

WATERSHED TREND REPORT

CENTRAL STUDY BASIN

2012 - 2019



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Introduction

Sanitation District No. 1 (SD1), a clean-water agency which serves over 30 communities in Campbell, Kenton, and Boone Counties, Kentucky, as both a wastewater and a storm water utility, is implementing an adaptive watershed management approach to cost-effectively meet numerous regulatory requirements (e.g., Combined Sewer Overflow (CSO) Program, Municipal Separate Storm Sewer System (MS4) Program, Total Maximum Daily Load (TMDL) Program, etc.) to address environmental impacts associated with sewer overflows and storm water runoff in the communities it serves. In complying with these regulatory requirements, SD1 is applying a comprehensive approach for identifying impairments. In 2009, SD1 developed Watershed Characterization Reports for 16 watersheds to relate instream conditions to watershed characteristics. The results of these Watershed Characterization Reports were used to identify impaired watersheds and prioritize them for consideration of control alternatives associated with sewer overflow mitigation¹.

SD1 is undertaking a long-term effort to collect and compile data that describes the water quality conditions of Northern Kentucky (NKY) streams. This information is compiled at a basin scale and a watershed scale to relate instream conditions to watershed characteristics. Figure 1 shows the four study basins (East, Central, North and West) that are used to group NKY watersheds into logical reporting units.

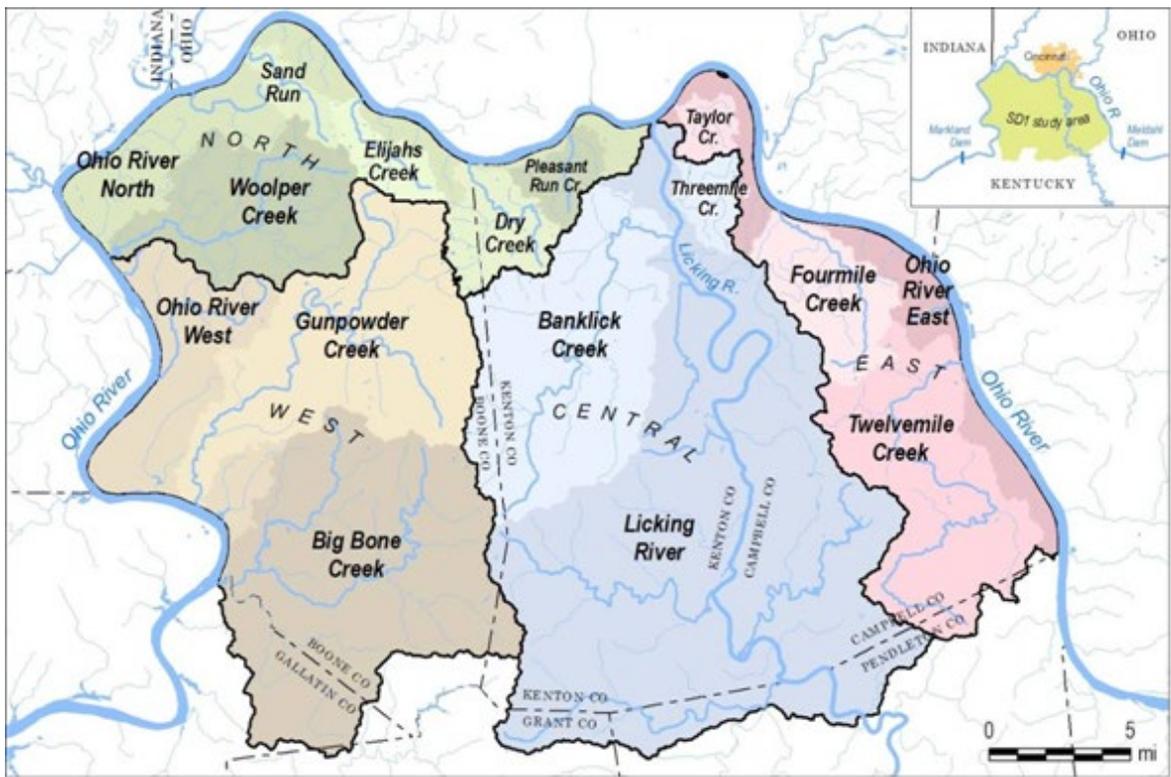


Figure 1. Study Basins and Watersheds

¹ SD1 entered into a Consent Decree with state and federal environmental regulators in 2007.

Background

The watersheds depicted in Figure 1 represent varying conditions with respect to the amount of development, as well as sources of stream pollution. The variation in the stream conditions can range from undeveloped watersheds that have been categorized as “exceptional” waters by the State, while other watersheds are more highly developed and are identified as “impaired” by the State.

As a result of the vast differences between these watersheds, SD1 initiated a comprehensive monitoring program in 2006 to collect instream water quality, biology, physical habitat, and stream stability data to establish current conditions and long-term datasets for model development and trend analysis.

This monitoring program is being implemented in a phased approach which is designed to achieve the following objectives:

- Characterize watershed conditions during baseflow/dry weather and storm flow/wet weather;
- Provide datasets for calibrating detailed watershed and water quality models;
- Provide datasets for assessment tools, such as a Stream Condition Index;
- Meet regulatory requirements for the Nine Minimum Controls as defined within the Long-term Control Plan requirements of the CSO Policy;
- Meet regulatory requirements for the Six Minimum Control Measures as defined within the Storm Water Quality Management Plan requirements of the Phase II MS4 Program;
- Characterize physical stream channel responses from urbanized storm water runoff (i.e., hydromodification);
- Establish a baseline for evaluating improvements from implementing controls; and,
- Respond to regulatory initiatives such as 305(b) assessments, 303(d) listings, TMDLs, etc.

Prior to 2006, limited water quality monitoring and biological assessments had been conducted in the watersheds of Northern Kentucky, thus the monitoring program has evolved over time based on the relative timetable associated with the objectives identified above. SD1 initiated a watershed wide monitoring program in 2006 to establish baseline conditions (base flow and storm flow) and datasets for model development - Period 1 (2006-2011). Period 2 spanned from 2012-2015 which established the basin rotation approach (e.g., 2012 - East Basin; 2013 - Central Basin; 2014 - North Basin; 2015 - West Basin). Period 3 spanned from 2016-2019 and was a continuation of the Period 2 basin rotation approach and established the ambient water quality monitoring approach to focus on spatial and temporal changes within the watersheds. After a temporary suspension of monitoring and assessment activities in 2020, Period 4 (2021-2024) data collection activities are in progress.

This report will focus on the Central Basin watersheds and each of the four monitoring components of SD1’s monitoring program to assess stream condition trends for Periods 2 and 3.

Ambient Water Quality Monitoring

The objective of the ambient monitoring program is to characterize instream water quality under a wide range of environmental conditions in Northern Kentucky streams. By monitoring instream water quality, the condition of watersheds can be assessed along with the impact of land-based activities on the local waterways. Specific or emerging water quality issues may also be identified by monitoring and gathering information on the various waterbodies.



Water Quality Sampling

Although watershed wide water quality monitoring was initiated in 2006, the development of an ambient monitoring program component began in 2015 (i.e., the last year of Period 2). During Period 3, the ambient monitoring was further enhanced to meet program objectives. In 2021 (the beginning of Period 4), additional sites will be added to each watershed’s rotational basin schedule to increase spatial resolution of the monitoring.

Biological Assessments

The objective of the biological assessment program is to characterize the biological diversity and habitat quality in Northern Kentucky streams. By assessing the biological community to determine pollutant tolerant and pollutant intolerant species, the overall integrity of a waterbody can be determined along with both present and past effects of stressors of the biological integrity on the aquatic ecosystem.



Biological Assessment

Watershed wide biological assessments were conducted from 2006 through 2011 (Period 1) in order to record baseline data on the current condition of the streams and to develop subsequent monitoring and assessment strategies. With respect to the Basin Trend Reports, results and analysis of biological assessments began with the Period 2 datasets.

Stream Stability Assessments

The objective of the stream stability assessment program is to characterize the rate of streambed and streambank movement in Northern Kentucky streams. By measuring physical stream channel responses over time, that are primarily attributable to land-use conversion from undeveloped to developed, a stream site can be designated as stable or unstable. The altered flow regime associated with conventional urban development leads to hydromodification – flashier streams, larger flow, excessive stream erosion and overall channel instability. Accelerated bank erosion,



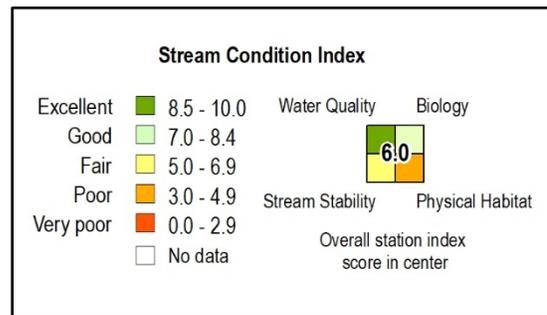
Stream Stability Assessment

channel deepening/widening, and overall enlargement pose risks to adjacent public infrastructure (i.e., sewers, roads and bridges), as well as private property losses. These same actions also cause water quality impairments (i.e., high TSS and sedimentation/siltation) and have adverse effects on aquatic biota, such as fish and macroinvertebrate populations.

Limited stream stability assessments began in 2008 after sampling crews documented significant stream erosion while conducting water quality monitoring and biological assessments. Throughout Periods 1 and 2, additional sites were added to meet program objectives. Beginning in 2019, rapid stream stability assessments were conducted at all biological assessment sites.

Stream Condition Index

To better evaluate, summarize, and communicate the results of the monitoring program, SD1 has utilized data collected from local streams and watersheds to develop a regionally based Stream Condition Index (SCI)². Appropriate indicators of stream condition were researched and selected in four key categories: water quality, biology, physical habitat, and stream stability. A scoring system for each indicator and a method to aggregate indicator scores at each site was established, creating a sub-index score for each of the four categories. At each site, the four sub-index scores are averaged to create a single Stream Condition Index (SCI) score. The SCI scores allow for a general comparison of stream conditions across the Northern Kentucky area.



Stream Condition Index

These types of environmental indices are commonly used by resource managers and scientists to summarize large amounts of complex data but are rarely calibrated to reflect conditions of such a localized area. The local focus of the SCI will allow its use in resource monitoring, potentially diagnosing problem areas, predicting relative resource condition, setting benchmarks for management targets, and (perhaps most importantly) streamlining complex data in terms that can be understood by a non-technical audience.³

The objectives for the SD1’s SCI were to:

- Summarize large amounts of complex data from Northern Kentucky streams;
- Use existing monitoring programs and indices to the extent possible;
- Incorporate and reflect broader conditions beyond water quality;
- Balance scientific rigor with the timely development of an index; and,
- Communicate information on monitoring data to a lay audience.

² A *Stream Condition Index for Water Utility Resource Management in Northern Kentucky*, 2015.

³ A *Manager’s Guide to Indicator Selection*. U.S. EPA, 2006.

Central Basin

The Central Basin study area is located in all three Northern Kentucky counties, but the majority of the area is in Kenton County (Figure 2). This basin includes the lower portion of the Licking River watershed: the mainstem of the Licking River, along with Threemile Creek, Banklick Creek and other smaller tributaries that discharge directly to the Licking River.

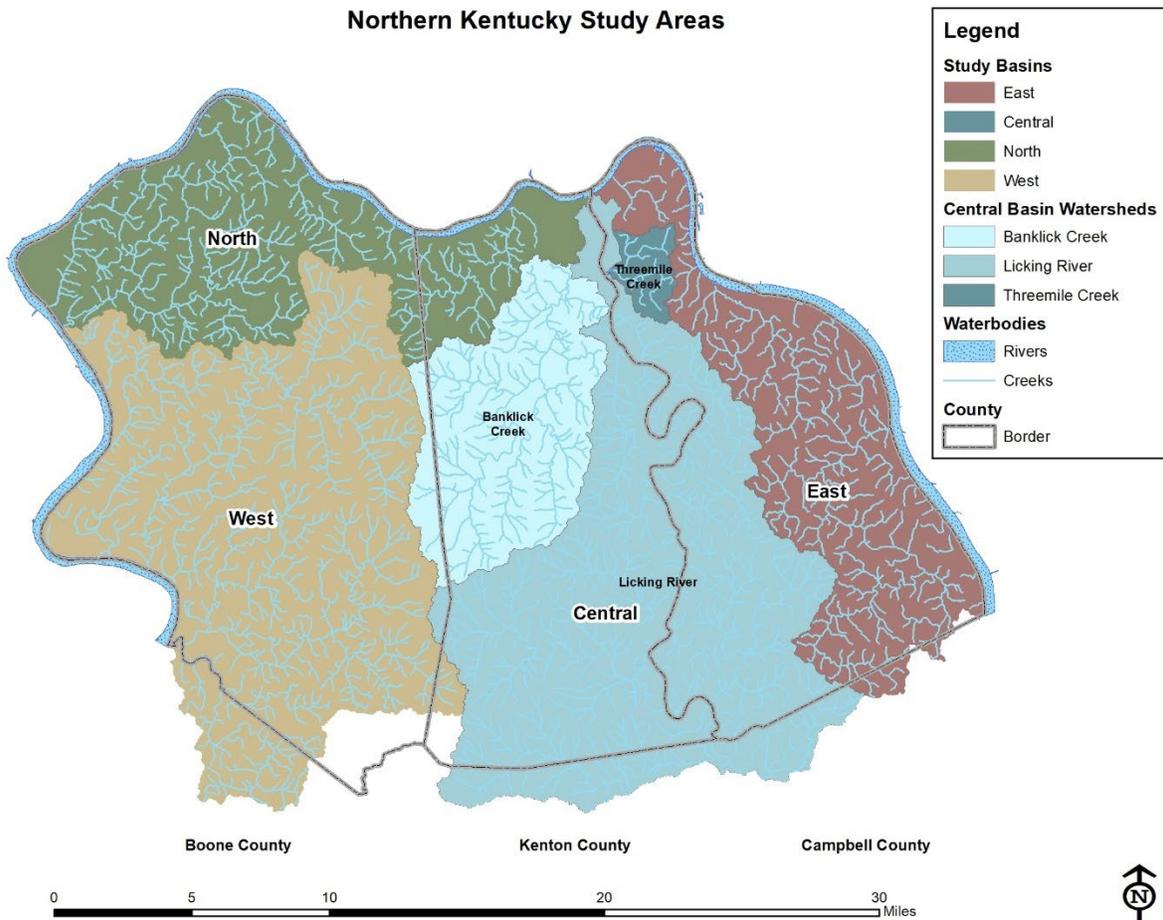


Figure 2. Central Basin Study Area Map

The Basin Trend monitoring and assessment sites within the Central Basin are located in two primary watersheds: Banklick Creek and Threemile Creek. Each watershed has multiple sites located throughout its drainage area, representing varying conditions with respect to the amount of development (i.e., impervious surface), as well as potential sources of stream pollution. Table 1 identifies the individual sites contained in each watershed.

Table 1. Central Basin Site Locations

Banklick Creek	Threemile Creek
BLC3.9	THC0.5-NBT0.8
BPC0.1	THC0.7
BLC8.1	THC1.3
BLC15.6	

Sampling site locations were selected using several criteria including, but not limited to, drainage area, accessibility, stream heterogeneity, adjacent land use, past studies, and available resources.

Land cover and sewer system areas each play an important role in the quantity and quality of runoff into receiving waters. Each watershed overview section includes a series of maps that depict watershed conditions, as follows:

- 1) General watershed characteristics displayed as follows:
 - a. Waterbodies include rivers and creeks that are designated as perennial, intermittent or piped, as well as reservoirs and impoundments, such as lakes and ponds.
 - b. Constructed features include buildings, pavement, such as roads, parking lots, etc., as well as other impervious surfaces.
- 2) National Land Cover Database (NLCD) modified and displayed as follows:
 - a. Initial dataset included agriculture, barren land, developed, forest, grassland, shrubland, water and wetlands categories representing 2019 conditions.
 - b. Modified dataset to Circa 2023 with local GIS and imagery data including parcel information, buildings, pavement surfaces and waterbodies to correct and refine the agriculture, developed, grassland and water land cover categories.
- 3) SD1 service area boundaries and the active sewer overflow locations displayed as follows:
 - a. Storm Water and Wastewater Service Area boundaries depicted as of December 2019.
 - b. Modeled Sewer Overflow Locations⁴ include model predicted sanitary sewer overflows⁵ and combined sewer overflows⁶, based on 2020 sewer system conditions.

⁴ Refer to SD1's Amended Consent Decree, Appendix A, filed 3/17/09.

⁵ Design storm modeling based on a 2-year, 6-hour rainfall event (2.29") for the Eastern Region of KY.

⁶ Typical year modeling based on 1970 rainfall events recorded at the Cincinnati-NKY International Airport.

Banklick Creek

Located mostly in Kenton County, the Banklick Creek watershed originates north of Walton, KY and flows approximately 19.5 miles in a north easterly direction to the Licking River (Figure 3). Brushy Fork, Bullock Pen Creek, Fowler Creek, Holds Branch, Horse Branch, and Wolf Pen Branch are all significant tributaries that contribute drainage to Banklick Creek. The overall watershed provides drainage to many political jurisdictions including the cities of Covington, Crestview Hills, Edgewood, Elsmere, Erlanger, Florence, Fort Mitchell, Fort Wright, Independence, Keton Vale, Lakeside Park, and Taylor Mill, as well as portions of unincorporated Kenton County and Boone County. The Banklick Creek watershed has a drainage area of approximately 58.2 square miles with 13.3% estimated as impervious surface. Monitoring is conducted at three sites on the main-stem of Banklick Creek, as well as one site within the Bullock Pen Creek sub-watershed.

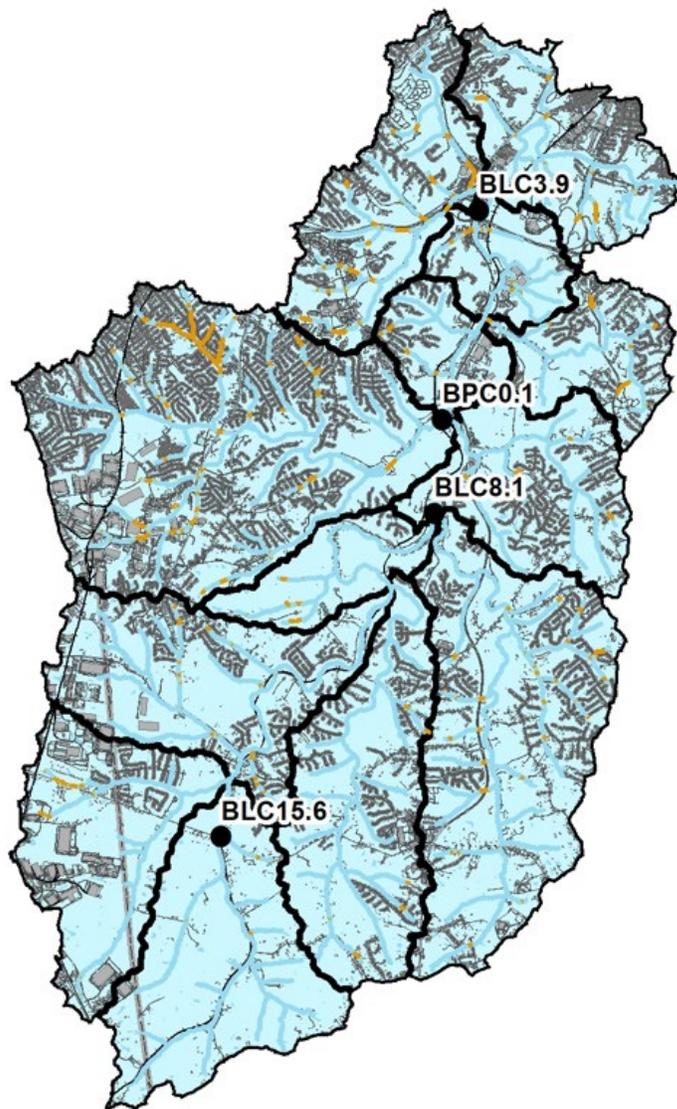


Figure 3. Banklick Creek Watershed

Banklick Creek watershed consists mostly of suburban areas, with some highly urbanized areas in the lower portion of the watershed and some rural areas in the upper portion of the watershed (Figure 4). Land cover consists of predominately developed land (~51%), with lesser amounts of forested land (~32%) and pastureland (~14%). Interstate highway I-275, a significant transportation route, traverses the lower portion of the watershed.

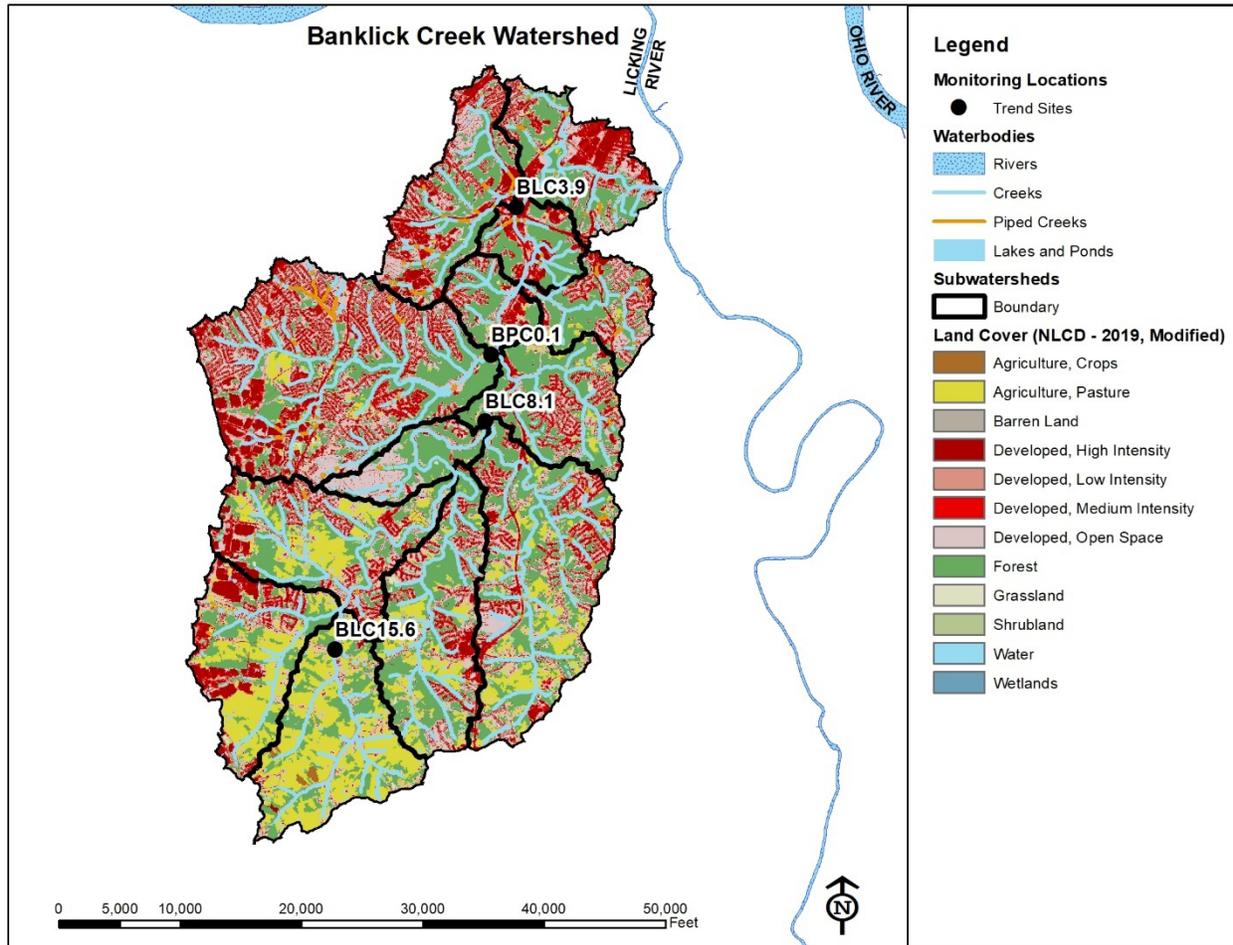


Figure 4. Banklick Creek Land Cover

Areas within the Banklick Creek watershed that are managed by SD1 with respect to centralized sanitary sewers and regional storm water systems, are depicted in Figure 5. Currently within the wastewater system 79 modeled overflow locations, consisting of 75 sanitary sewer overflows (SSOs) and four combined sewer overflows (CSO), discharge during various wet weather conditions. CSO locations occur in the lower portion of the watershed near the Licking River, while the largest number of SSO locations occur in the Bullock Pen sub-watershed. Most of the watershed, except for the headwaters of Banklick Creek, is subject to Kentucky's Phase II MS4 program. The majority of the MS4 program area is encompassed within SD1's storm water service area, representing the NKY Regional Storm Water Program, while area within the city limits of Florence is subject to the city's storm water program. KYTC rights-of-way within the MS4 program area are subject to the Transportation Cabinet's storm water program.

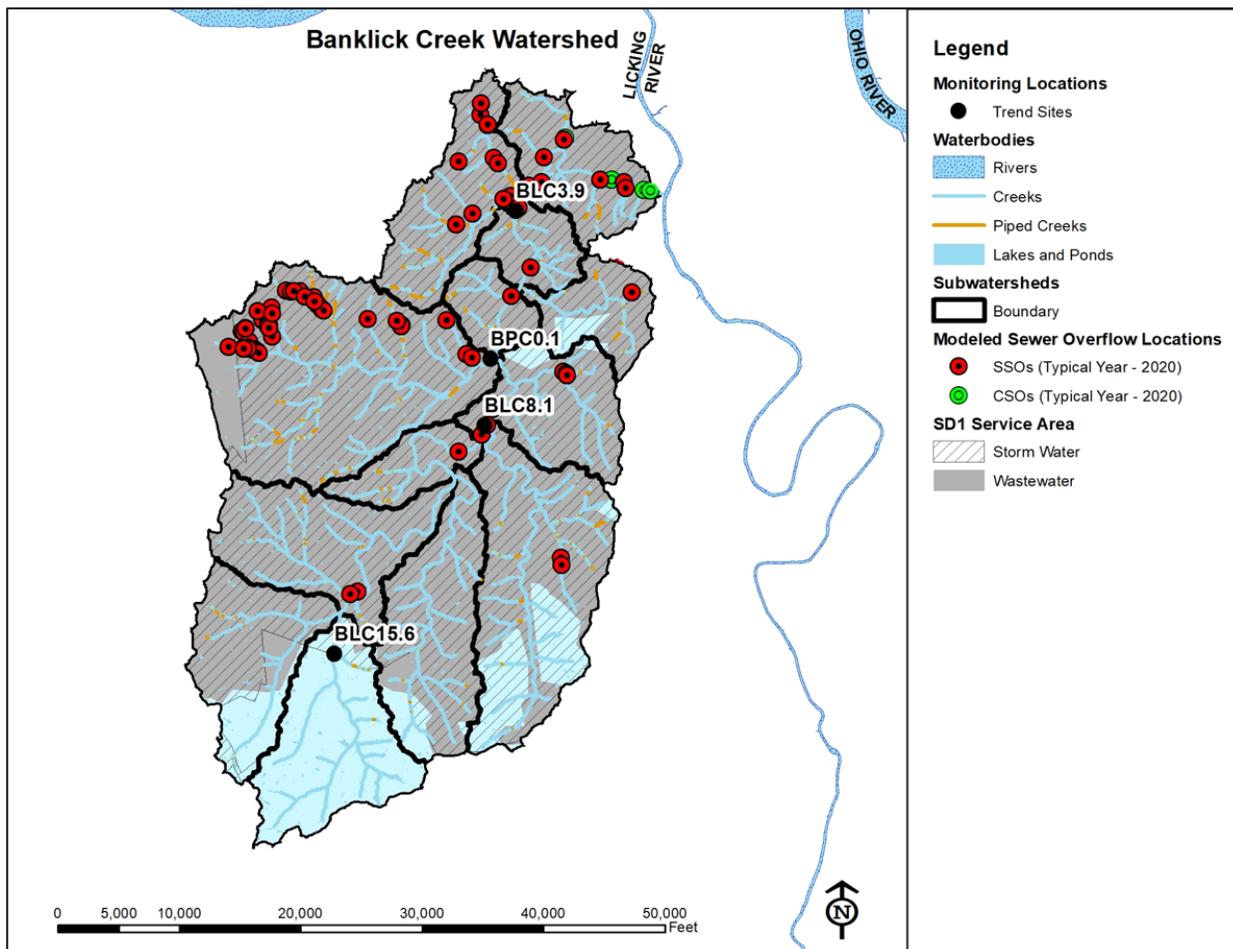


Figure 5. Banklick Creek Modeled Sewer Overflows and Service Areas

Note: The city of Covington withdrew from the Regional Storm Water Program on March 1, 2021, establishing its own storm water program separate from SD1.

Threemile Creek

Located entirely within Campbell County, the Threemile Creek watershed originates in the city of Highland Heights, KY and flows approximately 4.5 miles in a north westerly direction to the Licking River (Figure 6). North Branch Threemile Creek is a significant tributary that contributes drainage to Threemile Creek. The overall watershed provides drainage to many political jurisdictions including the cities of Fort Thomas, Highland Heights, Newport, Southgate, and Wilder, as well as portions of unincorporated Campbell County. The Threemile Creek watershed has a drainage area of approximately 5.9 square miles with 18.4% estimated as impervious surface. Monitoring is conducted at two sites on the main-stem of Threemile Creek, as well as one site within the North Branch Threemile Creek sub-watershed.

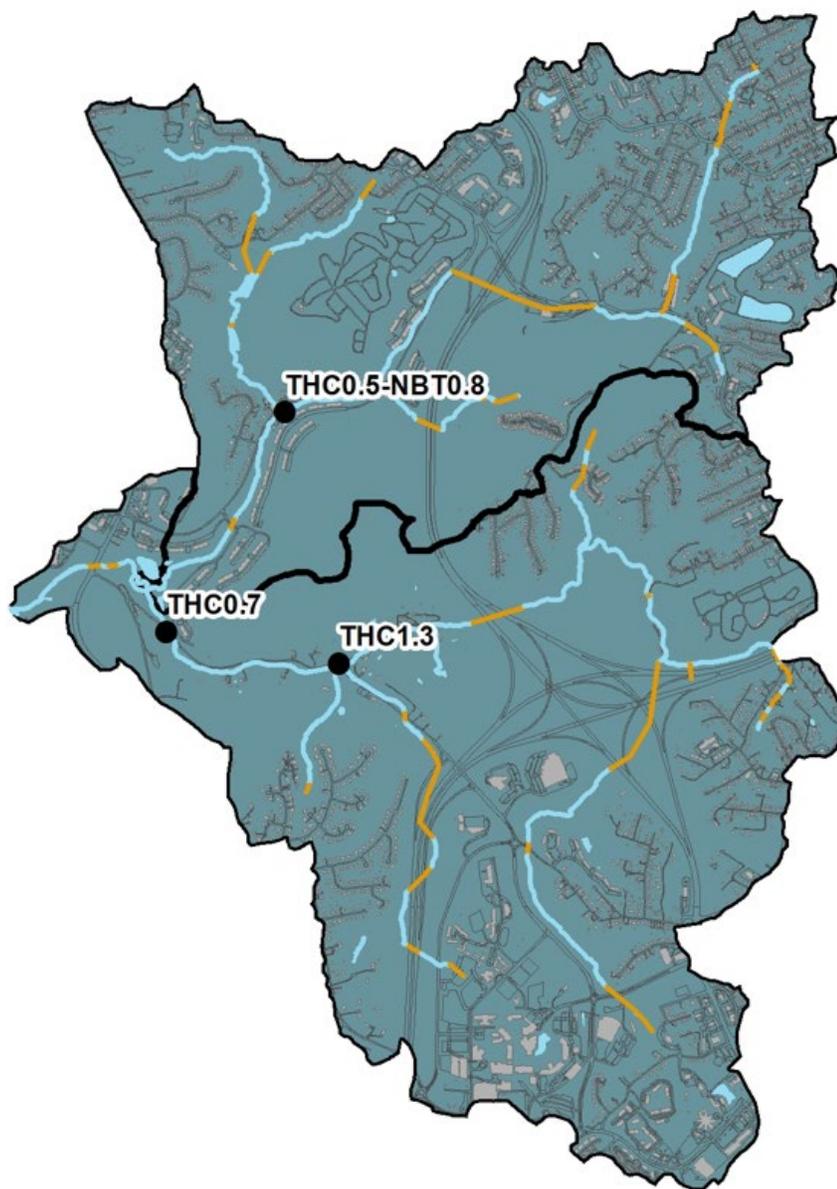


Figure 6. Threemile Creek Watershed

Threemile Creek watershed is highly urbanized and the most developed watershed in the Central Basin (Figure 7). Land cover consists of predominately developed land (~71%), followed by forested land (~26%). Interstate highways I-471 and I-275, significant transportation routes, traverse sizable areas of the watershed.

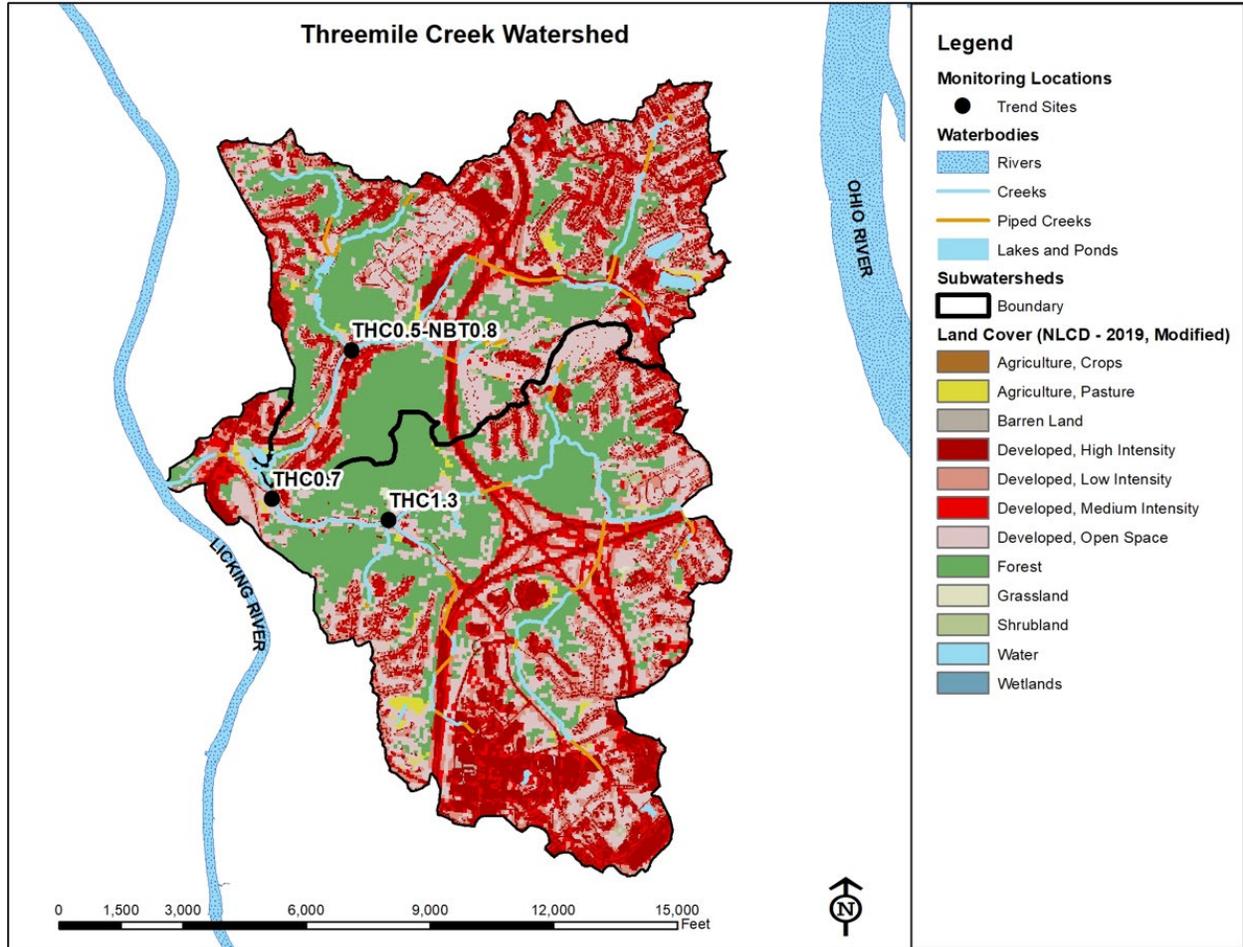


Figure 7. Threemile Creek Land Cover

Areas within the Threemile Creek watershed that are managed by SD1 with respect to centralized sanitary sewers and regional storm water systems, are depicted in Figure 8. Currently within the wastewater system 22 modeled overflow locations, consisting of only sanitary sewer overflows (SSOs), discharge during various wet weather conditions. The overflow locations occur throughout the watershed. The entire watershed is subject to Kentucky's Phase II MS4 program. The majority of the MS4 program area is encompassed within SD1's storm water service area, representing the NKY Regional Storm Water Program, while area within the city limits of Cold Spring is subject to the city's storm water program. KYTC rights-of-way within the MS4 program area are subject to the Transportation Cabinet's storm water program.

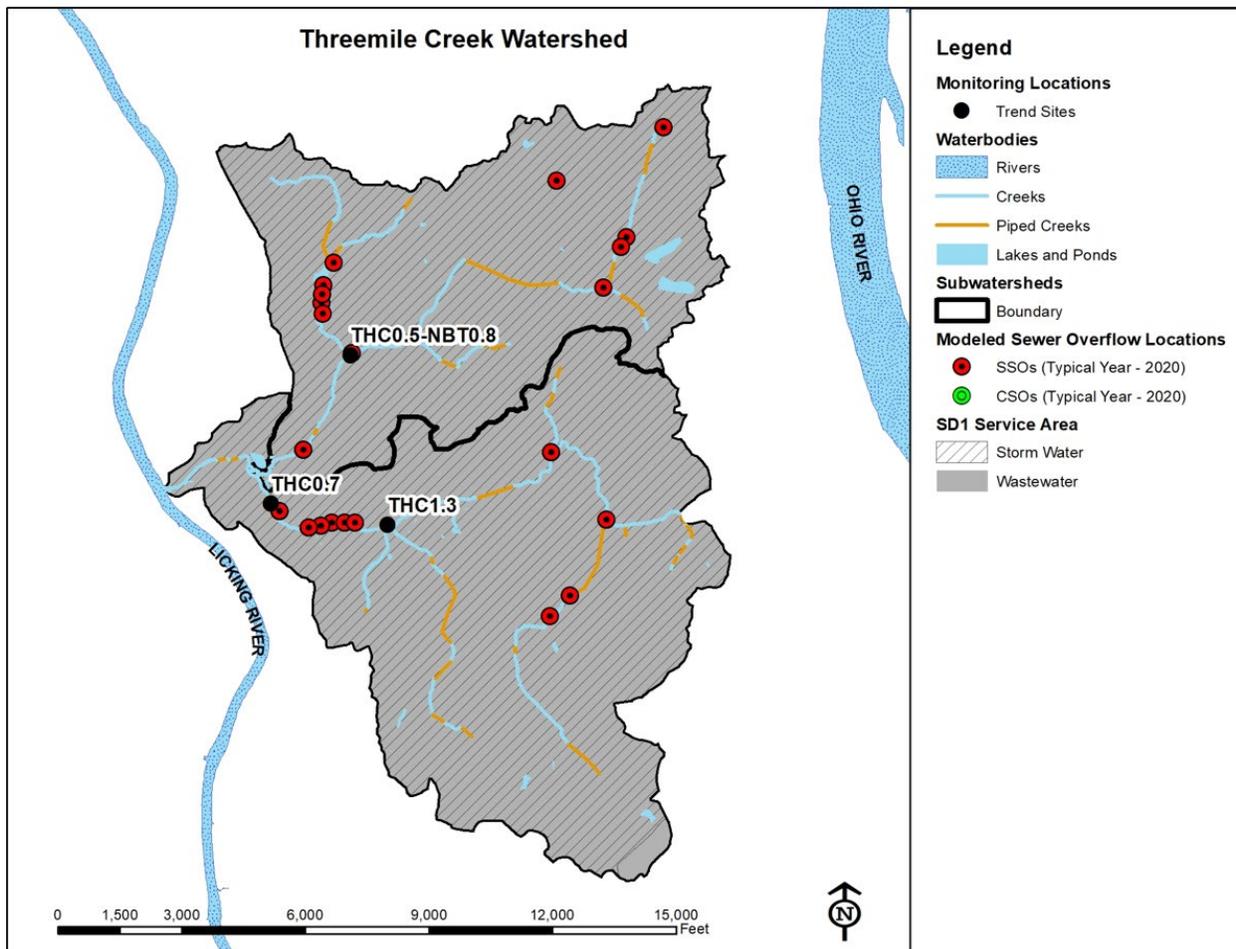


Figure 8. Threemile Creek Modeled Sewer Overflows and Service Areas

Further detailed characteristics of each watershed can be found on the SD1 website, <https://www.sd1.org/233/Watershed-Characterization-Reports>.

Ambient Water Quality Monitoring Results

SD1’s ambient water quality monitoring consists of surface water grab samples collected from March through November on a set schedule (10 – 16 events per year) to “capture” varying flow regimes during the spring, summer and fall seasons. All sampling events were conducted following the appropriate Field Monitoring and Sampling Plan (FMSP) and the associated Quality Assurance Program Plan (QAPP) utilizing approved sampling protocols⁷. The FMSP and QAPP were designed to ensure that all monitoring activities undertaken result in representative data necessary to support the characterization of the watershed being sampled. Samples collected were analyzed in a laboratory for bacteria (*Escherichia coli* - *E. coli*), solids (total suspended solids - TSS), and nutrients (total phosphorus - TP and total nitrogen - TN) per the associated QAPP following approved analytical protocols⁸.

- Bacteria are utilized as pathogen indicators and can range widely based on failing or undersized infrastructure and host source (e.g., human, livestock, pets, wildlife).
- TSS can rise significantly during and immediately after rainfall events due to land surface erosion and/or streambank erosion caused by runoff.
- Background phosphorus is typically higher in NKY area watersheds, primarily due to creek beds composed of limestone bedrock, however excess values are often attributed to point source and nonpoint source pollution.
- Nitrogen is found naturally in the environment; however excess values are often attributed to point source and nonpoint source pollution.

Ambient results for each site were compiled by parameter and represented in Box-and-Whisker plots. The whiskers for each plot represent the minimum and maximum values, while the box represents the 25th and 75th percentile range of the data. The “heavy” short black line represents the median value of the data. These plots are used to compare time periods within the watershed by site for each parameter. Additionally, either the water quality criteria or benchmark values are also shown in the figures. The water quality standard was derived from Section 401 of the Kentucky Administrative Regulations *401 KAR 10:031. Surface water standards*. The benchmarks were developed by Kentucky Division of Water as a guideline since there are no current standards developed for those parameters yet.

Table 2. Water Quality Criteria Type

Parameter	Water Quality Criteria Type	Value	Units	Applies
<i>E. coli</i>	KDOW Standard - Max	240	mpn/100 mL	May-Oct
TSS	KDOW Benchmark	7.25	mg/L	Apr-Oct
TP	KDOW Benchmark	0.08	mg/L	Jan-Dec
TN	KDOW Benchmark	0.6	mg/L	Jan-Dec

Refer to Appendix A for results from individual sites within the Central Basin study area.

⁷EPA Guidance for Quality Assurance Project Plans, 2002.

⁸ Standard Methods for the Examination of Water and Wastewater, 2017.

Banklick Creek

The Banklick Creek watershed monitoring site BLC 8.1 was sampled during Period 2 and all four years of Period 3. Monitoring sites BLC3.9, BPC0.1, and BLC15.6 were added to the ambient monitoring program in 2021, with all four sites scheduled for sampling during Period 4 per the basin rotation cycle.

Table 3. Banklick Creek Number of Samples Collected

Banklick Creek	Period 2 No. of Samples	Period 3 No. of Samples			
Site	2015	2016	2017	2018	2019
BLC3.9	NS	NS	NS	NS	NS
BPC0.1	NS	NS	NS	NS	NS
BLC8.1	10	16	13	12	12
BLC15.6	NS	NS	NS	NS	NS

Columns displaying “NS” do not currently have results available but will in subsequent years (i.e., Period 4).



Photo 1. Banklick Creek 3.9



Photo 2. Bullock Pen Creek 0.1



Photo 3. Banklick Creek 15.6

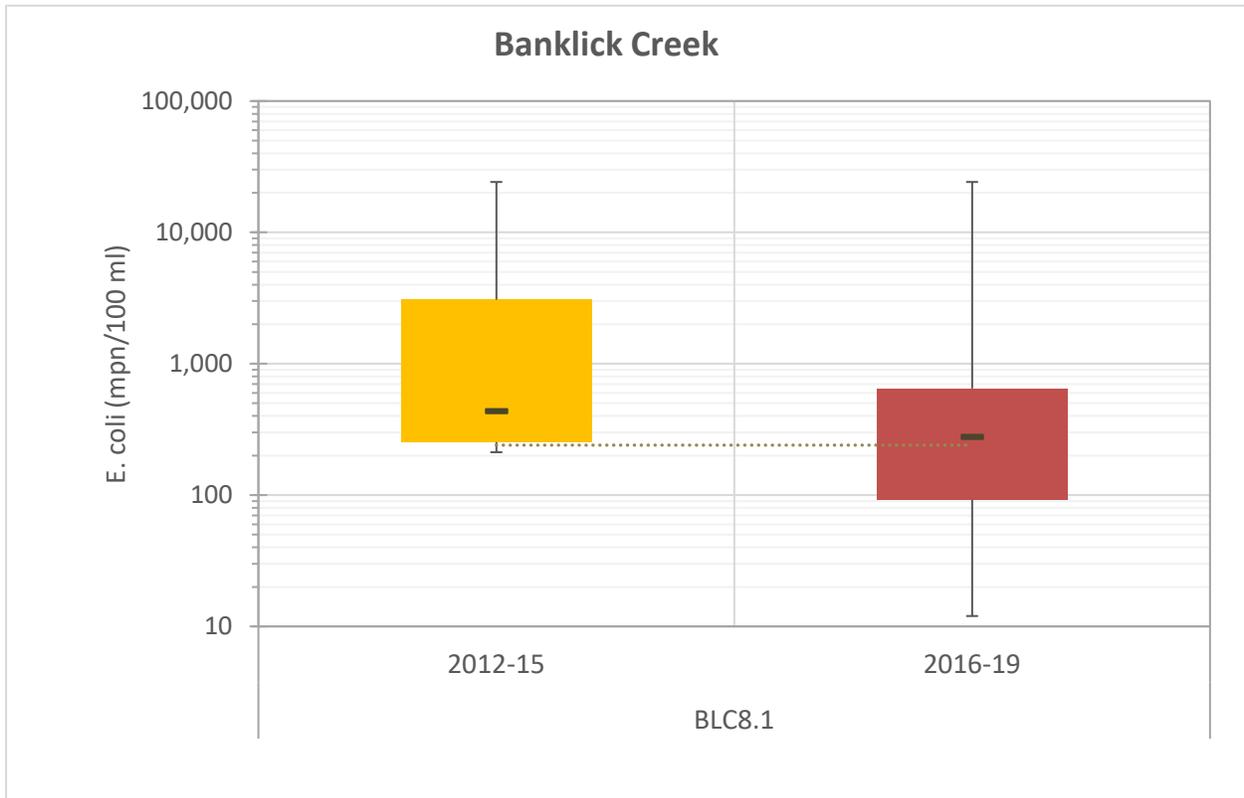
Banklick Creek *E. coli*

E. coli values ranged from 212 mpn/100ml to 24,200 mpn/100ml during Period 2 and ranged from 12 mpn/100ml to 24,200 mpn/100ml during Period 3 at BLC8.1. The median values during both periods were above the 240 mpn/100ml criteria, 434 and 276 mpn/100ml.

The median bacteria value for each reporting period was lowest within the Banklick Creek watershed when compared to the other Central Basin watershed. Suspected sources of elevated *E. coli* values within Banklick Creek watershed primarily includes sewer overflows, failing septic systems and storm water runoff.



Photo 4. Banklick Creek 8.1



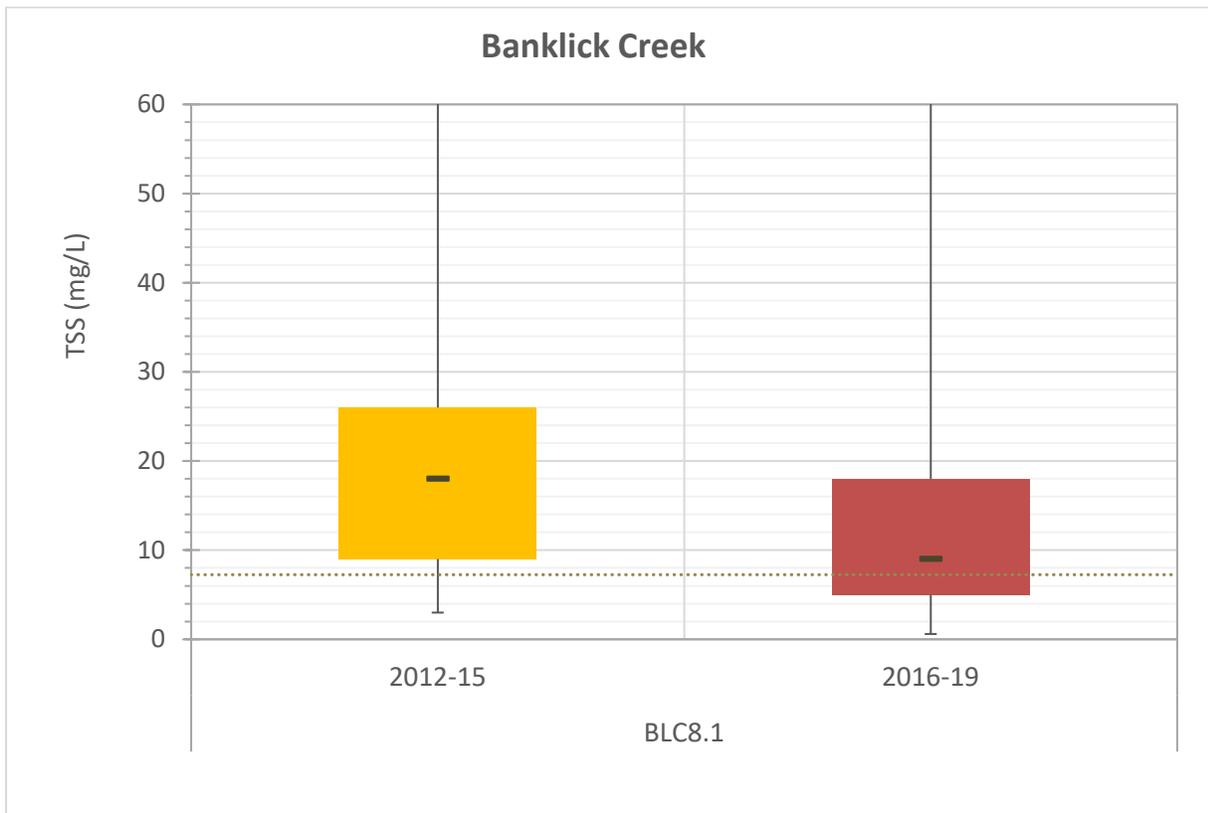
Note: The dashed line in the graph represents the single sample maximum criteria of 240 mpn/100ml.

Figure 9. Banklick Creek *E. coli* Results

Banklick Creek Total Suspended Solids

TSS values ranged from 3 mg/L to 143 mg/L during Period 2 and ranged from <1.2 mg/L to 620 mg/L during Period 3 at BLC8.1. The median values during both periods were above the 7.25 mg/L benchmark, 18 mg/L and 9 mg/L.

The median TSS value for each reporting period was the highest within the Banklick Creek watershed when compared to the other Central basin watershed. Suspected sources of elevated TSS values within the Banklick Creek watershed primarily includes storm water runoff and streambank erosion due to hydromodification.



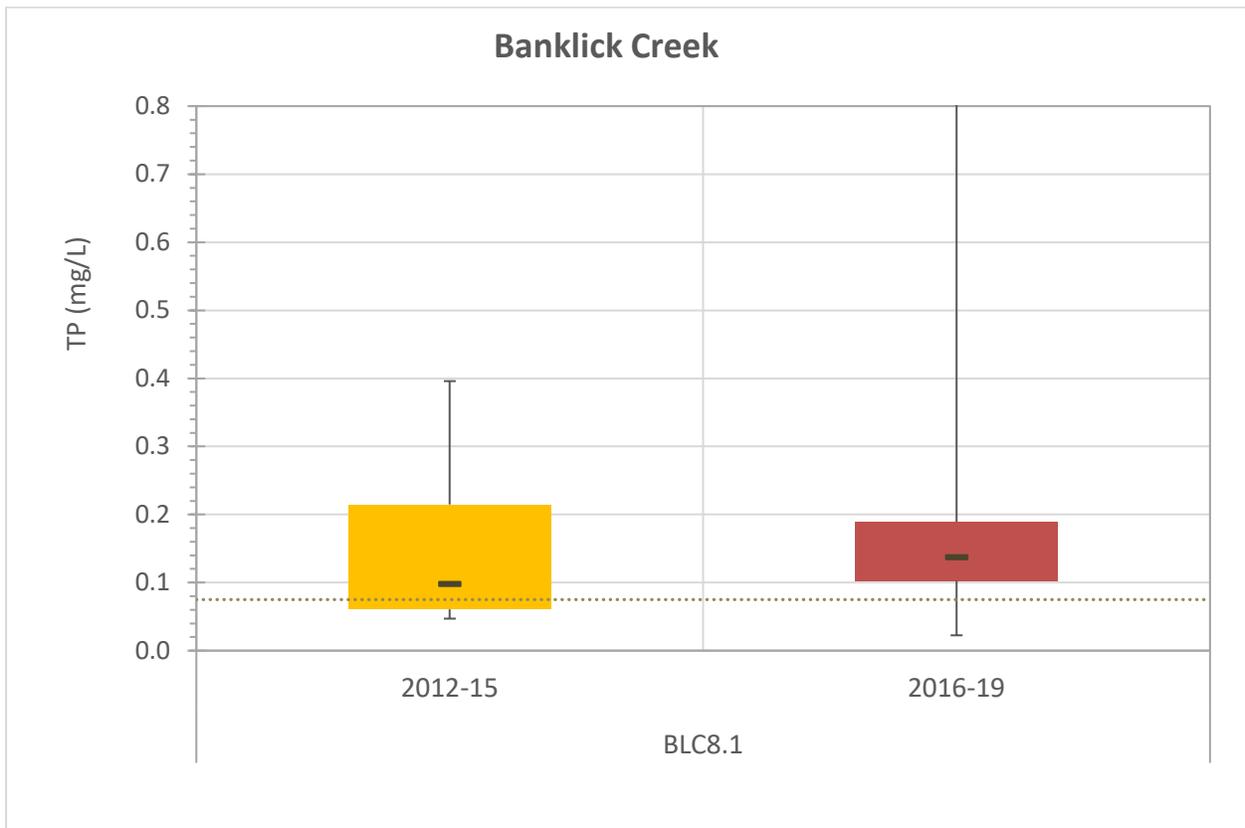
Note: The dashed line in the graph represents the benchmark value established by KDOW of 7.25 mg/L.

Figure 10. Banklick Creek TSS Results

Banklick Creek Total Phosphorous

TP values ranged from 0.047 mg/L to 0.396 mg/L during Period 2 and ranged from <0.045 mg/L to 1.620 mg/L during Period 3 at BLC8.1. The median values during both periods were above the 0.08 mg/L benchmark, 0.098 mg/L and 0.137 mg/L.

The median TP value for each reporting period was highest within the Banklick Creek watershed when compared to the other Central Basin watershed. Suspected sources of elevated phosphorus values within the Banklick Creek watershed primarily includes sewer overflows and storm water runoff.



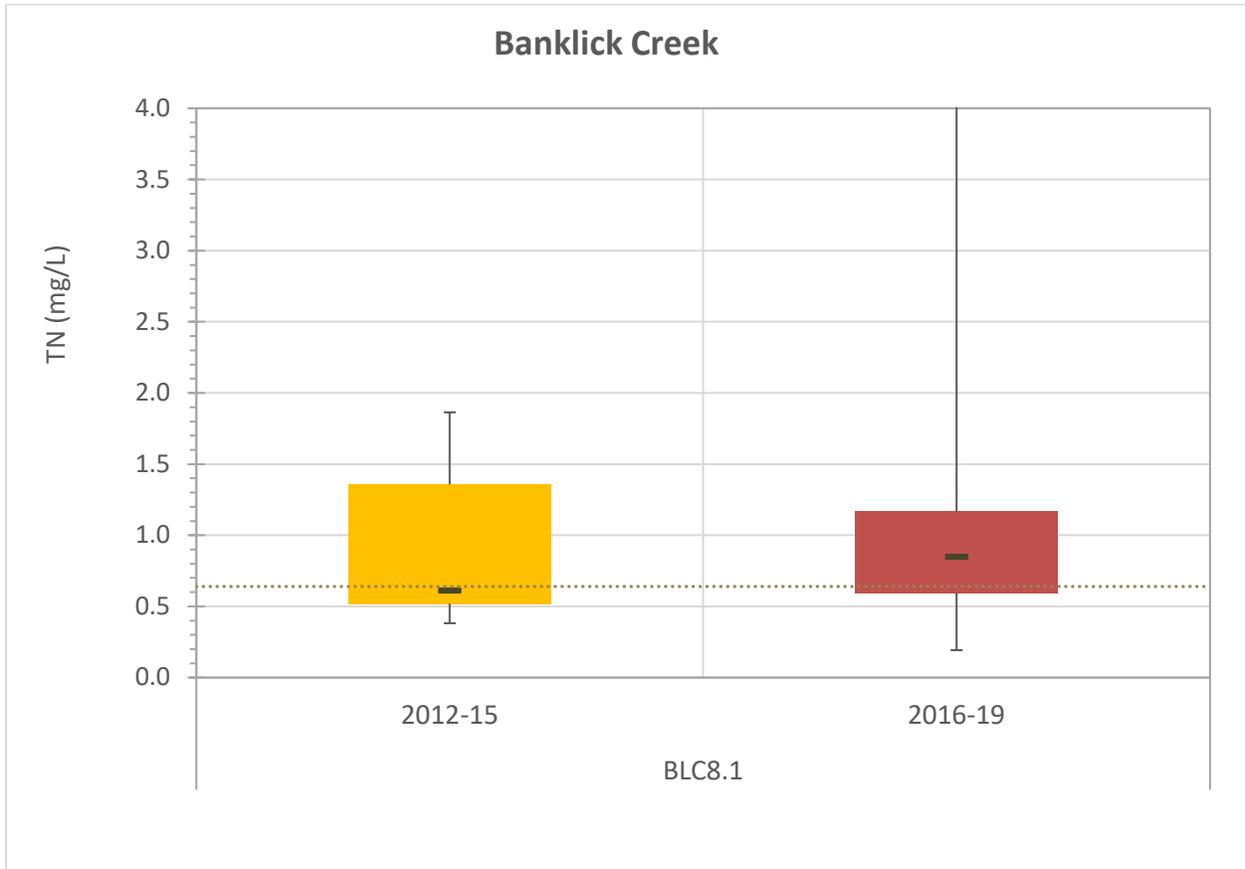
Note: The dashed line in the graph represents the benchmark value established by KDOW of 0.08 mg/L.

Figure 11. Banklick Creek TP Results

Banklick Creek Total Nitrogen

TN values ranged from 0.38 mg/L to 1.86 mg/L during Period 2 and 0.19 mg/L to 12.21 mg/L during Period 3 at BLC8.1. The median values during both periods were above the 0.6 mg/L benchmark, 0.61 mg/L and 0.85 mg/L.

The median TN value for each reporting period was highest within the Banklick Creek watershed when compared to the other watershed in the Central Basin. Suspected sources of excess nitrogen values within Banklick Creek watershed primarily include storm water runoff.



Note: The dashed line in the graph represents the benchmark value established by KDOW of 0.6 mg/L.

Figure 12. Banklick Creek TN Results

Threemile Creek

The Threemile Creek watershed monitoring site THC0.7 was sampled during Period 2 all four years of Period 3. Monitoring sites THC0.5-NBT0.8 and THC1.3 were added to the ambient monitoring program in 2021, with all three sites scheduled for sampling during Period 4 per the basin rotation cycle.

Table 4. Threemile Creek Number of Samples Collected

Threemile Creek Site	Period 2	Period 3			
	No. of Samples	No. of Samples			
	2015	2016	2017	2018	2019
THC0.5-NBT0.8	NS	NS	NS	NS	NS
THC0.7	10	16	13	12	12
THC1.3	NS	NS	NS	NS	NS

Columns displaying “NS” do not currently have results available but will in subsequent years (i.e., Period 4).



Photo 5. Threemile Creek 1.3



Photo 6. North Branch of Threemile Creek 0.8

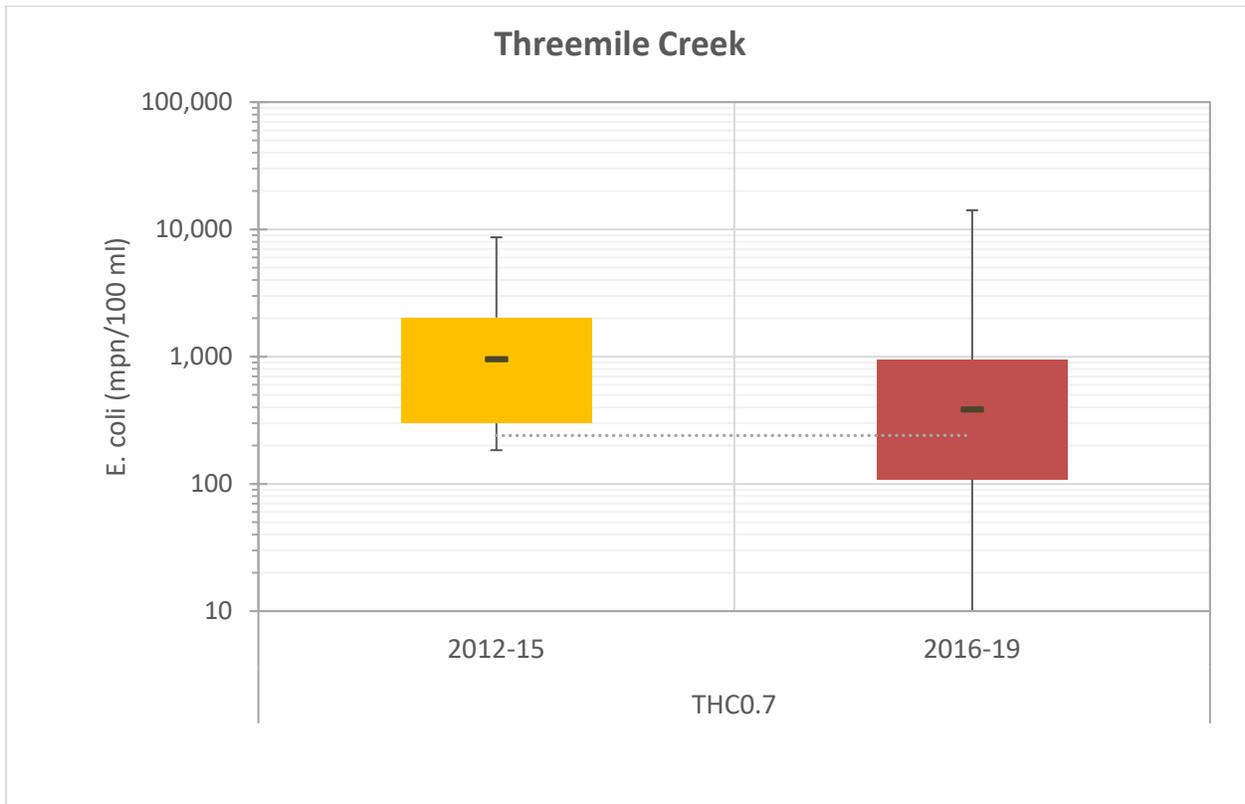
Threemile Creek *E. coli*

E. coli values ranged from 184 mpn/100ml to 8,660 mpn/100ml during Period 2 and ranged from 8 mpn/100ml to 14,140 mpn/100ml during Period 3 at THC0.7. The median values during both periods were above the 240 mpn/100ml criteria, 954 mpn/100 ml and 384 mpn/100ml.

The median bacteria value for each reporting period was highest within the Threemile Creek watershed when compared to the other watershed within the Central Basin. Suspected sources of elevated *E. coli* values within the Threemile Creek watershed primarily includes sewer overflows and storm water runoff.



Photo 7. Threemile Creek 0.7



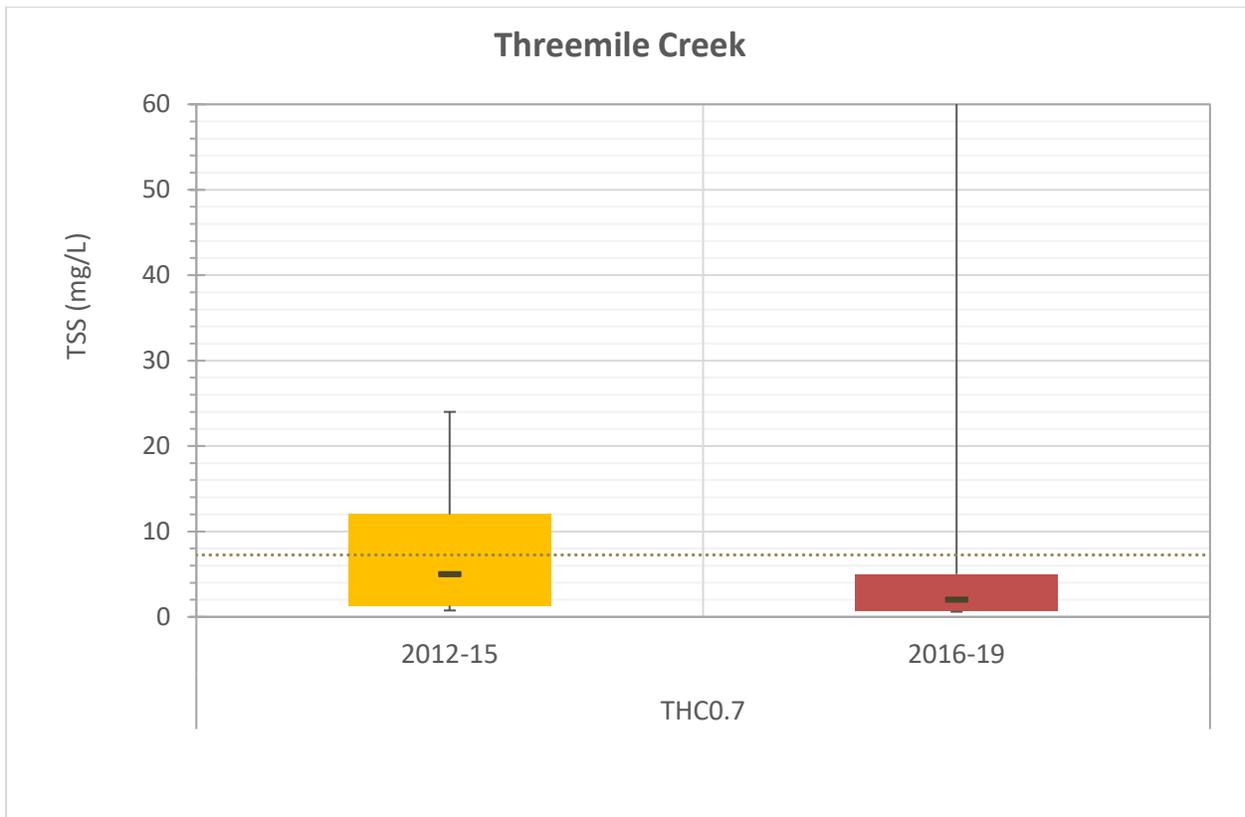
Note: The dashed line in the graph represents the single sample maximum criteria of 240 mpn/100ml.

Figure 13. Threemile Creek *E. coli* Results

Threemile Creek Total Suspended Solids

TSS values ranged from <1.5 mg/L to 24 mg/L during Period 2 and ranged from <1.2 mg/L to 176 mg/L during Period 3 at THC0.7. The median values during both periods were below the 7.25 mg/L benchmark, 5 mg/L and 2 mg/L.

The median TSS value for each reporting period was lowest within the Threemile Creek watershed when compared to the other watershed in the Central Basin. Suspected sources of elevated TSS values within Threemile Creek watershed primarily includes storm water runoff and streambank erosion due to hydromodification.



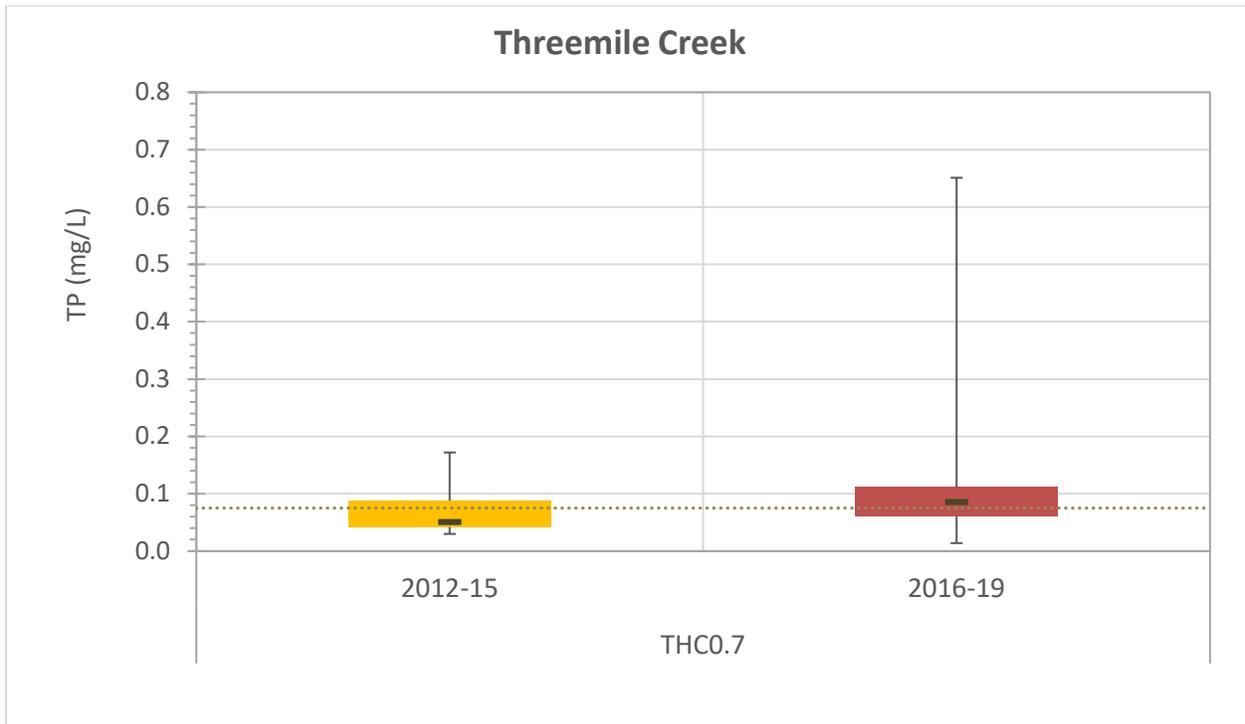
Note: The dashed line in the graph represents the benchmark value established by KDOW of 7.25 mg/L.

Figure 14. Threemile Creek TSS Results

Threemile Creek Total Phosphorous

TP values ranged from 0.030 mg/L to 0.172 mg/L during Period 2 and ranged from <0.045 mg/L to 0.651 mg/L during Period 3 at THC0.7. The median value during Period 2 was below the benchmark (0.05 mg/l) and the median value was above the benchmark during Period 3 (0.085 mg/l).

The median phosphorus value for each reporting period was lowest within the Threemile Creek watershed when compared to the other watershed in the Central Basin. The suspected sources of elevated phosphorus values within Threemile Creek watershed primarily includes sewer overflows and storm water runoff.



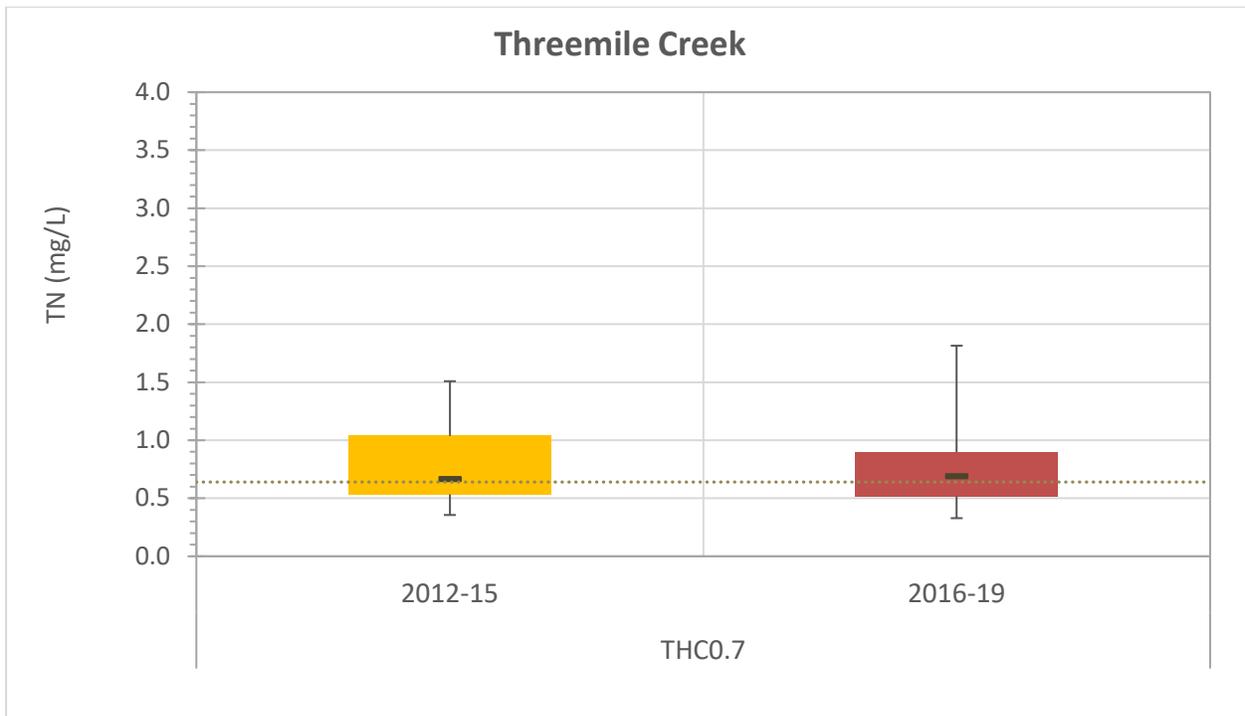
Note: The dashed line in the graph represents the benchmark value established by KDOW of 0.08 mg/L.

Figure 15. Threemile Creek TP Results

Threemile Creek Total Nitrogen

TN values ranged from 0.36 mg/L to 1.51 mg/L during Period 2 and 0.33 mg/L to 1.82 mg/L during Period 3 at THC0.7. The median values during both periods were above the 0.6 mg/L benchmark, 0.67 mg/L and 0.69 mg/L.

The median nitrogen value for each reporting period was lowest within the Threemile Creek watershed when compared to the other watershed in the Central Basin. The suspected sources of excess nitrogen values within Threemile Creek watershed primarily include storm water runoff.



Note: The dashed line in the graph represents the benchmark value established by KDOW of 0.6 mg/L.

Figure 16. Threemile Creek TN Results

Biological Assessment Results

SD1's biological assessments consist of macroinvertebrate specimen collection and habitat characterization conducted at multiple sites in each watershed. During the Period 2 basin rotation, Central Basin sites were collected in 2013; during Period 3 basin rotation, Central Basin sites were collected in 2017. All assessments were conducted following the appropriate Field Monitoring and Sampling Plan (FMSP) and the associated Quality Assurance Program Plan (QAPP) utilizing approved bioassessment protocols⁹.

Macroinvertebrate specimen samples were analyzed using the Kentucky Division of Water Macroinvertebrate Biologic Index (MBI), as well as statistical analyses that examine community structure. The MBI is a multi-metric index that uses various attributes to assign a score (0-100, scaled temporally and spatially) and a rating (Excellent, Good, Fair, Poor, Very Poor) to a given stream reach, with higher scores corresponding to higher quality streams. Key metrics that affect overall index scores (refer to Appendix B1 for additional details) are as follows:

- Abundance of genera (i.e., taxa richness) - increasing total number of genera generally indicates improving water quality and habitat conditions (see example photos below).



Photo 8. Hellgrammite Larvae (Megaloptera)



Photo 9. Crane Fly Larvae (Diptera)

- Abundance of pollution sensitive organisms (specifically insect orders of Ephemeroptera, Plecoptera and Trichoptera) - increasing total pollutant sensitive organisms generally indicate improving water quality and habitat conditions (see example photos below).



Photo 10. Mayfly Nymph (Ephemeroptera)



Photo 11. Stonefly (Plecoptera)

⁹ Kentucky Division of Water/U.S. Environmental Protection Agency criteria (Barbour et al. 1999, KDOW 2001)

- Abundance of pollution tolerant organisms - increasing total pollutant tolerant organisms generally indicate declining water quality conditions (see example photos below).

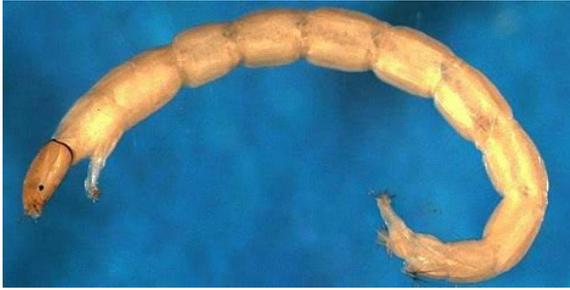


Photo 12. Chironomid Larvae (Chironomidae)¹⁰



Photo 13. Aquatic Worm (Oligochaete)

Habitat assessments were determined using Rapid Bioassessment Protocols (RBP). This protocol evaluates instream metrics – such as embeddedness, and velocity, as well as the surrounding riparian buffer metrics – such as bank stability, vegetative protection, and channel alteration. In combination, these metrics give an overall evaluation of the stream reach. In total there are ten metrics that are evaluated (refer to Appendix B2 for additional details). Each metric is assigned a score (0-20) by the field crew for each site. A final score is calculated, and a rating (Good, Fair, Poor) is given to the stream reach, with higher scores corresponding to higher quality streams.

Habitat and macroinvertebrate data were collected at sampling sites as defined in the FMSP. Sites were separated into two types and categorized as either headwater or wadeable. Headwater sites have 5 miles² or less drainage area, while wadeable sites have greater than 5 miles² of drainage area.

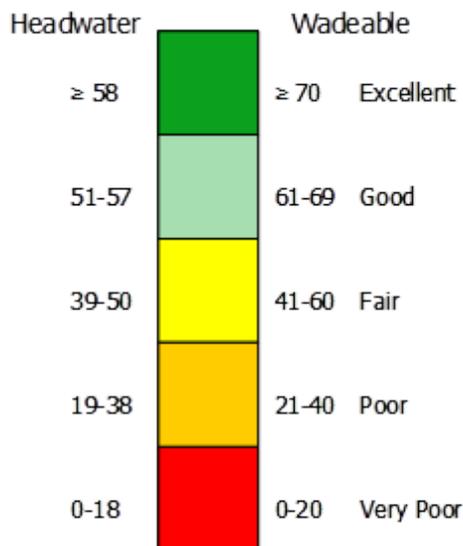


Figure 17. MBI Ratings

Table 5. RBP Ratings

Headwater		Wadeable	
Good	>156	Good	>130
Fair	142-155	Fair	114-129
Poor	<141	Poor	<113

Refer to Appendices B1 and B2 for results from individual sites within the Central Basin study area.

¹⁰ Photo taken from the North Carolina Department of Environmental Quality website.

Banklick Creek

Banklick Creek streams within the watershed are typically moderate gradient to very flat water as the mainstem of Banklick reaches the confluence with the Licking River, creating backwater effects up to approximately river mile 3.8. The streambeds consist of mainly bolder/bedrock substrate. Riparian zone habitat varies throughout the stream length, dependent on the surrounding land use. The current state of development has resulted in a watershed total impervious surface area of 13.3%. Assessments were performed at all four monitoring sites during Period 2 and Period 3.

Table 6. Banklick Creek MBI Scores

Banklick Creek	Site Type	Period 2 MBI Scores	Period 3 MBI Scores
Site	Category	2013	2017
BLC3.9	Wadeable	58.90 (Fair)	50.76 (Fair)
BPC0.1	Wadeable	56.00 (Fair)	53.35 (Fair)
BLC8.1	Wadeable	54.70 (Fair)	50.75 (Fair)
BLC15.6	Headwater	33.80 (Poor)	33.93 (Poor)

The Banklick Creek MBI scores ranged from fair to poor at all four sites. MBI scores for site BLC15.6 remained consistent, while scores for sites BLC3.9, BLC8.1, and BPC0.1 decreased from 2013 to 2017. This was primarily due to an increase in the percentage of pollutant tolerant organisms as well as a decrease in pollutant sensitive organisms.

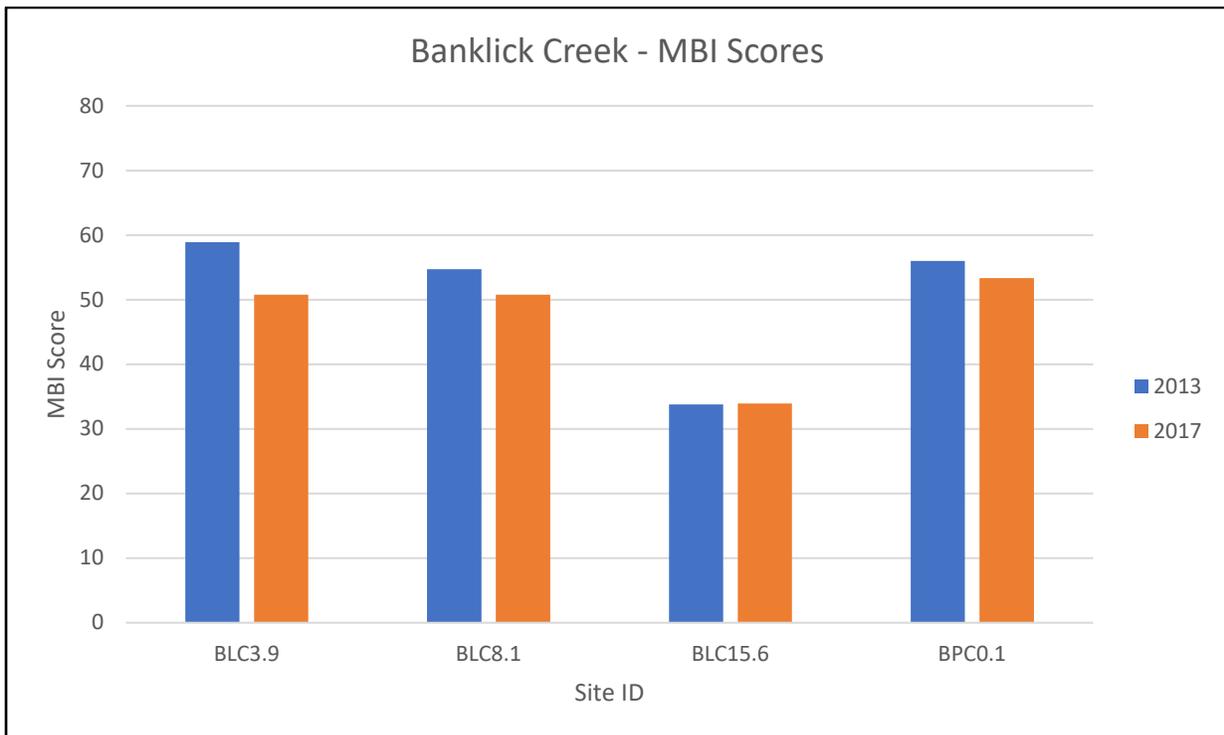


Figure 18. Banklick Creek MBI Scores

Table 7. Banklick Creek RBP Scores

Banklick Creek	Site Type	Period 2 RBP Scores	Period 3 RBP Scores
Site	Category	2013	2017
BLC3.9	Wadeable	74 (Poor)	94 (Poor)
BPC0.1	Wadeable	107 (Poor)	121 (Fair)
BLC8.1	Wadeable	86 (Poor)	101 (Poor)
BLC15.6	Headwater	117 (Poor)	125 (Poor)

The Banklick Creek habitat scores ranged from poor to fair at all four sites. Overall, each site’s habitat score increased, although all remained poor, except site BPC0.1 which improved to fair. Site BLC3.9 increased by 20 points, due to increases in embeddedness and bank and riparian vegetation metrics. Each site had an increase in bank stabilization and vegetation as well as sediment deposition (i.e., less fines present). However, three out of four sites recorded a decrease in frequency of riffles, while site BLC8.1 recorded an increase.

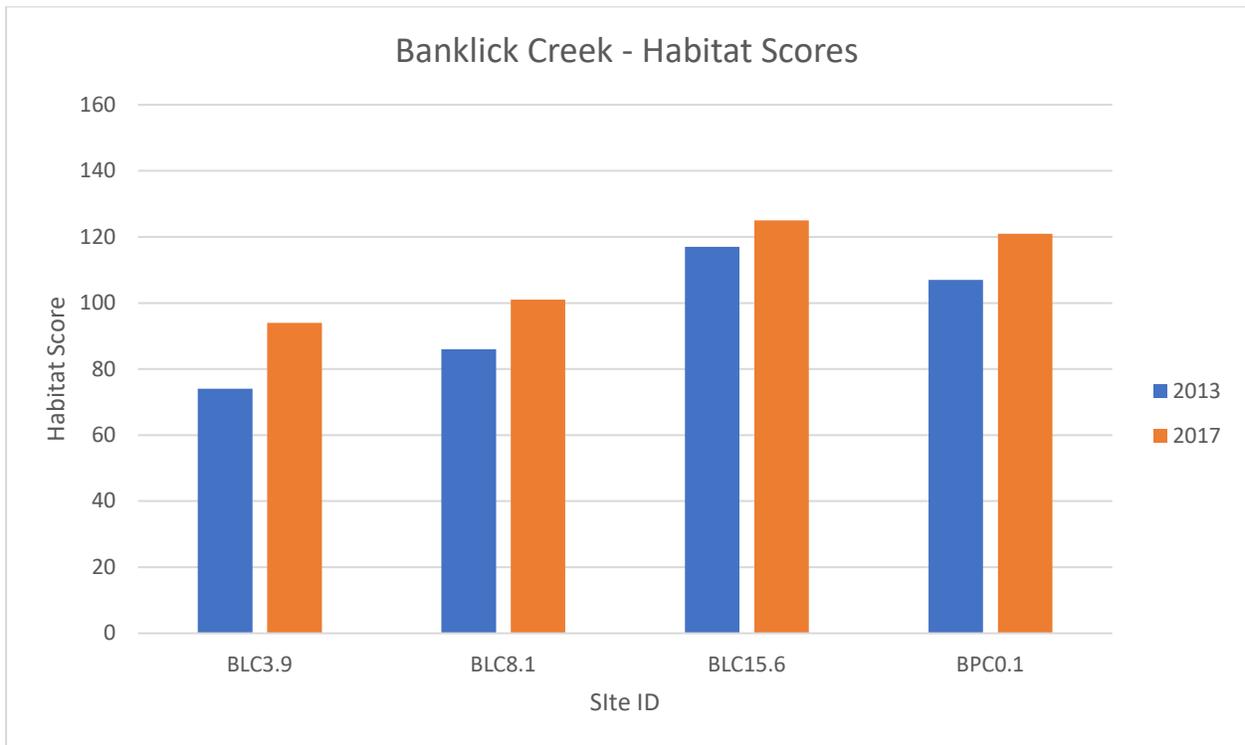


Figure 19. Banklick Creek Habitat Scores

Threemile Creek

Threemile Creek streams are typically moderately steep gradient, with streambeds that vary between cobble/gravel to bedrock and sand substrates. Riparian zone habitat is narrow throughout much of the watershed, leading to highly erodible banks and increased sediment deposition. The current state of development has resulted in a watershed total impervious surface area of 18.4%. Assessments were performed at two of the three monitoring sites during Period 2 (THC0.8 was established to replace a previous site which was discontinued due to Licking River backwater influence) and all three sites during Period 3.

Table 8. Threemile Creek MBI Scores

Threemile Creek	Site Type	Period 2 MBI Scores	Period 3 MBI Scores
Site	Category	2013	2017
THC0.5-NBT0.8	Headwater	30.4 (Poor)	39.92 (Fair)
THC0.8*	Headwater	NA	36.85 (Poor)
THC1.3	Headwater	37 (Poor)	29.88 (Poor)

Columns displaying “NA” were not assessed during the monitoring period.

*Site THC0.8 was established in 2017, however assessments occurred in 2018.

The Threemile Creek MBI scores were rated as poor or fair at all sites. The overall score at site THC0.5-NBT0.8 increased from 2013 to 2017, due to increases in pollutant sensitive organism metrics. The MBI score for site THC1.3 decreased from 2013 to 2017, due to a reduction in taxa richness and percentage increase in pollutant tolerant organisms.

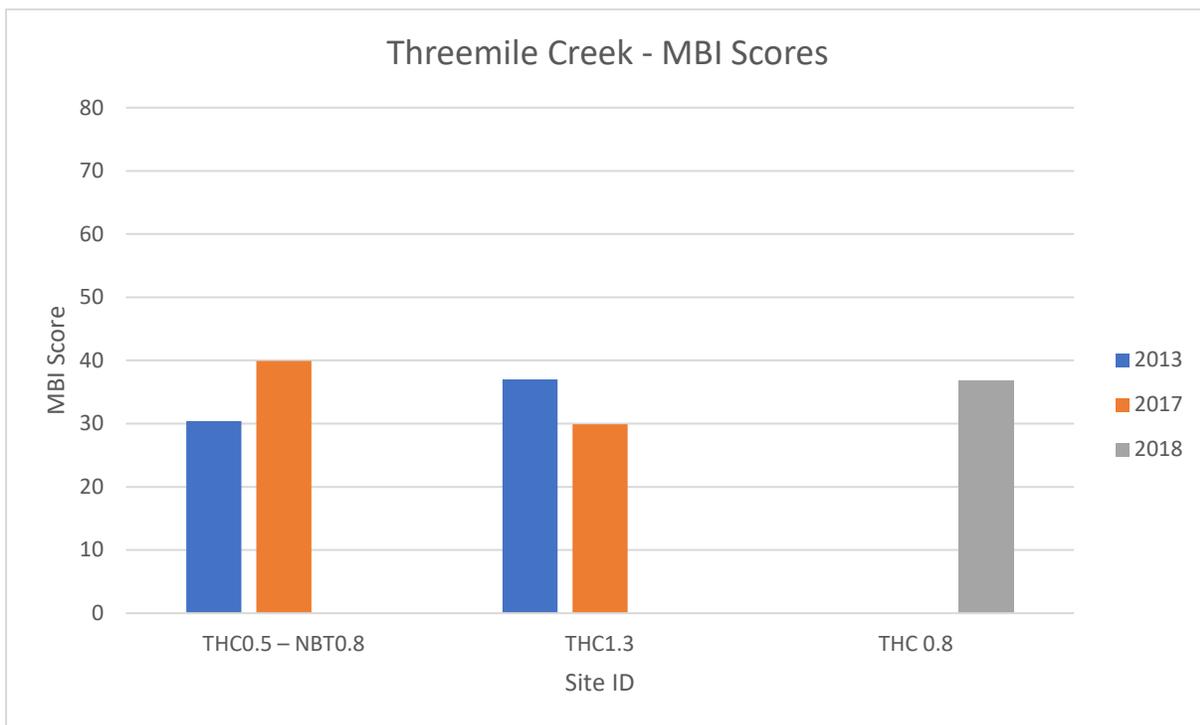


Figure 20. Threemile Creek MBI Scores

Table 9. Threemile Creek RBP Scores

Threemile Creek	Site Type	Period 2 RBP Scores	Period 3 RBP Scores
Site	Category	2013	2017
THC0.5-NBT0.8	Headwater	109 (Poor)	111 (Poor)
THC0.8*	Headwater	NA	108 (Poor)
THC1.3	Headwater	100 (Poor)	93 (Poor)

Columns displaying “NA” were not assessed during the monitoring period.

*Site THC0.8 was established in 2017, however assessments occurred in 2018.

The Threemile Creek habitat scores fluctuated at the sites from 2013 to 2017, however scores remained within the poor rating. Site THC0.5-NBT0.8 scores increased due to improvement in bank stability (left) and a marginal increase in embeddedness. While site THC1.3 scores decreased due to sediment deposition and channel flow status.

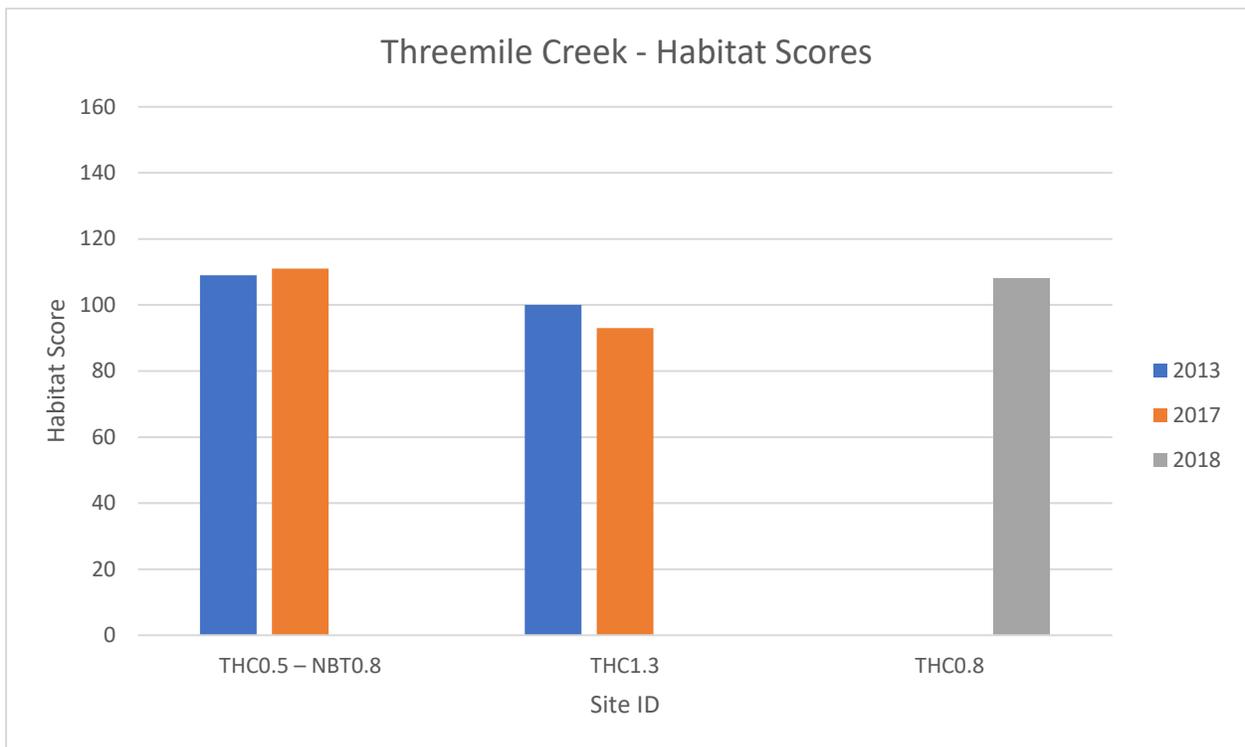


Figure 21. Threemile Creek Habitat Scores

Stream Stability Assessment Results

The stream stability monitoring program collects dimensions of stream geomorphology across NKY to develop a regional stream stability index, which consists of full surveys (i.e., channel cross-sections and longitudinal profiles, along with bed material particle counts), as well as rapid stability assessments¹¹ (i.e., bank height/angle, channel shape, bedrock, and pool depth indexes). The rapid stability assessment was developed to supplement the labor-intensive data collection of full surveys to enable the generation of a numerical score immediately upon data collection. For efficient data collection, rapid stream stability assessments were conducted during the biological assessments.

Rapid Stability Scores measure rates of channel change, as seen in Figure 22 (figure shows the channel evolution model – illustration of how a stream can deepen, then widen, and reestablish new banks, over time), in conjunction with field indicators, failure mechanisms, and sediment transport analyses to develop a regionally calibrated channel stability index. The index scale (i.e., 0 – 10 scale) is designed to have built-in flexibility to score sites without detailed stream stability surveys on the same scale as those with multiple years of data using simple but significant metrics. There is not a definitive separation between scores, as in the MBI, however, as a guideline, Table 10 shows stability rankings (i.e., Stable, Transition and Unstable) with respect to assessment scores.

Table 10. Rapid Stability Scores

Rapid Stability Scores	
Stable (relative equilibrium)	>7
Transition (intermediate)	>4 to <7
Unstable (actively adjusting in multiple dimensions)	<4

Refer to Appendix C for results from individual sites within the Central Basin study area.

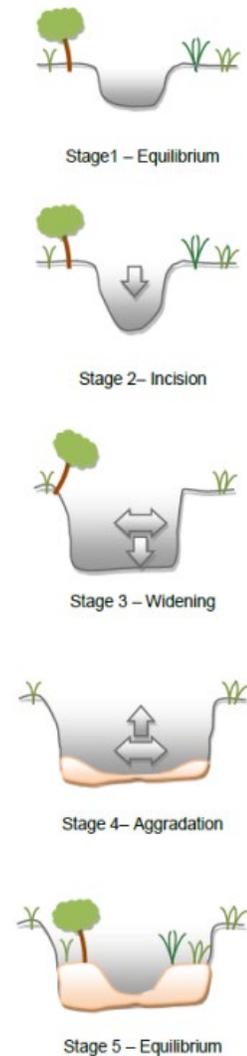


Figure 22. Channel Evolution Model¹²

¹¹ Regionally-Calibrated Channel Stability Index for Northern Kentucky Streams, July 2012 Memorandum

¹² Incised Channels: Morphology Dynamics and Control, Schumm et al. 1984

Banklick Creek

Banklick Creek watershed monitoring sites were assessed during Period 2 (BPC0.1 and BLC15.6 in 2012 and BLC3.9 and BLC8.1 in 2015). Only BLC15.6 was assessed during Period 3, all four sites are scheduled for assessment during Period 4, per the basin rotation cycle.

Table 11. Banklick Creek Rapid Stability Scores

Banklick Creek		Period 2		Period 3
Site	2012	2015	2017	
BLC3.9	NA	-1.50	NA	
BPC0.1	8.60	NA	NA	
BLC8.1	NA	-3.75	NA	
BLC15.6	4.35	NA	5.75	

Columns displaying “NA” do not currently have results available but will in subsequent years (i.e., Period 4).

The monitoring sites in the Banklick Creek watershed depicted a variety of stability scores. Site BPC0.1 had a stable score in 2012, while both BLC3.9 and BLC8.1 had very unstable scores in 2015. Whereas site BLC15.6 was classified as transition, represented by the area between the solid and dashed blue lines in Figure 23, showing an increase in stability from 2012 to 2017. Evidence of sediment transport and some erosion can be seen in the site photos that follow.

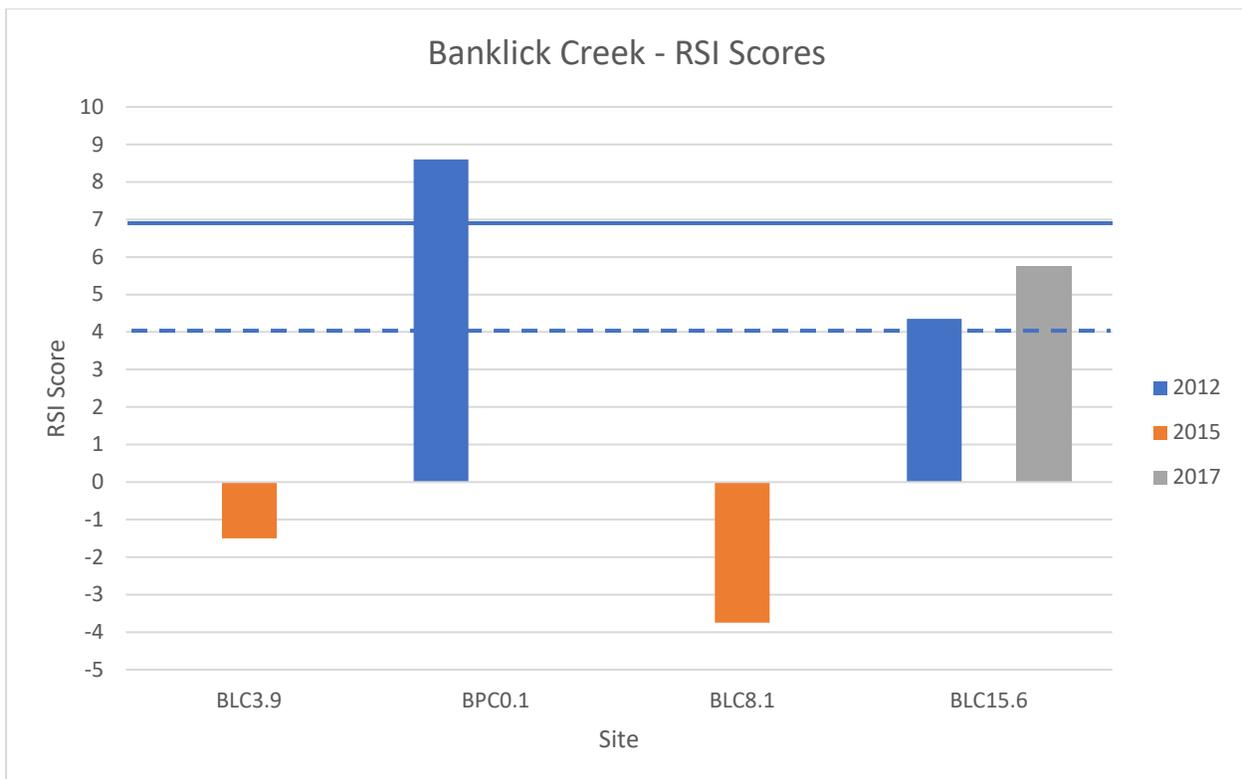


Figure 23. Banklick Creek Rapid Stability Scores



Photo 14. Banklick Creek 8.1



Photo 15. Banklick Creek 15.6

Threemile Creek

Threemile Creek watershed monitoring sites were assessed during Period 2 (THC0.7 and THC1.3 in 2012 and THC0.5-NBT0.8 in 2015). Although none of the sites were assessed during Period 3, all three sites are scheduled for assessment during Period 4, per the basin rotation cycle.

Table 12. Threemile Creek Rapid Stability Scores

Threemile Creek	Period 2		Period 3
Site	2012	2015	2017
THC0.5-NBT0.8	NA	4.3	NA
THC0.7	3.35	NA	NA
THC1.3	5.15	NA	NA

Columns displaying “NA” do not currently have results available but will in subsequent years (i.e., Period 4).

The monitoring sites in Threemile Creek watershed were all below the stable threshold score of 7, however sites THC1.3 and THC0.5-NBT0.8 were within the transition zone, as represented by the area between the solid and dashed blue lines in Figure 24. Site THC0.7 depicts an unstable score, primarily due to bank angle and height.

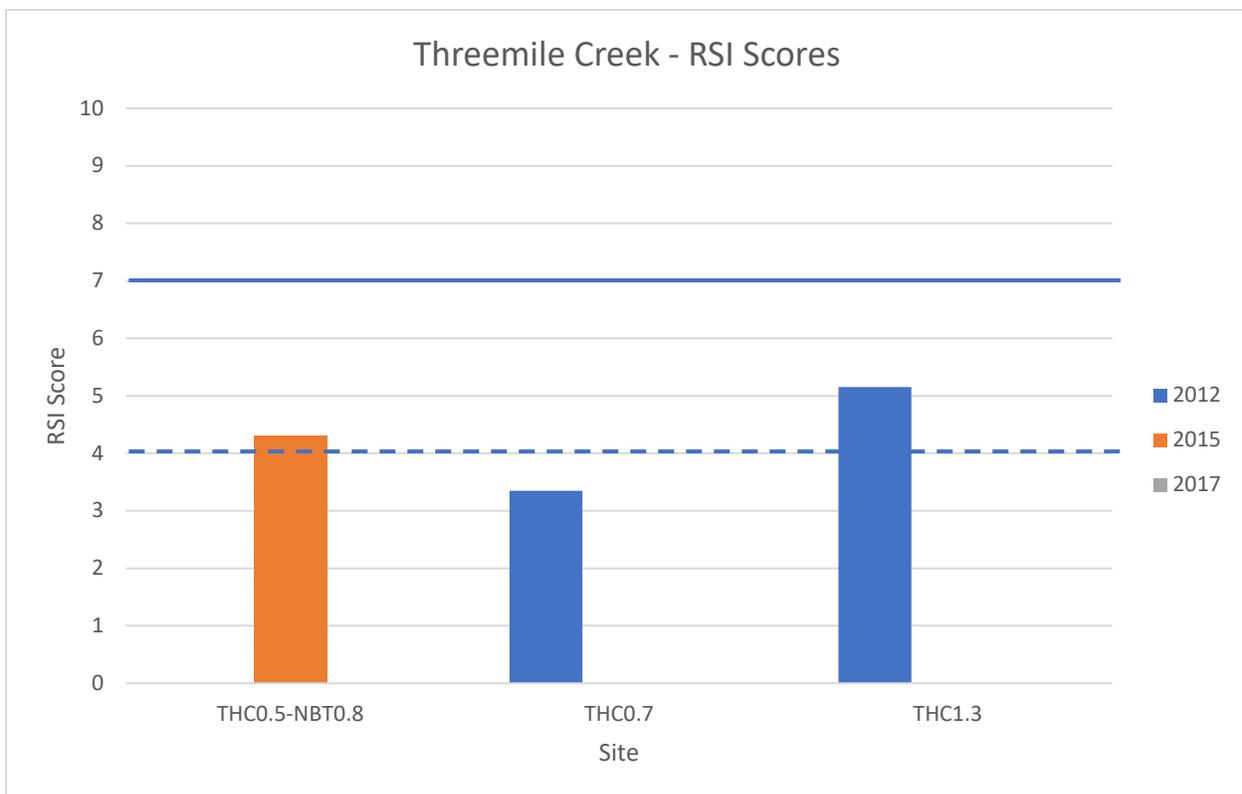


Figure 24. Threemile Creek Rapid Stability Scores



Photo 16. North Branch of Threemile Creek 0.8



Photo 17. Threemile Creek 0.7

Stream Condition Index Basin Trends

The Stream Condition Index (SCI) is a visual representation (Figure 25) of four key components of SD1’s watershed assessment program: water quality, biology, physical habitat, and stream stability¹³. Originally developed for a tool to summarize large amounts of complex information that can be easily understood by the general public, the SCI was updated in 2020 for trend analysis¹⁴. Each of these four components is essential to fully understand the ecological functions and relative health of the individual streams. Relying on a single parameter could be problematic since some streams may rate well in one category, but poor in others. Each of the four indicators used in the Stream Condition Index are given sub-scores. The four sub-scores are then averaged to generate a single overall Stream Condition Index score. These scores are updated as additional data is collected and as the characterization of the watersheds are refined. The overall score for a monitoring site is only calculated if 3 out of the 4 indicators are populated with a sub-score.

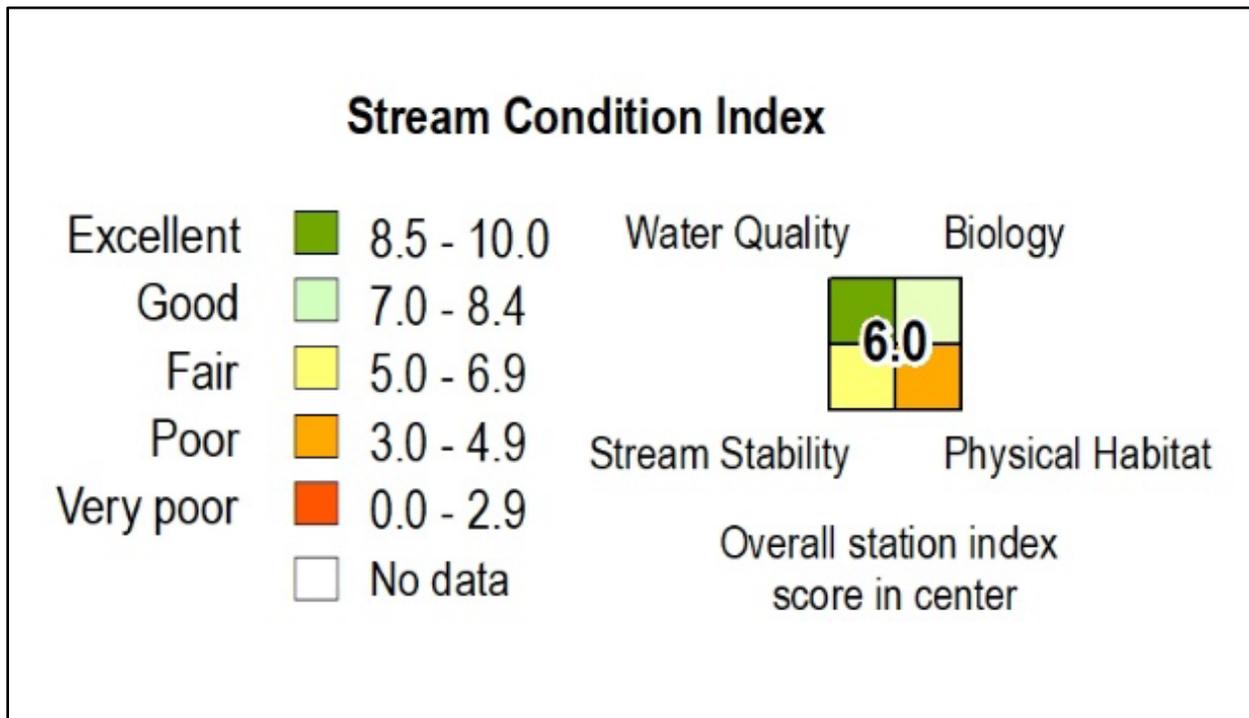


Figure 25. Stream Condition Index Visual Representation

An overall watershed SCI score is calculated if at least 50% of the monitoring sites within the watershed contain data and, if at minimum, sub-scores are calculated for water quality, biology and physical habitat. Watershed scores for Periods 2 and 3 are displayed in the preceding graphs and tables. These scores are out of a total rating of 10, which would be the highest score possible. Appendix D contains tables for Individual site scores for Periods 2 and 3.

¹³ A Stream Condition Index for Water Utility Resource Management in Northern Kentucky Document, June 2013

¹⁴ Basin Trend Stream Condition Index Water Quality Sub-Indices Development, October 2020 Memorandum

The overall SCI scores for the Central Basin watersheds from 2012 - 2015 range from 4.56 to 4.97. Banklick Creek had the higher score of 4.97 (Poor), while Threemile Creek had the lower score of 4.56 (Poor) (Table 13 and Figure 26).

Table 13. Stream Condition Index Basin Trend Scores by Watershed for Period 2 (2012 - 2015)

Watershed	Water Quality Score	Biology Score	Habitat Score	Stream Stability Score	Score
Banklick Creek	6.26	6.40	3.96	3.24	4.97
Threemile Creek	5.88	4.37	3.71	4.27	4.56

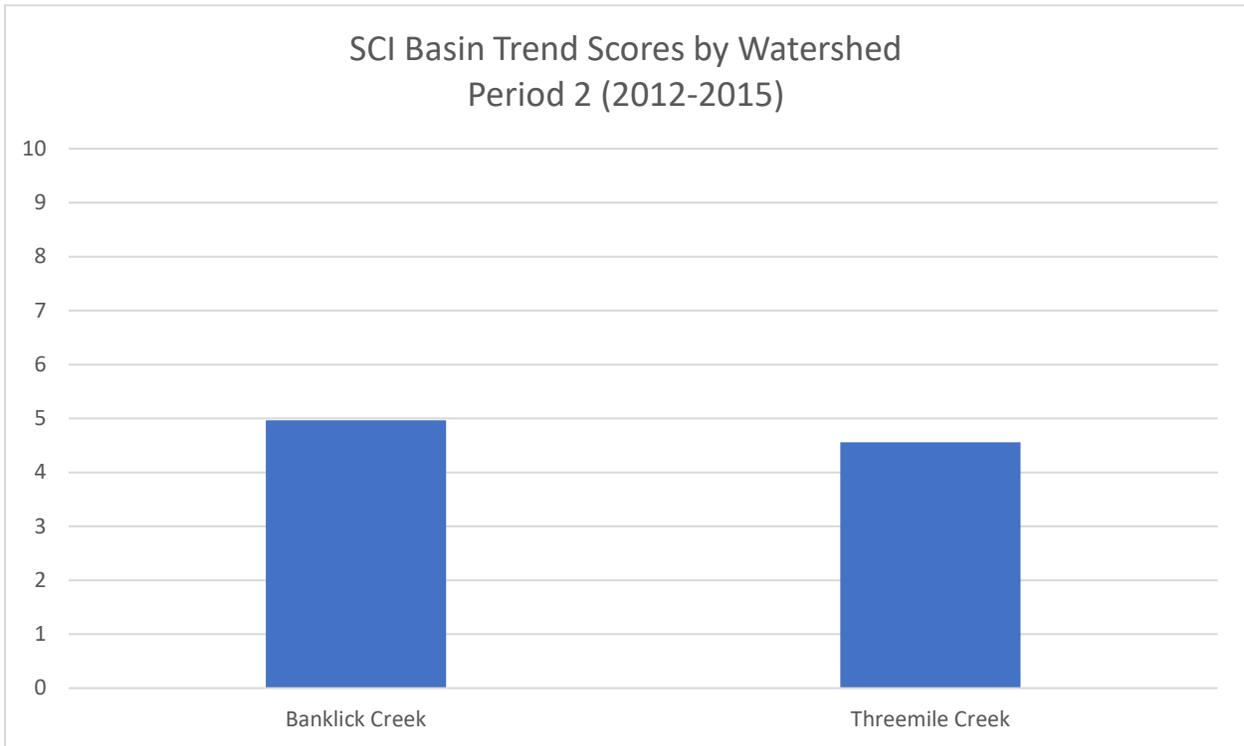


Figure 26. Stream Condition Index Basin Trend Scores by Watershed for Period 2

The overall SCI scores for the Central Basin watersheds from 2016 - 2019 range from 5.22 to 5.96. Banklick Creek had the higher score of 5.96 (Fair), while Threemile Creek had the lower score of 5.22 (Fair) (Table 14 and Figure 27).

Table 14. Stream Condition Index Basin Trend Scores by Watershed for Period 3 (2016 - 2019)

Watershed	Water Quality Score	Biology Score	Habitat Score	Stream Stability Score	Score
Banklick Creek	7.09	5.94	5.04	5.75	5.96
Threemile Creek	7.35	4.62	3.69	NA	5.22

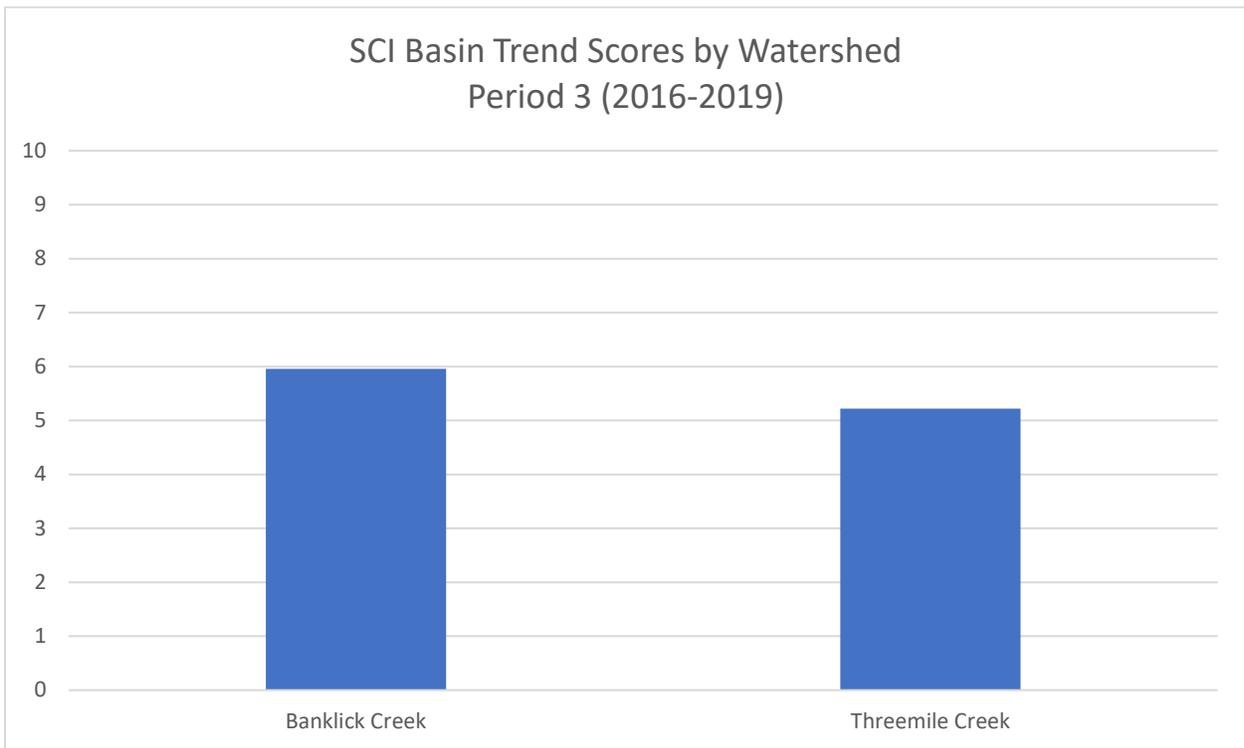


Figure 27. Stream Condition Index Basin Trend Scores by Watershed for Period 3

Conclusion

Table 15 and Figure 28 depict the initial points of a trend line representing SD1's Stream Condition Index for the two watersheds in the Central Basin. Although data was limited at some monitoring sites within the watersheds during Periods 2 and 3, a more complete dataset starting with Period 4 will increase the accuracy of the analysis.

Over time as the watersheds are sampled and assessed, the trend line representing each watershed's rating will extend. Currently, the lines between periods for both watersheds are trending upward (i.e., positive improvement).

Table 15. Stream Condition Index Basin Trend Scores

Watershed	Period 2 (2012-2015)	Period 3 (2016-2019)
Banklick Creek	4.97	5.96
Threemile Creek	4.56	5.22

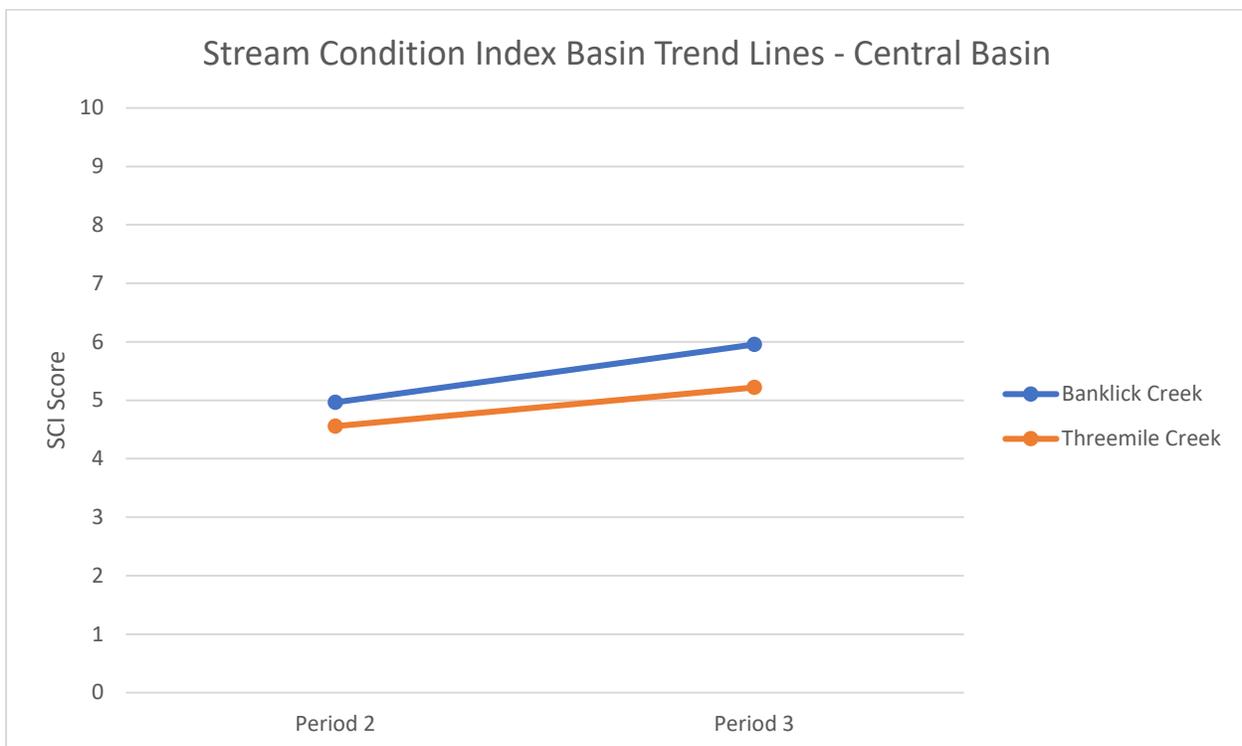


Figure 28. Stream Condition Index Basin Trend Scores

As stated in the beginning objectives, there are numerous reasons why SD1 continues to collect instream water quality, biology, physical habitat, and stream stability data. These monitoring program components together not only characterize the state of Northern Kentucky watersheds, but they also provide locally relevant data as to how to better manage the impacts to the watersheds by implementing effective regulatory requirements and improvement projects.

This data has been used to inform local storm water management policies and regulations that are effective in protecting the region's water quality. Additionally, the monitoring data collected by SD1 has been used by local partners (e.g., conservation districts and citizen watershed groups) to obtain 319 (h) grants from Kentucky to inform additional watershed plans and implementation projects that compliment SD1 initiatives.

SD1 is committed to balance the need to keep local waterways clean and safe with the need to provide affordable wastewater and storm water services in Northern Kentucky. Clean H₂O40 is SD1's commitment to increasing our capacity to better manage the flow of wastewater and storm water in Northern Kentucky. Through a number of strategic projects specifically designed to address sewer overflows, SD1 will meet the requirements of Northern Kentucky's consent decree and improve the quality of life in our community. By the year 2040, SD1 will completely eliminate typical-year sanitary sewer overflows and recapture at least 85 percent of all typical-year combined sewer overflows.

Additional information on SD1's monitoring programs and Clean H₂O40 initiative can be found at <https://www.sd1.org>.

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Appendix A – Water Quality Data

Instream water quality results are listed in tables beginning with the Banklick Creek watershed, followed by the Threemile Creek watershed. Along with the individual parameter results, the precipitation condition in which the samples were collected is also included in the tables as follows:

- Baseflow (Dry) – flow in the stream is comprised primarily of groundwater and/or the hydrograph is stable (typical example: no precipitation within 72 hours prior to sampling).
- Storm Flow (Wet) – flow in the stream is dominated by runoff and/or the hydrograph is rising or falling (typical example: greater than 0.25” of precipitation within 24 hours prior to sampling).

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Banklick Creek Water Quality Data

Watershed	Stream	RM	LocID	Period	Precip Condition	Date	E. coli (mpn/100 ml)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TKN (mg/L)	N/N (mg/L)
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Dry	7/23/15 9:35	420	15	0.087	0.501	0.162	0.339
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Dry	8/6/15 8:35	448	20	0.054	0.683	0.544	0.139
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Dry	9/3/15 9:05	244	20	0.066	0.576	0.447	0.129
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Dry	9/17/15 9:25	212	7	0.047	0.585	0.494	0.091
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Dry	10/1/15 9:25	688	16	0.109	0.640	0.546	0.094
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Dry	10/15/15 9:45	236	3	0.136	0.382	0.332	0.050
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Dry	10/29/15 8:45	3,870	28	0.241	1.582	0.798	0.784
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Wet	7/9/15 9:05	8,300	52	0.336	1.649	1.160	0.489
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Wet	8/20/15 10:10	24,200	143	0.396	1.864	1.110	0.754
Banklick Creek	Banklick Creek	8.1	BLC8.1	2	Wet	11/12/15 9:05	280	7	0.059	0.450	0.368	0.082
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	5/26/16 8:45	196	7	0.120	0.528	0.488	0.040
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	6/9/16 8:45	1,040	11	0.137	0.734	0.580	0.154
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	7/21/16 9:00	648	8	0.155	12.212	0.512	11.700
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	8/4/16 9:50	408	13	0.354	1.409	1.270	0.139
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/1/16 9:20	344	18	0.229	1.131	0.984	0.147
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/15/16 9:35	264	9	0.143	0.853	0.728	0.125
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	10/13/16 9:25	640	2	0.063	0.522	0.469	0.053
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	10/27/16 9:30	396	11	0.195	1.040	0.691	0.349
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	11/10/16 8:40	76	<1.2	0.111	0.874	0.869	<0.01
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	4/13/17 9:15	276	2	0.186	1.228	0.955	0.273
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	4/27/17 9:15	64	5	0.108	0.658	0.626	0.032
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	6/8/17 9:00	216	5	0.100	0.716	0.573	0.143
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	7/13/17 9:45	284	7	0.155	0.848	0.663	0.185
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/7/17 9:30	100	<1.4	0.122	0.701	0.657	0.044

Watershed	Stream	RM	LocID	Period	Precip Condition	Date	E. coli (mpn/100 ml)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TKN (mg/L)	N/N (mg/L)
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/21/17 9:40	68	2	0.136	0.628	0.601	0.027
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	10/19/17 9:30	52	<1.4	0.150	0.711	0.699	0.012
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	11/16/17 10:00	740	7	0.182	1.305	0.959	0.346
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	4/19/18 9:45	228	2	0.060	0.338	0.321	0.017
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	6/14/18 9:42	408	8	0.112	1.037	0.763	0.274
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	7/12/18 9:15	92	13	0.154	0.597	0.475	0.122
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	7/26/18 9:45	92	6	0.094	1.171	1.030	0.141
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/13/18 9:13	332	5	0.182	1.145	0.502	0.643
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/27/18 8:40	776	13	0.212	0.895	<0.102	0.844
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	10/18/18 9:50	36	<1.4	0.120	0.360	0.316	0.044
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	3/21/19 8:45	40	3	0.058	0.399	0.391	<0.016
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	4/25/19 9:35	1,140	23	0.098	0.504	0.464	0.040
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	5/9/19 9:00	176	5	0.099	0.438	0.228	0.210
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	6/13/19 9:10	408	12	0.144	0.870	0.504	0.366
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	7/11/19 9:20	92	10	0.077	0.512	0.387	0.125
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	7/25/19 8:45	120	13	0.107	0.521	0.420	0.101
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	8/15/19 10:20	64	10	0.078	0.798	0.733	0.065
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/12/19 9:05	52	5	0.108	0.747	0.639	0.108
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	9/26/19 9:20	12	6	0.085	0.866	0.777	0.089
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	10/24/19 9:20	24	<1.4	0.857	0.559	0.519	0.040
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Dry	11/14/19 9:15	112	<1.4	0.130	0.605	0.559	0.046
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	4/14/16 9:05	236	3	0.097	0.646	0.618	0.028
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	4/28/16 8:55	15,530	155	0.513	1.774	1.530	0.244
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	5/12/16 9:30	1,460	22	0.146	0.827	0.652	0.175
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	6/23/16 9:20	24,200	620	1.410	2.798	2.360	0.438
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	7/7/16 10:00	440	32	0.205	0.952	0.735	0.217

Watershed	Stream	RM	LocID	Period	Precip Condition	Date	E. coli (mpn/100 ml)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TKN (mg/L)	N/N (mg/L)
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	8/18/16 9:05	9,210	61	0.297	1.937	1.210	0.727
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	9/29/16 8:40	888	19	<0.045	0.193	<0.153	0.116
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	5/11/17 8:55	552	10	0.157	1.014	0.697	0.317
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	5/25/17 9:00	13,000	207	0.526	1.950	1.680	0.270
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	6/22/17 8:35	372	19	0.165	0.983	0.830	0.153
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	7/27/17 9:05	14,140	189	1.620	2.142	1.790	0.352
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	8/17/17 9:15	32	2	0.103	0.577	0.462	0.115
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	3/29/18 9:31	1,644	26	0.254	1.314	0.902	0.412
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	5/10/18 9:25	256	11	0.076	0.548	0.540	<0.016
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	5/24/18 9:20	384	19	0.189	1.167	0.652	0.515
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	8/23/18 8:40	100	6	0.129	0.634	0.473	0.161
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	11/15/18 8:40	14,140	107	0.552	1.807	1.220	0.587
Banklick Creek	Banklick Creek	8.1	BLC8.1	3	Wet	5/23/19 9:45	220	10	0.119	1.197	0.866	0.331

Threemile Creek Water Quality Data

Watershed	Stream	RM	LocID	Period	Precip Condition	Date	E. coli (mpn/100 ml)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TKN (mg/L)	N/N (mg/L)
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Dry	7/23/15 10:40	464	3	0.040	0.414	<0.139	0.344
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Dry	8/6/15 9:45	1,548	24	0.048	1.100	0.490	0.610
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Dry	9/3/15 10:05	184	<1.5	0.040	0.581	0.482	0.099
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Dry	9/17/15 10:15	188	<1.5	0.030	0.518	0.406	0.112
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Dry	10/1/15 10:30	404	4	0.048	0.593	0.487	0.106
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Dry	10/15/15 10:35	264	<1.5	0.052	0.356	0.298	0.058
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Dry	10/29/15 9:50	1,444	6	0.096	1.325	0.561	0.764
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Wet	7/9/15 10:05	2,596	12	0.063	0.851	0.566	0.285
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Wet	8/20/15 11:10	8,660	18	0.172	1.509	0.672	0.837
Threemile Creek	Threemile Creek	0.7	THC0.7	2	Wet	11/12/15 10:05	2,192	12	0.096	0.737	0.484	0.253
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	5/26/16 9:55	324	6	0.076	0.655	0.545	0.110
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	6/9/16 9:45	104	2	0.096	0.367	0.362	<0.01
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	7/21/16 10:00	1,952	<1.2	0.108	0.605	0.564	0.041
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	8/4/16 10:50	944	2	0.121	0.897	0.666	0.231
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/1/16 10:15	184	<1.2	<0.045	1.565	1.230	0.335
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/15/16 10:40	456	2	<0.045	0.614	0.609	<0.01
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	10/13/16 10:20	112	<1.2	0.055	0.626	0.604	0.022
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	10/27/16 10:20	44	<1.2	0.128	0.534	0.494	0.040
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	11/10/16 9:30	80	<1.2	0.085	0.481	0.467	0.014
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	4/13/17 10:15	40	<1.4	0.163	0.503	0.458	0.045
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	4/27/17 10:10	28	2	0.090	0.635	0.443	0.192
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	6/8/17 9:45	280	<1.4	0.072	0.491	0.391	0.100
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	7/13/17 10:15	200	<1.4	0.102	0.561	0.406	0.155
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/7/17 10:00	912	4	0.103	0.848	0.800	0.048

Watershed	Stream	RM	LocID	Period	Precip Condition	Date	E. coli (mpn/100 ml)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TKN (mg/L)	N/N (mg/L)
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/21/17 10:15	92	<1.4	0.103	0.681	0.625	0.056
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	10/19/17 10:05	80	<1.4	0.069	0.484	0.460	0.024
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	11/16/17 10:30	1,380	5	0.132	1.139	0.835	0.304
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	4/19/18 10:15	280	4	0.047	0.399	0.290	0.109
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	6/14/18 10:12	416	<1.4	0.073	0.897	0.494	0.403
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	7/12/18 9:40	240	6	0.051	0.575	0.493	0.082
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	7/26/18 10:20	452	2	0.037	0.490	0.412	0.078
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/13/18 9:45	432	<1.4	0.104	0.989	0.336	0.653
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/27/18 9:25	108	<1.4	0.068	1.115	0.332	0.783
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	10/18/18 10:30	8	2	0.061	0.383	0.250	0.133
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	3/21/19 9:15	36	<1.4	0.048	0.455	0.345	0.110
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	4/25/19 10:05	1,460	3	0.071	0.821	0.487	0.334
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	5/9/19 9:30	128	5	0.074	0.863	0.284	0.579
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	6/13/19 9:45	992	3	0.058	0.829	0.369	0.460
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	7/11/19 9:50	432	4	0.036	0.344	0.288	0.056
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	7/25/19 9:15	384	7	0.063	0.517	0.368	0.149
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	8/15/19 10:50	72	2	<0.028	0.710	0.596	0.114
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/12/19 9:50	52	<1.4	0.081	0.351	0.228	0.123
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	9/26/19 9:55	352	<1.4	0.043	0.722	0.639	0.083
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	10/24/19 9:55	16	40	0.099	0.646	0.543	0.103
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Dry	11/14/19 9:40	648	<1.4	0.082	1.113	0.525	0.588
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	4/14/16 10:30	76	<1.2	0.074	0.460	0.438	0.022
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	4/28/16 9:55	5,170	56	0.255	1.364	1.010	0.354
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	5/12/16 10:30	432	6	0.110	0.840	0.656	0.184
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	6/23/16 11:10	14,140	176	0.651	1.815	1.240	0.575
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	7/7/16 10:40	344	5	0.128	0.717	0.607	0.110

Watershed	Stream	RM	LocID	Period	Precip Condition	Date	E. coli (mpn/100 ml)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TKN (mg/L)	N/N (mg/L)
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	8/18/16 10:10	1,040	9	0.139	1.558	0.838	0.720
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	9/29/16 9:35	1,304	<1.2	<0.045	0.329	<0.153	0.252
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	5/11/17 9:55	272	2	0.132	0.954	0.456	0.498
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	5/25/17 10:15	12,030	139	0.361	1.682	1.410	0.272
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	6/22/17 9:20	488	2	0.123	0.882	0.664	0.218
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	7/27/17 9:40	2,316	4	0.107	0.730	0.517	0.213
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	8/17/17 9:45	420	<1.4	0.089	0.575	0.520	0.055
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	3/29/18 10:00	152	10	0.125	1.244	0.754	0.490
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	5/10/18 10:00	444	14	0.054	0.593	0.430	0.163
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	5/24/18 9:50	1,380	3	0.111	1.215	0.493	0.722
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	8/23/18 9:15	460	2	0.096	0.691	0.356	0.335
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	11/15/18 9:10	6,130	27	0.298	1.261	0.769	0.492
Threemile Creek	Threemile Creek	0.7	THC0.7	3	Wet	5/23/19 10:15	1,460	7	0.076	0.714	0.279	0.435

Appendix B1 – Biological Data

Macroinvertebrate assessment results are listed in tables beginning with the Banklick Creek watershed, followed by the Threemile Creek watershed. The MBI metrics included in the tables are as follows:

- Percent Chironomidae+Oligochaeta (%Chir+%Olig) – calculates the relative abundance of pollution tolerant organisms; increasing metric values generally indicate declining water quality conditions.
- Percent Primary Clingers (%CIngP) – calculates the relative abundance of organisms that require hard/silt-free substrates; increasing metric values generally indicate improving substrate stability.
- Percent Ephemeroptera (%Ephem) – calculates the abundance of mayfly species (insect order Ephemeroptera), which are pollution sensitive; metric is only utilized for assessing headwater streams.
- Modified Percent EPT Abundance (m%EPT) – calculates the abundance of pollution sensitive organisms (specifically insect orders of Ephemeroptera, Plecoptera and Trichoptera); increasing metric values generally indicate improving water quality and habitat conditions.
- Genus Ephemeroptera, Plecoptera, Trichoptera Richness (G-EPT) – calculates the total number of distinct genera of pollution sensitive organisms in a composite sample; increasing metric values generally indicate improving water quality and habitat conditions.
- Genus Taxa Richness (G-TR) – calculates the total number of genera in a composite sample; increasing metric values generally indicate improving water quality and habitat conditions.
- Modified Hilsenhoff Biotic Index (mHBI) – calculates the overall pollution tolerance of the benthic macroinvertebrate community (including arthropods) (Lenat 1993); increasing metric values generally indicate decreasing water quality conditions.

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Banklick Creek Macroinvertebrate Index Scores

Watershed	Stream	RM	LocID	Year	Site Type	%Chir+ %Olig	%CIngP	%Ephem	G-EPT	G-TR	m%EPT	mHBI	MBI_Genus	MBI_Genus Rating
Banklick Creek	Banklick Creek	15.6	BLC15.6	2013	H	53.60	33.70	0.70	9	36	4.10	6.11	33.80	Poor
Banklick Creek	Banklick Creek	15.6	BLC15.6	2017	H	48.84	33.99	1.32	8	34	4.95	6.10	33.93	Poor
Banklick Creek	Banklick Creek	8.1	BLC8.1	2013	W	19.40	51.70	N/A	8	25	32.30	5.27	54.70	Fair
Banklick Creek	Banklick Creek	8.1	BLC8.1	2017	W	34.21	28.29	N/A	10	31	40.79	5.60	50.75	Fair
Banklick Creek	Banklick Creek	3.9	BLC3.9	2013	W	19.00	58.40	N/A	10	36	27.50	5.36	58.90	Fair
Banklick Creek	Banklick Creek	3.9	BLC3.9	2017	W	31.99	27.27	N/A	10	49	21.89	5.70	50.76	Fair
Banklick Creek	Bullock Pen Creek	0.1	BPC0.1	2013	W	17.30	43.00	N/A	10	40	24.80	5.36	56.00	Fair
Banklick Creek	Bullock Pen Creek	0.1	BPC0.1	2017	W	21.67	41.33	N/A	8	33	30.33	5.35	53.35	Fair

Threemile Creek Macroinvertebrate Index Scores

Watershed	Stream	RM	LocID	Year	Site Type	%Chir+ %Olig	%CIngP	%Ephem	G-EPT	G-TR	m%EPT	mHBI	MBI_Genus	MBI_Genus Rating
Threemile Creek	North Branch Threemile Creek	0.8	NBT0.8	2013	H	5.60	7.60	4.00	3	23	7.90	6.57	30.40	Poor
Threemile Creek	North Branch Threemile Creek	0.8	NBT0.8	2017	H	32.03	9.15	37.25	3	21	41.83	6.13	39.92	Fair
Threemile Creek	Threemile Creek	1.3	THC1.3	2013	H	4.50	23.50	7.1	5	24	10.00	5.86	37.00	Poor
Threemile Creek	Threemile Creek	1.3	THC1.3	2017	H	12.59	8.50	3.74	3	21	4.42	5.79	29.88	Poor
Threemile Creek	Threemile Creek	0.8	THC0.8	2013	H									No Data
Threemile Creek	Threemile Creek	0.8	THC0.8	2018	H	21.38	18.62	14.14	4	25	25.17	6.20	36.85	Poor

Appendix B2 – Biological Data

Habitat assessment results are listed in tables beginning with the Banklick Creek watershed, followed by the Threemile Creek watershed. The RBP metrics included in the tables are as follows:

- Bank Stability (BankSta) – estimates actual or potential streambank erosion; eroded banks indicate sediment movement and deposition issues.
- Bank Vegetative Protection (BankVegP) – estimates the vegetative protection adjacent to the stream; differing vegetative types provide various abilities to resist erosion.
- Channel Flow Status (ChaFlowS) – estimates the degree to which the stream channel is filled with water; relates to the amount of substrate that is suitable for aquatic organisms.
- Channel Alteration (ChanAlter) – characterizes large scale or direct changes to the shape of the stream channel; relates to the amount of natural habitat with meandering streams having greater potential and straightened or deepened channels have less potential and subject to scouring.
- Embeddedness – estimates the extent of stream bottom substrate covered by silt, sand, or mud due to sedimentation; greater embeddedness decreases habitat diversity.
- Epifaunal Substrate/Available Cover (EpiFauSub) – estimates the relative quantity and variety of natural structures (e.g., boulders, logs, aquatic vegetation, etc.) in the stream that provide habitat; greater habitat opportunities provide greater potential for aquatic organism colonization.
- Frequency of Riffles (FreqOfRiffles) – determines the sequence of riffles occurring in the stream system; higher frequencies typically provide better habitat opportunities.
- Riparian Vegetative Zone Width (RipVegZW) – estimates the width of the vegetation from the edge of the streambank to the edge of the riparian zone; larger undisturbed riparian zones support more robust stream systems.
- Sediment Deposition (SedDep) – estimates the amount of stream bed sediment accumulation in pools; deposition signifies an unstable regime that is not suitable from many organisms.
- Velocity/Depth Regime (Vel/Dep Regime) – determines the occurrence pattern of stream velocity and stream depth regimes (i.e., slow-deep, slow-shallow, fast-deep and fast-shallow); the number of patterns present relates to the stability of the aquatic environment.

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Banklick Creek Habitat Scores

Watershed	Stream	RM	LocID	Year	Site Type	BankSta-LB	BankSta-RB	BankVegP-LB	BankVegP-RB	ChaFlows	ChanAlter	Embeddedness	EpifFauSub	FreqORfites	RipVegZW-LB	RipVegZW-RB	SedDep	Vel/Dep Regime	RBP_HA	RBP_HA Rating
Banklick Creek	Banklick Creek	15.6	BLC15.6	2013	H	7	6	4	3	15	14	13	11	15	4	3	10	12	117	Poor
Banklick Creek	Banklick Creek	15.6	BLC15.6	2017	H	9	7	7	7	15	12	14	9	13	6	3	11	12	125	Poor
Banklick Creek	Banklick Creek	8.1	BLC8.1	2013	W	1	3	4	6	7	11	13	7	10	5	2	4	13	86	Poor
Banklick Creek	Banklick Creek	8.1	BLC8.1	2017	W	4	5	5	5	7	10	12	8	14	5	4	9	13	101	Poor
Banklick Creek	Banklick Creek	3.9	BLC3.9	2013	W	2	2	3	3	13	3	11	8	8	2	2	6	11	74	Poor
Banklick Creek	Banklick Creek	3.9	BLC3.9	2017	W	2	2	4	4	16	9	16	10	2	5	4	9	11	94	Poor
Banklick Creek	Bullock Pen Creek	0.1	BPC0.1	2013	W	5	3	4	2	9	14	15	11	18	2	1	9	14	107	Poor
Banklick Creek	Bullock Pen Creek	0.1	BPC0.1	2017	W	6	7	5	4	15	11	17	11	10	5	5	12	13	121	Fair

Threemile Creek Habitat Scores

Watershed	Stream	RM	LocID	Year	Site Type	BankSta-LB	BankSta-RB	BankVegP-LB	BankVegP-RB	ChaFlows	ChanAlter	Embeddedness	EpifFauSub	FreqOfRiffls	RipVegZW-LB	RipVegZW-RB	SedDep	Vel/Dep Regime	RBP_HA	RBP_HA Rating
Threemile Creek	North Branch Threemile Creek	0.8	NBT0.8	2013	H	1	2	8	7	11	14	11	12	16	5	2	10	10	109	Poor
Threemile Creek	North Branch Threemile Creek	0.8	NBT0.8	2017	H	8	6	6	5	11	11	12	11	13	6	4	8	10	111	Poor
Threemile Creek	Threemile Creek	1.3	THC1.3	2013	H	1	4	5	4	15	8	7	9	19	2	1	15	10	100	Poor
Threemile Creek	Threemile Creek	1.3	THC1.3	2017	H	2	6	4	3	9	8	8	10	16	3	3	10	11	93	Poor
Threemile Creek	Threemile Creek	0.8	THC0.8	2013	H															No Data
Threemile Creek	Threemile Creek	0.8	THC0.8	2018	H	5	5	4	4	8	10	13	10	16	6	4	9	14	108	Poor

Appendix C – Stream Stability Data

Rapid stability assessment results are listed in tables beginning with the Banklick Creek watershed, followed by the Threemile Creek watershed. The stability metrics included in the tables are as follows:

- Bank (LEFT_BANK and RIGHT_BANK) – Bank height and bank angle are utilized to calculate the risk of bank failure score for each stream bank (i.e., left bank and right bank) based on logistic regression thresholds developed from NKY stream systems. Each stream bank is assessed separately with scores ranging from 0 (stable) to 10 (unstable).
- Shape (SHAPE) – Floodplain connectivity and stream bed irregularity are utilized to determine the channel shape score. Each parameter is assessed separately (a score of 5 is stable and a score of 0 is unstable) and then added together for a total score.
- Bedrock (BEDROCK) – Percent of bedrock is utilized to determine the bedrock score as follows: <2% receives a score of 10 (good), 2-10% receives a score of 4 (fair), and >10% receives a score of 0 (poor).
- Pool Depth (POOL) – Depth of the deepest pool in the assessment reach is used to determine the pool depth score as follows: <2.5' receives a score of 10 (good) and >2.5' receives a score of 0 (poor).
- Embeddedness (EMBDD) – Percent of embeddedness in the assessment reach is utilized to determine the embeddedness score as follows: 0-25% receives a score between 20 and 16 (Optimal), 25-50% receives a score between 15 and 11 (Suboptimal), 50-75% receives a score between 10 and 6 (Marginal), and >75% receives a score between 5 and 0 (Poor).
- Frequency of Riffles (RIFLE_FREQ) – Number of riffles occurring in the assessment reach is used to determine the riffle frequency score as follows: “relatively frequent” receives a score between 20 and 16 (Optimal), “infrequent” receives a score between 15 and 11 (Suboptimal), “occasional” receives a score between 10 and 6 (Marginal), and “generally all flat water” receives a score between 5 and 0 (Poor).

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Banklick Creek Stream Stability Index Scores

DATE	SITE	LEFT_BANK	RIGHT_BANK	SHAPE	BEDROCK	EMBEDD	POOL	RIFFLE FREQ	SITE SCORE
12/11/2015	BLC3.9	0	6	0	4	12	0	10	-1.50
6/26/2012	BPC0.1	9	10	10	10	13	10	16	8.60
12/11/2015	BLC8.1	0	10	0	0	7	0	6	-3.75
6/6/2012	BLC15.6	10	0	5	4	12	10	15	4.35
11/2/2017	BLC15.6	10	10	10	0	11	10	12	5.75

Threemile Creek Stream Stability Index Scores

DATE	SITE	LEFT_BANK	RIGHT_BANK	SHAPE	BEDROCK	EMBEDD	POOL	RIFFLE FREQ	SITE SCORE
12/17/2015	THC0.5-NBT0.8	8	10	10	4	12	0	14	4.30
9/6/2012	THC0.7	10	10	10	4	7	10	4	3.35
8/28/2012	THC1.3	7	10	5	4	13	10	13	5.15

Appendix D – Stream Condition Index Scores

Stream Condition Index Basin Trend Scores by Site – Period 2 (2012 - 2015)

Watershed	Site	Water Quality Score	Biology Score	Habitat Score	Stream Stability Score	Score
Banklick Creek	3.9	6.54	7.36	3.25	0.00	4.29
	8.1	5.98	6.84	3.77	0.00	4.15
	15.6	NA	4.38	4.15	4.35	4.29
	BPC0.2	NA	7.00	4.69	8.60	6.76
Threemile Creek	0.7	5.88	NA	NA	3.35	NA
	1.3	NA	4.76	3.55	5.15	4.49
	NBT0.8	NA	3.98	3.87	4.30	4.05

Note: An overall monitoring site score is only calculated if 3 out of the 4 categories are populated.

Stream Condition Index Basin Trend Scores by Site – Period 3 (2016 - 2019)

Watershed	Site	Water Quality Score	Biology Score	Habitat Score	Stream Stability Score	Score
Banklick Creek	3.9	NA	6.35	4.12	NA	NA
	8.1	7.09	6.34	4.43	NA	5.95
	15.6	NA	4.40	4.43	5.75	4.86
	BPC0.2	NA	6.67	7.19	NA	NA
Threemile Creek	0.7	7.35	4.74	3.83	NA	5.31
	1.3	NA	3.91	3.30	NA	NA
	NBT0.8	NA	5.19	3.94	NA	NA

Note: An overall monitoring site score is only calculated if 3 out of the 4 categories are populated.

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