
11/8/22	6.19	300	81.967	33.37	1.67	166.87	1.89E+10	1.89E+10
10/20/22	5.70	301	82.240	30.70	1.53	153.48	1.74E+10	1.74E+10
11/9/22	5.67	302	82.514	30.56	1.53	152.78	1.73E+10	1.73E+10
9/9/22	6.37	303	82.787	34.32	1.72	171.62	1.95E+10	1.95E+10
9/30/22	6.96	304	83.060	37.49	1.87	187.44	2.13E+10	2.13E+10

11/10/22	5.16	305	83.333	27.80	1.39	138.99	1.58E+10	1.58E+10
9/12/22	7.08	306	83.607	38.16	1.91	190.80	2.17E+10	2.17E+10
11/11/22	5.78	307	83.880	31.14	1.56	155.71	1.77E+10	1.77E+10
10/18/22	5.12	308	84.153	27.60	1.38	138.00	1.57E+10	1.57E+10
6/27/22	7.97	309	84.426	42.95	2.15	214.75	2.44E+10	2.44E+10
10/21/22	5.42	310	84.699	29.23	1.46	146.16	1.66E+10	1.66E+10
9/11/22	5.32	311	84.973	28.66	1.43	143.32	1.63E+10	1.63E+10
11/12/22	5.15	312	85.246	27.73	1.39	138.67	1.57E+10	1.57E+10
11/13/22	5.27	313	85.519	28.40	1.42	141.99	1.61E+10	1.61E+10
9/13/22	6.69	314	85.792	36.05	1.80	180.27	2.05E+10	2.05E+10
11/14/22	5.63	315	86.066	30.36	1.52	151.79	1.72E+10	1.72E+10
9/10/22	5.63	316	86.339	30.32	1.52	151.60	1.72E+10	1.72E+10
10/1/22	6.70	317	86.612	36.10	1.80	180.49	2.05E+10	2.05E+10
11/15/22	5.45	318	86.885	29.40	1.47	146.98	1.67E+10	1.67E+10
9/14/22	6.19	319	87.158	33.35	1.67	166.74	1.89E+10	1.89E+10
11/16/22	4.78	320	87.432	25.77	1.29	128.85	1.46E+10	1.46E+10
11/17/22	4.77	321	87.705	25.72	1.29	128.61	1.46E+10	1.46E+10
9/15/22	5.97	322	87.978	32.17	1.61	160.85	1.83E+10	1.83E+10
11/26/22	4.88	323	88.251	26.31	1.32	131.55	1.49E+10	1.49E+10
9/25/22	5.50	324	88.525	29.67	1.48	148.33	1.68E+10	1.68E+10
9/21/22	6.10	325	88.798	32.87	1.64	164.35	1.87E+10	1.87E+10
11/18/22	4.71	326	89.071	25.39	1.27	126.95	1.44E+10	1.44E+10
11/25/22	4.95	327	89.344	26.67	1.33	133.35	1.51E+10	1.51E+10
11/19/22	4.59	328	89.617	24.76	1.24	123.80	1.40E+10	1.40E+10
9/22/22	6.36	329	89.891	34.26	1.71	171.28	1.94E+10	1.94E+10
9/16/22	5.71	330	90.164	30.75	1.54	153.77	1.74E+10	1.74E+10
11/24/22	4.53	331	90.437	24.43	1.22	122.13	1.39E+10	1.39E+10
10/2/22	6.32	332	90.710	34.06	1.70	170.30	1.93E+10	1.93E+10
11/22/22	4.65	333	90.984	25.08	1.25	125.42	1.42E+10	1.42E+10
11/21/22	4.24	334	91.257	22.86	1.14	114.29	1.30E+10	1.30E+10
11/23/22	4.47	335	91.530	24.12	1.21	120.59	1.37E+10	1.37E+10
9/20/22	5.60	336	91.803	30.17	1.51	150.86	1.71E+10	1.71E+10
6/28/22	6.52	337	92.077	35.12	1.76	175.62	1.99E+10	1.99E+10
11/20/22	4.49	338	92.350	24.19	1.21	120.93	1.37E+10	1.37E+10
9/17/22	5.22	339	92.623	28.16	1.41	140.79	1.60E+10	1.60E+10
9/23/22	5.82	340	92.896	31.36	1.57	156.79	1.78E+10	1.78E+10
9/19/22	5.76	341	93.169	31.03	1.55	155.16	1.76E+10	1.76E+10
9/18/22	5.48	342	93.443	29.55	1.48	147.73	1.68E+10	1.68E+10
10/3/22	5.80	343	93.716	31.26	1.56	156.30	1.77E+10	1.77E+10
9/24/22	5.18	344	93.989	27.92	1.40	139.62	1.58E+10	1.58E+10
7/5/22	5.78	345	94.262	31.15	1.56	155.77	1.77E+10	1.77E+10
10/4/22	5.26	346	94.536	28.36	1.42	141.80	1.61E+10	1.61E+10
6/29/22	5.82	347	94.809	31.39	1.57	156.94	1.78E+10	1.78E+10
10/5/22	5.42	348	95.082	29.23	1.46	146.14	1.66E+10	1.66E+10
10/17/22	3.31	349	95.355	17.84	0.89	89.20	1.01E+10	1.01E+10
10/6/22	4.43	350	95.628	23.88	1.19	119.41	1.36E+10	1.36E+10
6/30/22	5.16	351	95.902	27.83	1.39	139.16	1.58E+10	1.58E+10
10/7/22	5.04	352	96.175	27.18	1.36	135.92	1.54E+10	1.54E+10
7/1/22	5.11	353	96.448	27.52	1.38	137.60	1.56E+10	1.56E+10
7/2/22	5.19	354	96.721	27.96	1.40	139.82	1.59E+10	1.59E+10
10/8/22	4.26	355	96.995	22.94	1.15	114.72	1.30E+10	1.30E+10
10/16/22	2.78	356	97.268	15.00	0.75	74.98	8.51E+09	8.51E+09
10/9/22	3.25	357	97.541	17.49	0.87	87.47	9.93E+09	9.93E+09
7/3/22	4.51	358	97.814	24.30	1.22	121.52	1.38E+10	1.38E+10
10/13/22	4.21	359	98.087	22.67	1.13	113.37	1.29E+10	1.29E+10
10/10/22	3.11	360	98.361	16.75	0.84	83.73	9.50E+09	9.50E+09
10/15/22	2.60	361	98.634	13.99	0.70	69.97	7.94E+09	7.94E+09
10/14/22	2.67	362	98.907	14.37	0.72	71.86	8.16E+09	8.16E+09
10/11/22	2.99	363	99.180	16.11	0.81	80.55	9.14E+09	9.14E+09
10/12/22	2.92	364	99.454	15.73	0.79	78.66	8.93E+09	8.93E+09
7/4/22	4.46	365	99.727	24.04	1.20	120.21	1.36E+10	1.36E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 8 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	113.49	2.22	0.208	12	1730	0.819672131	1358.035613	127.239373	7340.733041	4.80E+12	21	28518.74786	2672.026827	154155.3939	1.01E+14
3/15/22	22.42	2.45	0.05	3.2	4	19.67213115	296.0231774	6.04128934	386.6425175	2.19E+09	35	10360.81121	211.4451267	13532.48811	7.68E+10
4/19/22	26.37	3.46	0.05	1.2	50	16.12021858	491.7218202	7.10580665	170.5393596	3.23E+10	35	17210.26371	248.7032328	5968.877587	1.13E+12
5/24/22	9.86	4.99	0.05	3.6	55.0	34.15300546	265.188372	2.65719812	191.3182644	1.33E+10	28	7425.274417	74.40154727	5356.911403	3.71E+11
6/21/22	7.99	4.40	0.05	5.6	613.0	51.63934426	189.5773611	2.15428819	241.2802778	1.20E+11	28	5308.166111	60.32006944	6755.847778	3.36E+12
7/19/22	10.41	3.55	0.05	7.6	579.0	62.02185792	199.1848631	2.80542061	426.4239322	1.47E+11	35	6971.470208	98.18972124	14924.83763	5.16E+12
8/23/22	3.42	4.00	0.05	3.6	387.0	58.46994536	73.75810923	0.92243758	66.41550606	3.24E+10	28	2065.227058	25.82825236	1859.63417	9.07E+11
9/20/22	2.89	3.37	0.050	3.6	579.0	91.80327869	52.34084181	0.77751398	55.98100677	4.09E+10	36	1884.270305	27.99050339	2015.316244	1.47E+12
10/26/22	5.28	2.39	0.050	7.2	980.0	75.68306011	68.19021086	1.42386869	205.037092	1.27E+11	13	886.4727411	18.51029302	2665.482195	1.65E+12
11/8/22	3.83	2.39	0.050	2.4	921.0	81.96721311	49.40616939	1.03164218	49.51882472	8.63E+10	35	1729.215929	36.10747636	1733.158865	3.02E+12
12/13/22	4.98	6.60	0.050	3.6	41.0	64.75409836	177.199475	1.34242027	96.65425909	5.00E+09	36	6379.1811	48.32712955	3479.553327	1.80E+11
1/18/23	9.69	1.80	0.050	6.0	179.0	53.00546448	93.97601634	2.6104449	313.2533878	4.24E+10	37	3477.112605	96.58646124	11590.37535	1.57E+12
2/24/23															

Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	92,216.2	3,618.4	224,037.9	1.20E+14
											TARGET	40,010.4	2,000.5	200,052.0	2.27E+13

Site 9 Date	E9	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	458.07	1	0.273	2468.99	123.45	12344.95	1.40E+12	1.40E+12
2/24/22	462.55	2	0.546	2493.13	124.66	12465.67	1.41E+12	1.41E+12
2/22/22	436.76	3	0.820	2354.15	117.71	11770.73	1.34E+12	1.34E+12
2/25/22	450.24	4	1.093	2426.81	121.34	12134.03	1.38E+12	1.38E+12
2/26/22	431.89	5	1.366	2327.89	116.39	11639.43	1.32E+12	1.32E+12
2/21/22	422.91	6	1.639	2279.51	113.98	11397.53	1.29E+12	1.29E+12
2/27/22	423.86	7	1.913	2284.60	114.23	11422.98	1.30E+12	1.30E+12
2/20/22	377.94	8	2.186	2037.10	101.85	10185.48	1.16E+12	1.16E+12
2/19/22	405.70	9	2.459	2186.72	109.34	10933.58	1.24E+12	1.24E+12
2/28/22	406.03	10	2.732	2188.52	109.43	10942.62	1.24E+12	1.24E+12
3/1/22	402.97	11	3.005	2172.01	108.60	10860.07	1.23E+12	1.23E+12
3/2/22	389.94	12	3.279	2101.78	105.09	10508.92	1.19E+12	1.19E+12
3/3/22	390.89	13	3.552	2106.87	105.34	10534.37	1.20E+12	1.20E+12
3/4/22	387.05	14	3.825	2086.18	104.31	10430.89	1.18E+12	1.18E+12
3/26/22	354.54	15	4.098	1910.94	95.55	9554.72	1.08E+12	1.08E+12
3/27/22	355.89	16	4.372	1918.24	95.91	9591.19	1.09E+12	1.09E+12
3/28/22	357.94	17	4.645	1929.32	96.47	9646.61	1.09E+12	1.09E+12
3/25/22	344.75	18	4.918	1858.19	92.91	9290.94	1.05E+12	1.05E+12
3/5/22	353.88	19	5.191	1907.44	95.37	9537.19	1.08E+12	1.08E+12
2/18/22	335.37	20	5.464	1807.64	90.38	9038.18	1.03E+12	1.03E+12
3/29/22	354.86	21	5.738	1912.70	95.63	9563.49	1.09E+12	1.09E+12
3/24/22	331.05	22	6.011	1784.34	89.22	8921.70	1.01E+12	1.01E+12
3/30/22	325.84	23	6.284	1756.27	87.81	8781.33	9.96E+11	9.96E+11
3/7/22	344.91	24	6.557	1859.05	92.95	9295.27	1.05E+12	1.05E+12
3/6/22	340.58	25	6.831	1835.74	91.79	9178.70	1.04E+12	1.04E+12
3/8/22	351.58	26	7.104	1895.00	94.75	9474.99	1.08E+12	1.08E+12
3/31/22	310.40	27	7.377	1673.06	83.65	8365.29	9.49E+11	9.49E+11
3/9/22	344.60	28	7.650	1857.40	92.87	9286.98	1.05E+12	1.05E+12
4/1/22	316.00	29	7.923	1703.24	85.16	8516.22	9.66E+11	9.66E+11
4/2/22	318.77	30	8.197	1718.18	85.91	8590.91	9.75E+11	9.75E+11
3/10/22	341.41	31	8.470	1840.21	92.01	9201.03	1.04E+12	1.04E+12
3/23/22	300.06	32	8.743	1617.35	80.87	8086.73	9.18E+11	9.18E+11
4/3/22	312.82	33	9.016	1686.12	84.31	8430.60	9.57E+11	9.57E+11
5/8/22	301.01	34	9.290	1622.45	81.12	8112.26	9.21E+11	9.21E+11
3/11/22	306.73	35	9.563	1653.26	82.66	8266.30	9.38E+11	9.38E+11
5/9/22	294.15	36	9.836	1585.47	79.27	7927.35	9.00E+11	9.00E+11
5/7/22	302.27	37	10.109	1629.24	81.46	8146.18	9.24E+11	9.24E+11
4/4/22	296.62	38	10.383	1598.81	79.94	7994.03	9.07E+11	9.07E+11
5/10/22	292.51	39	10.656	1576.65	78.83	7883.25	8.95E+11	8.95E+11
4/5/22	309.57	40	10.929	1668.59	83.43	8342.96	9.47E+11	9.47E+11
4/7/22	295.45	41	11.202	1592.48	79.62	7962.41	9.04E+11	9.04E+11
5/11/22	298.47	42	11.475	1608.77	80.44	8043.84	9.13E+11	9.13E+11
4/6/22	291.80	43	11.749	1572.80	78.64	7864.02	8.92E+11	8.92E+11
4/8/22	274.15	44	12.022	1477.68	73.88	7388.41	8.38E+11	8.38E+11
3/12/22	300.42	45	12.295	1619.28	80.96	8096.42	9.19E+11	9.19E+11
4/15/22	287.67	46	12.568	1550.53	77.53	7752.63	8.80E+11	8.80E+11
4/16/22	285.32	47	12.842	1537.88	76.89	7689.39	8.73E+11	8.73E+11
4/9/22	291.01	48	13.115	1568.56	78.43	7842.82	8.90E+11	8.90E+11
5/12/22	281.52	49	13.388	1517.39	75.87	7586.95	8.61E+11	8.61E+11
3/22/22	283.13	50	13.661	1526.07	76.30	7630.35	8.66E+11	8.66E+11
4/17/22	291.75	51	13.934	1572.52	78.63	7862.61	8.92E+11	8.92E+11
4/14/22	271.37	52	14.208	1462.71	73.14	7313.55	8.30E+11	8.30E+11
3/21/22	288.47	53	14.481	1554.88	77.74	7774.40	8.82E+11	8.82E+11
5/6/22	264.48	54	14.754	1425.56	71.28	7127.81	8.09E+11	8.09E+11
4/10/22	283.96	55	15.027	1530.57	76.53	7652.83	8.68E+11	8.68E+11
3/13/22	281.35	56	15.301	1516.49	75.82	7582.43	8.60E+11	8.60E+11
4/18/22	268.19	57	15.574	1445.52	72.28	7227.59	8.20E+11	8.20E+11
5/13/22	267.82	58	15.847	1443.54	72.18	7217.71	8.19E+11	8.19E+11
4/19/22	275.06	59	16.120	1482.56	74.13	7412.79	8.41E+11	8.41E+11
3/20/22	269.51	60	16.393	1452.68	72.63	7263.41	8.24E+11	8.24E+11

4/20/22	263.93	61	16.667	1422.59	71.13	7112.93	8.07E+11	8.07E+11
4/11/22	280.60	62	16.940	1512.41	75.62	7562.07	8.58E+11	8.58E+11
5/14/22	259.11	63	17.213	1396.61	69.83	6983.05	7.92E+11	7.92E+11
3/14/22	279.86	64	17.486	1508.46	75.42	7542.28	8.56E+11	8.56E+11
4/13/22	237.23	65	17.760	1278.67	63.93	6393.34	7.26E+11	7.26E+11
4/21/22	250.37	66	18.033	1349.47	67.47	6747.34	7.66E+11	7.66E+11
4/12/22	267.28	67	18.306	1440.66	72.03	7203.29	8.17E+11	8.17E+11
2/17/22	239.02	68	18.579	1288.34	64.42	6441.69	7.31E+11	7.31E+11
4/22/22	266.56	69	18.852	1436.76	71.84	7183.78	8.15E+11	8.15E+11
5/15/22	252.40	70	19.126	1360.42	68.02	6802.10	7.72E+11	7.72E+11
5/5/22	253.93	71	19.399	1368.68	68.43	6843.38	7.77E+11	7.77E+11
3/15/22	270.26	72	19.672	1456.72	72.84	7283.59	8.27E+11	8.27E+11
4/23/22	242.99	73	19.945	1309.70	65.48	6548.50	7.43E+11	7.43E+11
4/25/22	253.91	74	20.219	1368.56	68.43	6842.82	7.77E+11	7.77E+11
4/24/22	231.75	75	20.492	1249.14	62.46	6245.70	7.09E+11	7.09E+11
5/4/22	250.93	76	20.765	1352.50	67.63	6762.52	7.67E+11	7.67E+11
4/26/22	247.70	77	21.038	1335.09	66.75	6675.44	7.58E+11	7.58E+11
3/16/22	256.05	78	21.311	1380.10	69.00	6900.49	7.83E+11	7.83E+11
5/16/22	240.44	79	21.585	1295.96	64.80	6479.80	7.35E+11	7.35E+11
3/19/22	236.94	80	21.858	1277.13	63.86	6385.64	7.25E+11	7.25E+11
4/27/22	246.62	81	22.131	1329.26	66.46	6646.32	7.54E+11	7.54E+11
3/17/22	250.99	82	22.404	1352.84	67.64	6764.22	7.68E+11	7.68E+11
4/28/22	231.54	83	22.678	1248.01	62.40	6240.04	7.08E+11	7.08E+11
5/17/22	225.86	84	22.951	1217.36	60.87	6086.81	6.91E+11	6.91E+11
3/18/22	225.87	85	23.224	1217.44	60.87	6087.19	6.91E+11	6.91E+11
5/3/22	224.76	86	23.497	1211.48	60.57	6057.40	6.87E+11	6.87E+11
4/29/22	222.75	87	23.770	1200.62	60.03	6003.12	6.81E+11	6.81E+11
5/18/22	214.65	88	24.044	1156.97	57.85	5784.86	6.56E+11	6.56E+11
5/1/22	214.33	89	24.317	1155.26	57.76	5776.32	6.55E+11	6.55E+11
6/11/22	219.99	90	24.590	1185.75	59.29	5928.76	6.73E+11	6.73E+11
6/12/22	217.97	91	24.863	1174.84	58.74	5874.20	6.67E+11	6.67E+11
4/30/22	208.36	92	25.137	1123.04	56.15	5615.22	6.37E+11	6.37E+11
5/2/22	220.14	93	25.410	1186.54	59.33	5932.72	6.73E+11	6.73E+11
6/10/22	216.68	94	25.683	1167.88	58.39	5839.42	6.63E+11	6.63E+11
5/19/22	208.18	95	25.956	1122.08	56.10	5610.41	6.37E+11	6.37E+11
6/13/22	215.90	96	26.230	1163.70	58.18	5818.50	6.60E+11	6.60E+11
6/9/22	213.17	97	26.503	1149.00	57.45	5744.99	6.52E+11	6.52E+11
6/14/22	214.99	98	26.776	1158.78	57.94	5793.90	6.57E+11	6.57E+11
5/20/22	200.36	99	27.049	1079.96	54.00	5399.78	6.13E+11	6.13E+11
6/15/22	208.38	100	27.322	1123.16	56.16	5615.79	6.37E+11	6.37E+11
6/8/22	196.16	101	27.596	1057.29	52.86	5286.44	6.00E+11	6.00E+11
6/2/22	198.98	102	27.869	1072.49	53.62	5362.46	6.09E+11	6.09E+11
5/21/22	194.87	103	28.142	1050.33	52.52	5251.63	5.96E+11	5.96E+11
6/1/22	193.18	104	28.415	1041.24	52.06	5206.20	5.91E+11	5.91E+11
5/30/22	196.61	105	28.689	1059.71	52.99	5298.57	6.01E+11	6.01E+11
7/28/22	182.47	106	28.962	983.49	49.17	4917.45	5.58E+11	5.58E+11
6/3/22	193.80	107	29.235	1044.56	52.23	5222.80	5.93E+11	5.93E+11
7/27/22	182.25	108	29.508	982.30	49.12	4911.51	5.57E+11	5.57E+11
5/31/22	196.90	109	29.781	1061.30	53.06	5306.48	6.02E+11	6.02E+11
7/29/22	181.86	110	30.055	980.21	49.01	4901.05	5.56E+11	5.56E+11
5/29/22	190.31	111	30.328	1025.79	51.29	5128.93	5.82E+11	5.82E+11
7/26/22	175.15	112	30.601	944.03	47.20	4720.17	5.36E+11	5.36E+11
5/22/22	187.42	113	30.874	1010.18	50.51	5050.90	5.73E+11	5.73E+11
6/7/22	190.05	114	31.148	1024.37	51.22	5121.86	5.81E+11	5.81E+11
6/16/22	195.96	115	31.421	1056.21	52.81	5281.04	5.99E+11	5.99E+11
6/4/22	186.92	116	31.694	1007.52	50.38	5037.61	5.72E+11	5.72E+11
7/30/22	173.86	117	31.967	937.12	46.86	4685.62	5.32E+11	5.32E+11
7/25/22	171.02	118	32.240	921.80	46.09	4608.99	5.23E+11	5.23E+11
5/23/22	176.29	119	32.514	950.19	47.51	4750.93	5.39E+11	5.39E+11
6/5/22	177.70	120	32.787	957.82	47.89	4789.09	5.43E+11	5.43E+11
7/31/22	166.09	121	33.060	895.22	44.76	4476.12	5.08E+11	5.08E+11

6/17/22	180.71	122	33.333	974.02	48.70	4870.10	5.53E+11	5.53E+11
6/6/22	168.86	123	33.607	910.13	45.51	4550.67	5.16E+11	5.16E+11
5/28/22	174.50	124	33.880	940.57	47.03	4702.86	5.34E+11	5.34E+11
5/24/22	165.95	125	34.153	894.49	44.72	4472.44	5.08E+11	5.08E+11
7/24/22	159.33	126	34.426	858.81	42.94	4294.04	4.87E+11	4.87E+11
8/1/22	157.84	127	34.699	850.77	42.54	4253.87	4.83E+11	4.83E+11
2/16/22	139.38	128	34.973	751.28	37.56	3756.38	4.26E+11	4.26E+11
5/27/22	170.06	129	35.246	916.60	45.83	4582.99	5.20E+11	5.20E+11
5/25/22	163.83	130	35.519	883.03	44.15	4415.15	5.01E+11	5.01E+11
5/26/22	168.46	131	35.792	908.00	45.40	4540.01	5.15E+11	5.15E+11
6/18/22	167.98	132	36.066	905.40	45.27	4527.01	5.14E+11	5.14E+11
8/2/22	148.42	133	36.339	800.00	40.00	4000.01	4.54E+11	4.54E+11
2/13/22	153.81	134	36.612	829.01	41.45	4145.04	4.70E+11	4.70E+11
2/14/22	152.63	135	36.885	822.68	41.13	4113.38	4.67E+11	4.67E+11
2/15/22	149.88	136	37.158	807.86	40.39	4039.31	4.58E+11	4.58E+11
8/3/22	138.48	137	37.432	746.43	37.32	3732.16	4.24E+11	4.24E+11
7/8/22	150.65	138	37.705	812.01	40.60	4060.05	4.61E+11	4.61E+11
7/9/22	150.26	139	37.978	809.90	40.49	4049.48	4.60E+11	4.60E+11
6/19/22	150.25	140	38.251	809.87	40.49	4049.34	4.60E+11	4.60E+11
2/12/22	147.29	141	38.525	793.89	39.69	3969.47	4.50E+11	4.50E+11
8/4/22	135.23	142	38.798	728.87	36.44	3644.34	4.14E+11	4.14E+11
1/25/23	123.83	143	39.071	667.46	33.37	3337.30	3.79E+11	3.79E+11
1/23/23	120.30	144	39.344	648.40	32.42	3242.02	3.68E+11	3.68E+11
1/22/23	123.31	145	39.617	664.63	33.23	3323.16	3.77E+11	3.77E+11
1/26/23	120.91	146	39.891	651.68	32.58	3258.42	3.70E+11	3.70E+11
7/10/22	147.56	147	40.164	795.36	39.77	3976.82	4.51E+11	4.51E+11
7/23/22	130.13	148	40.437	701.39	35.07	3506.96	3.98E+11	3.98E+11
1/24/23	116.50	149	40.710	627.95	31.40	3139.77	3.56E+11	3.56E+11
1/27/23	111.88	150	40.984	603.04	30.15	3015.19	3.42E+11	3.42E+11
7/7/22	145.75	151	41.257	785.60	39.28	3928.01	4.46E+11	4.46E+11
1/8/23	122.72	152	41.530	661.47	33.07	3307.33	3.75E+11	3.75E+11
1/28/23	121.06	153	41.803	652.53	32.63	3262.66	3.70E+11	3.70E+11
1/21/23	115.88	154	42.077	624.60	31.23	3122.99	3.54E+11	3.54E+11
1/7/23	120.94	155	42.350	651.85	32.59	3259.26	3.70E+11	3.70E+11
1/29/23	116.79	156	42.623	629.49	31.47	3147.46	3.57E+11	3.57E+11
1/6/23	118.04	157	42.896	636.25	31.81	3181.23	3.61E+11	3.61E+11
8/5/22	122.36	158	43.169	659.51	32.98	3297.55	3.74E+11	3.74E+11
1/9/23	119.36	159	43.443	643.37	32.17	3216.86	3.65E+11	3.65E+11
7/11/22	141.87	160	43.716	764.66	38.23	3823.30	4.34E+11	4.34E+11
1/30/23	118.74	161	43.989	640.03	32.00	3200.17	3.63E+11	3.63E+11
1/10/23	119.05	162	44.262	641.67	32.08	3208.34	3.64E+11	3.64E+11
1/5/23	115.10	163	44.536	620.37	31.02	3101.83	3.52E+11	3.52E+11
2/7/22	130.40	164	44.809	702.86	35.14	3514.28	3.99E+11	3.99E+11
1/20/23	113.23	165	45.082	610.30	30.51	3051.49	3.46E+11	3.46E+11
1/31/23	112.28	166	45.355	605.20	30.26	3026.02	3.43E+11	3.43E+11
2/8/22	125.78	167	45.628	677.97	33.90	3389.83	3.85E+11	3.85E+11
6/20/22	138.92	168	45.902	748.77	37.44	3743.86	4.25E+11	4.25E+11
2/6/22	115.21	169	46.175	620.98	31.05	3104.90	3.52E+11	3.52E+11
1/12/23	115.70	170	46.448	623.62	31.18	3118.10	3.54E+11	3.54E+11
2/3/22	132.52	171	46.721	714.28	35.71	3571.39	4.05E+11	4.05E+11
8/6/22	117.57	172	46.995	633.71	31.69	3168.55	3.60E+11	3.60E+11
7/12/22	132.58	173	47.268	714.62	35.73	3573.09	4.05E+11	4.05E+11
2/4/22	117.22	174	47.541	631.80	31.59	3158.98	3.58E+11	3.58E+11
2/5/22	126.39	175	47.814	681.26	34.06	3406.28	3.87E+11	3.87E+11
1/4/23	109.62	176	48.087	590.85	29.54	2954.27	3.35E+11	3.35E+11
1/13/23	110.78	177	48.361	597.12	29.86	2985.59	3.39E+11	3.39E+11
2/11/22	109.15	178	48.634	588.33	29.42	2941.64	3.34E+11	3.34E+11
1/19/23	107.95	179	48.907	581.86	29.09	2909.30	3.30E+11	3.30E+11
1/14/23	108.77	180	49.180	586.26	29.31	2931.30	3.33E+11	3.33E+11
2/9/22	119.03	181	49.454	641.56	32.08	3207.78	3.64E+11	3.64E+11
8/7/22	111.41	182	49.727	600.50	30.03	3002.50	3.41E+11	3.41E+11

1/15/23	104.74	183	50.000	564.55	28.23	2822.74	3.20E+11	3.20E+11
8/8/22	106.72	184	50.273	575.22	28.76	2876.11	3.26E+11	3.26E+11
2/2/22	124.81	185	50.546	672.71	33.64	3363.53	3.82E+11	3.82E+11
7/13/22	121.93	186	50.820	657.18	32.86	3285.90	3.73E+11	3.73E+11
2/10/22	120.70	187	51.093	650.55	32.53	3252.76	3.69E+11	3.69E+11
8/9/22	104.35	188	51.366	562.47	28.12	2812.34	3.19E+11	3.19E+11
6/21/22	123.84	189	51.639	667.52	33.38	3337.58	3.79E+11	3.79E+11
1/16/23	102.73	190	51.913	553.69	27.68	2768.45	3.14E+11	3.14E+11
1/3/23	94.62	191	52.186	510.03	25.50	2550.13	2.89E+11	2.89E+11
1/17/23	97.69	192	52.459	526.55	26.33	2632.74	2.99E+11	2.99E+11
7/14/22	113.37	193	52.732	611.08	30.55	3055.42	3.47E+11	3.47E+11
1/18/23	94.29	194	53.005	508.21	25.41	2541.05	2.88E+11	2.88E+11
7/22/22	95.19	195	53.279	513.09	25.65	2565.46	2.91E+11	2.91E+11
8/10/22	99.76	196	53.552	537.70	26.88	2688.50	3.05E+11	3.05E+11
8/22/22	95.41	197	53.825	514.26	25.71	2571.31	2.92E+11	2.92E+11
12/2/22	69.28	198	54.098	373.41	18.67	1867.04	2.12E+11	2.12E+11
12/1/22	81.68	199	54.372	440.24	22.01	2201.22	2.50E+11	2.50E+11
7/15/22	101.54	200	54.645	547.29	27.36	2736.44	3.11E+11	3.11E+11
7/6/22	105.28	201	54.918	567.48	28.37	2837.38	3.22E+11	3.22E+11
12/4/22	82.55	202	55.191	444.97	22.25	2224.86	2.52E+11	2.52E+11
1/2/23	90.45	203	55.464	487.54	24.38	2437.69	2.77E+11	2.77E+11
12/3/22	84.66	204	55.738	456.29	22.81	2281.46	2.59E+11	2.59E+11
11/30/22	81.44	205	56.011	438.94	21.95	2194.70	2.49E+11	2.49E+11
6/22/22	108.55	206	56.284	585.06	29.25	2925.31	3.32E+11	3.32E+11
7/16/22	95.91	207	56.557	516.95	25.85	2584.75	2.93E+11	2.93E+11
8/21/22	90.62	208	56.831	488.42	24.42	2442.08	2.77E+11	2.77E+11
12/5/22	80.94	209	57.104	436.26	21.81	2181.29	2.48E+11	2.48E+11
11/29/22	65.56	210	57.377	353.38	17.67	1766.88	2.01E+11	2.01E+11
8/11/22	90.84	211	57.650	489.64	24.48	2448.21	2.78E+11	2.78E+11
1/1/23	81.59	212	57.923	439.79	21.99	2198.97	2.50E+11	2.50E+11
12/6/22	83.70	213	58.197	451.12	22.56	2255.62	2.56E+11	2.56E+11
8/23/22	84.32	214	58.470	454.50	22.72	2272.49	2.58E+11	2.58E+11
7/17/22	94.88	215	58.743	511.43	25.57	2557.13	2.90E+11	2.90E+11
1/11/23	109.27	216	59.016	588.97	29.45	2944.87	3.34E+11	3.34E+11
12/7/22	78.41	217	59.290	422.62	21.13	2113.09	2.40E+11	2.40E+11
7/18/22	92.55	218	59.563	498.86	24.94	2494.32	2.83E+11	2.83E+11
12/8/22	76.59	219	59.836	412.84	20.64	2064.18	2.34E+11	2.34E+11
8/31/22	75.39	220	60.109	406.36	20.32	2031.81	2.31E+11	2.31E+11
12/9/22	64.78	221	60.383	349.19	17.46	1745.94	1.98E+11	1.98E+11
8/30/22	76.97	222	60.656	414.89	20.74	2074.47	2.35E+11	2.35E+11
12/10/22	68.44	223	60.929	368.88	18.44	1844.39	2.09E+11	2.09E+11
12/31/22	74.95	224	61.202	403.98	20.20	2019.90	2.29E+11	2.29E+11
2/1/22	84.37	225	61.475	454.74	22.74	2273.68	2.58E+11	2.58E+11
8/12/22	78.24	226	61.749	421.70	21.08	2108.49	2.39E+11	2.39E+11
7/19/22	81.32	227	62.022	438.33	21.92	2191.63	2.49E+11	2.49E+11
8/24/22	71.38	228	62.295	384.75	19.24	1923.74	2.18E+11	2.18E+11
11/28/22	60.23	229	62.568	324.63	16.23	1623.13	1.84E+11	1.84E+11
12/11/22	69.61	230	62.842	375.22	18.76	1876.11	2.13E+11	2.13E+11
6/23/22	92.34	231	63.115	497.69	24.88	2488.44	2.82E+11	2.82E+11
8/15/22	71.37	232	63.388	384.68	19.23	1923.38	2.18E+11	2.18E+11
9/1/22	65.95	233	63.661	355.47	17.77	1777.33	2.02E+11	2.02E+11
12/12/22	71.18	234	63.934	383.65	19.18	1918.24	2.18E+11	2.18E+11
8/14/22	72.40	235	64.208	390.25	19.51	1951.26	2.21E+11	2.21E+11
12/16/22	60.71	236	64.481	327.25	16.36	1636.24	1.86E+11	1.86E+11
12/13/22	60.15	237	64.754	324.20	16.21	1621.00	1.84E+11	1.84E+11
12/15/22	56.70	238	65.027	305.62	15.28	1528.10	1.73E+11	1.73E+11
12/17/22	63.25	239	65.301	340.89	17.04	1704.47	1.93E+11	1.93E+11
8/13/22	70.19	240	65.574	378.34	18.92	1891.72	2.15E+11	2.15E+11
7/20/22	72.32	241	65.847	389.79	19.49	1948.95	2.21E+11	2.21E+11
8/16/22	66.95	242	66.120	360.84	18.04	1804.19	2.05E+11	2.05E+11
12/14/22	62.62	243	66.393	337.52	16.88	1687.61	1.92E+11	1.92E+11

12/24/22	41.21	244	66.667	222.12	11.11	1110.61	1.26E+11	1.26E+11
8/25/22	66.02	245	66.940	355.87	17.79	1779.34	2.02E+11	2.02E+11
9/2/22	62.64	246	67.213	337.61	16.88	1688.07	1.92E+11	1.92E+11
12/18/22	62.65	247	67.486	337.68	16.88	1688.41	1.92E+11	1.92E+11
12/23/22	40.77	248	67.760	219.76	10.99	1098.79	1.25E+11	1.25E+11
12/20/22	63.09	249	68.033	340.05	17.00	1700.26	1.93E+11	1.93E+11
10/23/22	58.76	250	68.306	316.74	15.84	1583.69	1.80E+11	1.80E+11
12/19/22	62.42	251	68.579	336.44	16.82	1682.19	1.91E+11	1.91E+11
12/27/22	33.16	252	68.852	178.72	8.94	893.61	1.01E+11	1.01E+11
12/26/22	42.18	253	69.126	227.33	11.37	1136.65	1.29E+11	1.29E+11
12/30/22	54.81	254	69.399	295.41	14.77	1477.05	1.68E+11	1.68E+11
7/21/22	67.90	255	69.672	365.98	18.30	1829.89	2.08E+11	2.08E+11
8/17/22	61.55	256	69.945	331.77	16.59	1658.84	1.88E+11	1.88E+11
6/24/22	78.75	257	70.219	424.44	21.22	2122.19	2.41E+11	2.41E+11
12/21/22	63.11	258	70.492	340.18	17.01	1700.91	1.93E+11	1.93E+11
12/28/22	30.23	259	70.765	162.95	8.15	814.77	9.25E+10	9.25E+10
12/25/22	35.80	260	71.038	192.98	9.65	964.89	1.09E+11	1.09E+11
9/3/22	59.60	261	71.311	321.23	16.06	1606.14	1.82E+11	1.82E+11
8/26/22	58.82	262	71.585	317.04	15.85	1585.20	1.80E+11	1.80E+11
12/22/22	61.23	263	71.858	330.02	16.50	1650.08	1.87E+11	1.87E+11
8/29/22	53.64	264	72.131	289.14	14.46	1445.72	1.64E+11	1.64E+11
8/27/22	59.68	265	72.404	321.69	16.08	1608.43	1.83E+11	1.83E+11
9/4/22	56.99	266	72.678	307.15	15.36	1535.77	1.74E+11	1.74E+11
8/18/22	58.93	267	72.951	317.61	15.88	1588.04	1.80E+11	1.80E+11
12/29/22	34.10	268	73.224	183.82	9.19	919.09	1.04E+11	1.04E+11
10/24/22	49.92	269	73.497	269.04	13.45	1345.21	1.53E+11	1.53E+11
8/19/22	56.56	270	73.770	304.84	15.24	1524.22	1.73E+11	1.73E+11
8/28/22	56.03	271	74.044	302.00	15.10	1510.01	1.71E+11	1.71E+11
8/20/22	53.67	272	74.317	289.26	14.46	1446.29	1.64E+11	1.64E+11
9/5/22	55.27	273	74.590	297.93	14.90	1489.63	1.69E+11	1.69E+11
6/25/22	71.00	274	74.863	382.69	19.13	1913.46	2.17E+11	2.17E+11
9/6/22	52.67	275	75.137	283.91	14.20	1419.57	1.61E+11	1.61E+11
10/25/22	42.85	276	75.410	230.97	11.55	1154.87	1.31E+11	1.31E+11
10/26/22	46.32	277	75.683	249.66	12.48	1248.32	1.42E+11	1.42E+11
10/27/22	45.82	278	75.956	246.98	12.35	1234.89	1.40E+11	1.40E+11
11/27/22	41.42	279	76.230	223.25	11.16	1116.27	1.27E+11	1.27E+11
10/28/22	46.00	280	76.503	247.94	12.40	1239.72	1.41E+11	1.41E+11
9/7/22	52.94	281	76.776	285.35	14.27	1426.75	1.62E+11	1.62E+11
9/27/22	54.67	282	77.049	294.69	14.73	1473.45	1.67E+11	1.67E+11
10/29/22	43.56	283	77.322	234.80	11.74	1173.99	1.33E+11	1.33E+11
6/26/22	64.48	284	77.596	347.54	17.38	1737.72	1.97E+11	1.97E+11
9/28/22	51.98	285	77.869	280.15	14.01	1400.74	1.59E+11	1.59E+11
10/30/22	42.96	286	78.142	231.58	11.58	1157.89	1.31E+11	1.31E+11
11/1/22	40.56	287	78.415	218.64	10.93	1093.22	1.24E+11	1.24E+11
10/31/22	40.91	288	78.689	220.49	11.02	1102.45	1.25E+11	1.25E+11
11/2/22	42.71	289	78.962	230.22	11.51	1151.12	1.31E+11	1.31E+11
11/4/22	40.55	290	79.235	218.57	10.93	1092.87	1.24E+11	1.24E+11
11/3/22	42.92	291	79.508	231.35	11.57	1156.77	1.31E+11	1.31E+11
9/26/22	51.97	292	79.781	280.10	14.00	1400.48	1.59E+11	1.59E+11
9/8/22	49.35	293	80.055	265.98	13.30	1329.89	1.51E+11	1.51E+11
11/5/22	38.27	294	80.328	206.29	10.31	1031.47	1.17E+11	1.17E+11
10/19/22	40.09	295	80.601	216.10	10.80	1080.48	1.23E+11	1.23E+11
9/29/22	49.16	296	80.874	264.95	13.25	1324.77	1.50E+11	1.50E+11
10/22/22	41.46	297	81.148	223.49	11.17	1117.45	1.27E+11	1.27E+11
11/7/22	40.11	298	81.421	216.22	10.81	1081.09	1.23E+11	1.23E+11
11/6/22	39.71	299	81.694	214.06	10.70	1070.29	1.21E+11	1.21E+11
11/8/22	43.36	300	81.967	233.73	11.69	1168.65	1.33E+11	1.33E+11
10/20/22	39.88	301	82.240	214.98	10.75	1074.90	1.22E+11	1.22E+11
11/9/22	39.70	302	82.514	213.99	10.70	1069.94	1.21E+11	1.21E+11
9/9/22	44.60	303	82.787	240.38	12.02	1201.92	1.36E+11	1.36E+11
9/30/22	48.71	304	83.060	262.54	13.13	1312.72	1.49E+11	1.49E+11

11/10/22	36.12	305	83.333	194.67	9.73	973.37	1.10E+11	1.10E+11
9/12/22	49.58	306	83.607	267.25	13.36	1336.25	1.52E+11	1.52E+11
11/11/22	40.46	307	83.880	218.09	10.90	1090.47	1.24E+11	1.24E+11
10/18/22	35.86	308	84.153	193.30	9.66	966.49	1.10E+11	1.10E+11
6/27/22	55.81	309	84.426	300.79	15.04	1503.96	1.71E+11	1.71E+11
10/21/22	37.98	310	84.699	204.72	10.24	1023.61	1.16E+11	1.16E+11
9/11/22	37.24	311	84.973	200.74	10.04	1003.70	1.14E+11	1.14E+11
11/12/22	36.03	312	85.246	194.23	9.71	971.14	1.10E+11	1.10E+11
11/13/22	36.90	313	85.519	198.88	9.94	994.38	1.13E+11	1.13E+11
9/13/22	46.85	314	85.792	252.50	12.62	1262.48	1.43E+11	1.43E+11
11/14/22	39.45	315	86.066	212.61	10.63	1063.05	1.21E+11	1.21E+11
9/10/22	39.40	316	86.339	212.35	10.62	1061.73	1.20E+11	1.20E+11
10/1/22	46.90	317	86.612	252.80	12.64	1264.01	1.43E+11	1.43E+11
11/15/22	38.19	318	86.885	205.86	10.29	1029.32	1.17E+11	1.17E+11
9/14/22	43.33	319	87.158	233.55	11.68	1167.74	1.33E+11	1.33E+11
11/16/22	33.48	320	87.432	180.47	9.02	902.35	1.02E+11	1.02E+11
11/17/22	33.42	321	87.705	180.14	9.01	900.69	1.02E+11	1.02E+11
9/15/22	41.80	322	87.978	225.30	11.26	1126.49	1.28E+11	1.28E+11
11/26/22	34.18	323	88.251	184.26	9.21	921.28	1.05E+11	1.05E+11
9/25/22	38.54	324	88.525	207.75	10.39	1038.77	1.18E+11	1.18E+11
9/21/22	42.71	325	88.798	230.21	11.51	1151.03	1.31E+11	1.31E+11
11/18/22	32.99	326	89.071	177.82	8.89	889.09	1.01E+11	1.01E+11
11/25/22	34.65	327	89.344	186.78	9.34	933.89	1.06E+11	1.06E+11
11/19/22	32.17	328	89.617	173.40	8.67	867.02	9.84E+10	9.84E+10
9/22/22	44.51	329	89.891	239.90	12.00	1199.52	1.36E+11	1.36E+11
9/16/22	39.96	330	90.164	215.37	10.77	1076.87	1.22E+11	1.22E+11
11/24/22	31.74	331	90.437	171.07	8.55	855.35	9.71E+10	9.71E+10
10/2/22	44.26	332	90.710	238.54	11.93	1192.68	1.35E+11	1.35E+11
11/22/22	32.59	333	90.984	175.67	8.78	878.34	9.97E+10	9.97E+10
11/21/22	29.70	334	91.257	160.08	8.00	800.42	9.08E+10	9.08E+10
11/23/22	31.34	335	91.530	168.91	8.45	844.53	9.58E+10	9.58E+10
9/20/22	39.20	336	91.803	211.31	10.57	1056.55	1.20E+11	1.20E+11
6/28/22	45.64	337	92.077	245.98	12.30	1229.91	1.40E+11	1.40E+11
11/20/22	31.42	338	92.350	169.38	8.47	846.88	9.61E+10	9.61E+10
9/17/22	36.59	339	92.623	197.21	9.86	986.03	1.12E+11	1.12E+11
9/23/22	40.74	340	92.896	219.60	10.98	1098.02	1.25E+11	1.25E+11
9/19/22	40.32	341	93.169	217.32	10.87	1086.61	1.23E+11	1.23E+11
9/18/22	38.39	342	93.443	206.93	10.35	1034.64	1.17E+11	1.17E+11
10/3/22	40.62	343	93.716	218.93	10.95	1094.63	1.24E+11	1.24E+11
9/24/22	36.28	344	93.989	195.56	9.78	977.79	1.11E+11	1.11E+11
7/5/22	40.48	345	94.262	218.18	10.91	1090.89	1.24E+11	1.24E+11
10/4/22	36.85	346	94.536	198.61	9.93	993.06	1.13E+11	1.13E+11
6/29/22	40.78	347	94.809	219.82	10.99	1099.10	1.25E+11	1.25E+11
10/5/22	37.98	348	95.082	204.70	10.23	1023.50	1.16E+11	1.16E+11
10/17/22	23.18	349	95.355	124.94	6.25	624.71	7.09E+10	7.09E+10
10/6/22	31.03	350	95.628	167.26	8.36	836.29	9.49E+10	9.49E+10
6/30/22	36.16	351	95.902	194.92	9.75	974.60	1.11E+11	1.11E+11
10/7/22	35.32	352	96.175	190.39	9.52	951.93	1.08E+11	1.08E+11
7/1/22	35.76	353	96.448	192.74	9.64	963.69	1.09E+11	1.09E+11
7/2/22	36.33	354	96.721	195.84	9.79	979.19	1.11E+11	1.11E+11
10/8/22	29.81	355	96.995	160.68	8.03	803.40	9.12E+10	9.12E+10
10/16/22	19.48	356	97.268	105.02	5.25	525.09	5.96E+10	5.96E+10
10/9/22	22.73	357	97.541	122.52	6.13	612.59	6.95E+10	6.95E+10
7/3/22	31.58	358	97.814	170.22	8.51	851.08	9.66E+10	9.66E+10
10/13/22	29.46	359	98.087	158.79	7.94	793.95	9.01E+10	9.01E+10
10/10/22	21.76	360	98.361	117.28	5.86	586.40	6.65E+10	6.65E+10
10/15/22	18.18	361	98.634	98.01	4.90	490.05	5.56E+10	5.56E+10
10/14/22	18.68	362	98.907	100.66	5.03	503.29	5.71E+10	5.71E+10
10/11/22	20.93	363	99.180	112.82	5.64	564.10	6.40E+10	6.40E+10
10/12/22	20.44	364	99.454	110.18	5.51	550.91	6.25E+10	6.25E+10
7/4/22	31.24	365	99.727	168.38	8.42	841.89	9.55E+10	9.55E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 9 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	2218.05	1.69	0.079	4.4	193	0.819672131	20204.41651	944.466807	52603.21459	1.05E+13	21	424292.7467	19833.80295	1104667.506	2.20E+14
3/15/22	298.65	1.45	0.05	5.2	1	19.67213115	2334.121948	80.4869637	8370.644227	7.31E+09	35	81694.26817	2817.04373	292972.5479	2.56E+11
4/19/22	298.58	1.69	0.05	11.6	3	16.12021858	2719.754847	80.4661197	18668.13978	2.19E+10	35	95191.41964	2816.314191	653384.8922	7.67E+11
5/24/22	205.45	4.43	0.05	18.8	4.0	34.15300546	4905.778614	55.3699618	20819.10563	2.01E+10	28	137361.8012	1550.35893	582934.9576	5.63E+11
6/21/22	128.02	3.68	0.05	27.6	8.0	51.63934426	2539.240267	34.5005471	19044.302	2.51E+10	28	71098.72748	966.0153191	533240.4561	7.02E+11
7/19/22	225.55	2.60	0.058	31.6	6.0	62.02185792	3160.831913	70.5108657	38416.26478	3.31E+10	35	110629.1169	2467.880301	1344569.267	1.16E+12
8/23/22	115.13	0.25	0.05	11.6	12.0	58.46994536	155.1417804	31.0283561	7198.578612	3.38E+10	28	4343.969852	868.7939704	201560.2011	9.46E+11
9/20/22	77.31	2.30	0.050	14.2	8.0	91.80327869	960.1240073	20.8343968	5916.968685	1.51E+10	36	34564.46426	750.038284	213010.8726	5.45E+11
10/26/22	107.84	1.27	0.093	8.6	12.0	75.68306011	735.2901934	54.0551982	4998.652741	3.17E+10	13	9558.772514	702.7175772	64982.48563	4.12E+11
11/8/22	96.57	1.72	0.050	14.4	6.0	81.96721311	893.5997356	26.024549	7495.070125	1.42E+10	35	31275.99075	910.8592166	262327.4544	4.96E+11
12/13/22	71.06	2.30	0.050	7.2	1.0	64.75409836	880.8901518	19.1497859	2757.569171	1.74E+09	36	31712.04546	689.3922927	99272.49015	6.26E+10
1/18/23	326.23	0.20	0.050	7.6	3.0	53.00546448	351.6797151	87.9199288	13363.82917	2.39E+10	37	13012.14946	3253.037365	494461.6794	8.86E+11
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	1,044,735.5	37,626.3	5,847,384.8	2.27E+14
											TARGET	280,200.7	14,010.0	1,401,003.6	1.59E+14

Site 10 Date	E10	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	548.03	1	0.273	2953.90	147.69	14769.49	1.68E+12	1.68E+12
2/24/22	553.39	2	0.546	2982.79	149.14	14913.93	1.69E+12	1.69E+12
2/22/22	522.54	3	0.820	2816.50	140.83	14082.50	1.60E+12	1.60E+12
2/25/22	538.67	4	1.093	2903.43	145.17	14517.16	1.65E+12	1.65E+12
2/26/22	516.71	5	1.366	2785.08	139.25	13925.41	1.58E+12	1.58E+12
2/21/22	505.97	6	1.639	2727.20	136.36	13636.01	1.55E+12	1.55E+12
2/27/22	507.10	7	1.913	2733.29	136.66	13666.45	1.55E+12	1.55E+12
2/20/22	452.17	8	2.186	2437.18	121.86	12185.91	1.38E+12	1.38E+12
2/19/22	485.38	9	2.459	2616.19	130.81	13080.93	1.48E+12	1.48E+12
2/28/22	485.78	10	2.732	2618.35	130.92	13091.76	1.49E+12	1.49E+12
3/1/22	482.11	11	3.005	2598.60	129.93	12992.99	1.47E+12	1.47E+12
3/2/22	466.53	12	3.279	2514.58	125.73	12572.88	1.43E+12	1.43E+12
3/3/22	467.66	13	3.552	2520.66	126.03	12603.32	1.43E+12	1.43E+12
3/4/22	463.06	14	3.825	2495.90	124.80	12479.52	1.42E+12	1.42E+12
3/26/22	424.17	15	4.098	2286.25	114.31	11431.27	1.30E+12	1.30E+12
3/27/22	425.78	16	4.372	2294.98	114.75	11474.91	1.30E+12	1.30E+12
3/28/22	428.25	17	4.645	2308.24	115.41	11541.20	1.31E+12	1.31E+12
3/25/22	412.46	18	4.918	2223.14	111.16	11115.68	1.26E+12	1.26E+12
3/5/22	423.39	19	5.191	2282.06	114.10	11410.30	1.29E+12	1.29E+12
2/18/22	401.23	20	5.464	2162.66	108.13	10813.28	1.23E+12	1.23E+12
3/29/22	424.55	21	5.738	2288.35	114.42	11441.76	1.30E+12	1.30E+12
3/24/22	396.06	22	6.011	2134.78	106.74	10673.92	1.21E+12	1.21E+12
3/30/22	389.83	23	6.284	2101.20	105.06	10505.99	1.19E+12	1.19E+12
3/7/22	412.65	24	6.557	2224.17	111.21	11120.86	1.26E+12	1.26E+12
3/6/22	407.47	25	6.831	2196.28	109.81	10981.39	1.25E+12	1.25E+12
3/8/22	420.63	26	7.104	2267.18	113.36	11335.88	1.29E+12	1.29E+12
3/31/22	371.36	27	7.377	2001.65	100.08	10008.24	1.14E+12	1.14E+12
3/9/22	412.28	28	7.650	2222.19	111.11	11110.94	1.26E+12	1.26E+12
4/1/22	378.06	29	7.923	2037.76	101.89	10188.80	1.16E+12	1.16E+12
4/2/22	381.38	30	8.197	2055.63	102.78	10278.17	1.17E+12	1.17E+12
3/10/22	408.46	31	8.470	2201.62	110.08	11008.12	1.25E+12	1.25E+12
3/23/22	359.00	32	8.743	1934.99	96.75	9674.97	1.10E+12	1.10E+12
4/3/22	374.26	33	9.016	2017.28	100.86	10086.38	1.14E+12	1.14E+12
5/8/22	360.13	34	9.290	1941.10	97.06	9705.50	1.10E+12	1.10E+12
3/11/22	366.97	35	9.563	1977.96	98.90	9889.80	1.12E+12	1.12E+12
5/9/22	351.92	36	9.836	1896.86	94.84	9484.28	1.08E+12	1.08E+12
5/7/22	361.64	37	10.109	1949.22	97.46	9746.09	1.11E+12	1.11E+12
4/4/22	354.88	38	10.383	1912.81	95.64	9564.06	1.09E+12	1.09E+12
5/10/22	349.96	39	10.656	1886.30	94.32	9431.52	1.07E+12	1.07E+12
4/5/22	370.37	40	10.929	1996.30	99.82	9981.52	1.13E+12	1.13E+12
4/7/22	353.48	41	11.202	1905.25	95.26	9526.23	1.08E+12	1.08E+12
5/11/22	357.09	42	11.475	1924.73	96.24	9623.65	1.09E+12	1.09E+12
4/6/22	349.11	43	11.749	1881.70	94.09	9408.52	1.07E+12	1.07E+12
4/8/22	328.00	44	12.022	1767.90	88.39	8839.50	1.00E+12	1.00E+12
3/12/22	359.43	45	12.295	1937.31	96.87	9686.56	1.10E+12	1.10E+12
4/15/22	344.16	46	12.568	1855.05	92.75	9275.24	1.05E+12	1.05E+12
4/16/22	341.36	47	12.842	1839.92	92.00	9199.59	1.04E+12	1.04E+12
4/9/22	348.17	48	13.115	1876.63	93.83	9383.15	1.06E+12	1.06E+12
5/12/22	336.81	49	13.388	1815.41	90.77	9077.03	1.03E+12	1.03E+12
3/22/22	338.74	50	13.661	1825.79	91.29	9128.96	1.04E+12	1.04E+12
4/17/22	349.05	51	13.934	1881.36	94.07	9406.82	1.07E+12	1.07E+12
4/14/22	324.67	52	14.208	1749.99	87.50	8749.94	9.93E+11	9.93E+11
3/21/22	345.13	53	14.481	1860.26	93.01	9301.29	1.06E+12	1.06E+12
5/6/22	316.43	54	14.754	1705.54	85.28	8527.71	9.68E+11	9.68E+11
4/10/22	339.73	55	15.027	1831.17	91.56	9155.84	1.04E+12	1.04E+12
3/13/22	336.61	56	15.301	1814.32	90.72	9071.62	1.03E+12	1.03E+12
4/18/22	320.86	57	15.574	1729.42	86.47	8647.09	9.81E+11	9.81E+11
5/13/22	320.42	58	15.847	1727.05	86.35	8635.27	9.80E+11	9.80E+11
4/19/22	329.08	59	16.120	1773.73	88.69	8868.66	1.01E+12	1.01E+12
3/20/22	322.45	60	16.393	1737.99	86.90	8689.94	9.86E+11	9.86E+11

4/20/22	315.77	61	16.667	1701.98	85.10	8509.91	9.66E+11	9.66E+11
4/11/22	335.71	62	16.940	1809.45	90.47	9047.26	1.03E+12	1.03E+12
5/14/22	310.00	63	17.213	1670.90	83.55	8354.52	9.48E+11	9.48E+11
3/14/22	334.83	64	17.486	1804.72	90.24	9023.58	1.02E+12	1.02E+12
4/13/22	283.82	65	17.760	1529.80	76.49	7649.00	8.68E+11	8.68E+11
4/21/22	299.54	66	18.033	1614.50	80.73	8072.52	9.16E+11	9.16E+11
4/12/22	319.78	67	18.306	1723.60	86.18	8618.02	9.78E+11	9.78E+11
2/17/22	285.97	68	18.579	1541.37	77.07	7706.84	8.75E+11	8.75E+11
4/22/22	318.91	69	18.852	1718.94	85.95	8594.68	9.75E+11	9.75E+11
5/15/22	301.97	70	19.126	1627.61	81.38	8138.04	9.23E+11	9.23E+11
5/5/22	303.80	71	19.399	1637.48	81.87	8187.42	9.29E+11	9.29E+11
3/15/22	323.34	72	19.672	1742.82	87.14	8714.08	9.89E+11	9.89E+11
4/23/22	290.71	73	19.945	1566.92	78.35	7834.62	8.89E+11	8.89E+11
4/25/22	303.78	74	20.219	1637.35	81.87	8186.75	9.29E+11	9.29E+11
4/24/22	277.27	75	20.492	1494.47	74.72	7472.36	8.48E+11	8.48E+11
5/4/22	300.21	76	20.765	1618.14	80.91	8090.68	9.18E+11	9.18E+11
4/26/22	296.35	77	21.038	1597.30	79.86	7986.50	9.06E+11	9.06E+11
3/16/22	306.34	78	21.311	1651.15	82.56	8255.75	9.37E+11	9.37E+11
5/16/22	287.66	79	21.585	1550.49	77.52	7752.43	8.80E+11	8.80E+11
3/19/22	283.48	80	21.858	1527.96	76.40	7639.78	8.67E+11	8.67E+11
4/27/22	295.05	81	22.131	1590.33	79.52	7951.66	9.02E+11	9.02E+11
3/17/22	300.29	82	22.404	1618.54	80.93	8092.71	9.18E+11	9.18E+11
4/28/22	277.02	83	22.678	1493.12	74.66	7465.59	8.47E+11	8.47E+11
5/17/22	270.21	84	22.951	1456.45	72.82	7282.26	8.26E+11	8.26E+11
3/18/22	270.23	85	23.224	1456.54	72.83	7282.72	8.26E+11	8.26E+11
5/3/22	268.91	86	23.497	1449.42	72.47	7247.08	8.22E+11	8.22E+11
4/29/22	266.50	87	23.770	1436.43	71.82	7182.13	8.15E+11	8.15E+11
5/18/22	256.81	88	24.044	1384.20	69.21	6921.00	7.85E+11	7.85E+11
5/1/22	256.43	89	24.317	1382.16	69.11	6910.79	7.84E+11	7.84E+11
6/11/22	263.20	90	24.590	1418.63	70.93	7093.17	8.05E+11	8.05E+11
6/12/22	260.78	91	24.863	1405.58	70.28	7027.89	7.98E+11	7.98E+11
4/30/22	249.28	92	25.137	1343.61	67.18	6718.05	7.62E+11	7.62E+11
5/2/22	263.37	93	25.410	1419.58	70.98	7097.91	8.05E+11	8.05E+11
6/10/22	259.23	94	25.683	1397.26	69.86	6986.28	7.93E+11	7.93E+11
5/19/22	249.06	95	25.956	1342.46	67.12	6712.30	7.62E+11	7.62E+11
6/13/22	258.30	96	26.230	1392.25	69.61	6961.25	7.90E+11	7.90E+11
6/9/22	255.04	97	26.503	1374.66	68.73	6873.31	7.80E+11	7.80E+11
6/14/22	257.21	98	26.776	1386.37	69.32	6931.83	7.87E+11	7.87E+11
5/20/22	239.71	99	27.049	1292.06	64.60	6460.30	7.33E+11	7.33E+11
6/15/22	249.30	100	27.322	1343.75	67.19	6718.73	7.62E+11	7.62E+11
6/8/22	234.68	101	27.596	1264.94	63.25	6324.70	7.18E+11	7.18E+11
6/2/22	238.06	102	27.869	1283.13	64.16	6415.65	7.28E+11	7.28E+11
5/21/22	233.14	103	28.142	1256.61	62.83	6283.06	7.13E+11	7.13E+11
6/1/22	231.12	104	28.415	1245.74	62.29	6228.69	7.07E+11	7.07E+11
5/30/22	235.22	105	28.689	1267.84	63.39	6339.21	7.19E+11	7.19E+11
7/28/22	218.30	106	28.962	1176.65	58.83	5883.24	6.68E+11	6.68E+11
6/3/22	231.86	107	29.235	1249.71	62.49	6248.55	7.09E+11	7.09E+11
7/27/22	218.04	108	29.508	1175.23	58.76	5876.14	6.67E+11	6.67E+11
5/31/22	235.57	109	29.781	1269.74	63.49	6348.68	7.20E+11	7.20E+11
7/29/22	217.57	110	30.055	1172.72	58.64	5863.62	6.65E+11	6.65E+11
5/29/22	227.69	111	30.328	1227.25	61.36	6136.25	6.96E+11	6.96E+11
7/26/22	209.54	112	30.601	1129.44	56.47	5647.21	6.41E+11	6.41E+11
5/22/22	224.23	113	30.874	1208.58	60.43	6042.90	6.86E+11	6.86E+11
6/7/22	227.38	114	31.148	1225.56	61.28	6127.80	6.95E+11	6.95E+11
6/16/22	234.44	115	31.421	1263.65	63.18	6318.23	7.17E+11	7.17E+11
6/4/22	223.64	116	31.694	1205.40	60.27	6027.00	6.84E+11	6.84E+11
7/30/22	208.01	117	31.967	1121.17	56.06	5605.87	6.36E+11	6.36E+11
7/25/22	204.61	118	32.240	1102.84	55.14	5514.20	6.26E+11	6.26E+11
5/23/22	210.91	119	32.514	1136.80	56.84	5684.01	6.45E+11	6.45E+11
6/5/22	212.60	120	32.787	1145.93	57.30	5729.67	6.50E+11	6.50E+11
7/31/22	198.71	121	33.060	1071.05	53.55	5355.23	6.08E+11	6.08E+11

6/17/22	216.20	122	33.333	1165.32	58.27	5826.59	6.61E+11	6.61E+11
6/6/22	202.02	123	33.607	1088.88	54.44	5444.42	6.18E+11	6.18E+11
5/28/22	208.78	124	33.880	1125.30	56.27	5626.51	6.38E+11	6.38E+11
5/24/22	198.55	125	34.153	1070.17	53.51	5350.83	6.07E+11	6.07E+11
7/24/22	190.63	126	34.426	1027.48	51.37	5137.39	5.83E+11	5.83E+11
8/1/22	188.84	127	34.699	1017.87	50.89	5089.33	5.78E+11	5.78E+11
2/16/22	166.76	128	34.973	898.83	44.94	4494.14	5.10E+11	5.10E+11
5/27/22	203.45	129	35.246	1096.62	54.83	5483.09	6.22E+11	6.22E+11
5/25/22	196.00	130	35.519	1056.46	52.82	5282.29	5.99E+11	5.99E+11
5/26/22	201.55	131	35.792	1086.33	54.32	5431.67	6.16E+11	6.16E+11
6/18/22	200.97	132	36.066	1083.22	54.16	5416.11	6.15E+11	6.15E+11
8/2/22	177.57	133	36.339	957.12	47.86	4785.61	5.43E+11	5.43E+11
2/13/22	184.01	134	36.612	991.83	49.59	4959.13	5.63E+11	5.63E+11
2/14/22	182.61	135	36.885	984.25	49.21	4921.25	5.58E+11	5.58E+11
2/15/22	179.32	136	37.158	966.53	48.33	4832.63	5.48E+11	5.48E+11
8/3/22	165.68	137	37.432	893.03	44.65	4465.16	5.07E+11	5.07E+11
7/8/22	180.24	138	37.705	971.49	48.57	4857.45	5.51E+11	5.51E+11
7/9/22	179.77	139	37.978	968.96	48.45	4844.80	5.50E+11	5.50E+11
6/19/22	179.76	140	38.251	968.93	48.45	4844.63	5.50E+11	5.50E+11
2/12/22	176.22	141	38.525	949.82	47.49	4749.08	5.39E+11	5.39E+11
8/4/22	161.78	142	38.798	872.02	43.60	4360.09	4.95E+11	4.95E+11
1/25/23	148.15	143	39.071	798.55	39.93	3992.74	4.53E+11	4.53E+11
1/23/23	143.92	144	39.344	775.75	38.79	3878.75	4.40E+11	4.40E+11
1/22/23	147.53	145	39.617	795.17	39.76	3975.83	4.51E+11	4.51E+11
1/26/23	144.65	146	39.891	779.67	38.98	3898.37	4.42E+11	4.42E+11
7/10/22	176.54	147	40.164	951.57	47.58	4757.87	5.40E+11	5.40E+11
7/23/22	155.69	148	40.437	839.14	41.96	4195.72	4.76E+11	4.76E+11
1/24/23	139.38	149	40.710	751.28	37.56	3756.42	4.26E+11	4.26E+11
1/27/23	133.85	150	40.984	721.47	36.07	3607.37	4.09E+11	4.09E+11
7/7/22	174.38	151	41.257	939.89	46.99	4699.47	5.33E+11	5.33E+11
1/8/23	146.82	152	41.530	791.38	39.57	3956.89	4.49E+11	4.49E+11
1/28/23	144.84	153	41.803	780.69	39.03	3903.44	4.43E+11	4.43E+11
1/21/23	138.64	154	42.077	747.27	37.36	3736.35	4.24E+11	4.24E+11
1/7/23	144.69	155	42.350	779.88	38.99	3899.38	4.42E+11	4.42E+11
1/29/23	139.73	156	42.623	753.12	37.66	3765.62	4.27E+11	4.27E+11
1/6/23	141.23	157	42.896	761.21	38.06	3806.03	4.32E+11	4.32E+11
8/5/22	146.39	158	43.169	789.04	39.45	3945.18	4.48E+11	4.48E+11
1/9/23	142.81	159	43.443	769.73	38.49	3848.65	4.37E+11	4.37E+11
7/11/22	169.73	160	43.716	914.84	45.74	4574.20	5.19E+11	5.19E+11
1/30/23	142.07	161	43.989	765.74	38.29	3828.69	4.34E+11	4.34E+11
1/10/23	142.43	162	44.262	767.69	38.38	3838.46	4.36E+11	4.36E+11
1/5/23	137.70	163	44.536	742.20	37.11	3711.02	4.21E+11	4.21E+11
2/7/22	156.01	164	44.809	840.90	42.04	4204.49	4.77E+11	4.77E+11
1/20/23	135.47	165	45.082	730.16	36.51	3650.81	4.14E+11	4.14E+11
1/31/23	134.33	166	45.355	724.07	36.20	3620.33	4.11E+11	4.11E+11
2/8/22	150.49	167	45.628	811.12	40.56	4055.59	4.60E+11	4.60E+11
6/20/22	166.20	168	45.902	895.83	44.79	4479.15	5.08E+11	5.08E+11
2/6/22	137.84	169	46.175	742.94	37.15	3714.70	4.22E+11	4.22E+11
1/12/23	138.42	170	46.448	746.10	37.30	3730.50	4.23E+11	4.23E+11
2/3/22	158.55	171	46.721	854.56	42.73	4272.82	4.85E+11	4.85E+11
8/6/22	140.66	172	46.995	758.17	37.91	3790.86	4.30E+11	4.30E+11
7/12/22	158.62	173	47.268	854.97	42.75	4274.85	4.85E+11	4.85E+11
2/4/22	140.24	174	47.541	755.88	37.79	3779.41	4.29E+11	4.29E+11
2/5/22	151.22	175	47.814	815.06	40.75	4075.28	4.62E+11	4.62E+11
1/4/23	131.15	176	48.087	706.90	35.34	3534.48	4.01E+11	4.01E+11
1/13/23	132.54	177	48.361	714.39	35.72	3571.96	4.05E+11	4.05E+11
2/11/22	130.59	178	48.634	703.88	35.19	3519.38	3.99E+11	3.99E+11
1/19/23	129.15	179	48.907	696.14	34.81	3480.68	3.95E+11	3.95E+11
1/14/23	130.13	180	49.180	701.40	35.07	3507.01	3.98E+11	3.98E+11
2/9/22	142.40	181	49.454	767.56	38.38	3837.79	4.36E+11	4.36E+11
8/7/22	133.29	182	49.727	718.44	35.92	3592.19	4.08E+11	4.08E+11

1/15/23	125.31	183	50.000	675.42	33.77	3377.12	3.83E+11	3.83E+11
8/8/22	127.68	184	50.273	688.20	34.41	3440.98	3.90E+11	3.90E+11
2/2/22	149.32	185	50.546	804.83	40.24	4024.13	4.57E+11	4.57E+11
7/13/22	145.87	186	50.820	786.25	39.31	3931.25	4.46E+11	4.46E+11
2/10/22	144.40	187	51.093	778.32	38.92	3891.60	4.42E+11	4.42E+11
8/9/22	124.85	188	51.366	672.94	33.65	3364.69	3.82E+11	3.82E+11
6/21/22	148.17	189	51.639	798.62	39.93	3993.08	4.53E+11	4.53E+11
1/16/23	122.90	190	51.913	662.44	33.12	3312.18	3.76E+11	3.76E+11
1/3/23	113.21	191	52.186	610.19	30.51	3050.97	3.46E+11	3.46E+11
1/17/23	116.88	192	52.459	629.96	31.50	3149.81	3.57E+11	3.57E+11
7/14/22	135.64	193	52.732	731.10	36.56	3655.50	4.15E+11	4.15E+11
1/18/23	112.81	194	53.005	608.02	30.40	3040.11	3.45E+11	3.45E+11
7/22/22	113.89	195	53.279	613.86	30.69	3069.32	3.48E+11	3.48E+11
8/10/22	119.35	196	53.552	643.30	32.17	3216.52	3.65E+11	3.65E+11
8/22/22	114.15	197	53.825	615.26	30.76	3076.31	3.49E+11	3.49E+11
12/2/22	82.88	198	54.098	446.74	22.34	2233.72	2.53E+11	2.53E+11
12/1/22	97.72	199	54.372	526.71	26.34	2633.54	2.99E+11	2.99E+11
7/15/22	121.48	200	54.645	654.78	32.74	3273.88	3.72E+11	3.72E+11
7/6/22	125.96	201	54.918	678.93	33.95	3394.64	3.85E+11	3.85E+11
12/4/22	98.77	202	55.191	532.36	26.62	2661.82	3.02E+11	3.02E+11
1/2/23	108.22	203	55.464	583.29	29.16	2916.45	3.31E+11	3.31E+11
12/3/22	101.28	204	55.738	545.91	27.30	2729.54	3.10E+11	3.10E+11
11/30/22	97.43	205	56.011	525.15	26.26	2625.74	2.98E+11	2.98E+11
6/22/22	129.86	206	56.284	699.97	35.00	3499.84	3.97E+11	3.97E+11
7/16/22	114.75	207	56.557	618.48	30.92	3092.39	3.51E+11	3.51E+11
8/21/22	108.41	208	56.831	584.34	29.22	2921.71	3.32E+11	3.32E+11
12/5/22	96.83	209	57.104	521.94	26.10	2609.69	2.96E+11	2.96E+11
11/29/22	78.44	210	57.377	422.78	21.14	2113.90	2.40E+11	2.40E+11
8/11/22	108.68	211	57.650	585.81	29.29	2929.04	3.32E+11	3.32E+11
1/1/23	97.62	212	57.923	526.17	26.31	2630.85	2.99E+11	2.99E+11
12/6/22	100.13	213	58.197	539.72	26.99	2698.62	3.06E+11	3.06E+11
8/23/22	100.88	214	58.470	543.76	27.19	2718.81	3.09E+11	3.09E+11
7/17/22	113.52	215	58.743	611.87	30.59	3059.35	3.47E+11	3.47E+11
1/11/23	130.73	216	59.016	704.65	35.23	3523.25	4.00E+11	4.00E+11
12/7/22	93.81	217	59.290	505.62	25.28	2528.11	2.87E+11	2.87E+11
7/18/22	110.73	218	59.563	596.84	29.84	2984.21	3.39E+11	3.39E+11
12/8/22	91.64	219	59.836	493.92	24.70	2469.59	2.80E+11	2.80E+11
8/31/22	90.20	220	60.109	486.17	24.31	2430.86	2.76E+11	2.76E+11
12/9/22	77.51	221	60.383	417.77	20.89	2088.84	2.37E+11	2.37E+11
8/30/22	92.09	222	60.656	496.38	24.82	2481.90	2.82E+11	2.82E+11
12/10/22	81.88	223	60.929	441.32	22.07	2206.62	2.50E+11	2.50E+11
12/31/22	89.67	224	61.202	483.32	24.17	2416.61	2.74E+11	2.74E+11
2/1/22	100.94	225	61.475	544.05	27.20	2720.24	3.09E+11	3.09E+11
8/12/22	93.60	226	61.749	504.52	25.23	2522.59	2.86E+11	2.86E+11
7/19/22	97.29	227	62.022	524.41	26.22	2622.07	2.98E+11	2.98E+11
8/24/22	85.40	228	62.295	460.31	23.02	2301.56	2.61E+11	2.61E+11
11/28/22	72.06	229	62.568	388.38	19.42	1941.91	2.20E+11	2.20E+11
12/11/22	83.29	230	62.842	448.92	22.45	2244.58	2.55E+11	2.55E+11
6/23/22	110.47	231	63.115	595.43	29.77	2977.17	3.38E+11	3.38E+11
8/15/22	85.39	232	63.388	460.23	23.01	2301.14	2.61E+11	2.61E+11
9/1/22	78.90	233	63.661	425.28	21.26	2126.40	2.41E+11	2.41E+11
12/12/22	85.16	234	63.934	459.00	22.95	2294.98	2.60E+11	2.60E+11
8/14/22	86.62	235	64.208	466.90	23.34	2334.49	2.65E+11	2.65E+11
12/16/22	72.64	236	64.481	391.52	19.58	1957.60	2.22E+11	2.22E+11
12/13/22	71.96	237	64.754	387.87	19.39	1939.36	2.20E+11	2.20E+11
12/15/22	67.84	238	65.027	365.64	18.28	1828.22	2.07E+11	2.07E+11
12/17/22	75.67	239	65.301	407.85	20.39	2039.23	2.31E+11	2.31E+11
8/13/22	83.98	240	65.574	452.65	22.63	2263.25	2.57E+11	2.57E+11
7/20/22	86.52	241	65.847	466.34	23.32	2331.72	2.65E+11	2.65E+11
8/16/22	80.09	242	66.120	431.71	21.59	2158.53	2.45E+11	2.45E+11
12/14/22	74.92	243	66.393	403.81	20.19	2019.06	2.29E+11	2.29E+11

12/24/22	49.30	244	66.667	265.75	13.29	1328.73	1.51E+11	1.51E+11
8/25/22	78.99	245	66.940	425.76	21.29	2128.80	2.42E+11	2.42E+11
9/2/22	74.94	246	67.213	403.92	20.20	2019.61	2.29E+11	2.29E+11
12/18/22	74.95	247	67.486	404.00	20.20	2020.01	2.29E+11	2.29E+11
12/23/22	48.78	248	67.760	262.92	13.15	1314.59	1.49E+11	1.49E+11
12/20/22	75.48	249	68.033	406.84	20.34	2034.19	2.31E+11	2.31E+11
10/23/22	70.31	250	68.306	378.95	18.95	1894.73	2.15E+11	2.15E+11
12/19/22	74.68	251	68.579	402.51	20.13	2012.57	2.28E+11	2.28E+11
12/27/22	39.67	252	68.852	213.82	10.69	1069.11	1.21E+11	1.21E+11
12/26/22	50.46	253	69.126	271.98	13.60	1359.89	1.54E+11	1.54E+11
12/30/22	65.57	254	69.399	353.43	17.67	1767.14	2.01E+11	2.01E+11
7/21/22	81.23	255	69.672	437.86	21.89	2189.28	2.48E+11	2.48E+11
8/17/22	73.64	256	69.945	396.93	19.85	1984.63	2.25E+11	2.25E+11
6/24/22	94.21	257	70.219	507.80	25.39	2538.99	2.88E+11	2.88E+11
12/21/22	75.51	258	70.492	406.99	20.35	2034.97	2.31E+11	2.31E+11
12/28/22	36.17	259	70.765	194.96	9.75	974.79	1.11E+11	1.11E+11
12/25/22	42.83	260	71.038	230.88	11.54	1154.40	1.31E+11	1.31E+11
9/3/22	71.30	261	71.311	384.32	19.22	1921.58	2.18E+11	2.18E+11
8/26/22	70.37	262	71.585	379.31	18.97	1896.54	2.15E+11	2.15E+11
12/22/22	73.25	263	71.858	394.83	19.74	1974.16	2.24E+11	2.24E+11
8/29/22	64.18	264	72.131	345.93	17.30	1729.66	1.96E+11	1.96E+11
8/27/22	71.40	265	72.404	384.86	19.24	1924.32	2.18E+11	2.18E+11
9/4/22	68.18	266	72.678	367.48	18.37	1837.39	2.09E+11	2.09E+11
8/18/22	70.50	267	72.951	379.99	19.00	1899.94	2.16E+11	2.16E+11
12/29/22	40.80	268	73.224	219.92	11.00	1099.60	1.25E+11	1.25E+11
10/24/22	59.72	269	73.497	321.88	16.09	1609.41	1.83E+11	1.83E+11
8/19/22	67.66	270	73.770	364.71	18.24	1823.57	2.07E+11	2.07E+11
8/28/22	67.03	271	74.044	361.31	18.07	1806.57	2.05E+11	2.05E+11
8/20/22	64.21	272	74.317	346.07	17.30	1730.34	1.96E+11	1.96E+11
9/5/22	66.13	273	74.590	356.44	17.82	1782.19	2.02E+11	2.02E+11
6/25/22	84.94	274	74.863	457.85	22.89	2289.26	2.60E+11	2.60E+11
9/6/22	63.02	275	75.137	339.67	16.98	1698.37	1.93E+11	1.93E+11
10/25/22	51.27	276	75.410	276.34	13.82	1381.68	1.57E+11	1.57E+11
10/26/22	55.42	277	75.683	298.70	14.93	1493.49	1.69E+11	1.69E+11
10/27/22	54.82	278	75.956	295.48	14.77	1477.42	1.68E+11	1.68E+11
11/27/22	49.55	279	76.230	267.10	13.36	1335.50	1.52E+11	1.52E+11
10/28/22	55.04	280	76.503	296.64	14.83	1483.21	1.68E+11	1.68E+11
9/7/22	63.34	281	76.776	341.39	17.07	1706.96	1.94E+11	1.94E+11
9/27/22	65.41	282	77.049	352.57	17.63	1762.83	2.00E+11	2.00E+11
10/29/22	52.12	283	77.322	280.91	14.05	1404.56	1.59E+11	1.59E+11
6/26/22	77.14	284	77.596	415.80	20.79	2079.01	2.36E+11	2.36E+11
9/28/22	62.18	285	77.869	335.17	16.76	1675.84	1.90E+11	1.90E+11
10/30/22	51.40	286	78.142	277.06	13.85	1385.30	1.57E+11	1.57E+11
11/1/22	48.53	287	78.415	261.58	13.08	1307.92	1.48E+11	1.48E+11
10/31/22	48.94	288	78.689	263.79	13.19	1318.97	1.50E+11	1.50E+11
11/2/22	51.10	289	78.962	275.44	13.77	1377.20	1.56E+11	1.56E+11
11/4/22	48.52	290	79.235	261.50	13.08	1307.50	1.48E+11	1.48E+11
11/3/22	51.35	291	79.508	276.79	13.84	1383.96	1.57E+11	1.57E+11
9/26/22	62.17	292	79.781	335.11	16.76	1675.54	1.90E+11	1.90E+11
9/8/22	59.04	293	80.055	318.22	15.91	1591.08	1.81E+11	1.81E+11
11/5/22	45.79	294	80.328	246.81	12.34	1234.05	1.40E+11	1.40E+11
10/19/22	47.97	295	80.601	258.54	12.93	1292.68	1.47E+11	1.47E+11
9/29/22	58.81	296	80.874	316.99	15.85	1584.95	1.80E+11	1.80E+11
10/22/22	49.61	297	81.148	267.38	13.37	1336.91	1.52E+11	1.52E+11
11/7/22	47.99	298	81.421	258.68	12.93	1293.41	1.47E+11	1.47E+11
11/6/22	47.51	299	81.694	256.10	12.80	1280.49	1.45E+11	1.45E+11
11/8/22	51.88	300	81.967	279.63	13.98	1398.17	1.59E+11	1.59E+11
10/20/22	47.72	301	82.240	257.20	12.86	1286.01	1.46E+11	1.46E+11
11/9/22	47.50	302	82.514	256.02	12.80	1280.08	1.45E+11	1.45E+11
9/9/22	53.36	303	82.787	287.60	14.38	1437.98	1.63E+11	1.63E+11
9/30/22	58.28	304	83.060	314.11	15.71	1570.54	1.78E+11	1.78E+11

11/10/22	43.21	305	83.333	232.91	11.65	1164.55	1.32E+11	1.32E+11
9/12/22	59.32	306	83.607	319.74	15.99	1598.69	1.81E+11	1.81E+11
11/11/22	48.41	307	83.880	260.93	13.05	1304.64	1.48E+11	1.48E+11
10/18/22	42.91	308	84.153	231.26	11.56	1156.31	1.31E+11	1.31E+11
6/27/22	66.77	309	84.426	359.87	17.99	1799.34	2.04E+11	2.04E+11
10/21/22	45.44	310	84.699	244.93	12.25	1224.65	1.39E+11	1.39E+11
9/11/22	44.56	311	84.973	240.17	12.01	1200.83	1.36E+11	1.36E+11
11/12/22	43.11	312	85.246	232.37	11.62	1161.87	1.32E+11	1.32E+11
11/13/22	44.14	313	85.519	237.93	11.90	1189.67	1.35E+11	1.35E+11
9/13/22	56.05	314	85.792	302.09	15.10	1510.44	1.71E+11	1.71E+11
11/14/22	47.19	315	86.066	254.37	12.72	1271.83	1.44E+11	1.44E+11
9/10/22	47.13	316	86.339	254.05	12.70	1270.26	1.44E+11	1.44E+11
10/1/22	56.11	317	86.612	302.45	15.12	1512.26	1.72E+11	1.72E+11
11/15/22	45.69	318	86.885	246.30	12.31	1231.48	1.40E+11	1.40E+11
9/14/22	51.84	319	87.158	279.42	13.97	1397.09	1.59E+11	1.59E+11
11/16/22	40.06	320	87.432	215.91	10.80	1079.57	1.23E+11	1.23E+11
11/17/22	39.98	321	87.705	215.52	10.78	1077.58	1.22E+11	1.22E+11
9/15/22	50.01	322	87.978	269.55	13.48	1347.74	1.53E+11	1.53E+11
11/26/22	40.90	323	88.251	220.44	11.02	1102.22	1.25E+11	1.25E+11
9/25/22	46.11	324	88.525	248.56	12.43	1242.79	1.41E+11	1.41E+11
9/21/22	51.10	325	88.798	275.42	13.77	1377.10	1.56E+11	1.56E+11
11/18/22	39.47	326	89.071	212.74	10.64	1063.71	1.21E+11	1.21E+11
11/25/22	41.46	327	89.344	223.46	11.17	1117.31	1.27E+11	1.27E+11
11/19/22	38.49	328	89.617	207.46	10.37	1037.30	1.18E+11	1.18E+11
9/22/22	53.25	329	89.891	287.02	14.35	1435.11	1.63E+11	1.63E+11
9/16/22	47.81	330	90.164	257.67	12.88	1288.37	1.46E+11	1.46E+11
11/24/22	37.97	331	90.437	204.67	10.23	1023.34	1.16E+11	1.16E+11
10/2/22	52.95	332	90.710	285.38	14.27	1426.92	1.62E+11	1.62E+11
11/22/22	38.99	333	90.984	210.17	10.51	1050.85	1.19E+11	1.19E+11
11/21/22	35.53	334	91.257	191.52	9.58	957.62	1.09E+11	1.09E+11
11/23/22	37.49	335	91.530	202.08	10.10	1010.40	1.15E+11	1.15E+11
9/20/22	46.90	336	91.803	252.81	12.64	1264.06	1.43E+11	1.43E+11
6/28/22	54.60	337	92.077	294.29	14.71	1471.47	1.67E+11	1.67E+11
11/20/22	37.60	338	92.350	202.64	10.13	1013.21	1.15E+11	1.15E+11
9/17/22	43.77	339	92.623	235.94	11.80	1179.69	1.34E+11	1.34E+11
9/23/22	48.74	340	92.896	262.73	13.14	1313.67	1.49E+11	1.49E+11
9/19/22	48.24	341	93.169	260.00	13.00	1300.02	1.48E+11	1.48E+11
9/18/22	45.93	342	93.443	247.57	12.38	1237.84	1.40E+11	1.40E+11
10/3/22	48.59	343	93.716	261.92	13.10	1309.62	1.49E+11	1.49E+11
9/24/22	43.41	344	93.989	233.97	11.70	1169.83	1.33E+11	1.33E+11
7/5/22	48.43	345	94.262	261.03	13.05	1305.14	1.48E+11	1.48E+11
10/4/22	44.09	346	94.536	237.62	11.88	1188.09	1.35E+11	1.35E+11
6/29/22	48.79	347	94.809	262.99	13.15	1314.96	1.49E+11	1.49E+11
10/5/22	45.44	348	95.082	244.90	12.25	1224.51	1.39E+11	1.39E+11
10/17/22	27.73	349	95.355	149.48	7.47	747.40	8.48E+10	8.48E+10
10/6/22	37.13	350	95.628	200.11	10.01	1000.54	1.14E+11	1.14E+11
6/30/22	43.27	351	95.902	233.20	11.66	1166.01	1.32E+11	1.32E+11
10/7/22	42.26	352	96.175	227.78	11.39	1138.89	1.29E+11	1.29E+11
7/1/22	42.78	353	96.448	230.59	11.53	1152.96	1.31E+11	1.31E+11
7/2/22	43.47	354	96.721	234.30	11.72	1171.51	1.33E+11	1.33E+11
10/8/22	35.67	355	96.995	192.24	9.61	961.19	1.09E+11	1.09E+11
10/16/22	23.31	356	97.268	125.64	6.28	628.21	7.13E+10	7.13E+10
10/9/22	27.20	357	97.541	146.58	7.33	732.91	8.32E+10	8.32E+10
7/3/22	37.78	358	97.814	203.65	10.18	1018.23	1.16E+11	1.16E+11
10/13/22	35.25	359	98.087	189.98	9.50	949.88	1.08E+11	1.08E+11
10/10/22	26.03	360	98.361	140.31	7.02	701.57	7.96E+10	7.96E+10
10/15/22	21.76	361	98.634	117.26	5.86	586.30	6.65E+10	6.65E+10
10/14/22	22.34	362	98.907	120.43	6.02	602.14	6.83E+10	6.83E+10
10/11/22	25.04	363	99.180	134.98	6.75	674.89	7.66E+10	7.66E+10
10/12/22	24.46	364	99.454	131.82	6.59	659.11	7.48E+10	7.48E+10
7/4/22	37.37	365	99.727	201.45	10.07	1007.23	1.14E+11	1.14E+11

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 10 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	2653.67	1.85	0.132	5.2	488	3.005464481	26461.0916	1888.03464	74377.12234	3.17E+13	21	555682.9236	39648.72752	1561919.569	6.65E+14
3/15/22	357.31	2.21	0.05	5.2	17	36.61202186	4256.221619	96.2946068	10014.6391	1.49E+11	35	148967.7567	3370.311237	350512.3686	5.20E+12
4/19/22	357.22	2.60	0.05	8.8	166	36.8852459	5006.022789	96.269669	16943.46175	1.45E+12	35	175210.7976	3369.438415	593021.1611	5.08E+13
5/24/22	245.81	4.40	0.188	40.4	78.0	48.36065574	5829.526964	249.079788	53525.65667	4.69E+11	28	163226.755	6974.234077	1498718.387	1.31E+13
6/21/22	153.16	3.77	0.09	44.4	187.0	58.46994536	3112.244783	74.2976208	36653.49293	7.01E+11	28	87142.85392	2080.333383	1026297.802	1.96E+13
7/19/22	269.85	2.75	0.05	11.6	248.0	45.6284153	3999.789784	72.7234506	16871.84054	1.64E+12	35	139992.6424	2545.320772	590514.419	5.73E+13
8/23/22	137.75	3.30	0.05	14.8	231.0	61.20218579	2450.07355	37.1223265	10988.20865	7.78E+11	28	68602.05941	1039.425143	307669.8422	2.18E+13
9/20/22	92.49	2.28	0.050	6.0	261.0	78.68852459	1137.430712	24.9262732	2991.152781	5.91E+11	36	40947.50564	897.3458343	107681.5001	2.13E+13
10/26/22	129.02	1.42	0.050	5.2	1730.0	63.38797814	989.6638704	34.7696997	3616.048769	5.46E+12	13	12865.63032	452.0060961	47008.63399	7.10E+13
11/8/22	115.53	1.72	0.050	3.2	132.0	68.85245902	1069.102761	31.1357716	1992.68938	3.73E+11	35	37418.59664	1089.752005	69744.12831	1.31E+13
12/13/22	85.01	4.10	0.050	4.8	93.0	84.15300546	1878.685982	22.9108047	2199.437248	1.93E+11	36	67632.69536	824.7889678	79179.74091	6.96E+12
1/18/23	390.31	2.20	0.050	10.0	248.0	41.53005464	4628.245884	105.187406	21037.48129	2.37E+12	37	171245.0977	3891.934039	778386.8078	8.76E+13
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	1,668,935.3	66,183.6	7,010,654.4	1.03E+15
											TARGET	335,232.0	16,761.6	1,676,159.8	1.90E+14

Site 11 Date	E11	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	389.34	1	0.273	2098.55	104.93	10492.73	1.19E+12	1.19E+12
2/24/22	393.15	2	0.546	2119.07	105.95	10595.34	1.20E+12	1.20E+12
2/22/22	371.23	3	0.820	2000.93	100.05	10004.67	1.14E+12	1.14E+12
2/25/22	382.69	4	1.093	2062.69	103.13	10313.46	1.17E+12	1.17E+12
2/26/22	367.09	5	1.366	1978.61	98.93	9893.07	1.12E+12	1.12E+12
2/21/22	359.46	6	1.639	1937.49	96.87	9687.47	1.10E+12	1.10E+12
2/27/22	360.26	7	1.913	1941.82	97.09	9709.09	1.10E+12	1.10E+12
2/20/22	321.23	8	2.186	1731.45	86.57	8657.27	9.82E+11	9.82E+11
2/19/22	344.83	9	2.459	1858.62	92.93	9293.12	1.05E+12	1.05E+12
2/28/22	345.11	10	2.732	1860.16	93.01	9300.81	1.06E+12	1.06E+12
3/1/22	342.51	11	3.005	1846.13	92.31	9230.64	1.05E+12	1.05E+12
3/2/22	331.44	12	3.279	1786.44	89.32	8932.18	1.01E+12	1.01E+12
3/3/22	332.24	13	3.552	1790.76	89.54	8953.81	1.02E+12	1.02E+12
3/4/22	328.97	14	3.825	1773.17	88.66	8865.86	1.01E+12	1.01E+12
3/26/22	301.34	15	4.098	1624.23	81.21	8121.15	9.22E+11	9.22E+11
3/27/22	302.49	16	4.372	1630.43	81.52	8152.15	9.25E+11	9.25E+11
3/28/22	304.24	17	4.645	1639.85	81.99	8199.25	9.30E+11	9.30E+11
3/25/22	293.02	18	4.918	1579.39	78.97	7896.94	8.96E+11	8.96E+11
3/5/22	300.79	19	5.191	1621.25	81.06	8106.25	9.20E+11	9.20E+11
2/18/22	285.05	20	5.464	1536.42	76.82	7682.11	8.72E+11	8.72E+11
3/29/22	301.62	21	5.738	1625.72	81.29	8128.60	9.22E+11	9.22E+11
3/24/22	281.38	22	6.011	1516.62	75.83	7583.10	8.61E+11	8.61E+11
3/30/22	276.95	23	6.284	1492.76	74.64	7463.80	8.47E+11	8.47E+11
3/7/22	293.16	24	6.557	1580.12	79.01	7900.62	8.97E+11	8.97E+11
3/6/22	289.48	25	6.831	1560.31	78.02	7801.54	8.85E+11	8.85E+11
3/8/22	298.83	26	7.104	1610.68	80.53	8053.38	9.14E+11	9.14E+11
3/31/22	263.83	27	7.377	1422.04	71.10	7110.18	8.07E+11	8.07E+11
3/9/22	292.90	28	7.650	1578.72	78.94	7893.58	8.96E+11	8.96E+11
4/1/22	268.59	29	7.923	1447.69	72.38	7238.46	8.21E+11	8.21E+11
4/2/22	270.94	30	8.197	1460.39	73.02	7301.95	8.29E+11	8.29E+11
3/10/22	290.19	31	8.470	1564.11	78.21	7820.53	8.87E+11	8.87E+11
3/23/22	255.04	32	8.743	1374.68	68.73	6873.42	7.80E+11	7.80E+11
4/3/22	265.89	33	9.016	1433.14	71.66	7165.69	8.13E+11	8.13E+11
5/8/22	255.85	34	9.290	1379.02	68.95	6895.11	7.82E+11	7.82E+11
3/11/22	260.71	35	9.563	1405.21	70.26	7026.04	7.97E+11	7.97E+11
5/9/22	250.02	36	9.836	1347.59	67.38	6737.95	7.65E+11	7.65E+11
5/7/22	256.92	37	10.109	1384.79	69.24	6923.94	7.86E+11	7.86E+11
4/4/22	252.12	38	10.383	1358.92	67.95	6794.62	7.71E+11	7.71E+11
5/10/22	248.63	39	10.656	1340.09	67.00	6700.46	7.60E+11	7.60E+11
4/5/22	263.12	40	10.929	1418.24	70.91	7091.20	8.05E+11	8.05E+11
4/7/22	251.12	41	11.202	1353.55	67.68	6767.75	7.68E+11	7.68E+11
5/11/22	253.69	42	11.475	1367.39	68.37	6836.95	7.76E+11	7.76E+11
4/6/22	248.02	43	11.749	1336.82	66.84	6684.12	7.58E+11	7.58E+11
4/8/22	233.02	44	12.022	1255.97	62.80	6279.87	7.13E+11	7.13E+11
3/12/22	255.35	45	12.295	1376.33	68.82	6881.65	7.81E+11	7.81E+11
4/15/22	244.51	46	12.568	1317.89	65.89	6589.44	7.48E+11	7.48E+11
4/16/22	242.51	47	12.842	1307.14	65.36	6535.69	7.42E+11	7.42E+11
4/9/22	247.35	48	13.115	1333.22	66.66	6666.10	7.56E+11	7.56E+11
5/12/22	239.28	49	13.388	1289.72	64.49	6448.62	7.32E+11	7.32E+11
3/22/22	240.65	50	13.661	1297.10	64.86	6485.51	7.36E+11	7.36E+11
4/17/22	247.97	51	13.934	1336.58	66.83	6682.92	7.58E+11	7.58E+11
4/14/22	230.66	52	14.208	1243.25	62.16	6216.24	7.05E+11	7.05E+11
3/21/22	245.19	53	14.481	1321.59	66.08	6607.94	7.50E+11	7.50E+11
5/6/22	224.80	54	14.754	1211.67	60.58	6058.37	6.87E+11	6.87E+11
4/10/22	241.36	55	15.027	1300.92	65.05	6504.61	7.38E+11	7.38E+11
3/13/22	239.14	56	15.301	1288.95	64.45	6444.77	7.31E+11	7.31E+11
4/18/22	227.95	57	15.574	1228.64	61.43	6143.18	6.97E+11	6.97E+11
5/13/22	227.64	58	15.847	1226.96	61.35	6134.78	6.96E+11	6.96E+11
4/19/22	233.79	59	16.120	1260.12	63.01	6300.59	7.15E+11	7.15E+11
3/20/22	229.08	60	16.393	1234.72	61.74	6173.62	7.01E+11	7.01E+11

4/20/22	224.33	61	16.667	1209.14	60.46	6045.72	6.86E+11	6.86E+11
4/11/22	238.50	62	16.940	1285.49	64.27	6427.47	7.29E+11	7.29E+11
5/14/22	220.23	63	17.213	1187.06	59.35	5935.32	6.74E+11	6.74E+11
3/14/22	237.87	64	17.486	1282.13	64.11	6410.65	7.27E+11	7.27E+11
4/13/22	201.64	65	17.760	1086.82	54.34	5434.10	6.17E+11	6.17E+11
4/21/22	212.80	66	18.033	1147.00	57.35	5734.99	6.51E+11	6.51E+11
4/12/22	227.18	67	18.306	1224.50	61.23	6122.52	6.95E+11	6.95E+11
2/17/22	203.16	68	18.579	1095.04	54.75	5475.19	6.21E+11	6.21E+11
4/22/22	226.57	69	18.852	1221.19	61.06	6105.94	6.93E+11	6.93E+11
5/15/22	214.53	70	19.126	1156.31	57.82	5781.53	6.56E+11	6.56E+11
5/5/22	215.83	71	19.399	1163.32	58.17	5816.61	6.60E+11	6.60E+11
3/15/22	229.71	72	19.672	1238.15	61.91	6190.77	7.03E+11	7.03E+11
4/23/22	206.53	73	19.945	1113.19	55.66	5565.97	6.32E+11	6.32E+11
4/25/22	215.81	74	20.219	1163.23	58.16	5816.13	6.60E+11	6.60E+11
4/24/22	196.98	75	20.492	1061.72	53.09	5308.61	6.02E+11	6.02E+11
5/4/22	213.28	76	20.765	1149.58	57.48	5747.89	6.52E+11	6.52E+11
4/26/22	210.53	77	21.038	1134.77	56.74	5673.87	6.44E+11	6.44E+11
3/16/22	217.63	78	21.311	1173.03	58.65	5865.16	6.66E+11	6.66E+11
5/16/22	204.36	79	21.585	1101.52	55.08	5507.58	6.25E+11	6.25E+11
3/19/22	201.39	80	21.858	1085.51	54.28	5427.55	6.16E+11	6.16E+11
4/27/22	209.61	81	22.131	1129.82	56.49	5649.12	6.41E+11	6.41E+11
3/17/22	213.33	82	22.404	1149.87	57.49	5749.33	6.52E+11	6.52E+11
4/28/22	196.80	83	22.678	1060.76	53.04	5303.80	6.02E+11	6.02E+11
5/17/22	191.97	84	22.951	1034.71	51.74	5173.55	5.87E+11	5.87E+11
3/18/22	191.98	85	23.224	1034.78	51.74	5173.88	5.87E+11	5.87E+11
5/3/22	191.04	86	23.497	1029.71	51.49	5148.56	5.84E+11	5.84E+11
4/29/22	189.33	87	23.770	1020.48	51.02	5102.42	5.79E+11	5.79E+11
5/18/22	182.45	88	24.044	983.38	49.17	4916.91	5.58E+11	5.58E+11
5/1/22	182.18	89	24.317	981.93	49.10	4909.65	5.57E+11	5.57E+11
6/11/22	186.98	90	24.590	1007.84	50.39	5039.22	5.72E+11	5.72E+11
6/12/22	185.26	91	24.863	998.57	49.93	4992.84	5.67E+11	5.67E+11
4/30/22	177.10	92	25.137	954.54	47.73	4772.72	5.42E+11	5.42E+11
5/2/22	187.11	93	25.410	1008.52	50.43	5042.59	5.72E+11	5.72E+11
6/10/22	184.17	94	25.683	992.66	49.63	4963.29	5.63E+11	5.63E+11
5/19/22	176.94	95	25.956	953.73	47.69	4768.64	5.41E+11	5.41E+11
6/13/22	183.51	96	26.230	989.10	49.46	4945.50	5.61E+11	5.61E+11
6/9/22	181.19	97	26.503	976.60	48.83	4883.02	5.54E+11	5.54E+11
6/14/22	182.73	98	26.776	984.92	49.25	4924.60	5.59E+11	5.59E+11
5/20/22	170.30	99	27.049	917.92	45.90	4589.61	5.21E+11	5.21E+11
6/15/22	177.11	100	27.322	954.64	47.73	4773.20	5.42E+11	5.42E+11
6/8/22	166.73	101	27.596	898.66	44.93	4493.28	5.10E+11	5.10E+11
6/2/22	169.12	102	27.869	911.58	45.58	4557.89	5.17E+11	5.17E+11
5/21/22	165.63	103	28.142	892.74	44.64	4463.69	5.07E+11	5.07E+11
6/1/22	164.20	104	28.415	885.01	44.25	4425.07	5.02E+11	5.02E+11
5/30/22	167.11	105	28.689	900.72	45.04	4503.58	5.11E+11	5.11E+11
7/28/22	155.09	106	28.962	835.93	41.80	4179.65	4.74E+11	4.74E+11
6/3/22	164.72	107	29.235	887.84	44.39	4439.18	5.04E+11	5.04E+11
7/27/22	154.90	108	29.508	834.92	41.75	4174.60	4.74E+11	4.74E+11
5/31/22	167.36	109	29.781	902.06	45.10	4510.31	5.12E+11	5.12E+11
7/29/22	154.57	110	30.055	833.14	41.66	4165.71	4.73E+11	4.73E+11
5/29/22	161.76	111	30.328	871.88	43.59	4359.40	4.95E+11	4.95E+11
7/26/22	148.87	112	30.601	802.39	40.12	4011.96	4.55E+11	4.55E+11
5/22/22	159.30	113	30.874	858.61	42.93	4293.07	4.87E+11	4.87E+11
6/7/22	161.54	114	31.148	870.68	43.53	4353.39	4.94E+11	4.94E+11
6/16/22	166.56	115	31.421	897.74	44.89	4488.68	5.09E+11	5.09E+11
6/4/22	158.88	116	31.694	856.36	42.82	4281.78	4.86E+11	4.86E+11
7/30/22	147.78	117	31.967	796.52	39.83	3982.60	4.52E+11	4.52E+11
7/25/22	145.36	118	32.240	783.49	39.17	3917.47	4.45E+11	4.45E+11
5/23/22	149.84	119	32.514	807.62	40.38	4038.11	4.58E+11	4.58E+11
6/5/22	151.04	120	32.787	814.11	40.71	4070.55	4.62E+11	4.62E+11
7/31/22	141.17	121	33.060	760.91	38.05	3804.53	4.32E+11	4.32E+11

6/17/22	153.60	122	33.333	827.88	41.39	4139.40	4.70E+11	4.70E+11
6/6/22	143.52	123	33.607	773.58	38.68	3867.90	4.39E+11	4.39E+11
5/28/22	148.32	124	33.880	799.45	39.97	3997.25	4.54E+11	4.54E+11
5/24/22	141.05	125	34.153	760.28	38.01	3801.41	4.31E+11	4.31E+11
7/24/22	135.43	126	34.426	729.95	36.50	3649.77	4.14E+11	4.14E+11
8/1/22	134.16	127	34.699	723.13	36.16	3615.63	4.10E+11	4.10E+11
2/16/22	118.47	128	34.973	638.56	31.93	3192.78	3.62E+11	3.62E+11
5/27/22	144.54	129	35.246	779.07	38.95	3895.36	4.42E+11	4.42E+11
5/25/22	139.25	130	35.519	750.54	37.53	3752.71	4.26E+11	4.26E+11
5/26/22	143.19	131	35.792	771.77	38.59	3858.84	4.38E+11	4.38E+11
6/18/22	142.77	132	36.066	769.56	38.48	3847.78	4.37E+11	4.37E+11
8/2/22	126.15	133	36.339	679.97	34.00	3399.85	3.86E+11	3.86E+11
2/13/22	130.73	134	36.612	704.63	35.23	3523.13	4.00E+11	4.00E+11
2/14/22	129.73	135	36.885	699.24	34.96	3496.22	3.97E+11	3.97E+11
2/15/22	127.39	136	37.158	686.65	34.33	3433.26	3.90E+11	3.90E+11
8/3/22	117.71	137	37.432	634.44	31.72	3172.20	3.60E+11	3.60E+11
7/8/22	128.05	138	37.705	690.18	34.51	3450.89	3.92E+11	3.92E+11
7/9/22	127.71	139	37.978	688.38	34.42	3441.91	3.91E+11	3.91E+11
6/19/22	127.71	140	38.251	688.36	34.42	3441.78	3.91E+11	3.91E+11
2/12/22	125.19	141	38.525	674.78	33.74	3373.90	3.83E+11	3.83E+11
8/4/22	114.94	142	38.798	619.51	30.98	3097.55	3.52E+11	3.52E+11
1/25/23	105.25	143	39.071	567.32	28.37	2836.58	3.22E+11	3.22E+11
1/23/23	102.25	144	39.344	551.12	27.56	2755.59	3.13E+11	3.13E+11
1/22/23	104.81	145	39.617	564.91	28.25	2824.56	3.21E+11	3.21E+11
1/26/23	102.77	146	39.891	553.91	27.70	2769.53	3.14E+11	3.14E+11
7/10/22	125.42	147	40.164	676.03	33.80	3380.15	3.84E+11	3.84E+11
7/23/22	110.60	148	40.437	596.16	29.81	2980.78	3.38E+11	3.38E+11
1/24/23	99.02	149	40.710	533.74	26.69	2668.68	3.03E+11	3.03E+11
1/27/23	95.09	150	40.984	512.56	25.63	2562.79	2.91E+11	2.91E+11
7/7/22	123.88	151	41.257	667.73	33.39	3338.66	3.79E+11	3.79E+11
1/8/23	104.31	152	41.530	562.22	28.11	2811.10	3.19E+11	3.19E+11
1/28/23	102.90	153	41.803	554.63	27.73	2773.13	3.15E+11	3.15E+11
1/21/23	98.49	154	42.077	530.88	26.54	2654.42	3.01E+11	3.01E+11
1/7/23	102.79	155	42.350	554.05	27.70	2770.25	3.14E+11	3.14E+11
1/29/23	99.27	156	42.623	535.04	26.75	2675.22	3.04E+11	3.04E+11
1/6/23	100.33	157	42.896	540.79	27.04	2703.93	3.07E+11	3.07E+11
8/5/22	104.00	158	43.169	560.56	28.03	2802.79	3.18E+11	3.18E+11
1/9/23	101.45	159	43.443	546.84	27.34	2734.20	3.10E+11	3.10E+11
7/11/22	120.58	160	43.716	649.93	32.50	3249.66	3.69E+11	3.69E+11
1/30/23	100.93	161	43.989	544.01	27.20	2720.03	3.09E+11	3.09E+11
1/10/23	101.19	162	44.262	545.39	27.27	2726.97	3.09E+11	3.09E+11
1/5/23	97.83	163	44.536	527.29	26.36	2636.43	2.99E+11	2.99E+11
2/7/22	110.84	164	44.809	597.40	29.87	2987.01	3.39E+11	3.39E+11
1/20/23	96.24	165	45.082	518.73	25.94	2593.65	2.94E+11	2.94E+11
1/31/23	95.44	166	45.355	514.40	25.72	2572.00	2.92E+11	2.92E+11
2/8/22	106.91	167	45.628	576.24	28.81	2881.22	3.27E+11	3.27E+11
6/20/22	118.08	168	45.902	636.43	31.82	3182.14	3.61E+11	3.61E+11
2/6/22	97.92	169	46.175	527.81	26.39	2639.04	2.99E+11	2.99E+11
1/12/23	98.34	170	46.448	530.05	26.50	2650.27	3.01E+11	3.01E+11
2/3/22	112.64	171	46.721	607.11	30.36	3035.55	3.44E+11	3.44E+11
8/6/22	99.93	172	46.995	538.63	26.93	2693.15	3.06E+11	3.06E+11
7/12/22	112.69	173	47.268	607.40	30.37	3036.99	3.45E+11	3.45E+11
2/4/22	99.63	174	47.541	537.00	26.85	2685.01	3.05E+11	3.05E+11
2/5/22	107.43	175	47.814	579.04	28.95	2895.21	3.29E+11	3.29E+11
1/4/23	93.17	176	48.087	502.20	25.11	2511.01	2.85E+11	2.85E+11
1/13/23	94.16	177	48.361	507.53	25.38	2537.63	2.88E+11	2.88E+11
2/11/22	92.77	178	48.634	500.06	25.00	2500.28	2.84E+11	2.84E+11
1/19/23	91.75	179	48.907	494.56	24.73	2472.79	2.81E+11	2.81E+11
1/14/23	92.45	180	49.180	498.30	24.91	2491.50	2.83E+11	2.83E+11
2/9/22	101.17	181	49.454	545.30	27.26	2726.49	3.09E+11	3.09E+11
8/7/22	94.69	182	49.727	510.40	25.52	2552.01	2.90E+11	2.90E+11

1/15/23	89.02	183	50.000	479.84	23.99	2399.22	2.72E+11	2.72E+11
8/8/22	90.71	184	50.273	488.92	24.45	2444.59	2.77E+11	2.77E+11
2/2/22	106.08	185	50.546	571.77	28.59	2858.87	3.24E+11	3.24E+11
7/13/22	103.63	186	50.820	558.58	27.93	2792.89	3.17E+11	3.17E+11
2/10/22	102.59	187	51.093	552.94	27.65	2764.72	3.14E+11	3.14E+11
8/9/22	88.70	188	51.366	478.08	23.90	2390.38	2.71E+11	2.71E+11
6/21/22	105.26	189	51.639	567.36	28.37	2836.82	3.22E+11	3.22E+11
1/16/23	87.31	190	51.913	470.62	23.53	2353.08	2.67E+11	2.67E+11
1/3/23	80.43	191	52.186	433.50	21.68	2167.51	2.46E+11	2.46E+11
1/17/23	83.03	192	52.459	447.55	22.38	2237.73	2.54E+11	2.54E+11
7/14/22	96.36	193	52.732	519.40	25.97	2596.99	2.95E+11	2.95E+11
1/18/23	80.14	194	53.005	431.96	21.60	2159.79	2.45E+11	2.45E+11
7/22/22	80.91	195	53.279	436.11	21.81	2180.55	2.47E+11	2.47E+11
8/10/22	84.79	196	53.552	457.02	22.85	2285.12	2.59E+11	2.59E+11
8/22/22	81.10	197	53.825	437.10	21.86	2185.51	2.48E+11	2.48E+11
12/2/22	58.88	198	54.098	317.38	15.87	1586.91	1.80E+11	1.80E+11
12/1/22	69.42	199	54.372	374.19	18.71	1870.95	2.12E+11	2.12E+11
7/15/22	86.30	200	54.645	465.17	23.26	2325.87	2.64E+11	2.64E+11
7/6/22	89.49	201	54.918	482.33	24.12	2411.67	2.74E+11	2.74E+11
12/4/22	70.17	202	55.191	378.21	18.91	1891.04	2.15E+11	2.15E+11
1/2/23	76.88	203	55.464	414.39	20.72	2071.94	2.35E+11	2.35E+11
12/3/22	71.95	204	55.738	387.83	19.39	1939.15	2.20E+11	2.20E+11
11/30/22	69.22	205	56.011	373.08	18.65	1865.41	2.12E+11	2.12E+11
6/22/22	92.26	206	56.284	497.28	24.86	2486.40	2.82E+11	2.82E+11
7/16/22	81.52	207	56.557	439.39	21.97	2196.94	2.49E+11	2.49E+11
8/21/22	77.02	208	56.831	415.14	20.76	2075.68	2.36E+11	2.36E+11
12/5/22	68.79	209	57.104	370.80	18.54	1854.01	2.10E+11	2.10E+11
11/29/22	55.72	210	57.377	300.36	15.02	1501.78	1.70E+11	1.70E+11
8/11/22	77.21	211	57.650	416.18	20.81	2080.88	2.36E+11	2.36E+11
1/1/23	69.35	212	57.923	373.81	18.69	1869.04	2.12E+11	2.12E+11
12/6/22	71.14	213	58.197	383.44	19.17	1917.19	2.18E+11	2.18E+11
8/23/22	71.67	214	58.470	386.31	19.32	1931.53	2.19E+11	2.19E+11
7/17/22	80.65	215	58.743	434.69	21.73	2173.46	2.47E+11	2.47E+11
1/11/23	92.88	216	59.016	500.61	25.03	2503.03	2.84E+11	2.84E+11
12/7/22	66.64	217	59.290	359.21	17.96	1796.05	2.04E+11	2.04E+11
7/18/22	78.67	218	59.563	424.02	21.20	2120.08	2.41E+11	2.41E+11
12/8/22	65.10	219	59.836	350.90	17.54	1754.48	1.99E+11	1.99E+11
8/31/22	64.08	220	60.109	345.39	17.27	1726.96	1.96E+11	1.96E+11
12/9/22	55.06	221	60.383	296.80	14.84	1483.98	1.68E+11	1.68E+11
8/30/22	65.43	222	60.656	352.64	17.63	1763.22	2.00E+11	2.00E+11
12/10/22	58.17	223	60.929	313.53	15.68	1567.66	1.78E+11	1.78E+11
12/31/22	63.70	224	61.202	343.37	17.17	1716.84	1.95E+11	1.95E+11
2/1/22	71.71	225	61.475	386.51	19.33	1932.55	2.19E+11	2.19E+11
8/12/22	66.50	226	61.749	358.43	17.92	1792.13	2.03E+11	2.03E+11
7/19/22	69.12	227	62.022	372.56	18.63	1862.80	2.11E+11	2.11E+11
8/24/22	60.67	228	62.295	327.02	16.35	1635.10	1.86E+11	1.86E+11
11/28/22	51.19	229	62.568	275.92	13.80	1379.60	1.57E+11	1.57E+11
12/11/22	59.17	230	62.842	318.92	15.95	1594.62	1.81E+11	1.81E+11
6/23/22	78.48	231	63.115	423.02	21.15	2115.08	2.40E+11	2.40E+11
8/15/22	60.66	232	63.388	326.96	16.35	1634.80	1.86E+11	1.86E+11
9/1/22	56.05	233	63.661	302.13	15.11	1510.66	1.71E+11	1.71E+11
12/12/22	60.50	234	63.934	326.09	16.30	1630.43	1.85E+11	1.85E+11
8/14/22	61.54	235	64.208	331.70	16.58	1658.50	1.88E+11	1.88E+11
12/16/22	51.60	236	64.481	278.15	13.91	1390.74	1.58E+11	1.58E+11
12/13/22	51.12	237	64.754	275.56	13.78	1377.79	1.56E+11	1.56E+11
12/15/22	48.19	238	65.027	259.77	12.99	1298.83	1.47E+11	1.47E+11
12/17/22	53.76	239	65.301	289.75	14.49	1448.73	1.64E+11	1.64E+11
8/13/22	59.66	240	65.574	321.58	16.08	1607.89	1.82E+11	1.82E+11
7/20/22	61.47	241	65.847	331.31	16.57	1656.53	1.88E+11	1.88E+11
8/16/22	56.90	242	66.120	306.70	15.33	1533.49	1.74E+11	1.74E+11
12/14/22	53.22	243	66.393	286.88	14.34	1434.40	1.63E+11	1.63E+11

12/24/22	35.03	244	66.667	188.79	9.44	943.97	1.07E+11	1.07E+11
8/25/22	56.12	245	66.940	302.47	15.12	1512.37	1.72E+11	1.72E+11
9/2/22	53.24	246	67.213	286.96	14.35	1434.80	1.63E+11	1.63E+11
12/18/22	53.25	247	67.486	287.02	14.35	1435.09	1.63E+11	1.63E+11
12/23/22	34.65	248	67.760	186.79	9.34	933.93	1.06E+11	1.06E+11
12/20/22	53.62	249	68.033	289.03	14.45	1445.16	1.64E+11	1.64E+11
10/23/22	49.95	250	68.306	269.22	13.46	1346.08	1.53E+11	1.53E+11
12/19/22	53.05	251	68.579	285.96	14.30	1429.80	1.62E+11	1.62E+11
12/27/22	28.18	252	68.852	151.91	7.60	759.53	8.62E+10	8.62E+10
12/26/22	35.85	253	69.126	193.22	9.66	966.11	1.10E+11	1.10E+11
12/30/22	46.58	254	69.399	251.09	12.55	1255.43	1.42E+11	1.42E+11
7/21/22	57.71	255	69.672	311.07	15.55	1555.33	1.76E+11	1.76E+11
8/17/22	52.32	256	69.945	281.99	14.10	1409.95	1.60E+11	1.60E+11
6/24/22	66.93	257	70.219	360.76	18.04	1803.78	2.05E+11	2.05E+11
12/21/22	53.64	258	70.492	289.14	14.46	1445.71	1.64E+11	1.64E+11
12/28/22	25.70	259	70.765	138.50	6.93	692.52	7.86E+10	7.86E+10
12/25/22	30.43	260	71.038	164.02	8.20	820.12	9.31E+10	9.31E+10
9/3/22	50.66	261	71.311	273.03	13.65	1365.16	1.55E+11	1.55E+11
8/26/22	49.99	262	71.585	269.47	13.47	1347.36	1.53E+11	1.53E+11
12/22/22	52.04	263	71.858	280.50	14.03	1402.51	1.59E+11	1.59E+11
8/29/22	45.60	264	72.131	245.76	12.29	1228.81	1.39E+11	1.39E+11
8/27/22	50.73	265	72.404	273.42	13.67	1367.10	1.55E+11	1.55E+11
9/4/22	48.44	266	72.678	261.07	13.05	1305.34	1.48E+11	1.48E+11
8/18/22	50.08	267	72.951	269.96	13.50	1349.78	1.53E+11	1.53E+11
12/29/22	28.99	268	73.224	156.24	7.81	781.19	8.86E+10	8.86E+10
10/24/22	42.43	269	73.497	228.68	11.43	1143.38	1.30E+11	1.30E+11
8/19/22	48.07	270	73.770	259.10	12.96	1295.52	1.47E+11	1.47E+11
8/28/22	47.62	271	74.044	256.69	12.83	1283.45	1.46E+11	1.46E+11
8/20/22	45.61	272	74.317	245.86	12.29	1229.29	1.39E+11	1.39E+11
9/5/22	46.98	273	74.590	253.23	12.66	1266.13	1.44E+11	1.44E+11
6/25/22	60.35	274	74.863	325.27	16.26	1626.37	1.85E+11	1.85E+11
9/6/22	44.77	275	75.137	241.32	12.07	1206.58	1.37E+11	1.37E+11
10/25/22	36.42	276	75.410	196.32	9.82	981.59	1.11E+11	1.11E+11
10/26/22	39.37	277	75.683	212.20	10.61	1061.02	1.20E+11	1.20E+11
10/27/22	38.95	278	75.956	209.92	10.50	1049.61	1.19E+11	1.19E+11
11/27/22	35.21	279	76.230	189.76	9.49	948.78	1.08E+11	1.08E+11
10/28/22	39.10	280	76.503	210.74	10.54	1053.72	1.20E+11	1.20E+11
9/7/22	45.00	281	76.776	242.54	12.13	1212.68	1.38E+11	1.38E+11
9/27/22	46.47	282	77.049	250.48	12.52	1252.38	1.42E+11	1.42E+11
10/29/22	37.03	283	77.322	199.57	9.98	997.85	1.13E+11	1.13E+11
6/26/22	54.80	284	77.596	295.40	14.77	1476.99	1.68E+11	1.68E+11
9/28/22	44.18	285	77.869	238.11	11.91	1190.57	1.35E+11	1.35E+11
10/30/22	36.52	286	78.142	196.83	9.84	984.16	1.12E+11	1.12E+11
11/1/22	34.48	287	78.415	185.84	9.29	929.19	1.05E+11	1.05E+11
10/31/22	34.77	288	78.689	187.41	9.37	937.04	1.06E+11	1.06E+11
11/2/22	36.30	289	78.962	195.68	9.78	978.41	1.11E+11	1.11E+11
11/4/22	34.47	290	79.235	185.78	9.29	928.89	1.05E+11	1.05E+11
11/3/22	36.48	291	79.508	196.64	9.83	983.21	1.12E+11	1.12E+11
9/26/22	44.17	292	79.781	238.07	11.90	1190.36	1.35E+11	1.35E+11
9/8/22	41.94	293	80.055	226.07	11.30	1130.35	1.28E+11	1.28E+11
11/5/22	32.53	294	80.328	175.34	8.77	876.71	9.95E+10	9.95E+10
10/19/22	34.08	295	80.601	183.67	9.18	918.36	1.04E+11	1.04E+11
9/29/22	41.78	296	80.874	225.20	11.26	1126.00	1.28E+11	1.28E+11
10/22/22	35.24	297	81.148	189.96	9.50	949.79	1.08E+11	1.08E+11
11/7/22	34.10	298	81.421	183.78	9.19	918.88	1.04E+11	1.04E+11
11/6/22	33.76	299	81.694	181.94	9.10	909.70	1.03E+11	1.03E+11
11/8/22	36.86	300	81.967	198.66	9.93	993.31	1.13E+11	1.13E+11
10/20/22	33.90	301	82.240	182.72	9.14	913.62	1.04E+11	1.04E+11
11/9/22	33.74	302	82.514	181.88	9.09	909.41	1.03E+11	1.03E+11
9/9/22	37.91	303	82.787	204.32	10.22	1021.59	1.16E+11	1.16E+11
9/30/22	41.40	304	83.060	223.15	11.16	1115.77	1.27E+11	1.27E+11

11/10/22	30.70	305	83.333	165.47	8.27	827.33	9.39E+10	9.39E+10
9/12/22	42.14	306	83.607	227.15	11.36	1135.76	1.29E+11	1.29E+11
11/11/22	34.39	307	83.880	185.37	9.27	926.86	1.05E+11	1.05E+11
10/18/22	30.48	308	84.153	164.30	8.21	821.48	9.32E+10	9.32E+10
6/27/22	47.43	309	84.426	255.66	12.78	1278.31	1.45E+11	1.45E+11
10/21/22	32.28	310	84.699	174.01	8.70	870.03	9.87E+10	9.87E+10
9/11/22	31.66	311	84.973	170.62	8.53	853.11	9.68E+10	9.68E+10
11/12/22	30.63	312	85.246	165.09	8.25	825.43	9.37E+10	9.37E+10
11/13/22	31.36	313	85.519	169.04	8.45	845.18	9.59E+10	9.59E+10
9/13/22	39.82	314	85.792	214.61	10.73	1073.06	1.22E+11	1.22E+11
11/14/22	33.53	315	86.066	180.71	9.04	903.55	1.03E+11	1.03E+11
9/10/22	33.49	316	86.339	180.49	9.02	902.43	1.02E+11	1.02E+11
10/1/22	39.86	317	86.612	214.87	10.74	1074.36	1.22E+11	1.22E+11
11/15/22	32.46	318	86.885	174.98	8.75	874.88	9.93E+10	9.93E+10
9/14/22	36.83	319	87.158	198.51	9.93	992.54	1.13E+11	1.13E+11
11/16/22	28.46	320	87.432	153.39	7.67	766.96	8.70E+10	8.70E+10
11/17/22	28.41	321	87.705	153.11	7.66	765.55	8.69E+10	8.69E+10
9/15/22	35.53	322	87.978	191.50	9.57	957.48	1.09E+11	1.09E+11
11/26/22	29.06	323	88.251	156.61	7.83	783.05	8.89E+10	8.89E+10
9/25/22	32.76	324	88.525	176.58	8.83	882.92	1.00E+11	1.00E+11
9/21/22	36.30	325	88.798	195.67	9.78	978.33	1.11E+11	1.11E+11
11/18/22	28.04	326	89.071	151.14	7.56	755.70	8.58E+10	8.58E+10
11/25/22	29.45	327	89.344	158.75	7.94	793.77	9.01E+10	9.01E+10
11/19/22	27.34	328	89.617	147.39	7.37	736.93	8.36E+10	8.36E+10
9/22/22	37.83	329	89.891	203.91	10.20	1019.55	1.16E+11	1.16E+11
9/16/22	33.96	330	90.164	183.06	9.15	915.30	1.04E+11	1.04E+11
11/24/22	26.98	331	90.437	145.40	7.27	727.01	8.25E+10	8.25E+10
10/2/22	37.62	332	90.710	202.75	10.14	1013.73	1.15E+11	1.15E+11
11/22/22	27.70	333	90.984	149.31	7.47	746.56	8.47E+10	8.47E+10
11/21/22	25.24	334	91.257	136.07	6.80	680.33	7.72E+10	7.72E+10
11/23/22	26.64	335	91.530	143.56	7.18	717.82	8.15E+10	8.15E+10
9/20/22	33.32	336	91.803	179.61	8.98	898.03	1.02E+11	1.02E+11
6/28/22	38.79	337	92.077	209.08	10.45	1045.38	1.19E+11	1.19E+11
11/20/22	26.71	338	92.350	143.96	7.20	719.82	8.17E+10	8.17E+10
9/17/22	31.10	339	92.623	167.62	8.38	838.09	9.51E+10	9.51E+10
9/23/22	34.63	340	92.896	186.66	9.33	933.28	1.06E+11	1.06E+11
9/19/22	34.27	341	93.169	184.72	9.24	923.58	1.05E+11	1.05E+11
9/18/22	32.63	342	93.443	175.88	8.79	879.40	9.98E+10	9.98E+10
10/3/22	34.52	343	93.716	186.08	9.30	930.39	1.06E+11	1.06E+11
9/24/22	30.84	344	93.989	166.22	8.31	831.09	9.43E+10	9.43E+10
7/5/22	34.40	345	94.262	185.44	9.27	927.21	1.05E+11	1.05E+11
10/4/22	31.32	346	94.536	168.81	8.44	844.06	9.58E+10	9.58E+10
6/29/22	34.66	347	94.809	186.84	9.34	934.19	1.06E+11	1.06E+11
10/5/22	32.28	348	95.082	173.99	8.70	869.93	9.87E+10	9.87E+10
10/17/22	19.70	349	95.355	106.20	5.31	530.98	6.03E+10	6.03E+10
10/6/22	26.38	350	95.628	142.16	7.11	710.82	8.07E+10	8.07E+10
6/30/22	30.74	351	95.902	165.67	8.28	828.37	9.40E+10	9.40E+10
10/7/22	30.02	352	96.175	161.82	8.09	809.10	9.18E+10	9.18E+10
7/1/22	30.39	353	96.448	163.82	8.19	819.10	9.29E+10	9.29E+10
7/2/22	30.88	354	96.721	166.46	8.32	832.28	9.44E+10	9.44E+10
10/8/22	25.34	355	96.995	136.57	6.83	682.86	7.75E+10	7.75E+10
10/16/22	16.56	356	97.268	89.26	4.46	446.30	5.06E+10	5.06E+10
10/9/22	19.32	357	97.541	104.14	5.21	520.68	5.91E+10	5.91E+10
7/3/22	26.84	358	97.814	144.68	7.23	723.38	8.21E+10	8.21E+10
10/13/22	25.04	359	98.087	134.97	6.75	674.83	7.66E+10	7.66E+10
10/10/22	18.49	360	98.361	99.68	4.98	498.42	5.66E+10	5.66E+10
10/15/22	15.46	361	98.634	83.31	4.17	416.53	4.73E+10	4.73E+10
10/14/22	15.87	362	98.907	85.56	4.28	427.78	4.85E+10	4.85E+10
10/11/22	17.79	363	99.180	95.89	4.79	479.47	5.44E+10	5.44E+10
10/12/22	17.37	364	99.454	93.65	4.68	468.25	5.31E+10	5.31E+10
7/4/22	26.55	365	99.727	143.11	7.16	715.57	8.12E+10	8.12E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 11 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	1885.26	2.01	0.059	4.4	30.5	3.005464481	20424.67417	599.530237	44710.72953	1.41E+12	21	428918.1576	12590.13497	938925.3201	2.95E+13
3/15/22	253.84	2.10	0.05	2.8	8	36.61202186	2873.255894	68.4108546	3831.007858	4.97E+10	35	100563.9563	2394.379912	134085.275	1.74E+12
4/19/22	253.78	3.20	0.05	2.4	11	36.8852459	4377.160833	68.393138	3282.870625	6.83E+10	35	153200.6292	2393.759831	114900.4719	2.39E+12
5/24/22	174.63	4.00	0.186	3.2	5.0	48.36065574	3763.10625	175.071977	3011.990995	2.14E+10	28	105366.975	4902.015345	84335.74787	5.98E+11
6/21/22	108.81	3.88	0.293	7.6	238.0	58.46994536	2275.554151	171.839527	4457.271018	6.34E+11	28	63715.51623	4811.506767	124803.5885	1.77E+13
7/19/22	191.71	2.98	0.252	6.4	1730.0	45.6284153	3079.241767	260.392257	6613.136681	8.11E+12	35	107773.4619	9113.728989	231459.7838	2.84E+14
8/23/22	97.86	3.68	0.196	3.6	93.0	61.20218579	1941.047005	103.381851	1898.850331	2.23E+11	28	54349.31615	2894.691838	53167.80927	6.23E+12
9/20/22	65.71	2.60	0.226	4.4	14.0	78.68852459	920.0776244	80.0421668	1558.343071	2.25E+10	36	33122.79448	2881.518006	56100.35056	8.10E+11
10/26/22	91.66	1.87	0.050	3.2	25.0	63.38797814	926.2928475	24.7015378	1580.898421	5.61E+10	13	12041.80702	321.1199917	20551.67947	7.29E+11
11/8/22	82.08	2.01	0.050	4.4	15.0	68.85245902	887.445878	22.1198758	1946.549071	3.01E+10	35	31060.60573	774.1956531	68129.21747	1.05E+12
12/13/22	60.40	1.90	0.054	6.8	53.0	84.15300546	618.5103779	17.578716	2213.616089	7.83E+10	36	22266.37361	632.8337762	79690.17922	2.82E+12
1/18/23	277.29	2.00	0.079	8.0	30.0	41.53005464	2989.143676	118.071175	11956.5747	2.04E+11	37	110598.316	4368.633483	442393.2641	7.53E+12
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	1,222,977.9	48,078.5	2,348,542.7	3.55E+14
											TARGET	238,160.1	11,908.0	1,190,800.5	1.35E+14

Site 13 Date	E13	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	167.16	1	0.273	900.99	45.05	4504.96	5.11E+11	5.11E+11
2/24/22	168.79	2	0.546	909.80	45.49	4549.01	5.16E+11	5.16E+11
2/22/22	159.38	3	0.820	859.08	42.95	4295.41	4.87E+11	4.87E+11
2/25/22	164.30	4	1.093	885.60	44.28	4427.99	5.02E+11	5.02E+11
2/26/22	157.61	5	1.366	849.50	42.47	4247.50	4.82E+11	4.82E+11
2/21/22	154.33	6	1.639	831.84	41.59	4159.22	4.72E+11	4.72E+11
2/27/22	154.68	7	1.913	833.70	41.69	4168.51	4.73E+11	4.73E+11
2/20/22	137.92	8	2.186	743.38	37.17	3716.92	4.22E+11	4.22E+11
2/19/22	148.05	9	2.459	797.98	39.90	3989.92	4.53E+11	4.53E+11
2/28/22	148.17	10	2.732	798.64	39.93	3993.22	4.53E+11	4.53E+11
3/1/22	147.05	11	3.005	792.62	39.63	3963.09	4.50E+11	4.50E+11
3/2/22	142.30	12	3.279	766.99	38.35	3834.95	4.35E+11	4.35E+11
3/3/22	142.64	13	3.552	768.85	38.44	3844.24	4.36E+11	4.36E+11
3/4/22	141.24	14	3.825	761.29	38.06	3806.47	4.32E+11	4.32E+11
3/26/22	129.38	15	4.098	697.35	34.87	3486.74	3.96E+11	3.96E+11
3/27/22	129.87	16	4.372	700.01	35.00	3500.05	3.97E+11	3.97E+11
3/28/22	130.62	17	4.645	704.05	35.20	3520.27	3.99E+11	3.99E+11
3/25/22	125.81	18	4.918	678.10	33.90	3390.48	3.85E+11	3.85E+11
3/5/22	129.14	19	5.191	696.07	34.80	3480.34	3.95E+11	3.95E+11
2/18/22	122.38	20	5.464	659.65	32.98	3298.24	3.74E+11	3.74E+11
3/29/22	129.50	21	5.738	697.99	34.90	3489.94	3.96E+11	3.96E+11
3/24/22	120.81	22	6.011	651.15	32.56	3255.73	3.69E+11	3.69E+11
3/30/22	118.91	23	6.284	640.90	32.05	3204.51	3.64E+11	3.64E+11
3/7/22	125.86	24	6.557	678.41	33.92	3392.06	3.85E+11	3.85E+11
3/6/22	124.29	25	6.831	669.90	33.50	3349.52	3.80E+11	3.80E+11
3/8/22	128.30	26	7.104	691.53	34.58	3457.64	3.92E+11	3.92E+11
3/31/22	113.27	27	7.377	610.54	30.53	3052.69	3.46E+11	3.46E+11
3/9/22	125.75	28	7.650	677.81	33.89	3389.03	3.85E+11	3.85E+11
4/1/22	115.32	29	7.923	621.55	31.08	3107.76	3.53E+11	3.53E+11
4/2/22	116.33	30	8.197	627.00	31.35	3135.02	3.56E+11	3.56E+11
3/10/22	124.59	31	8.470	671.53	33.58	3357.67	3.81E+11	3.81E+11
3/23/22	109.50	32	8.743	590.21	29.51	2951.04	3.35E+11	3.35E+11
4/3/22	114.16	33	9.016	615.30	30.77	3076.52	3.49E+11	3.49E+11
5/8/22	109.85	34	9.290	592.07	29.60	2960.35	3.36E+11	3.36E+11
3/11/22	111.93	35	9.563	603.31	30.17	3016.56	3.42E+11	3.42E+11
5/9/22	107.34	36	9.836	578.57	28.93	2892.87	3.28E+11	3.28E+11
5/7/22	110.31	37	10.109	594.55	29.73	2972.73	3.37E+11	3.37E+11
4/4/22	108.25	38	10.383	583.44	29.17	2917.21	3.31E+11	3.31E+11
5/10/22	106.75	39	10.656	575.36	28.77	2876.78	3.26E+11	3.26E+11
4/5/22	112.97	40	10.929	608.91	30.45	3044.54	3.45E+11	3.45E+11
4/7/22	107.82	41	11.202	581.13	29.06	2905.67	3.30E+11	3.30E+11
5/11/22	108.92	42	11.475	587.08	29.35	2935.38	3.33E+11	3.33E+11
4/6/22	106.48	43	11.749	573.95	28.70	2869.76	3.26E+11	3.26E+11
4/8/22	100.04	44	12.022	539.24	26.96	2696.20	3.06E+11	3.06E+11
3/12/22	109.63	45	12.295	590.91	29.55	2954.57	3.35E+11	3.35E+11
4/15/22	104.98	46	12.568	565.82	28.29	2829.11	3.21E+11	3.21E+11
4/16/22	104.12	47	12.842	561.21	28.06	2806.04	3.18E+11	3.18E+11
4/9/22	106.20	48	13.115	572.41	28.62	2862.03	3.25E+11	3.25E+11
5/12/22	102.73	49	13.388	553.73	27.69	2768.65	3.14E+11	3.14E+11
3/22/22	103.32	50	13.661	556.90	27.84	2784.49	3.16E+11	3.16E+11
4/17/22	106.47	51	13.934	573.85	28.69	2869.25	3.26E+11	3.26E+11
4/14/22	99.03	52	14.208	533.78	26.69	2668.89	3.03E+11	3.03E+11
3/21/22	105.27	53	14.481	567.41	28.37	2837.06	3.22E+11	3.22E+11
5/6/22	96.52	54	14.754	520.22	26.01	2601.10	2.95E+11	2.95E+11
4/10/22	103.62	55	15.027	558.54	27.93	2792.69	3.17E+11	3.17E+11
3/13/22	102.67	56	15.301	553.40	27.67	2767.00	3.14E+11	3.14E+11
4/18/22	97.87	57	15.574	527.50	26.38	2637.51	2.99E+11	2.99E+11
5/13/22	97.73	58	15.847	526.78	26.34	2633.91	2.99E+11	2.99E+11
4/19/22	100.37	59	16.120	541.02	27.05	2705.10	3.07E+11	3.07E+11
3/20/22	98.35	60	16.393	530.12	26.51	2650.59	3.01E+11	3.01E+11

4/20/22	96.31	61	16.667	519.13	25.96	2595.67	2.95E+11	2.95E+11
4/11/22	102.40	62	16.940	551.91	27.60	2759.57	3.13E+11	3.13E+11
5/14/22	94.56	63	17.213	509.66	25.48	2548.28	2.89E+11	2.89E+11
3/14/22	102.13	64	17.486	550.47	27.52	2752.35	3.12E+11	3.12E+11
4/13/22	86.57	65	17.760	466.62	23.33	2333.08	2.65E+11	2.65E+11
4/21/22	91.36	66	18.033	492.45	24.62	2462.26	2.79E+11	2.79E+11
4/12/22	97.54	67	18.306	525.73	26.29	2628.65	2.98E+11	2.98E+11
2/17/22	87.23	68	18.579	470.14	23.51	2350.72	2.67E+11	2.67E+11
4/22/22	97.27	69	18.852	524.31	26.22	2621.53	2.97E+11	2.97E+11
5/15/22	92.11	70	19.126	496.45	24.82	2482.25	2.82E+11	2.82E+11
5/5/22	92.66	71	19.399	499.46	24.97	2497.31	2.83E+11	2.83E+11
3/15/22	98.63	72	19.672	531.59	26.58	2657.95	3.02E+11	3.02E+11
4/23/22	88.67	73	19.945	477.94	23.90	2389.70	2.71E+11	2.71E+11
4/25/22	92.66	74	20.219	499.42	24.97	2497.10	2.83E+11	2.83E+11
4/24/22	84.57	75	20.492	455.84	22.79	2279.20	2.59E+11	2.59E+11
5/4/22	91.57	76	20.765	493.56	24.68	2467.80	2.80E+11	2.80E+11
4/26/22	90.39	77	21.038	487.20	24.36	2436.02	2.76E+11	2.76E+11
3/16/22	93.44	78	21.311	503.63	25.18	2518.15	2.86E+11	2.86E+11
5/16/22	87.74	79	21.585	472.93	23.65	2364.63	2.68E+11	2.68E+11
3/19/22	86.47	80	21.858	466.05	23.30	2330.27	2.64E+11	2.64E+11
4/27/22	90.00	81	22.131	485.08	24.25	2425.40	2.75E+11	2.75E+11
3/17/22	91.59	82	22.404	493.68	24.68	2468.42	2.80E+11	2.80E+11
4/28/22	84.49	83	22.678	455.43	22.77	2277.14	2.58E+11	2.58E+11
5/17/22	82.42	84	22.951	444.24	22.21	2221.22	2.52E+11	2.52E+11
3/18/22	82.43	85	23.224	444.27	22.21	2221.36	2.52E+11	2.52E+11
5/3/22	82.02	86	23.497	442.10	22.10	2210.49	2.51E+11	2.51E+11
4/29/22	81.29	87	23.770	438.14	21.91	2190.68	2.49E+11	2.49E+11
5/18/22	78.33	88	24.044	422.21	21.11	2111.03	2.40E+11	2.40E+11
5/1/22	78.22	89	24.317	421.58	21.08	2107.91	2.39E+11	2.39E+11
6/11/22	80.28	90	24.590	432.71	21.64	2163.54	2.46E+11	2.46E+11
6/12/22	79.54	91	24.863	428.73	21.44	2143.63	2.43E+11	2.43E+11
4/30/22	76.03	92	25.137	409.82	20.49	2049.12	2.33E+11	2.33E+11
5/2/22	80.33	93	25.410	433.00	21.65	2164.99	2.46E+11	2.46E+11
6/10/22	79.07	94	25.683	426.19	21.31	2130.94	2.42E+11	2.42E+11
5/19/22	75.97	95	25.956	409.47	20.47	2047.37	2.32E+11	2.32E+11
6/13/22	78.79	96	26.230	424.66	21.23	2123.31	2.41E+11	2.41E+11
6/9/22	77.79	97	26.503	419.30	20.96	2096.48	2.38E+11	2.38E+11
6/14/22	78.45	98	26.776	422.87	21.14	2114.33	2.40E+11	2.40E+11
5/20/22	73.12	99	27.049	394.10	19.71	1970.51	2.24E+11	2.24E+11
6/15/22	76.04	100	27.322	409.87	20.49	2049.33	2.33E+11	2.33E+11
6/8/22	71.58	101	27.596	385.83	19.29	1929.15	2.19E+11	2.19E+11
6/2/22	72.61	102	27.869	391.38	19.57	1956.89	2.22E+11	2.22E+11
5/21/22	71.11	103	28.142	383.29	19.16	1916.44	2.17E+11	2.17E+11
6/1/22	70.50	104	28.415	379.97	19.00	1899.86	2.16E+11	2.16E+11
5/30/22	71.75	105	28.689	386.71	19.34	1933.57	2.19E+11	2.19E+11
7/28/22	66.59	106	28.962	358.90	17.94	1794.49	2.04E+11	2.04E+11
6/3/22	70.72	107	29.235	381.18	19.06	1905.92	2.16E+11	2.16E+11
7/27/22	66.51	108	29.508	358.47	17.92	1792.33	2.03E+11	2.03E+11
5/31/22	71.85	109	29.781	387.29	19.36	1936.46	2.20E+11	2.20E+11
7/29/22	66.36	110	30.055	357.70	17.89	1788.51	2.03E+11	2.03E+11
5/29/22	69.45	111	30.328	374.33	18.72	1871.67	2.12E+11	2.12E+11
7/26/22	63.91	112	30.601	344.50	17.22	1722.50	1.95E+11	1.95E+11
5/22/22	68.39	113	30.874	368.64	18.43	1843.19	2.09E+11	2.09E+11
6/7/22	69.35	114	31.148	373.82	18.69	1869.09	2.12E+11	2.12E+11
6/16/22	71.51	115	31.421	385.43	19.27	1927.17	2.19E+11	2.19E+11
6/4/22	68.21	116	31.694	367.67	18.38	1838.34	2.09E+11	2.09E+11
7/30/22	63.45	117	31.967	341.98	17.10	1709.89	1.94E+11	1.94E+11
7/25/22	62.41	118	32.240	336.39	16.82	1681.93	1.91E+11	1.91E+11
5/23/22	64.33	119	32.514	346.74	17.34	1733.72	1.97E+11	1.97E+11
6/5/22	64.85	120	32.787	349.53	17.48	1747.65	1.98E+11	1.98E+11
7/31/22	60.61	121	33.060	326.69	16.33	1633.44	1.85E+11	1.85E+11

6/17/22	65.94	122	33.333	355.44	17.77	1777.21	2.02E+11	2.02E+11
6/6/22	61.62	123	33.607	332.13	16.61	1660.64	1.88E+11	1.88E+11
5/28/22	63.68	124	33.880	343.24	17.16	1716.18	1.95E+11	1.95E+11
5/24/22	60.56	125	34.153	326.42	16.32	1632.10	1.85E+11	1.85E+11
7/24/22	58.14	126	34.426	313.40	15.67	1567.00	1.78E+11	1.78E+11
8/1/22	57.60	127	34.699	310.47	15.52	1552.34	1.76E+11	1.76E+11
2/16/22	50.86	128	34.973	274.16	13.71	1370.79	1.56E+11	1.56E+11
5/27/22	62.06	129	35.246	334.49	16.72	1672.44	1.90E+11	1.90E+11
5/25/22	59.78	130	35.519	322.24	16.11	1611.19	1.83E+11	1.83E+11
5/26/22	61.48	131	35.792	331.35	16.57	1656.76	1.88E+11	1.88E+11
6/18/22	61.30	132	36.066	330.40	16.52	1652.01	1.87E+11	1.87E+11
8/2/22	54.16	133	36.339	291.94	14.60	1459.70	1.66E+11	1.66E+11
2/13/22	56.13	134	36.612	302.52	15.13	1512.62	1.72E+11	1.72E+11
2/14/22	55.70	135	36.885	300.21	15.01	1501.07	1.70E+11	1.70E+11
2/15/22	54.70	136	37.158	294.81	14.74	1474.04	1.67E+11	1.67E+11
8/3/22	50.54	137	37.432	272.39	13.62	1361.95	1.55E+11	1.55E+11
7/8/22	54.98	138	37.705	296.32	14.82	1481.61	1.68E+11	1.68E+11
7/9/22	54.83	139	37.978	295.55	14.78	1477.75	1.68E+11	1.68E+11
6/19/22	54.83	140	38.251	295.54	14.78	1477.70	1.68E+11	1.68E+11
2/12/22	53.75	141	38.525	289.71	14.49	1448.55	1.64E+11	1.64E+11
8/4/22	49.35	142	38.798	265.98	13.30	1329.90	1.51E+11	1.51E+11
1/25/23	45.19	143	39.071	243.57	12.18	1217.86	1.38E+11	1.38E+11
1/23/23	43.90	144	39.344	236.62	11.83	1183.09	1.34E+11	1.34E+11
1/22/23	45.00	145	39.617	242.54	12.13	1212.70	1.38E+11	1.38E+11
1/26/23	44.12	146	39.891	237.81	11.89	1189.07	1.35E+11	1.35E+11
7/10/22	53.85	147	40.164	290.25	14.51	1451.23	1.65E+11	1.65E+11
7/23/22	47.49	148	40.437	255.95	12.80	1279.77	1.45E+11	1.45E+11
1/24/23	42.51	149	40.710	229.15	11.46	1145.77	1.30E+11	1.30E+11
1/27/23	40.83	150	40.984	220.06	11.00	1100.31	1.25E+11	1.25E+11
7/7/22	53.19	151	41.257	286.68	14.33	1433.42	1.63E+11	1.63E+11
1/8/23	44.78	152	41.530	241.38	12.07	1206.92	1.37E+11	1.37E+11
1/28/23	44.18	153	41.803	238.12	11.91	1190.62	1.35E+11	1.35E+11
1/21/23	42.29	154	42.077	227.93	11.40	1139.65	1.29E+11	1.29E+11
1/7/23	44.13	155	42.350	237.88	11.89	1189.38	1.35E+11	1.35E+11
1/29/23	42.62	156	42.623	229.72	11.49	1148.58	1.30E+11	1.30E+11
1/6/23	43.08	157	42.896	232.18	11.61	1160.91	1.32E+11	1.32E+11
8/5/22	44.65	158	43.169	240.67	12.03	1203.35	1.37E+11	1.37E+11
1/9/23	43.56	159	43.443	234.78	11.74	1173.91	1.33E+11	1.33E+11
7/11/22	51.77	160	43.716	279.04	13.95	1395.21	1.58E+11	1.58E+11
1/30/23	43.33	161	43.989	233.56	11.68	1167.82	1.33E+11	1.33E+11
1/10/23	43.44	162	44.262	234.16	11.71	1170.80	1.33E+11	1.33E+11
1/5/23	42.00	163	44.536	226.39	11.32	1131.93	1.28E+11	1.28E+11
2/7/22	47.59	164	44.809	256.49	12.82	1282.44	1.46E+11	1.46E+11
1/20/23	41.32	165	45.082	222.71	11.14	1113.56	1.26E+11	1.26E+11
1/31/23	40.97	166	45.355	220.85	11.04	1104.26	1.25E+11	1.25E+11
2/8/22	45.90	167	45.628	247.41	12.37	1237.03	1.40E+11	1.40E+11
6/20/22	50.69	168	45.902	273.24	13.66	1366.22	1.55E+11	1.55E+11
2/6/22	42.04	169	46.175	226.61	11.33	1133.05	1.29E+11	1.29E+11
1/12/23	42.22	170	46.448	227.57	11.38	1137.87	1.29E+11	1.29E+11
2/3/22	48.36	171	46.721	260.66	13.03	1303.28	1.48E+11	1.48E+11
8/6/22	42.90	172	46.995	231.26	11.56	1156.28	1.31E+11	1.31E+11
7/12/22	48.38	173	47.268	260.78	13.04	1303.90	1.48E+11	1.48E+11
2/4/22	42.77	174	47.541	230.56	11.53	1152.79	1.31E+11	1.31E+11
2/5/22	46.12	175	47.814	248.61	12.43	1243.03	1.41E+11	1.41E+11
1/4/23	40.00	176	48.087	215.62	10.78	1078.08	1.22E+11	1.22E+11
1/13/23	40.43	177	48.361	217.90	10.90	1089.51	1.24E+11	1.24E+11
2/11/22	39.83	178	48.634	214.69	10.73	1073.47	1.22E+11	1.22E+11
1/19/23	39.39	179	48.907	212.33	10.62	1061.67	1.20E+11	1.20E+11
1/14/23	39.69	180	49.180	213.94	10.70	1069.70	1.21E+11	1.21E+11
2/9/22	43.44	181	49.454	234.12	11.71	1170.59	1.33E+11	1.33E+11
8/7/22	40.66	182	49.727	219.14	10.96	1095.68	1.24E+11	1.24E+11

1/15/23	38.22	183	50.000	206.02	10.30	1030.08	1.17E+11	1.17E+11
8/8/22	38.94	184	50.273	209.91	10.50	1049.56	1.19E+11	1.19E+11
2/2/22	45.54	185	50.546	245.49	12.27	1227.43	1.39E+11	1.39E+11
7/13/22	44.49	186	50.820	239.82	11.99	1199.10	1.36E+11	1.36E+11
2/10/22	44.04	187	51.093	237.40	11.87	1187.01	1.35E+11	1.35E+11
8/9/22	38.08	188	51.366	205.26	10.26	1026.29	1.16E+11	1.16E+11
6/21/22	45.19	189	51.639	243.59	12.18	1217.96	1.38E+11	1.38E+11
1/16/23	37.49	190	51.913	202.05	10.10	1010.27	1.15E+11	1.15E+11
1/3/23	34.53	191	52.186	186.12	9.31	930.60	1.06E+11	1.06E+11
1/17/23	35.65	192	52.459	192.15	9.61	960.75	1.09E+11	1.09E+11
7/14/22	41.37	193	52.732	223.00	11.15	1114.99	1.27E+11	1.27E+11
1/18/23	34.41	194	53.005	185.46	9.27	927.29	1.05E+11	1.05E+11
7/22/22	34.74	195	53.279	187.24	9.36	936.20	1.06E+11	1.06E+11
8/10/22	36.40	196	53.552	196.22	9.81	981.10	1.11E+11	1.11E+11
8/22/22	34.82	197	53.825	187.67	9.38	938.33	1.06E+11	1.06E+11
12/2/22	25.28	198	54.098	136.27	6.81	681.33	7.73E+10	7.73E+10
12/1/22	29.81	199	54.372	160.66	8.03	803.28	9.12E+10	9.12E+10
7/15/22	37.05	200	54.645	199.72	9.99	998.59	1.13E+11	1.13E+11
7/6/22	38.42	201	54.918	207.09	10.35	1035.43	1.17E+11	1.17E+11
12/4/22	30.13	202	55.191	162.38	8.12	811.90	9.21E+10	9.21E+10
1/2/23	33.01	203	55.464	177.91	8.90	889.57	1.01E+11	1.01E+11
12/3/22	30.89	204	55.738	166.51	8.33	832.56	9.45E+10	9.45E+10
11/30/22	29.72	205	56.011	160.18	8.01	800.90	9.09E+10	9.09E+10
6/22/22	39.61	206	56.284	213.50	10.68	1067.51	1.21E+11	1.21E+11
7/16/22	35.00	207	56.557	188.65	9.43	943.23	1.07E+11	1.07E+11
8/21/22	33.07	208	56.831	178.23	8.91	891.17	1.01E+11	1.01E+11
12/5/22	29.54	209	57.104	159.20	7.96	796.00	9.03E+10	9.03E+10
11/29/22	23.92	210	57.377	128.96	6.45	644.78	7.32E+10	7.32E+10
8/11/22	33.15	211	57.650	178.68	8.93	893.41	1.01E+11	1.01E+11
1/1/23	29.78	212	57.923	160.49	8.02	802.45	9.11E+10	9.11E+10
12/6/22	30.54	213	58.197	164.63	8.23	823.13	9.34E+10	9.34E+10
8/23/22	30.77	214	58.470	165.86	8.29	829.29	9.41E+10	9.41E+10
7/17/22	34.63	215	58.743	186.63	9.33	933.16	1.06E+11	1.06E+11
1/11/23	39.88	216	59.016	214.93	10.75	1074.65	1.22E+11	1.22E+11
12/7/22	28.61	217	59.290	154.22	7.71	771.12	8.75E+10	8.75E+10
7/18/22	33.77	218	59.563	182.05	9.10	910.24	1.03E+11	1.03E+11
12/8/22	27.95	219	59.836	150.65	7.53	753.27	8.55E+10	8.55E+10
8/31/22	27.51	220	60.109	148.29	7.41	741.45	8.41E+10	8.41E+10
12/9/22	23.64	221	60.383	127.43	6.37	637.13	7.23E+10	7.23E+10
8/30/22	28.09	222	60.656	151.40	7.57	757.02	8.59E+10	8.59E+10
12/10/22	24.97	223	60.929	134.61	6.73	673.06	7.64E+10	7.64E+10
12/31/22	27.35	224	61.202	147.42	7.37	737.11	8.36E+10	8.36E+10
2/1/22	30.79	225	61.475	165.94	8.30	829.72	9.42E+10	9.42E+10
8/12/22	28.55	226	61.749	153.89	7.69	769.44	8.73E+10	8.73E+10
7/19/22	29.68	227	62.022	159.96	8.00	799.78	9.08E+10	9.08E+10
8/24/22	26.05	228	62.295	140.40	7.02	702.02	7.97E+10	7.97E+10
11/28/22	21.98	229	62.568	118.46	5.92	592.32	6.72E+10	6.72E+10
12/11/22	25.40	230	62.842	136.93	6.85	684.64	7.77E+10	7.77E+10
6/23/22	33.70	231	63.115	181.62	9.08	908.09	1.03E+11	1.03E+11
8/15/22	26.04	232	63.388	140.38	7.02	701.89	7.96E+10	7.96E+10
9/1/22	24.07	233	63.661	129.72	6.49	648.59	7.36E+10	7.36E+10
12/12/22	25.97	234	63.934	140.00	7.00	700.01	7.94E+10	7.94E+10
8/14/22	26.42	235	64.208	142.41	7.12	712.06	8.08E+10	8.08E+10
12/16/22	22.16	236	64.481	119.42	5.97	597.10	6.78E+10	6.78E+10
12/13/22	21.95	237	64.754	118.31	5.92	591.54	6.71E+10	6.71E+10
12/15/22	20.69	238	65.027	111.53	5.58	557.64	6.33E+10	6.33E+10
12/17/22	23.08	239	65.301	124.40	6.22	622.00	7.06E+10	7.06E+10
8/13/22	25.62	240	65.574	138.07	6.90	690.33	7.83E+10	7.83E+10
7/20/22	26.39	241	65.847	142.24	7.11	711.22	8.07E+10	8.07E+10
8/16/22	24.43	242	66.120	131.68	6.58	658.39	7.47E+10	7.47E+10
12/14/22	22.85	243	66.393	123.17	6.16	615.85	6.99E+10	6.99E+10

12/24/22	15.04	244	66.667	81.06	4.05	405.29	4.60E+10	4.60E+10
8/25/22	24.09	245	66.940	129.86	6.49	649.32	7.37E+10	7.37E+10
9/2/22	22.86	246	67.213	123.20	6.16	616.02	6.99E+10	6.99E+10
12/18/22	22.86	247	67.486	123.23	6.16	616.14	6.99E+10	6.99E+10
12/23/22	14.88	248	67.760	80.19	4.01	400.97	4.55E+10	4.55E+10
12/20/22	23.02	249	68.033	124.09	6.20	620.47	7.04E+10	7.04E+10
10/23/22	21.44	250	68.306	115.58	5.78	577.92	6.56E+10	6.56E+10
12/19/22	22.78	251	68.579	122.77	6.14	613.87	6.97E+10	6.97E+10
12/27/22	12.10	252	68.852	65.22	3.26	326.10	3.70E+10	3.70E+10
12/26/22	15.39	253	69.126	82.96	4.15	414.79	4.71E+10	4.71E+10
12/30/22	20.00	254	69.399	107.80	5.39	539.01	6.12E+10	6.12E+10
7/21/22	24.78	255	69.672	133.55	6.68	667.77	7.58E+10	7.58E+10
8/17/22	22.46	256	69.945	121.07	6.05	605.35	6.87E+10	6.87E+10
6/24/22	28.74	257	70.219	154.89	7.74	774.44	8.79E+10	8.79E+10
12/21/22	23.03	258	70.492	124.14	6.21	620.70	7.04E+10	7.04E+10
12/28/22	11.03	259	70.765	59.47	2.97	297.33	3.37E+10	3.37E+10
12/25/22	13.07	260	71.038	70.42	3.52	352.11	4.00E+10	4.00E+10
9/3/22	21.75	261	71.311	117.22	5.86	586.12	6.65E+10	6.65E+10
8/26/22	21.46	262	71.585	115.70	5.78	578.48	6.56E+10	6.56E+10
12/22/22	22.34	263	71.858	120.43	6.02	602.15	6.83E+10	6.83E+10
8/29/22	19.58	264	72.131	105.52	5.28	527.58	5.99E+10	5.99E+10
8/27/22	21.78	265	72.404	117.39	5.87	586.95	6.66E+10	6.66E+10
9/4/22	20.80	266	72.678	112.09	5.60	560.44	6.36E+10	6.36E+10
8/18/22	21.50	267	72.951	115.90	5.80	579.51	6.58E+10	6.58E+10
12/29/22	12.45	268	73.224	67.08	3.35	335.40	3.81E+10	3.81E+10
10/24/22	18.22	269	73.497	98.18	4.91	490.90	5.57E+10	5.57E+10
8/19/22	20.64	270	73.770	111.24	5.56	556.22	6.31E+10	6.31E+10
8/28/22	20.45	271	74.044	110.21	5.51	551.04	6.25E+10	6.25E+10
8/20/22	19.58	272	74.317	105.56	5.28	527.78	5.99E+10	5.99E+10
9/5/22	20.17	273	74.590	108.72	5.44	543.60	6.17E+10	6.17E+10
6/25/22	25.91	274	74.863	139.65	6.98	698.27	7.92E+10	7.92E+10
9/6/22	19.22	275	75.137	103.61	5.18	518.03	5.88E+10	5.88E+10
10/25/22	15.64	276	75.410	84.29	4.21	421.44	4.78E+10	4.78E+10
10/26/22	16.90	277	75.683	91.11	4.56	455.54	5.17E+10	5.17E+10
10/27/22	16.72	278	75.956	90.13	4.51	450.64	5.11E+10	5.11E+10
11/27/22	15.12	279	76.230	81.47	4.07	407.35	4.62E+10	4.62E+10
10/28/22	16.79	280	76.503	90.48	4.52	452.40	5.13E+10	5.13E+10
9/7/22	19.32	281	76.776	104.13	5.21	520.65	5.91E+10	5.91E+10
9/27/22	19.95	282	77.049	107.54	5.38	537.70	6.10E+10	6.10E+10
10/29/22	15.90	283	77.322	85.68	4.28	428.42	4.86E+10	4.86E+10
6/26/22	23.53	284	77.596	126.83	6.34	634.13	7.20E+10	7.20E+10
9/28/22	18.97	285	77.869	102.23	5.11	511.16	5.80E+10	5.80E+10
10/30/22	15.68	286	78.142	84.51	4.23	422.54	4.79E+10	4.79E+10
11/1/22	14.80	287	78.415	79.79	3.99	398.94	4.53E+10	4.53E+10
10/31/22	14.93	288	78.689	80.46	4.02	402.31	4.57E+10	4.57E+10
11/2/22	15.59	289	78.962	84.01	4.20	420.07	4.77E+10	4.77E+10
11/4/22	14.80	290	79.235	79.76	3.99	398.81	4.53E+10	4.53E+10
11/3/22	15.66	291	79.508	84.43	4.22	422.13	4.79E+10	4.79E+10
9/26/22	18.96	292	79.781	102.21	5.11	511.07	5.80E+10	5.80E+10
9/8/22	18.01	293	80.055	97.06	4.85	485.31	5.51E+10	5.51E+10
11/5/22	13.97	294	80.328	75.28	3.76	376.41	4.27E+10	4.27E+10
10/19/22	14.63	295	80.601	78.86	3.94	394.29	4.47E+10	4.47E+10
9/29/22	17.94	296	80.874	96.69	4.83	483.44	5.49E+10	5.49E+10
10/22/22	15.13	297	81.148	81.56	4.08	407.78	4.63E+10	4.63E+10
11/7/22	14.64	298	81.421	78.90	3.95	394.51	4.48E+10	4.48E+10
11/6/22	14.49	299	81.694	78.11	3.91	390.57	4.43E+10	4.43E+10
11/8/22	15.82	300	81.967	85.29	4.26	426.47	4.84E+10	4.84E+10
10/20/22	14.55	301	82.240	78.45	3.92	392.25	4.45E+10	4.45E+10
11/9/22	14.49	302	82.514	78.09	3.90	390.45	4.43E+10	4.43E+10
9/9/22	16.27	303	82.787	87.72	4.39	438.61	4.98E+10	4.98E+10
9/30/22	17.78	304	83.060	95.81	4.79	479.04	5.44E+10	5.44E+10

11/10/22	13.18	305	83.333	71.04	3.55	355.21	4.03E+10	4.03E+10
9/12/22	18.09	306	83.607	97.53	4.88	487.63	5.53E+10	5.53E+10
11/11/22	14.77	307	83.880	79.59	3.98	397.94	4.52E+10	4.52E+10
10/18/22	13.09	308	84.153	70.54	3.53	352.70	4.00E+10	4.00E+10
6/27/22	20.36	309	84.426	109.77	5.49	548.83	6.23E+10	6.23E+10
10/21/22	13.86	310	84.699	74.71	3.74	373.54	4.24E+10	4.24E+10
9/11/22	13.59	311	84.973	73.25	3.66	366.27	4.16E+10	4.16E+10
11/12/22	13.15	312	85.246	70.88	3.54	354.39	4.02E+10	4.02E+10
11/13/22	13.46	313	85.519	72.57	3.63	362.87	4.12E+10	4.12E+10
9/13/22	17.09	314	85.792	92.14	4.61	460.71	5.23E+10	5.23E+10
11/14/22	14.39	315	86.066	77.59	3.88	387.93	4.40E+10	4.40E+10
9/10/22	14.38	316	86.339	77.49	3.87	387.45	4.40E+10	4.40E+10
10/1/22	17.12	317	86.612	92.25	4.61	461.27	5.23E+10	5.23E+10
11/15/22	13.94	318	86.885	75.12	3.76	375.62	4.26E+10	4.26E+10
9/14/22	15.81	319	87.158	85.23	4.26	426.14	4.84E+10	4.84E+10
11/16/22	12.22	320	87.432	65.86	3.29	329.29	3.74E+10	3.74E+10
11/17/22	12.20	321	87.705	65.74	3.29	328.68	3.73E+10	3.73E+10
9/15/22	15.25	322	87.978	82.22	4.11	411.08	4.66E+10	4.66E+10
11/26/22	12.47	323	88.251	67.24	3.36	336.20	3.82E+10	3.82E+10
9/25/22	14.07	324	88.525	75.81	3.79	379.07	4.30E+10	4.30E+10
9/21/22	15.59	325	88.798	84.01	4.20	420.04	4.77E+10	4.77E+10
11/18/22	12.04	326	89.071	64.89	3.24	324.45	3.68E+10	3.68E+10
11/25/22	12.65	327	89.344	68.16	3.41	340.80	3.87E+10	3.87E+10
11/19/22	11.74	328	89.617	63.28	3.16	316.39	3.59E+10	3.59E+10
9/22/22	16.24	329	89.891	87.55	4.38	437.73	4.97E+10	4.97E+10
9/16/22	14.58	330	90.164	78.60	3.93	392.98	4.46E+10	4.46E+10
11/24/22	11.58	331	90.437	62.43	3.12	312.14	3.54E+10	3.54E+10
10/2/22	16.15	332	90.710	87.05	4.35	435.24	4.94E+10	4.94E+10
11/22/22	11.89	333	90.984	64.11	3.21	320.53	3.64E+10	3.64E+10
11/21/22	10.84	334	91.257	58.42	2.92	292.09	3.31E+10	3.31E+10
11/23/22	11.44	335	91.530	61.64	3.08	308.19	3.50E+10	3.50E+10
9/20/22	14.31	336	91.803	77.11	3.86	385.56	4.38E+10	4.38E+10
6/28/22	16.65	337	92.077	89.76	4.49	448.82	5.09E+10	5.09E+10
11/20/22	11.47	338	92.350	61.81	3.09	309.05	3.51E+10	3.51E+10
9/17/22	13.35	339	92.623	71.97	3.60	359.83	4.08E+10	4.08E+10
9/23/22	14.87	340	92.896	80.14	4.01	400.69	4.55E+10	4.55E+10
9/19/22	14.71	341	93.169	79.31	3.97	396.53	4.50E+10	4.50E+10
9/18/22	14.01	342	93.443	75.51	3.78	377.56	4.28E+10	4.28E+10
10/3/22	14.82	343	93.716	79.89	3.99	399.46	4.53E+10	4.53E+10
9/24/22	13.24	344	93.989	71.36	3.57	356.82	4.05E+10	4.05E+10
7/5/22	14.77	345	94.262	79.62	3.98	398.09	4.52E+10	4.52E+10
10/4/22	13.45	346	94.536	72.48	3.62	362.39	4.11E+10	4.11E+10
6/29/22	14.88	347	94.809	80.22	4.01	401.09	4.55E+10	4.55E+10
10/5/22	13.86	348	95.082	74.70	3.73	373.50	4.24E+10	4.24E+10
10/17/22	8.46	349	95.355	45.59	2.28	227.97	2.59E+10	2.59E+10
10/6/22	11.32	350	95.628	61.04	3.05	305.18	3.46E+10	3.46E+10
6/30/22	13.20	351	95.902	71.13	3.56	355.65	4.04E+10	4.04E+10
10/7/22	12.89	352	96.175	69.48	3.47	347.38	3.94E+10	3.94E+10
7/1/22	13.05	353	96.448	70.33	3.52	351.67	3.99E+10	3.99E+10
7/2/22	13.26	354	96.721	71.47	3.57	357.33	4.05E+10	4.05E+10
10/8/22	10.88	355	96.995	58.64	2.93	293.18	3.33E+10	3.33E+10
10/16/22	7.11	356	97.268	38.32	1.92	191.62	2.17E+10	2.17E+10
10/9/22	8.29	357	97.541	44.71	2.24	223.55	2.54E+10	2.54E+10
7/3/22	11.52	358	97.814	62.12	3.11	310.58	3.52E+10	3.52E+10
10/13/22	10.75	359	98.087	57.95	2.90	289.73	3.29E+10	3.29E+10
10/10/22	7.94	360	98.361	42.80	2.14	213.99	2.43E+10	2.43E+10
10/15/22	6.64	361	98.634	35.77	1.79	178.83	2.03E+10	2.03E+10
10/14/22	6.81	362	98.907	36.73	1.84	183.66	2.08E+10	2.08E+10
10/11/22	7.64	363	99.180	41.17	2.06	205.85	2.34E+10	2.34E+10
10/12/22	7.46	364	99.454	40.21	2.01	201.04	2.28E+10	2.28E+10
7/4/22	11.40	365	99.727	61.44	3.07	307.22	3.49E+10	3.49E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 13 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	809.42	2.04	0.118	7.2	41	3.005464481	8900.024948	514.805365	31411.85276	8.12E+11	21	186900.5239	10810.91266	659648.9079	1.71E+13
3/15/22	108.99	1.84	0.05	7.2	4	36.61202186	1080.873356	29.3715586	4229.504437	1.07E+10	35	37830.56746	1028.004551	148032.6553	3.73E+11
4/19/22	108.96	2.11	0.05	6.4	10	36.8852459	1239.15878	29.3639521	3758.585873	2.67E+10	35	43370.5573	1027.738325	131550.5056	9.33E+11
5/24/22	74.98	2.73	0.05	22.4	66.0	48.36065574	1103.23572	20.2057824	9052.190524	1.21E+11	28	30890.60016	565.7619077	253461.3347	3.39E+12
6/21/22	46.72	4.09	0.075	39.2	102.0	58.46994536	1029.866032	18.8850739	9870.598646	1.17E+11	28	28836.2489	528.7820703	276376.7621	3.26E+12
7/19/22	82.31	2.75	0.069	30.4	121.0	45.6284153	1220.006644	30.6110758	13486.6189	2.44E+11	35	42700.23252	1071.387652	472031.6614	8.53E+12
8/23/22	42.01	3.27	0.05	19.6	155.0	61.20218579	740.5219967	11.3229663	4438.602794	1.59E+11	28	20734.61591	317.0430567	124280.8782	4.46E+12
9/20/22	28.21	2.78	0.104	20.0	260.0	78.68852459	422.5068137	15.8141449	3041.181713	1.79E+11	36	15210.24529	569.3092168	109482.5417	6.46E+12
10/26/22	39.35	1.40	0.050	7.6	299.0	63.38797814	297.0734806	10.6053735	1612.016774	2.88E+11	13	3861.955248	137.8698556	20956.21806	3.74E+12
11/8/22	35.24	1.17	0.050	16.0	119.0	68.85245902	223.1178063	9.49696114	3039.027566	1.03E+11	35	7809.123221	332.39364	106365.9648	3.59E+12
12/13/22	25.93	4.90	0.050	11.6	43.0	84.15300546	684.8436717	6.98820073	1621.26257	2.73E+10	36	24654.37218	251.5752263	58365.45251	9.82E+11
1/18/23	119.05	2.70	0.050	10.8	33.0	41.53005464	1732.53707	32.0840198	6930.14828	9.61E+10	37	64103.87159	1187.108733	256415.4864	3.56E+12
2/24/23															

Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	506,902.9	17,827.9	2,616,968.4	5.63E+13
											TARGET	102,252.4	5,112.6	511,261.9	5.80E+13

Site 14 Date	E14	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	66.37	1	0.273	357.74	17.89	1788.71	2.03E+11	2.03E+11
2/24/22	67.02	2	0.546	361.24	18.06	1806.20	2.05E+11	2.05E+11
2/22/22	63.28	3	0.820	341.10	17.06	1705.51	1.94E+11	1.94E+11
2/25/22	65.24	4	1.093	351.63	17.58	1758.15	2.00E+11	2.00E+11
2/26/22	62.58	5	1.366	337.30	16.86	1686.49	1.91E+11	1.91E+11
2/21/22	61.28	6	1.639	330.29	16.51	1651.44	1.87E+11	1.87E+11
2/27/22	61.41	7	1.913	331.02	16.55	1655.12	1.88E+11	1.88E+11
2/20/22	54.76	8	2.186	295.16	14.76	1475.82	1.67E+11	1.67E+11
2/19/22	58.78	9	2.459	316.84	15.84	1584.21	1.80E+11	1.80E+11
2/28/22	58.83	10	2.732	317.10	15.86	1585.52	1.80E+11	1.80E+11
3/1/22	58.39	11	3.005	314.71	15.74	1573.56	1.79E+11	1.79E+11
3/2/22	56.50	12	3.279	304.54	15.23	1522.68	1.73E+11	1.73E+11
3/3/22	56.64	13	3.552	305.27	15.26	1526.37	1.73E+11	1.73E+11
3/4/22	56.08	14	3.825	302.28	15.11	1511.38	1.72E+11	1.72E+11
3/26/22	51.37	15	4.098	276.88	13.84	1384.42	1.57E+11	1.57E+11
3/27/22	51.57	16	4.372	277.94	13.90	1389.71	1.58E+11	1.58E+11
3/28/22	51.86	17	4.645	279.55	13.98	1397.74	1.59E+11	1.59E+11
3/25/22	49.95	18	4.918	269.24	13.46	1346.20	1.53E+11	1.53E+11
3/5/22	51.28	19	5.191	276.38	13.82	1381.88	1.57E+11	1.57E+11
2/18/22	48.59	20	5.464	261.92	13.10	1309.58	1.49E+11	1.49E+11
3/29/22	51.42	21	5.738	277.14	13.86	1385.69	1.57E+11	1.57E+11
3/24/22	47.97	22	6.011	258.54	12.93	1292.70	1.47E+11	1.47E+11
3/30/22	47.21	23	6.284	254.47	12.72	1272.36	1.44E+11	1.44E+11
3/7/22	49.98	24	6.557	269.37	13.47	1346.83	1.53E+11	1.53E+11
3/6/22	49.35	25	6.831	265.99	13.30	1329.94	1.51E+11	1.51E+11
3/8/22	50.94	26	7.104	274.57	13.73	1372.87	1.56E+11	1.56E+11
3/31/22	44.98	27	7.377	242.42	12.12	1212.08	1.38E+11	1.38E+11
3/9/22	49.93	28	7.650	269.13	13.46	1345.63	1.53E+11	1.53E+11
4/1/22	45.79	29	7.923	246.79	12.34	1233.95	1.40E+11	1.40E+11
4/2/22	46.19	30	8.197	248.95	12.45	1244.77	1.41E+11	1.41E+11
3/10/22	49.47	31	8.470	266.64	13.33	1333.18	1.51E+11	1.51E+11
3/23/22	43.48	32	8.743	234.34	11.72	1171.72	1.33E+11	1.33E+11
4/3/22	45.33	33	9.016	244.31	12.22	1221.55	1.39E+11	1.39E+11
5/8/22	43.61	34	9.290	235.08	11.75	1175.42	1.33E+11	1.33E+11
3/11/22	44.44	35	9.563	239.55	11.98	1197.74	1.36E+11	1.36E+11
5/9/22	42.62	36	9.836	229.73	11.49	1148.63	1.30E+11	1.30E+11
5/7/22	43.80	37	10.109	236.07	11.80	1180.33	1.34E+11	1.34E+11
4/4/22	42.98	38	10.383	231.66	11.58	1158.29	1.31E+11	1.31E+11
5/10/22	42.38	39	10.656	228.45	11.42	1142.24	1.30E+11	1.30E+11
4/5/22	44.86	40	10.929	241.77	12.09	1208.85	1.37E+11	1.37E+11
4/7/22	42.81	41	11.202	230.74	11.54	1153.71	1.31E+11	1.31E+11
5/11/22	43.25	42	11.475	233.10	11.66	1165.51	1.32E+11	1.32E+11
4/6/22	42.28	43	11.749	227.89	11.39	1139.45	1.29E+11	1.29E+11
4/8/22	39.72	44	12.022	214.11	10.71	1070.54	1.21E+11	1.21E+11
3/12/22	43.53	45	12.295	234.62	11.73	1173.12	1.33E+11	1.33E+11
4/15/22	41.68	46	12.568	224.66	11.23	1123.31	1.27E+11	1.27E+11
4/16/22	41.34	47	12.842	222.83	11.14	1114.15	1.26E+11	1.26E+11
4/9/22	42.17	48	13.115	227.28	11.36	1136.38	1.29E+11	1.29E+11
5/12/22	40.79	49	13.388	219.86	10.99	1099.31	1.25E+11	1.25E+11
3/22/22	41.02	50	13.661	221.12	11.06	1105.59	1.25E+11	1.25E+11
4/17/22	42.27	51	13.934	227.85	11.39	1139.25	1.29E+11	1.29E+11
4/14/22	39.32	52	14.208	211.94	10.60	1059.69	1.20E+11	1.20E+11
3/21/22	41.80	53	14.481	225.29	11.26	1126.47	1.28E+11	1.28E+11
5/6/22	38.32	54	14.754	206.56	10.33	1032.78	1.17E+11	1.17E+11
4/10/22	41.14	55	15.027	221.77	11.09	1108.85	1.26E+11	1.26E+11
3/13/22	40.77	56	15.301	219.73	10.99	1098.65	1.25E+11	1.25E+11
4/18/22	38.86	57	15.574	209.45	10.47	1047.24	1.19E+11	1.19E+11
5/13/22	38.81	58	15.847	209.16	10.46	1045.80	1.19E+11	1.19E+11
4/19/22	39.85	59	16.120	214.81	10.74	1074.07	1.22E+11	1.22E+11
3/20/22	39.05	60	16.393	210.49	10.52	1052.43	1.19E+11	1.19E+11

4/20/22	38.24	61	16.667	206.12	10.31	1030.62	1.17E+11	1.17E+11
4/11/22	40.66	62	16.940	219.14	10.96	1095.70	1.24E+11	1.24E+11
5/14/22	37.54	63	17.213	202.36	10.12	1011.80	1.15E+11	1.15E+11
3/14/22	40.55	64	17.486	218.57	10.93	1092.83	1.24E+11	1.24E+11
4/13/22	34.37	65	17.760	185.27	9.26	926.36	1.05E+11	1.05E+11
4/21/22	36.28	66	18.033	195.53	9.78	977.65	1.11E+11	1.11E+11
4/12/22	38.73	67	18.306	208.74	10.44	1043.72	1.18E+11	1.18E+11
2/17/22	34.63	68	18.579	186.67	9.33	933.36	1.06E+11	1.06E+11
4/22/22	38.62	69	18.852	208.18	10.41	1040.89	1.18E+11	1.18E+11
5/15/22	36.57	70	19.126	197.12	9.86	985.59	1.12E+11	1.12E+11
5/5/22	36.79	71	19.399	198.31	9.92	991.57	1.13E+11	1.13E+11
3/15/22	39.16	72	19.672	211.07	10.55	1055.35	1.20E+11	1.20E+11
4/23/22	35.21	73	19.945	189.77	9.49	948.84	1.08E+11	1.08E+11
4/25/22	36.79	74	20.219	198.30	9.91	991.48	1.13E+11	1.13E+11
4/24/22	33.58	75	20.492	180.99	9.05	904.97	1.03E+11	1.03E+11
5/4/22	36.36	76	20.765	195.97	9.80	979.85	1.11E+11	1.11E+11
4/26/22	35.89	77	21.038	193.45	9.67	967.23	1.10E+11	1.10E+11
3/16/22	37.10	78	21.311	199.97	10.00	999.84	1.13E+11	1.13E+11
5/16/22	34.84	79	21.585	187.78	9.39	938.88	1.07E+11	1.07E+11
3/19/22	34.33	80	21.858	185.05	9.25	925.24	1.05E+11	1.05E+11
4/27/22	35.73	81	22.131	192.60	9.63	963.01	1.09E+11	1.09E+11
3/17/22	36.37	82	22.404	196.02	9.80	980.10	1.11E+11	1.11E+11
4/28/22	33.55	83	22.678	180.83	9.04	904.15	1.03E+11	1.03E+11
5/17/22	32.73	84	22.951	176.39	8.82	881.94	1.00E+11	1.00E+11
3/18/22	32.73	85	23.224	176.40	8.82	882.00	1.00E+11	1.00E+11
5/3/22	32.57	86	23.497	175.54	8.78	877.68	9.96E+10	9.96E+10
4/29/22	32.28	87	23.770	173.96	8.70	869.82	9.87E+10	9.87E+10
5/18/22	31.10	88	24.044	167.64	8.38	838.19	9.51E+10	9.51E+10
5/1/22	31.06	89	24.317	167.39	8.37	836.96	9.50E+10	9.50E+10
6/11/22	31.88	90	24.590	171.81	8.59	859.04	9.75E+10	9.75E+10
6/12/22	31.58	91	24.863	170.23	8.51	851.14	9.66E+10	9.66E+10
4/30/22	30.19	92	25.137	162.72	8.14	813.61	9.23E+10	9.23E+10
5/2/22	31.90	93	25.410	171.92	8.60	859.62	9.75E+10	9.75E+10
6/10/22	31.40	94	25.683	169.22	8.46	846.10	9.60E+10	9.60E+10
5/19/22	30.16	95	25.956	162.58	8.13	812.92	9.22E+10	9.22E+10
6/13/22	31.28	96	26.230	168.61	8.43	843.07	9.57E+10	9.57E+10
6/9/22	30.89	97	26.503	166.48	8.32	832.42	9.45E+10	9.45E+10
6/14/22	31.15	98	26.776	167.90	8.40	839.50	9.53E+10	9.53E+10
5/20/22	29.03	99	27.049	156.48	7.82	782.40	8.88E+10	8.88E+10
6/15/22	30.19	100	27.322	162.74	8.14	813.69	9.23E+10	9.23E+10
6/8/22	28.42	101	27.596	153.20	7.66	765.98	8.69E+10	8.69E+10
6/2/22	28.83	102	27.869	155.40	7.77	776.99	8.82E+10	8.82E+10
5/21/22	28.23	103	28.142	152.19	7.61	760.93	8.63E+10	8.63E+10
6/1/22	27.99	104	28.415	150.87	7.54	754.35	8.56E+10	8.56E+10
5/30/22	28.49	105	28.689	153.55	7.68	767.73	8.71E+10	8.71E+10
7/28/22	26.44	106	28.962	142.50	7.13	712.51	8.09E+10	8.09E+10
6/3/22	28.08	107	29.235	151.35	7.57	756.75	8.59E+10	8.59E+10
7/27/22	26.41	108	29.508	142.33	7.12	711.65	8.08E+10	8.08E+10
5/31/22	28.53	109	29.781	153.78	7.69	768.88	8.73E+10	8.73E+10
7/29/22	26.35	110	30.055	142.03	7.10	710.13	8.06E+10	8.06E+10
5/29/22	27.58	111	30.328	148.63	7.43	743.15	8.43E+10	8.43E+10
7/26/22	25.38	112	30.601	136.78	6.84	683.92	7.76E+10	7.76E+10
5/22/22	27.16	113	30.874	146.37	7.32	731.85	8.30E+10	8.30E+10
6/7/22	27.54	114	31.148	148.43	7.42	742.13	8.42E+10	8.42E+10
6/16/22	28.39	115	31.421	153.04	7.65	765.19	8.68E+10	8.68E+10
6/4/22	27.08	116	31.694	145.98	7.30	729.92	8.28E+10	8.28E+10
7/30/22	25.19	117	31.967	135.78	6.79	678.92	7.70E+10	7.70E+10
7/25/22	24.78	118	32.240	133.56	6.68	667.82	7.58E+10	7.58E+10
5/23/22	25.54	119	32.514	137.68	6.88	688.38	7.81E+10	7.81E+10
6/5/22	25.75	120	32.787	138.78	6.94	693.91	7.87E+10	7.87E+10
7/31/22	24.07	121	33.060	129.71	6.49	648.56	7.36E+10	7.36E+10

6/17/22	26.18	122	33.333	141.13	7.06	705.65	8.01E+10	8.01E+10
6/6/22	24.47	123	33.607	131.87	6.59	659.37	7.48E+10	7.48E+10
5/28/22	25.28	124	33.880	136.28	6.81	681.42	7.73E+10	7.73E+10
5/24/22	24.05	125	34.153	129.61	6.48	648.03	7.35E+10	7.35E+10
7/24/22	23.09	126	34.426	124.44	6.22	622.18	7.06E+10	7.06E+10
8/1/22	22.87	127	34.699	123.27	6.16	616.36	6.99E+10	6.99E+10
2/16/22	20.20	128	34.973	108.86	5.44	544.28	6.18E+10	6.18E+10
5/27/22	24.64	129	35.246	132.81	6.64	664.05	7.54E+10	7.54E+10
5/25/22	23.74	130	35.519	127.95	6.40	639.73	7.26E+10	7.26E+10
5/26/22	24.41	131	35.792	131.56	6.58	657.82	7.46E+10	7.46E+10
6/18/22	24.34	132	36.066	131.19	6.56	655.94	7.44E+10	7.44E+10
8/2/22	21.51	133	36.339	115.92	5.80	579.58	6.58E+10	6.58E+10
2/13/22	22.29	134	36.612	120.12	6.01	600.59	6.82E+10	6.82E+10
2/14/22	22.12	135	36.885	119.20	5.96	596.00	6.76E+10	6.76E+10
2/15/22	21.72	136	37.158	117.05	5.85	585.27	6.64E+10	6.64E+10
8/3/22	20.07	137	37.432	108.15	5.41	540.77	6.14E+10	6.14E+10
7/8/22	21.83	138	37.705	117.66	5.88	588.28	6.68E+10	6.68E+10
7/9/22	21.77	139	37.978	117.35	5.87	586.75	6.66E+10	6.66E+10
6/19/22	21.77	140	38.251	117.35	5.87	586.73	6.66E+10	6.66E+10
2/12/22	21.34	141	38.525	115.03	5.75	575.15	6.53E+10	6.53E+10
8/4/22	19.59	142	38.798	105.61	5.28	528.04	5.99E+10	5.99E+10
1/25/23	17.94	143	39.071	96.71	4.84	483.56	5.49E+10	5.49E+10
1/23/23	17.43	144	39.344	93.95	4.70	469.75	5.33E+10	5.33E+10
1/22/23	17.87	145	39.617	96.30	4.82	481.51	5.46E+10	5.46E+10
1/26/23	17.52	146	39.891	94.43	4.72	472.13	5.36E+10	5.36E+10
7/10/22	21.38	147	40.164	115.24	5.76	576.22	6.54E+10	6.54E+10
7/23/22	18.85	148	40.437	101.63	5.08	508.14	5.77E+10	5.77E+10
1/24/23	16.88	149	40.710	90.99	4.55	454.93	5.16E+10	5.16E+10
1/27/23	16.21	150	40.984	87.38	4.37	436.88	4.96E+10	4.96E+10
7/7/22	21.12	151	41.257	113.83	5.69	569.15	6.46E+10	6.46E+10
1/8/23	17.78	152	41.530	95.84	4.79	479.21	5.44E+10	5.44E+10
1/28/23	17.54	153	41.803	94.55	4.73	472.74	5.36E+10	5.36E+10
1/21/23	16.79	154	42.077	90.50	4.53	452.50	5.13E+10	5.13E+10
1/7/23	17.52	155	42.350	94.45	4.72	472.25	5.36E+10	5.36E+10
1/29/23	16.92	156	42.623	91.21	4.56	456.05	5.18E+10	5.18E+10
1/6/23	17.10	157	42.896	92.19	4.61	460.94	5.23E+10	5.23E+10
8/5/22	17.73	158	43.169	95.56	4.78	477.80	5.42E+10	5.42E+10
1/9/23	17.30	159	43.443	93.22	4.66	466.10	5.29E+10	5.29E+10
7/11/22	20.56	160	43.716	110.79	5.54	553.97	6.29E+10	6.29E+10
1/30/23	17.21	161	43.989	92.74	4.64	463.69	5.26E+10	5.26E+10
1/10/23	17.25	162	44.262	92.97	4.65	464.87	5.28E+10	5.28E+10
1/5/23	16.68	163	44.536	89.89	4.49	449.44	5.10E+10	5.10E+10
2/7/22	18.89	164	44.809	101.84	5.09	509.20	5.78E+10	5.78E+10
1/20/23	16.41	165	45.082	88.43	4.42	442.14	5.02E+10	5.02E+10
1/31/23	16.27	166	45.355	87.69	4.38	438.45	4.98E+10	4.98E+10
2/8/22	18.23	167	45.628	98.23	4.91	491.17	5.57E+10	5.57E+10
6/20/22	20.13	168	45.902	108.49	5.42	542.46	6.16E+10	6.16E+10
2/6/22	16.69	169	46.175	89.98	4.50	449.88	5.11E+10	5.11E+10
1/12/23	16.76	170	46.448	90.36	4.52	451.79	5.13E+10	5.13E+10
2/3/22	19.20	171	46.721	103.49	5.17	517.47	5.87E+10	5.87E+10
8/6/22	17.04	172	46.995	91.82	4.59	459.11	5.21E+10	5.21E+10
7/12/22	19.21	173	47.268	103.54	5.18	517.72	5.87E+10	5.87E+10
2/4/22	16.98	174	47.541	91.54	4.58	457.72	5.19E+10	5.19E+10
2/5/22	18.31	175	47.814	98.71	4.94	493.55	5.60E+10	5.60E+10
1/4/23	15.88	176	48.087	85.61	4.28	428.06	4.86E+10	4.86E+10
1/13/23	16.05	177	48.361	86.52	4.33	432.59	4.91E+10	4.91E+10
2/11/22	15.82	178	48.634	85.25	4.26	426.23	4.84E+10	4.84E+10
1/19/23	15.64	179	48.907	84.31	4.22	421.54	4.78E+10	4.78E+10
1/14/23	15.76	180	49.180	84.95	4.25	424.73	4.82E+10	4.82E+10
2/9/22	17.25	181	49.454	92.96	4.65	464.79	5.27E+10	5.27E+10
8/7/22	16.14	182	49.727	87.01	4.35	435.05	4.94E+10	4.94E+10

1/15/23	15.18	183	50.000	81.80	4.09	409.00	4.64E+10	4.64E+10
8/8/22	15.46	184	50.273	83.35	4.17	416.73	4.73E+10	4.73E+10
2/2/22	18.08	185	50.546	97.47	4.87	487.36	5.53E+10	5.53E+10
7/13/22	17.67	186	50.820	95.22	4.76	476.11	5.40E+10	5.40E+10
2/10/22	17.49	187	51.093	94.26	4.71	471.31	5.35E+10	5.35E+10
8/9/22	15.12	188	51.366	81.50	4.07	407.49	4.62E+10	4.62E+10
6/21/22	17.94	189	51.639	96.72	4.84	483.60	5.49E+10	5.49E+10
1/16/23	14.88	190	51.913	80.23	4.01	401.13	4.55E+10	4.55E+10
1/3/23	13.71	191	52.186	73.90	3.69	369.50	4.19E+10	4.19E+10
1/17/23	14.15	192	52.459	76.29	3.81	381.47	4.33E+10	4.33E+10
7/14/22	16.43	193	52.732	88.54	4.43	442.71	5.02E+10	5.02E+10
1/18/23	13.66	194	53.005	73.64	3.68	368.18	4.18E+10	4.18E+10
7/22/22	13.79	195	53.279	74.34	3.72	371.72	4.22E+10	4.22E+10
8/10/22	14.45	196	53.552	77.91	3.90	389.55	4.42E+10	4.42E+10
8/22/22	13.82	197	53.825	74.51	3.73	372.57	4.23E+10	4.23E+10
12/2/22	10.04	198	54.098	54.10	2.71	270.52	3.07E+10	3.07E+10
12/1/22	11.83	199	54.372	63.79	3.19	318.94	3.62E+10	3.62E+10
7/15/22	14.71	200	54.645	79.30	3.96	396.49	4.50E+10	4.50E+10
7/6/22	15.25	201	54.918	82.22	4.11	411.12	4.67E+10	4.67E+10
12/4/22	11.96	202	55.191	64.47	3.22	322.37	3.66E+10	3.66E+10
1/2/23	13.11	203	55.464	70.64	3.53	353.21	4.01E+10	4.01E+10
12/3/22	12.27	204	55.738	66.11	3.31	330.57	3.75E+10	3.75E+10
11/30/22	11.80	205	56.011	63.60	3.18	318.00	3.61E+10	3.61E+10
6/22/22	15.73	206	56.284	84.77	4.24	423.86	4.81E+10	4.81E+10
7/16/22	13.90	207	56.557	74.90	3.75	374.51	4.25E+10	4.25E+10
8/21/22	13.13	208	56.831	70.77	3.54	353.84	4.02E+10	4.02E+10
12/5/22	11.73	209	57.104	63.21	3.16	316.06	3.59E+10	3.59E+10
11/29/22	9.50	210	57.377	51.20	2.56	256.01	2.91E+10	2.91E+10
8/11/22	13.16	211	57.650	70.95	3.55	354.73	4.03E+10	4.03E+10
1/1/23	11.82	212	57.923	63.72	3.19	318.62	3.62E+10	3.62E+10
12/6/22	12.13	213	58.197	65.37	3.27	326.83	3.71E+10	3.71E+10
8/23/22	12.22	214	58.470	65.85	3.29	329.27	3.74E+10	3.74E+10
7/17/22	13.75	215	58.743	74.10	3.71	370.51	4.20E+10	4.20E+10
1/11/23	15.83	216	59.016	85.34	4.27	426.70	4.84E+10	4.84E+10
12/7/22	11.36	217	59.290	61.24	3.06	306.18	3.47E+10	3.47E+10
7/18/22	13.41	218	59.563	72.28	3.61	361.41	4.10E+10	4.10E+10
12/8/22	11.10	219	59.836	59.82	2.99	299.09	3.39E+10	3.39E+10
8/31/22	10.92	220	60.109	58.88	2.94	294.40	3.34E+10	3.34E+10
12/9/22	9.39	221	60.383	50.60	2.53	252.98	2.87E+10	2.87E+10
8/30/22	11.15	222	60.656	60.12	3.01	300.58	3.41E+10	3.41E+10
12/10/22	9.92	223	60.929	53.45	2.67	267.24	3.03E+10	3.03E+10
12/31/22	10.86	224	61.202	58.53	2.93	292.67	3.32E+10	3.32E+10
2/1/22	12.22	225	61.475	65.89	3.29	329.44	3.74E+10	3.74E+10
8/12/22	11.34	226	61.749	61.10	3.06	305.51	3.47E+10	3.47E+10
7/19/22	11.78	227	62.022	63.51	3.18	317.55	3.60E+10	3.60E+10
8/24/22	10.34	228	62.295	55.75	2.79	278.74	3.16E+10	3.16E+10
11/28/22	8.73	229	62.568	47.04	2.35	235.18	2.67E+10	2.67E+10
12/11/22	10.09	230	62.842	54.37	2.72	271.84	3.08E+10	3.08E+10
6/23/22	13.38	231	63.115	72.11	3.61	360.56	4.09E+10	4.09E+10
8/15/22	10.34	232	63.388	55.74	2.79	278.69	3.16E+10	3.16E+10
9/1/22	9.56	233	63.661	51.50	2.58	257.52	2.92E+10	2.92E+10
12/12/22	10.31	234	63.934	55.59	2.78	277.94	3.15E+10	3.15E+10
8/14/22	10.49	235	64.208	56.55	2.83	282.73	3.21E+10	3.21E+10
12/16/22	8.80	236	64.481	47.42	2.37	237.08	2.69E+10	2.69E+10
12/13/22	8.72	237	64.754	46.97	2.35	234.87	2.67E+10	2.67E+10
12/15/22	8.22	238	65.027	44.28	2.21	221.41	2.51E+10	2.51E+10
12/17/22	9.16	239	65.301	49.39	2.47	246.97	2.80E+10	2.80E+10
8/13/22	10.17	240	65.574	54.82	2.74	274.10	3.11E+10	3.11E+10
7/20/22	10.48	241	65.847	56.48	2.82	282.39	3.20E+10	3.20E+10
8/16/22	9.70	242	66.120	52.28	2.61	261.42	2.97E+10	2.97E+10
12/14/22	9.07	243	66.393	48.91	2.45	244.53	2.77E+10	2.77E+10

12/24/22	5.97	244	66.667	32.18	1.61	160.92	1.83E+10	1.83E+10
8/25/22	9.57	245	66.940	51.56	2.58	257.82	2.93E+10	2.93E+10
9/2/22	9.08	246	67.213	48.92	2.45	244.59	2.78E+10	2.78E+10
12/18/22	9.08	247	67.486	48.93	2.45	244.64	2.78E+10	2.78E+10
12/23/22	5.91	248	67.760	31.84	1.59	159.21	1.81E+10	1.81E+10
12/20/22	9.14	249	68.033	49.27	2.46	246.36	2.80E+10	2.80E+10
10/23/22	8.51	250	68.306	45.89	2.29	229.47	2.60E+10	2.60E+10
12/19/22	9.04	251	68.579	48.75	2.44	243.74	2.77E+10	2.77E+10
12/27/22	4.80	252	68.852	25.90	1.29	129.48	1.47E+10	1.47E+10
12/26/22	6.11	253	69.126	32.94	1.65	164.69	1.87E+10	1.87E+10
12/30/22	7.94	254	69.399	42.80	2.14	214.02	2.43E+10	2.43E+10
7/21/22	9.84	255	69.672	53.03	2.65	265.14	3.01E+10	3.01E+10
8/17/22	8.92	256	69.945	48.07	2.40	240.36	2.73E+10	2.73E+10
6/24/22	11.41	257	70.219	61.50	3.07	307.49	3.49E+10	3.49E+10
12/21/22	9.14	258	70.492	49.29	2.46	246.45	2.80E+10	2.80E+10
12/28/22	4.38	259	70.765	23.61	1.18	118.06	1.34E+10	1.34E+10
12/25/22	5.19	260	71.038	27.96	1.40	139.81	1.59E+10	1.59E+10
9/3/22	8.64	261	71.311	46.54	2.33	232.72	2.64E+10	2.64E+10
8/26/22	8.52	262	71.585	45.94	2.30	229.69	2.61E+10	2.61E+10
12/22/22	8.87	263	71.858	47.82	2.39	239.09	2.71E+10	2.71E+10
8/29/22	7.77	264	72.131	41.90	2.09	209.48	2.38E+10	2.38E+10
8/27/22	8.65	265	72.404	46.61	2.33	233.05	2.64E+10	2.64E+10
9/4/22	8.26	266	72.678	44.50	2.23	222.52	2.53E+10	2.53E+10
8/18/22	8.54	267	72.951	46.02	2.30	230.10	2.61E+10	2.61E+10
12/29/22	4.94	268	73.224	26.63	1.33	133.17	1.51E+10	1.51E+10
10/24/22	7.23	269	73.497	38.98	1.95	194.91	2.21E+10	2.21E+10
8/19/22	8.19	270	73.770	44.17	2.21	220.85	2.51E+10	2.51E+10
8/28/22	8.12	271	74.044	43.76	2.19	218.79	2.48E+10	2.48E+10
8/20/22	7.78	272	74.317	41.91	2.10	209.56	2.38E+10	2.38E+10
9/5/22	8.01	273	74.590	43.17	2.16	215.84	2.45E+10	2.45E+10
6/25/22	10.29	274	74.863	55.45	2.77	277.25	3.15E+10	3.15E+10
9/6/22	7.63	275	75.137	41.14	2.06	205.69	2.33E+10	2.33E+10
10/25/22	6.21	276	75.410	33.47	1.67	167.33	1.90E+10	1.90E+10
10/26/22	6.71	277	75.683	36.17	1.81	180.87	2.05E+10	2.05E+10
10/27/22	6.64	278	75.956	35.79	1.79	178.93	2.03E+10	2.03E+10
11/27/22	6.00	279	76.230	32.35	1.62	161.74	1.84E+10	1.84E+10
10/28/22	6.67	280	76.503	35.93	1.80	179.63	2.04E+10	2.04E+10
9/7/22	7.67	281	76.776	41.35	2.07	206.73	2.35E+10	2.35E+10
9/27/22	7.92	282	77.049	42.70	2.13	213.49	2.42E+10	2.42E+10
10/29/22	6.31	283	77.322	34.02	1.70	170.10	1.93E+10	1.93E+10
6/26/22	9.34	284	77.596	50.36	2.52	251.79	2.86E+10	2.86E+10
9/28/22	7.53	285	77.869	40.59	2.03	202.96	2.30E+10	2.30E+10
10/30/22	6.23	286	78.142	33.55	1.68	167.77	1.90E+10	1.90E+10
11/1/22	5.88	287	78.415	31.68	1.58	158.40	1.80E+10	1.80E+10
10/31/22	5.93	288	78.689	31.95	1.60	159.74	1.81E+10	1.81E+10
11/2/22	6.19	289	78.962	33.36	1.67	166.79	1.89E+10	1.89E+10
11/4/22	5.88	290	79.235	31.67	1.58	158.35	1.80E+10	1.80E+10
11/3/22	6.22	291	79.508	33.52	1.68	167.61	1.90E+10	1.90E+10
9/26/22	7.53	292	79.781	40.58	2.03	202.92	2.30E+10	2.30E+10
9/8/22	7.15	293	80.055	38.54	1.93	192.69	2.19E+10	2.19E+10
11/5/22	5.55	294	80.328	29.89	1.49	149.45	1.70E+10	1.70E+10
10/19/22	5.81	295	80.601	31.31	1.57	156.55	1.78E+10	1.78E+10
9/29/22	7.12	296	80.874	38.39	1.92	191.95	2.18E+10	2.18E+10
10/22/22	6.01	297	81.148	32.38	1.62	161.91	1.84E+10	1.84E+10
11/7/22	5.81	298	81.421	31.33	1.57	156.64	1.78E+10	1.78E+10
11/6/22	5.75	299	81.694	31.02	1.55	155.08	1.76E+10	1.76E+10
11/8/22	6.28	300	81.967	33.87	1.69	169.33	1.92E+10	1.92E+10
10/20/22	5.78	301	82.240	31.15	1.56	155.75	1.77E+10	1.77E+10
11/9/22	5.75	302	82.514	31.01	1.55	155.03	1.76E+10	1.76E+10
9/9/22	6.46	303	82.787	34.83	1.74	174.15	1.98E+10	1.98E+10
9/30/22	7.06	304	83.060	38.04	1.90	190.21	2.16E+10	2.16E+10

11/10/22	5.23	305	83.333	28.21	1.41	141.04	1.60E+10	1.60E+10
9/12/22	7.18	306	83.607	38.72	1.94	193.61	2.20E+10	2.20E+10
11/11/22	5.86	307	83.880	31.60	1.58	158.00	1.79E+10	1.79E+10
10/18/22	5.20	308	84.153	28.01	1.40	140.04	1.59E+10	1.59E+10
6/27/22	8.09	309	84.426	43.58	2.18	217.92	2.47E+10	2.47E+10
10/21/22	5.50	310	84.699	29.66	1.48	148.32	1.68E+10	1.68E+10
9/11/22	5.40	311	84.973	29.09	1.45	145.43	1.65E+10	1.65E+10
11/12/22	5.22	312	85.246	28.14	1.41	140.71	1.60E+10	1.60E+10
11/13/22	5.35	313	85.519	28.82	1.44	144.08	1.63E+10	1.63E+10
9/13/22	6.79	314	85.792	36.59	1.83	182.93	2.08E+10	2.08E+10
11/14/22	5.72	315	86.066	30.81	1.54	154.03	1.75E+10	1.75E+10
9/10/22	5.71	316	86.339	30.77	1.54	153.84	1.75E+10	1.75E+10
10/1/22	6.80	317	86.612	36.63	1.83	183.15	2.08E+10	2.08E+10
11/15/22	5.53	318	86.885	29.83	1.49	149.14	1.69E+10	1.69E+10
9/14/22	6.28	319	87.158	33.84	1.69	169.20	1.92E+10	1.92E+10
11/16/22	4.85	320	87.432	26.15	1.31	130.75	1.48E+10	1.48E+10
11/17/22	4.84	321	87.705	26.10	1.31	130.50	1.48E+10	1.48E+10
9/15/22	6.06	322	87.978	32.64	1.63	163.22	1.85E+10	1.85E+10
11/26/22	4.95	323	88.251	26.70	1.33	133.49	1.51E+10	1.51E+10
9/25/22	5.58	324	88.525	30.10	1.51	150.51	1.71E+10	1.71E+10
9/21/22	6.19	325	88.798	33.36	1.67	166.78	1.89E+10	1.89E+10
11/18/22	4.78	326	89.071	25.76	1.29	128.82	1.46E+10	1.46E+10
11/25/22	5.02	327	89.344	27.06	1.35	135.32	1.54E+10	1.54E+10
11/19/22	4.66	328	89.617	25.13	1.26	125.63	1.43E+10	1.43E+10
9/22/22	6.45	329	89.891	34.76	1.74	173.80	1.97E+10	1.97E+10
9/16/22	5.79	330	90.164	31.21	1.56	156.03	1.77E+10	1.77E+10
11/24/22	4.60	331	90.437	24.79	1.24	123.93	1.41E+10	1.41E+10
10/2/22	6.41	332	90.710	34.56	1.73	172.81	1.96E+10	1.96E+10
11/22/22	4.72	333	90.984	25.45	1.27	127.27	1.44E+10	1.44E+10
11/21/22	4.30	334	91.257	23.20	1.16	115.98	1.32E+10	1.32E+10
11/23/22	4.54	335	91.530	24.47	1.22	122.37	1.39E+10	1.39E+10
9/20/22	5.68	336	91.803	30.62	1.53	153.09	1.74E+10	1.74E+10
6/28/22	6.61	337	92.077	35.64	1.78	178.21	2.02E+10	2.02E+10
11/20/22	4.55	338	92.350	24.54	1.23	122.71	1.39E+10	1.39E+10
9/17/22	5.30	339	92.623	28.57	1.43	142.87	1.62E+10	1.62E+10
9/23/22	5.90	340	92.896	31.82	1.59	159.10	1.81E+10	1.81E+10
9/19/22	5.84	341	93.169	31.49	1.57	157.44	1.79E+10	1.79E+10
9/18/22	5.56	342	93.443	29.98	1.50	149.91	1.70E+10	1.70E+10
10/3/22	5.89	343	93.716	31.72	1.59	158.61	1.80E+10	1.80E+10
9/24/22	5.26	344	93.989	28.34	1.42	141.68	1.61E+10	1.61E+10
7/5/22	5.87	345	94.262	31.61	1.58	158.06	1.79E+10	1.79E+10
10/4/22	5.34	346	94.536	28.78	1.44	143.89	1.63E+10	1.63E+10
6/29/22	5.91	347	94.809	31.85	1.59	159.25	1.81E+10	1.81E+10
10/5/22	5.50	348	95.082	29.66	1.48	148.30	1.68E+10	1.68E+10
10/17/22	3.36	349	95.355	18.10	0.91	90.52	1.03E+10	1.03E+10
10/6/22	4.50	350	95.628	24.23	1.21	121.17	1.38E+10	1.38E+10
6/30/22	5.24	351	95.902	28.24	1.41	141.21	1.60E+10	1.60E+10
10/7/22	5.12	352	96.175	27.59	1.38	137.93	1.57E+10	1.57E+10
7/1/22	5.18	353	96.448	27.93	1.40	139.63	1.58E+10	1.58E+10
7/2/22	5.26	354	96.721	28.38	1.42	141.88	1.61E+10	1.61E+10
10/8/22	4.32	355	96.995	23.28	1.16	116.41	1.32E+10	1.32E+10
10/16/22	2.82	356	97.268	15.22	0.76	76.08	8.63E+09	8.63E+09
10/9/22	3.29	357	97.541	17.75	0.89	88.76	1.01E+10	1.01E+10
7/3/22	4.58	358	97.814	24.66	1.23	123.32	1.40E+10	1.40E+10
10/13/22	4.27	359	98.087	23.01	1.15	115.04	1.31E+10	1.31E+10
10/10/22	3.15	360	98.361	16.99	0.85	84.97	9.64E+09	9.64E+09
10/15/22	2.63	361	98.634	14.20	0.71	71.01	8.06E+09	8.06E+09
10/14/22	2.71	362	98.907	14.58	0.73	72.92	8.28E+09	8.28E+09
10/11/22	3.03	363	99.180	16.35	0.82	81.74	9.28E+09	9.28E+09
10/12/22	2.96	364	99.454	15.96	0.80	79.82	9.06E+09	9.06E+09
7/4/22	4.53	365	99.727	24.40	1.22	121.98	1.38E+10	1.38E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 14 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	115.17	2.07	0.143	8	21.3	0.819672131	1284.946844	88.7668593	4965.97814	6.00E+10	21	26983.88372	1864.104044	104285.5409	1.26E+12
3/15/22	22.75	2.11	0.05	9.2	49	19.67213115	258.7013642	6.13036408	1127.986991	2.73E+10	35	9054.547748	214.5627428	39479.54468	9.54E+11
4/19/22	26.76	3.14	0.05	5.2	25	16.12021858	452.8242349	7.21057699	749.9000068	1.64E+10	35	15848.84822	252.3701946	26246.50024	5.73E+11
5/24/22	10.01	3.18	0.05	9.6	71.0	34.15300546	171.4895591	2.69637671	517.7043293	1.74E+10	28	4801.707654	75.49854802	14495.72122	4.87E+11
6/21/22	8.11	3.43	0.059	2.4	84.0	51.63934426	149.9631483	2.57954103	104.9304828	1.67E+10	28	4198.968152	72.22714897	2938.053517	4.67E+11
7/19/22	10.56	2.66	0.091	4	91.0	62.02185792	151.4489432	5.18114806	227.7427717	2.35E+10	35	5300.713011	181.3401819	7970.997008	8.23E+11
8/23/22	3.47	3.30	0.053	1.2	104.0	58.46994536	61.77852817	0.9922006	22.46491933	8.84E+09	28	1729.798789	27.78161691	629.0177414	2.47E+11
9/20/22	2.93	2.78	0.050	6.0	579.0	91.80327869	43.84460666	0.7889779	94.67734841	4.15E+10	36	1578.40584	28.40320452	3408.384543	1.49E+12
10/26/22	5.36	1.36	0.050	2.0	122.0	75.68306011	39.16733753	1.44486268	57.7945072	1.60E+10	13	509.1753879	18.78321484	751.3285936	2.08E+11
11/8/22	3.88	1.11	0.050	4.4	114.0	81.96721311	23.17544222	1.04685305	92.12306852	1.08E+10	35	811.1404778	36.6398568	3224.307398	3.79E+11
12/13/22	5.05	12.20	0.116	2.8	25.0	64.75409836	332.3800571	3.16033497	76.28394753	3.09E+09	36	11965.68205	113.7720589	2746.222111	1.11E+11
1/18/23	9.83	1.50	0.074	2.4	10.0	53.00546448	79.46802456	3.92042254	127.1488393	2.40E+09	37	2940.316909	145.0556342	4704.507054	8.90E+10
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	85,723.2	3,030.5	210,880.1	7.09E+12
											TARGET	40,600.3	2,030.0	203,001.6	2.30E+13

Site 15 Date	E15	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	62.09	1	0.273	334.68	16.73	1673.41	1.90E+11	1.90E+11
2/24/22	62.70	2	0.546	337.96	16.90	1689.78	1.92E+11	1.92E+11
2/22/22	59.21	3	0.820	319.12	15.96	1595.58	1.81E+11	1.81E+11
2/25/22	61.03	4	1.093	328.96	16.45	1644.82	1.87E+11	1.87E+11
2/26/22	58.54	5	1.366	315.56	15.78	1577.78	1.79E+11	1.79E+11
2/21/22	57.33	6	1.639	309.00	15.45	1544.99	1.75E+11	1.75E+11
2/27/22	57.46	7	1.913	309.69	15.48	1548.44	1.76E+11	1.76E+11
2/20/22	51.23	8	2.186	276.14	13.81	1380.69	1.57E+11	1.57E+11
2/19/22	54.99	9	2.459	296.42	14.82	1482.10	1.68E+11	1.68E+11
2/28/22	55.04	10	2.732	296.66	14.83	1483.32	1.68E+11	1.68E+11
3/1/22	54.62	11	3.005	294.43	14.72	1472.13	1.67E+11	1.67E+11
3/2/22	52.86	12	3.279	284.91	14.25	1424.53	1.62E+11	1.62E+11
3/3/22	52.99	13	3.552	285.60	14.28	1427.98	1.62E+11	1.62E+11
3/4/22	52.47	14	3.825	282.79	14.14	1413.96	1.60E+11	1.60E+11
3/26/22	48.06	15	4.098	259.04	12.95	1295.19	1.47E+11	1.47E+11
3/27/22	48.24	16	4.372	260.03	13.00	1300.13	1.48E+11	1.48E+11
3/28/22	48.52	17	4.645	261.53	13.08	1307.64	1.48E+11	1.48E+11
3/25/22	46.73	18	4.918	251.89	12.59	1259.43	1.43E+11	1.43E+11
3/5/22	47.97	19	5.191	258.56	12.93	1292.81	1.47E+11	1.47E+11
2/18/22	45.46	20	5.464	245.03	12.25	1225.17	1.39E+11	1.39E+11
3/29/22	48.10	21	5.738	259.27	12.96	1296.37	1.47E+11	1.47E+11
3/24/22	44.87	22	6.011	241.88	12.09	1209.38	1.37E+11	1.37E+11
3/30/22	44.17	23	6.284	238.07	11.90	1190.35	1.35E+11	1.35E+11
3/7/22	46.75	24	6.557	252.00	12.60	1260.02	1.43E+11	1.43E+11
3/6/22	46.17	25	6.831	248.84	12.44	1244.21	1.41E+11	1.41E+11
3/8/22	47.66	26	7.104	256.88	12.84	1284.38	1.46E+11	1.46E+11
3/31/22	42.08	27	7.377	226.79	11.34	1133.95	1.29E+11	1.29E+11
3/9/22	46.71	28	7.650	251.78	12.59	1258.89	1.43E+11	1.43E+11
4/1/22	42.84	29	7.923	230.88	11.54	1154.41	1.31E+11	1.31E+11
4/2/22	43.21	30	8.197	232.91	11.65	1164.54	1.32E+11	1.32E+11
3/10/22	46.28	31	8.470	249.45	12.47	1247.24	1.42E+11	1.42E+11
3/23/22	40.68	32	8.743	219.24	10.96	1096.19	1.24E+11	1.24E+11
4/3/22	42.40	33	9.016	228.56	11.43	1142.81	1.30E+11	1.30E+11
5/8/22	40.80	34	9.290	219.93	11.00	1099.65	1.25E+11	1.25E+11
3/11/22	41.58	35	9.563	224.11	11.21	1120.53	1.27E+11	1.27E+11
5/9/22	39.87	36	9.836	214.92	10.75	1074.59	1.22E+11	1.22E+11
5/7/22	40.97	37	10.109	220.85	11.04	1104.25	1.25E+11	1.25E+11
4/4/22	40.21	38	10.383	216.73	10.84	1083.63	1.23E+11	1.23E+11
5/10/22	39.65	39	10.656	213.72	10.69	1068.61	1.21E+11	1.21E+11
4/5/22	41.96	40	10.929	226.19	11.31	1130.93	1.28E+11	1.28E+11
4/7/22	40.05	41	11.202	215.87	10.79	1079.34	1.22E+11	1.22E+11
5/11/22	40.46	42	11.475	218.08	10.90	1090.38	1.24E+11	1.24E+11
4/6/22	39.55	43	11.749	213.20	10.66	1066.00	1.21E+11	1.21E+11
4/8/22	37.16	44	12.022	200.31	10.02	1001.53	1.14E+11	1.14E+11
3/12/22	40.72	45	12.295	219.50	10.98	1097.51	1.25E+11	1.25E+11
4/15/22	38.99	46	12.568	210.18	10.51	1050.90	1.19E+11	1.19E+11
4/16/22	38.68	47	12.842	208.47	10.42	1042.33	1.18E+11	1.18E+11
4/9/22	39.45	48	13.115	212.63	10.63	1063.13	1.21E+11	1.21E+11
5/12/22	38.16	49	13.388	205.69	10.28	1028.45	1.17E+11	1.17E+11
3/22/22	38.38	50	13.661	206.87	10.34	1034.33	1.17E+11	1.17E+11
4/17/22	39.55	51	13.934	213.16	10.66	1065.81	1.21E+11	1.21E+11
4/14/22	36.79	52	14.208	198.28	9.91	991.39	1.13E+11	1.13E+11
3/21/22	39.10	53	14.481	210.77	10.54	1053.86	1.20E+11	1.20E+11
5/6/22	35.85	54	14.754	193.24	9.66	966.21	1.10E+11	1.10E+11
4/10/22	38.49	55	15.027	207.48	10.37	1037.38	1.18E+11	1.18E+11
3/13/22	38.14	56	15.301	205.57	10.28	1027.83	1.17E+11	1.17E+11
4/18/22	36.35	57	15.574	195.95	9.80	979.73	1.11E+11	1.11E+11
5/13/22	36.30	58	15.847	195.68	9.78	978.39	1.11E+11	1.11E+11
4/19/22	37.29	59	16.120	200.97	10.05	1004.84	1.14E+11	1.14E+11
3/20/22	36.53	60	16.393	196.92	9.85	984.59	1.12E+11	1.12E+11

4/20/22	35.78	61	16.667	192.84	9.64	964.19	1.09E+11	1.09E+11
4/11/22	38.04	62	16.940	205.01	10.25	1025.07	1.16E+11	1.16E+11
5/14/22	35.12	63	17.213	189.32	9.47	946.58	1.07E+11	1.07E+11
3/14/22	37.94	64	17.486	204.48	10.22	1022.39	1.16E+11	1.16E+11
4/13/22	32.16	65	17.760	173.33	8.67	866.65	9.83E+10	9.83E+10
4/21/22	33.94	66	18.033	182.93	9.15	914.63	1.04E+11	1.04E+11
4/12/22	36.23	67	18.306	195.29	9.76	976.44	1.11E+11	1.11E+11
2/17/22	32.40	68	18.579	174.64	8.73	873.20	9.91E+10	9.91E+10
4/22/22	36.13	69	18.852	194.76	9.74	973.80	1.11E+11	1.11E+11
5/15/22	34.21	70	19.126	184.41	9.22	922.06	1.05E+11	1.05E+11
5/5/22	34.42	71	19.399	185.53	9.28	927.65	1.05E+11	1.05E+11
3/15/22	36.64	72	19.672	197.46	9.87	987.32	1.12E+11	1.12E+11
4/23/22	32.94	73	19.945	177.54	8.88	887.68	1.01E+11	1.01E+11
4/25/22	34.42	74	20.219	185.52	9.28	927.58	1.05E+11	1.05E+11
4/24/22	31.41	75	20.492	169.33	8.47	846.63	9.61E+10	9.61E+10
5/4/22	34.01	76	20.765	183.34	9.17	916.69	1.04E+11	1.04E+11
4/26/22	33.58	77	21.038	180.98	9.05	904.89	1.03E+11	1.03E+11
3/16/22	34.71	78	21.311	187.08	9.35	935.39	1.06E+11	1.06E+11
5/16/22	32.59	79	21.585	175.67	8.78	878.37	9.97E+10	9.97E+10
3/19/22	32.12	80	21.858	173.12	8.66	865.60	9.82E+10	9.82E+10
4/27/22	33.43	81	22.131	180.19	9.01	900.94	1.02E+11	1.02E+11
3/17/22	34.02	82	22.404	183.38	9.17	916.92	1.04E+11	1.04E+11
4/28/22	31.39	83	22.678	169.17	8.46	845.87	9.60E+10	9.60E+10
5/17/22	30.62	84	22.951	165.02	8.25	825.09	9.36E+10	9.36E+10
3/18/22	30.62	85	23.224	165.03	8.25	825.15	9.36E+10	9.36E+10
5/3/22	30.47	86	23.497	164.22	8.21	821.11	9.32E+10	9.32E+10
4/29/22	30.19	87	23.770	162.75	8.14	813.75	9.23E+10	9.23E+10
5/18/22	29.10	88	24.044	156.83	7.84	784.16	8.90E+10	8.90E+10
5/1/22	29.05	89	24.317	156.60	7.83	783.01	8.89E+10	8.89E+10
6/11/22	29.82	90	24.590	160.73	8.04	803.67	9.12E+10	9.12E+10
6/12/22	29.55	91	24.863	159.25	7.96	796.27	9.04E+10	9.04E+10
4/30/22	28.24	92	25.137	152.23	7.61	761.17	8.64E+10	8.64E+10
5/2/22	29.84	93	25.410	160.84	8.04	804.21	9.13E+10	9.13E+10
6/10/22	29.37	94	25.683	158.31	7.92	791.56	8.98E+10	8.98E+10
5/19/22	28.22	95	25.956	152.10	7.61	760.52	8.63E+10	8.63E+10
6/13/22	29.27	96	26.230	157.74	7.89	788.72	8.95E+10	8.95E+10
6/9/22	28.90	97	26.503	155.75	7.79	778.76	8.84E+10	8.84E+10
6/14/22	29.14	98	26.776	157.08	7.85	785.39	8.91E+10	8.91E+10
5/20/22	27.16	99	27.049	146.39	7.32	731.97	8.31E+10	8.31E+10
6/15/22	28.25	100	27.322	152.25	7.61	761.25	8.64E+10	8.64E+10
6/8/22	26.59	101	27.596	143.32	7.17	716.60	8.13E+10	8.13E+10
6/2/22	26.97	102	27.869	145.38	7.27	726.91	8.25E+10	8.25E+10
5/21/22	26.41	103	28.142	142.38	7.12	711.88	8.08E+10	8.08E+10
6/1/22	26.19	104	28.415	141.14	7.06	705.72	8.01E+10	8.01E+10
5/30/22	26.65	105	28.689	143.65	7.18	718.25	8.15E+10	8.15E+10
7/28/22	24.73	106	28.962	133.32	6.67	666.58	7.56E+10	7.56E+10
6/3/22	26.27	107	29.235	141.59	7.08	707.97	8.03E+10	8.03E+10
7/27/22	24.70	108	29.508	133.16	6.66	665.78	7.56E+10	7.56E+10
5/31/22	26.69	109	29.781	143.86	7.19	719.32	8.16E+10	8.16E+10
7/29/22	24.65	110	30.055	132.87	6.64	664.36	7.54E+10	7.54E+10
5/29/22	25.80	111	30.328	139.05	6.95	695.25	7.89E+10	7.89E+10
7/26/22	23.74	112	30.601	127.97	6.40	639.84	7.26E+10	7.26E+10
5/22/22	25.41	113	30.874	136.93	6.85	684.67	7.77E+10	7.77E+10
6/7/22	25.76	114	31.148	138.86	6.94	694.29	7.88E+10	7.88E+10
6/16/22	26.56	115	31.421	143.17	7.16	715.87	8.12E+10	8.12E+10
6/4/22	25.34	116	31.694	136.57	6.83	682.87	7.75E+10	7.75E+10
7/30/22	23.57	117	31.967	127.03	6.35	635.16	7.21E+10	7.21E+10
7/25/22	23.18	118	32.240	124.95	6.25	624.77	7.09E+10	7.09E+10
5/23/22	23.90	119	32.514	128.80	6.44	644.01	7.31E+10	7.31E+10
6/5/22	24.09	120	32.787	129.84	6.49	649.18	7.37E+10	7.37E+10
7/31/22	22.51	121	33.060	121.35	6.07	606.76	6.89E+10	6.89E+10

6/17/22	24.50	122	33.333	132.03	6.60	660.16	7.49E+10	7.49E+10
6/6/22	22.89	123	33.607	123.37	6.17	616.86	7.00E+10	7.00E+10
5/28/22	23.65	124	33.880	127.50	6.37	637.49	7.23E+10	7.23E+10
5/24/22	22.50	125	34.153	121.25	6.06	606.26	6.88E+10	6.88E+10
7/24/22	21.60	126	34.426	116.42	5.82	582.08	6.61E+10	6.61E+10
8/1/22	21.40	127	34.699	115.33	5.77	576.63	6.54E+10	6.54E+10
2/16/22	18.89	128	34.973	101.84	5.09	509.20	5.78E+10	5.78E+10
5/27/22	23.05	129	35.246	124.25	6.21	621.25	7.05E+10	7.05E+10
5/25/22	22.21	130	35.519	119.70	5.98	598.49	6.79E+10	6.79E+10
5/26/22	22.84	131	35.792	123.08	6.15	615.42	6.98E+10	6.98E+10
6/18/22	22.77	132	36.066	122.73	6.14	613.66	6.96E+10	6.96E+10
8/2/22	20.12	133	36.339	108.44	5.42	542.22	6.15E+10	6.15E+10
2/13/22	20.85	134	36.612	112.38	5.62	561.88	6.38E+10	6.38E+10
2/14/22	20.69	135	36.885	111.52	5.58	557.59	6.33E+10	6.33E+10
2/15/22	20.32	136	37.158	109.51	5.48	547.55	6.21E+10	6.21E+10
8/3/22	18.77	137	37.432	101.18	5.06	505.91	5.74E+10	5.74E+10
7/8/22	20.42	138	37.705	110.07	5.50	550.36	6.25E+10	6.25E+10
7/9/22	20.37	139	37.978	109.79	5.49	548.93	6.23E+10	6.23E+10
6/19/22	20.37	140	38.251	109.78	5.49	548.91	6.23E+10	6.23E+10
2/12/22	19.97	141	38.525	107.62	5.38	538.08	6.11E+10	6.11E+10
8/4/22	18.33	142	38.798	98.80	4.94	494.01	5.61E+10	5.61E+10
1/25/23	16.79	143	39.071	90.48	4.52	452.39	5.13E+10	5.13E+10
1/23/23	16.31	144	39.344	87.89	4.39	439.47	4.99E+10	4.99E+10
1/22/23	16.72	145	39.617	90.09	4.50	450.47	5.11E+10	5.11E+10
1/26/23	16.39	146	39.891	88.34	4.42	441.69	5.01E+10	5.01E+10
7/10/22	20.00	147	40.164	107.82	5.39	539.08	6.12E+10	6.12E+10
7/23/22	17.64	148	40.437	95.08	4.75	475.38	5.39E+10	5.39E+10
1/24/23	15.79	149	40.710	85.12	4.26	425.61	4.83E+10	4.83E+10
1/27/23	15.17	150	40.984	81.74	4.09	408.72	4.64E+10	4.64E+10
7/7/22	19.76	151	41.257	106.49	5.32	532.46	6.04E+10	6.04E+10
1/8/23	16.64	152	41.530	89.66	4.48	448.32	5.09E+10	5.09E+10
1/28/23	16.41	153	41.803	88.45	4.42	442.27	5.02E+10	5.02E+10
1/21/23	15.71	154	42.077	84.67	4.23	423.34	4.80E+10	4.80E+10
1/7/23	16.39	155	42.350	88.36	4.42	441.81	5.01E+10	5.01E+10
1/29/23	15.83	156	42.623	85.33	4.27	426.65	4.84E+10	4.84E+10
1/6/23	16.00	157	42.896	86.25	4.31	431.23	4.89E+10	4.89E+10
8/5/22	16.59	158	43.169	89.40	4.47	447.00	5.07E+10	5.07E+10
1/9/23	16.18	159	43.443	87.21	4.36	436.06	4.95E+10	4.95E+10
7/11/22	19.23	160	43.716	103.65	5.18	518.27	5.88E+10	5.88E+10
1/30/23	16.10	161	43.989	86.76	4.34	433.80	4.92E+10	4.92E+10
1/10/23	16.14	162	44.262	86.98	4.35	434.91	4.94E+10	4.94E+10
1/5/23	15.60	163	44.536	84.09	4.20	420.47	4.77E+10	4.77E+10
2/7/22	17.68	164	44.809	95.28	4.76	476.38	5.41E+10	5.41E+10
1/20/23	15.35	165	45.082	82.73	4.14	413.64	4.69E+10	4.69E+10
1/31/23	15.22	166	45.355	82.04	4.10	410.19	4.65E+10	4.65E+10
2/8/22	17.05	167	45.628	91.90	4.60	459.51	5.21E+10	5.21E+10
6/20/22	18.83	168	45.902	101.50	5.07	507.50	5.76E+10	5.76E+10
2/6/22	15.62	169	46.175	84.18	4.21	420.88	4.78E+10	4.78E+10
1/12/23	15.68	170	46.448	84.53	4.23	422.67	4.80E+10	4.80E+10
2/3/22	17.96	171	46.721	96.82	4.84	484.12	5.49E+10	5.49E+10
8/6/22	15.94	172	46.995	85.90	4.30	429.51	4.87E+10	4.87E+10
7/12/22	17.97	173	47.268	96.87	4.84	484.35	5.50E+10	5.50E+10
2/4/22	15.89	174	47.541	85.64	4.28	428.21	4.86E+10	4.86E+10
2/5/22	17.13	175	47.814	92.35	4.62	461.74	5.24E+10	5.24E+10
1/4/23	14.86	176	48.087	80.09	4.00	400.46	4.54E+10	4.54E+10
1/13/23	15.02	177	48.361	80.94	4.05	404.71	4.59E+10	4.59E+10
2/11/22	14.80	178	48.634	79.75	3.99	398.75	4.52E+10	4.52E+10
1/19/23	14.63	179	48.907	78.87	3.94	394.37	4.48E+10	4.48E+10
1/14/23	14.74	180	49.180	79.47	3.97	397.35	4.51E+10	4.51E+10
2/9/22	16.13	181	49.454	86.97	4.35	434.83	4.93E+10	4.93E+10
8/7/22	15.10	182	49.727	81.40	4.07	407.00	4.62E+10	4.62E+10

1/15/23	14.20	183	50.000	76.53	3.83	382.63	4.34E+10	4.34E+10
8/8/22	14.47	184	50.273	77.97	3.90	389.87	4.42E+10	4.42E+10
2/2/22	16.92	185	50.546	91.19	4.56	455.94	5.17E+10	5.17E+10
7/13/22	16.53	186	50.820	89.08	4.45	445.42	5.05E+10	5.05E+10
2/10/22	16.36	187	51.093	88.19	4.41	440.93	5.00E+10	5.00E+10
8/9/22	14.15	188	51.366	76.25	3.81	381.23	4.33E+10	4.33E+10
6/21/22	16.79	189	51.639	90.48	4.52	452.42	5.13E+10	5.13E+10
1/16/23	13.92	190	51.913	75.06	3.75	375.28	4.26E+10	4.26E+10
1/3/23	12.83	191	52.186	69.14	3.46	345.68	3.92E+10	3.92E+10
1/17/23	13.24	192	52.459	71.38	3.57	356.88	4.05E+10	4.05E+10
7/14/22	15.37	193	52.732	82.84	4.14	414.18	4.70E+10	4.70E+10
1/18/23	12.78	194	53.005	68.89	3.44	344.45	3.91E+10	3.91E+10
7/22/22	12.90	195	53.279	69.55	3.48	347.76	3.95E+10	3.95E+10
8/10/22	13.52	196	53.552	72.89	3.64	364.44	4.14E+10	4.14E+10
8/22/22	12.93	197	53.825	69.71	3.49	348.55	3.96E+10	3.96E+10
12/2/22	9.39	198	54.098	50.62	2.53	253.09	2.87E+10	2.87E+10
12/1/22	11.07	199	54.372	59.68	2.98	298.39	3.39E+10	3.39E+10
7/15/22	13.76	200	54.645	74.19	3.71	370.94	4.21E+10	4.21E+10
7/6/22	14.27	201	54.918	76.92	3.85	384.62	4.36E+10	4.36E+10
12/4/22	11.19	202	55.191	60.32	3.02	301.59	3.42E+10	3.42E+10
1/2/23	12.26	203	55.464	66.09	3.30	330.44	3.75E+10	3.75E+10
12/3/22	11.48	204	55.738	61.85	3.09	309.26	3.51E+10	3.51E+10
11/30/22	11.04	205	56.011	59.50	2.98	297.50	3.38E+10	3.38E+10
6/22/22	14.71	206	56.284	79.31	3.97	396.54	4.50E+10	4.50E+10
7/16/22	13.00	207	56.557	70.07	3.50	350.37	3.98E+10	3.98E+10
8/21/22	12.28	208	56.831	66.21	3.31	331.04	3.76E+10	3.76E+10
12/5/22	10.97	209	57.104	59.14	2.96	295.68	3.36E+10	3.36E+10
11/29/22	8.89	210	57.377	47.90	2.40	239.51	2.72E+10	2.72E+10
8/11/22	12.31	211	57.650	66.37	3.32	331.87	3.77E+10	3.77E+10
1/1/23	11.06	212	57.923	59.62	2.98	298.08	3.38E+10	3.38E+10
12/6/22	11.35	213	58.197	61.15	3.06	305.76	3.47E+10	3.47E+10
8/23/22	11.43	214	58.470	61.61	3.08	308.05	3.50E+10	3.50E+10
7/17/22	12.86	215	58.743	69.33	3.47	346.63	3.93E+10	3.93E+10
1/11/23	14.81	216	59.016	79.84	3.99	399.19	4.53E+10	4.53E+10
12/7/22	10.63	217	59.290	57.29	2.86	286.44	3.25E+10	3.25E+10
7/18/22	12.55	218	59.563	67.62	3.38	338.12	3.84E+10	3.84E+10
12/8/22	10.38	219	59.836	55.96	2.80	279.81	3.18E+10	3.18E+10
8/31/22	10.22	220	60.109	55.08	2.75	275.42	3.13E+10	3.13E+10
12/9/22	8.78	221	60.383	47.33	2.37	236.67	2.69E+10	2.69E+10
8/30/22	10.43	222	60.656	56.24	2.81	281.20	3.19E+10	3.19E+10
12/10/22	9.28	223	60.929	50.00	2.50	250.01	2.84E+10	2.84E+10
12/31/22	10.16	224	61.202	54.76	2.74	273.81	3.11E+10	3.11E+10
2/1/22	11.44	225	61.475	61.64	3.08	308.21	3.50E+10	3.50E+10
8/12/22	10.61	226	61.749	57.16	2.86	285.81	3.24E+10	3.24E+10
7/19/22	11.02	227	62.022	59.42	2.97	297.09	3.37E+10	3.37E+10
8/24/22	9.68	228	62.295	52.15	2.61	260.77	2.96E+10	2.96E+10
11/28/22	8.16	229	62.568	44.00	2.20	220.02	2.50E+10	2.50E+10
12/11/22	9.44	230	62.842	50.86	2.54	254.32	2.89E+10	2.89E+10
6/23/22	12.52	231	63.115	67.46	3.37	337.32	3.83E+10	3.83E+10
8/15/22	9.67	232	63.388	52.14	2.61	260.72	2.96E+10	2.96E+10
9/1/22	8.94	233	63.661	48.19	2.41	240.93	2.73E+10	2.73E+10
12/12/22	9.65	234	63.934	52.01	2.60	260.03	2.95E+10	2.95E+10
8/14/22	9.81	235	64.208	52.90	2.65	264.50	3.00E+10	3.00E+10
12/16/22	8.23	236	64.481	44.36	2.22	221.80	2.52E+10	2.52E+10
12/13/22	8.15	237	64.754	43.95	2.20	219.73	2.49E+10	2.49E+10
12/15/22	7.69	238	65.027	41.43	2.07	207.14	2.35E+10	2.35E+10
12/17/22	8.57	239	65.301	46.21	2.31	231.05	2.62E+10	2.62E+10
8/13/22	9.52	240	65.574	51.29	2.56	256.43	2.91E+10	2.91E+10
7/20/22	9.80	241	65.847	52.84	2.64	264.19	3.00E+10	3.00E+10
8/16/22	9.07	242	66.120	48.91	2.45	244.57	2.78E+10	2.78E+10
12/14/22	8.49	243	66.393	45.75	2.29	228.76	2.60E+10	2.60E+10

12/24/22	5.59	244	66.667	30.11	1.51	150.55	1.71E+10	1.71E+10
8/25/22	8.95	245	66.940	48.24	2.41	241.20	2.74E+10	2.74E+10
9/2/22	8.49	246	67.213	45.77	2.29	228.83	2.60E+10	2.60E+10
12/18/22	8.49	247	67.486	45.77	2.29	228.87	2.60E+10	2.60E+10
12/23/22	5.53	248	67.760	29.79	1.49	148.95	1.69E+10	1.69E+10
12/20/22	8.55	249	68.033	46.10	2.30	230.48	2.62E+10	2.62E+10
10/23/22	7.97	250	68.306	42.94	2.15	214.68	2.44E+10	2.44E+10
12/19/22	8.46	251	68.579	45.61	2.28	228.03	2.59E+10	2.59E+10
12/27/22	4.49	252	68.852	24.23	1.21	121.13	1.37E+10	1.37E+10
12/26/22	5.72	253	69.126	30.82	1.54	154.08	1.75E+10	1.75E+10
12/30/22	7.43	254	69.399	40.04	2.00	200.22	2.27E+10	2.27E+10
7/21/22	9.20	255	69.672	49.61	2.48	248.05	2.81E+10	2.81E+10
8/17/22	8.34	256	69.945	44.97	2.25	224.86	2.55E+10	2.55E+10
6/24/22	10.67	257	70.219	57.53	2.88	287.67	3.26E+10	3.26E+10
12/21/22	8.56	258	70.492	46.11	2.31	230.57	2.62E+10	2.62E+10
12/28/22	4.10	259	70.765	22.09	1.10	110.45	1.25E+10	1.25E+10
12/25/22	4.85	260	71.038	26.16	1.31	130.80	1.48E+10	1.48E+10
9/3/22	8.08	261	71.311	43.54	2.18	217.72	2.47E+10	2.47E+10
8/26/22	7.97	262	71.585	42.98	2.15	214.88	2.44E+10	2.44E+10
12/22/22	8.30	263	71.858	44.74	2.24	223.68	2.54E+10	2.54E+10
8/29/22	7.27	264	72.131	39.19	1.96	195.97	2.22E+10	2.22E+10
8/27/22	8.09	265	72.404	43.61	2.18	218.03	2.47E+10	2.47E+10
9/4/22	7.72	266	72.678	41.64	2.08	208.18	2.36E+10	2.36E+10
8/18/22	7.99	267	72.951	43.05	2.15	215.27	2.44E+10	2.44E+10
12/29/22	4.62	268	73.224	24.92	1.25	124.59	1.41E+10	1.41E+10
10/24/22	6.77	269	73.497	36.47	1.82	182.35	2.07E+10	2.07E+10
8/19/22	7.67	270	73.770	41.32	2.07	206.61	2.34E+10	2.34E+10
8/28/22	7.60	271	74.044	40.94	2.05	204.69	2.32E+10	2.32E+10
8/20/22	7.27	272	74.317	39.21	1.96	196.05	2.22E+10	2.22E+10
9/5/22	7.49	273	74.590	40.39	2.02	201.93	2.29E+10	2.29E+10
6/25/22	9.62	274	74.863	51.88	2.59	259.38	2.94E+10	2.94E+10
9/6/22	7.14	275	75.137	38.49	1.92	192.43	2.18E+10	2.18E+10
10/25/22	5.81	276	75.410	31.31	1.57	156.55	1.78E+10	1.78E+10
10/26/22	6.28	277	75.683	33.84	1.69	169.22	1.92E+10	1.92E+10
10/27/22	6.21	278	75.956	33.48	1.67	167.40	1.90E+10	1.90E+10
11/27/22	5.61	279	76.230	30.26	1.51	151.32	1.72E+10	1.72E+10
10/28/22	6.24	280	76.503	33.61	1.68	168.05	1.91E+10	1.91E+10
9/7/22	7.18	281	76.776	38.68	1.93	193.40	2.19E+10	2.19E+10
9/27/22	7.41	282	77.049	39.95	2.00	199.73	2.27E+10	2.27E+10
10/29/22	5.91	283	77.322	31.83	1.59	159.14	1.81E+10	1.81E+10
6/26/22	8.74	284	77.596	47.11	2.36	235.56	2.67E+10	2.67E+10
9/28/22	7.05	285	77.869	37.98	1.90	189.88	2.15E+10	2.15E+10
10/30/22	5.82	286	78.142	31.39	1.57	156.96	1.78E+10	1.78E+10
11/1/22	5.50	287	78.415	29.64	1.48	148.19	1.68E+10	1.68E+10
10/31/22	5.55	288	78.689	29.89	1.49	149.44	1.70E+10	1.70E+10
11/2/22	5.79	289	78.962	31.21	1.56	156.04	1.77E+10	1.77E+10
11/4/22	5.50	290	79.235	29.63	1.48	148.14	1.68E+10	1.68E+10
11/3/22	5.82	291	79.508	31.36	1.57	156.81	1.78E+10	1.78E+10
9/26/22	7.04	292	79.781	37.97	1.90	189.84	2.15E+10	2.15E+10
9/8/22	6.69	293	80.055	36.05	1.80	180.27	2.05E+10	2.05E+10
11/5/22	5.19	294	80.328	27.96	1.40	139.82	1.59E+10	1.59E+10
10/19/22	5.43	295	80.601	29.29	1.46	146.46	1.66E+10	1.66E+10
9/29/22	6.66	296	80.874	35.92	1.80	179.58	2.04E+10	2.04E+10
10/22/22	5.62	297	81.148	30.29	1.51	151.47	1.72E+10	1.72E+10
11/7/22	5.44	298	81.421	29.31	1.47	146.55	1.66E+10	1.66E+10
11/6/22	5.38	299	81.694	29.02	1.45	145.08	1.65E+10	1.65E+10
11/8/22	5.88	300	81.967	31.68	1.58	158.42	1.80E+10	1.80E+10
10/20/22	5.41	301	82.240	29.14	1.46	145.71	1.65E+10	1.65E+10
11/9/22	5.38	302	82.514	29.01	1.45	145.04	1.65E+10	1.65E+10
9/9/22	6.05	303	82.787	32.59	1.63	162.93	1.85E+10	1.85E+10
9/30/22	6.60	304	83.060	35.59	1.78	177.95	2.02E+10	2.02E+10

11/10/22	4.90	305	83.333	26.39	1.32	131.95	1.50E+10	1.50E+10
9/12/22	6.72	306	83.607	36.23	1.81	181.13	2.06E+10	2.06E+10
11/11/22	5.48	307	83.880	29.56	1.48	147.82	1.68E+10	1.68E+10
10/18/22	4.86	308	84.153	26.20	1.31	131.01	1.49E+10	1.49E+10
6/27/22	7.56	309	84.426	40.77	2.04	203.87	2.31E+10	2.31E+10
10/21/22	5.15	310	84.699	27.75	1.39	138.75	1.57E+10	1.57E+10
9/11/22	5.05	311	84.973	27.21	1.36	136.06	1.54E+10	1.54E+10
11/12/22	4.88	312	85.246	26.33	1.32	131.64	1.49E+10	1.49E+10
11/13/22	5.00	313	85.519	26.96	1.35	134.79	1.53E+10	1.53E+10
9/13/22	6.35	314	85.792	34.23	1.71	171.14	1.94E+10	1.94E+10
11/14/22	5.35	315	86.066	28.82	1.44	144.10	1.64E+10	1.64E+10
9/10/22	5.34	316	86.339	28.78	1.44	143.92	1.63E+10	1.63E+10
10/1/22	6.36	317	86.612	34.27	1.71	171.34	1.94E+10	1.94E+10
11/15/22	5.18	318	86.885	27.91	1.40	139.53	1.58E+10	1.58E+10
9/14/22	5.87	319	87.158	31.66	1.58	158.29	1.80E+10	1.80E+10
11/16/22	4.54	320	87.432	24.46	1.22	122.32	1.39E+10	1.39E+10
11/17/22	4.53	321	87.705	24.42	1.22	122.09	1.39E+10	1.39E+10
9/15/22	5.67	322	87.978	30.54	1.53	152.70	1.73E+10	1.73E+10
11/26/22	4.63	323	88.251	24.98	1.25	124.88	1.42E+10	1.42E+10
9/25/22	5.22	324	88.525	28.16	1.41	140.81	1.60E+10	1.60E+10
9/21/22	5.79	325	88.798	31.21	1.56	156.03	1.77E+10	1.77E+10
11/18/22	4.47	326	89.071	24.10	1.21	120.52	1.37E+10	1.37E+10
11/25/22	4.70	327	89.344	25.32	1.27	126.59	1.44E+10	1.44E+10
11/19/22	4.36	328	89.617	23.51	1.18	117.53	1.33E+10	1.33E+10
9/22/22	6.03	329	89.891	32.52	1.63	162.60	1.85E+10	1.85E+10
9/16/22	5.42	330	90.164	29.20	1.46	145.98	1.66E+10	1.66E+10
11/24/22	4.30	331	90.437	23.19	1.16	115.95	1.32E+10	1.32E+10
10/2/22	6.00	332	90.710	32.33	1.62	161.67	1.83E+10	1.83E+10
11/22/22	4.42	333	90.984	23.81	1.19	119.06	1.35E+10	1.35E+10
11/21/22	4.03	334	91.257	21.70	1.09	108.50	1.23E+10	1.23E+10
11/23/22	4.25	335	91.530	22.90	1.14	114.48	1.30E+10	1.30E+10
9/20/22	5.31	336	91.803	28.64	1.43	143.22	1.63E+10	1.63E+10
6/28/22	6.19	337	92.077	33.34	1.67	166.72	1.89E+10	1.89E+10
11/20/22	4.26	338	92.350	22.96	1.15	114.80	1.30E+10	1.30E+10
9/17/22	4.96	339	92.623	26.73	1.34	133.66	1.52E+10	1.52E+10
9/23/22	5.52	340	92.896	29.77	1.49	148.84	1.69E+10	1.69E+10
9/19/22	5.47	341	93.169	29.46	1.47	147.30	1.67E+10	1.67E+10
9/18/22	5.20	342	93.443	28.05	1.40	140.25	1.59E+10	1.59E+10
10/3/22	5.51	343	93.716	29.68	1.48	148.38	1.68E+10	1.68E+10
9/24/22	4.92	344	93.989	26.51	1.33	132.54	1.50E+10	1.50E+10
7/5/22	5.49	345	94.262	29.57	1.48	147.87	1.68E+10	1.68E+10
10/4/22	4.99	346	94.536	26.92	1.35	134.61	1.53E+10	1.53E+10
6/29/22	5.53	347	94.809	29.80	1.49	148.99	1.69E+10	1.69E+10
10/5/22	5.15	348	95.082	27.75	1.39	138.74	1.57E+10	1.57E+10
10/17/22	3.14	349	95.355	16.94	0.85	84.68	9.61E+09	9.61E+09
10/6/22	4.21	350	95.628	22.67	1.13	113.36	1.29E+10	1.29E+10
6/30/22	4.90	351	95.902	26.42	1.32	132.11	1.50E+10	1.50E+10
10/7/22	4.79	352	96.175	25.81	1.29	129.04	1.46E+10	1.46E+10
7/1/22	4.85	353	96.448	26.13	1.31	130.63	1.48E+10	1.48E+10
7/2/22	4.93	354	96.721	26.55	1.33	132.73	1.51E+10	1.51E+10
10/8/22	4.04	355	96.995	21.78	1.09	108.90	1.24E+10	1.24E+10
10/16/22	2.64	356	97.268	14.24	0.71	71.18	8.08E+09	8.08E+09
10/9/22	3.08	357	97.541	16.61	0.83	83.04	9.42E+09	9.42E+09
7/3/22	4.28	358	97.814	23.07	1.15	115.37	1.31E+10	1.31E+10
10/13/22	3.99	359	98.087	21.52	1.08	107.62	1.22E+10	1.22E+10
10/10/22	2.95	360	98.361	15.90	0.79	79.49	9.02E+09	9.02E+09
10/15/22	2.46	361	98.634	13.29	0.66	66.43	7.54E+09	7.54E+09
10/14/22	2.53	362	98.907	13.64	0.68	68.22	7.74E+09	7.74E+09
10/11/22	2.84	363	99.180	15.29	0.76	76.47	8.68E+09	8.68E+09
10/12/22	2.77	364	99.454	14.94	0.75	74.68	8.47E+09	8.47E+09
7/4/22	4.23	365	99.727	22.82	1.14	114.12	1.30E+10	1.30E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 15 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	107.74	2.77	0.126	10.8	83.9	0.819672131	1608.636415	73.1726311	6271.939812	2.21E+11	21	33781.36471	1536.625254	131710.7361	4.64E+12
3/15/22	21.28	2.41	0.05	10	11	19.67213115	276.4372833	5.73521335	1147.042669	5.73E+09	35	9675.304915	200.7324671	40146.49342	2.00E+11
4/19/22	25.03	3.54	0.05	0.8	60	16.12021858	477.602494	6.74579794	107.932767	3.67E+10	35	16716.08729	236.1029278	3777.646845	1.29E+12
5/24/22	9.36	4.58	0.05	5.2	99.0	34.15300546	231.0677587	2.52257378	262.3476736	2.27E+10	28	6469.897243	70.63206597	7345.734861	6.35E+11
6/21/22	7.59	4.49	0.05	8.8	225.0	51.63934426	183.6538683	2.0451433	359.9452207	4.18E+10	28	5142.308312	57.26401239	10078.46618	1.17E+12
7/19/22	9.88	3.59	0.05	6.4	488.0	62.02185792	191.2239871	2.66328673	340.9007012	1.18E+11	35	6692.839547	93.21503548	11931.52454	4.13E+12
8/23/22	3.25	4.54	0.05	2.8	345.0	58.46994536	79.51384967	0.87570319	49.03937865	2.74E+10	28	2226.387791	24.51968933	1373.102602	7.68E+11
9/20/22	2.74	3.70	0.050	4.4	687.0	91.80327869	54.69129728	0.738122	64.95473607	4.60E+10	36	1968.886702	26.57239203	2338.370499	1.66E+12
10/26/22	5.02	2.48	0.050	26.4	866.0	75.68306011	67.17826689	1.35172979	713.7133268	1.06E+11	13	873.3174695	17.57248721	9278.273248	1.38E+12
11/8/22	3.63	2.26	0.050	3.6	172.0	81.96721311	44.24816449	0.97937504	70.51500317	1.53E+10	35	1548.685757	34.27812654	2468.025111	5.35E+11
12/13/22	4.73	4.90	0.050	6.4	105.0	64.75409836	124.8919704	1.27440786	163.1242062	1.21E+10	36	4496.110935	45.87868301	5872.471425	4.37E+11
1/18/23	9.20	0.30	0.050	6.0	49.0	53.00546448	14.86913563	2.47818927	297.3827127	1.10E+10	37	550.1580184	91.69300307	11003.16037	4.08E+11
2/24/23															

Conversion Factor	5.39	5.39	5.39	2.45E+07		TOTAL	90,141.3	2,435.1	237,324.0	1.73E+13
						TARGET	37,983.4	1,899.2	189,916.8	2.16E+13

Site 16 Date	E16	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	79.48	1	0.273	428.38	21.42	2141.88	2.43E+11	2.43E+11
2/24/22	80.25	2	0.546	432.57	21.63	2162.83	2.45E+11	2.45E+11
2/22/22	75.78	3	0.820	408.45	20.42	2042.25	2.32E+11	2.32E+11
2/25/22	78.12	4	1.093	421.06	21.05	2105.29	2.39E+11	2.39E+11
2/26/22	74.93	5	1.366	403.89	20.19	2019.47	2.29E+11	2.29E+11
2/21/22	73.38	6	1.639	395.50	19.78	1977.50	2.24E+11	2.24E+11
2/27/22	73.54	7	1.913	396.38	19.82	1981.92	2.25E+11	2.25E+11
2/20/22	65.57	8	2.186	353.44	17.67	1767.21	2.01E+11	2.01E+11
2/19/22	70.39	9	2.459	379.40	18.97	1897.01	2.15E+11	2.15E+11
2/28/22	70.45	10	2.732	379.72	18.99	1898.58	2.15E+11	2.15E+11
3/1/22	69.92	11	3.005	376.85	18.84	1884.25	2.14E+11	2.14E+11
3/2/22	67.66	12	3.279	364.67	18.23	1823.33	2.07E+11	2.07E+11
3/3/22	67.82	13	3.552	365.55	18.28	1827.74	2.07E+11	2.07E+11
3/4/22	67.15	14	3.825	361.96	18.10	1809.79	2.05E+11	2.05E+11
3/26/22	61.51	15	4.098	331.55	16.58	1657.77	1.88E+11	1.88E+11
3/27/22	61.75	16	4.372	332.82	16.64	1664.10	1.89E+11	1.89E+11
3/28/22	62.10	17	4.645	334.74	16.74	1673.71	1.90E+11	1.90E+11
3/25/22	59.81	18	4.918	322.40	16.12	1612.00	1.83E+11	1.83E+11
3/5/22	61.40	19	5.191	330.95	16.55	1654.73	1.88E+11	1.88E+11
2/18/22	58.19	20	5.464	313.63	15.68	1568.15	1.78E+11	1.78E+11
3/29/22	61.57	21	5.738	331.86	16.59	1659.29	1.88E+11	1.88E+11
3/24/22	57.44	22	6.011	309.59	15.48	1547.94	1.76E+11	1.76E+11
3/30/22	56.53	23	6.284	304.72	15.24	1523.59	1.73E+11	1.73E+11
3/7/22	59.84	24	6.557	322.55	16.13	1612.75	1.83E+11	1.83E+11
3/6/22	59.09	25	6.831	318.51	15.93	1592.53	1.81E+11	1.81E+11
3/8/22	61.00	26	7.104	328.79	16.44	1643.94	1.87E+11	1.87E+11
3/31/22	53.86	27	7.377	290.28	14.51	1451.40	1.65E+11	1.65E+11
3/9/22	59.79	28	7.650	322.26	16.11	1611.32	1.83E+11	1.83E+11
4/1/22	54.83	29	7.923	295.52	14.78	1477.59	1.68E+11	1.68E+11
4/2/22	55.31	30	8.197	298.11	14.91	1490.55	1.69E+11	1.69E+11
3/10/22	59.24	31	8.470	319.28	15.96	1596.40	1.81E+11	1.81E+11
3/23/22	52.06	32	8.743	280.61	14.03	1403.07	1.59E+11	1.59E+11
4/3/22	54.28	33	9.016	292.55	14.63	1462.73	1.66E+11	1.66E+11
5/8/22	52.23	34	9.290	281.50	14.07	1407.50	1.60E+11	1.60E+11
3/11/22	53.22	35	9.563	286.85	14.34	1434.23	1.63E+11	1.63E+11
5/9/22	51.04	36	9.836	275.08	13.75	1375.42	1.56E+11	1.56E+11
5/7/22	52.44	37	10.109	282.68	14.13	1413.39	1.60E+11	1.60E+11
4/4/22	51.47	38	10.383	277.40	13.87	1386.99	1.57E+11	1.57E+11
5/10/22	50.75	39	10.656	273.55	13.68	1367.77	1.55E+11	1.55E+11
4/5/22	53.71	40	10.929	289.51	14.48	1447.53	1.64E+11	1.64E+11
4/7/22	51.26	41	11.202	276.30	13.82	1381.50	1.57E+11	1.57E+11
5/11/22	51.79	42	11.475	279.13	13.96	1395.63	1.58E+11	1.58E+11
4/6/22	50.63	43	11.749	272.89	13.64	1364.43	1.55E+11	1.55E+11
4/8/22	47.57	44	12.022	256.38	12.82	1281.91	1.45E+11	1.45E+11
3/12/22	52.12	45	12.295	280.95	14.05	1404.75	1.59E+11	1.59E+11
4/15/22	49.91	46	12.568	269.02	13.45	1345.10	1.53E+11	1.53E+11
4/16/22	49.50	47	12.842	266.83	13.34	1334.13	1.51E+11	1.51E+11
4/9/22	50.49	48	13.115	272.15	13.61	1360.75	1.54E+11	1.54E+11
5/12/22	48.84	49	13.388	263.27	13.16	1316.36	1.49E+11	1.49E+11
3/22/22	49.12	50	13.661	264.78	13.24	1323.89	1.50E+11	1.50E+11
4/17/22	50.62	51	13.934	272.84	13.64	1364.18	1.55E+11	1.55E+11
4/14/22	47.08	52	14.208	253.78	12.69	1268.92	1.44E+11	1.44E+11
3/21/22	50.05	53	14.481	269.78	13.49	1348.88	1.53E+11	1.53E+11
5/6/22	45.89	54	14.754	247.34	12.37	1236.70	1.40E+11	1.40E+11
4/10/22	49.27	55	15.027	265.56	13.28	1327.79	1.51E+11	1.51E+11
3/13/22	48.82	56	15.301	263.11	13.16	1315.57	1.49E+11	1.49E+11
4/18/22	46.53	57	15.574	250.80	12.54	1254.01	1.42E+11	1.42E+11
5/13/22	46.47	58	15.847	250.46	12.52	1252.29	1.42E+11	1.42E+11
4/19/22	47.72	59	16.120	257.23	12.86	1286.14	1.46E+11	1.46E+11
3/20/22	46.76	60	16.393	252.04	12.60	1260.22	1.43E+11	1.43E+11

4/20/22	45.79	61	16.667	246.82	12.34	1234.11	1.40E+11	1.40E+11
4/11/22	48.68	62	16.940	262.41	13.12	1312.04	1.49E+11	1.49E+11
5/14/22	44.96	63	17.213	242.32	12.12	1211.58	1.37E+11	1.37E+11
3/14/22	48.56	64	17.486	261.72	13.09	1308.61	1.48E+11	1.48E+11
4/13/22	41.16	65	17.760	221.85	11.09	1109.26	1.26E+11	1.26E+11
4/21/22	43.44	66	18.033	234.14	11.71	1170.68	1.33E+11	1.33E+11
4/12/22	46.37	67	18.306	249.96	12.50	1249.79	1.42E+11	1.42E+11
2/17/22	41.47	68	18.579	223.53	11.18	1117.65	1.27E+11	1.27E+11
4/22/22	46.25	69	18.852	249.28	12.46	1246.41	1.41E+11	1.41E+11
5/15/22	43.79	70	19.126	236.04	11.80	1180.18	1.34E+11	1.34E+11
5/5/22	44.06	71	19.399	237.47	11.87	1187.35	1.35E+11	1.35E+11
3/15/22	46.89	72	19.672	252.74	12.64	1263.72	1.43E+11	1.43E+11
4/23/22	42.16	73	19.945	227.24	11.36	1136.18	1.29E+11	1.29E+11
4/25/22	44.05	74	20.219	237.45	11.87	1187.25	1.35E+11	1.35E+11
4/24/22	40.21	75	20.492	216.73	10.84	1083.65	1.23E+11	1.23E+11
5/4/22	43.54	76	20.765	234.66	11.73	1173.32	1.33E+11	1.33E+11
4/26/22	42.98	77	21.038	231.64	11.58	1158.21	1.31E+11	1.31E+11
3/16/22	44.43	78	21.311	239.45	11.97	1197.25	1.36E+11	1.36E+11
5/16/22	41.72	79	21.585	224.85	11.24	1124.26	1.28E+11	1.28E+11
3/19/22	41.11	80	21.858	221.59	11.08	1107.93	1.26E+11	1.26E+11
4/27/22	42.79	81	22.131	230.63	11.53	1153.16	1.31E+11	1.31E+11
3/17/22	43.55	82	22.404	234.72	11.74	1173.61	1.33E+11	1.33E+11
4/28/22	40.17	83	22.678	216.53	10.83	1082.66	1.23E+11	1.23E+11
5/17/22	39.19	84	22.951	211.22	10.56	1056.08	1.20E+11	1.20E+11
3/18/22	39.19	85	23.224	211.23	10.56	1056.14	1.20E+11	1.20E+11
5/3/22	39.00	86	23.497	210.20	10.51	1050.98	1.19E+11	1.19E+11
4/29/22	38.65	87	23.770	208.31	10.42	1041.56	1.18E+11	1.18E+11
5/18/22	37.24	88	24.044	200.74	10.04	1003.69	1.14E+11	1.14E+11
5/1/22	37.19	89	24.317	200.44	10.02	1002.21	1.14E+11	1.14E+11
6/11/22	38.17	90	24.590	205.73	10.29	1028.66	1.17E+11	1.17E+11
6/12/22	37.82	91	24.863	203.84	10.19	1019.19	1.16E+11	1.16E+11
4/30/22	36.15	92	25.137	194.85	9.74	974.26	1.11E+11	1.11E+11
5/2/22	38.19	93	25.410	205.87	10.29	1029.34	1.17E+11	1.17E+11
6/10/22	37.59	94	25.683	202.63	10.13	1013.16	1.15E+11	1.15E+11
5/19/22	36.12	95	25.956	194.68	9.73	973.42	1.10E+11	1.10E+11
6/13/22	37.46	96	26.230	201.91	10.10	1009.53	1.15E+11	1.15E+11
6/9/22	36.99	97	26.503	199.35	9.97	996.77	1.13E+11	1.13E+11
6/14/22	37.30	98	26.776	201.05	10.05	1005.26	1.14E+11	1.14E+11
5/20/22	34.76	99	27.049	187.38	9.37	936.88	1.06E+11	1.06E+11
6/15/22	36.15	100	27.322	194.87	9.74	974.35	1.11E+11	1.11E+11
6/8/22	34.03	101	27.596	183.44	9.17	917.21	1.04E+11	1.04E+11
6/2/22	34.52	102	27.869	186.08	9.30	930.40	1.06E+11	1.06E+11
5/21/22	33.81	103	28.142	182.23	9.11	911.17	1.03E+11	1.03E+11
6/1/22	33.52	104	28.415	180.66	9.03	903.29	1.03E+11	1.03E+11
5/30/22	34.11	105	28.689	183.86	9.19	919.32	1.04E+11	1.04E+11
7/28/22	31.66	106	28.962	170.64	8.53	853.19	9.68E+10	9.68E+10
6/3/22	33.62	107	29.235	181.23	9.06	906.17	1.03E+11	1.03E+11
7/27/22	31.62	108	29.508	170.43	8.52	852.16	9.67E+10	9.67E+10
5/31/22	34.16	109	29.781	184.14	9.21	920.69	1.04E+11	1.04E+11
7/29/22	31.55	110	30.055	170.07	8.50	850.35	9.65E+10	9.65E+10
5/29/22	33.02	111	30.328	177.98	8.90	889.88	1.01E+11	1.01E+11
7/26/22	30.39	112	30.601	163.79	8.19	818.96	9.29E+10	9.29E+10
5/22/22	32.52	113	30.874	175.27	8.76	876.34	9.94E+10	9.94E+10
6/7/22	32.97	114	31.148	177.73	8.89	888.66	1.01E+11	1.01E+11
6/16/22	34.00	115	31.421	183.25	9.16	916.27	1.04E+11	1.04E+11
6/4/22	32.43	116	31.694	174.81	8.74	874.04	9.92E+10	9.92E+10
7/30/22	30.17	117	31.967	162.59	8.13	812.97	9.23E+10	9.23E+10
7/25/22	29.67	118	32.240	159.93	8.00	799.67	9.07E+10	9.07E+10
5/23/22	30.59	119	32.514	164.86	8.24	824.30	9.35E+10	9.35E+10
6/5/22	30.83	120	32.787	166.18	8.31	830.92	9.43E+10	9.43E+10
7/31/22	28.82	121	33.060	155.32	7.77	776.62	8.81E+10	8.81E+10

6/17/22	31.35	122	33.333	169.00	8.45	844.98	9.59E+10	9.59E+10
6/6/22	29.30	123	33.607	157.91	7.90	789.55	8.96E+10	8.96E+10
5/28/22	30.28	124	33.880	163.19	8.16	815.96	9.26E+10	9.26E+10
5/24/22	28.79	125	34.153	155.20	7.76	775.98	8.81E+10	8.81E+10
7/24/22	27.64	126	34.426	149.01	7.45	745.03	8.45E+10	8.45E+10
8/1/22	27.39	127	34.699	147.61	7.38	738.06	8.38E+10	8.38E+10
2/16/22	24.18	128	34.973	130.35	6.52	651.74	7.40E+10	7.40E+10
5/27/22	29.51	129	35.246	159.03	7.95	795.16	9.02E+10	9.02E+10
5/25/22	28.42	130	35.519	153.21	7.66	766.04	8.69E+10	8.69E+10
5/26/22	29.23	131	35.792	157.54	7.88	787.70	8.94E+10	8.94E+10
6/18/22	29.14	132	36.066	157.09	7.85	785.45	8.91E+10	8.91E+10
8/2/22	25.75	133	36.339	138.80	6.94	694.01	7.88E+10	7.88E+10
2/13/22	26.69	134	36.612	143.84	7.19	719.18	8.16E+10	8.16E+10
2/14/22	26.48	135	36.885	142.74	7.14	713.68	8.10E+10	8.10E+10
2/15/22	26.00	136	37.158	140.17	7.01	700.83	7.95E+10	7.95E+10
8/3/22	24.03	137	37.432	129.51	6.48	647.54	7.35E+10	7.35E+10
7/8/22	26.14	138	37.705	140.89	7.04	704.43	7.99E+10	7.99E+10
7/9/22	26.07	139	37.978	140.52	7.03	702.60	7.97E+10	7.97E+10
6/19/22	26.07	140	38.251	140.51	7.03	702.57	7.97E+10	7.97E+10
2/12/22	25.56	141	38.525	137.74	6.89	688.71	7.82E+10	7.82E+10
8/4/22	23.46	142	38.798	126.46	6.32	632.30	7.18E+10	7.18E+10
1/25/23	21.49	143	39.071	115.81	5.79	579.03	6.57E+10	6.57E+10
1/23/23	20.87	144	39.344	112.50	5.62	562.50	6.38E+10	6.38E+10
1/22/23	21.39	145	39.617	115.32	5.77	576.58	6.54E+10	6.54E+10
1/26/23	20.98	146	39.891	113.07	5.65	565.34	6.42E+10	6.42E+10
7/10/22	25.60	147	40.164	138.00	6.90	689.99	7.83E+10	7.83E+10
7/23/22	22.58	148	40.437	121.69	6.08	608.47	6.90E+10	6.90E+10
1/24/23	20.21	149	40.710	108.95	5.45	544.76	6.18E+10	6.18E+10
1/27/23	19.41	150	40.984	104.63	5.23	523.14	5.94E+10	5.94E+10
7/7/22	25.29	151	41.257	136.30	6.82	681.52	7.73E+10	7.73E+10
1/8/23	21.29	152	41.530	114.77	5.74	573.83	6.51E+10	6.51E+10
1/28/23	21.00	153	41.803	113.22	5.66	566.08	6.42E+10	6.42E+10
1/21/23	20.11	154	42.077	108.37	5.42	541.85	6.15E+10	6.15E+10
1/7/23	20.98	155	42.350	113.10	5.65	565.49	6.42E+10	6.42E+10
1/29/23	20.26	156	42.623	109.22	5.46	546.09	6.20E+10	6.20E+10
1/6/23	20.48	157	42.896	110.39	5.52	551.95	6.26E+10	6.26E+10
8/5/22	21.23	158	43.169	114.43	5.72	572.13	6.49E+10	6.49E+10
1/9/23	20.71	159	43.443	111.63	5.58	558.13	6.33E+10	6.33E+10
7/11/22	24.61	160	43.716	132.67	6.63	663.35	7.53E+10	7.53E+10
1/30/23	20.60	161	43.989	111.05	5.55	555.24	6.30E+10	6.30E+10
1/10/23	20.66	162	44.262	111.33	5.57	556.66	6.32E+10	6.32E+10
1/5/23	19.97	163	44.536	107.64	5.38	538.18	6.11E+10	6.11E+10
2/7/22	22.62	164	44.809	121.95	6.10	609.74	6.92E+10	6.92E+10
1/20/23	19.65	165	45.082	105.89	5.29	529.44	6.01E+10	6.01E+10
1/31/23	19.48	166	45.355	105.00	5.25	525.02	5.96E+10	5.96E+10
2/8/22	21.82	167	45.628	117.63	5.88	588.14	6.67E+10	6.67E+10
6/20/22	24.10	168	45.902	129.91	6.50	649.57	7.37E+10	7.37E+10
2/6/22	19.99	169	46.175	107.74	5.39	538.71	6.11E+10	6.11E+10
1/12/23	20.07	170	46.448	108.20	5.41	541.00	6.14E+10	6.14E+10
2/3/22	22.99	171	46.721	123.93	6.20	619.65	7.03E+10	7.03E+10
8/6/22	20.40	172	46.995	109.95	5.50	549.75	6.24E+10	6.24E+10
7/12/22	23.00	173	47.268	123.99	6.20	619.94	7.03E+10	7.03E+10
2/4/22	20.34	174	47.541	109.62	5.48	548.09	6.22E+10	6.22E+10
2/5/22	21.93	175	47.814	118.20	5.91	591.00	6.71E+10	6.71E+10
1/4/23	19.02	176	48.087	102.51	5.13	512.57	5.82E+10	5.82E+10
1/13/23	19.22	177	48.361	103.60	5.18	518.01	5.88E+10	5.88E+10
2/11/22	18.94	178	48.634	102.08	5.10	510.38	5.79E+10	5.79E+10
1/19/23	18.73	179	48.907	100.95	5.05	504.77	5.73E+10	5.73E+10
1/14/23	18.87	180	49.180	101.72	5.09	508.59	5.77E+10	5.77E+10
2/9/22	20.65	181	49.454	111.31	5.57	556.56	6.32E+10	6.32E+10
8/7/22	19.33	182	49.727	104.19	5.21	520.94	5.91E+10	5.91E+10

1/15/23	18.17	183	50.000	97.95	4.90	489.75	5.56E+10	5.56E+10
8/8/22	18.52	184	50.273	99.80	4.99	499.01	5.66E+10	5.66E+10
2/2/22	21.65	185	50.546	116.72	5.84	583.58	6.62E+10	6.62E+10
7/13/22	21.15	186	50.820	114.02	5.70	570.11	6.47E+10	6.47E+10
2/10/22	20.94	187	51.093	112.87	5.64	564.36	6.40E+10	6.40E+10
8/9/22	18.11	188	51.366	97.59	4.88	487.95	5.54E+10	5.54E+10
6/21/22	21.49	189	51.639	115.82	5.79	579.08	6.57E+10	6.57E+10
1/16/23	17.82	190	51.913	96.07	4.80	480.33	5.45E+10	5.45E+10
1/3/23	16.42	191	52.186	88.49	4.42	442.45	5.02E+10	5.02E+10
1/17/23	16.95	192	52.459	91.36	4.57	456.79	5.18E+10	5.18E+10
7/14/22	19.67	193	52.732	106.02	5.30	530.12	6.02E+10	6.02E+10
1/18/23	16.36	194	53.005	88.18	4.41	440.88	5.00E+10	5.00E+10
7/22/22	16.52	195	53.279	89.02	4.45	445.12	5.05E+10	5.05E+10
8/10/22	17.31	196	53.552	93.29	4.66	466.46	5.29E+10	5.29E+10
8/22/22	16.55	197	53.825	89.23	4.46	446.13	5.06E+10	5.06E+10
12/2/22	12.02	198	54.098	64.79	3.24	323.94	3.68E+10	3.68E+10
12/1/22	14.17	199	54.372	76.38	3.82	381.92	4.33E+10	4.33E+10
7/15/22	17.62	200	54.645	94.96	4.75	474.78	5.39E+10	5.39E+10
7/6/22	18.27	201	54.918	98.46	4.92	492.29	5.59E+10	5.59E+10
12/4/22	14.32	202	55.191	77.20	3.86	386.02	4.38E+10	4.38E+10
1/2/23	15.69	203	55.464	84.59	4.23	422.95	4.80E+10	4.80E+10
12/3/22	14.69	204	55.738	79.17	3.96	395.84	4.49E+10	4.49E+10
11/30/22	14.13	205	56.011	76.16	3.81	380.79	4.32E+10	4.32E+10
6/22/22	18.83	206	56.284	101.51	5.08	507.55	5.76E+10	5.76E+10
7/16/22	16.64	207	56.557	89.69	4.48	448.46	5.09E+10	5.09E+10
8/21/22	15.72	208	56.831	84.74	4.24	423.71	4.81E+10	4.81E+10
12/5/22	14.04	209	57.104	75.69	3.78	378.46	4.29E+10	4.29E+10
11/29/22	11.38	210	57.377	61.31	3.07	306.56	3.48E+10	3.48E+10
8/11/22	15.76	211	57.650	84.95	4.25	424.77	4.82E+10	4.82E+10
1/1/23	14.16	212	57.923	76.31	3.82	381.53	4.33E+10	4.33E+10
12/6/22	14.52	213	58.197	78.27	3.91	391.36	4.44E+10	4.44E+10
8/23/22	14.63	214	58.470	78.86	3.94	394.28	4.47E+10	4.47E+10
7/17/22	16.46	215	58.743	88.73	4.44	443.67	5.03E+10	5.03E+10
1/11/23	18.96	216	59.016	102.19	5.11	510.94	5.80E+10	5.80E+10
12/7/22	13.60	217	59.290	73.33	3.67	366.63	4.16E+10	4.16E+10
7/18/22	16.06	218	59.563	86.55	4.33	432.77	4.91E+10	4.91E+10
12/8/22	13.29	219	59.836	71.63	3.58	358.14	4.06E+10	4.06E+10
8/31/22	13.08	220	60.109	70.50	3.53	352.52	4.00E+10	4.00E+10
12/9/22	11.24	221	60.383	60.59	3.03	302.93	3.44E+10	3.44E+10
8/30/22	13.36	222	60.656	71.99	3.60	359.93	4.08E+10	4.08E+10
12/10/22	11.87	223	60.929	64.00	3.20	320.01	3.63E+10	3.63E+10
12/31/22	13.00	224	61.202	70.09	3.50	350.46	3.98E+10	3.98E+10
2/1/22	14.64	225	61.475	78.90	3.94	394.49	4.48E+10	4.48E+10
8/12/22	13.57	226	61.749	73.17	3.66	365.83	4.15E+10	4.15E+10
7/19/22	14.11	227	62.022	76.05	3.80	380.25	4.32E+10	4.32E+10
8/24/22	12.38	228	62.295	66.75	3.34	333.77	3.79E+10	3.79E+10
11/28/22	10.45	229	62.568	56.32	2.82	281.62	3.20E+10	3.20E+10
12/11/22	12.08	230	62.842	65.10	3.26	325.51	3.69E+10	3.69E+10
6/23/22	16.02	231	63.115	86.35	4.32	431.75	4.90E+10	4.90E+10
8/15/22	12.38	232	63.388	66.74	3.34	333.71	3.79E+10	3.79E+10
9/1/22	11.44	233	63.661	61.67	3.08	308.37	3.50E+10	3.50E+10
12/12/22	12.35	234	63.934	66.56	3.33	332.82	3.78E+10	3.78E+10
8/14/22	12.56	235	64.208	67.71	3.39	338.55	3.84E+10	3.84E+10
12/16/22	10.53	236	64.481	56.78	2.84	283.89	3.22E+10	3.22E+10
12/13/22	10.44	237	64.754	56.25	2.81	281.25	3.19E+10	3.19E+10
12/15/22	9.84	238	65.027	53.03	2.65	265.13	3.01E+10	3.01E+10
12/17/22	10.97	239	65.301	59.15	2.96	295.73	3.36E+10	3.36E+10
8/13/22	12.18	240	65.574	65.64	3.28	328.22	3.72E+10	3.72E+10
7/20/22	12.55	241	65.847	67.63	3.38	338.15	3.84E+10	3.84E+10
8/16/22	11.62	242	66.120	62.61	3.13	313.03	3.55E+10	3.55E+10
12/14/22	10.86	243	66.393	58.56	2.93	292.81	3.32E+10	3.32E+10

12/24/22	7.15	244	66.667	38.54	1.93	192.69	2.19E+10	2.19E+10
8/25/22	11.46	245	66.940	61.74	3.09	308.72	3.50E+10	3.50E+10
9/2/22	10.87	246	67.213	58.58	2.93	292.89	3.32E+10	3.32E+10
12/18/22	10.87	247	67.486	58.59	2.93	292.94	3.32E+10	3.32E+10
12/23/22	7.07	248	67.760	38.13	1.91	190.64	2.16E+10	2.16E+10
12/20/22	10.95	249	68.033	59.00	2.95	295.00	3.35E+10	3.35E+10
10/23/22	10.20	250	68.306	54.95	2.75	274.77	3.12E+10	3.12E+10
12/19/22	10.83	251	68.579	58.37	2.92	291.86	3.31E+10	3.31E+10
12/27/22	5.75	252	68.852	31.01	1.55	155.04	1.76E+10	1.76E+10
12/26/22	7.32	253	69.126	39.44	1.97	197.21	2.24E+10	2.24E+10
12/30/22	9.51	254	69.399	51.25	2.56	256.27	2.91E+10	2.91E+10
7/21/22	11.78	255	69.672	63.50	3.17	317.49	3.60E+10	3.60E+10
8/17/22	10.68	256	69.945	57.56	2.88	287.81	3.27E+10	3.27E+10
6/24/22	13.66	257	70.219	73.64	3.68	368.21	4.18E+10	4.18E+10
12/21/22	10.95	258	70.492	59.02	2.95	295.11	3.35E+10	3.35E+10
12/28/22	5.25	259	70.765	28.27	1.41	141.36	1.60E+10	1.60E+10
12/25/22	6.21	260	71.038	33.48	1.67	167.41	1.90E+10	1.90E+10
9/3/22	10.34	261	71.311	55.73	2.79	278.67	3.16E+10	3.16E+10
8/26/22	10.21	262	71.585	55.01	2.75	275.04	3.12E+10	3.12E+10
12/22/22	10.62	263	71.858	57.26	2.86	286.29	3.25E+10	3.25E+10
8/29/22	9.31	264	72.131	50.17	2.51	250.84	2.85E+10	2.85E+10
8/27/22	10.35	265	72.404	55.81	2.79	279.07	3.17E+10	3.17E+10
9/4/22	9.89	266	72.678	53.29	2.66	266.46	3.02E+10	3.02E+10
8/18/22	10.22	267	72.951	55.11	2.76	275.53	3.13E+10	3.13E+10
12/29/22	5.92	268	73.224	31.89	1.59	159.47	1.81E+10	1.81E+10
10/24/22	8.66	269	73.497	46.68	2.33	233.40	2.65E+10	2.65E+10
8/19/22	9.81	270	73.770	52.89	2.64	264.46	3.00E+10	3.00E+10
8/28/22	9.72	271	74.044	52.40	2.62	261.99	2.97E+10	2.97E+10
8/20/22	9.31	272	74.317	50.19	2.51	250.94	2.85E+10	2.85E+10
9/5/22	9.59	273	74.590	51.69	2.58	258.45	2.93E+10	2.93E+10
6/25/22	12.32	274	74.863	66.40	3.32	331.99	3.77E+10	3.77E+10
9/6/22	9.14	275	75.137	49.26	2.46	246.30	2.79E+10	2.79E+10
10/25/22	7.43	276	75.410	40.07	2.00	200.37	2.27E+10	2.27E+10
10/26/22	8.04	277	75.683	43.32	2.17	216.59	2.46E+10	2.46E+10
10/27/22	7.95	278	75.956	42.85	2.14	214.26	2.43E+10	2.43E+10
11/27/22	7.19	279	76.230	38.74	1.94	193.68	2.20E+10	2.20E+10
10/28/22	7.98	280	76.503	43.02	2.15	215.10	2.44E+10	2.44E+10
9/7/22	9.19	281	76.776	49.51	2.48	247.54	2.81E+10	2.81E+10
9/27/22	9.49	282	77.049	51.13	2.56	255.65	2.90E+10	2.90E+10
10/29/22	7.56	283	77.322	40.74	2.04	203.69	2.31E+10	2.31E+10
6/26/22	11.19	284	77.596	60.30	3.01	301.50	3.42E+10	3.42E+10
9/28/22	9.02	285	77.869	48.61	2.43	243.03	2.76E+10	2.76E+10
10/30/22	7.45	286	78.142	40.18	2.01	200.90	2.28E+10	2.28E+10
11/1/22	7.04	287	78.415	37.94	1.90	189.68	2.15E+10	2.15E+10
10/31/22	7.10	288	78.689	38.26	1.91	191.28	2.17E+10	2.17E+10
11/2/22	7.41	289	78.962	39.94	2.00	199.72	2.27E+10	2.27E+10
11/4/22	7.04	290	79.235	37.92	1.90	189.62	2.15E+10	2.15E+10
11/3/22	7.45	291	79.508	40.14	2.01	200.70	2.28E+10	2.28E+10
9/26/22	9.02	292	79.781	48.60	2.43	242.99	2.76E+10	2.76E+10
9/8/22	8.56	293	80.055	46.15	2.31	230.74	2.62E+10	2.62E+10
11/5/22	6.64	294	80.328	35.79	1.79	178.96	2.03E+10	2.03E+10
10/19/22	6.96	295	80.601	37.49	1.87	187.47	2.13E+10	2.13E+10
9/29/22	8.53	296	80.874	45.97	2.30	229.85	2.61E+10	2.61E+10
10/22/22	7.19	297	81.148	38.78	1.94	193.88	2.20E+10	2.20E+10
11/7/22	6.96	298	81.421	37.51	1.88	187.57	2.13E+10	2.13E+10
11/6/22	6.89	299	81.694	37.14	1.86	185.70	2.11E+10	2.11E+10
11/8/22	7.52	300	81.967	40.55	2.03	202.76	2.30E+10	2.30E+10
10/20/22	6.92	301	82.240	37.30	1.86	186.50	2.12E+10	2.12E+10
11/9/22	6.89	302	82.514	37.13	1.86	185.64	2.11E+10	2.11E+10
9/9/22	7.74	303	82.787	41.71	2.09	208.54	2.37E+10	2.37E+10
9/30/22	8.45	304	83.060	45.55	2.28	227.76	2.58E+10	2.58E+10

11/10/22	6.27	305	83.333	33.78	1.69	168.88	1.92E+10	1.92E+10
9/12/22	8.60	306	83.607	46.37	2.32	231.84	2.63E+10	2.63E+10
11/11/22	7.02	307	83.880	37.84	1.89	189.20	2.15E+10	2.15E+10
10/18/22	6.22	308	84.153	33.54	1.68	167.69	1.90E+10	1.90E+10
6/27/22	9.68	309	84.426	52.19	2.61	260.94	2.96E+10	2.96E+10
10/21/22	6.59	310	84.699	35.52	1.78	177.60	2.02E+10	2.02E+10
9/11/22	6.46	311	84.973	34.83	1.74	174.14	1.98E+10	1.98E+10
11/12/22	6.25	312	85.246	33.70	1.68	168.49	1.91E+10	1.91E+10
11/13/22	6.40	313	85.519	34.51	1.73	172.53	1.96E+10	1.96E+10
9/13/22	8.13	314	85.792	43.81	2.19	219.04	2.49E+10	2.49E+10
11/14/22	6.84	315	86.066	36.89	1.84	184.44	2.09E+10	2.09E+10
9/10/22	6.84	316	86.339	36.84	1.84	184.21	2.09E+10	2.09E+10
10/1/22	8.14	317	86.612	43.86	2.19	219.31	2.49E+10	2.49E+10
11/15/22	6.63	318	86.885	35.72	1.79	178.59	2.03E+10	2.03E+10
9/14/22	7.52	319	87.158	40.52	2.03	202.61	2.30E+10	2.30E+10
11/16/22	5.81	320	87.432	31.31	1.57	156.56	1.78E+10	1.78E+10
11/17/22	5.80	321	87.705	31.25	1.56	156.27	1.77E+10	1.77E+10
9/15/22	7.25	322	87.978	39.09	1.95	195.45	2.22E+10	2.22E+10
11/26/22	5.93	323	88.251	31.97	1.60	159.84	1.81E+10	1.81E+10
9/25/22	6.69	324	88.525	36.05	1.80	180.23	2.05E+10	2.05E+10
9/21/22	7.41	325	88.798	39.94	2.00	199.71	2.27E+10	2.27E+10
11/18/22	5.72	326	89.071	30.85	1.54	154.26	1.75E+10	1.75E+10
11/25/22	6.01	327	89.344	32.41	1.62	162.03	1.84E+10	1.84E+10
11/19/22	5.58	328	89.617	30.09	1.50	150.43	1.71E+10	1.71E+10
9/22/22	7.72	329	89.891	41.62	2.08	208.12	2.36E+10	2.36E+10
9/16/22	6.93	330	90.164	37.37	1.87	186.84	2.12E+10	2.12E+10
11/24/22	5.51	331	90.437	29.68	1.48	148.41	1.68E+10	1.68E+10
10/2/22	7.68	332	90.710	41.39	2.07	206.93	2.35E+10	2.35E+10
11/22/22	5.65	333	90.984	30.48	1.52	152.39	1.73E+10	1.73E+10
11/21/22	5.15	334	91.257	27.78	1.39	138.88	1.58E+10	1.58E+10
11/23/22	5.44	335	91.530	29.31	1.47	146.53	1.66E+10	1.66E+10
9/20/22	6.80	336	91.803	36.66	1.83	183.31	2.08E+10	2.08E+10
6/28/22	7.92	337	92.077	42.68	2.13	213.39	2.42E+10	2.42E+10
11/20/22	5.45	338	92.350	29.39	1.47	146.94	1.67E+10	1.67E+10
9/17/22	6.35	339	92.623	34.22	1.71	171.08	1.94E+10	1.94E+10
9/23/22	7.07	340	92.896	38.10	1.91	190.51	2.16E+10	2.16E+10
9/19/22	7.00	341	93.169	37.71	1.89	188.53	2.14E+10	2.14E+10
9/18/22	6.66	342	93.443	35.90	1.80	179.51	2.04E+10	2.04E+10
10/3/22	7.05	343	93.716	37.98	1.90	189.92	2.16E+10	2.16E+10
9/24/22	6.29	344	93.989	33.93	1.70	169.65	1.93E+10	1.93E+10
7/5/22	7.02	345	94.262	37.85	1.89	189.27	2.15E+10	2.15E+10
10/4/22	6.39	346	94.536	34.46	1.72	172.30	1.96E+10	1.96E+10
6/29/22	7.08	347	94.809	38.14	1.91	190.70	2.16E+10	2.16E+10
10/5/22	6.59	348	95.082	35.52	1.78	177.58	2.02E+10	2.02E+10
10/17/22	4.02	349	95.355	21.68	1.08	108.39	1.23E+10	1.23E+10
10/6/22	5.38	350	95.628	29.02	1.45	145.10	1.65E+10	1.65E+10
6/30/22	6.27	351	95.902	33.82	1.69	169.10	1.92E+10	1.92E+10
10/7/22	6.13	352	96.175	33.03	1.65	165.16	1.87E+10	1.87E+10
7/1/22	6.20	353	96.448	33.44	1.67	167.20	1.90E+10	1.90E+10
7/2/22	6.30	354	96.721	33.98	1.70	169.89	1.93E+10	1.93E+10
10/8/22	5.17	355	96.995	27.88	1.39	139.39	1.58E+10	1.58E+10
10/16/22	3.38	356	97.268	18.22	0.91	91.10	1.03E+10	1.03E+10
10/9/22	3.94	357	97.541	21.26	1.06	106.29	1.21E+10	1.21E+10
7/3/22	5.48	358	97.814	29.53	1.48	147.66	1.68E+10	1.68E+10
10/13/22	5.11	359	98.087	27.55	1.38	137.75	1.56E+10	1.56E+10
10/10/22	3.78	360	98.361	20.35	1.02	101.74	1.15E+10	1.15E+10
10/15/22	3.15	361	98.634	17.01	0.85	85.03	9.65E+09	9.65E+09
10/14/22	3.24	362	98.907	17.46	0.87	87.32	9.91E+09	9.91E+09
10/11/22	3.63	363	99.180	19.57	0.98	97.87	1.11E+10	1.11E+10
10/12/22	3.55	364	99.454	19.12	0.96	95.58	1.08E+10	1.08E+10
7/4/22	5.42	365	99.727	29.21	1.46	146.07	1.66E+10	1.66E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 16 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	137.91	2.43	0.05	13.2	78.4	0.819672131	1806.244053	37.1655155	9811.696092	2.65E+11	21	37931.12512	780.4758255	206045.6179	5.55E+12
3/15/22	27.24	3.41	0.05	8.4	46	19.67213115	500.6405038	7.34076985	1233.249335	3.07E+10	35	17522.41763	256.9269447	43163.72672	1.07E+12
4/19/22	32.04	3.44	0.05	7.6	365	16.12021858	594.037411	8.6342647	1312.408234	2.86E+11	35	20791.30939	302.1992643	45934.28818	1.00E+13
5/24/22	11.98	4.88	0.05	7.2	126.0	34.15300546	315.1270805	3.22876107	464.9415941	3.69E+10	28	8823.558253	90.40530997	13018.36464	1.03E+12
6/21/22	9.71	4.63	0.05	5.2	411.0	51.63934426	242.3967321	2.61767529	272.2382304	9.77E+10	28	6787.108498	73.29490818	7622.670451	2.73E+12
7/19/22	12.65	3.79	0.06	2.8	613.0	62.02185792	258.3920578	4.09063944	190.8965071	1.90E+11	35	9043.722023	143.1723803	6681.377748	6.64E+12
8/23/22	4.16	4.43	0.05	37.6	291.0	58.46994536	99.30764518	1.12085378	842.8820449	2.96E+10	28	2780.614065	31.38390593	23600.69726	8.29E+11
9/20/22	3.51	3.19	0.050	38.8	548.0	91.80327869	60.18461958	0.94475713	733.1315367	4.70E+10	36	2166.646305	34.01125686	26392.73532	1.69E+12
10/26/22	6.42	2.17	0.050	16.8	308.0	75.68306011	75.04113142	1.73014266	581.3279326	4.84E+10	13	975.5347085	22.49185454	7557.263124	6.29E+11
11/8/22	4.65	2.06	0.050	15.6	411.0	81.96721311	51.53813305	1.25354827	391.1070617	4.68E+10	35	1803.834657	43.87418961	13688.74716	1.64E+12
12/13/22	6.05	5.30	0.050	16.0	236.0	64.75409836	172.9045163	1.63117468	521.9758982	3.49E+10	36	6224.562586	58.72228854	18791.13233	1.26E+12
1/18/23	11.77	2.10	0.050	18.0	291.0	53.00546448	133.2219521	3.17195124	1141.902447	8.38E+10	37	4929.212229	117.3621959	42250.39053	3.10E+12
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	119,779.6	1,954.3	454,747.0	3.62E+13
											TARGET	48,616.4	2,430.8	243,082.1	2.76E+13

Site 17 Date	E17	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/18/22	1667.29	1	0.273	8986.68	449.33	44933.42	5.10E+12	5.10E+12
2/23/22	1206.68	2	0.546	6503.99	325.20	32519.97	3.69E+12	3.69E+12
2/17/22	1197.45	3	0.820	6454.24	322.71	32271.21	3.66E+12	3.66E+12
2/19/22	1154.33	4	1.093	6221.85	311.09	31109.26	3.53E+12	3.53E+12
2/22/22	1107.30	5	1.366	5968.33	298.42	29841.63	3.39E+12	3.39E+12
2/24/22	1055.18	6	1.639	5687.42	284.37	28437.12	3.23E+12	3.23E+12
2/20/22	955.71	7	1.913	5151.26	257.56	25756.32	2.92E+12	2.92E+12
2/25/22	931.65	8	2.186	5021.58	251.08	25107.89	2.85E+12	2.85E+12
2/21/22	922.59	9	2.459	4972.74	248.64	24863.69	2.82E+12	2.82E+12
2/26/22	857.01	10	2.732	4619.30	230.96	23096.49	2.62E+12	2.62E+12
3/25/22	816.48	11	3.005	4400.82	220.04	22004.09	2.50E+12	2.50E+12
2/27/22	797.82	12	3.279	4300.25	215.01	21501.23	2.44E+12	2.44E+12
3/24/22	773.53	13	3.552	4169.33	208.47	20846.66	2.37E+12	2.37E+12
2/28/22	758.98	14	3.825	4090.91	204.55	20454.55	2.32E+12	2.32E+12
3/26/22	731.07	15	4.098	3940.45	197.02	19702.24	2.24E+12	2.24E+12
3/1/22	729.83	16	4.372	3933.80	196.69	19669.01	2.23E+12	2.23E+12
3/2/22	696.81	17	4.645	3755.78	187.79	18778.90	2.13E+12	2.13E+12
3/27/22	693.96	18	4.918	3740.46	187.02	18702.32	2.12E+12	2.12E+12
3/3/22	669.89	19	5.191	3610.70	180.54	18053.52	2.05E+12	2.05E+12
4/7/22	658.47	20	5.464	3549.15	177.46	17745.74	2.01E+12	2.01E+12
3/28/22	647.10	21	5.738	3487.88	174.39	17439.41	1.98E+12	1.98E+12
3/8/22	642.54	22	6.011	3463.32	173.17	17316.59	1.97E+12	1.97E+12
3/4/22	636.54	23	6.284	3430.95	171.55	17154.75	1.95E+12	1.95E+12
4/8/22	631.29	24	6.557	3402.63	170.13	17013.14	1.93E+12	1.93E+12
3/29/22	616.97	25	6.831	3325.47	166.27	16627.33	1.89E+12	1.89E+12
3/9/22	608.12	26	7.104	3277.78	163.89	16388.91	1.86E+12	1.86E+12
3/31/22	601.96	27	7.377	3244.55	162.23	16222.74	1.84E+12	1.84E+12
3/5/22	600.94	28	7.650	3239.06	161.95	16195.28	1.84E+12	1.84E+12
3/30/22	600.40	29	7.923	3236.17	161.81	16180.83	1.84E+12	1.84E+12
5/7/22	590.32	30	8.197	3181.84	159.09	15909.18	1.81E+12	1.81E+12
4/1/22	590.05	31	8.470	3180.39	159.02	15901.95	1.80E+12	1.80E+12
4/15/22	586.57	32	8.743	3161.61	158.08	15808.03	1.79E+12	1.79E+12
3/7/22	582.65	33	9.016	3140.51	157.03	15702.55	1.78E+12	1.78E+12
3/6/22	572.31	34	9.290	3084.73	154.24	15423.67	1.75E+12	1.75E+12
4/2/22	559.60	35	9.563	3016.24	150.81	15081.21	1.71E+12	1.71E+12
3/10/22	551.83	36	9.836	2974.34	148.72	14871.69	1.69E+12	1.69E+12
4/4/22	550.81	37	10.109	2968.85	148.44	14844.23	1.68E+12	1.68E+12
4/3/22	549.41	38	10.383	2961.33	148.07	14806.66	1.68E+12	1.68E+12
3/20/22	546.15	39	10.656	2943.76	147.19	14718.81	1.67E+12	1.67E+12
5/8/22	542.20	40	10.929	2922.46	146.12	14612.31	1.66E+12	1.66E+12
4/9/22	541.07	41	11.202	2916.36	145.82	14581.82	1.65E+12	1.65E+12
5/4/22	540.39	42	11.475	2912.69	145.63	14563.47	1.65E+12	1.65E+12
4/14/22	538.76	43	11.749	2903.91	145.20	14519.55	1.65E+12	1.65E+12
4/6/22	538.18	44	12.022	2900.79	145.04	14503.94	1.65E+12	1.65E+12
4/5/22	536.28	45	12.295	2890.53	144.53	14452.64	1.64E+12	1.64E+12
3/23/22	533.40	46	12.568	2875.01	143.75	14375.05	1.63E+12	1.63E+12
4/16/22	531.77	47	12.842	2866.22	143.31	14331.12	1.63E+12	1.63E+12
3/21/22	525.11	48	13.115	2830.33	141.52	14151.66	1.61E+12	1.61E+12
3/11/22	523.00	49	13.388	2818.94	140.95	14094.72	1.60E+12	1.60E+12
3/12/22	501.33	50	13.661	2702.19	135.11	13510.95	1.53E+12	1.53E+12
4/10/22	497.87	51	13.934	2683.52	134.18	13417.61	1.52E+12	1.52E+12
4/17/22	492.15	52	14.208	2652.71	132.64	13263.57	1.51E+12	1.51E+12
5/5/22	489.72	53	14.481	2639.59	131.98	13197.97	1.50E+12	1.50E+12
3/13/22	479.34	54	14.754	2583.62	129.18	12918.08	1.47E+12	1.47E+12
4/19/22	478.96	55	15.027	2581.59	129.08	12907.97	1.46E+12	1.46E+12
4/18/22	475.62	56	15.301	2563.59	128.18	12817.94	1.45E+12	1.45E+12
5/6/22	475.09	57	15.574	2560.73	128.04	12803.64	1.45E+12	1.45E+12
8/5/22	473.71	58	15.847	2553.27	127.66	12766.36	1.45E+12	1.45E+12
4/20/22	472.83	59	16.120	2548.53	127.43	12742.66	1.45E+12	1.45E+12
4/11/22	469.68	60	16.393	2531.60	126.58	12657.98	1.44E+12	1.44E+12

5/9/22	469.39	61	16.667	2530.01	126.50	12650.04	1.44E+12	1.44E+12
4/21/22	469.14	62	16.940	2528.68	126.43	12643.39	1.43E+12	1.43E+12
3/22/22	469.01	63	17.213	2527.96	126.40	12639.78	1.43E+12	1.43E+12
6/14/22	468.98	64	17.486	2527.78	126.39	12638.91	1.43E+12	1.43E+12
3/14/22	466.35	65	17.760	2513.65	125.68	12568.25	1.43E+12	1.43E+12
4/22/22	463.15	66	18.033	2496.37	124.82	12481.84	1.42E+12	1.42E+12
8/8/22	451.10	67	18.306	2431.40	121.57	12157.01	1.38E+12	1.38E+12
4/12/22	449.55	68	18.579	2423.08	121.15	12115.40	1.37E+12	1.37E+12
4/13/22	449.30	69	18.852	2421.75	121.09	12108.75	1.37E+12	1.37E+12
4/23/22	447.00	70	19.126	2409.35	120.47	12046.76	1.37E+12	1.37E+12
3/15/22	444.80	71	19.399	2397.47	119.87	11987.37	1.36E+12	1.36E+12
5/10/22	441.14	72	19.672	2377.74	118.89	11888.68	1.35E+12	1.35E+12
3/19/22	441.04	73	19.945	2377.19	118.86	11885.93	1.35E+12	1.35E+12
6/15/22	429.81	74	20.219	2316.70	115.84	11583.50	1.31E+12	1.31E+12
5/11/22	429.18	75	20.492	2313.26	115.66	11566.31	1.31E+12	1.31E+12
4/24/22	426.98	76	20.765	2301.44	115.07	11507.21	1.31E+12	1.31E+12
4/25/22	425.03	77	21.038	2290.89	114.54	11454.46	1.30E+12	1.30E+12
6/9/22	423.52	78	21.311	2282.77	114.14	11413.86	1.30E+12	1.30E+12
6/8/22	423.40	79	21.585	2282.11	114.11	11410.54	1.29E+12	1.29E+12
8/9/22	422.22	80	21.858	2275.75	113.79	11378.75	1.29E+12	1.29E+12
6/7/22	421.61	81	22.131	2272.46	113.62	11362.28	1.29E+12	1.29E+12
3/16/22	419.64	82	22.404	2261.85	113.09	11309.24	1.28E+12	1.28E+12
5/12/22	417.65	83	22.678	2251.16	112.56	11255.78	1.28E+12	1.28E+12
8/6/22	416.29	84	22.951	2243.82	112.19	11219.08	1.27E+12	1.27E+12
4/26/22	411.43	85	23.224	2217.63	110.88	11088.16	1.26E+12	1.26E+12
5/13/22	406.09	86	23.497	2188.85	109.44	10944.24	1.24E+12	1.24E+12
6/10/22	401.87	87	23.770	2166.10	108.31	10830.52	1.23E+12	1.23E+12
5/3/22	398.25	88	24.044	2146.57	107.33	10732.84	1.22E+12	1.22E+12
3/17/22	397.55	89	24.317	2142.81	107.14	10714.06	1.22E+12	1.22E+12
7/24/22	397.28	90	24.590	2141.34	107.07	10706.69	1.21E+12	1.21E+12
5/14/22	395.35	91	24.863	2130.96	106.55	10654.82	1.21E+12	1.21E+12
5/16/22	391.97	92	25.137	2112.70	105.63	10563.49	1.20E+12	1.20E+12
4/27/22	391.02	93	25.410	2107.58	105.38	10537.92	1.20E+12	1.20E+12
5/15/22	388.40	94	25.683	2093.45	104.67	10467.26	1.19E+12	1.19E+12
5/2/22	387.84	95	25.956	2090.45	104.52	10452.23	1.19E+12	1.19E+12
3/18/22	386.18	96	26.230	2081.49	104.07	10407.44	1.18E+12	1.18E+12
7/7/22	385.53	97	26.503	2077.99	103.90	10389.95	1.18E+12	1.18E+12
5/1/22	382.85	98	26.776	2063.54	103.18	10317.70	1.17E+12	1.17E+12
6/16/22	378.85	99	27.049	2042.01	102.10	10210.05	1.16E+12	1.16E+12
8/7/22	377.99	100	27.322	2037.36	101.87	10186.79	1.16E+12	1.16E+12
8/10/22	377.58	101	27.596	2035.16	101.76	10175.81	1.15E+12	1.15E+12
7/25/22	377.34	102	27.869	2033.86	101.69	10169.30	1.15E+12	1.15E+12
6/11/22	377.17	103	28.142	2032.94	101.65	10164.68	1.15E+12	1.15E+12
5/17/22	374.68	104	28.415	2019.53	100.98	10097.63	1.15E+12	1.15E+12
6/13/22	374.08	105	28.689	2016.29	100.81	10081.45	1.14E+12	1.14E+12
4/28/22	373.07	106	28.962	2010.86	100.54	10054.28	1.14E+12	1.14E+12
6/12/22	368.71	107	29.235	1987.36	99.37	9936.81	1.13E+12	1.13E+12
7/26/22	366.63	108	29.508	1976.15	98.81	9880.74	1.12E+12	1.12E+12
5/19/22	366.59	109	29.781	1975.95	98.80	9879.73	1.12E+12	1.12E+12
5/18/22	364.69	110	30.055	1965.69	98.28	9828.43	1.12E+12	1.12E+12
4/29/22	362.49	111	30.328	1953.81	97.69	9769.05	1.11E+12	1.11E+12
7/28/22	362.45	112	30.601	1953.59	97.68	9767.94	1.11E+12	1.11E+12
7/27/22	361.06	113	30.874	1946.09	97.30	9730.46	1.10E+12	1.10E+12
2/13/22	360.52	114	31.148	1943.21	97.16	9716.03	1.10E+12	1.10E+12
7/8/22	359.16	115	31.421	1935.86	96.79	9679.31	1.10E+12	1.10E+12
7/29/22	356.74	116	31.694	1922.84	96.14	9614.18	1.09E+12	1.09E+12
4/30/22	356.30	117	31.967	1920.46	96.02	9602.30	1.09E+12	1.09E+12
6/17/22	353.36	118	32.240	1904.59	95.23	9522.97	1.08E+12	1.08E+12
7/12/22	352.40	119	32.514	1899.42	94.97	9497.10	1.08E+12	1.08E+12
5/20/22	351.60	120	32.787	1895.11	94.76	9475.57	1.08E+12	1.08E+12
7/13/22	350.76	121	33.060	1890.61	94.53	9453.03	1.07E+12	1.07E+12

7/6/22	350.00	122	33.333	1886.47	94.32	9432.37	1.07E+12	1.07E+12
7/30/22	349.16	123	33.607	1881.96	94.10	9409.78	1.07E+12	1.07E+12
7/14/22	346.57	124	33.880	1868.04	93.40	9340.18	1.06E+12	1.06E+12
7/18/22	346.12	125	34.153	1865.61	93.28	9328.04	1.06E+12	1.06E+12
7/16/22	345.35	126	34.426	1861.45	93.07	9307.23	1.06E+12	1.06E+12
7/11/22	345.30	127	34.699	1861.19	93.06	9305.93	1.06E+12	1.06E+12
7/9/22	345.12	128	34.973	1860.17	93.01	9300.87	1.06E+12	1.06E+12
7/17/22	343.59	129	35.246	1851.94	92.60	9259.69	1.05E+12	1.05E+12
7/15/22	343.54	130	35.519	1851.71	92.59	9258.54	1.05E+12	1.05E+12
7/31/22	342.82	131	35.792	1847.78	92.39	9238.89	1.05E+12	1.05E+12
5/21/22	340.19	132	36.066	1833.64	91.68	9168.22	1.04E+12	1.04E+12
8/11/22	340.11	133	36.339	1833.21	91.66	9166.06	1.04E+12	1.04E+12
7/19/22	338.68	134	36.612	1825.47	91.27	9127.33	1.04E+12	1.04E+12
7/10/22	338.51	135	36.885	1824.57	91.23	9122.85	1.04E+12	1.04E+12
8/1/22	336.16	136	37.158	1811.92	90.60	9059.60	1.03E+12	1.03E+12
7/23/22	335.50	137	37.432	1808.33	90.42	9041.64	1.03E+12	1.03E+12
2/12/22	334.73	138	37.705	1804.20	90.21	9020.98	1.02E+12	1.02E+12
6/6/22	332.96	139	37.978	1794.66	89.73	8973.30	1.02E+12	1.02E+12
5/22/22	329.22	140	38.251	1774.52	88.73	8872.58	1.01E+12	1.01E+12
6/5/22	326.51	141	38.525	1759.89	87.99	8799.47	9.99E+11	9.99E+11
6/18/22	326.51	142	38.798	1759.86	87.99	8799.32	9.99E+11	9.99E+11
6/4/22	323.66	143	39.071	1744.55	87.23	8722.74	9.90E+11	9.90E+11
8/2/22	323.51	144	39.344	1743.74	87.19	8718.69	9.89E+11	9.89E+11
8/4/22	321.72	145	39.617	1734.06	86.70	8670.29	9.84E+11	9.84E+11
7/20/22	320.47	146	39.891	1727.35	86.37	8636.76	9.80E+11	9.80E+11
6/3/22	319.99	147	40.164	1724.75	86.24	8623.76	9.79E+11	9.79E+11
6/2/22	318.39	148	40.437	1716.14	85.81	8580.70	9.74E+11	9.74E+11
8/12/22	318.07	149	40.710	1714.38	85.72	8571.88	9.73E+11	9.73E+11
1/20/23	315.80	150	40.984	1702.18	85.11	8510.91	9.66E+11	9.66E+11
2/16/22	315.65	151	41.257	1701.37	85.07	8506.86	9.65E+11	9.65E+11
8/3/22	314.04	152	41.530	1692.70	84.64	8463.51	9.60E+11	9.60E+11
6/19/22	313.11	153	41.803	1687.67	84.38	8438.37	9.58E+11	9.58E+11
5/26/22	311.57	154	42.077	1679.35	83.97	8396.75	9.53E+11	9.53E+11
5/23/22	311.41	155	42.350	1678.51	83.93	8392.56	9.52E+11	9.52E+11
5/27/22	305.04	156	42.623	1644.15	82.21	8220.75	9.33E+11	9.33E+11
7/21/22	304.87	157	42.896	1643.23	82.16	8216.13	9.32E+11	9.32E+11
6/20/22	304.21	158	43.169	1639.67	81.98	8198.36	9.30E+11	9.30E+11
8/13/22	303.12	159	43.443	1633.80	81.69	8169.02	9.27E+11	9.27E+11
5/24/22	300.29	160	43.716	1618.55	80.93	8092.73	9.18E+11	9.18E+11
5/25/22	299.05	161	43.989	1611.87	80.59	8059.35	9.15E+11	9.15E+11
8/14/22	297.78	162	44.262	1605.05	80.25	8025.25	9.11E+11	9.11E+11
1/4/23	296.45	163	44.536	1597.88	79.89	7989.41	9.07E+11	9.07E+11
1/21/23	294.87	164	44.809	1589.36	79.47	7946.79	9.02E+11	9.02E+11
6/1/22	293.76	165	45.082	1583.38	79.17	7916.88	8.98E+11	8.98E+11
8/15/22	293.45	166	45.355	1581.67	79.08	7908.35	8.97E+11	8.97E+11
5/28/22	292.81	167	45.628	1578.26	78.91	7891.30	8.95E+11	8.95E+11
7/22/22	291.26	168	45.902	1569.88	78.49	7849.40	8.91E+11	8.91E+11
6/21/22	290.30	169	46.175	1564.73	78.24	7823.67	8.88E+11	8.88E+11
2/14/22	284.13	170	46.448	1531.44	76.57	7657.21	8.69E+11	8.69E+11
5/29/22	283.85	171	46.721	1529.97	76.50	7649.84	8.68E+11	8.68E+11
8/16/22	282.80	172	46.995	1524.28	76.21	7621.38	8.65E+11	8.65E+11
5/30/22	280.39	173	47.268	1511.33	75.57	7556.64	8.58E+11	8.58E+11
5/31/22	279.49	174	47.541	1506.44	75.32	7532.22	8.55E+11	8.55E+11
6/22/22	276.60	175	47.814	1490.87	74.54	7454.34	8.46E+11	8.46E+11
1/5/23	276.35	176	48.087	1489.51	74.48	7447.55	8.45E+11	8.45E+11
8/17/22	275.74	177	48.361	1486.22	74.31	7431.08	8.43E+11	8.43E+11
2/3/22	273.98	178	48.634	1476.76	73.84	7383.82	8.38E+11	8.38E+11
2/15/22	272.98	179	48.907	1471.38	73.57	7356.92	8.35E+11	8.35E+11
8/23/22	271.92	180	49.180	1465.67	73.28	7328.34	8.32E+11	8.32E+11
8/22/22	271.54	181	49.454	1463.59	73.18	7317.93	8.30E+11	8.30E+11
8/21/22	271.09	182	49.727	1461.16	73.06	7305.80	8.29E+11	8.29E+11

1/22/23	269.69	183	50.000	1453.65	72.68	7268.23	8.25E+11	8.25E+11
2/2/22	269.12	184	50.273	1450.58	72.53	7252.91	8.23E+11	8.23E+11
8/18/22	268.72	185	50.546	1448.39	72.42	7241.93	8.22E+11	8.22E+11
6/23/22	265.77	186	50.820	1432.49	71.62	7162.45	8.13E+11	8.13E+11
1/23/23	259.42	187	51.093	1398.27	69.91	6991.37	7.93E+11	7.93E+11
8/24/22	258.23	188	51.366	1391.86	69.59	6959.29	7.90E+11	7.90E+11
1/26/23	256.79	189	51.639	1384.10	69.20	6920.50	7.85E+11	7.85E+11
8/19/22	256.27	190	51.913	1381.28	69.06	6906.40	7.84E+11	7.84E+11
8/20/22	253.90	191	52.186	1368.51	68.43	6842.54	7.76E+11	7.76E+11
6/24/22	252.96	192	52.459	1363.48	68.17	6817.39	7.74E+11	7.74E+11
1/6/23	252.49	193	52.732	1360.94	68.05	6804.68	7.72E+11	7.72E+11
2/11/22	252.07	194	53.005	1358.68	67.93	6793.41	7.71E+11	7.71E+11
1/25/23	251.48	195	53.279	1355.47	67.77	6777.33	7.69E+11	7.69E+11
1/27/23	250.66	196	53.552	1351.05	67.55	6755.23	7.67E+11	7.67E+11
1/30/23	250.48	197	53.825	1350.07	67.50	6750.35	7.66E+11	7.66E+11
1/24/23	250.18	198	54.098	1348.49	67.42	6742.45	7.65E+11	7.65E+11
8/31/22	248.33	199	54.372	1338.51	66.93	6692.55	7.59E+11	7.59E+11
1/28/23	247.65	200	54.645	1334.81	66.74	6674.05	7.57E+11	7.57E+11
1/29/23	245.35	201	54.918	1322.44	66.12	6612.21	7.50E+11	7.50E+11
7/5/22	245.10	202	55.191	1321.11	66.06	6605.56	7.50E+11	7.50E+11
2/10/22	244.84	203	55.464	1319.67	65.98	6598.34	7.49E+11	7.49E+11
6/25/22	244.66	204	55.738	1318.74	65.94	6593.71	7.48E+11	7.48E+11
1/19/23	243.55	205	56.011	1312.73	65.64	6563.66	7.45E+11	7.45E+11
1/7/23	242.22	206	56.284	1305.56	65.28	6527.82	7.41E+11	7.41E+11
6/26/22	241.73	207	56.557	1302.91	65.15	6514.53	7.39E+11	7.39E+11
8/25/22	241.23	208	56.831	1300.25	65.01	6501.23	7.38E+11	7.38E+11
2/9/22	240.93	209	57.104	1298.63	64.93	6493.14	7.37E+11	7.37E+11
1/31/23	239.28	210	57.377	1289.73	64.49	6448.64	7.32E+11	7.32E+11
1/12/23	237.67	211	57.650	1281.06	64.05	6405.29	7.27E+11	7.27E+11
1/8/23	237.61	212	57.923	1280.71	64.04	6403.55	7.27E+11	7.27E+11
1/9/23	236.56	213	58.197	1275.05	63.75	6375.23	7.23E+11	7.23E+11
1/11/23	235.68	214	58.470	1270.31	63.52	6351.53	7.21E+11	7.21E+11
1/10/23	234.80	215	58.743	1265.57	63.28	6327.84	7.18E+11	7.18E+11
8/30/22	234.77	216	59.016	1265.39	63.27	6326.97	7.18E+11	7.18E+11
6/27/22	234.03	217	59.290	1261.41	63.07	6307.03	7.16E+11	7.16E+11
1/13/23	231.73	218	59.563	1249.04	62.45	6245.18	7.09E+11	7.09E+11
8/26/22	229.28	219	59.836	1235.80	61.79	6179.00	7.01E+11	7.01E+11
9/1/22	228.00	220	60.109	1228.92	61.45	6144.59	6.97E+11	6.97E+11
2/8/22	227.37	221	60.383	1225.53	61.28	6127.67	6.95E+11	6.95E+11
6/28/22	225.02	222	60.656	1212.85	60.64	6064.27	6.88E+11	6.88E+11
1/14/23	224.01	223	60.929	1207.39	60.37	6036.96	6.85E+11	6.85E+11
1/17/23	220.02	224	61.202	1185.92	59.30	5929.60	6.73E+11	6.73E+11
1/3/23	219.50	225	61.475	1183.09	59.15	5915.44	6.71E+11	6.71E+11
8/27/22	218.94	226	61.749	1180.08	59.00	5900.41	6.70E+11	6.70E+11
1/15/23	217.66	227	62.022	1173.20	58.66	5866.02	6.66E+11	6.66E+11
1/16/23	215.65	228	62.295	1162.34	58.12	5811.69	6.59E+11	6.59E+11
1/1/23	215.29	229	62.568	1160.40	58.02	5802.01	6.58E+11	6.58E+11
6/29/22	215.15	230	62.842	1159.68	57.98	5798.40	6.58E+11	6.58E+11
1/18/23	213.82	231	63.115	1152.48	57.62	5762.42	6.54E+11	6.54E+11
9/2/22	212.95	232	63.388	1147.80	57.39	5739.00	6.51E+11	6.51E+11
8/28/22	210.36	233	63.661	1133.84	56.69	5669.22	6.43E+11	6.43E+11
2/7/22	210.01	234	63.934	1131.94	56.60	5659.68	6.42E+11	6.42E+11
8/29/22	208.62	235	64.208	1124.48	56.22	5622.40	6.38E+11	6.38E+11
7/2/22	207.75	236	64.481	1119.77	55.99	5598.85	6.35E+11	6.35E+11
6/30/22	206.30	237	64.754	1111.97	55.60	5559.83	6.31E+11	6.31E+11
2/1/22	205.96	238	65.027	1110.14	55.51	5550.69	6.30E+11	6.30E+11
2/4/22	205.17	239	65.301	1105.86	55.29	5529.29	6.27E+11	6.27E+11
7/1/22	203.59	240	65.574	1097.37	54.87	5486.86	6.23E+11	6.23E+11
9/3/22	201.90	241	65.847	1088.26	54.41	5441.28	6.17E+11	6.17E+11
7/3/22	201.28	242	66.120	1084.89	54.24	5424.44	6.16E+11	6.16E+11
1/2/23	200.34	243	66.393	1079.86	53.99	5399.30	6.13E+11	6.13E+11

2/6/22	199.97	244	66.667	1077.84	53.89	5389.18	6.12E+11	6.12E+11
7/4/22	199.49	245	66.940	1075.24	53.76	5376.18	6.10E+11	6.10E+11
12/31/22	199.44	246	67.213	1075.00	53.75	5375.02	6.10E+11	6.10E+11
2/5/22	194.82	247	67.486	1050.09	52.50	5250.46	5.96E+11	5.96E+11
9/4/22	190.78	248	67.760	1028.33	51.42	5141.65	5.83E+11	5.83E+11
9/5/22	183.83	249	68.033	990.85	49.54	4954.27	5.62E+11	5.62E+11
11/29/22	182.76	250	68.306	985.07	49.25	4925.34	5.59E+11	5.59E+11
9/6/22	177.83	251	68.579	958.51	47.93	4792.53	5.44E+11	5.44E+11
12/16/22	175.90	252	68.852	948.08	47.40	4740.39	5.38E+11	5.38E+11
11/30/22	174.48	253	69.126	940.45	47.02	4702.24	5.34E+11	5.34E+11
12/3/22	173.58	254	69.399	935.59	46.78	4677.96	5.31E+11	5.31E+11
12/6/22	173.46	255	69.672	934.96	46.75	4674.78	5.30E+11	5.30E+11
12/4/22	172.93	256	69.945	932.07	46.60	4660.33	5.29E+11	5.29E+11
12/5/22	172.69	257	70.219	930.80	46.54	4653.98	5.28E+11	5.28E+11
12/7/22	172.22	258	70.492	928.28	46.41	4641.41	5.27E+11	5.27E+11
11/28/22	171.55	259	70.765	924.67	46.23	4623.34	5.25E+11	5.25E+11
12/2/22	170.52	260	71.038	919.12	45.96	4595.60	5.21E+11	5.21E+11
12/1/22	170.21	261	71.311	917.41	45.87	4587.07	5.21E+11	5.21E+11
12/10/22	169.36	262	71.585	912.85	45.64	4564.24	5.18E+11	5.18E+11
9/7/22	169.09	263	71.858	911.37	45.57	4556.87	5.17E+11	5.17E+11
12/8/22	169.06	264	72.131	911.26	45.56	4556.30	5.17E+11	5.17E+11
12/15/22	168.76	265	72.404	909.61	45.48	4548.06	5.16E+11	5.16E+11
12/17/22	168.68	266	72.678	909.21	45.46	4546.04	5.16E+11	5.16E+11
12/9/22	168.48	267	72.951	908.08	45.40	4540.40	5.15E+11	5.15E+11
12/11/22	166.05	268	73.224	895.02	44.75	4475.09	5.08E+11	5.08E+11
12/12/22	161.47	269	73.497	870.31	43.52	4351.54	4.94E+11	4.94E+11
12/18/22	161.35	270	73.770	869.67	43.48	4348.36	4.93E+11	4.93E+11
9/8/22	160.23	271	74.044	863.66	43.18	4318.28	4.90E+11	4.90E+11
12/13/22	157.47	272	74.317	848.78	42.44	4243.89	4.82E+11	4.82E+11
12/14/22	155.74	273	74.590	839.42	41.97	4197.08	4.76E+11	4.76E+11
9/12/22	155.57	274	74.863	838.55	41.93	4192.74	4.76E+11	4.76E+11
12/30/22	152.80	275	75.137	823.58	41.18	4117.89	4.67E+11	4.67E+11
12/21/22	151.54	276	75.410	816.82	40.84	4084.08	4.63E+11	4.63E+11
9/13/22	150.57	277	75.683	811.56	40.58	4057.81	4.60E+11	4.60E+11
9/9/22	150.31	278	75.956	810.15	40.51	4050.73	4.60E+11	4.60E+11
12/22/22	148.37	279	76.230	799.74	39.99	3998.68	4.54E+11	4.54E+11
12/20/22	147.91	280	76.503	797.22	39.86	3986.11	4.52E+11	4.52E+11
9/11/22	145.06	281	76.776	781.88	39.09	3909.42	4.44E+11	4.44E+11
12/19/22	143.38	282	77.049	772.80	38.64	3864.01	4.38E+11	4.38E+11
9/14/22	142.94	283	77.322	770.46	38.52	3852.30	4.37E+11	4.37E+11
9/10/22	140.61	284	77.596	757.90	37.90	3789.51	4.30E+11	4.30E+11
9/15/22	133.46	285	77.869	719.37	35.97	3596.83	4.08E+11	4.08E+11
12/23/22	132.26	286	78.142	712.89	35.64	3564.45	4.04E+11	4.04E+11
12/29/22	129.11	287	78.415	695.90	34.80	3479.50	3.95E+11	3.95E+11
11/27/22	127.25	288	78.689	685.87	34.29	3429.36	3.89E+11	3.89E+11
9/16/22	124.06	289	78.962	668.71	33.44	3343.53	3.79E+11	3.79E+11
12/26/22	121.98	290	79.235	657.49	32.87	3287.46	3.73E+11	3.73E+11
12/25/22	121.20	291	79.508	653.27	32.66	3266.37	3.71E+11	3.71E+11
12/28/22	120.14	292	79.781	647.58	32.38	3237.90	3.67E+11	3.67E+11
10/19/22	117.67	293	80.055	634.26	31.71	3171.29	3.60E+11	3.60E+11
12/27/22	117.57	294	80.328	633.70	31.69	3168.52	3.60E+11	3.60E+11
9/17/22	116.46	295	80.601	627.70	31.38	3138.49	3.56E+11	3.56E+11
11/2/22	115.74	296	80.874	623.85	31.19	3119.27	3.54E+11	3.54E+11
10/27/22	114.15	297	81.148	615.24	30.76	3076.21	3.49E+11	3.49E+11
11/25/22	112.64	298	81.421	607.15	30.36	3035.75	3.44E+11	3.44E+11
11/26/22	112.47	299	81.694	606.20	30.31	3030.98	3.44E+11	3.44E+11
11/1/22	112.22	300	81.967	604.87	30.24	3024.33	3.43E+11	3.43E+11
10/20/22	111.53	301	82.240	601.17	30.06	3005.84	3.41E+11	3.41E+11
9/19/22	110.73	302	82.514	596.83	29.84	2984.16	3.39E+11	3.39E+11
11/17/22	110.63	303	82.787	596.31	29.82	2981.56	3.38E+11	3.38E+11
11/24/22	110.32	304	83.060	594.64	29.73	2973.18	3.37E+11	3.37E+11

11/3/22	110.23	305	83.333	594.12	29.71	2970.58	3.37E+11	3.37E+11
11/5/22	109.41	306	83.607	589.72	29.49	2948.62	3.35E+11	3.35E+11
11/18/22	109.31	307	83.880	589.20	29.46	2946.02	3.34E+11	3.34E+11
9/18/22	109.13	308	84.153	588.23	29.41	2941.13	3.34E+11	3.34E+11
10/31/22	109.11	309	84.426	588.10	29.41	2940.52	3.34E+11	3.34E+11
11/4/22	108.93	310	84.699	587.12	29.36	2935.61	3.33E+11	3.33E+11
11/23/22	108.91	311	84.973	587.04	29.35	2935.18	3.33E+11	3.33E+11
10/26/22	108.76	312	85.246	586.20	29.31	2930.99	3.33E+11	3.33E+11
10/28/22	108.67	313	85.519	585.74	29.29	2928.68	3.32E+11	3.32E+11
11/19/22	106.95	314	85.792	576.49	28.82	2882.44	3.27E+11	3.27E+11
11/10/22	106.80	315	86.066	575.68	28.78	2878.39	3.27E+11	3.27E+11
11/6/22	106.52	316	86.339	574.15	28.71	2870.73	3.26E+11	3.26E+11
11/22/22	106.38	317	86.612	573.40	28.67	2866.98	3.25E+11	3.25E+11
11/16/22	106.28	318	86.885	572.85	28.64	2864.23	3.25E+11	3.25E+11
11/11/22	106.27	319	87.158	572.79	28.64	2863.94	3.25E+11	3.25E+11
11/7/22	105.46	320	87.432	568.45	28.42	2842.27	3.23E+11	3.23E+11
11/8/22	105.03	321	87.705	566.11	28.31	2830.56	3.21E+11	3.21E+11
11/14/22	104.89	322	87.978	565.36	28.27	2826.81	3.21E+11	3.21E+11
11/20/22	104.61	323	88.251	563.86	28.19	2819.29	3.20E+11	3.20E+11
11/13/22	104.59	324	88.525	563.74	28.19	2818.71	3.20E+11	3.20E+11
11/12/22	104.52	325	88.798	563.37	28.17	2816.84	3.20E+11	3.20E+11
10/30/22	104.46	326	89.071	563.05	28.15	2815.25	3.19E+11	3.19E+11
10/29/22	104.45	327	89.344	562.99	28.15	2814.96	3.19E+11	3.19E+11
11/15/22	104.31	328	89.617	562.24	28.11	2811.20	3.19E+11	3.19E+11
11/9/22	104.07	329	89.891	560.91	28.05	2804.55	3.18E+11	3.18E+11
9/20/22	102.90	330	90.164	554.61	27.73	2773.05	3.15E+11	3.15E+11
10/21/22	102.67	331	90.437	553.40	27.67	2766.98	3.14E+11	3.14E+11
11/21/22	100.44	332	90.710	541.35	27.07	2706.73	3.07E+11	3.07E+11
9/21/22	100.26	333	90.984	540.39	27.02	2701.96	3.07E+11	3.07E+11
10/25/22	97.73	334	91.257	526.75	26.34	2633.76	2.99E+11	2.99E+11
10/22/22	96.62	335	91.530	520.77	26.04	2603.85	2.95E+11	2.95E+11
10/18/22	95.85	336	91.803	516.64	25.83	2583.18	2.93E+11	2.93E+11
9/22/22	94.96	337	92.077	511.84	25.59	2559.20	2.90E+11	2.90E+11
9/27/22	94.70	338	92.350	510.45	25.52	2552.26	2.90E+11	2.90E+11
12/24/22	93.68	339	92.623	504.96	25.25	2524.81	2.87E+11	2.87E+11
9/26/22	93.29	340	92.896	502.82	25.14	2514.11	2.85E+11	2.85E+11
10/23/22	92.81	341	93.169	500.22	25.01	2501.11	2.84E+11	2.84E+11
10/24/22	91.61	342	93.443	493.78	24.69	2468.88	2.80E+11	2.80E+11
9/28/22	91.21	343	93.716	491.64	24.58	2458.19	2.79E+11	2.79E+11
9/23/22	88.67	344	93.989	477.94	23.90	2389.70	2.71E+11	2.71E+11
9/25/22	88.60	345	94.262	477.54	23.88	2387.68	2.71E+11	2.71E+11
9/29/22	88.12	346	94.536	474.99	23.75	2374.96	2.70E+11	2.70E+11
9/30/22	86.60	347	94.809	466.76	23.34	2333.78	2.65E+11	2.65E+11
9/24/22	85.83	348	95.082	462.62	23.13	2313.12	2.62E+11	2.62E+11
10/1/22	84.02	349	95.355	452.88	22.64	2264.42	2.57E+11	2.57E+11
10/2/22	80.81	350	95.628	435.54	21.78	2177.72	2.47E+11	2.47E+11
10/3/22	77.70	351	95.902	418.78	20.94	2093.91	2.38E+11	2.38E+11
10/4/22	75.49	352	96.175	406.88	20.34	2034.38	2.31E+11	2.31E+11
10/17/22	73.95	353	96.448	398.61	19.93	1993.05	2.26E+11	2.26E+11
10/5/22	72.88	354	96.721	392.80	19.64	1964.01	2.23E+11	2.23E+11
10/6/22	71.52	355	96.995	385.49	19.27	1927.45	2.19E+11	2.19E+11
10/7/22	68.77	356	97.268	370.67	18.53	1853.33	2.10E+11	2.10E+11
10/13/22	67.98	357	97.541	366.42	18.32	1832.08	2.08E+11	2.08E+11
10/12/22	67.79	358	97.814	365.38	18.27	1826.88	2.07E+11	2.07E+11
10/14/22	66.80	359	98.087	360.03	18.00	1800.15	2.04E+11	2.04E+11
10/15/22	66.35	360	98.361	357.60	17.88	1788.01	2.03E+11	2.03E+11
10/8/22	66.31	361	98.634	357.40	17.87	1787.00	2.03E+11	2.03E+11
10/9/22	65.63	362	98.907	353.76	17.69	1768.79	2.01E+11	2.01E+11
10/16/22	65.39	363	99.180	352.46	17.62	1762.29	2.00E+11	2.00E+11
10/10/22	65.07	364	99.454	350.72	17.54	1753.62	1.99E+11	1.99E+11
10/11/22	65.01	365	99.727	350.41	17.52	1752.03	1.99E+11	1.99E+11

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 17 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	1107.30	2.08	0.380	3.2	115.0	1.366120219	12414.11894	2267.96404	19098.64452	3.12E+12	21	260696.4977	47627.24478	401071.535	6.54E+13
3/15/22	444.80	2.14	0.05	4.8	40.0	19.3989071	5130.594986	119.873715	11507.8766	4.35E+11	35	179570.8245	4195.580012	402775.6812	1.52E+13
4/19/22	478.96	3.10	0.05	1.6	96.0	15.0273224	8002.938482	129.079653	4130.548894	1.12E+12	35	280102.8469	4517.787853	144569.2113	3.94E+13
5/24/22	300.29	4.18	0.064	9.2	68.0	43.71584699	6765.521656	103.586934	14890.62183	5.00E+11	28	189434.6064	2900.434165	416937.4112	1.40E+13
6/21/22	290.30	3.86	0.145	12.4	75.0	46.17486339	6039.876971	226.88657	19402.71359	5.33E+11	28	169116.5552	6352.823965	543275.9804	1.49E+13
7/19/22	338.68	3.66	0.257	8	548.0	36.61202186	6681.206763	469.144846	14603.73063	4.54E+12	35	233842.2367	16420.06963	511130.5721	1.59E+14
8/23/22	271.92	3.48	0.062	4.4	104.0	49.18032787	5100.522736	90.8713821	6448.936793	6.92E+11	28	142814.6366	2544.398698	180570.2302	1.94E+13
9/20/22	102.90	2.85	0.062	1.2	99.0	90.16393443	1578.609937	34.3858485	665.532552	2.49E+11	36	56829.95772	1237.890547	23959.17187	8.97E+12
10/26/22	108.76	1.72	0.050	4.4	206.0	85.24590164	1006.407526	29.3098811	2579.269538	5.48E+11	13	13083.29784	381.0284545	33530.504	7.13E+12
11/8/22	105.03	1.79	0.050	1.2	73.0	87.70491803	1011.568813	28.3056232	679.334957	1.88E+11	35	35404.90845	990.6968124	23776.7235	6.57E+12
12/13/22	157.47	4.30	0.050	2.4	62.0	74.31693989	3649.747778	42.4389276	2037.068527	2.39E+11	36	131390.92	1527.801395	73334.46698	8.60E+12
1/18/23	237.61	3.80	0.056	9.6	62.0	63.1147541	4866.700284	71.7197937	12294.82177	3.60E+11	37	180067.9105	2653.632365	454908.4055	1.33E+13
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	1,872,355.2	91,349.4	3,209,839.9	3.72E+14
											TARGET	609,104.1	30,455.2	3,045,520.3	3.46E+14

Site 18 Date	E18	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	69.26	1	0.273	373.32	18.67	1866.59	2.12E+11	2.12E+11
2/24/22	69.94	2	0.546	376.97	18.85	1884.84	2.14E+11	2.14E+11
2/22/22	66.04	3	0.820	355.95	17.80	1779.77	2.02E+11	2.02E+11
2/25/22	68.08	4	1.093	366.94	18.35	1834.70	2.08E+11	2.08E+11
2/26/22	65.30	5	1.366	351.98	17.60	1759.91	2.00E+11	2.00E+11
2/21/22	63.95	6	1.639	344.67	17.23	1723.34	1.96E+11	1.96E+11
2/27/22	64.09	7	1.913	345.44	17.27	1727.19	1.96E+11	1.96E+11
2/20/22	57.15	8	2.186	308.01	15.40	1540.07	1.75E+11	1.75E+11
2/19/22	61.34	9	2.459	330.64	16.53	1653.19	1.88E+11	1.88E+11
2/28/22	61.39	10	2.732	330.91	16.55	1654.55	1.88E+11	1.88E+11
3/1/22	60.93	11	3.005	328.41	16.42	1642.07	1.86E+11	1.86E+11
3/2/22	58.96	12	3.279	317.80	15.89	1588.98	1.80E+11	1.80E+11
3/3/22	59.10	13	3.552	318.57	15.93	1592.83	1.81E+11	1.81E+11
3/4/22	58.52	14	3.825	315.44	15.77	1577.18	1.79E+11	1.79E+11
3/26/22	53.61	15	4.098	288.94	14.45	1444.70	1.64E+11	1.64E+11
3/27/22	53.81	16	4.372	290.04	14.50	1450.21	1.65E+11	1.65E+11
3/28/22	54.12	17	4.645	291.72	14.59	1458.59	1.66E+11	1.66E+11
3/25/22	52.13	18	4.918	280.96	14.05	1404.82	1.59E+11	1.59E+11
3/5/22	53.51	19	5.191	288.41	14.42	1442.05	1.64E+11	1.64E+11
2/18/22	50.71	20	5.464	273.32	13.67	1366.60	1.55E+11	1.55E+11
3/29/22	53.66	21	5.738	289.21	14.46	1446.03	1.64E+11	1.64E+11
3/24/22	50.06	22	6.011	269.80	13.49	1348.99	1.53E+11	1.53E+11
3/30/22	49.27	23	6.284	265.55	13.28	1327.76	1.51E+11	1.51E+11
3/7/22	52.15	24	6.557	281.09	14.05	1405.47	1.59E+11	1.59E+11
3/6/22	51.50	25	6.831	277.57	13.88	1387.84	1.57E+11	1.57E+11
3/8/22	53.16	26	7.104	286.53	14.33	1432.64	1.63E+11	1.63E+11
3/31/22	46.93	27	7.377	252.97	12.65	1264.86	1.44E+11	1.44E+11
3/9/22	52.10	28	7.650	280.84	14.04	1404.22	1.59E+11	1.59E+11
4/1/22	47.78	29	7.923	257.54	12.88	1287.68	1.46E+11	1.46E+11
4/2/22	48.20	30	8.197	259.79	12.99	1298.97	1.47E+11	1.47E+11
3/10/22	51.62	31	8.470	278.24	13.91	1391.22	1.58E+11	1.58E+11
3/23/22	45.37	32	8.743	244.55	12.23	1222.74	1.39E+11	1.39E+11
4/3/22	47.30	33	9.016	254.95	12.75	1274.73	1.45E+11	1.45E+11
5/8/22	45.51	34	9.290	245.32	12.27	1226.60	1.39E+11	1.39E+11
3/11/22	46.38	35	9.563	249.98	12.50	1249.89	1.42E+11	1.42E+11
5/9/22	44.48	36	9.836	239.73	11.99	1198.64	1.36E+11	1.36E+11
5/7/22	45.70	37	10.109	246.34	12.32	1231.72	1.40E+11	1.40E+11
4/4/22	44.85	38	10.383	241.74	12.09	1208.72	1.37E+11	1.37E+11
5/10/22	44.23	39	10.656	238.39	11.92	1191.97	1.35E+11	1.35E+11
4/5/22	46.81	40	10.929	252.30	12.61	1261.48	1.43E+11	1.43E+11
4/7/22	44.67	41	11.202	240.79	12.04	1203.94	1.37E+11	1.37E+11
5/11/22	45.13	42	11.475	243.25	12.16	1216.25	1.38E+11	1.38E+11
4/6/22	44.12	43	11.749	237.81	11.89	1189.06	1.35E+11	1.35E+11
4/8/22	41.45	44	12.022	223.43	11.17	1117.15	1.27E+11	1.27E+11
3/12/22	45.42	45	12.295	244.84	12.24	1224.20	1.39E+11	1.39E+11
4/15/22	43.50	46	12.568	234.44	11.72	1172.22	1.33E+11	1.33E+11
4/16/22	43.14	47	12.842	232.53	11.63	1162.66	1.32E+11	1.32E+11
4/9/22	44.00	48	13.115	237.17	11.86	1185.86	1.35E+11	1.35E+11
5/12/22	42.57	49	13.388	229.43	11.47	1147.17	1.30E+11	1.30E+11
3/22/22	42.81	50	13.661	230.75	11.54	1153.73	1.31E+11	1.31E+11
4/17/22	44.11	51	13.934	237.77	11.89	1188.85	1.35E+11	1.35E+11
4/14/22	41.03	52	14.208	221.17	11.06	1105.83	1.25E+11	1.25E+11
3/21/22	43.62	53	14.481	235.10	11.76	1175.51	1.33E+11	1.33E+11
5/6/22	39.99	54	14.754	215.55	10.78	1077.74	1.22E+11	1.22E+11
4/10/22	42.94	55	15.027	231.43	11.57	1157.13	1.31E+11	1.31E+11
3/13/22	42.54	56	15.301	229.30	11.46	1146.48	1.30E+11	1.30E+11
4/18/22	40.55	57	15.574	218.57	10.93	1092.83	1.24E+11	1.24E+11
5/13/22	40.49	58	15.847	218.27	10.91	1091.34	1.24E+11	1.24E+11
4/19/22	41.59	59	16.120	224.17	11.21	1120.83	1.27E+11	1.27E+11
3/20/22	40.75	60	16.393	219.65	10.98	1098.25	1.25E+11	1.25E+11

4/20/22	39.91	61	16.667	215.10	10.75	1075.49	1.22E+11	1.22E+11
4/11/22	42.43	62	16.940	228.68	11.43	1143.41	1.30E+11	1.30E+11
5/14/22	39.18	63	17.213	211.17	10.56	1055.86	1.20E+11	1.20E+11
3/14/22	42.32	64	17.486	228.08	11.40	1140.41	1.29E+11	1.29E+11
4/13/22	35.87	65	17.760	193.34	9.67	966.69	1.10E+11	1.10E+11
4/21/22	37.86	66	18.033	204.04	10.20	1020.22	1.16E+11	1.16E+11
4/12/22	40.41	67	18.306	217.83	10.89	1089.16	1.24E+11	1.24E+11
2/17/22	36.14	68	18.579	194.80	9.74	974.00	1.11E+11	1.11E+11
4/22/22	40.30	69	18.852	217.24	10.86	1086.21	1.23E+11	1.23E+11
5/15/22	38.16	70	19.126	205.70	10.28	1028.50	1.17E+11	1.17E+11
5/5/22	38.39	71	19.399	206.95	10.35	1034.74	1.17E+11	1.17E+11
3/15/22	40.86	72	19.672	220.26	11.01	1101.30	1.25E+11	1.25E+11
4/23/22	36.74	73	19.945	198.03	9.90	990.15	1.12E+11	1.12E+11
4/25/22	38.39	74	20.219	206.93	10.35	1034.65	1.17E+11	1.17E+11
4/24/22	35.04	75	20.492	188.87	9.44	944.37	1.07E+11	1.07E+11
5/4/22	37.94	76	20.765	204.50	10.23	1022.51	1.16E+11	1.16E+11
4/26/22	37.45	77	21.038	201.87	10.09	1009.35	1.15E+11	1.15E+11
3/16/22	38.72	78	21.311	208.67	10.43	1043.37	1.18E+11	1.18E+11
5/16/22	36.35	79	21.585	195.95	9.80	979.76	1.11E+11	1.11E+11
3/19/22	35.83	80	21.858	193.11	9.66	965.53	1.10E+11	1.10E+11
4/27/22	37.29	81	22.131	200.99	10.05	1004.94	1.14E+11	1.14E+11
3/17/22	37.95	82	22.404	204.55	10.23	1022.77	1.16E+11	1.16E+11
4/28/22	35.01	83	22.678	188.70	9.44	943.51	1.07E+11	1.07E+11
5/17/22	34.15	84	22.951	184.07	9.20	920.34	1.04E+11	1.04E+11
3/18/22	34.15	85	23.224	184.08	9.20	920.40	1.04E+11	1.04E+11
5/3/22	33.99	86	23.497	183.18	9.16	915.90	1.04E+11	1.04E+11
4/29/22	33.68	87	23.770	181.54	9.08	907.69	1.03E+11	1.03E+11
5/18/22	32.46	88	24.044	174.94	8.75	874.69	9.93E+10	9.93E+10
5/1/22	32.41	89	24.317	174.68	8.73	873.40	9.91E+10	9.91E+10
6/11/22	33.26	90	24.590	179.29	8.96	896.45	1.02E+11	1.02E+11
6/12/22	32.96	91	24.863	177.64	8.88	888.19	1.01E+11	1.01E+11
4/30/22	31.50	92	25.137	169.81	8.49	849.04	9.63E+10	9.63E+10
5/2/22	33.29	93	25.410	179.41	8.97	897.04	1.02E+11	1.02E+11
6/10/22	32.76	94	25.683	176.59	8.83	882.94	1.00E+11	1.00E+11
5/19/22	31.48	95	25.956	169.66	8.48	848.31	9.63E+10	9.63E+10
6/13/22	32.64	96	26.230	175.95	8.80	879.77	9.98E+10	9.98E+10
6/9/22	32.23	97	26.503	173.73	8.69	868.66	9.86E+10	9.86E+10
6/14/22	32.51	98	26.776	175.21	8.76	876.05	9.94E+10	9.94E+10
5/20/22	30.30	99	27.049	163.29	8.16	816.46	9.27E+10	9.27E+10
6/15/22	31.51	100	27.322	169.82	8.49	849.12	9.64E+10	9.64E+10
6/8/22	29.66	101	27.596	159.86	7.99	799.32	9.07E+10	9.07E+10
6/2/22	30.09	102	27.869	162.16	8.11	810.82	9.20E+10	9.20E+10
5/21/22	29.46	103	28.142	158.81	7.94	794.06	9.01E+10	9.01E+10
6/1/22	29.21	104	28.415	157.44	7.87	787.19	8.93E+10	8.93E+10
5/30/22	29.73	105	28.689	160.23	8.01	801.16	9.09E+10	9.09E+10
7/28/22	27.59	106	28.962	148.71	7.44	743.53	8.44E+10	8.44E+10
6/3/22	29.30	107	29.235	157.94	7.90	789.70	8.96E+10	8.96E+10
7/27/22	27.56	108	29.508	148.53	7.43	742.63	8.43E+10	8.43E+10
5/31/22	29.77	109	29.781	160.47	8.02	802.35	9.10E+10	9.10E+10
7/29/22	27.50	110	30.055	148.21	7.41	741.05	8.41E+10	8.41E+10
5/29/22	28.78	111	30.328	155.10	7.76	775.51	8.80E+10	8.80E+10
7/26/22	26.48	112	30.601	142.74	7.14	713.70	8.10E+10	8.10E+10
5/22/22	28.34	113	30.874	152.74	7.64	763.71	8.67E+10	8.67E+10
6/7/22	28.74	114	31.148	154.89	7.74	774.44	8.79E+10	8.79E+10
6/16/22	29.63	115	31.421	159.70	7.99	798.51	9.06E+10	9.06E+10
6/4/22	28.26	116	31.694	152.34	7.62	761.70	8.64E+10	8.64E+10
7/30/22	26.29	117	31.967	141.70	7.08	708.48	8.04E+10	8.04E+10
7/25/22	25.86	118	32.240	139.38	6.97	696.89	7.91E+10	7.91E+10
5/23/22	26.66	119	32.514	143.67	7.18	718.35	8.15E+10	8.15E+10
6/5/22	26.87	120	32.787	144.82	7.24	724.12	8.22E+10	8.22E+10
7/31/22	25.11	121	33.060	135.36	6.77	676.80	7.68E+10	7.68E+10

6/17/22	27.32	122	33.333	147.27	7.36	736.37	8.36E+10	8.36E+10
6/6/22	25.53	123	33.607	137.61	6.88	688.07	7.81E+10	7.81E+10
5/28/22	26.39	124	33.880	142.22	7.11	711.09	8.07E+10	8.07E+10
5/24/22	25.09	125	34.153	135.25	6.76	676.25	7.67E+10	7.67E+10
7/24/22	24.09	126	34.426	129.85	6.49	649.27	7.37E+10	7.37E+10
8/1/22	23.87	127	34.699	128.64	6.43	643.20	7.30E+10	7.30E+10
2/16/22	21.08	128	34.973	113.60	5.68	567.98	6.45E+10	6.45E+10
5/27/22	25.71	129	35.246	138.59	6.93	692.96	7.86E+10	7.86E+10
5/25/22	24.77	130	35.519	133.52	6.68	667.58	7.58E+10	7.58E+10
5/26/22	25.47	131	35.792	137.29	6.86	686.46	7.79E+10	7.79E+10
6/18/22	25.40	132	36.066	136.90	6.84	684.50	7.77E+10	7.77E+10
8/2/22	22.44	133	36.339	120.96	6.05	604.81	6.86E+10	6.86E+10
2/13/22	23.26	134	36.612	125.35	6.27	626.74	7.11E+10	7.11E+10
2/14/22	23.08	135	36.885	124.39	6.22	621.95	7.06E+10	7.06E+10
2/15/22	22.66	136	37.158	122.15	6.11	610.75	6.93E+10	6.93E+10
8/3/22	20.94	137	37.432	112.86	5.64	564.31	6.40E+10	6.40E+10
7/8/22	22.78	138	37.705	122.78	6.14	613.89	6.97E+10	6.97E+10
7/9/22	22.72	139	37.978	122.46	6.12	612.29	6.95E+10	6.95E+10
6/19/22	22.72	140	38.251	122.45	6.12	612.27	6.95E+10	6.95E+10
2/12/22	22.27	141	38.525	120.04	6.00	600.19	6.81E+10	6.81E+10
8/4/22	20.45	142	38.798	110.21	5.51	551.03	6.25E+10	6.25E+10
1/25/23	18.72	143	39.071	100.92	5.05	504.61	5.73E+10	5.73E+10
1/23/23	18.19	144	39.344	98.04	4.90	490.20	5.56E+10	5.56E+10
1/22/23	18.64	145	39.617	100.49	5.02	502.47	5.70E+10	5.70E+10
1/26/23	18.28	146	39.891	98.54	4.93	492.68	5.59E+10	5.59E+10
7/10/22	22.31	147	40.164	120.26	6.01	601.31	6.82E+10	6.82E+10
7/23/22	19.68	148	40.437	106.05	5.30	530.26	6.02E+10	6.02E+10
1/24/23	17.62	149	40.710	94.95	4.75	474.74	5.39E+10	5.39E+10
1/27/23	16.92	150	40.984	91.18	4.56	455.90	5.17E+10	5.17E+10
7/7/22	22.04	151	41.257	118.79	5.94	593.93	6.74E+10	6.74E+10
1/8/23	18.56	152	41.530	100.02	5.00	500.08	5.67E+10	5.67E+10
1/28/23	18.31	153	41.803	98.66	4.93	493.32	5.60E+10	5.60E+10
1/21/23	17.52	154	42.077	94.44	4.72	472.20	5.36E+10	5.36E+10
1/7/23	18.29	155	42.350	98.56	4.93	492.81	5.59E+10	5.59E+10
1/29/23	17.66	156	42.623	95.18	4.76	475.90	5.40E+10	5.40E+10
1/6/23	17.85	157	42.896	96.20	4.81	481.01	5.46E+10	5.46E+10
8/5/22	18.50	158	43.169	99.72	4.99	498.60	5.66E+10	5.66E+10
1/9/23	18.05	159	43.443	97.28	4.86	486.40	5.52E+10	5.52E+10
7/11/22	21.45	160	43.716	115.62	5.78	578.09	6.56E+10	6.56E+10
1/30/23	17.95	161	43.989	96.78	4.84	483.88	5.49E+10	5.49E+10
1/10/23	18.00	162	44.262	97.02	4.85	485.11	5.50E+10	5.50E+10
1/5/23	17.40	163	44.536	93.80	4.69	469.00	5.32E+10	5.32E+10
2/7/22	19.72	164	44.809	106.27	5.31	531.37	6.03E+10	6.03E+10
1/20/23	17.12	165	45.082	92.28	4.61	461.39	5.24E+10	5.24E+10
1/31/23	16.98	166	45.355	91.51	4.58	457.54	5.19E+10	5.19E+10
2/8/22	19.02	167	45.628	102.51	5.13	512.55	5.82E+10	5.82E+10
6/20/22	21.00	168	45.902	113.22	5.66	566.08	6.42E+10	6.42E+10
2/6/22	17.42	169	46.175	93.89	4.69	469.47	5.33E+10	5.33E+10
1/12/23	17.49	170	46.448	94.29	4.71	471.47	5.35E+10	5.35E+10
2/3/22	20.04	171	46.721	108.00	5.40	540.00	6.13E+10	6.13E+10
8/6/22	17.78	172	46.995	95.82	4.79	479.09	5.44E+10	5.44E+10
7/12/22	20.05	173	47.268	108.05	5.40	540.26	6.13E+10	6.13E+10
2/4/22	17.72	174	47.541	95.53	4.78	477.65	5.42E+10	5.42E+10
2/5/22	19.11	175	47.814	103.01	5.15	515.04	5.84E+10	5.84E+10
1/4/23	16.57	176	48.087	89.34	4.47	446.69	5.07E+10	5.07E+10
1/13/23	16.75	177	48.361	90.29	4.51	451.43	5.12E+10	5.12E+10
2/11/22	16.50	178	48.634	88.96	4.45	444.78	5.05E+10	5.05E+10
1/19/23	16.32	179	48.907	87.98	4.40	439.89	4.99E+10	4.99E+10
1/14/23	16.45	180	49.180	88.64	4.43	443.22	5.03E+10	5.03E+10
2/9/22	18.00	181	49.454	97.01	4.85	485.03	5.50E+10	5.50E+10
8/7/22	16.85	182	49.727	90.80	4.54	453.99	5.15E+10	5.15E+10

1/15/23	15.84	183	50.000	85.36	4.27	426.81	4.84E+10	4.84E+10
8/8/22	16.14	184	50.273	86.98	4.35	434.88	4.93E+10	4.93E+10
2/2/22	18.87	185	50.546	101.71	5.09	508.57	5.77E+10	5.77E+10
7/13/22	18.44	186	50.820	99.37	4.97	496.84	5.64E+10	5.64E+10
2/10/22	18.25	187	51.093	98.37	4.92	491.83	5.58E+10	5.58E+10
8/9/22	15.78	188	51.366	85.05	4.25	425.23	4.83E+10	4.83E+10
6/21/22	18.73	189	51.639	100.93	5.05	504.65	5.73E+10	5.73E+10
1/16/23	15.53	190	51.913	83.72	4.19	418.60	4.75E+10	4.75E+10
1/3/23	14.31	191	52.186	77.12	3.86	385.59	4.38E+10	4.38E+10
1/17/23	14.77	192	52.459	79.62	3.98	398.08	4.52E+10	4.52E+10
7/14/22	17.14	193	52.732	92.40	4.62	461.99	5.24E+10	5.24E+10
1/18/23	14.26	194	53.005	76.84	3.84	384.21	4.36E+10	4.36E+10
7/22/22	14.39	195	53.279	77.58	3.88	387.91	4.40E+10	4.40E+10
8/10/22	15.08	196	53.552	81.30	4.07	406.51	4.61E+10	4.61E+10
8/22/22	14.43	197	53.825	77.76	3.89	388.79	4.41E+10	4.41E+10
12/2/22	10.47	198	54.098	56.46	2.82	282.30	3.20E+10	3.20E+10
12/1/22	12.35	199	54.372	66.57	3.33	332.83	3.78E+10	3.78E+10
7/15/22	15.35	200	54.645	82.75	4.14	413.76	4.70E+10	4.70E+10
7/6/22	15.92	201	54.918	85.80	4.29	429.02	4.87E+10	4.87E+10
12/4/22	12.48	202	55.191	67.28	3.36	336.40	3.82E+10	3.82E+10
1/2/23	13.68	203	55.464	73.72	3.69	368.59	4.18E+10	4.18E+10
12/3/22	12.80	204	55.738	68.99	3.45	344.96	3.91E+10	3.91E+10
11/30/22	12.31	205	56.011	66.37	3.32	331.84	3.77E+10	3.77E+10
6/22/22	16.41	206	56.284	88.46	4.42	442.31	5.02E+10	5.02E+10
7/16/22	14.50	207	56.557	78.16	3.91	390.82	4.43E+10	4.43E+10
8/21/22	13.70	208	56.831	73.85	3.69	369.25	4.19E+10	4.19E+10
12/5/22	12.24	209	57.104	65.96	3.30	329.82	3.74E+10	3.74E+10
11/29/22	9.91	210	57.377	53.43	2.67	267.16	3.03E+10	3.03E+10
8/11/22	13.74	211	57.650	74.04	3.70	370.18	4.20E+10	4.20E+10
1/1/23	12.34	212	57.923	66.50	3.32	332.49	3.77E+10	3.77E+10
12/6/22	12.66	213	58.197	68.21	3.41	341.06	3.87E+10	3.87E+10
8/23/22	12.75	214	58.470	68.72	3.44	343.61	3.90E+10	3.90E+10
7/17/22	14.35	215	58.743	77.33	3.87	386.64	4.39E+10	4.39E+10
1/11/23	16.52	216	59.016	89.05	4.45	445.27	5.05E+10	5.05E+10
12/7/22	11.86	217	59.290	63.90	3.20	319.51	3.63E+10	3.63E+10
7/18/22	13.99	218	59.563	75.43	3.77	377.15	4.28E+10	4.28E+10
12/8/22	11.58	219	59.836	62.42	3.12	312.11	3.54E+10	3.54E+10
8/31/22	11.40	220	60.109	61.44	3.07	307.22	3.49E+10	3.49E+10
12/9/22	9.80	221	60.383	52.80	2.64	263.99	3.00E+10	3.00E+10
8/30/22	11.64	222	60.656	62.73	3.14	313.67	3.56E+10	3.56E+10
12/10/22	10.35	223	60.929	55.78	2.79	278.88	3.16E+10	3.16E+10
12/31/22	11.33	224	61.202	61.08	3.05	305.42	3.47E+10	3.47E+10
2/1/22	12.76	225	61.475	68.76	3.44	343.79	3.90E+10	3.90E+10
8/12/22	11.83	226	61.749	63.76	3.19	318.81	3.62E+10	3.62E+10
7/19/22	12.30	227	62.022	66.28	3.31	331.38	3.76E+10	3.76E+10
8/24/22	10.79	228	62.295	58.17	2.91	290.87	3.30E+10	3.30E+10
11/28/22	9.11	229	62.568	49.08	2.45	245.42	2.78E+10	2.78E+10
12/11/22	10.53	230	62.842	56.73	2.84	283.67	3.22E+10	3.22E+10
6/23/22	13.96	231	63.115	75.25	3.76	376.26	4.27E+10	4.27E+10
8/15/22	10.79	232	63.388	58.16	2.91	290.82	3.30E+10	3.30E+10
9/1/22	9.97	233	63.661	53.75	2.69	268.74	3.05E+10	3.05E+10
12/12/22	10.76	234	63.934	58.01	2.90	290.04	3.29E+10	3.29E+10
8/14/22	10.95	235	64.208	59.01	2.95	295.04	3.35E+10	3.35E+10
12/16/22	9.18	236	64.481	49.48	2.47	247.40	2.81E+10	2.81E+10
12/13/22	9.09	237	64.754	49.02	2.45	245.10	2.78E+10	2.78E+10
12/15/22	8.57	238	65.027	46.21	2.31	231.05	2.62E+10	2.62E+10
12/17/22	9.56	239	65.301	51.54	2.58	257.72	2.92E+10	2.92E+10
8/13/22	10.61	240	65.574	57.21	2.86	286.03	3.25E+10	3.25E+10
7/20/22	10.93	241	65.847	58.94	2.95	294.69	3.34E+10	3.34E+10
8/16/22	10.12	242	66.120	54.56	2.73	272.80	3.10E+10	3.10E+10
12/14/22	9.47	243	66.393	51.03	2.55	255.17	2.90E+10	2.90E+10

12/24/22	6.23	244	66.667	33.59	1.68	167.93	1.91E+10	1.91E+10
8/25/22	9.98	245	66.940	53.81	2.69	269.04	3.05E+10	3.05E+10
9/2/22	9.47	246	67.213	51.05	2.55	255.24	2.90E+10	2.90E+10
12/18/22	9.47	247	67.486	51.06	2.55	255.29	2.90E+10	2.90E+10
12/23/22	6.16	248	67.760	33.23	1.66	166.14	1.89E+10	1.89E+10
12/20/22	9.54	249	68.033	51.42	2.57	257.08	2.92E+10	2.92E+10
10/23/22	8.89	250	68.306	47.89	2.39	239.46	2.72E+10	2.72E+10
12/19/22	9.44	251	68.579	50.87	2.54	254.35	2.89E+10	2.89E+10
12/27/22	5.01	252	68.852	27.02	1.35	135.12	1.53E+10	1.53E+10
12/26/22	6.38	253	69.126	34.37	1.72	171.86	1.95E+10	1.95E+10
12/30/22	8.29	254	69.399	44.67	2.23	223.33	2.53E+10	2.53E+10
7/21/22	10.27	255	69.672	55.34	2.77	276.68	3.14E+10	3.14E+10
8/17/22	9.31	256	69.945	50.16	2.51	250.82	2.85E+10	2.85E+10
6/24/22	11.91	257	70.219	64.18	3.21	320.88	3.64E+10	3.64E+10
12/21/22	9.54	258	70.492	51.44	2.57	257.18	2.92E+10	2.92E+10
12/28/22	4.57	259	70.765	24.64	1.23	123.20	1.40E+10	1.40E+10
12/25/22	5.41	260	71.038	29.18	1.46	145.89	1.66E+10	1.66E+10
9/3/22	9.01	261	71.311	48.57	2.43	242.85	2.76E+10	2.76E+10
8/26/22	8.89	262	71.585	47.94	2.40	239.69	2.72E+10	2.72E+10
12/22/22	9.26	263	71.858	49.90	2.49	249.50	2.83E+10	2.83E+10
8/29/22	8.11	264	72.131	43.72	2.19	218.60	2.48E+10	2.48E+10
8/27/22	9.02	265	72.404	48.64	2.43	243.20	2.76E+10	2.76E+10
9/4/22	8.62	266	72.678	46.44	2.32	232.21	2.64E+10	2.64E+10
8/18/22	8.91	267	72.951	48.02	2.40	240.12	2.72E+10	2.72E+10
12/29/22	5.16	268	73.224	27.79	1.39	138.97	1.58E+10	1.58E+10
10/24/22	7.55	269	73.497	40.68	2.03	203.40	2.31E+10	2.31E+10
8/19/22	8.55	270	73.770	46.09	2.30	230.47	2.62E+10	2.62E+10
8/28/22	8.47	271	74.044	45.66	2.28	228.32	2.59E+10	2.59E+10
8/20/22	8.11	272	74.317	43.74	2.19	218.68	2.48E+10	2.48E+10
9/5/22	8.36	273	74.590	45.05	2.25	225.24	2.56E+10	2.56E+10
6/25/22	10.74	274	74.863	57.86	2.89	289.32	3.28E+10	3.28E+10
9/6/22	7.96	275	75.137	42.93	2.15	214.64	2.44E+10	2.44E+10
10/25/22	6.48	276	75.410	34.92	1.75	174.62	1.98E+10	1.98E+10
10/26/22	7.00	277	75.683	37.75	1.89	188.75	2.14E+10	2.14E+10
10/27/22	6.93	278	75.956	37.34	1.87	186.72	2.12E+10	2.12E+10
11/27/22	6.26	279	76.230	33.76	1.69	168.78	1.92E+10	1.92E+10
10/28/22	6.96	280	76.503	37.49	1.87	187.45	2.13E+10	2.13E+10
9/7/22	8.00	281	76.776	43.15	2.16	215.73	2.45E+10	2.45E+10
9/27/22	8.27	282	77.049	44.56	2.23	222.79	2.53E+10	2.53E+10
10/29/22	6.59	283	77.322	35.50	1.78	177.51	2.01E+10	2.01E+10
6/26/22	9.75	284	77.596	52.55	2.63	262.75	2.98E+10	2.98E+10
9/28/22	7.86	285	77.869	42.36	2.12	211.80	2.40E+10	2.40E+10
10/30/22	6.50	286	78.142	35.02	1.75	175.08	1.99E+10	1.99E+10
11/1/22	6.13	287	78.415	33.06	1.65	165.30	1.88E+10	1.88E+10
10/31/22	6.19	288	78.689	33.34	1.67	166.69	1.89E+10	1.89E+10
11/2/22	6.46	289	78.962	34.81	1.74	174.05	1.98E+10	1.98E+10
11/4/22	6.13	290	79.235	33.05	1.65	165.24	1.88E+10	1.88E+10
11/3/22	6.49	291	79.508	34.98	1.75	174.91	1.98E+10	1.98E+10
9/26/22	7.86	292	79.781	42.35	2.12	211.76	2.40E+10	2.40E+10
9/8/22	7.46	293	80.055	40.22	2.01	201.08	2.28E+10	2.28E+10
11/5/22	5.79	294	80.328	31.19	1.56	155.96	1.77E+10	1.77E+10
10/19/22	6.06	295	80.601	32.67	1.63	163.37	1.85E+10	1.85E+10
9/29/22	7.43	296	80.874	40.06	2.00	200.31	2.27E+10	2.27E+10
10/22/22	6.27	297	81.148	33.79	1.69	168.96	1.92E+10	1.92E+10
11/7/22	6.07	298	81.421	32.69	1.63	163.46	1.85E+10	1.85E+10
11/6/22	6.00	299	81.694	32.37	1.62	161.83	1.84E+10	1.84E+10
11/8/22	6.56	300	81.967	35.34	1.77	176.70	2.01E+10	2.01E+10
10/20/22	6.03	301	82.240	32.51	1.63	162.53	1.84E+10	1.84E+10
11/9/22	6.00	302	82.514	32.36	1.62	161.78	1.84E+10	1.84E+10
9/9/22	6.74	303	82.787	36.35	1.82	181.73	2.06E+10	2.06E+10
9/30/22	7.37	304	83.060	39.70	1.98	198.49	2.25E+10	2.25E+10

11/10/22	5.46	305	83.333	29.44	1.47	147.18	1.67E+10	1.67E+10
9/12/22	7.50	306	83.607	40.41	2.02	202.04	2.29E+10	2.29E+10
11/11/22	6.12	307	83.880	32.98	1.65	164.88	1.87E+10	1.87E+10
10/18/22	5.42	308	84.153	29.23	1.46	146.14	1.66E+10	1.66E+10
6/27/22	8.44	309	84.426	45.48	2.27	227.40	2.58E+10	2.58E+10
10/21/22	5.74	310	84.699	30.95	1.55	154.77	1.76E+10	1.76E+10
9/11/22	5.63	311	84.973	30.35	1.52	151.76	1.72E+10	1.72E+10
11/12/22	5.45	312	85.246	29.37	1.47	146.84	1.67E+10	1.67E+10
11/13/22	5.58	313	85.519	30.07	1.50	150.35	1.71E+10	1.71E+10
9/13/22	7.08	314	85.792	38.18	1.91	190.89	2.17E+10	2.17E+10
11/14/22	5.96	315	86.066	32.15	1.61	160.74	1.82E+10	1.82E+10
9/10/22	5.96	316	86.339	32.11	1.61	160.54	1.82E+10	1.82E+10
10/1/22	7.09	317	86.612	38.22	1.91	191.12	2.17E+10	2.17E+10
11/15/22	5.77	318	86.885	31.13	1.56	155.64	1.77E+10	1.77E+10
9/14/22	6.55	319	87.158	35.31	1.77	176.57	2.00E+10	2.00E+10
11/16/22	5.06	320	87.432	27.29	1.36	136.44	1.55E+10	1.55E+10
11/17/22	5.05	321	87.705	27.24	1.36	136.19	1.55E+10	1.55E+10
9/15/22	6.32	322	87.978	34.07	1.70	170.33	1.93E+10	1.93E+10
11/26/22	5.17	323	88.251	27.86	1.39	139.30	1.58E+10	1.58E+10
9/25/22	5.83	324	88.525	31.41	1.57	157.07	1.78E+10	1.78E+10
9/21/22	6.46	325	88.798	34.81	1.74	174.04	1.97E+10	1.97E+10
11/18/22	4.99	326	89.071	26.89	1.34	134.43	1.53E+10	1.53E+10
11/25/22	5.24	327	89.344	28.24	1.41	141.21	1.60E+10	1.60E+10
11/19/22	4.86	328	89.617	26.22	1.31	131.10	1.49E+10	1.49E+10
9/22/22	6.73	329	89.891	36.27	1.81	181.37	2.06E+10	2.06E+10
9/16/22	6.04	330	90.164	32.57	1.63	162.83	1.85E+10	1.85E+10
11/24/22	4.80	331	90.437	25.87	1.29	129.33	1.47E+10	1.47E+10
10/2/22	6.69	332	90.710	36.07	1.80	180.34	2.05E+10	2.05E+10
11/22/22	4.93	333	90.984	26.56	1.33	132.81	1.51E+10	1.51E+10
11/21/22	4.49	334	91.257	24.21	1.21	121.03	1.37E+10	1.37E+10
11/23/22	4.74	335	91.530	25.54	1.28	127.70	1.45E+10	1.45E+10
9/20/22	5.93	336	91.803	31.95	1.60	159.75	1.81E+10	1.81E+10
6/28/22	6.90	337	92.077	37.19	1.86	185.97	2.11E+10	2.11E+10
11/20/22	4.75	338	92.350	25.61	1.28	128.05	1.45E+10	1.45E+10
9/17/22	5.53	339	92.623	29.82	1.49	149.09	1.69E+10	1.69E+10
9/23/22	6.16	340	92.896	33.20	1.66	166.02	1.88E+10	1.88E+10
9/19/22	6.10	341	93.169	32.86	1.64	164.30	1.86E+10	1.86E+10
9/18/22	5.80	342	93.443	31.29	1.56	156.44	1.78E+10	1.78E+10
10/3/22	6.14	343	93.716	33.10	1.66	165.51	1.88E+10	1.88E+10
9/24/22	5.49	344	93.989	29.57	1.48	147.85	1.68E+10	1.68E+10
7/5/22	6.12	345	94.262	32.99	1.65	164.95	1.87E+10	1.87E+10
10/4/22	5.57	346	94.536	30.03	1.50	150.15	1.70E+10	1.70E+10
6/29/22	6.17	347	94.809	33.24	1.66	166.19	1.89E+10	1.89E+10
10/5/22	5.74	348	95.082	30.95	1.55	154.76	1.76E+10	1.76E+10
10/17/22	3.50	349	95.355	18.89	0.94	94.46	1.07E+10	1.07E+10
10/6/22	4.69	350	95.628	25.29	1.26	126.45	1.43E+10	1.43E+10
6/30/22	5.47	351	95.902	29.47	1.47	147.36	1.67E+10	1.67E+10
10/7/22	5.34	352	96.175	28.79	1.44	143.93	1.63E+10	1.63E+10
7/1/22	5.41	353	96.448	29.14	1.46	145.71	1.65E+10	1.65E+10
7/2/22	5.49	354	96.721	29.61	1.48	148.06	1.68E+10	1.68E+10
10/8/22	4.51	355	96.995	24.30	1.21	121.48	1.38E+10	1.38E+10
10/16/22	2.95	356	97.268	15.88	0.79	79.39	9.01E+09	9.01E+09
10/9/22	3.44	357	97.541	18.53	0.93	92.63	1.05E+10	1.05E+10
7/3/22	4.77	358	97.814	25.74	1.29	128.69	1.46E+10	1.46E+10
10/13/22	4.45	359	98.087	24.01	1.20	120.05	1.36E+10	1.36E+10
10/10/22	3.29	360	98.361	17.73	0.89	88.67	1.01E+10	1.01E+10
10/15/22	2.75	361	98.634	14.82	0.74	74.10	8.41E+09	8.41E+09
10/14/22	2.82	362	98.907	15.22	0.76	76.10	8.64E+09	8.64E+09
10/11/22	3.16	363	99.180	17.06	0.85	85.29	9.68E+09	9.68E+09
10/12/22	3.09	364	99.454	16.66	0.83	83.30	9.45E+09	9.45E+09
7/4/22	4.72	365	99.727	25.46	1.27	127.30	1.44E+10	1.44E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 18 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	120.18	2.63	0.631	8	613.0	0.819672131	1703.645162	408.745284	5182.190606	1.80E+12	21	35776.54839	8583.650964	108826.0027	3.79E+13
3/15/22	23.74	2.70	0.073	2.8	28.0	19.67213115	345.4527124	9.34001778	358.2472573	1.63E+10	35	12090.84493	326.9006223	12538.654	5.69E+11
4/19/22	27.92	3.12	0.092	3.2	206.0	16.12021858	469.529828	13.8451103	481.5690544	1.41E+11	35	16433.54398	484.578861	16854.9169	4.93E+12
5/24/22	10.44	4.61	0.09	1.2	62.0	34.15300546	259.4299239	5.06479244	67.53056588	1.58E+10	28	7264.03787	141.8141883	1890.855845	4.43E+11
6/21/22	8.46	4.31	0.25	6	770.0	51.63934426	196.6419982	11.4061484	273.7475612	1.59E+11	28	5505.975948	319.3721548	7664.931715	4.46E+12
7/19/22	11.02	2.87	0.05	6.8	78.0	62.02185792	170.5199067	2.97073008	404.0192912	2.10E+10	35	5968.196735	103.9755529	14140.67519	7.36E+11
8/23/22	3.62	4.11	0.216	4.8	1050.0	58.46994536	80.29232217	4.21974248	93.77205509	9.31E+10	28	2248.185021	118.1527894	2625.617542	2.61E+12
9/20/22	3.06	2.73	0.217	3.6	548.0	91.80327869	45.0095858	3.57324792	59.27968891	4.10E+10	36	1620.345089	128.6369249	2134.068801	1.47E+12
10/26/22	5.59	1.78	0.256	3.6	1200.0	75.68306011	53.81563519	7.71978338	108.5594537	1.64E+11	13	699.6032575	100.3571839	1411.272898	2.14E+12
11/8/22	4.05	2.33	0.315	1.6	687.0	81.96721311	50.83674713	6.88231985	34.95781509	6.81E+10	35	1779.28615	240.8811946	1223.523528	2.38E+12
12/13/22	5.27	3.40	0.102	1.6	138.0	64.75409836	96.66352394	2.89990572	45.48871715	1.78E+10	36	3479.886862	104.3966059	1637.593817	6.41E+11
1/18/23	10.26	0.50	0.148	3.6	461.0	53.00546448	27.64265425	8.18222566	199.0271106	1.16E+11	37	1022.778207	302.7423494	7364.003093	4.28E+12
2/24/23															

Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	93,889.2	10,955.5	178,312.1	6.25E+13
											TARGET	42,368.0	2,118.4	211,839.8	2.40E+13

Site 19 Date	E19	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/23/22	155.71	1	0.273	839.26	41.96	4196.30	4.76E+11	4.76E+11
2/24/22	157.23	2	0.546	847.47	42.37	4237.34	4.81E+11	4.81E+11
2/22/22	148.46	3	0.820	800.22	40.01	4001.11	4.54E+11	4.54E+11
2/25/22	153.05	4	1.093	824.92	41.25	4124.61	4.68E+11	4.68E+11
2/26/22	146.81	5	1.366	791.30	39.56	3956.48	4.49E+11	4.49E+11
2/21/22	143.76	6	1.639	774.85	38.74	3874.26	4.40E+11	4.40E+11
2/27/22	144.08	7	1.913	776.58	38.83	3882.90	4.41E+11	4.41E+11
2/20/22	128.47	8	2.186	692.45	34.62	3462.26	3.93E+11	3.93E+11
2/19/22	137.91	9	2.459	743.31	37.17	3716.55	4.22E+11	4.22E+11
2/28/22	138.02	10	2.732	743.92	37.20	3719.62	4.22E+11	4.22E+11
3/1/22	136.98	11	3.005	738.31	36.92	3691.56	4.19E+11	4.19E+11
3/2/22	132.55	12	3.279	714.44	35.72	3572.20	4.05E+11	4.05E+11
3/3/22	132.87	13	3.552	716.17	35.81	3580.85	4.06E+11	4.06E+11
3/4/22	131.56	14	3.825	709.13	35.46	3545.67	4.02E+11	4.02E+11
3/26/22	120.51	15	4.098	649.57	32.48	3247.85	3.69E+11	3.69E+11
3/27/22	120.97	16	4.372	652.05	32.60	3260.24	3.70E+11	3.70E+11
3/28/22	121.67	17	4.645	655.82	32.79	3279.08	3.72E+11	3.72E+11
3/25/22	117.19	18	4.918	631.64	31.58	3158.18	3.58E+11	3.58E+11
3/5/22	120.29	19	5.191	648.38	32.42	3241.89	3.68E+11	3.68E+11
2/18/22	114.00	20	5.464	614.45	30.72	3072.26	3.49E+11	3.49E+11
3/29/22	120.62	21	5.738	650.17	32.51	3250.83	3.69E+11	3.69E+11
3/24/22	112.53	22	6.011	606.53	30.33	3032.67	3.44E+11	3.44E+11
3/30/22	110.76	23	6.284	596.99	29.85	2984.96	3.39E+11	3.39E+11
3/7/22	117.24	24	6.557	631.93	31.60	3159.65	3.59E+11	3.59E+11
3/6/22	115.77	25	6.831	624.01	31.20	3120.03	3.54E+11	3.54E+11
3/8/22	119.51	26	7.104	644.15	32.21	3220.75	3.65E+11	3.65E+11
3/31/22	105.51	27	7.377	568.71	28.44	2843.54	3.23E+11	3.23E+11
3/9/22	117.14	28	7.650	631.37	31.57	3156.84	3.58E+11	3.58E+11
4/1/22	107.42	29	7.923	578.97	28.95	2894.84	3.28E+11	3.28E+11
4/2/22	108.36	30	8.197	584.05	29.20	2920.23	3.31E+11	3.31E+11
3/10/22	116.05	31	8.470	625.52	31.28	3127.62	3.55E+11	3.55E+11
3/23/22	102.00	32	8.743	549.77	27.49	2748.85	3.12E+11	3.12E+11
4/3/22	106.34	33	9.016	573.15	28.66	2865.74	3.25E+11	3.25E+11
5/8/22	102.32	34	9.290	551.50	27.58	2757.52	3.13E+11	3.13E+11
3/11/22	104.26	35	9.563	561.98	28.10	2809.88	3.19E+11	3.19E+11
5/9/22	99.99	36	9.836	538.93	26.95	2694.67	3.06E+11	3.06E+11
5/7/22	102.75	37	10.109	553.81	27.69	2769.05	3.14E+11	3.14E+11
4/4/22	100.83	38	10.383	543.47	27.17	2717.34	3.08E+11	3.08E+11
5/10/22	99.43	39	10.656	535.94	26.80	2679.68	3.04E+11	3.04E+11
4/5/22	105.23	40	10.929	567.19	28.36	2835.94	3.22E+11	3.22E+11
4/7/22	100.43	41	11.202	541.32	27.07	2706.59	3.07E+11	3.07E+11
5/11/22	101.46	42	11.475	546.85	27.34	2734.27	3.10E+11	3.10E+11
4/6/22	99.19	43	11.749	534.63	26.73	2673.14	3.03E+11	3.03E+11
4/8/22	93.19	44	12.022	502.29	25.11	2511.47	2.85E+11	2.85E+11
3/12/22	102.12	45	12.295	550.43	27.52	2752.14	3.12E+11	3.12E+11
4/15/22	97.78	46	12.568	527.06	26.35	2635.28	2.99E+11	2.99E+11
4/16/22	96.99	47	12.842	522.76	26.14	2613.78	2.97E+11	2.97E+11
4/9/22	98.92	48	13.115	533.19	26.66	2665.93	3.03E+11	3.03E+11
5/12/22	95.69	49	13.388	515.79	25.79	2578.96	2.93E+11	2.93E+11
3/22/22	96.24	50	13.661	518.74	25.94	2593.71	2.94E+11	2.94E+11
4/17/22	99.17	51	13.934	534.53	26.73	2672.66	3.03E+11	3.03E+11
4/14/22	92.25	52	14.208	497.21	24.86	2486.03	2.82E+11	2.82E+11
3/21/22	98.06	53	14.481	528.54	26.43	2642.68	3.00E+11	3.00E+11
5/6/22	89.90	54	14.754	484.58	24.23	2422.89	2.75E+11	2.75E+11
4/10/22	96.53	55	15.027	520.27	26.01	2601.35	2.95E+11	2.95E+11
3/13/22	95.64	56	15.301	515.48	25.77	2577.42	2.92E+11	2.92E+11
4/18/22	91.16	57	15.574	491.36	24.57	2456.81	2.79E+11	2.79E+11
5/13/22	91.04	58	15.847	490.69	24.53	2453.45	2.78E+11	2.78E+11
4/19/22	93.50	59	16.120	503.95	25.20	2519.76	2.86E+11	2.86E+11
3/20/22	91.61	60	16.393	493.80	24.69	2468.98	2.80E+11	2.80E+11

4/20/22	89.72	61	16.667	483.57	24.18	2417.83	2.74E+11	2.74E+11
4/11/22	95.38	62	16.940	514.10	25.71	2570.50	2.92E+11	2.92E+11
5/14/22	88.08	63	17.213	474.74	23.74	2373.68	2.69E+11	2.69E+11
3/14/22	95.13	64	17.486	512.76	25.64	2563.78	2.91E+11	2.91E+11
4/13/22	80.64	65	17.760	434.65	21.73	2173.23	2.47E+11	2.47E+11
4/21/22	85.10	66	18.033	458.71	22.94	2293.56	2.60E+11	2.60E+11
4/12/22	90.86	67	18.306	489.71	24.49	2448.55	2.78E+11	2.78E+11
2/17/22	81.25	68	18.579	437.93	21.90	2189.66	2.48E+11	2.48E+11
4/22/22	90.61	69	18.852	488.38	24.42	2441.92	2.77E+11	2.77E+11
5/15/22	85.79	70	19.126	462.43	23.12	2312.17	2.62E+11	2.62E+11
5/5/22	86.32	71	19.399	465.24	23.26	2326.21	2.64E+11	2.64E+11
3/15/22	91.87	72	19.672	495.17	24.76	2475.84	2.81E+11	2.81E+11
4/23/22	82.60	73	19.945	445.19	22.26	2225.97	2.53E+11	2.53E+11
4/25/22	86.31	74	20.219	465.20	23.26	2326.01	2.64E+11	2.64E+11
4/24/22	78.78	75	20.492	424.61	21.23	2123.04	2.41E+11	2.41E+11
5/4/22	85.30	76	20.765	459.74	22.99	2298.72	2.61E+11	2.61E+11
4/26/22	84.20	77	21.038	453.82	22.69	2269.12	2.57E+11	2.57E+11
3/16/22	87.04	78	21.311	469.12	23.46	2345.62	2.66E+11	2.66E+11
5/16/22	81.73	79	21.585	440.52	22.03	2202.62	2.50E+11	2.50E+11
3/19/22	80.54	80	21.858	434.12	21.71	2170.61	2.46E+11	2.46E+11
4/27/22	83.83	81	22.131	451.84	22.59	2259.22	2.56E+11	2.56E+11
3/17/22	85.32	82	22.404	459.86	22.99	2299.30	2.61E+11	2.61E+11
4/28/22	78.71	83	22.678	424.22	21.21	2121.12	2.41E+11	2.41E+11
5/17/22	76.77	84	22.951	413.81	20.69	2069.03	2.35E+11	2.35E+11
3/18/22	76.78	85	23.224	413.83	20.69	2069.16	2.35E+11	2.35E+11
5/3/22	76.40	86	23.497	411.81	20.59	2059.04	2.34E+11	2.34E+11
4/29/22	75.72	87	23.770	408.12	20.41	2040.58	2.32E+11	2.32E+11
5/18/22	72.96	88	24.044	393.28	19.66	1966.39	2.23E+11	2.23E+11
5/1/22	72.86	89	24.317	392.70	19.63	1963.49	2.23E+11	2.23E+11
6/11/22	74.78	90	24.590	403.06	20.15	2015.31	2.29E+11	2.29E+11
6/12/22	74.09	91	24.863	399.35	19.97	1996.76	2.27E+11	2.27E+11
4/30/22	70.82	92	25.137	381.75	19.09	1908.73	2.17E+11	2.17E+11
5/2/22	74.83	93	25.410	403.33	20.17	2016.65	2.29E+11	2.29E+11
6/10/22	73.65	94	25.683	396.99	19.85	1984.94	2.25E+11	2.25E+11
5/19/22	70.76	95	25.956	381.42	19.07	1907.09	2.16E+11	2.16E+11
6/13/22	73.39	96	26.230	395.57	19.78	1977.83	2.24E+11	2.24E+11
6/9/22	72.46	97	26.503	390.57	19.53	1952.84	2.22E+11	2.22E+11
6/14/22	73.08	98	26.776	393.89	19.69	1969.47	2.23E+11	2.23E+11
5/20/22	68.11	99	27.049	367.10	18.35	1835.50	2.08E+11	2.08E+11
6/15/22	70.83	100	27.322	381.78	19.09	1908.92	2.17E+11	2.17E+11
6/8/22	66.68	101	27.596	359.39	17.97	1796.97	2.04E+11	2.04E+11
6/2/22	67.64	102	27.869	364.56	18.23	1822.81	2.07E+11	2.07E+11
5/21/22	66.24	103	28.142	357.03	17.85	1785.14	2.03E+11	2.03E+11
6/1/22	65.67	104	28.415	353.94	17.70	1769.69	2.01E+11	2.01E+11
5/30/22	66.83	105	28.689	360.22	18.01	1801.09	2.04E+11	2.04E+11
7/28/22	62.02	106	28.962	334.31	16.72	1671.54	1.90E+11	1.90E+11
6/3/22	65.88	107	29.235	355.07	17.75	1775.34	2.01E+11	2.01E+11
7/27/22	61.95	108	29.508	333.90	16.70	1669.52	1.89E+11	1.89E+11
5/31/22	66.93	109	29.781	360.76	18.04	1803.78	2.05E+11	2.05E+11
7/29/22	61.82	110	30.055	333.19	16.66	1665.97	1.89E+11	1.89E+11
5/29/22	64.69	111	30.328	348.69	17.43	1743.43	1.98E+11	1.98E+11
7/26/22	59.54	112	30.601	320.90	16.04	1604.48	1.82E+11	1.82E+11
5/22/22	63.71	113	30.874	343.38	17.17	1716.90	1.95E+11	1.95E+11
6/7/22	64.60	114	31.148	348.21	17.41	1741.03	1.98E+11	1.98E+11
6/16/22	66.61	115	31.421	359.03	17.95	1795.13	2.04E+11	2.04E+11
6/4/22	63.54	116	31.694	342.48	17.12	1712.39	1.94E+11	1.94E+11
7/30/22	59.10	117	31.967	318.55	15.93	1592.74	1.81E+11	1.81E+11
7/25/22	58.13	118	32.240	313.34	15.67	1566.69	1.78E+11	1.78E+11
5/23/22	59.92	119	32.514	322.99	16.15	1614.94	1.83E+11	1.83E+11
6/5/22	60.40	120	32.787	325.58	16.28	1627.91	1.85E+11	1.85E+11
7/31/22	56.46	121	33.060	304.30	15.22	1521.52	1.73E+11	1.73E+11

6/17/22	61.43	122	33.333	331.09	16.55	1655.45	1.88E+11	1.88E+11
6/6/22	57.40	123	33.607	309.37	15.47	1546.87	1.76E+11	1.76E+11
5/28/22	59.32	124	33.880	319.72	15.99	1598.60	1.81E+11	1.81E+11
5/24/22	56.41	125	34.153	304.05	15.20	1520.27	1.73E+11	1.73E+11
7/24/22	54.16	126	34.426	291.93	14.60	1459.63	1.66E+11	1.66E+11
8/1/22	53.65	127	34.699	289.20	14.46	1445.98	1.64E+11	1.64E+11
2/16/22	47.38	128	34.973	255.37	12.77	1276.87	1.45E+11	1.45E+11
5/27/22	57.81	129	35.246	311.57	15.58	1557.85	1.77E+11	1.77E+11
5/25/22	55.69	130	35.519	300.16	15.01	1500.80	1.70E+11	1.70E+11
5/26/22	57.26	131	35.792	308.65	15.43	1543.24	1.75E+11	1.75E+11
6/18/22	57.10	132	36.066	307.76	15.39	1538.82	1.75E+11	1.75E+11
8/2/22	50.45	133	36.339	271.94	13.60	1359.68	1.54E+11	1.54E+11
2/13/22	52.28	134	36.612	281.80	14.09	1408.99	1.60E+11	1.60E+11
2/14/22	51.88	135	36.885	279.64	13.98	1398.22	1.59E+11	1.59E+11
2/15/22	50.95	136	37.158	274.61	13.73	1373.04	1.56E+11	1.56E+11
8/3/22	47.07	137	37.432	253.73	12.69	1268.64	1.44E+11	1.44E+11
7/8/22	51.21	138	37.705	276.02	13.80	1380.10	1.57E+11	1.57E+11
7/9/22	51.08	139	37.978	275.30	13.77	1376.50	1.56E+11	1.56E+11
6/19/22	51.07	140	38.251	275.29	13.76	1376.45	1.56E+11	1.56E+11
2/12/22	50.07	141	38.525	269.86	13.49	1349.31	1.53E+11	1.53E+11
8/4/22	45.97	142	38.798	247.76	12.39	1238.79	1.41E+11	1.41E+11
1/25/23	42.09	143	39.071	226.88	11.34	1134.42	1.29E+11	1.29E+11
1/23/23	40.89	144	39.344	220.41	11.02	1102.03	1.25E+11	1.25E+11
1/22/23	41.92	145	39.617	225.92	11.30	1129.61	1.28E+11	1.28E+11
1/26/23	41.10	146	39.891	221.52	11.08	1107.60	1.26E+11	1.26E+11
7/10/22	50.16	147	40.164	270.36	13.52	1351.80	1.53E+11	1.53E+11
7/23/22	44.23	148	40.437	238.42	11.92	1192.09	1.35E+11	1.35E+11
1/24/23	39.60	149	40.710	213.45	10.67	1067.27	1.21E+11	1.21E+11
1/27/23	38.03	150	40.984	204.98	10.25	1024.92	1.16E+11	1.16E+11
7/7/22	49.54	151	41.257	267.04	13.35	1335.21	1.52E+11	1.52E+11
1/8/23	41.72	152	41.530	224.85	11.24	1124.23	1.28E+11	1.28E+11
1/28/23	41.15	153	41.803	221.81	11.09	1109.04	1.26E+11	1.26E+11
1/21/23	39.39	154	42.077	212.31	10.62	1061.57	1.20E+11	1.20E+11
1/7/23	41.11	155	42.350	221.58	11.08	1107.89	1.26E+11	1.26E+11
1/29/23	39.70	156	42.623	213.98	10.70	1069.89	1.21E+11	1.21E+11
1/6/23	40.12	157	42.896	216.27	10.81	1081.37	1.23E+11	1.23E+11
8/5/22	41.59	158	43.169	224.18	11.21	1120.90	1.27E+11	1.27E+11
1/9/23	40.57	159	43.443	218.70	10.93	1093.48	1.24E+11	1.24E+11
7/11/22	48.22	160	43.716	259.92	13.00	1299.62	1.47E+11	1.47E+11
1/30/23	40.36	161	43.989	217.56	10.88	1087.81	1.23E+11	1.23E+11
1/10/23	40.47	162	44.262	218.12	10.91	1090.58	1.24E+11	1.24E+11
1/5/23	39.12	163	44.536	210.87	10.54	1054.37	1.20E+11	1.20E+11
2/7/22	44.33	164	44.809	238.92	11.95	1194.58	1.36E+11	1.36E+11
1/20/23	38.49	165	45.082	207.45	10.37	1037.27	1.18E+11	1.18E+11
1/31/23	38.17	166	45.355	205.72	10.29	1028.60	1.17E+11	1.17E+11
2/8/22	42.76	167	45.628	230.45	11.52	1152.27	1.31E+11	1.31E+11
6/20/22	47.22	168	45.902	254.52	12.73	1272.61	1.44E+11	1.44E+11
2/6/22	39.16	169	46.175	211.08	10.55	1055.42	1.20E+11	1.20E+11
1/12/23	39.33	170	46.448	211.98	10.60	1059.91	1.20E+11	1.20E+11
2/3/22	45.05	171	46.721	242.80	12.14	1213.99	1.38E+11	1.38E+11
8/6/22	39.97	172	46.995	215.41	10.77	1077.06	1.22E+11	1.22E+11
7/12/22	45.07	173	47.268	242.91	12.15	1214.57	1.38E+11	1.38E+11
2/4/22	39.84	174	47.541	214.76	10.74	1073.80	1.22E+11	1.22E+11
2/5/22	42.96	175	47.814	231.57	11.58	1157.87	1.31E+11	1.31E+11
1/4/23	37.26	176	48.087	200.84	10.04	1004.22	1.14E+11	1.14E+11
1/13/23	37.66	177	48.361	202.97	10.15	1014.86	1.15E+11	1.15E+11
2/11/22	37.10	178	48.634	199.98	10.00	999.92	1.13E+11	1.13E+11
1/19/23	36.69	179	48.907	197.79	9.89	988.93	1.12E+11	1.12E+11
1/14/23	36.97	180	49.180	199.28	9.96	996.41	1.13E+11	1.13E+11
2/9/22	40.46	181	49.454	218.08	10.90	1090.39	1.24E+11	1.24E+11
8/7/22	37.87	182	49.727	204.12	10.21	1020.61	1.16E+11	1.16E+11

1/15/23	35.60	183	50.000	191.90	9.60	959.51	1.09E+11	1.09E+11
8/8/22	36.28	184	50.273	195.53	9.78	977.65	1.11E+11	1.11E+11
2/2/22	42.42	185	50.546	228.67	11.43	1143.33	1.30E+11	1.30E+11
7/13/22	41.45	186	50.820	223.39	11.17	1116.94	1.27E+11	1.27E+11
2/10/22	41.03	187	51.093	221.14	11.06	1105.68	1.25E+11	1.25E+11
8/9/22	35.47	188	51.366	191.19	9.56	955.97	1.08E+11	1.08E+11
6/21/22	42.10	189	51.639	226.90	11.35	1134.51	1.29E+11	1.29E+11
1/16/23	34.92	190	51.913	188.21	9.41	941.05	1.07E+11	1.07E+11
1/3/23	32.16	191	52.186	173.37	8.67	866.84	9.84E+10	9.84E+10
1/17/23	33.21	192	52.459	178.98	8.95	894.92	1.02E+11	1.02E+11
7/14/22	38.54	193	52.732	207.72	10.39	1038.60	1.18E+11	1.18E+11
1/18/23	32.05	194	53.005	172.75	8.64	863.75	9.80E+10	9.80E+10
7/22/22	32.36	195	53.279	174.41	8.72	872.05	9.90E+10	9.90E+10
8/10/22	33.91	196	53.552	182.78	9.14	913.88	1.04E+11	1.04E+11
8/22/22	32.43	197	53.825	174.81	8.74	874.04	9.92E+10	9.92E+10
12/2/22	23.55	198	54.098	126.93	6.35	634.64	7.20E+10	7.20E+10
12/1/22	27.76	199	54.372	149.65	7.48	748.24	8.49E+10	8.49E+10
7/15/22	34.51	200	54.645	186.03	9.30	930.17	1.06E+11	1.06E+11
7/6/22	35.79	201	54.918	192.90	9.64	964.48	1.09E+11	1.09E+11
12/4/22	28.06	202	55.191	151.25	7.56	756.27	8.58E+10	8.58E+10
1/2/23	30.75	203	55.464	165.72	8.29	828.62	9.40E+10	9.40E+10
12/3/22	28.78	204	55.738	155.10	7.76	775.51	8.80E+10	8.80E+10
11/30/22	27.68	205	56.011	149.20	7.46	746.02	8.47E+10	8.47E+10
6/22/22	36.90	206	56.284	198.87	9.94	994.37	1.13E+11	1.13E+11
7/16/22	32.60	207	56.557	175.72	8.79	878.61	9.97E+10	9.97E+10
8/21/22	30.80	208	56.831	166.02	8.30	830.11	9.42E+10	9.42E+10
12/5/22	27.51	209	57.104	148.29	7.41	741.46	8.41E+10	8.41E+10
11/29/22	22.29	210	57.377	120.12	6.01	600.60	6.82E+10	6.82E+10
8/11/22	30.88	211	57.650	166.44	8.32	832.20	9.44E+10	9.44E+10
1/1/23	27.74	212	57.923	149.49	7.47	747.47	8.48E+10	8.48E+10
12/6/22	28.45	213	58.197	153.35	7.67	766.73	8.70E+10	8.70E+10
8/23/22	28.66	214	58.470	154.49	7.72	772.47	8.77E+10	8.77E+10
7/17/22	32.25	215	58.743	173.84	8.69	869.22	9.86E+10	9.86E+10
1/11/23	37.14	216	59.016	200.20	10.01	1001.02	1.14E+11	1.14E+11
12/7/22	26.65	217	59.290	143.66	7.18	718.28	8.15E+10	8.15E+10
7/18/22	31.46	218	59.563	169.57	8.48	847.87	9.62E+10	9.62E+10
12/8/22	26.04	219	59.836	140.33	7.02	701.66	7.96E+10	7.96E+10
8/31/22	25.63	220	60.109	138.13	6.91	690.65	7.84E+10	7.84E+10
12/9/22	22.02	221	60.383	118.70	5.93	593.48	6.73E+10	6.73E+10
8/30/22	26.17	222	60.656	141.03	7.05	705.15	8.00E+10	8.00E+10
12/10/22	23.26	223	60.929	125.39	6.27	626.94	7.11E+10	7.11E+10
12/31/22	25.48	224	61.202	137.32	6.87	686.61	7.79E+10	7.79E+10
2/1/22	28.68	225	61.475	154.57	7.73	772.87	8.77E+10	8.77E+10
8/12/22	26.59	226	61.749	143.34	7.17	716.72	8.13E+10	8.13E+10
7/19/22	27.64	227	62.022	149.00	7.45	744.98	8.45E+10	8.45E+10
8/24/22	24.26	228	62.295	130.78	6.54	653.92	7.42E+10	7.42E+10
11/28/22	20.47	229	62.568	110.35	5.52	551.74	6.26E+10	6.26E+10
12/11/22	23.66	230	62.842	127.55	6.38	637.73	7.24E+10	7.24E+10
6/23/22	31.39	231	63.115	169.17	8.46	845.87	9.60E+10	9.60E+10
8/15/22	24.26	232	63.388	130.76	6.54	653.80	7.42E+10	7.42E+10
9/1/22	22.42	233	63.661	120.83	6.04	604.15	6.86E+10	6.86E+10
12/12/22	24.19	234	63.934	130.41	6.52	652.05	7.40E+10	7.40E+10
8/14/22	24.61	235	64.208	132.65	6.63	663.27	7.53E+10	7.53E+10
12/16/22	20.64	236	64.481	111.24	5.56	556.19	6.31E+10	6.31E+10
12/13/22	20.45	237	64.754	110.20	5.51	551.01	6.25E+10	6.25E+10
12/15/22	19.27	238	65.027	103.89	5.19	519.43	5.89E+10	5.89E+10
12/17/22	21.50	239	65.301	115.88	5.79	579.38	6.57E+10	6.57E+10
8/13/22	23.86	240	65.574	128.61	6.43	643.03	7.30E+10	7.30E+10
7/20/22	24.58	241	65.847	132.50	6.62	662.49	7.52E+10	7.52E+10
8/16/22	22.76	242	66.120	122.66	6.13	613.28	6.96E+10	6.96E+10
12/14/22	21.29	243	66.393	114.73	5.74	573.65	6.51E+10	6.51E+10

12/24/22	14.01	244	66.667	75.50	3.78	377.52	4.28E+10	4.28E+10
8/25/22	22.44	245	66.940	120.97	6.05	604.83	6.86E+10	6.86E+10
9/2/22	21.29	246	67.213	114.76	5.74	573.81	6.51E+10	6.51E+10
12/18/22	21.30	247	67.486	114.79	5.74	573.93	6.51E+10	6.51E+10
12/23/22	13.86	248	67.760	74.70	3.74	373.50	4.24E+10	4.24E+10
12/20/22	21.45	249	68.033	115.59	5.78	577.95	6.56E+10	6.56E+10
10/23/22	19.98	250	68.306	107.67	5.38	538.33	6.11E+10	6.11E+10
12/19/22	21.22	251	68.579	114.36	5.72	571.81	6.49E+10	6.49E+10
12/27/22	11.27	252	68.852	60.75	3.04	303.76	3.45E+10	3.45E+10
12/26/22	14.34	253	69.126	77.27	3.86	386.37	4.38E+10	4.38E+10
12/30/22	18.63	254	69.399	100.42	5.02	502.08	5.70E+10	5.70E+10
7/21/22	23.08	255	69.672	124.40	6.22	622.02	7.06E+10	7.06E+10
8/17/22	20.92	256	69.945	112.77	5.64	563.87	6.40E+10	6.40E+10
6/24/22	26.77	257	70.219	144.28	7.21	721.38	8.19E+10	8.19E+10
12/21/22	21.45	258	70.492	115.63	5.78	578.17	6.56E+10	6.56E+10
12/28/22	10.28	259	70.765	55.39	2.77	276.96	3.14E+10	3.14E+10
12/25/22	12.17	260	71.038	65.60	3.28	327.99	3.72E+10	3.72E+10
9/3/22	20.26	261	71.311	109.19	5.46	545.96	6.20E+10	6.20E+10
8/26/22	19.99	262	71.585	107.77	5.39	538.84	6.11E+10	6.11E+10
12/22/22	20.81	263	71.858	112.18	5.61	560.90	6.36E+10	6.36E+10
8/29/22	18.23	264	72.131	98.29	4.91	491.43	5.58E+10	5.58E+10
8/27/22	20.29	265	72.404	109.35	5.47	546.74	6.20E+10	6.20E+10
9/4/22	19.37	266	72.678	104.41	5.22	522.04	5.92E+10	5.92E+10
8/18/22	20.03	267	72.951	107.96	5.40	539.81	6.13E+10	6.13E+10
12/29/22	11.59	268	73.224	62.48	3.12	312.42	3.55E+10	3.55E+10
10/24/22	16.97	269	73.497	91.45	4.57	457.26	5.19E+10	5.19E+10
8/19/22	19.22	270	73.770	103.62	5.18	518.11	5.88E+10	5.88E+10
8/28/22	19.05	271	74.044	102.66	5.13	513.28	5.82E+10	5.82E+10
8/20/22	18.24	272	74.317	98.32	4.92	491.62	5.58E+10	5.58E+10
9/5/22	18.79	273	74.590	101.27	5.06	506.35	5.75E+10	5.75E+10
6/25/22	24.13	274	74.863	130.08	6.50	650.42	7.38E+10	7.38E+10
9/6/22	17.91	275	75.137	96.51	4.83	482.54	5.48E+10	5.48E+10
10/25/22	14.57	276	75.410	78.51	3.93	392.56	4.45E+10	4.45E+10
10/26/22	15.75	277	75.683	84.87	4.24	424.33	4.82E+10	4.82E+10
10/27/22	15.58	278	75.956	83.95	4.20	419.76	4.76E+10	4.76E+10
11/27/22	14.08	279	76.230	75.89	3.79	379.44	4.31E+10	4.31E+10
10/28/22	15.64	280	76.503	84.28	4.21	421.41	4.78E+10	4.78E+10
9/7/22	18.00	281	76.776	97.00	4.85	484.98	5.50E+10	5.50E+10
9/27/22	18.58	282	77.049	100.17	5.01	500.86	5.68E+10	5.68E+10
10/29/22	14.81	283	77.322	79.81	3.99	399.06	4.53E+10	4.53E+10
6/26/22	21.92	284	77.596	118.14	5.91	590.69	6.70E+10	6.70E+10
9/28/22	17.67	285	77.869	95.23	4.76	476.14	5.40E+10	5.40E+10
10/30/22	14.60	286	78.142	78.72	3.94	393.59	4.47E+10	4.47E+10
11/1/22	13.79	287	78.415	74.32	3.72	371.61	4.22E+10	4.22E+10
10/31/22	13.91	288	78.689	74.95	3.75	374.74	4.25E+10	4.25E+10
11/2/22	14.52	289	78.962	78.26	3.91	391.29	4.44E+10	4.44E+10
11/4/22	13.78	290	79.235	74.30	3.71	371.49	4.22E+10	4.22E+10
11/3/22	14.59	291	79.508	78.64	3.93	393.21	4.46E+10	4.46E+10
9/26/22	17.66	292	79.781	95.21	4.76	476.05	5.40E+10	5.40E+10
9/8/22	16.77	293	80.055	90.41	4.52	452.06	5.13E+10	5.13E+10
11/5/22	13.01	294	80.328	70.12	3.51	350.62	3.98E+10	3.98E+10
10/19/22	13.63	295	80.601	73.46	3.67	367.28	4.17E+10	4.17E+10
9/29/22	16.71	296	80.874	90.06	4.50	450.32	5.11E+10	5.11E+10
10/22/22	14.09	297	81.148	75.97	3.80	379.84	4.31E+10	4.31E+10
11/7/22	13.64	298	81.421	73.50	3.67	367.48	4.17E+10	4.17E+10
11/6/22	13.50	299	81.694	72.76	3.64	363.81	4.13E+10	4.13E+10
11/8/22	14.74	300	81.967	79.45	3.97	397.25	4.51E+10	4.51E+10
10/20/22	13.56	301	82.240	73.08	3.65	365.38	4.15E+10	4.15E+10
11/9/22	13.50	302	82.514	72.74	3.64	363.70	4.13E+10	4.13E+10
9/9/22	15.16	303	82.787	81.71	4.09	408.56	4.64E+10	4.64E+10
9/30/22	16.56	304	83.060	89.24	4.46	446.22	5.06E+10	5.06E+10

11/10/22	12.28	305	83.333	66.17	3.31	330.87	3.75E+10	3.75E+10
9/12/22	16.85	306	83.607	90.84	4.54	454.22	5.15E+10	5.15E+10
11/11/22	13.75	307	83.880	74.13	3.71	370.67	4.21E+10	4.21E+10
10/18/22	12.19	308	84.153	65.71	3.29	328.53	3.73E+10	3.73E+10
6/27/22	18.97	309	84.426	102.25	5.11	511.23	5.80E+10	5.80E+10
10/21/22	12.91	310	84.699	69.59	3.48	347.95	3.95E+10	3.95E+10
9/11/22	12.66	311	84.973	68.24	3.41	341.18	3.87E+10	3.87E+10
11/12/22	12.25	312	85.246	66.02	3.30	330.11	3.75E+10	3.75E+10
11/13/22	12.54	313	85.519	67.60	3.38	338.01	3.84E+10	3.84E+10
9/13/22	15.92	314	85.792	85.83	4.29	429.14	4.87E+10	4.87E+10
11/14/22	13.41	315	86.066	72.27	3.61	361.35	4.10E+10	4.10E+10
9/10/22	13.39	316	86.339	72.18	3.61	360.90	4.10E+10	4.10E+10
10/1/22	15.94	317	86.612	85.93	4.30	429.66	4.88E+10	4.88E+10
11/15/22	12.98	318	86.885	69.98	3.50	349.89	3.97E+10	3.97E+10
9/14/22	14.73	319	87.158	79.39	3.97	396.94	4.50E+10	4.50E+10
11/16/22	11.38	320	87.432	61.35	3.07	306.73	3.48E+10	3.48E+10
11/17/22	11.36	321	87.705	61.23	3.06	306.16	3.47E+10	3.47E+10
9/15/22	14.21	322	87.978	76.58	3.83	382.92	4.35E+10	4.35E+10
11/26/22	11.62	323	88.251	62.63	3.13	313.16	3.55E+10	3.55E+10
9/25/22	13.10	324	88.525	70.62	3.53	353.10	4.01E+10	4.01E+10
9/21/22	14.52	325	88.798	78.25	3.91	391.26	4.44E+10	4.44E+10
11/18/22	11.21	326	89.071	60.44	3.02	302.22	3.43E+10	3.43E+10
11/25/22	11.78	327	89.344	63.49	3.17	317.45	3.60E+10	3.60E+10
11/19/22	10.94	328	89.617	58.94	2.95	294.72	3.34E+10	3.34E+10
9/22/22	15.13	329	89.891	81.55	4.08	407.74	4.63E+10	4.63E+10
9/16/22	13.58	330	90.164	73.21	3.66	366.05	4.15E+10	4.15E+10
11/24/22	10.79	331	90.437	58.15	2.91	290.75	3.30E+10	3.30E+10
10/2/22	15.04	332	90.710	81.08	4.05	405.42	4.60E+10	4.60E+10
11/22/22	11.08	333	90.984	59.71	2.99	298.57	3.39E+10	3.39E+10
11/21/22	10.10	334	91.257	54.42	2.72	272.08	3.09E+10	3.09E+10
11/23/22	10.65	335	91.530	57.41	2.87	287.07	3.26E+10	3.26E+10
9/20/22	13.33	336	91.803	71.83	3.59	359.14	4.08E+10	4.08E+10
6/28/22	15.51	337	92.077	83.61	4.18	418.07	4.74E+10	4.74E+10
11/20/22	10.68	338	92.350	57.57	2.88	287.87	3.27E+10	3.27E+10
9/17/22	12.44	339	92.623	67.03	3.35	335.17	3.80E+10	3.80E+10
9/23/22	13.85	340	92.896	74.65	3.73	373.24	4.24E+10	4.24E+10
9/19/22	13.71	341	93.169	73.87	3.69	369.36	4.19E+10	4.19E+10
9/18/22	13.05	342	93.443	70.34	3.52	351.69	3.99E+10	3.99E+10
10/3/22	13.81	343	93.716	74.42	3.72	372.09	4.22E+10	4.22E+10
9/24/22	12.33	344	93.989	66.47	3.32	332.37	3.77E+10	3.77E+10
7/5/22	13.76	345	94.262	74.16	3.71	370.82	4.21E+10	4.21E+10
10/4/22	12.53	346	94.536	67.51	3.38	337.56	3.83E+10	3.83E+10
6/29/22	13.86	347	94.809	74.72	3.74	373.61	4.24E+10	4.24E+10
10/5/22	12.91	348	95.082	69.58	3.48	347.91	3.95E+10	3.95E+10
10/17/22	7.88	349	95.355	42.47	2.12	212.35	2.41E+10	2.41E+10
10/6/22	10.55	350	95.628	56.85	2.84	284.27	3.23E+10	3.23E+10
6/30/22	12.29	351	95.902	66.26	3.31	331.29	3.76E+10	3.76E+10
10/7/22	12.01	352	96.175	64.72	3.24	323.58	3.67E+10	3.67E+10
7/1/22	12.16	353	96.448	65.52	3.28	327.58	3.72E+10	3.72E+10
7/2/22	12.35	354	96.721	66.57	3.33	332.85	3.78E+10	3.78E+10
10/8/22	10.13	355	96.995	54.62	2.73	273.09	3.10E+10	3.10E+10
10/16/22	6.62	356	97.268	35.70	1.78	178.49	2.03E+10	2.03E+10
10/9/22	7.73	357	97.541	41.65	2.08	208.23	2.36E+10	2.36E+10
7/3/22	10.73	358	97.814	57.86	2.89	289.30	3.28E+10	3.28E+10
10/13/22	10.01	359	98.087	53.98	2.70	269.88	3.06E+10	3.06E+10
10/10/22	7.40	360	98.361	39.87	1.99	199.33	2.26E+10	2.26E+10
10/15/22	6.18	361	98.634	33.32	1.67	166.58	1.89E+10	1.89E+10
10/14/22	6.35	362	98.907	34.22	1.71	171.08	1.94E+10	1.94E+10
10/11/22	7.12	363	99.180	38.35	1.92	191.75	2.18E+10	2.18E+10
10/12/22	6.95	364	99.454	37.45	1.87	187.27	2.13E+10	2.13E+10
7/4/22	10.62	365	99.727	57.23	2.86	286.17	3.25E+10	3.25E+10

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 19 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	753.96	2.57	0.131	24	172.0	3.005464481	10444.07956	532.363589	97532.26049	3.17E+12	21	219325.6708	11179.63536	2048177.47	6.66E+13
3/15/22	101.52	2.67	0.05	4.4	105.0	36.61202186	1460.979901	27.3591742	2407.607328	2.61E+11	35	51134.29655	957.5710964	84266.25648	9.13E+12
4/19/22	101.49	4.10	0.05	4.8	326.0	36.8852459	2242.871288	27.3520889	2625.800533	8.09E+11	35	78500.4951	957.3231109	91903.01865	2.83E+13
5/24/22	69.84	5.04	0.05	9.6	248.0	48.36065574	1897.19598	18.8213887	3613.706629	4.24E+11	28	53121.48745	526.9988834	101183.7856	1.19E+13
6/21/22	43.52	4.47	0.05	10	308.0	58.46994536	1048.433625	11.7274455	2345.489093	3.28E+11	28	29356.14149	328.3684731	65673.69461	9.18E+12
7/19/22	76.67	3.55	0.05	8.4	866.0	45.6284153	1467.012608	20.6621494	3471.241102	1.62E+12	35	51345.4413	723.1752295	121493.4386	5.69E+13
8/23/22	39.14	4.45	0.05	10.8	921.0	61.20218579	938.6986935	10.5471763	2278.190088	8.82E+11	28	26283.56342	295.3209373	63789.32246	2.47E+13
9/20/22	26.28	3.05	0.050	6.4	411.0	78.68852459	431.9548611	7.08203992	906.5011103	2.64E+11	36	15550.375	254.9534373	32634.03997	9.51E+12
10/26/22	36.66	1.99	0.050	4.4	201.0	63.38797814	392.7632626	9.87874921	869.3299304	1.80E+11	13	5105.922413	128.4237397	11301.2891	2.34E+12
11/8/22	32.82	2.10	0.050	1.6	120.0	68.85245902	371.6976607	8.84627942	283.0809413	9.64E+10	35	13009.41812	309.6197795	9907.832945	3.37E+12
12/13/22	24.15	6.20	0.050	4.0	82.0	84.15300546	807.1663497	6.50940605	520.7524837	4.85E+10	36	29057.98859	234.3386176	18747.08941	1.74E+12
1/18/23	110.89	3.50	0.050	22.0	104.0	41.53005464	2092.00543	29.8857919	13149.74842	2.82E+11	37	77404.20093	1105.774299	486540.6915	1.04E+13
2/24/23															
Conversion Factor		5.39	5.39	5.39	2.45E+07						TOTAL	649,195.0	17,001.5	3,135,617.9	2.34E+14
											TARGET	95,246.6	4,762.3	476,233.2	5.40E+13

Site 20 Date	E20	Rank	PercentExceeded	NO3 Load	TP Load	TSS Load	Ecoli Load	Ecoli geo Load
2/18/22	2172.17	1	0.273	11707.98	585.40	58539.91	6.64E+12	6.64E+12
2/23/22	1572.08	2	0.546	8473.50	423.67	42367.49	4.81E+12	4.81E+12
2/17/22	1560.05	3	0.820	8408.68	420.43	42043.40	4.77E+12	4.77E+12
2/19/22	1503.88	4	1.093	8105.92	405.30	40529.59	4.60E+12	4.60E+12
2/22/22	1442.60	5	1.366	7775.62	388.78	38878.11	4.41E+12	4.41E+12
2/24/22	1374.70	6	1.639	7409.66	370.48	37048.29	4.20E+12	4.20E+12
2/20/22	1245.11	7	1.913	6711.14	335.56	33555.70	3.81E+12	3.81E+12
2/25/22	1213.76	8	2.186	6542.19	327.11	32710.93	3.71E+12	3.71E+12
2/21/22	1201.96	9	2.459	6478.56	323.93	32392.78	3.68E+12	3.68E+12
2/26/22	1116.53	10	2.732	6018.09	300.90	30090.44	3.41E+12	3.41E+12
3/25/22	1063.72	11	3.005	5733.45	286.67	28667.24	3.25E+12	3.25E+12
2/27/22	1039.41	12	3.279	5602.42	280.12	28012.12	3.18E+12	3.18E+12
3/24/22	1007.77	13	3.552	5431.87	271.59	27159.33	3.08E+12	3.08E+12
2/28/22	988.81	14	3.825	5329.70	266.48	26648.48	3.02E+12	3.02E+12
3/26/22	952.44	15	4.098	5133.67	256.68	25668.36	2.91E+12	2.91E+12
3/1/22	950.84	16	4.372	5125.01	256.25	25625.06	2.91E+12	2.91E+12
3/2/22	907.81	17	4.645	4893.08	244.65	24465.42	2.78E+12	2.78E+12
3/27/22	904.11	18	4.918	4873.13	243.66	24365.65	2.76E+12	2.76E+12
3/3/22	872.74	19	5.191	4704.08	235.20	23520.39	2.67E+12	2.67E+12
4/7/22	857.86	20	5.464	4623.88	231.19	23119.41	2.62E+12	2.62E+12
3/28/22	843.05	21	5.738	4544.06	227.20	22720.31	2.58E+12	2.58E+12
3/8/22	837.12	22	6.011	4512.06	225.60	22560.30	2.56E+12	2.56E+12
3/4/22	829.29	23	6.284	4469.89	223.49	22349.45	2.54E+12	2.54E+12
4/8/22	822.45	24	6.557	4432.99	221.65	22164.96	2.52E+12	2.52E+12
3/29/22	803.80	25	6.831	4332.47	216.62	21662.33	2.46E+12	2.46E+12
3/9/22	792.27	26	7.104	4270.34	213.52	21351.71	2.42E+12	2.42E+12
3/31/22	784.24	27	7.377	4227.04	211.35	21135.22	2.40E+12	2.40E+12
3/5/22	782.91	28	7.650	4219.89	210.99	21099.45	2.39E+12	2.39E+12
3/30/22	782.21	29	7.923	4216.12	210.81	21080.62	2.39E+12	2.39E+12
5/7/22	769.08	30	8.197	4145.34	207.27	20726.71	2.35E+12	2.35E+12
4/1/22	768.73	31	8.470	4143.46	207.17	20717.30	2.35E+12	2.35E+12
4/15/22	764.19	32	8.743	4118.99	205.95	20594.93	2.34E+12	2.34E+12
3/7/22	759.09	33	9.016	4091.50	204.58	20457.51	2.32E+12	2.32E+12
3/6/22	745.61	34	9.290	4018.84	200.94	20094.18	2.28E+12	2.28E+12
4/2/22	729.05	35	9.563	3929.60	196.48	19648.02	2.23E+12	2.23E+12
3/10/22	718.93	36	9.836	3875.01	193.75	19375.05	2.20E+12	2.20E+12
4/4/22	717.60	37	10.109	3867.86	193.39	19339.28	2.19E+12	2.19E+12
4/3/22	715.78	38	10.383	3858.07	192.90	19290.33	2.19E+12	2.19E+12
3/20/22	711.54	39	10.656	3835.18	191.76	19175.88	2.18E+12	2.18E+12
5/8/22	706.39	40	10.929	3807.43	190.37	19037.13	2.16E+12	2.16E+12
4/9/22	704.91	41	11.202	3799.48	189.97	18997.41	2.16E+12	2.16E+12
5/4/22	704.03	42	11.475	3794.70	189.74	18973.50	2.15E+12	2.15E+12
4/14/22	701.90	43	11.749	3783.25	189.16	18916.27	2.15E+12	2.15E+12
4/6/22	701.15	44	12.022	3779.19	188.96	18895.94	2.14E+12	2.14E+12
4/5/22	698.67	45	12.295	3765.82	188.29	18829.11	2.14E+12	2.14E+12
3/23/22	694.92	46	12.568	3745.60	187.28	18728.02	2.13E+12	2.13E+12
4/16/22	692.79	47	12.842	3734.16	186.71	18670.79	2.12E+12	2.12E+12
3/21/22	684.12	48	13.115	3687.40	184.37	18436.98	2.09E+12	2.09E+12
3/11/22	681.37	49	13.388	3672.56	183.63	18362.81	2.08E+12	2.08E+12
3/12/22	653.15	50	13.661	3520.45	176.02	17602.27	2.00E+12	2.00E+12
4/10/22	648.63	51	13.934	3496.13	174.81	17480.65	1.98E+12	1.98E+12
4/17/22	641.19	52	14.208	3456.00	172.80	17279.98	1.96E+12	1.96E+12
5/5/22	638.02	53	14.481	3438.90	171.95	17194.51	1.95E+12	1.95E+12
3/13/22	624.48	54	14.754	3365.97	168.30	16829.86	1.91E+12	1.91E+12
4/19/22	624.00	55	15.027	3363.34	168.17	16816.68	1.91E+12	1.91E+12
4/18/22	619.64	56	15.301	3339.88	166.99	16699.40	1.90E+12	1.90E+12
5/6/22	618.95	57	15.574	3336.15	166.81	16680.76	1.89E+12	1.89E+12
8/5/22	617.15	58	15.847	3326.44	166.32	16632.20	1.89E+12	1.89E+12
4/20/22	616.00	59	16.120	3320.26	166.01	16601.32	1.88E+12	1.88E+12
4/11/22	611.91	60	16.393	3298.20	164.91	16491.01	1.87E+12	1.87E+12

5/9/22	611.53	61	16.667	3296.13	164.81	16480.65	1.87E+12	1.87E+12
4/21/22	611.21	62	16.940	3294.40	164.72	16471.99	1.87E+12	1.87E+12
3/22/22	611.03	63	17.213	3293.46	164.67	16467.29	1.87E+12	1.87E+12
6/14/22	610.99	64	17.486	3293.23	164.66	16466.16	1.87E+12	1.87E+12
3/14/22	607.57	65	17.760	3274.82	163.74	16374.10	1.86E+12	1.86E+12
4/22/22	603.40	66	18.033	3252.30	162.62	16261.52	1.85E+12	1.85E+12
8/8/22	587.69	67	18.306	3167.67	158.38	15838.33	1.80E+12	1.80E+12
4/12/22	585.68	68	18.579	3156.82	157.84	15784.11	1.79E+12	1.79E+12
4/13/22	585.36	69	18.852	3155.09	157.75	15775.45	1.79E+12	1.79E+12
4/23/22	582.36	70	19.126	3138.94	156.95	15694.69	1.78E+12	1.78E+12
3/15/22	579.49	71	19.399	3123.46	156.17	15617.32	1.77E+12	1.77E+12
5/10/22	574.72	72	19.672	3097.75	154.89	15488.74	1.76E+12	1.76E+12
3/19/22	574.59	73	19.945	3097.03	154.85	15485.17	1.76E+12	1.76E+12
6/15/22	559.97	74	20.219	3018.23	150.91	15091.15	1.71E+12	1.71E+12
5/11/22	559.14	75	20.492	3013.75	150.69	15068.75	1.71E+12	1.71E+12
4/24/22	556.28	76	20.765	2998.35	149.92	14991.75	1.70E+12	1.70E+12
4/25/22	553.73	77	21.038	2984.61	149.23	14923.04	1.69E+12	1.69E+12
6/9/22	551.77	78	21.311	2974.03	148.70	14870.14	1.69E+12	1.69E+12
6/8/22	551.61	79	21.585	2973.16	148.66	14865.81	1.69E+12	1.69E+12
8/9/22	550.07	80	21.858	2964.88	148.24	14824.40	1.68E+12	1.68E+12
6/7/22	549.27	81	22.131	2960.59	148.03	14802.94	1.68E+12	1.68E+12
3/16/22	546.71	82	22.404	2946.77	147.34	14733.85	1.67E+12	1.67E+12
5/12/22	544.13	83	22.678	2932.84	146.64	14664.19	1.66E+12	1.66E+12
8/6/22	542.35	84	22.951	2923.28	146.16	14616.38	1.66E+12	1.66E+12
4/26/22	536.02	85	23.224	2889.16	144.46	14445.82	1.64E+12	1.64E+12
5/13/22	529.07	86	23.497	2851.66	142.58	14258.32	1.62E+12	1.62E+12
6/10/22	523.57	87	23.770	2822.03	141.10	14110.16	1.60E+12	1.60E+12
5/3/22	518.85	88	24.044	2796.58	139.83	13982.90	1.59E+12	1.59E+12
3/17/22	517.94	89	24.317	2791.69	139.58	13958.43	1.58E+12	1.58E+12
7/24/22	517.58	90	24.590	2789.77	139.49	13948.83	1.58E+12	1.58E+12
5/14/22	515.07	91	24.863	2776.25	138.81	13881.25	1.58E+12	1.58E+12
5/16/22	510.66	92	25.137	2752.45	137.62	13762.27	1.56E+12	1.56E+12
4/27/22	509.42	93	25.410	2745.79	137.29	13728.95	1.56E+12	1.56E+12
5/15/22	506.01	94	25.683	2727.38	136.37	13636.89	1.55E+12	1.55E+12
5/2/22	505.28	95	25.956	2723.46	136.17	13617.32	1.55E+12	1.55E+12
3/18/22	503.12	96	26.230	2711.79	135.59	13558.96	1.54E+12	1.54E+12
7/7/22	502.27	97	26.503	2707.24	135.36	13536.18	1.54E+12	1.54E+12
5/1/22	498.78	98	26.776	2688.41	134.42	13442.05	1.53E+12	1.53E+12
6/16/22	493.57	99	27.049	2660.36	133.02	13301.80	1.51E+12	1.51E+12
8/7/22	492.45	100	27.322	2654.30	132.71	13271.49	1.51E+12	1.51E+12
8/10/22	491.92	101	27.596	2651.44	132.57	13257.19	1.50E+12	1.50E+12
7/25/22	491.60	102	27.869	2649.74	132.49	13248.72	1.50E+12	1.50E+12
6/11/22	491.38	103	28.142	2648.54	132.43	13242.69	1.50E+12	1.50E+12
5/17/22	488.14	104	28.415	2631.07	131.55	13155.34	1.49E+12	1.49E+12
6/13/22	487.36	105	28.689	2626.85	131.34	13134.26	1.49E+12	1.49E+12
4/28/22	486.04	106	28.962	2619.77	130.99	13098.87	1.49E+12	1.49E+12
6/12/22	480.36	107	29.235	2589.16	129.46	12945.82	1.47E+12	1.47E+12
7/26/22	477.65	108	29.508	2574.55	128.73	12872.77	1.46E+12	1.46E+12
5/19/22	477.61	109	29.781	2574.29	128.71	12871.46	1.46E+12	1.46E+12
5/18/22	475.13	110	30.055	2560.93	128.05	12804.63	1.45E+12	1.45E+12
4/29/22	472.25	111	30.328	2545.45	127.27	12727.25	1.44E+12	1.44E+12
7/28/22	472.20	112	30.601	2545.16	127.26	12725.81	1.44E+12	1.44E+12
7/27/22	470.39	113	30.874	2535.40	126.77	12676.99	1.44E+12	1.44E+12
2/13/22	469.69	114	31.148	2531.64	126.58	12658.19	1.44E+12	1.44E+12
7/8/22	467.92	115	31.421	2522.07	126.10	12610.35	1.43E+12	1.43E+12
7/29/22	464.77	116	31.694	2505.10	125.25	12525.49	1.42E+12	1.42E+12
4/30/22	464.19	117	31.967	2502.00	125.10	12510.01	1.42E+12	1.42E+12
6/17/22	460.36	118	32.240	2481.33	124.07	12406.66	1.41E+12	1.41E+12
7/12/22	459.11	119	32.514	2474.59	123.73	12372.96	1.40E+12	1.40E+12
5/20/22	458.07	120	32.787	2468.98	123.45	12344.91	1.40E+12	1.40E+12
7/13/22	456.98	121	33.060	2463.11	123.16	12315.54	1.40E+12	1.40E+12

7/6/22	455.98	122	33.333	2457.72	122.89	12288.62	1.39E+12	1.39E+12
7/30/22	454.89	123	33.607	2451.84	122.59	12259.19	1.39E+12	1.39E+12
7/14/22	451.52	124	33.880	2433.70	121.69	12168.52	1.38E+12	1.38E+12
7/18/22	450.94	125	34.153	2430.54	121.53	12152.70	1.38E+12	1.38E+12
7/16/22	449.93	126	34.426	2425.12	121.26	12125.60	1.38E+12	1.38E+12
7/11/22	449.87	127	34.699	2424.78	121.24	12123.90	1.38E+12	1.38E+12
7/9/22	449.62	128	34.973	2423.46	121.17	12117.31	1.38E+12	1.38E+12
7/17/22	447.63	129	35.246	2412.73	120.64	12063.66	1.37E+12	1.37E+12
7/15/22	447.58	130	35.519	2412.43	120.62	12062.15	1.37E+12	1.37E+12
7/31/22	446.63	131	35.792	2407.31	120.37	12036.56	1.37E+12	1.37E+12
5/21/22	443.21	132	36.066	2388.90	119.44	11944.50	1.36E+12	1.36E+12
8/11/22	443.10	133	36.339	2388.33	119.42	11941.67	1.36E+12	1.36E+12
7/19/22	441.23	134	36.612	2378.24	118.91	11891.22	1.35E+12	1.35E+12
7/10/22	441.02	135	36.885	2377.08	118.85	11885.38	1.35E+12	1.35E+12
8/1/22	437.96	136	37.158	2360.60	118.03	11802.98	1.34E+12	1.34E+12
7/23/22	437.09	137	37.432	2355.92	117.80	11779.59	1.34E+12	1.34E+12
2/12/22	436.09	138	37.705	2350.53	117.53	11752.66	1.33E+12	1.33E+12
6/6/22	433.79	139	37.978	2338.11	116.91	11690.54	1.33E+12	1.33E+12
5/22/22	428.92	140	38.251	2311.87	115.59	11559.33	1.31E+12	1.31E+12
6/5/22	425.38	141	38.525	2292.81	114.64	11464.07	1.30E+12	1.30E+12
6/18/22	425.38	142	38.798	2292.78	114.64	11463.88	1.30E+12	1.30E+12
6/4/22	421.67	143	39.071	2272.82	113.64	11364.11	1.29E+12	1.29E+12
8/2/22	421.48	144	39.344	2271.77	113.59	11358.84	1.29E+12	1.29E+12
8/4/22	419.14	145	39.617	2259.15	112.96	11295.77	1.28E+12	1.28E+12
7/20/22	417.52	146	39.891	2250.42	112.52	11252.10	1.28E+12	1.28E+12
6/3/22	416.89	147	40.164	2247.03	112.35	11235.16	1.27E+12	1.27E+12
6/2/22	414.81	148	40.437	2235.81	111.79	11179.06	1.27E+12	1.27E+12
8/12/22	414.38	149	40.710	2233.51	111.68	11167.57	1.27E+12	1.27E+12
1/20/23	411.43	150	40.984	2217.63	110.88	11088.13	1.26E+12	1.26E+12
2/16/22	411.24	151	41.257	2216.57	110.83	11082.86	1.26E+12	1.26E+12
8/3/22	409.14	152	41.530	2205.28	110.26	11026.38	1.25E+12	1.25E+12
6/19/22	407.93	153	41.803	2198.73	109.94	10993.63	1.25E+12	1.25E+12
5/26/22	405.92	154	42.077	2187.88	109.39	10939.41	1.24E+12	1.24E+12
5/23/22	405.71	155	42.350	2186.79	109.34	10933.95	1.24E+12	1.24E+12
5/27/22	397.41	156	42.623	2142.02	107.10	10710.12	1.22E+12	1.22E+12
7/21/22	397.18	157	42.896	2140.82	107.04	10704.09	1.21E+12	1.21E+12
6/20/22	396.32	158	43.169	2136.19	106.81	10680.94	1.21E+12	1.21E+12
8/13/22	394.91	159	43.443	2128.54	106.43	10642.72	1.21E+12	1.21E+12
5/24/22	391.22	160	43.716	2108.66	105.43	10543.32	1.20E+12	1.20E+12
5/25/22	389.60	161	43.989	2099.97	105.00	10499.84	1.19E+12	1.19E+12
8/14/22	387.96	162	44.262	2091.08	104.55	10455.41	1.19E+12	1.19E+12
1/4/23	386.22	163	44.536	2081.74	104.09	10408.72	1.18E+12	1.18E+12
1/21/23	384.16	164	44.809	2070.64	103.53	10353.19	1.17E+12	1.17E+12
6/1/22	382.72	165	45.082	2062.84	103.14	10314.22	1.17E+12	1.17E+12
8/15/22	382.30	166	45.355	2060.62	103.03	10303.11	1.17E+12	1.17E+12
5/28/22	381.48	167	45.628	2056.18	102.81	10280.90	1.17E+12	1.17E+12
7/22/22	379.45	168	45.902	2045.26	102.26	10226.31	1.16E+12	1.16E+12
6/21/22	378.21	169	46.175	2038.56	101.93	10192.80	1.16E+12	1.16E+12
2/14/22	370.16	170	46.448	1995.19	99.76	9975.93	1.13E+12	1.13E+12
5/29/22	369.81	171	46.721	1993.27	99.66	9966.33	1.13E+12	1.13E+12
8/16/22	368.43	172	46.995	1985.85	99.29	9929.24	1.13E+12	1.13E+12
5/30/22	365.30	173	47.268	1968.98	98.45	9844.90	1.12E+12	1.12E+12
5/31/22	364.12	174	47.541	1962.62	98.13	9813.09	1.11E+12	1.11E+12
6/22/22	360.36	175	47.814	1942.32	97.12	9711.62	1.10E+12	1.10E+12
1/5/23	360.03	176	48.087	1940.55	97.03	9702.77	1.10E+12	1.10E+12
8/17/22	359.23	177	48.361	1936.26	96.81	9681.31	1.10E+12	1.10E+12
2/3/22	356.95	178	48.634	1923.95	96.20	9619.75	1.09E+12	1.09E+12
2/15/22	355.65	179	48.907	1916.94	95.85	9584.70	1.09E+12	1.09E+12
8/23/22	354.27	180	49.180	1909.49	95.47	9547.46	1.08E+12	1.08E+12
8/22/22	353.76	181	49.454	1906.78	95.34	9533.91	1.08E+12	1.08E+12
8/21/22	353.18	182	49.727	1903.62	95.18	9518.10	1.08E+12	1.08E+12

1/22/23	351.36	183	50.000	1893.83	94.69	9469.15	1.07E+12	1.07E+12
2/2/22	350.62	184	50.273	1889.84	94.49	9449.20	1.07E+12	1.07E+12
8/18/22	350.09	185	50.546	1886.98	94.35	9434.89	1.07E+12	1.07E+12
6/23/22	346.25	186	50.820	1866.27	93.31	9331.35	1.06E+12	1.06E+12
1/23/23	337.98	187	51.093	1821.69	91.08	9108.46	1.03E+12	1.03E+12
8/24/22	336.43	188	51.366	1813.33	90.67	9066.66	1.03E+12	1.03E+12
1/26/23	334.55	189	51.639	1803.22	90.16	9016.12	1.02E+12	1.02E+12
8/19/22	333.87	190	51.913	1799.55	89.98	8997.76	1.02E+12	1.02E+12
8/20/22	330.78	191	52.186	1782.91	89.15	8914.56	1.01E+12	1.01E+12
6/24/22	329.57	192	52.459	1776.36	88.82	8881.80	1.01E+12	1.01E+12
1/6/23	328.95	193	52.732	1773.05	88.65	8865.23	1.01E+12	1.01E+12
2/11/22	328.41	194	53.005	1770.11	88.51	8850.55	1.00E+12	1.00E+12
1/25/23	327.63	195	53.279	1765.92	88.30	8829.60	1.00E+12	1.00E+12
1/27/23	326.56	196	53.552	1760.16	88.01	8800.81	9.99E+11	9.99E+11
1/30/23	326.32	197	53.825	1758.89	87.94	8794.45	9.98E+11	9.98E+11
1/24/23	325.94	198	54.098	1756.83	87.84	8784.16	9.97E+11	9.97E+11
8/31/22	323.53	199	54.372	1743.83	87.19	8719.15	9.89E+11	9.89E+11
1/28/23	322.64	200	54.645	1739.01	86.95	8695.05	9.87E+11	9.87E+11
1/29/23	319.65	201	54.918	1722.90	86.14	8614.48	9.78E+11	9.78E+11
7/5/22	319.33	202	55.191	1721.16	86.06	8605.82	9.77E+11	9.77E+11
2/10/22	318.98	203	55.464	1719.28	85.96	8596.41	9.75E+11	9.75E+11
6/25/22	318.75	204	55.738	1718.08	85.90	8590.38	9.75E+11	9.75E+11
1/19/23	317.30	205	56.011	1710.25	85.51	8551.23	9.70E+11	9.70E+11
1/7/23	315.57	206	56.284	1700.91	85.05	8504.54	9.65E+11	9.65E+11
6/26/22	314.92	207	56.557	1697.44	84.87	8487.22	9.63E+11	9.63E+11
8/25/22	314.28	208	56.831	1693.98	84.70	8469.90	9.61E+11	9.61E+11
2/9/22	313.89	209	57.104	1691.87	84.59	8459.36	9.60E+11	9.60E+11
1/31/23	311.74	210	57.377	1680.28	84.01	8401.38	9.53E+11	9.53E+11
1/12/23	309.64	211	57.650	1668.98	83.45	8344.90	9.47E+11	9.47E+11
1/8/23	309.56	212	57.923	1668.53	83.43	8342.64	9.47E+11	9.47E+11
1/9/23	308.19	213	58.197	1661.15	83.06	8305.74	9.43E+11	9.43E+11
1/11/23	307.05	214	58.470	1654.97	82.75	8274.87	9.39E+11	9.39E+11
1/10/23	305.90	215	58.743	1648.80	82.44	8244.00	9.36E+11	9.36E+11
8/30/22	305.86	216	59.016	1648.57	82.43	8242.87	9.35E+11	9.35E+11
6/27/22	304.89	217	59.290	1643.38	82.17	8216.89	9.32E+11	9.32E+11
1/13/23	301.90	218	59.563	1627.26	81.36	8136.32	9.23E+11	9.23E+11
8/26/22	298.70	219	59.836	1610.02	80.50	8050.10	9.14E+11	9.14E+11
9/1/22	297.04	220	60.109	1601.05	80.05	8005.27	9.08E+11	9.08E+11
2/8/22	296.22	221	60.383	1596.64	79.83	7983.22	9.06E+11	9.06E+11
6/28/22	293.16	222	60.656	1580.12	79.01	7900.62	8.97E+11	8.97E+11
1/14/23	291.84	223	60.929	1573.01	78.65	7865.04	8.93E+11	8.93E+11
1/17/23	286.65	224	61.202	1545.03	77.25	7725.17	8.77E+11	8.77E+11
1/3/23	285.96	225	61.475	1541.34	77.07	7706.72	8.75E+11	8.75E+11
8/27/22	285.24	226	61.749	1537.43	76.87	7687.14	8.72E+11	8.72E+11
1/15/23	283.57	227	62.022	1528.47	76.42	7642.34	8.67E+11	8.67E+11
1/16/23	280.95	228	62.295	1514.31	75.72	7571.56	8.59E+11	8.59E+11
1/1/23	280.48	229	62.568	1511.79	75.59	7558.94	8.58E+11	8.58E+11
6/29/22	280.31	230	62.842	1510.85	75.54	7554.24	8.57E+11	8.57E+11
1/18/23	278.57	231	63.115	1501.47	75.07	7507.36	8.52E+11	8.52E+11
9/2/22	277.43	232	63.388	1495.37	74.77	7476.85	8.48E+11	8.48E+11
8/28/22	274.06	233	63.661	1477.19	73.86	7385.94	8.38E+11	8.38E+11
2/7/22	273.60	234	63.934	1474.70	73.74	7373.51	8.37E+11	8.37E+11
8/29/22	271.80	235	64.208	1464.99	73.25	7324.94	8.31E+11	8.31E+11
7/2/22	270.66	236	64.481	1458.85	72.94	7294.26	8.28E+11	8.28E+11
6/30/22	268.77	237	64.754	1448.69	72.43	7243.43	8.22E+11	8.22E+11
2/1/22	268.33	238	65.027	1446.30	72.32	7231.52	8.21E+11	8.21E+11
2/4/22	267.30	239	65.301	1440.73	72.04	7203.63	8.17E+11	8.17E+11
7/1/22	265.25	240	65.574	1429.67	71.48	7148.36	8.11E+11	8.11E+11
9/3/22	263.04	241	65.847	1417.80	70.89	7088.98	8.04E+11	8.04E+11
7/3/22	262.23	242	66.120	1413.41	70.67	7067.04	8.02E+11	8.02E+11
1/2/23	261.01	243	66.393	1406.86	70.34	7034.28	7.98E+11	7.98E+11

2/6/22	260.52	244	66.667	1404.22	70.21	7021.10	7.97E+11	7.97E+11
7/4/22	259.89	245	66.940	1400.83	70.04	7004.16	7.95E+11	7.95E+11
12/31/22	259.84	246	67.213	1400.53	70.03	7002.65	7.95E+11	7.95E+11
2/5/22	253.82	247	67.486	1368.08	68.40	6840.38	7.76E+11	7.76E+11
9/4/22	248.56	248	67.760	1339.72	66.99	6698.61	7.60E+11	7.60E+11
9/5/22	239.50	249	68.033	1290.90	64.55	6454.50	7.32E+11	7.32E+11
11/29/22	238.10	250	68.306	1283.36	64.17	6416.81	7.28E+11	7.28E+11
9/6/22	231.68	251	68.579	1248.75	62.44	6243.77	7.09E+11	7.09E+11
12/16/22	229.16	252	68.852	1235.17	61.76	6175.84	7.01E+11	7.01E+11
11/30/22	227.32	253	69.126	1225.23	61.26	6126.14	6.95E+11	6.95E+11
12/3/22	226.14	254	69.399	1218.90	60.95	6094.52	6.92E+11	6.92E+11
12/6/22	225.99	255	69.672	1218.08	60.90	6090.38	6.91E+11	6.91E+11
12/4/22	225.29	256	69.945	1214.31	60.72	6071.55	6.89E+11	6.89E+11
12/5/22	224.98	257	70.219	1212.65	60.63	6063.27	6.88E+11	6.88E+11
12/7/22	224.37	258	70.492	1209.38	60.47	6046.89	6.86E+11	6.86E+11
11/28/22	223.50	259	70.765	1204.67	60.23	6023.36	6.84E+11	6.84E+11
12/2/22	222.16	260	71.038	1197.44	59.87	5987.21	6.79E+11	6.79E+11
12/1/22	221.75	261	71.311	1195.22	59.76	5976.11	6.78E+11	6.78E+11
12/10/22	220.64	262	71.585	1189.27	59.46	5946.36	6.75E+11	6.75E+11
9/7/22	220.29	263	71.858	1187.35	59.37	5936.76	6.74E+11	6.74E+11
12/8/22	220.26	264	72.131	1187.20	59.36	5936.01	6.74E+11	6.74E+11
12/15/22	219.86	265	72.404	1185.06	59.25	5925.28	6.72E+11	6.72E+11
12/17/22	219.76	266	72.678	1184.53	59.23	5922.64	6.72E+11	6.72E+11
12/9/22	219.49	267	72.951	1183.06	59.15	5915.30	6.71E+11	6.71E+11
12/11/22	216.33	268	73.224	1166.04	58.30	5830.21	6.62E+11	6.62E+11
12/12/22	210.36	269	73.497	1133.85	56.69	5669.25	6.43E+11	6.43E+11
12/18/22	210.21	270	73.770	1133.02	56.65	5665.11	6.43E+11	6.43E+11
9/8/22	208.75	271	74.044	1125.18	56.26	5625.92	6.38E+11	6.38E+11
12/13/22	205.16	272	74.317	1105.80	55.29	5529.00	6.27E+11	6.27E+11
12/14/22	202.89	273	74.590	1093.60	54.68	5468.01	6.20E+11	6.20E+11
9/12/22	202.69	274	74.863	1092.47	54.62	5462.36	6.20E+11	6.20E+11
12/30/22	199.07	275	75.137	1072.97	53.65	5364.85	6.09E+11	6.09E+11
12/21/22	197.43	276	75.410	1064.16	53.21	5320.80	6.04E+11	6.04E+11
9/13/22	196.16	277	75.683	1057.31	52.87	5286.57	6.00E+11	6.00E+11
9/9/22	195.82	278	75.956	1055.47	52.77	5277.35	5.99E+11	5.99E+11
12/22/22	193.30	279	76.230	1041.91	52.10	5209.54	5.91E+11	5.91E+11
12/20/22	192.70	280	76.503	1038.63	51.93	5193.16	5.89E+11	5.89E+11
9/11/22	188.99	281	76.776	1018.65	50.93	5093.24	5.78E+11	5.78E+11
12/19/22	186.79	282	77.049	1006.82	50.34	5034.09	5.71E+11	5.71E+11
9/14/22	186.23	283	77.322	1003.77	50.19	5018.84	5.70E+11	5.70E+11
9/10/22	183.19	284	77.596	987.41	49.37	4937.03	5.60E+11	5.60E+11
9/15/22	173.88	285	77.869	937.20	46.86	4686.01	5.32E+11	5.32E+11
12/23/22	172.31	286	78.142	928.76	46.44	4643.81	5.27E+11	5.27E+11
12/29/22	168.21	287	78.415	906.63	45.33	4533.14	5.14E+11	5.14E+11
11/27/22	165.78	288	78.689	893.56	44.68	4467.82	5.07E+11	5.07E+11
9/16/22	161.63	289	78.962	871.20	43.56	4356.00	4.94E+11	4.94E+11
12/26/22	158.92	290	79.235	856.59	42.83	4282.95	4.86E+11	4.86E+11
12/25/22	157.90	291	79.508	851.09	42.55	4255.47	4.83E+11	4.83E+11
12/28/22	156.53	292	79.781	843.68	42.18	4218.38	4.79E+11	4.79E+11
10/19/22	153.31	293	80.055	826.32	41.32	4131.60	4.69E+11	4.69E+11
12/27/22	153.17	294	80.328	825.60	41.28	4127.99	4.68E+11	4.68E+11
9/17/22	151.72	295	80.601	817.77	40.89	4088.87	4.64E+11	4.64E+11
11/2/22	150.79	296	80.874	812.77	40.64	4063.83	4.61E+11	4.61E+11
10/27/22	148.71	297	81.148	801.55	40.08	4007.73	4.55E+11	4.55E+11
11/25/22	146.75	298	81.421	791.00	39.55	3955.02	4.49E+11	4.49E+11
11/26/22	146.52	299	81.694	789.76	39.49	3948.81	4.48E+11	4.48E+11
11/1/22	146.20	300	81.967	788.03	39.40	3940.15	4.47E+11	4.47E+11
10/20/22	145.31	301	82.240	783.21	39.16	3916.05	4.44E+11	4.44E+11
9/19/22	144.26	302	82.514	777.56	38.88	3887.81	4.41E+11	4.41E+11
11/17/22	144.13	303	82.787	776.88	38.84	3884.42	4.41E+11	4.41E+11
11/24/22	143.73	304	83.060	774.70	38.74	3873.50	4.40E+11	4.40E+11

11/3/22	143.60	305	83.333	774.02	38.70	3870.12	4.39E+11	4.39E+11
11/5/22	142.54	306	83.607	768.30	38.42	3841.50	4.36E+11	4.36E+11
11/18/22	142.42	307	83.880	767.62	38.38	3838.11	4.36E+11	4.36E+11
9/18/22	142.18	308	84.153	766.35	38.32	3831.75	4.35E+11	4.35E+11
10/31/22	142.15	309	84.426	766.19	38.31	3830.96	4.35E+11	4.35E+11
11/4/22	141.91	310	84.699	764.91	38.25	3824.56	4.34E+11	4.34E+11
11/23/22	141.89	311	84.973	764.80	38.24	3823.99	4.34E+11	4.34E+11
10/26/22	141.69	312	85.246	763.71	38.19	3818.53	4.33E+11	4.33E+11
10/28/22	141.58	313	85.519	763.10	38.16	3815.52	4.33E+11	4.33E+11
11/19/22	139.34	314	85.792	751.06	37.55	3755.28	4.26E+11	4.26E+11
11/10/22	139.15	315	86.066	750.00	37.50	3750.01	4.26E+11	4.26E+11
11/6/22	138.78	316	86.339	748.01	37.40	3740.03	4.24E+11	4.24E+11
11/22/22	138.60	317	86.612	747.03	37.35	3735.14	4.24E+11	4.24E+11
11/16/22	138.46	318	86.885	746.31	37.32	3731.56	4.23E+11	4.23E+11
11/11/22	138.45	319	87.158	746.24	37.31	3731.18	4.23E+11	4.23E+11
11/7/22	137.40	320	87.432	740.59	37.03	3702.95	4.20E+11	4.20E+11
11/8/22	136.83	321	87.705	737.54	36.88	3687.70	4.18E+11	4.18E+11
11/14/22	136.65	322	87.978	736.56	36.83	3682.80	4.18E+11	4.18E+11
11/20/22	136.29	323	88.251	734.60	36.73	3673.01	4.17E+11	4.17E+11
11/13/22	136.26	324	88.525	734.45	36.72	3672.26	4.17E+11	4.17E+11
11/12/22	136.17	325	88.798	733.96	36.70	3669.81	4.16E+11	4.16E+11
10/30/22	136.09	326	89.071	733.55	36.68	3667.74	4.16E+11	4.16E+11
10/29/22	136.08	327	89.344	733.47	36.67	3667.37	4.16E+11	4.16E+11
11/15/22	135.90	328	89.617	732.49	36.62	3662.47	4.16E+11	4.16E+11
11/9/22	135.58	329	89.891	730.76	36.54	3653.81	4.15E+11	4.15E+11
9/20/22	134.05	330	90.164	722.55	36.13	3612.77	4.10E+11	4.10E+11
10/21/22	133.76	331	90.437	720.97	36.05	3604.87	4.09E+11	4.09E+11
11/21/22	130.85	332	90.710	705.27	35.26	3526.36	4.00E+11	4.00E+11
9/21/22	130.62	333	90.984	704.03	35.20	3520.15	3.99E+11	3.99E+11
10/25/22	127.32	334	91.257	686.26	34.31	3431.30	3.89E+11	3.89E+11
10/22/22	125.87	335	91.530	678.47	33.92	3392.33	3.85E+11	3.85E+11
10/18/22	124.88	336	91.803	673.08	33.65	3365.41	3.82E+11	3.82E+11
9/22/22	123.72	337	92.077	666.83	33.34	3334.16	3.78E+11	3.78E+11
9/27/22	123.38	338	92.350	665.02	33.25	3325.12	3.77E+11	3.77E+11
12/24/22	122.05	339	92.623	657.87	32.89	3289.35	3.73E+11	3.73E+11
9/26/22	121.54	340	92.896	655.08	32.75	3275.42	3.72E+11	3.72E+11
10/23/22	120.91	341	93.169	651.70	32.58	3258.48	3.70E+11	3.70E+11
10/24/22	119.35	342	93.443	643.30	32.16	3216.50	3.65E+11	3.65E+11
9/28/22	118.83	343	93.716	640.51	32.03	3202.57	3.63E+11	3.63E+11
9/23/22	115.52	344	93.989	622.67	31.13	3113.34	3.53E+11	3.53E+11
9/25/22	115.42	345	94.262	622.14	31.11	3110.70	3.53E+11	3.53E+11
9/29/22	114.81	346	94.536	618.83	30.94	3094.13	3.51E+11	3.51E+11
9/30/22	112.82	347	94.809	608.10	30.40	3040.48	3.45E+11	3.45E+11
9/24/22	111.82	348	95.082	602.71	30.14	3013.56	3.42E+11	3.42E+11
10/1/22	109.47	349	95.355	590.02	29.50	2950.12	3.35E+11	3.35E+11
10/2/22	105.28	350	95.628	567.43	28.37	2837.17	3.22E+11	3.22E+11
10/3/22	101.22	351	95.902	545.60	27.28	2727.98	3.10E+11	3.10E+11
10/4/22	98.35	352	96.175	530.08	26.50	2650.42	3.01E+11	3.01E+11
10/17/22	96.35	353	96.448	519.32	25.97	2596.58	2.95E+11	2.95E+11
10/5/22	94.94	354	96.721	511.75	25.59	2558.74	2.90E+11	2.90E+11
10/6/22	93.18	355	96.995	502.22	25.11	2511.11	2.85E+11	2.85E+11
10/7/22	89.59	356	97.268	482.91	24.15	2414.54	2.74E+11	2.74E+11
10/13/22	88.57	357	97.541	477.37	23.87	2386.87	2.71E+11	2.71E+11
10/12/22	88.31	358	97.814	476.02	23.80	2380.09	2.70E+11	2.70E+11
10/14/22	87.02	359	98.087	469.05	23.45	2345.26	2.66E+11	2.66E+11
10/15/22	86.44	360	98.361	465.89	23.29	2329.45	2.64E+11	2.64E+11
10/8/22	86.39	361	98.634	465.63	23.28	2328.13	2.64E+11	2.64E+11
10/9/22	85.51	362	98.907	460.88	23.04	2304.41	2.61E+11	2.61E+11
10/16/22	85.19	363	99.180	459.19	22.96	2295.94	2.61E+11	2.61E+11
10/10/22	84.77	364	99.454	456.93	22.85	2284.64	2.59E+11	2.59E+11
10/11/22	84.70	365	99.727	456.51	22.83	2282.57	2.59E+11	2.59E+11

TOTAL NUMBI	365				
	1.00	0.05	5.00	125.00	125.00
	5.39	5.39	5.39	24465758.40	24465758.40

Site 20 Date	Flow	NO3_N (mg/L)	TP (mg/L)	TSS (mg/L)	Ecoli (col/100 mL)	% Flow Exceed	NO3 Act Load	TP Act Load	TSS Act Load	Ecoli Act Load	Ann Load Proxy Range	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
2/22/22	1442.60	3.77	0.102	0.8	326.0	1.366120219	29314.09424	793.113425	6220.497452	1.15E+13	21	615595.9791	16655.38193	130630.4465	2.42E+14
3/15/22	579.49	3.84	0.05	3.2	80.0	19.3989071	11994.10222	156.173206	9995.085185	1.13E+12	35	419793.5778	5466.062211	349827.9815	3.97E+13
4/19/22	624.00	4.21	0.05	0.8	77.0	15.0273224	14159.64754	168.166835	2690.669366	1.18E+12	35	495587.6638	5885.839237	94173.4278	4.11E+13
5/24/22	391.22	4.52	0.056	10.4	60.0	43.71584699	9531.165353	118.085234	21930.11497	5.74E+11	28	266872.6299	3306.386565	614043.2192	1.61E+13
6/21/22	378.21	4.02	0.132	12.8	172.0	46.17486339	8195.008404	269.089828	26093.5591	1.59E+12	28	229460.2353	7534.515189	730619.6547	4.46E+13
7/19/22	441.23	2.85	0.09	13.6	167.0	36.61202186	6777.995078	214.04195	32344.11686	1.80E+12	35	237229.8277	7491.468244	1132044.09	6.31E+13
8/23/22	354.27	3.52	0.069	5.6	172.0	49.18032787	6721.414365	131.754997	10693.15922	1.49E+12	28	188199.6022	3689.13993	299408.4581	4.17E+13
9/20/22	134.05	2.73	0.051	2.4	119.0	90.16393443	1975.023283	36.8502802	1734.130834	3.90E+11	36	71100.8382	1326.610088	62428.71002	1.41E+13
10/26/22	141.69	1.60	0.050	6.0	155.0	85.24590164	1224.90158	38.1853363	4582.240351	5.37E+11	13	15923.72053	496.4093714	59569.12457	6.99E+12
11/8/22	136.83	1.83	0.050	0.8	84.0	87.70491803	1349.542386	36.8769746	590.031593	2.81E+11	35	47233.9835	1290.69411	20651.10576	9.84E+12
12/13/22	205.16	2.50	0.050	5.2	77.0	74.31693989	2764.502381	55.2900476	5750.164953	3.86E+11	36	99522.08572	1990.441714	207005.9383	1.39E+13
1/18/23	309.56	4.30	0.050	18.4	66.0	63.1147541	7174.67152	83.426413	30700.91999	5.00E+11	37	265462.8462	3086.777282	1135934.04	1.85E+13
2/24/23															

Conversion Factor	5.39	5.39	5.39	2.45E+07

	NO3 Ann Load	TP Ann Load	TSS Ann Load	Ecoli Ann Load
TOTAL	2,951,983.0	58,219.7	4,836,336.2	5.51E+14
TARGET	793,549.3	39,677.5	3,967,746.3	4.50E+14

Appendix D: Subwatershed Data

Subwatershed Name	Tamarack Lake-Little Elkhart Creek	Dallas Lake-Little Elkhart Creek	Oliver Lake-Little Elkhart Creek	Waterhouse Ditch-Henderson Lake Ditch	Oviate Ditch-Middle Branch Elkhart River	Jones Lake-North Branch Elkhart River	Huston Ditch-North Branch Elkhart River	Rivir Lake-Forker Creek	Winebrenner Branch-Carrol Creek
HUC	40500011501	40500011502	40500011503	40500011504	40500011505	40500011506	40500011507	40500011601	40500011602
Area (acres)	12,395	13,311	10,126	12,788	11,052	26,049	18,488	11,960	11,799
% of Watershed	5%	5%	4%	5%	4%	10%	7%	5%	5%
Stream (miles)	28.5	30.5	31.0	22.3	20.2	62.3	32.1	25.6	24.2
Impaired ECOLI 4A (miles)					6.80	11.98	11.39		6.23
Impaired Nutr 5A (miles)									
Impaired PCBs 5B (miles)			3.79	0.3	5.14			0.46	
Impaired biotic comm (miles)		3.81	1.33			0.16			
Impaired DO (miles)					6.80	0.00			
HEL (acres)	7,107.0	6,899.2	5,268.7	7,524.2	5,910.3	12,847.3	6,877.4	8,296.3	4869.5321
HEL (%)	57.3%	51.8%	52.0%	59%	53.5%	49.3%	37.2%	69.4%	41%
Hydric (acres)	3,675.8	2,953.1	2,922.6	3,679.8	2,538.5	8,574.3	5,767.6	2,637.2	4588.7524
Hydric (%)	29.7%	22.2%	28.9%	29%	23.0%	32.9%	31.2%	22.1%	39%
Septic-VeryLimited	11,189.2	8,855.2	8,452.2	11,773.5	9,542.0	24,355.1	18,204.4	11,638.4	11064.2016
Septic-VL (%)	90.3%	66.5%	83.5%	92%	86.3%	93.5%	98.5%	97.3%	94%
Floodplain (acres)	688	1,707	1,175	902.6	1,013	2,308	860	363	1058.5471
Floodplain (%)	6%	13%	12%	7%	9%	9%	5%	3%	9%
CFO (animals)		1,000		994.0	1,415	75,962	41,847		
CFO/CAFO animals/acre	0.00	0.08	0.00	0.08	0.13	2.92	2.26	0.00	0.00
Hobby Farm (animals)	31	475	1,147	87.0	102	1,322	4,821	242	95
Hobby animals/acre	0.00	0.04	0.11	0.01	0.01	0.05	0.26	0.02	0.01
Manure estimate (tons)	431	30,179	21,692	4,305	33,050	109,397	287,891	3,903	2,068
Manure N estimate (lb)	449	15,804	13,795	13,908	15,767	1,761,761	566,533	3,051	997
Manure P estimate (lb)	217	7,876	6,833	10,044	7,741	1,410,210	410,845	1,607	491
Manure Ecoli Estimate (col)	9.91E+13	8.88E+14	1.50E+15	6.43E+14	9.32E+14	1.21E+19	1.04E+16	3.97E+14	5.74E+13
Municipal Sludge App (acres)									
Livestock Access (miles)							0.6	1.0	
Livestock Access (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	4.0%	0.0%
Streambank Erosion (miles)				1.8	0.6	4.6	3.3	2.9	
Streambank Erosion (%)	0.0%	0.0%	0.0%	8.1%	2.9%	7.4%	10.3%	11.2%	0.0%
Narrow Buffer (miles)	2.2	0.7		1.6	0.6	3.1	11.4		5.7272
Narrow Buffer (%)	7.6%	2.2%	0.0%	7.3%	2.9%	5.0%	35.5%	0.0%	23.7%
Land Use (%)									
Ag - Row +Pasture	63.0%	54.9%	60.8%	45.1%	55.3%	65.7%	78.7%	51.5%	67.8%
Forest	0.2%	2.2%	2.5%	7.7%	4.5%	4.5%	3.7%	31.3%	10.1%
Wetland + Open water + grass	26.4%	34.7%	30.7%	30.9%	32.3%	23.7%	13.0%	9.9%	15.9%
Urban	5.8%	8.2%	6.1%	16.3%	8.0%	6.2%	4.6%	4.4%	6.3%

Subwatershed Name	Tamarack Lake-Little Elkhart Creek	Dallas Lake-Little Elkhart Creek	Oliver Lake-Little Elkhart Creek	Waterhouse Ditch-Henderson Lake Ditch	Oviate Ditch-Middle Branch Elkhart River	Jones Lake-North Branch Elkhart River	Huston Ditch-North Branch Elkhart River	Rivir Lake-Forker Creek	Winebrenner Branch-Carrol Creek
HUC	40500011501	40500011502	40500011503	40500011504	40500011505	40500011506	40500011507	40500011601	40500011602
LUST	3	7	3	56.0	8	7	1	3	3
NPDES	1 (Wolcottville WWTP)			1 (Kendallville WWTP)		1 (Lakeside RSD and Rome City WWTP)	1 (West Lakes RSD)		1 (Bear High Wolf Lake
NPDES SSO									
Superfund									
VRP									
Brownfields									
Industrial Waste				15.0		2			
Solid Waste									
Waste Restricted									
Historic Water Quality Samples Exceeding Targets									
Ammonia	25%	0%	18%	25%	0%	0%	50%		33%
Cond	0%	0%	0%	14%	0%	0%	0%	0%	0%
DO	0%	7%	8%	10%	26%	10%	6%	0%	9%
Ecoli		100%	80%	6%	60%	29%	21%	19%	33%
Nitrate	80%	13%	45%	60%	0%	79%	80%	69%	81%
Dissolved phosphorus		53%	44%	50%				50%	
pH	29%	0%	0%	0%	0%	0%	0%	0%	0%
Total Kjeldahl nitrogen	100%	54%	42%	100%	100%	83%	100%	100%	33%
Total phosphorus	80%	67%	67%	80%	33%	65%	78%	81%	75%
Total suspended solids	40%	19%	17%	25%	0%	15%	30%	25%	13%
Turbidity	100%		33%	36%	30%	28%	43%	33%	26%
Current Water Quality Samples Exceeding Targets									
Temp	0%	0%	0%	0%	0%	0%	0%	0%	0%
DO	8%	0%	17%	0%	0%	3%	0%	25%	0%
pH	0%	0%	0%	0%	0%	0%	0%	0%	0%
Conductivity	0%	0%	0%	8%	0%	0%	0%	0%	0%
Turbidity	17%	25%	17%	33%	8%	19%	17%	17%	17%
Nitrate	92%	100%	100%	100%	92%	94%	100%	100%	92%
Total Phosphorus	17%	25%	46%	42%	0%	11%	25%	25%	8%
Total Suspended Solids	25%	0%	46%	58%	25%	8%	17%	0%	8%
E.c oli	25%	33%	29%	50%	0%	36%	100%	8%	33%

Subwatershed Name	Skinner Lake-Croft Ditch	Muncie Lake-South Branch Elkhart River	Diamond Lake-South Branch Elkhart River	Phillips Ditch-Stony Creek	Indian Lake-Elkhart River	Headwaters Solomon Creek	Hire Ditch-Solomon Creek	Whetten Ditch-Elkhart River
HUC	40500011603	40500011604	40500011605	40500011801	40500011802	40500011803	40500011804	40500011805
Area (acres)	15,890	10,527	22,904	13,017	20,182	15,158	14,189	18,207
% of Watershed	6%	4%	9%	5%	8%	6%	5%	7%
Stream (miles)	25.3	25.3	50.5	26.4	31.7	22.7	31.5	49.8338
Impaired ECOLI 4A (miles)	17.06	2.59	25.81	17.06	20.94	18.18	17.89	28.32
Impaired Nutr 5A (miles)			3.14				10.17	
Impaired PCBs 5B (miles)								
Impaired biotic comm (miles)								
Impaired DO (miles)							10.17	
HEL (acres)	8,912.9	6,822.9	11,907.1	3,461.1	7,419.8	6,232.9	2,844.4	3688.1429
HEL (%)	56.1%	64.8%	52.0%	26.6%	36.8%	41.1%	20.0%	20%
Hydric (acres)	4,736.6	2,732.0	7,507.8	2,843.1	4,431.0	4,712.4	5,254.6	3699.1963
Hydric (%)	29.8%	26.0%	32.8%	21.8%	22.0%	31.1%	37.0%	20%
Septic-VeryLimited	15,464.0	9,953.2	21,710.0	12,979.1	19,780.5	14,896.8	14,114.6	17978.6283
Septic-VL (%)	97.3%	94.6%	94.8%	99.7%	98.0%	98.3%	99.5%	99%
Floodplain (acres)	902	942	2,786	15	1,241	1,088	1,279	1528.8588
Floodplain (%)	6%	9%	12%	0%	6%	7%	9%	8%
CFO (animals)			8,573	68,456	62,166	20,305	2,280	114016
CFO/CAFO animals/acre	0.00	0.00	0.37	5.26	3.08	1.34	0.16	6.26
Hobby Farm (animals)	514	110	730	2,084	579	181	133	521
Hobby animals/acre	0.03	0.01	0.03	0.16	0.03	0.01	0.01	0.03
Manure estimate (tons)	10,163	2,382	49,215	119,367	117,999	131,036	11,951	28,253
Manure N estimate (lb)	5,626	1,163	113,798	1,569,535	1,331,535	246,988	29,436	3,004,598
Manure P estimate (lb)	2,960	574	83,797	1,248,895	1,059,893	179,433	21,906	2,431,426
Manure Ecoli Estimate (col)	3.24E+14	6.48E+13	1.01E+15	1.05E+19	8.38E+18	1.64E+15	5.97E+13	2.39E+19
Municipal Sludge App (acres)								
Livestock Access (miles)			0.5	1.4				
Livestock Access (%)	0.0%	0.0%	0.9%	5.1%	0.0%	0.0%	0.0%	0.0%
Streambank Erosion (miles)	3.1		0.5	1.4	1.5			0.9201
Streambank Erosion (%)	12.2%	0.0%	0.9%	5.1%	4.9%	0.0%	0.0%	1.8%
Narrow Buffer (miles)	5.4	3.4	2.4	1.8		9.5	8.1	7.8338
Narrow Buffer (%)	21.2%	13.6%	4.8%	6.7%	0.0%	41.8%	25.8%	15.7%
Land Use (%)								
Ag - Row +Pasture	70.3%	62.6%	61.3%	80.2%	74.8%	84.2%	82.2%	70.4%
Forest	10.4%	15.8%	12.5%	3.5%	3.5%	5.9%	3.5%	3.6%
Wetland + Open water + grass	11.2%	15.6%	20.8%	9.3%	11.3%	4.6%	7.8%	13.5%
Urban	8.1%	6.0%	5.4%	7.1%	10.4%	5.4%	6.6%	12.5%

Subwatershed Name	Skinner Lake-Croft Ditch	Muncie Lake-South Branch Elkhart River	Diamond Lake-South Branch Elkhart River	Phillips Ditch-Stony Creek	Indian Lake-Elkhart River	Headwaters Solomon Creek	Hire Ditch-Solomon Creek	Whetten Ditch-Elkhart River
HUC	40500011603	40500011604	40500011605	40500011801	40500011802	40500011803	40500011804	40500011805
LUST	17	1	2	8	21	1	1	6
NPDES	1 (Albion WWTP)	ain o lakes state park)		1 (Millersburg WWTP)	1 (Ligonier WWTP)	Cromwell WWTP	Turkey Creek wwtp	Paris Conservancy
NPDES SSO								
Superfund								
VRP								
Brownfields								
Industrial Waste	1				13		1	
Solid Waste								
Waste Restricted								
Historic Water Quality Samples Exceeding Targets								
Ammonia	4%	0%	0%	0%	60%	0%	33%	0%
Cond	0%	0%	0%	12%	4%	2%	11%	1%
DO	18%	9%	22%	16%	5%	22%	6%	21%
Ecoli	59%	20%	13%	60%	28%	33%	42%	29%
Nitrate	76%	50%	25%	83%	59%	34%	88%	82%
Dissolved phosphorus	15%					50%	53%	50%
pH	0%	3%	0%	4%	0%	0%	1%	1%
Total Kjeldahl nitrogen	92%	83%	100%	50%	50%	38%	41%	84%
Total phosphorus	84%	33%	36%	67%	86%	31%	60%	79%
Total suspended solids	36%	17%	10%	0%	6%	19%	12%	18%
Turbidity	60%	80%	22%	52%	48%	44%	38%	67%
Current Water Quality Samples Exceeding Targets								
Temp	0%	0%	0%	0%	0%	0%	0%	0%
DO	0%	0%	33%	0%	0%	0%	0%	0%
pH	0%	0%	0%	0%	0%	0%	0%	0%
Conductivity	0%	0%	0%	0%	0%	0%	0%	0%
Turbidity	8%	50%	25%	17%	8%	58%	33%	25%
Nitrate	92%	100%	100%	92%	100%	100%	100%	100%
Total Phosphorus	58%	17%	42%	83%	25%	0%	8%	25%
Total Suspended Solids	0%	50%	0%	0%	0%	50%	17%	8%
E.c oli	67%	17%	17%	58%	8%	75%	50%	8%

Appendix E: Critical Area Data

Nutrients	Tamarack Lake-Little Elkhart Creek	Dallas Lake-Little Elkhart Creek	Oliver Lake-Little Elkhart Creek	Waterhouse Ditch-Henderson Lake Ditch
HUC	40500011501	40500011502	40500011503	40500011504
Impaired Nutr 5A (miles)				
Manure N estimate (lb)	449	15,804	13,795	13,908
Manure P estimate (lb)	217	7,876	6,833	10,044
Ag - Row +Pasture	63.0%	54.9%	60.8%	45.1%
Urban	5.8%	8.2%	6.1%	16.3%
Historic Water Quality Samples Exceeding Targets				
Nitrate	80%	13%	45%	60%
Total Kjeldahl nitrogen	100%	54%	42%	100%
Total phosphorus	80%	67%	67%	80%
Current Water Quality Samples Exceeding Targets				
Nitrate	92%	100%	100%	100%
Total Phosphorus	17%	25%	46%	42%
Count	4	3	2	5

Sediment	Tamarack Lake-Little Elkhart Creek	Dallas Lake-Little Elkhart Creek	Oliver Lake-Little Elkhart Creek	Waterhouse Ditch-Henderson Lake Ditch
HUC	40500011501	40500011502	40500011503	40500011504
HEL (%)	57.3%	51.8%	52.0%	59%
Streambank Erosion (%)	0.0%	0.0%	0.0%	8.1%
Narrow Buffer (%)	7.6%	2.2%	0.0%	7.3%
Ag - Row +Pasture	63.0%	54.9%	60.8%	45.1%
Urban	5.8%	8.2%	6.1%	16.3%
Historic Water Quality Samples Exceeding Targets				
Total suspended solids	40%	19%	17%	25%
Turbidity	100%		33%	36%
Current Water Quality Samples Exceeding Targets				
Turbidity	17%	25%	17%	33%
Total Suspended Solids	25%	0%	46%	58%
Count	4	2	2	4

Pathogens	Tamarack Lake-Little Elkhart Creek	Dallas Lake-Little Elkhart Creek	Oliver Lake-Little Elkhart Creek	Waterhouse Ditch-Henderson Lake Ditch
HUC	40500011501	40500011502	40500011503	40500011504
Impaired ECOLI 4A (miles)				
Lack of sanitary sewer (points/acre)	0.06	0.09	0.12	0.11
Manure estimate (tons)	431	30,179	21,692	4,305
Historic Water Quality Samples Exceeding Targets				
Ecoli		100%	80%	6%
Current Water Quality Samples Exceeding Targets				
Ecoli	25%	33%	29%	50%
Count	1	3	3	2

Nutrients	Oviate Ditch-Middle Branch Elkhart River	Jones Lake-North Branch Elkhart River	Huston Ditch-North Branch Elkhart River	Rivir Lake-Forker Creek
HUC	40500011505	40500011506	40500011507	40500011601
Impaired Nutr 5A (miles)				
Manure N estimate (lb)	15,767	1,761,761	566,533	3,051
Manure P estimate (lb)	7,741	1,410,210	410,845	1,607
Ag - Row +Pasture	55.3%	65.7%	78.7%	51.5%
Urban	8.0%	6.2%	4.6%	4.4%
Historic Water Quality Samples Exceeding Targets				
Nitrate	0%	79%	80%	69%
Total Kjeldahl nitrogen	100%	83%	100%	100%
Total phosphorus	33%	65%	78%	81%
Current Water Quality Samples Exceeding Targets				
Nitrate	92%	94%	100%	100%
Total Phosphorus	0%	11%	25%	25%
Count	2	6	7	4

Sediment	Oviate Ditch-Middle Branch Elkhart River	Jones Lake-North Branch Elkhart River	Huston Ditch-North Branch Elkhart River	Rivir Lake-Forker Creek
HUC	40500011505	40500011506	40500011507	40500011601
HEL (%)	53.5%	49.3%	37.2%	69.4%
Streambank Erosion (%)	2.9%	7.4%	10.3%	11.2%
Narrow Buffer (%)	2.9%	5.0%	35.5%	0.0%
Ag - Row +Pasture	55.3%	65.7%	78.7%	51.5%
Urban	8.0%	6.2%	4.6%	4.4%
Historic Water Quality Samples Exceeding Targets				
Total suspended solids	0%	15%	30%	25%
Turbidity	30%	28%	43%	33%
Current Water Quality Samples Exceeding Targets				
Turbidity	8%	19%	17%	17%
Total Suspended Solids	25%	8%	17%	0%
Count	3	1	4	2

Pathogens	Oviate Ditch-Middle Branch Elkhart River	Jones Lake-North Branch Elkhart River	Huston Ditch-North Branch Elkhart River	Rivir Lake-Forker Creek
HUC	40500011505	40500011506	40500011507	40500011601
Impaired ECOLI 4A (miles)	6.80	11.98	11.39	
Lack of sanitary sewer (points/acre)	0.05	0.06	0.02	0.02
Manure estimate (tons)	33,050	109,397	287,891	3,903
Historic Water Quality Samples Exceeding Targets				
Ecoli	60%	29%	21%	19%
Current Water Quality Samples Exceeding Targets				
Ecoli	0%	36%	100%	8%
Count	4	3	3	1

Nutrients	Winebrenner Branch-Carrol Creek	Skinner Lake-Croft Ditch	Muncie Lake-South Branch Elkhart River	Diamond Lake-South Branch Elkhart River
HUC	40500011602	40500011603	40500011604	40500011605
Impaired Nutr 5A (miles)				3.14
Manure N estimate (lb)	997	5,626	1,163	113,798
Manure P estimate (lb)	491	2,960	574	83,797
Ag - Row +Pasture	67.8%	70.3%	62.6%	61.3%
Urban	6.3%	8.1%	6.0%	5.4%
Historic Water Quality Samples Exceeding Targets				
Nitrate	81%	76%	50%	25%
Total Kjeldahl nitrogen	33%	92%	83%	100%
Total phosphorus	75%	84%	33%	36%
Current Water Quality Samples Exceeding Targets				
Nitrate	92%	92%	100%	100%
Total Phosphorus	8%	58%	17%	42%
Count	4	6	3	5

Sediment	Winebrenner Branch-Carrol Creek	Skinner Lake-Croft Ditch	Muncie Lake-South Branch Elkhart River	Diamond Lake-South Branch Elkhart River
HUC	40500011602	40500011603	40500011604	40500011605
HEL (%)	41%	56.1%	64.8%	52.0%
Streambank Erosion (%)	0.0%	12.2%	0.0%	0.9%
Narrow Buffer (%)	23.7%	21.2%	13.6%	4.8%
Ag - Row +Pasture	67.8%	70.3%	62.6%	61.3%
Urban	6.3%	8.1%	6.0%	5.4%
Historic Water Quality Samples Exceeding Targets				
Total suspended solids	13%	36%	17%	10%
Turbidity	26%	60%	80%	22%
Current Water Quality Samples Exceeding Targets				
Turbidity	17%	8%	50%	25%
Total Suspended Solids	8%	0%	50%	0%
Count	2	6	4	2

Pathogens	Winebrenner Branch-Carrol Creek	Skinner Lake-Croft Ditch	Muncie Lake-South Branch Elkhart River	Diamond Lake-South Branch Elkhart River
HUC	40500011602	40500011603	40500011604	40500011605
Impaired ECOLI 4A (miles)	6.23	17.06	2.59	25.81
Lack of sanitary sewer (points/acre)	0.03	0.04	0.05	0.04
Manure estimate (tons)	2,068	10,163	2,382	49,215
Historic Water Quality Samples Exceeding Targets				
Ecoli	33%	59%	20%	13%
Current Water Quality Samples Exceeding Targets				
Ecoli	33%	67%	17%	17%
Count	1	3	2	1

Nutrients	Phillips Ditch-Stony Creek	Indian Lake-Elkhart River	Headwaters Solomon Creek	Hire Ditch-Solomon Creek	Whetten Ditch-Elkhart River
HUC	40500011801	40500011802	40500011803	40500011804	40500011805
Impaired Nutr 5A (miles)				10.17	
Manure N estimate (lb)	1,569,535	1,331,535	246,988	29,436	3,004,598
Manure P estimate (lb)	1,248,895	1,059,893	179,433	21,906	2,431,426
Ag - Row +Pasture	80.2%	74.8%	84.2%	82.2%	70.4%
Urban	7.1%	10.4%	5.4%	6.6%	12.5%
Historic Water Quality Samples Exceeding Targets					
Nitrate	83%	59%	34%	88%	82%
Total Kjeldahl nitrogen	50%	50%	38%	41%	84%
Total phosphorus	67%	86%	31%	60%	79%
Current Water Quality Samples Exceeding Targets					
Nitrate	92%	100%	100%	100%	100%
Total Phosphorus	83%	25%	0%	8%	25%
Count	8	8	4	5	8

Sediment	Phillips Ditch-Stony Creek	Indian Lake-Elkhart River	Headwaters Solomon Creek	Hire Ditch-Solomon Creek	Whetten Ditch-Elkhart River
HUC	40500011801	40500011802	40500011803	40500011804	40500011805
HEL (%)	26.6%	36.8%	41.1%	20.0%	20%
Streambank Erosion (%)	5.1%	4.9%	0.0%	0.0%	1.8%
Narrow Buffer (%)	6.7%	0.0%	41.8%	25.8%	15.7%
Ag - Row +Pasture	80.2%	74.8%	84.2%	82.2%	70.4%
Urban	7.1%	10.4%	5.4%	6.6%	12.5%
Historic Water Quality Samples Exceeding Targets					
Total suspended solids	0%	6%	19%	12%	18%
Turbidity	52%	48%	44%	38%	67%
Current Water Quality Samples Exceeding Targets					
Turbidity	17%	8%	58%	33%	25%
Total Suspended Solids	0%	0%	50%	17%	8%
Count	3	3	4	3	5

Pathogens	Phillips Ditch-Stony Creek	Indian Lake-Elkhart River	Headwaters Solomon Creek	Hire Ditch-Solomon Creek	Whetten Ditch-Elkhart River
HUC	40500011801	40500011802	40500011803	40500011804	40500011805
Impaired ECOLI 4A (miles)	17.06	20.94	18.18	17.89	28.32
Lack of sanitary sewer (points/acre)	0.07	0.05	0.04	0.03	0.08
Manure estimate (tons)	119,367	117,999	131,036	11,951	28,253
Historic Water Quality Samples Exceeding Targets					
Ecoli	60%	28%	33%	42%	29%
Current Water Quality Samples Exceeding Targets					
Ecoli	58%	8%	75%	50%	8%
Count	5	3	3	3	3