Stream Quality Monitoring 2013 Annual Report
Big & Little Darby Creek State & National Scenic River

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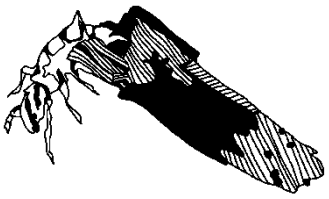
Ohio Scenic Rivers Program



With more than 60,000 miles of streams, Ohio is a water-rich state. Many of Ohio's streams support thriving plant and animal communities, including Ohio's state designated scenic rivers. Administered by the Ohio Division of Watercraft, the Ohio Scenic Rivers Program oversees 14 state designated scenic river systems, comprising 800 river miles along 26 stream segments. These streams represent some of the best of Ohio's waterways.

Stream Quality Monitoring Project

Developed in 1983, the Ohio Stream Quality Monitoring (SQM) Project uses volunteers in aquatic macroinvertebrate monitoring to compile biological and water quality data on the state's scenic rivers. The Ohio SQM Project is an excellent, simple, and cost-effective method of assessing a stream's health.

Aquatic macroinvertebrate organisms lack a backbone (invertebrate), are large enough to view with the naked eye (macro), and spend at least a portion of their lives in the water (aquatic). Macroinvertebrates, such as various aquatic insects (e.g. mayfly, stonefly), are good indicators of stream health. When negative impacts to a stream occur, the result may show a decline or absence of certain macroinvertebrate species.

Through consistent monitoring, changes observed in the macroinvertebrate community help the Ohio Scenic Rivers Program detect and address potential impacts to a stream. The Ohio Scenic Rivers Program compiles volunteer field assessment information into a statewide database. The database serves as a tool to track short- and long-term changes and trends over time.

SQM Project Relies on Volunteers

Coordinated by the Ohio Division of Watercraft's Scenic River Program, the Ohio SQM Project provides opportunities for public participation in scenic river protection efforts. Many local, youth and conservation organizations, individuals, and families are committed to monitoring more than 150 stations along Ohio's scenic rivers.

SQM volunteers collect macroinvertebrate data from selected monitoring stations, also referred to as monitoring sites or reference stations, at least three times during the monitoring season. Volunteers complete field assessment forms that document taxonomy, tolerance, and abundance of collected organisms.

SQM Annual Report

The information collected by volunteers has become a critical tool for documenting the health of Ohio's state scenic, wild, and recreational rivers. This report is a compilation of field data collected during 2013 by volunteers and staff. It also represents a year of dedication and commitment shown to Ohio's special waterways by thousands of SQM volunteers.

Overview

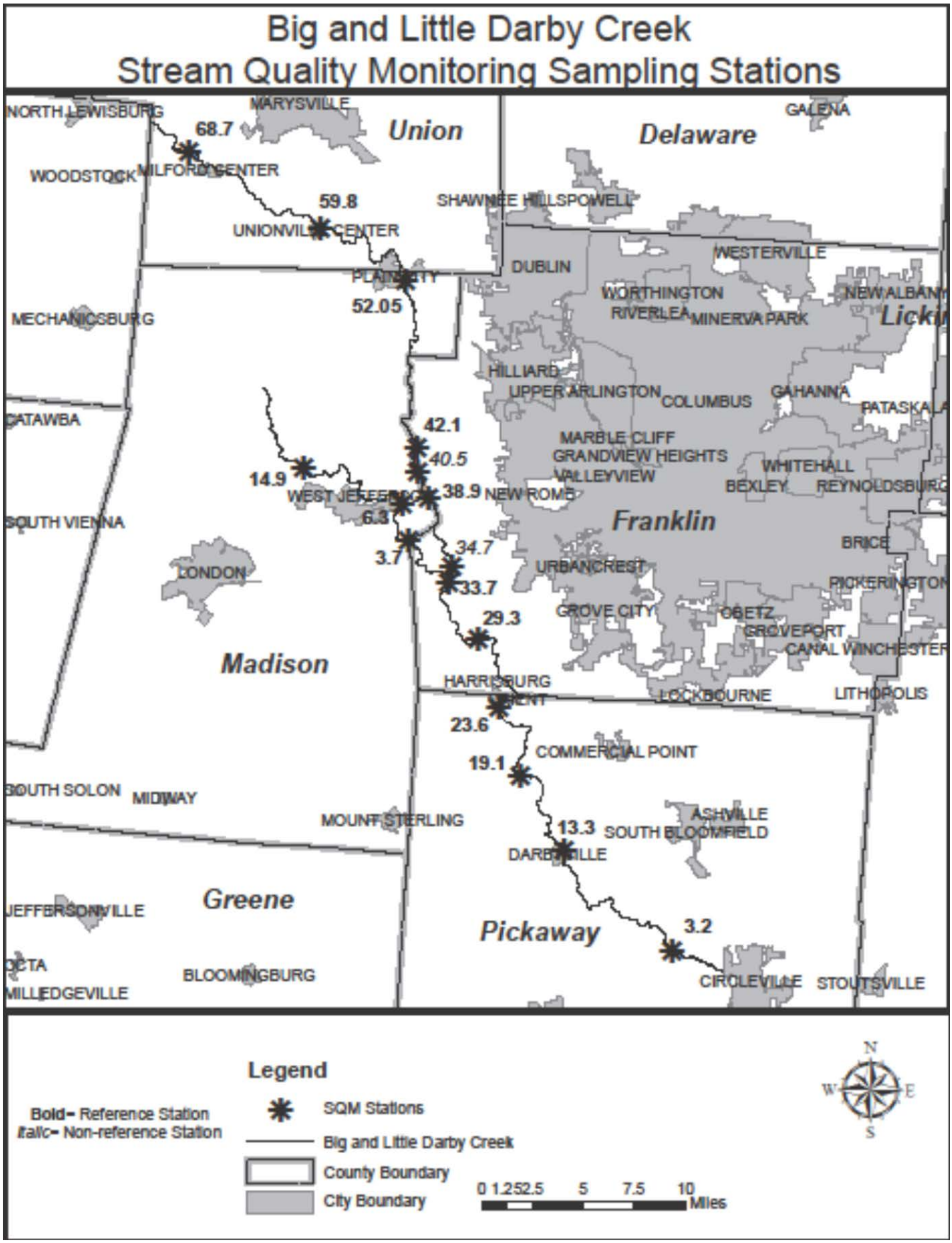
The Big and Little Darby Creeks flow from the gently rolling hills of Logan and Champaign Counties before turning south through the glacial till plains of Union, Madison and Franklin Counties. In southern Franklin County, the creeks converge and Big Darby Creek continues through Pickaway County before joining the Scioto River in Circleville.

Eighty-four miles of the Darby Creek system were designated as Ohio's 10th scenic river in 1984. A decade later, these creeks became Ohio's third national scenic river. Boulders, rocks, and cobbles left in the valley by receding glaciers more than 13,000 years ago created an exceptional warm water habitat. More than 100 species of fish, 41 species of freshwater mussels, and aquatic insects inhabit the Darby Creek system. Nearly 100 species of breeding birds also may be found in the forested lands along the riverbanks. These wooded corridors are a vital part of the Darby Creeks' exceptional habitat and water quality.

The Darby Creek corridor also possesses a wealth of history and numerous archaeological sites. Sites ranging from the remnants of small camps to sizeable prehistoric villages and burial mounds provide glimpses into the lives of Ohio's prehistoric inhabitants, including the Paleo-Indians, the Adenas, and more recently, the Wyandot Indians.

Before European settlement, the Darby Creek watershed was blanketed in tall grass prairies and oak-hickory savannahs. Considered "barren" by early settlers, these prairies were too wet to plow in the spring and so dry in the late summer that they were subject to burning. Today, most of the pre-settlement prairies have been drained and converted to cropland and housing developments. Fortunately, small populations of native prairie plants, such as big bluestem, purple coneflower, stiff goldenrod, and whorled rosinweed, are still found in isolated areas of the Darby Plains. Several sites such as Smith Cemetery and Bigelow Cemetery in Madison County are protected through Ohio's state nature preserve system.

The Big and Little Darby Creeks are popular streams for canoeing, fishing, bird watching, and other outdoor activities. Additional information about public access facilities on the Darby Creeks is available through the Ohio Division of Watercraft by calling 740-548-5490.


Big and Little Darby Creek
Stream Quality Monitoring Sampling Stations
NORTH LEWISBURG
MARYSVILLE
Union
Delaware
GALENA
68.7
WOODSTOCK
MILFORD CENTER
59.8
SHAWNEE HILLS
SPOWELL
UNIONVILLE CENTER
DUBLIN
WESTERVILLE
WORTHINGTON
RIVERLEA
MINERVA PARK
NEW ALBANY
Licki
52.05
MECHANICSBURG
HILLIARD
UPPER ARLINGTON
COLUMBUS
GAHANNA
PATASKALA
CATAWBA
42.1
MARBLE CLIFF
GRANDVIEW HEIGHTS
40.5
VALLEYVIEW
WHITEHALL
14.9
38.9
NEW ROME
BEXLEY
REYNOLDSBURG
6.3
SOUTH VIENNA
Franklin
BRICE
3.7
34.7
LONDON
URBANCREST
PICKERINGTON
33.7
29.3
GROVE CITY
OBETZ
GROVEPORT
CANAL WINCHESTER
Madison
HARRISBURG
LOCKBOURNE
LITHOPOLIS
23.6
COMMERCIAL POINT
19.1
SOUTH SOLON
MIDWAY
MOUNT STERLING
ASHVILLE
13.3
SOUTH BLOOMFIELD
DARBYVILLE
Greene
JEFFERSONVILLE
Pickaway
3.2
OCTA
BLOOMINGBURG
CIRCLEVILLE
STOUTSVILLE
MILLEDGEVILLE
Legend
Bold= Reference Station
Italic= Non-reference Station
SQM Stations
Big and Little Darby Creek
County Boundary
City Boundary
0 1.252.5 5 7.5 10
Miles
N
W
E
S

2013 Stream Quality Monitoring Participants

Whether their contribution was a one-time event or a recurring adventure in stream exploration, the individuals and organizations listed below played a significant role in protecting the Darby Creeks. Their time and dedication to this river and the Ohio SMQ Program are greatly appreciated. Special thanks are also extended to the Battelle-Darby Creek Metro Park, private landowners, and to all of the Darby Creek partners for their continued efforts. These reference stations are also closely monitored by the Division of Watercraft staff.

Big Darby Creek

River Mile 3.2 - State Route 104
Mary Warren
Lisa Strohm

River Mile 13.3 - Water Street, Darbyville
Helen and Don Hollis
Jeff and Rachel Lewis

River Mile 19.1 - Scioto-Darby Road Bridge
David Trego
Chris Rea

River Mile 23.6 - Orient Railroad Trestle
Matthew Malcuit
Dan and Darren Koah

River Mile 29.3 - Trapper John's Canoe Livery
Nick, Julia and Sandy Shew
Susan Riggins

River Mile 33.7 - Indian Ridge, Battelle-Darby Creek Metro Park
Ashley Krutko
Hilliard Station Sixth Grade
Hilliard Tharp Sixth Grade
Chris Rea
Dave Trego
Cub Scout Pack 734
Franklin Heights High School

River Mile 34.7 - Cedar Ridge, Battelle-Darby Creek Metro Park *(non-reference station)*
Bob Ashcraft
David Henderson

River Mile 38.9 - U.S. Route 40 Bridge
Tim Hetzler and Chance Dummitt
Scott and Katie Hogsten
Mike Hall

River Mile 40.4/40.5 - Battelle North *(non-reference station)*
Battelle Institute of Technology

River Mile 42.1- Sasson Riffle at Sycamore Plains, Prairie Oaks Metro Park
Anthony, Mariah and Colleen Sasson
Stuart Johnson

River Mile 52.05 - Plain City Waste Water Treatment Facility
Duane Davis

River Mile 59.8 - Unionville Center
Eric and Liam Slosser
Chris Hall
David and Michael Barfuss

River Mile 68.7 - Milford Center, Middleburg Plain City Rd.
Duane Davis

Little Darby Creek

River Mile 3.7 - Central Ohio Anglers and Hunters Club (COAHC)
Mike Hall and Family

River Mile 6.3 - U.S. Route 40, West Jefferson
Dick and Kathy Miller

River Mile 14.9 - Goodson Road
Bob Braithwaite
Chris Hall
Eric Slosser

The continued success of the Ohio SQM Project depends on the commitment and dedication of these (and past) volunteers. We would like to acknowledge volunteers *David and Michael Barfuss; Mary Warren; Lisa Strohm; David Trego; Chris Rea; Dick and Kathy Miller; Anthony and Colleen Sasson; Don and Helen Hollis; Hilliard Station and Hilliard Tharp Schools 6th Grade Classes; Bob Braithwaite; Dave Henderson; Bob Ashcraft, Eric Slosser; Duane Davis; Scott Hogsten; Mathew Malcuit; Dan Koah; Mike Hall and Chris Hall* for monitoring three times or more during the 2013 season. If you are interested in becoming a volunteer for the Ohio SQM Project on Darby Creek, please contact the Central Ohio SQM Coordinator at 740-548-5490.

Station Descriptions

Big and Little Darby Creeks are largely agricultural watersheds. Most land bordering the stream is privately owned with very little public access. Where possible, sampling stations are located at or adjacent to areas where public access to the stream is permitted. Following are brief descriptions of official SQM stations on Big Darby Creek and Little Darby Creek Scenic Rivers. When describing the location of riffles the phrases “river right” and “river left” are used to help more accurately describe the proximity of the riffle. When looking down river, “river right” is on your right and “river left” is on your left.

Big Darby Creek

River Mile 3.2 - State Route 104, Jackson Township

Located immediately downstream from the State Route 104 Bridge in Pickaway County, this site is the furthest downstream reference station on Big Darby Creek. During the heavy flooding of June 1997, the adjacent trailer park was severely damaged and has been permanently closed. Parking is available in front of the closed trailer park. A moderately steep path leads to the creek.

River Mile 13.3 - Water Street, Village of Darbyville

Located downstream of the State Route 316 Bridge in Pickaway County, this reference site is accessed by private property on river right. An island divides the riffle at this location. The riffle on river right of the island is monitored.

River Mile 19.1 - Scioto-Darby Road Bridge, Darby Township

An island divides the riffle area of this remote station located in Pickaway County. Sampling is conducted on the riffle river left of the island located upstream from the Scioto-Darby Road Bridge. Parking for several vehicles is available on the river left side of the creek along the road. Access to this site is through private property, so it is necessary to obtain permission from landowner.

River Mile 23.6 - Orient Railroad Trestle, Village of Orient

Located directly upstream from the railroad trestle in Pickaway County, the length of this riffle is relatively short and has a step gradient at the mouth of the riffle. The site may be accessed from river right. A small pull-off is located under the railroad trestle along Darby Creek Road. A trail leads to the creek from the road. This riffle has a steep gradient and the current is extremely swift. Caution should be taken when at this site. A healthy population of dobsonfly larvae has been observed here.

River Mile 29.3 - Trapper John’s Canoe Livery, Pleasant Township

Trapper John’s Canoe Livery is located in Franklin County in Darbydale at the corner of State Route 665 and Harrisburg-Georgesville Road. There is plenty of parking and easy access to the riffle upstream of the canoe launching area. This is private property so permission must be obtained from the canoe livery. Strong currents and deep pockets of water are characteristic of this area, so volunteers are urged to exercise caution when monitoring this site.

River Mile 33.7 - Indian Ridge, Battelle-Darby Creek Metro Park, Pleasant Township

Battelle-Darby Creek Metro Park in Franklin County is one of the few public facilities that provide ready access to the Darby Creeks. The Indian Ridge Public Use Area entrance is one mile south of the main park entrance off Darby Creek Drive. Restroom facilities and ample parking make this an excellent site for large groups.

River Mile 34.7 - Cedar Ridge, Battelle Darby Metro Park *(non-reference station)*
Battelle-Darby Creek Metro Park in Franklin County is one of the few public facilities that provide ready access to the Darby Creeks. The Cedar Ridge Public Use Area is the main entrance for the park off Darby Creek Drive. Restroom facilities and ample parking make this an excellent site for large groups.

River Mile 38.9 - U.S. Route 40 Bridge, Prairie Township
The riffle is located upstream of the Route 40 overpass and is accessed.by the Columbus and Franklin County Metro Park property on the northeast side of the bridge if you are heading away from Columbus. A gated dead-end road leads to the creek. Park at the gate and access the river under the bridge.

River Mile 40.5 - Battelle Institute of Technology, Jefferson Township
This riffle is located on the Battelle Institute of Technology's property off of Plain City-Georgesville Road. This site is off-limits to public access and is monitored by a Battelle employee.

River Mile 42.1 - Sasson Riffle-Sycamore Plains, Prairie Oaks Metro Park
The riffle is located at the Sycamore Plains access of Prairie Oaks Metro Park. The entrance is located on Amity Road several miles from the main entrance of the park at 3225 Plain City-Georgesville Road. The riffle is named for the volunteer who monitors the site, Anthony Sasson, a devoted supporter of Darby Creek. He has spent much of his career with The Nature Conservancy and is highly dedicated to the conservation of this unique watershed.

River Mile 52.05 - Plain City Waste Water Treatment Facility, Village of Plain City
This site is located at the wastewater treatment facility and upstream from the railroad trestle in Madison County. The riffle is located adjacent and downstream of the wastewater effluent discharge. Good populations of damselfly larvae and some pollution-tolerant organisms, such as leeches and bloodworm midge larvae, have been observed.

River Mile 59.8 - Unionville Road Bridge, Village of Unionville Center
The site is located in Unionville Center in Union County; it is a short distance downstream from the bridge. Although wide and pooled immediately under the bridge, the creek narrows into a riffle area 15 feet wide. Access to the riffle area is easiest from the north side of the creek via private property. Landowner permission is required.

River Mile 68.7 - Middleburg Plain City Rd, Milford Center *(New Non-Reference Station)*
The riffle site is located upstream of Milford Center off of Middleburg-Plain City Road, in Union County. This part of the river is protected by the Scenic River Program. The river is narrow with a well-developed wetland adjacent to the riffle site during the spring and early summer. The riffle is comprised of a soft substrate primarily gravel and sand.

Little Darby Creek

River Mile 3.7 - Central Ohio Anglers and Hunters Club (COAHC), Jefferson Township
COAHC is a private club located south of West Jefferson along the south side of Little Darby Creek in Madison County. Several COAHC members monitor this station as it is not accessible to the public; permission from COAHC should be granted before monitoring. The current can be swift and deep through this area. Since Little Darby Creek has a higher stream gradient than Big Darby Creek, currents tend to be swifter.

River Mile 6.3 - U.S. Route 40, Village of West Jefferson
This site is located adjacent to the McDonald's restaurant in West Jefferson, Madison County. The sampling station is approximately one-tenth of a mile downstream from the bridge, on the downstream tip of the island. This riffle is quite small, but offers good riparian buffer and in-stream habitat.

River Mile 14.9 - Goodson Road, Jefferson Township
Goodson Road runs west toward Little Darby Creek off of Taylor-Blair Road before making a sharp turn to the north towards U.S. Route 42. The riffle area in Madison County is just west of this turn and may not be accessed without first obtaining the landowner's permission.

Sampling Results and General Trends

Early summer flooding made conducting late spring assessments a challenge. According to the National Oceanic and Atmospheric Administration (NOAA), during the months of June and July central Ohio saw a total of 12.47" of rain, a 4.38" increase over the 100-year average (1913 to 2012) of 8.09". Many volunteers that had waited until the end of June to take their spring samples were unable to perform their assessment until the end of July. August and September were slightly below the 100-year average allowing an opportunity for the rivers to recover from the early season floods. Despite the deficiency in August and September, the sampling season (May to October) ended with a deviation of +2.09" over the 100-year average. The flooding during the 2013 season appeared to have little effect on the macroinvertebrate community. The Scenic Rivers SQM Project requires that each assessment is to be conducted at a minimum of 30 days apart between the months of May and October. Additionally, the SQM Project requires a minimum of three readings to calculate a Cumulative Index Value (CIV). In 2013, volunteers or ODNR staff monitored all sites a minimum of three times.

During 2013, volunteers and ODNR staff conducted 62 assessments at 10 official reference stations in Big Darby Creek. In addition, two non-reference stations, River Mile 34.7 and 68.7, were monitored. Big Darby Creek scored an average CIV of 29.48, corresponding to the excellent range of water quality. The average increased slightly from the 2012 average of 29.2. Five of the reference stations showed a decrease in the individual CIV; despite the decrease at these stations, the river maintains its excellent health score. All sites scored in the excellent water quality range, except for River Mile 3.2. It is unclear why there was a decrease at this site. Three samples were taken during the season, ranging from a CIV of 20 to 28. Scenic Rivers staff will watch the site closely in 2014. The average taxonomic diversity per assessment was 13 macroinvertebrate orders (e.g. stonefly, damselfly, mayfly, etc.), a slight increase from 2012. The mid-season flooding did not seem to have a significant effect on the macroinvertebrate community.

During 2013, volunteers and ODNR staff conducted 12 assessments at 3 official monitoring sites in Little Darby Creek. Little Darby Creek scored an average CIV of 29.83, meeting the excellent range of stream quality. The average of the Little Darby Creek has slightly decreased from the 2012 average of 31.57. The average taxonomic diversity per assessment was 12 macroinvertebrate orders, up 1 from the previous year.

The continued efforts by the Columbus and Franklin County Metro Parks, The Nature Conservancy, the Darby Creek Association, and many other valuable constituents in conjunction with the Ohio Department of Natural Resources has been crucial in the preservation of this delicate ecosystem. The return of sensitive species such as otters and bald eagles are a testament to the combined conservation efforts. Development and agriculture continue to put pressure on the northern and southern parts of the watershed. We will continue to closely monitor these areas and work to maintain or improve conditions throughout the watershed.

Data collected by SQM Project volunteers and ODNR staff is used as a water quality-screening method. The data helps to detect significant changes in stream quality based on CIV data from sites monitored for many years. If there is a significant decline in the average CIV, potential problems that may be causing stream degradation can be further investigated and addressed.

The staff of the Ohio Scenic Rivers Program appreciates the assistance we received from our dedicated volunteer monitors. It is only through their efforts that it was possible to complete the SQM samples in the Big and Little Darby during 2013. Working together has produced significant results but additional Scenic Rivers' volunteers are needed to monitor reference sites, ensuring accurate and thorough data collection. For more information, please contact the Central Ohio SQM Coordinator at 740-548-5490.

Total Suspended Solids (TSS)

In 1999, the Scenic River Program added Total Suspended Solids (TSS) monitoring to the Stream Quality Monitoring Project. The purpose of this addition is to estimate the amount of soil sediments affecting a stream by estimating the turbidity of the water. These sediments are attributed to problems originating upstream of the sampling site. The equipment is calibrated to predict TSS at 90% accuracy. The measurements are accurate enough to determine the changes in sediment rates in a stream at a given location and time.

Variables such as amount of precipitation, slope and gradient of the river system, soil type, time of year data is collected, amount of development, amount of riparian corridor, velocity of the river flow and the amount of waste water effluent have an effect on the TSS value.

Precipitation amount is important because of the increased potential for sediments to be carried into the river during a rain event. The TSS value may appear higher than normal if precipitation amounts are not taken into account. Since large rain events usually happen in the spring and early summer, the time of year the samples are taken could affect the TSS score. The gradient of the stream is important as well. Sediments do not settle out as easily in high gradient streams because the velocity of the water washes it downstream. In low gradient streams, sediment has a chance to settle out, resulting in a lower TSS value. Soil types affect TSS values because some soil types erode faster than others. A better understanding of the types of soils within the watershed may give way to a better understanding of the baseline TSS values for a stream.

Development in an area can cause changes in the TSS score. Areas cleared for new buildings are often not covered, causing an acute rise in the amount of suspended solids in nearby streams. Impermeable surfaces can also cause chronic elevation of TSS values because there is no buffer to absorb or trap runoff. Wastewater treatment plant effluent would only affect TSS scores in low flow situations, and only if the plant employs only primary or secondary treatment.

The actual process of taking a sample is simple. Using a clear Lucite sediment stick developed by the Lake Soil and Water Conservation District, a water sample is collected from the stream. Keeping the sample materials suspended, water is then poured out of the tube until the 0.4-inch target dot is visible on the tube bottom. A reading of the water column height is taken from the markings on the stick to the nearest ¼ inch. A conversion table is then used to convert the sediment stick reading to total suspended solids measurement in the form of an estimate of the weight of solids suspended in the water column (mg/l).

The TSS measurement can be used to estimate water quality with the following scale:

TSS <10 mg/l = excellent water quality
TSS 10-28 mg/l = normal water quality
TSS 29-133 mg/l = impaired water quality
TSS >133 mg/l = severely impacted water quality

2013 Results: A total of 52 TSS readings were taken in Big Darby Creek. Big Darby Creek had a median value of 13 mg/L of TSS, which corresponds to the normal range. The data set ranged from <6.2 mg/L to 39 mg/L of total suspended solids. A total of five TSS readings were taken in Little Darby Creek. Little Darby Creek had a median value of 10 mg/L of TSS, which corresponds to the excellent range. The data set ranged from <6.2 mg/L to 20 mg/L of total suspended solids.

Comparisons of Collected Stream Quality Monitoring Data

Frequent monitoring of the same reference station is performed a minimum of three times per year consistently year after year. An assessment of the diversity and tolerance levels of taxonomy collected generates the Cumulative Index Value (CIV) for the site on a given date. Field assessment results are used as basic indicators of long-term changes in a stream's macroinvertebrate community and help the Scenic Rivers staff identify pronounced stream quality problems.

The following Table 1 identifies the 20 macroinvertebrates assessed and their general tolerance to pollutants. Pollution-intolerant organisms, such as those listed in Group I, require unpolluted, high quality water in order to survive. Pollution-tolerant organisms, such as those listed in Group III, are extremely tolerant of deteriorated water conditions.

Table 1. Macroinvertebrate Pollution Tolerance

Group I Taxa Pollution Intolerant	Group II Taxa Moderately Tolerant	Group III Taxa Pollution Tolerant
Water Penny Beetle Larvae (WP)	Damselfly Nymphs (DA)	Black Fly Larvae (BF)
Mayfly Nymphs (MF)	Dragonfly Nymphs (DR)	Aquatic Worms (AW)
Stonefly Nymphs (ST)	Crane Fly Larvae (CR)	Midge Larvae (MI)
Dobsonfly Larvae (DO)	Beetle Larvae (BL)	Pouch Snails (PS)
Caddisfly Larvae (CD)	Crayfish (CF)	Leeches (LE)
Riffle Beetle Adult (RI)	Scuds (SC)	
Other Snails (OS)	Clams (CL)	
	Aquatic Sowbugs (SW)	

Tables 2 and 3 represent the mean CIV for each SQM reference station sampled on the river during 2013. In addition, the table uses symbols (◆) to indicate those macroinvertebrates found to be present at least once during the year at the respective reference station. Each macroinvertebrate is identified by a two-letter code given in Table 1. A CIV of 23 or greater indicates *Excellent* stream quality; a CIV of 17-22 indicates *Good* stream quality; a CIV of 11-16 suggests *Fair* stream quality; and a CIV of 10 or less reflects *Poor* stream quality. Situated beside the CIVs are the symbols + (improved), = (equal), or – (declined) indicating the relationship to the previous year's CIV.

For the full range of CIVs attained at all sites monitored during the year including non-reference stations, please see the *Appendix*.

Table 2. Big Darby Creek 2013 Mean CIVs by Reference Station

Station	WP	MF	ST	DO	CD	RI	OS	DA	DR	CR	BL	CF	SC	CL	SW	BF	AW	MI	PS	LE	CIV
3.2	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆			◆			◆			◆	**22-**
13.3	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆		◆	◆	◆	◆	◆	**28-**
19.1	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆			◆		◆	◆	**28=**
23.6	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆			◆		◆	◆	**30+**
29.3	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆		◆		◆	◆	◆			**24+**
33.7	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	**33+**
38.9	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆		◆	◆	◆			**28+**
42.1	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆		◆	◆		◆	**26-**
52.05*	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆		◆			◆	◆		◆	**26-**
59.8	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆			◆	◆	◆	◆	**30-**

Table 3. Little Darby Creek 2013 Mean CIVs by Reference Station

Station	WP	MF	ST	DO	CD	RI	OS	DA	DR	CR	BL	CF	SC	CL	SW	BF	AW	MI	PS	LE	CIV
3.7	◆	◆	◆		◆	◆	◆	◆		◆	◆	◆		◆		◆	◆	◆	◆		29
6.3	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	30-
14.9	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆		◆	3

*River mile 52.05 replaced river mile 51.95 after a review of the river miles showed that it was mislabeled by 0.1 mile.

Figures 1.1 and 1.2 represent the maximum and minimum range of CIVs recorded during the year for each reference station. Figures 2.1 and 2.2 represent the mean CIVs at each reference station over many years.

Figure 1.1 - Big Darby Creek 2013 CIV Maximum and Minimum Ranges

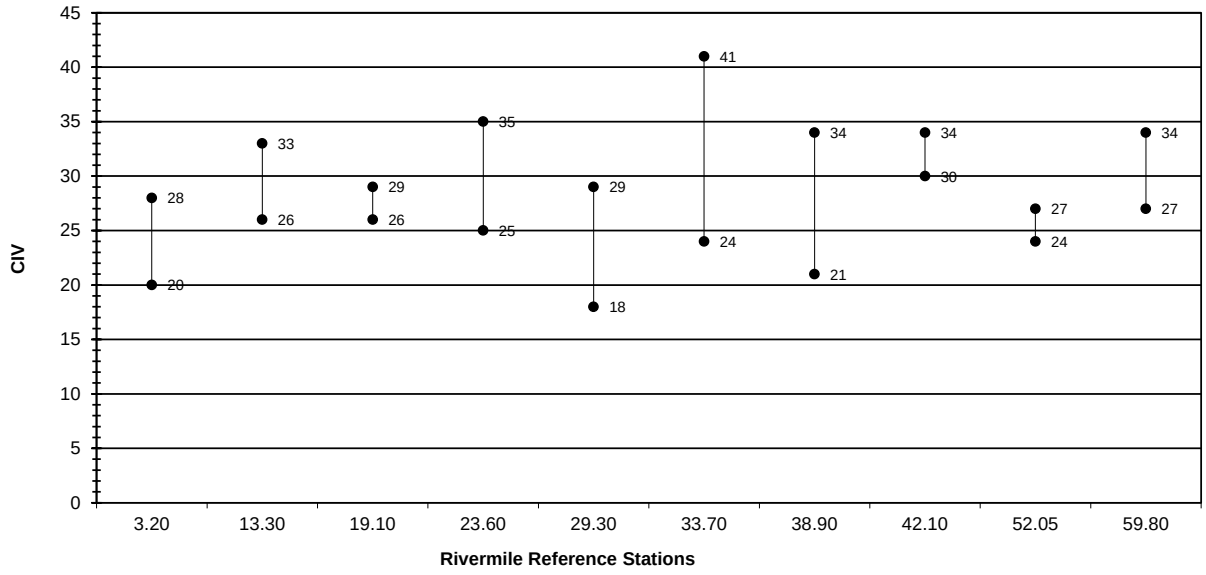


Figure 2.1 - Big Darby Creek 2004-2013 Mean CIVs

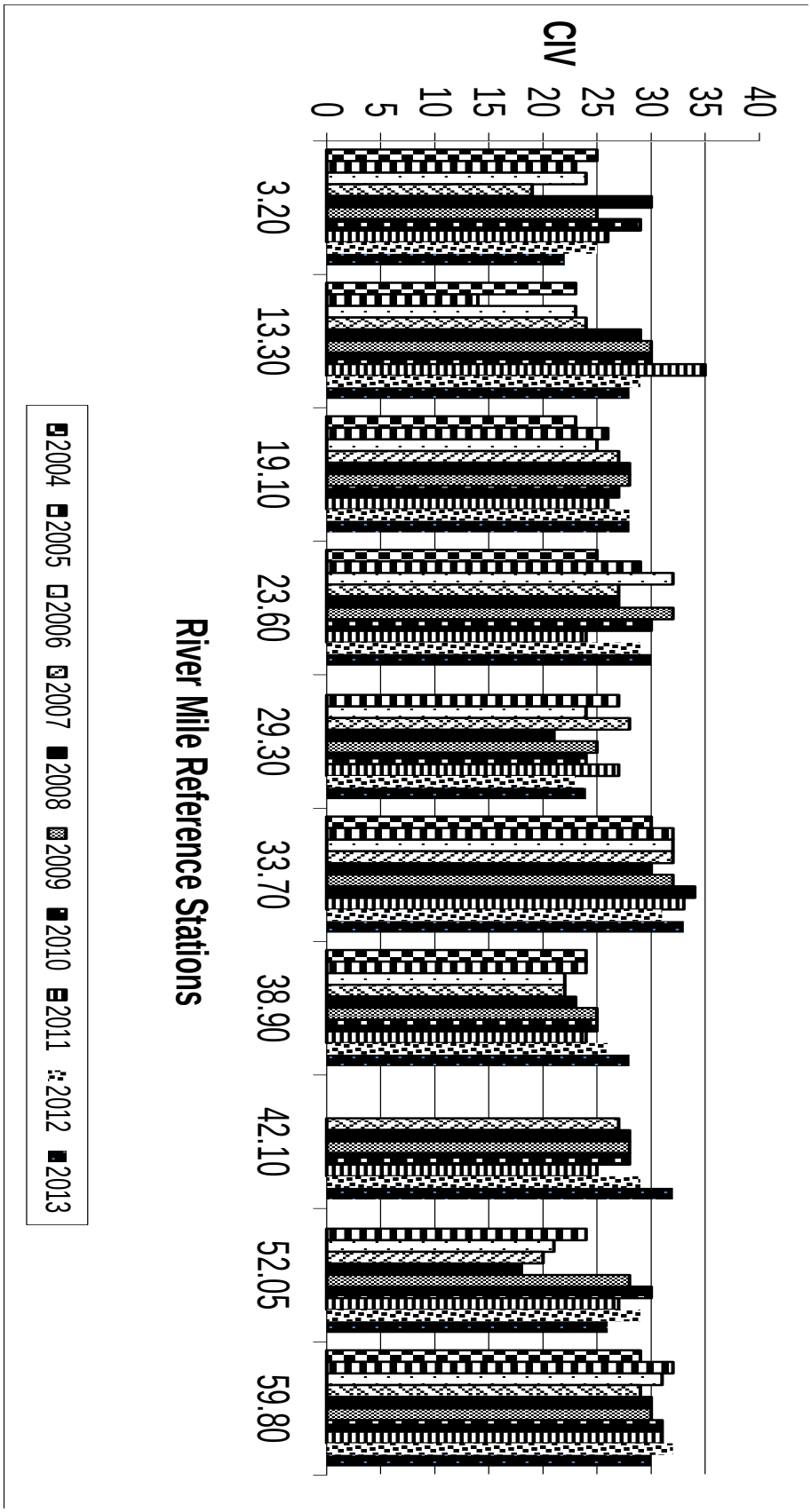


Figure 1.2 - Little Darby Creek 2013 CIV Maximum and Minimum Ranges

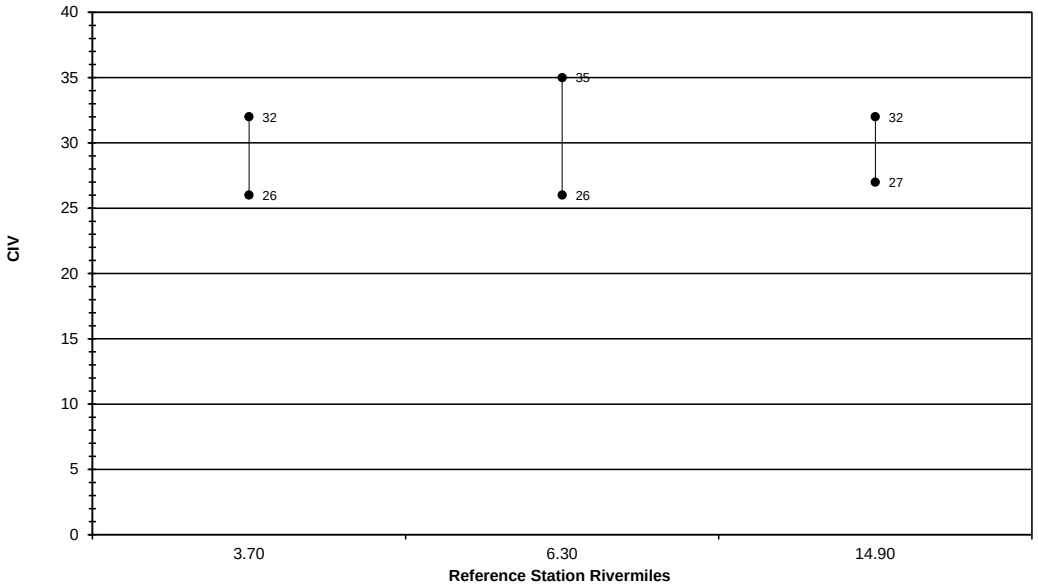
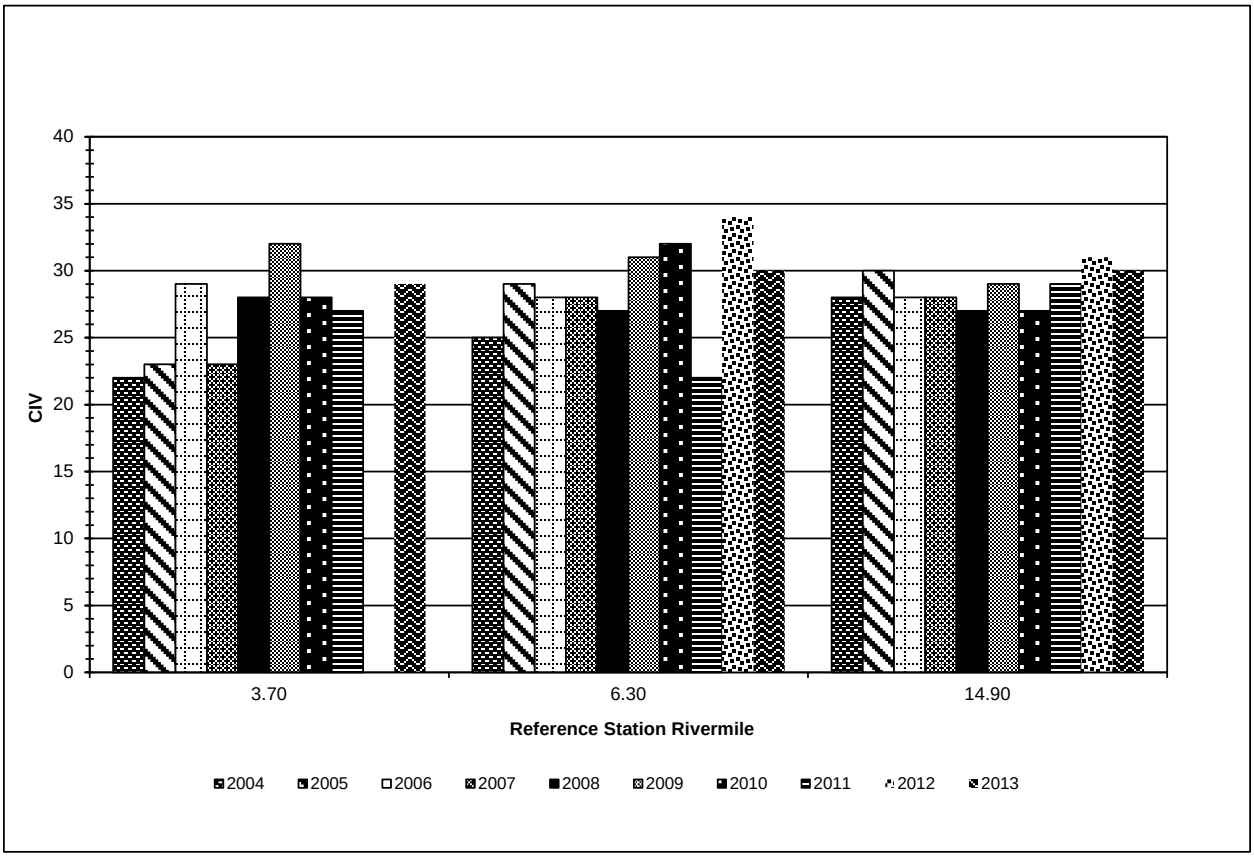


Figure 2.2 - Little Darby Creek 2004-2013 Mean CIVs



Qualitative Habitat Evaluation Index (QHEI)

The Qualitative Habitat Evaluation Index (QHEI) is a system developed and employed by the Ohio Enironmental Protection Agency (OEPA) to measure physical habitat conditions in and around rivers and streams in Ohio. During 1998, the Stream Quality Monitoring Project staff tested a modified version of the QHEI, referred to as *Citizen's QHEI,* to gather baseline measurements at reference stations on several of Ohio's scenic rivers. It is anticipated that such measurements will become yet another annual tool that will be used to monitor habitat and water quality conditions on all Ohio scenic rivers.

Beginning in 2001, Central Ohio Scenic Rivers staff completed QHEI evaluations at four reference stations on Big Darby Creek. These habitat conditions will be re-evaluated every five years.

Results from 2009 QHEI are included below. When attempting to interpret this data, it is important to recognize that OEPA generally concludes that any site receiving a QHEI value greater than 60 meets current warm water habitat (WWH) standards. Meeting WWH standards suggests that such locations should be adequate for supporting reproducing communities of fish and macroinvertebrate life. Sites attaining QHEI scores of greater than 80 are generally believed to contain exceptional habitat conditions for warm water communities.

Tables 4 and 5 have been prepared to assist with determining the relationship between habitat conditions, measured by the QHEI, and macroinvertebrate community performance, measured by the Cumulative Index Value, at each of the reference stations on selected rivers.

Table 4 - Big Darby Creek 2009 QHEI and SQM Assessment Data

Reference Station	QHEI	2009 Average CIV	SQM Assessment
RM 3.2	76.5	25	Excellent
RM 13.3	86.0	30	Excellent
RM 19.1	78.0	28	Excellent
RM 23.6	89.0	32	Excellent
RM 29.3	90.5	25	Excellent
RM 33.7	93.0	32	Excellent
RM 38.9	90.0	25	Excellent
RM 42.1	85.5	28	Excellent
RM 52.05	81.0	28	Excellent
RM 59.8	86.0	30	Excellent

Table 5 - Little Darby Creek 2009 QHEI and SQM Assessment Data

Reference Station	QHEI	2009 Average CIV	SQM Assessment
RM 3.7	94.25	32	Excellent
RM 6.3	90.0	31	Excellent
RM 14.9	77.0	29	Excellent

Appendix

2013 Data by Monitoring Station

BIG DARBY CREEK																					
RM	DATE	WP	MF	ST	DO	CD	RI	OS	DA	DR	CR	BL	CF	SC	CL	SW	BF	AW	MI	PS	LE	CIV
3.20	5/24/2013	A	A	A		A	A	B			A											20
3.20	8/5/2013	A	B	A	A	A	C	B		A	A	A									A	28
3.20	9/9/2013	B	C			C	C	B			A				A			B				20
13.30	6/19/2013	C	A	A	A	C	C			A	B	B	A					B	B	C		29
13.30	6/22/2013	A	A	A		B	B	B		A					B		A		A		A	25
13.30	8/18/2013	B	B	B	A	C	C		A	B	A	C	A		C			A	B	C		33
13.30	8/25/2013	B	B	A	A	C	B	B							A		A	A	A			26
13.30	10/12/2013	B	A	B		B	C	B			B	A			B		A	B			A	27
19.10	6/19/2013	B	B	A	A	C	C	B	A			A		A		B		A				29
19.10	8/29/2013	B	A	B	A	C	C	B	A		A				C			A			A	29
19.10	11/7/2013	A		C	A	C	A	B			A		A		C			A		A		26
23.60	5/4/2013	A	B	B	A	B	B	B	A	A	A	B	A		B			A	B			35
23.60	5/29/2013	B	B	A		B	B	B	A			B			A				C			25
23.60	7/26/2013	A	B	B	A	B	B	B	A	A	A	B	A		A			A	A			35
23.60	8/17/2013	B	C	B	B	C	C	B	A			A			B			B	C		B	30
23.60	9/27/2013	A	A	B	B	B	B	A	A		A	B			A			A	A	A		32
23.60	10/19/2013	A	B	C	B	C	B	B				A			B							25
29.30	7/18/2013	B	B		A	B	B	B				B	A		B				A			25
29.30	8/27/2013	A	A	A		B	A	A							A			B				21
29.30	9/11/2013	A	B	A		C	B	A	A			B			A		B	B	B			27
29.30	10/14/2013	B	A	A	A	B	B	A	A		A		A		A			A				29
29.30	10/27/2013	A	B	B		B			A						A			B	B			18
33.70	5/12/2013	A	A	B		A		A	A	A	A		A		A							25
33.70	5/13/2013	B	B	B	A	B	B	B	A	A	B	B	A		B		B	A	B	A		37
33.70	6/22/2013	B		A	A	C	B	A			A				C			A			A	24
33.70	8/16/2013	B	A	A	A	C	B	B		A		B	B		B			A				30
33.70	8/28/2013	B	A	A	B	C	B	A		A			A		C			A				28
33.70	9/11/2013	B	A	C	B	C	C	B	A				B		B			B	C		B	30
33.70	9/11/2013	C	B	C	C	B	B	B	A	A	A		B		B			A				32
33.70	9/12/2013	C	B	B	B	A	B	B	B	A	A		B							B		32
33.70	9/16/2013	C	B	B	B	A	B	B	B	A	A	B	B		B					B	A	35
33.70	9/19/2013	C	B	C	B	B	B	B	B	B	A	B	B		C	B				B	A	37
33.70	9/20/2013	C	B	B	B	B	B	B	B	B	A	A	A	A	B	A	A	A	A	B		41
33.70	9/23/2013	B	A	B	B	B	B	B	A	A	A	B	B		C	A		A			A	37
33.70	9/24/2013	C	B	B	B	B	A	C	A	A		A	B		C			A		A	A	34

BIG DARBY CREEK																						
RM	DATE	WP	MF	ST	DO	CD	RI	OS	DA	DR	CR	BL	CF	SC	CL	SW	BF	AW	MI	PS	LE	CIV
33.70	9/26/2013	B	A	B	B	A	A	A	A	A			B	A	B			A	A			33
33.70	9/26/2013	B	A	B	B	B		B	B	B		A	B		B	A		A	A	A	A	34
33.70	9/26/2013	B	A	B	A	A	A	B	A	A	A	A	B	A	B	A		A	A	A		40
33.70	9/27/2013	B		B	B	A		A	A	A	A	A	A							A		28
33.70	9/27/2013	A	A	B	A		A	B	A	A	A	A	A	A	A	A			A	A		36
33.70	10/1/2013	C	B	C	B	B	B	B	A		A	A	A		B							31
33.70	10/4/2013	C	B	B	B	B	B	B	B	A		A	B	A	B					B		34
33.70	10/11/2013	B	B	B	A	B	B	C	A		A		A	A	C			A	A		B	30
33.70	11/7/2013	B	A	C	A	C	A	A			A		A		C			A				28
34.60	5/21/2012	A	A	A		A	A	A	A				A		A		A	A			A	27
34.60	5/14/2013	B	A	B	B	B	B	B	A	B	B	A	B		B		A	B	A			36
34.60	8/15/2013	B	A	B	A	B	A	C	A	A	B		C		C					A		32
34.60	9/27/2013	B	A	B	A	B	A		A	A	B		A		B		A			A		30
38.90	5/21/2013	B	A	B			C	B		A	A	B	A		A		A	A	B			28
38.90	6/19/2013	B	B	B	A		B	A		A	A		C		A		A	B				28
38.90	8/3/2013	B	A	A		A	B	B		A	A	A	B		B		A	A	A			31
38.90	8/20/2013	B		A		A	A	B	A	A			B									21
38.90	9/26/2013	B	A	B			B	B	B	A			B		A			A				24
38.90	10/6/2013	B	A	B		A	B	A		A	A	A	B		B		A	A	A			34
42.10	5/19/2013	B	A	B		A	B	C	A		A	B	A		A				A		A	30
42.10	8/24/2013	B	A	B	A	B	B	B	A	A	A	B	B		A							33
42.10	10/18/2013	A	B	A		B	B	B	A	A	A	B	A		A	A		A	A			34
52.05	6/14/2013	B	A	A		C	C	A	B			A	A		B			A				27
52.05	8/16/2013	B	A			C	C	A			A	B	B		B			A	A		A	26
52.05	10/2/2013	B	A	A		B	C		B			C	C		A				A			24
59.80	6/8/2013	B	B	A	A	C	B	B	A		A	A	B		B			B	B	A		34
59.80	6/16/2013	B	A	A	A	B	A	B			A		B		A				A			28
59.80	8/4/2013	B	B	A	A	C	B	B				B	B		C			B	A			29
59.80	8/11/2013	B	A	A	A	B	B	B	A				A		B							27
59.80	9/15/2013	B	B	B	B	C	B	B	B		B	B	B		C			B	A			33
59.80	9/15/2013	C		B		C	B	C	B	A	A		B		B			A	A		A	28
68.70	6/24/2013	C	A	A		C	B	B			B	B	B		C			A	A			28
68.70	8/16/2013	B	A			C	C	A			A	C	C		B			A	A	A		26
68.70	10/2/2013	C	A			C	B	A	A		A	B	B		A					A		26

LITTLE DARBY																					
RM	DATE	WP	MF	ST	DO	CD	RI	OS	DA	DR	CR	BL	CF	SC	CL	SW	BF	AW	MI	PS	LE	CIV
3.70	7/18/2013	B	B			B	B	A			A	B	B		B			A	A	A		26
3.70	9/10/2013	B	B	A		B	A	A	A			A	A		A		B	A	B			29
3.70	11/8/2013	B	B	B		B	A	B	A		B	B	A		B			B	A			32
6.30	6/2/2013	B	A	B		C	A	B			A	B	B		B		B	B	C		A	30
6.30	7/28/2013	A	C			C	B	B			A	B	B		C		A	B	B			26
6.30	9/1/2013	C	B	A	A	B	B	A	B		A	A	A		A		A	B	A		A	35
14.90	5/20/2013	A	A		A	B	A	B	A		A	A	B					B		A	A	29
14.90	6/29/2013	A	A	A		B	B	B	A		A		B		A		A	A	A		B	30
14.90	8/3/2013	A	B	A		B	A	B		A	A		B		A		A	A	A		A	30
14.90	8/22/2013	A	B			B	A	B	A	A	A	A	B					A			A	27
14.90	9/22/2013	A	B	B	A	B	B	A	A		A		B		A		A		A		A	32
14.90	9/27/2013	B	B	A	A	C	B	B	A	A	A	B	B					B				32