Appendix

B

STATUS OF WATER QUALITY
MOXAHALA CREEK WATERSHED

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Streams in the Moxahala Creek watershed are designated with various aquatic life uses, including coldwater habitat (CWH), exceptional warmwater habitat (EWH), a dual use of CWH and EWH, warmwater habitat (WWH), modified warmwater habitat (MWH) from both acid mine drainage and channelization, and limited resource water (LRW). All waters are designated as primary contact recreation (PCR) class B. Some aquatic life uses were changed in rule OAC 3745-1-24 following the 2008 field study. Results of that study (*Biological and Water Quality Study of the Moxahala Creek Watershed, 2008. Perry, Morgan, Muskingum and Licking Counties, Ohio)*, also called the technical support document (TSD), are available at http://www.epa.ohio.gov/portals/35/documents/MoxahalaCreekTSD2008.pdf.

B1 Aquatic Life Use Attainment

Overall, the Moxahala Creek watershed is mostly meeting the aquatic life use goals of the Clean Water Act, with 59% of the watershed fully attaining goals, 13% in partial attainment and 28% in non-attainment of the goals. Due to the extensive impacts from historic mining, none of the six sites on the Moxahala Creek mainstem are meeting the LRW-acid mine drainage (AMD) aquatic life use designation. The biological community performance was mostly fair to very poor in the Moxahala Creek subwatershed. In contrast, seven of the eight sites on the Jonathan Creek mainstem were meeting the WWH aquatic life use designation. The majority of the sites in the Jonathan Creek subwatershed had a biological community performance of good to excellent.

Table B-1. Aquatic life use attainment table for the Moxahala Creek watershed.

Nested Sub-watershed	Site Name	River Mile	Drainage Area (sq. mi.)	Designated ALU	Attainment Status	Causes of Impairment	Sources of Impairment
04 01	Valley Run upst. Berry Run @ Laurel Hill Rd.	5.40	9.7	EWH	Partial	Dissolved oxygen	On-site treatment systems (septic systems and similar decencentralized systems), nonpoint source
04 01	Valley Run @ Cherry Hill Rd. (Twp. Rd. 333)	3.50	17.3	EWH	Full	-	-
04 01	Valley Run @ Hopewell Indian Rd.	1.28	26.4	EWH	Full	-	-
04 02	Bowling Green Run @ Boundaries Rd.	0.10	11.1	WWH	Full	-	-
04 02	Jonathan Creek @ St. Rt. 204	27.10	7.4	CWH	Full	-	-
04 02	Jonathan Creek @ Hopewell Indian Rd.	22.32	27.4	WWH	Full	-	-
04 03	Turkey Run @ Twp. Rd. 49 (upper crossing)	2.90	8.1	WWH	Full	-	-
04 03	Turkey Run near mouth @ RR bridge	0.25	14.2	WWH	Full	-	-
04 04	Buckeye Fork adj St. Rt. 345/Old Ranier Rd.	4.90	8.1	LRW	Non	Aluminum, manganese, nickel, sulfates, acidity (cold titration)	Acid mine drainage, coal mining
04 04	Buckeye Fork @ Fletcher Rd.	3.41	16.7	LRW	Non	Aluminum, sulfates, acidity (cold titration), nickel, manganese	Acid mine drainage, coal mining
04 04	Buckeye Fork at East Fultonham, adj. Rabbit Lane or TR 88	1.20	22.7	LRW	Full	-	-
04 04	Bush Creek at mouth @ St. Rt. 345	0.10	3.0	WWH	Full	-	-
04 04	Butcherknife Creek @ St. Rt. 345	0.08	6.8	LRW	Non	Aluminum, manganese, nickel, acidity (cold titration), sulfates	Acid mine drainage, coal mining
04 05	Kent Run @ Asbury Chapel Rd.	8.85	9.8	WWH	Full	-	-
04 05	Kent Run @ Slack Rd.	3.68	15.1	WWH	Full	-	-
04 05	Kent Run @ Lower Kroft Rd, at the Maysville WTP intake	1.35	22.3	WWH	Full	-	-
04 05	Salt Run at mouth @ Bagley Rd.	0.02	3.2	CWH	Full	-	-
04 06	Hibbs Run @ Coppermill Rd.	0.10	1.6	EWH/CWH	Full	-	-
04 06	Thompson Run @ Coppermill Rd.	4.73	9.3	CWH	Full	-	-
04 06	Thompson Run @ U.S. Rt. 22	0.39	15.3	WWH	Full	-	-

Nested Sub-watershed	Site Name	River Mile	Drainage Area (sq. mi.)	Designated ALU	Attainment Status	Causes of Impairment	Sources of Impairment
04 07	Jonathan Creek dst Glass Rock trib, off St. Rt. 204	17.40	70.0	WWH	Full	-	-
04 07	Jonathan Creek at Mt. Perry @ Co. Rd. 34	12.30	103.0	WWH	Full	-	-
04 07	Jonathan Creek @ Workman Rd.	7.60	125.0	WWH	Full	-	-
04 07	Jonathan Creek near white cottage @ Crock Rd.	3.35	150.0	WWH	Full	-	-
04 07	Jonathan Creek near Avondale @ St. Rt. 93	1.06	193.0	WWH	Partial	Direct habitat alterations	Dam or impoundment
04 07	Jonathan Creek dst St. Rt. 93 dam pool @ Powell Rd.	0.90	193.0	WWH	Full	-	-
04 07	Painter Creek @ Twp. Rd. 76, dst. trib.	2.48	11.3	WWH	Full	-	-
04 07	Painter Creek @ Cooperrider Rd. (covered bridge)	0.85	17.8	WWH	Full	-	-
04 07	Painter Run @ mouth	0.10	4.6	MWH-C	Full	-	-
04 07	Trib to Jonathan Cr (13.74) dst suburban LF @ Snook Rd.	0.32	1.3	WWH	-	-	-
04 07	Trib. to Jonathan Creek (19.47) near mouth @ Twp. Rd. 19	0.75	6.0	WWH	Full	-	-
05 01	Black Fork upst. Ogg Creek, adj. Tatmans Rd. (Co. Rd. 22)	3.20	9.5	WWH	Partial	Dissolved oxygen	On-site treatment systems (septic systems and similar decencentralized systems)
05 01	Black Fork dst. Ogg Creek, dst. seep	2.50	23.0	LRW	Non	Aluminum, manganese, acidity (cold titration), sulfates, iron	Acid mine drainage, coal mining
05 01	Black Fork dst. Ogg Creek @ St. Rt. 669	1.93	24.4	LRW	Non	Iron, acidity (cold titration), aluminum, manganese, sulfates	Coal mining, acid mine drainage
05 01	Black Fork just S of Crooksville @ St. Rt. 669	0.10	28.7	LRW	Non	Sulfates, acidity (cold titration), iron, aluminum, manganese	Acid mine drainage, coal mining
05 01	Ogg Creek S of Deavertown @ St. Rt. 555	2.10	6.1	WWH	Partial	Ammonia (total), nitrate/nitrite (nitrite + nitrate as N)	On-site treatment systems (septic systems and similar decencentralized systems)
05 01	Ogg Creek near mouth (at white house)	0.20	13.3	MWH-A	Non	Sulfates, iron, aluminum	Acid mine drainage, coal mining

Nested Sub-watershed	Site Name	River Mile	Drainage Area (sq. mi.)	Designated ALU	Attainment Status	Causes of Impairment	Sources of Impairment
05 02	Andrews Run (trib to Moxahala Creek @ RM 24.79) @ St. Rt. 13	0.33	5.8	LRW	Non	Sulfates, acidity (cold titration), nickel, manganese, iron	Acid mine drainage, coal mining
05 02	Moxahala Creek S of Moores Junction @ Twp. Rd. 312	24.00	9.0	LRW	Non	Manganese, aluminum, iron, pH, nickel	Coal mining, acid mine drainage
05 02	Moxahala Creek dst. St. Rt. 37	21.80	23.3	LRW	Non	pH, acidity (cold titration), nickel, manganese, aluminum	Coal mining, acid mine drainage
05 02	Trib. to Moxahala Creek (22.56) S of Moores Junction @ SR 13	0.10	0.4	MWH-A	Partial	Acidity (cold titration), nickel, iron, sulfates, aluminum	Acid mine drainage, coal mining
05 03	Moxahala Creek dst. Roseville WWTP	13.40	75.0	LRW	Non	pH, manganese, acidity (cold titration), sulfates, nickel	Coal mining, acid mine drainage
05 04	Moxahala Creek S of Avondale @ Lambert Rd.	6.80	98.0	LRW	Non	Sulfates, pH, acidity (cold titration), nickel, manganese	Coal mining, acid mine drainage
05 04	Moxahala Creek just dst. Jonathan Creek @ Twp. Rd. 261	4.30	194.0	WWH	Non	Nickel, manganese, aluminum	Coal mining, acid mine drainage
05 04	Moxahala Creek at South Zanesville @ Co. Rd. 6	0.58	302.0	WWH	Partial	Ammonia (total), manganese, aluminum	Coal mining, acid mine drainage, sanitary sewer overflows (collection system failures)
05 04	Shawnee Run @ Milldale Rd./Greenhouse Rd.	0.08	2.6	WWH	Full	-	-

B1.1 Causes and Sources of Impairment

Pollutants related to acid mine drainage were the most common in the watershed, aprticularly in the Moxahala Creek subwatershed. One nested subwatershed in the Jonathan Creek subwatershed also had AMD-related impacts. Figures B-1 through B-4 show the distribution of causes and sources of aquatic life use impairment within each subwatershed.

Figure B-1. Causes of aquatic life use impairment in the Jonathan Creek subwatershed.

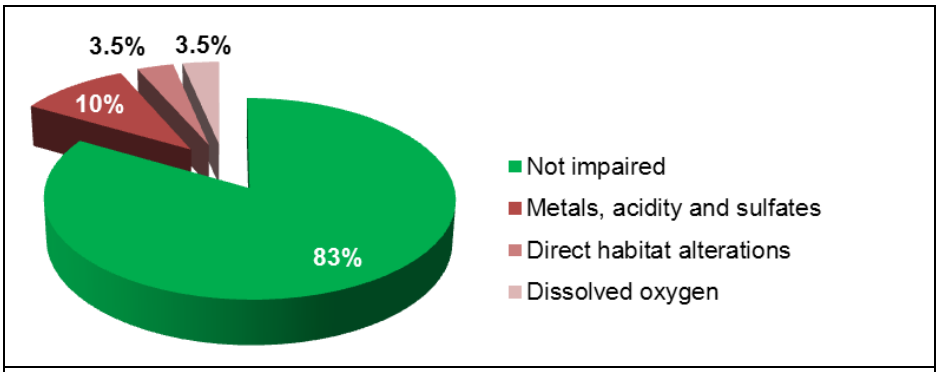
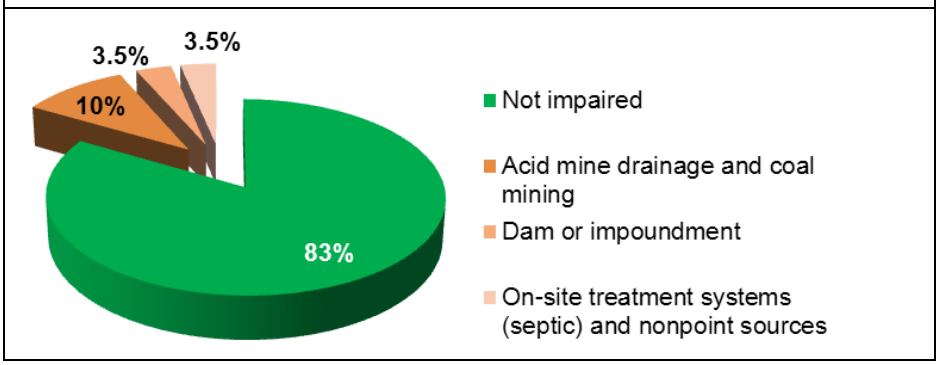


Figure B-2. Sources of aquatic life use impairment in the Jonathan Creek subwatershed.



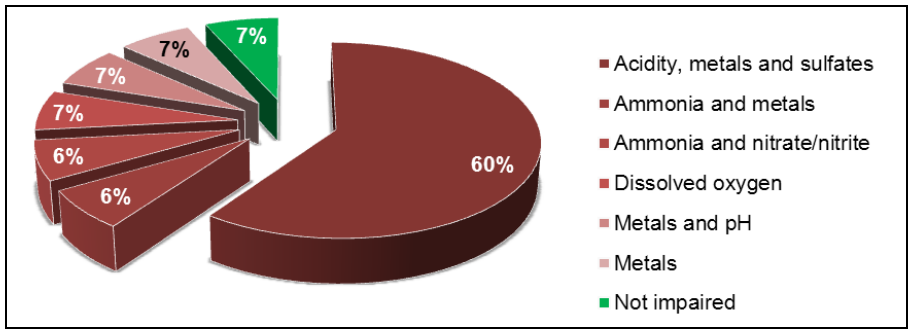


Figure B-3. Causes of aquatic life use impairment in the Moxahala Creek subwatershed.

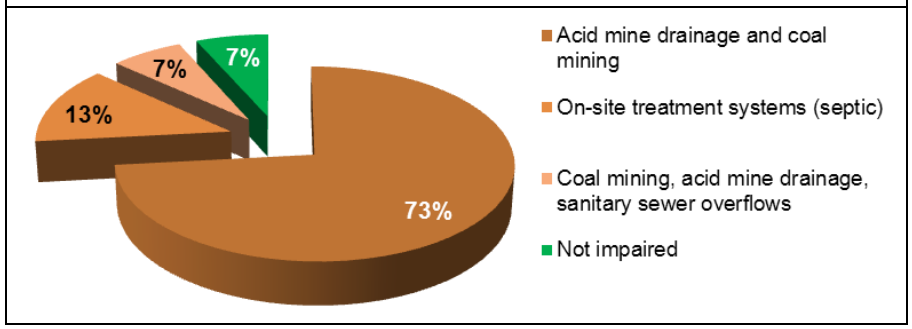


Figure B-4. Sources of aquatic life use impairment in the Moxahala Creek subwatershed.

B1.2 Water and Sediment Chemistry

Water Chemistry

Impairment of aquatic life use criteria is determined based on biological sampling. Once impairment is located, investigation into the causes and sources of the impairment occurs. Surface water samples were analyzed for metals, nutrients, bacteria, pH, temperature, conductivity, dissolved oxygen, percent saturation, suspended and dissolved solids, semivolatile organic compounds and organochlorinated pesticides. Of these parameters, dissolved oxygen, metals, bacteria, nutrients and pH were all causing aquatic life use impairment at one or more locations in the watershed. Sources of these parameters include AMD, a dam and home sewage treatment systems (HSTS). In addition, some metals and dissolved oxygen exceeded their goals but were not at levels causing biological impairment.

Sediment Chemistry

Sediment samples were collected from nine locations in the Moxahala Creek study area in 2008. Samples were analyzed for metals, semivolatile organic compounds, organochlorinated pesticides, polychlorinated biphenyls, nutrients and particle size. Various metals were detected and occasionally exceeded targets. Organic chemicals were not detected in sediment samples. Two significant observations concerning the sediment metals data included the following: 1) at Ogg Creek river mile 0.2, the arsenic level was above the *Probable Effect Concentration*, iron was above the Sediment Reference value and mercury was above the Threshold Effect Concentration (TEC) value; and 2) at Jonathan Creek river mile 3.35, arsenic and nickel were above the TEC. These elevated sediment metals conditions did not correlate with co-located biological sampling results. Exceptional biological integrity was documented in Jonathan Creek at river mile 12.2, a location with two metal parameters at levels considered likely to cause harmful effects to stream biology. The elevated metals at Ogg Creek were possibly caused by the AMD discharges into the stream. The high metals in Ogg Creek could be the cause of the low-fair macroinvertebrate community score at that site. The sparse deposits of fine grained material at each sampling site contributed to low exposure levels of sediment contaminants to biological communities. The source of the elevated metals in Jonathan Creek is unknown but is thought to be associated with the natural geology in the area.

B1.3 Trends

In 2004, Midwest Biological Institute (MBI) conducted an extensive biological survey of the Moxahala Creek subwatershed (Rankin 2004) in support of the acid mine drainage abatement and treatment (AMDAT) plan. Ohio EPA's sampling in 2008 did not repeat MBI's work from several years before, but rather sought to study areas not sampled by MBI. Therefore, no trends analysis was possible.

B2 Recreation Use Attainment

Non-attainment of recreation use criteria was prevalent in the northern half of the watershed. Attainment occurred at multiple locations in the southern half of the watershed. Most of the bacteria issues were attributed to failing HSTS and agricultural land uses. Shows recreation use attainment for the watershed.

Table B-2. Recreation use attainment table for the Moxahala Creek watershed.

Nested Sub-watershed	Name	River Mile	Drainage Area (sq. mi.)	Attainment Status	Geometric Mean	Sources
04 01	Valley Run upst. Berry Run @ Laurel Hill Rd.	5.40	9.7	Non	841	Failing HSTS, agriculture
04 01	Valley Run @ Cherry Hill Rd. (Twp. Rd. 333)	3.50	17.3	Non	1529	Failing HSTS, agriculture
04 01	Valley Run @ Hopewell Indian Rd.	1.28	26.4	Non	681	Failing HSTS, agriculture
04 02	Bowling Green Run @ Boundaries Rd.	0.10	11.1	Non	710	Agriculture
04 02	Jonathan Creek @ St. Rt. 204	27.10	7.4	Non	336	Failing HSTS, agriculture
04 02	Jonathan Creek @ Hopewell Indian Rd.	22.32	27.4	Non	217	Failing HSTS, agriculture
04 03	Turkey Run @ Twp. Rd. 49 (upper crossing)	2.90	8.1	Non	508	Failing HSTS, agriculture
04 03	Turkey Run near mouth @ RR bridge	0.25	14.2	Non	463	Failing HSTS, agriculture
04 04	Buckeye Fork adj St. Rt. 345/Old Ranier Rd.	4.90	8.1	Full	21	
04 04	Buckeye Fork @ Fletcher Rd.	3.41	16.7	Full	27	
04 04	Buckeye Fork at East Fultonham, adj. Rabbit Lane or Tr 88	1.20	22.7	Full	90	
04 04	Butcherknife Creek @ St. Rt. 345	0.08	6.8	Full	85	
04 05	Kent Run @ Asbury Chapel Rd.	8.85	9.8	Non	1814	Failing HSTS, agriculture
04 05	Kent Run @ Slack Rd.	3.68	15.1	Non	965	Failing HSTS, agriculture
04 05	Kent Run @ Lower Kroft Rd, at the Maysville WTP intake	1.35	22.3	Non	200	Failing HSTS, agriculture
04 06	Thompson Run @ Coppermill Rd.	4.73	9.3	Non	1358	Failing HSTS, agriculture
04 06	Thompson Run @ U.S. Rt. 22	0.39	15.3	Non	633	Failing HSTS, agriculture
04 07	Jonathan Creek dst Glass Rock trib, off St. Rt. 204	17.40	70.0	Non	913	Failing HSTS, agriculture
04 07	Jonathan Creek at Mt. Perry @ Co. Rd. 34	12.30	103.0	Non	365	Failing HSTS, agriculture
04 07	Jonathan Creek @ Workman Rd.	7.60	125.0	Non	194	Failing HSTS, agriculture
04 07	Jonathan Creek near white cottage @ Crock Rd.	3.35	150.0	Non	167	Failing HSTS, agriculture
04 07	Jonathan Creek near Avondale @ St. Rt. 93	1.06	193.0	Non	207	Failing HSTS, agriculture
04 07	Jonathan Creek dst St. Rt. 93 dam pool @ Powell Rd.	0.90	193.0	Non	176	Failing HSTS, agriculture
04 07	Painter Creek @ Twp. Rd. 76, dst. trib.	2.48	11.3	Non	692	Failing HSTS
04 07	Painter Creek @ Cooperrider Rd. (covered bridge)	0.85	17.8	Non	809	Failing HSTS
04 07	Trib to Jonathan Cr (13.74) dst suburban LF @ Snook Rd.	0.32	1.3	Non	553	Landfill, agriculture
04 07	Trib to Jonathan Creek (17.55) dst Oglebay Norton @ TR 92a	0.10	0.9	Non	8972	Failing HSTS
04 07	Trib. to Jonathan Creek (19.47) near mouth @ Twp. Rd. 19	0.75	6.0	Non	1686	Failing HSTS, agriculture
05 01	Black Fork upst. Ogg Creek, adj. Tatmans Rd. (Co. Rd. 22)	3.20	9.5	Non	252	Failing HSTS, livestock
05 01	Black Fork dst. Ogg Creek, Dst. Seep	2.50	23.0	Full	36	
05 01	Black Fork dst. Ogg Creek @ St. Rt. 669	1.93	24.4	Full	34	
05 01	Black Fork just S of Crooksville @ St. Rt. 669	0.10	28.7	Full	31	
05 01	Ogg Creek S of Deavertown @ St. Rt. 555	2.10	6.1	Non	420	Failing HSTS, livestock
05 01	Ogg Creek near mouth (at white house)	0.20	13.3	Non	177	Failing HSTS, livestock
05 02	Andrews Run (trib to Moxahala Creek @ RM 24.79) @ St. Rt. 13	0.33	5.8	Full	6	

Nested Sub-watershed	Name	River Mile	Drainage Area (sq. mi.)	Attainment Status	Geometric Mean	Sources
05 02	Moxahala Creek S of Moores Junction @ Twp. Rd. 312	24.00	9.0	Full	16	
05 03	Moxahala Creek dst. Roseville Wwtp	13.40	75.0	Full	26	
05 04	Moxahala Creek S of Avondale @ Lambert Rd.	6.80	98.0	Full	78	
05 04	Moxahala Creek @ Moxadarla Rd.	3.3	297.0	Non	366	Failing HSTS, livestock
05 04	Moxahala Creek at South Zanesville @ Co. Rd. 6	0.58	302.0	Non	382	Sanitary sewer overflows (South Zanesville)

B3 Public Drinking Water Supply Use Attainment

Approximately 6,000 residents live within the Maysville Regional Water District (RWD) with 2,287 meters in use. Maysville RWD receives its raw water from Frazier's Lake, an old limestone quarry. During summer months, Maysville RWD also uses Kent Run as a supplemental supply with Lake Isabella (another quarry) as an emergency source.

The Village of Crooksville no longer uses Black Fork as a source of drinking water. Crooksville has connected to Burr Oak RWD as a sole-source water provider. Crooksville has cut the intake pipes at the up-ground reservoir and at the water treatment plant, which is no longer being used. Crooksville intends to leave the reservoirs and structures at the reservoir unchanged.

Table B-3. Public drinking water supply use attainment table for the Moxahala Creek watershed.

Name/Community	Waterbody	Nitrate Status	Atrazine Status	Impairment (Y/N)
Kent Run (05040004 04 05)				
Maysville Regional Water	Kent Run	None	None	Insufficient information to assess
Painter Creek-Jonathan Creek (05040004 04 07)				
Maysville Regional Water	Frazier's Run (Fraziers Lake)	None	None	No

B4 Human Health Use Attainment

No fish tissue data were collected during the 2008 field survey with which to assess support of the human health use. A few samples were collected in 2000 from the downstream portion of Moxahala Creek, but the data were insufficient to assess the use.

B5 Special Conditions of Note

The Institute for Local Government Administration and Rural Development (ILGARD) wrote an AMDAT plan to address impairment caused by acid mine drainage in the Moxahala Creek subwatershed. Impacts related to AMD are prevalent in this subwatershed. The AMDAT estimated that remediation would require over 50 million dollars to achieve. During the 2008 field survey, similar AMD-related impacts were discovered in one nested subwatershed in the Jonathan Creek subwatershed, Buckeye Fork. Both Buckeye Fork and Butcherknife Creek were identified as impaired by AMD-related causes and sources. The Ohio Department of Natural Resources is considering writing an AMDAT for this nested subwatershed if resources allow.